Sea turtles in the OCEANIA region

2021 Marine Turtle Specialist Group regional report

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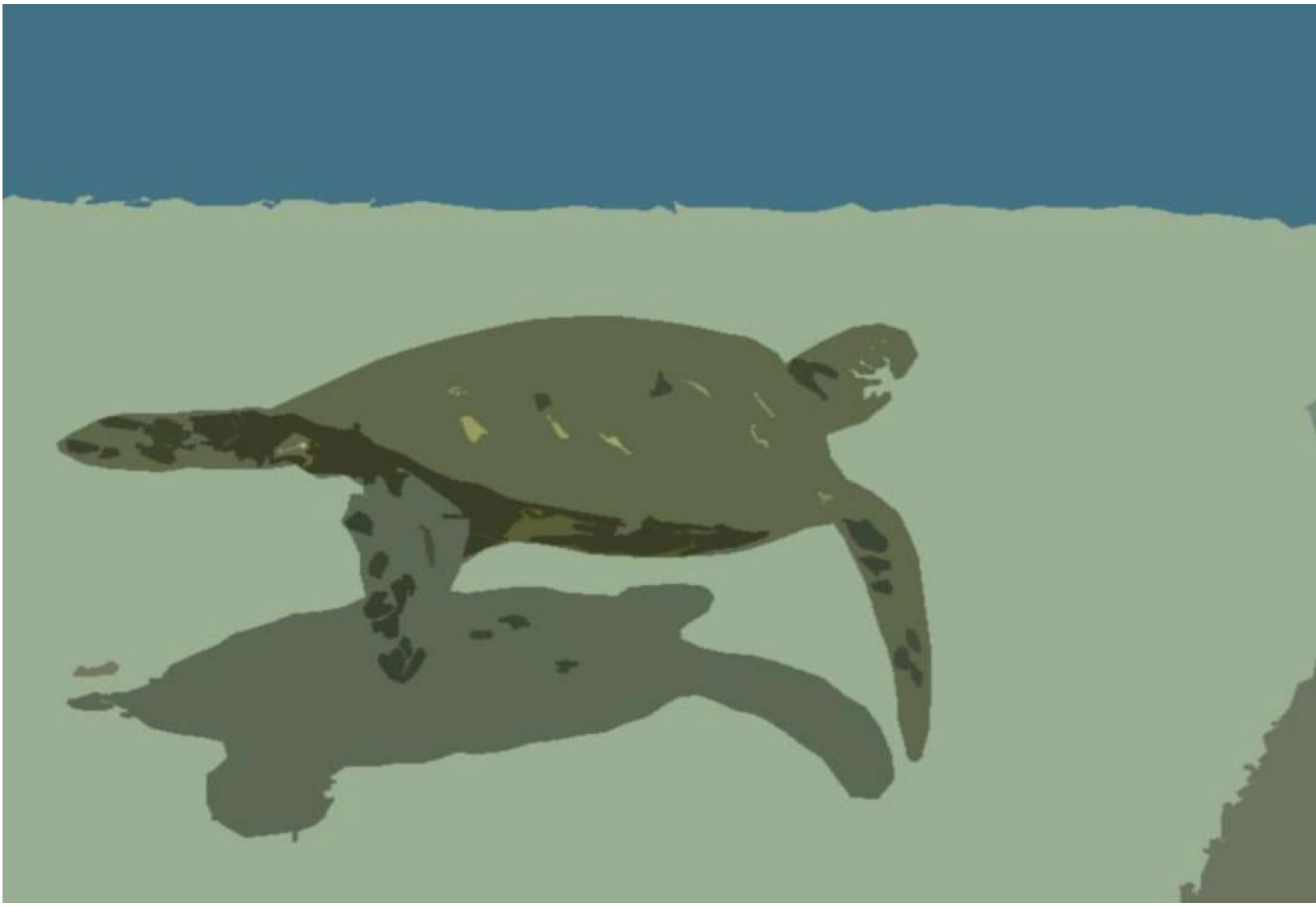

IUCN-SSC Marine Turtle Specialist Group

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Cover photo: Green turtle (Honu), Waianae, Oahu, Hawaii, USA (T.M. Work)

Layout by: Brian Hutchinson

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The Regional Vice Chairs of MTSG Oceania express their sincere thanks and appreciation to all authors of these 25 chapters for their hard work, perseverance, patience, and accomplishments. The task has been long and at times difficult, but ultimately of high reward. We dedicate this report to our dearly departed MTSG members Lui Bell (1956-2012), George Petro (2013), and Sue Taei (1962-2020). We are also grateful to the people of Oceania in support of their deep cultural and traditional ties to sea turtles in ways that are not always easily understood by others.

Turtle health workshop, Fiji, 2020. Photo: Shritika Prakash

REGIONAL OVERVIEW

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The Oceania Region of the IUCN/SSC Marine Turtle Specialist Group historically consists of 24 countries/territories culturally and linguistically known as Micronesia, Melanesia and Polynesia. The Region extends from Pitcairn Islands in the East, to Palau in the West, and from the Hawaiian Islands in the North, to New Zealand in the South (Fig. 1). This vast area encompasses 100 million square kilometers of Pacific Ocean containing over1200 islands, many of which are extremely remote and without human habitation. Excepting the large land-mass countries of Polynesian New Zealand and Melanesian Papua New Guinea, the total human population of the 22 smaller countries/territories is relatively low at 3.7 million people, or only <0.5% of the world population.

For the purposes of this report, the Oceania Region was organized by the Regional Vice Chairs to contain 25 chapters comprising 15 Sea Turtle Regional Management Units (RMU's as defined by Wallace et al. 2010).

The 25 chapters in alphabetical order comprise American Samoa, Commonwealth of the Northern Marianna Islands (CNMI), Cook Islands, Fiji, French Polynesia, Federated States of Micronesia (FSM), Guam, Hawaii, Kiribati, Nauru, New Caledonia, New Zealand, Niue, Palau, Palmyra, Pitcairn Islands, Papua New Guinea (PNG), Jarvis/Baker/Howland, Republic of the Marshall Islands (RMI), Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, and Vanuatu. The MTSG Oceania country/territory of Wallis and Futuna is not included in this report due to the absence of any information on sea turtles. In addition, the Polynesian outlier of Rapa Nui (Easter Island) has not been included here since administratively it falls within the East Pacific Region of the Marine Turtle Specialist Group. The decision was made by the Regional Vice Chairs, in consultation with the chapter authors, to treat Palmyra (isolated outlier territory of the USA) and Jarvis/Baker/Howland (isolated outlier territories of the USA) as chapters of their own.

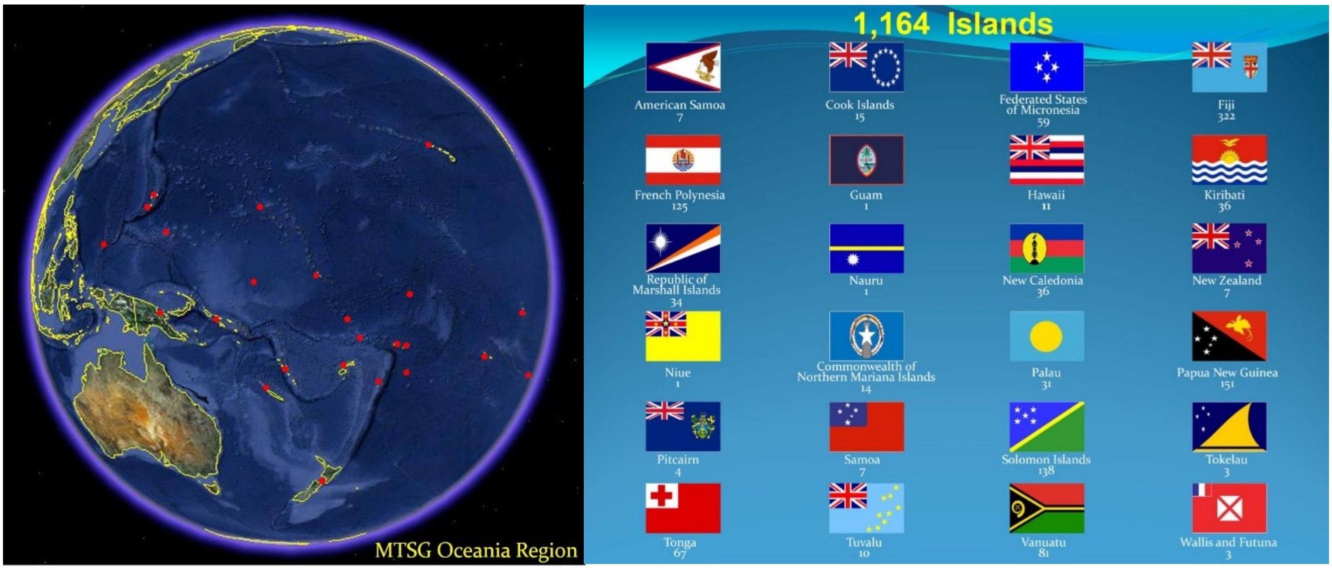

Figure 1. 24 countries/territories of Oceania Region.

1. RMU: Green turtle (*Chelonia mydas*) - North Central Pacific

Countries contributing to this summary: United States (Hawaii)
Countries in which nesting of this RMU also occurs: United States (Hawaii)

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

The majority of green turtle nesting in Hawaii occurs in the northwestern Hawaiian Islands, mainly French Frigate Shoals, and there are extensive long-term data on nesting numbers and distribution.

1.1.2 Marine areas

Specific foraging and inter-nesting areas for this RMU are in the main and Northwestern Hawaiian Islands and Johnston Atoll. Nesting numbers are up since systematic monitoring started in 1973 but there are no recent population trends for foraging grounds and oldest documented abundance is not quantified.

1.2 Other biological data

There are data on nest productivity, growth rates, stocks defined by genetic markers, remote tracking, survival rates, population dynamics, foraging ecology, capture-mark-recapture, and long term stranding trends.

1.3 Threats

1.3.1 Nesting sites

Climate change and coastal degradation.

1.3.2 Marine areas

Longline, set nets, and recreational shore-based fisheries are sources of bycatch. Pollutions, disease, climate change, and foraging habitat degradation.

1.4 Conservation

Nesting and foraging turtles in this RMU are protected by government legislation, marine protected areas, and nesting habitat protection.

1.5 Research

This RMU has benefited from extensive long-term research on nesting sites, foraging populations, disease, satellite tracking, diets, genetics, and demographics. Research is ongoing to reduce bycatch in longline fisheries and coastal recreational fisheries.

2. RMU: Green turtle (*Chelonia mydas*) - South Central Pacific

Countries/Islands contributing to this summary: Cook Islands, Fiji, Kiribati, New Zealand, Niue, PNG, Samoa, Tokelau, Tonga, French Polynesia, American Samoa, Howland-Baker-Jarvis, Palmyra, Nauru.

Countries in which nesting of this RMU also occurs: Cook Islands, Fiji, Kiribati, PNG, Tokelau, Tonga, French Polynesia, American Samoa, Samoa, Palmyra.

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

Nesting occurs in Cook Islands, Fiji, Kiritibati, PNG, Tokelau, Tonga, France (French Polynesia), United States (American Samoa, Palmyra).

2.1.2 Marine areas

Pelagic foraging grounds are known around Tonga, New Zealand, Niue, French Polynesia, and American Samoa. In addition to aforementioned, benthic foraging grounds are known in Tokelau, Samoa, Kiribati, PNG, Nauru, Cook Islands, Fiji, American Samoa, Howland-Baker-Jarvis, and Palmyra.

2.2 Other biological data

See individual island reports for nesting trends and data. For all islands/countries, data are lacking for age at maturity, recent trends at foraging grounds, sex rations and remigration intervals. Nesting numbers are declining in Fiji and Tokelau but increasing in French Polynesia. Data on growth and survival rates and foraging ecology exist for all islands, but data on genetics, tracking, mark recapture, and population dynamics are island specific.

2.3 Threats

2.3.1 Nesting sites

Intentional take, egg illegal harvest, coastal development, disease, climate change, and habitat degradation are threats for all islands to varying degrees.

2.3.2 Marine areas

Bycatch (industrial and artisanal) poses variable threats depending on the island. Bycatch is quantified only for New Zealand, Fiji, American Samoa, Howland-Baker-Jarvis and Palmyra.

2.4 Conservation

National laws protecting sea turtles exist for Cook Islands, Kiribati, New Zeland, Samoa, Fiji, PNG, Nauru, French Polynesia, and US territories. Some islands have long term conservation projects.

2.5 Research

For all islands/countries, data are lacking for age at maturity, recent trends at foraging grounds, sex rations and remigration intervals. Nesting numbers are declining in Fiji and Tokelau but increasing in French Polynesia. Data on growth and survival rates and foraging ecology exist for all islands, but data on genetics, tracking, mark recapture, and population dynamics are island specific.

3. RMU: Green turtle (*Chelonia mydas*) - West Central Pacific

Countries/Islands contributing to this summary: Kiribati, New Zealand, United States (Palmyra, Guam, Commonwealth of the Northern Marianas), FSM, RMI, Palau

Countries in which nesting of this RMU also occurs: Kiribati, Palmyra, Guam, CNMI, FSM, RMI, Palau.

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

Nesting occurs in Kiribati, Palmyra, Guam, CNMI, FSM, RMI, Palau. Nesting is declining in RMI, FSM and CNMI, increasing in Guam, and remaining steady in Palau.

3.1.2 Marine areas

Pelagic foraging grounds are known in RMI, New Zealand, Palau and Guam, and in addition, benthic foraging grounds are known in Kiribati, Palau and CNMI. There is a decreasing trend in foraging turtles around Palau.

3.2 Other biological data

See individual island reports for nesting trends and data. Depending on island, data exist for growth rates, genetics, movements (satellites), population dynamics, foraging ecology. No data on survival rates for any island.

3.3 Threats

3.3.1 Nesting sites

Intentional harvest, egg illegal harvest, coastal development, disease, climate change, and habitat degradation are threats for all islands to varying degrees.

3.3.2 Marine areas

Bycatch (industrial and artisanal) poses variable threats depending on the island. Bycatch is quantified only for New Zealand, RMI, and Palmyra.

3.4 Conservation

National laws protecting sea turtles exist for all islands, except Palau. There is one area for marine and habitat preservation in Palau. Some islands have long term conservation projects, and head starting exists for FSM. Variable efforts to mitigate bycatch exist depending on island, and in-situ nest protection occurs on Guam.

3.5 Research

For all islands, there are variably available research data on growth rates, genetics, remote tracking (satellite or other), survival rates, population dynamics, foraging ecology (diet or isotopes), capture-mark-recapture.

4. RMU: Green turtle (*Chelonia mydas*) - Southwest Pacific

Countries/Islands contributing to this summary: New Zealand, Tuvalu, Vanuatu, New Caledonia, PNG, Solomon Islands.

Countries in which nesting of this RMU also occurs: Tuvalu, Vanuatu, New Caledonia, PNG, Solomon Islands.

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

Nesting occurs in Tuvalu, Vanuatu, New Caledonia, PNG, Solomon Islands. Nesting trends available only from Vanuatu where they are declining.

4.1.2 Marine areas

Pelagic foraging grounds are known in New Zealand, Solomon Islands and PNG, and benthic foraging grounds are known in all islands except PNG.

4.2 Other biological data

Data exists on genetics and stock assessment for New Caledonia and Vanuatu, growth rates for New Caledonia, and remote tracking or mark recapture for Vanuatu and New Caledonia. No other data exist for any of the islands.

4.3 Threats

4.3.1 Nesting sites

Coastal development/degradation threatens nesting beaches for all islands, pathogens are a known threat in New Caledonia and New Zealand, climate change is a threat to all regions, and intentional harvest and illegal harvest as well.

4.3.2 Marine areas

Artisanal fisheries are a threat for all but PNG, and industrial bycatch is a threat for New Zealand, Vanuatu, and New Caledonia where it is quantified. Little data exists from PNG and Solomon Islands.

4.4 Conservation

National laws exist to protect turtles in all but PNG. Marine protected areas also occur in New Zealand and Tuvalu. New Zealand has best measures for bycatch mitigation, but efforts to reduce bycatch are non-existent in other islands/countries.

4.5 Research

Long term foraging and nesting research projects exist in New Caledonia. Data exists on genetics and stock assessment for New Caledonia and Vanuatu, growth rates for New Caledonia, and remote tracking or mark recapture for Vanuatu. No other data exist for any of the islands.

5. RMU: Hawksbill turtle (*Eretmochelys imbricata*) - North Central Pacific

Countries/Islands contributing to this summary: United States (Hawaii)

Countries in which nesting of this RMU also occurs: United States (Hawaii)

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

Mainly island of Hawaii, some nesting on Maui. Nesting trends are stable.

5.1.2 Marine areas

Data exist on foraging in pelagic and neritic areas that occur throughout Hawaii.

5.2 Other biological data

Extensive data on nesting exists due to long term monitoring. Data also exist on growth rates, remote tracking, and foraging ecology.

5.3 Threats

5.3.1 Nesting sites

Nesting threats include coastal development/degradation, egg predation, pollution, climate change.

5.3.2 Marine areas

Pole and line, coastal fishing, set nets, and crab trabs are the main fisheries threats for Hawaiian hawksbills. Climage change and foraging habitat degradation are other threats.

5.4 Conservation

National laws exist to protect the species. The main nesting sites are protected and there are marine protected areas. Bycatch onboard best practices are adopted.

5.5 Research

Extensive data on nesting exists due to long term monitoring. Data also exist on growth rates, remote tracking, and foraging ecology.

6. RMU: Hawksbill turtle (*Eretmochelys imbricata*) - South Central Pacific

Countries/Islands contributing to this summary: Cook Islands, Samoa, New Caledonia, French Polynesia, Tokelau, Niue, Fiji.

Countries in which nesting of this RMU also occurs: Fiji, Tokelau, Samoa, American Samoa, French Polynesia.

6.1 Distribution, abundance, trends

6.1.1 Nesting sites

Some data exists on nests/year, clutch size, hatching success and nesting sites for Samoa, Fiji, Tokelau, but data on other nesting demographics are absent. No trend data available.

6.1.2 Marine areas

Some data on pelagic foraging grounds in Niue and French Polynesia and data on benthic foraging ground for all countries.

6.2 Other biological data

Some data on remote tracking in Fiji, but no data elsewhere.

6.3 Threats

6.3.1 Nesting sites

Egg harvest in Tokelau. Coastal development/pollution in French Polynesia, climate change in Niue and Tokelau.

6.3.2 Marine areas

Industrial bycatch in Niue, Tokelau, and Samoa and artisanal bycatch in Niue none of which are quantified. Intentional take in all but Samoa, Niue. No data on foraging habitats.

6.4 Conservation

National laws to protect sea turtles exist in all countries. Protected nesting sites in Tokelau, Samoa, Fiji and protected areas in French Polynesia/New Caledonia, Tokelau. Long term conservation projects in New Caledonia, Fiji, Tokelau. Some research on bycatch mitigation in Samoa.

6.5 Research

Some data on remote tracking in Fiji, but no data elsewhere.

7. RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Southwest Pacific

Countries/Islands contributing to this summary: PNG, Vanuatu, Tuvalu, Solomon Islands
Countries in which nesting of this RMU also occurs: PNG, Vanuatu, Solomon Islands

7.1 Distribution, abundance, trends

7.1.1 Nesting sites

Nesting data exists for Vanuatu where trends are declining and Solomon Islands where nesting numbers are increasing. Data include nests/year, sites. No other nesting demographics available. Some information exists on nesting sites in PNG.

7.1.2 Marine areas

Information on pelagic foraging exists for PNG, Solomon Islands and Vanuatu and benthic foraging grounds for Vanuatu, and Solomon Islands.

7.2 Other biological data

Stock definition by genetic markers exists for PNG and Solomon Islands and some mark-recapture data exists for Vanuatu and Solomon Islands.

7.3 Threats

7.3.1 Nesting sites

Intentional harvest of turtles and eggs for Vanuatu, Solomon Islands and PNG. For Vanuatu, coastal development/pollution.

7.3.2 Marine areas

For Vanuatu, industrial and artisanal bycatch, which is quantified, climate change.

7.4 Conservation

For Vanuatu and Solomon Islands, there is protection under national laws, but few measures to enforce or apply.

7.5 Research

Stock definition by genetic markers exists for PNG and Solomon Islands and some mark-recapture data exists for Vanuatu and Solomon Islands.

8. RMU: Hawksbill turtle (*Eretmochelys imbricata*) - West Central Pacific

Countries/Islands contributing to this summary: Tonga, Nauru, Howland-Baker-Jarvis, American Samoa, Samoa, Guam, CNMI, FSM, Cook Islands, Palau.

Countries in which nesting of this RMU also occurs: FSM, Tonga, American Samoa, Samoa, RMI, Palau.

8.1 Distribution, abundance, trends

8.1.1 Nesting sites

Nesting occurs in FSM, Tonga, American Samoa, Samoa, RMI and Palau. Nesting trends declining in RMI and extirpated in Guam.

8.1.2 Marine areas

Foraging grounds populations declining in RMI and Palau but increasing in Guam and CNMI. Information on pelagic foraging grounds exists for Tonga, American Samoa, RMI. Information on benthic foraging grounds exists for Cook Islands, Nauru, Tonga, American Samoa, Guam, CNMI, Palau, and RMI.

8.2 Other biological data

Data on growth rates, remote tracking, and mark recapture exists for CMNI and American Samoa. Data on population dynamics, foraging ecology also exists for CNMI. Long term monitoring of nesting (CNMI, RMI) and foraging (CNMI, RMI, Guam) exist.

8.3 Threats

8.3.1 Nesting sites

Egg illegal harvest is an issue on multiple islands. Coastal development/pollution are threats in American Samoa and RMI.

8.3.2 Marine areas

Artisanal and industrial fisheries bycatch occurs for many of the islands listed and is quantified in American Samoa and Howland-Baker-Jarvis. Foraging habitat degradation is a threat in most islands. Intentional killing happens in RMI and Tonga.

8.4 Conservation

National laws exist to protect tutles in CNMI, Guam, American Samoa, Samoa, Howland-Baker-Jarvis, and RMI. Protected sites and conservation projects exist in US territories/affiliated states.

8.5 Research

Data on growth rates, remote tracking, and mark recapture exists for CMNI and American Samoa. Also data on population dynamics, foraging ecology exists for CNMI.

9. RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Unidentified

Countries/Islands contributing to this summary: Kiribati, Tokelau, PNG, Palmyra.
Countries in which nesting of this RMU also occurs: United States (Palmyra)

9.1 Distribution, abundance, trends

9.1.1 Nesting sites

Although nesting rarely occurs at Palmyra, there are no nesting data for this species.

9.1.2 Marine areas

There are known pelagic foraging grounds for PNG and benthic foraging grounds for PNG, Kiribati, and Palmyra.

9.2 Other biological data

Some remote tracking data for PNG and some mark recapture data for Palmyra.

9.3 Threats

9.3.1 Nesting sites

Coastal development (Kiribati), pollution (New Zealand, Kiribati), disease (New Zealand).

9.3.2 Marine areas

Artisanal (New Zealand, Kiribati) and industrial (aforementioned and Palmyra) bycatch which is quantified in New Zealand and Palmyra. Foraging habitat degradation in Kiribati.

9.4 Conservation

National laws protect turtles in New Zealand, Kiribati, Palmyra, and PNG. Marine protected areas in Palmyra, Kiribati, New Zealand and bycatch mitigation (New Zealand, Palmyra).

9.5 Research

Some remote tracking data for PNG and some mark recapture data for Palmyra.

10. RMU: Loggerhead turtle (*Caretta caretta)* - North Pacific

Countries/Islands contributing to this summary: Hawaii.

Countries in which nesting of this RMU also occurs: N/A

10.1 Distribution, abundance, trends

10.1.1 Nesting sites

None in Hawaii.

10.1.2 Marine areas

Pelagic foraging ground for juveniles and subadults.

10.2 Other biological data

Bycatch data from longline fisheries.

10.3 Threats

Bycatch in longline fisheries

10.3.1 Nesting sites

Not applicable.

10.3.2 Marine areas

Industrial longline fisheries.

10.4 Conservation

Laws exist to protect turtles and observer program exists in USA longline fisheries. An ongoing mitigation program is in the works to reduce this by designing hooks/baits to reduce attraction.

10.5 Research

See 10.4.

11. RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

Countries/Islands contributing to this summary: Tonga, Tuvalu, Samoa, Fiji, Tokelau, RMI, Kiribati, French Polynesia, New Caledonia, Vanuatu, PNG, Solomon Islands.

Countries in which nesting of this RMU also occurs: Tokelau, New Caledonia, Vanuatu, PNG

11.1 Distribution, abundance, trends

11.1.1 Nesting sites

Tokelau, New Caledonia, Vanuatu, PNG. Nesting is rare in Tokelau, declining in Vanuatu, and increasing in New Caledonia.

11.1.2 Marine areas

Known pelagic (French Polynesia, RMI, PNG, New Zeland, Vanuatu, Kiribati and Solomon Islands) and benthic (Vanuatu, New Zealand, Fiji, New Caledonia) foraging grounds. No trends available.

11.2 Other biological data

Data on growth rates, genetics (New Caledonia) and additionally, remote tracking (French Polynesia, RMI), and some mark recapture in Vanuatu.

11.3 Threats

11.3.1 Nesting sites

Coastal development (all islands), egg predation (New Caledonia/Vanuatu), harvest (multiple islands).

11.3.2 Marine areas

Industrial and artisanal bycatch in multiple islands which is quantified in Fiji, New Zealand, RMI, Vanuatu and New Caledonia. Pathogens (New Zealand), climate change and foraging habitat degradation (all).

11.4 Conservation

Laws to protect turtles in all islands except PNG exist. Some protected marine and nesting areas (multiple islands) along with bycatch mitigation and head starting (New Caledonia).

11.5 Research

Data on growth rates, genetics (New Caledonia) and additionally, remote tracking (French Polynesia, RMI), and some mark recapture in Vanuatu.

12. RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

Countries/Islands contributing to this summary: FSM, French Polynesia, New Caledonia, Kiribati, RMI, New Zealand, PNG, Vanuatu, Solomon Islands, Palau, Hawaii, Palmyra, Howland-Baker-Jarvis, American Samoa.

Countries in which nesting of this RMU also occurs: Vanuatu, Kiribati, Solomon Islands.

12.1 Distribution, abundance, trends

12.1.1 Nesting sites

Nesting known to occur in Vanuatu, Solomon Islands, and Kiribati. No trends exist.

12.1.2 Marine areas

Pelagic foraging in FSM, New Caledonia, RMI, PNG, American Samoa, Hawaii, Vanuatu and benthic foraging in Vanuatu, Palau, and Kiribati. No trends available.

12.2 Other biological data

Data exist on genetics, stock assessment in American Samoa and remote tracking (French Polynesia).

12.3 Threats

12.3.1 Nesting sites

Harvest in PNG and Vanuatu, egg illegal harvest in the Solomon Islands, pollution in multiple islands, pathogens in New Zealand and climate change in RMI.

12.3.2 Marine areas

Industrial and artisanal bycatch in multiple islands which is quantified in RMI, Vanuatu, Palmyra, Howland-Baker-Jarvis, American Samoa, Hawaii.

12.4 Conservation

Laws to protect turtles in all islands except PNG and Palau exist. Some protected marine and nesting areas (multiple islands) along with long term conservation projects (RMI).

12.5 Research

Data exist on genetics, stock assessment in American Samoa and remote tracking (French Polynesia).

13. RMU: Olive ridley turtle (*Lepidochelys olivacea*) -East Pacific

Countries/Islands contributing to this summary: United States (Hawaii, Palmyra), Kiribati

Countries in which nesting of this RMU also occurs: NA

13.1 Distribution, abundance, trends

13.1.1 Nesting sites

N/A

13.1.2 Marine areas

Pelagic foraging grounds juveniles, adults. No trends data.

13.2 Other biological data

None.

13.3 Threats

13.3.1 Nesting sites

N/A.

13.3.2 Marine areas

Industrial longline fisheries which are quantified in US territories.

13.4 Conservation

Laws exist to protect species in US territories. Long term efforts underway to mitigate longline bycatch in US territories.

13.5 Research

Long term efforts underway to mitigate longline bycatch in US territories.

14. RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

Countries/Islands contributing to this summary: Fiji, PNG, Vanuatu, Palmyra, American Samoa, Guam, Howland-Baker-Jarvis, Hawaii, Palau, Solomon Islands, FSM, New Zealand, Kiribati, Samoa, Tuvalu, New Caledonia, French Polynesia, Tonga, RMI.

Countries in which nesting of this RMU also occurs: Fiji, PNG, Vanuatu, Solomon Islands.

14.1 Distribution, abundance, trends

14.1.1 Nesting sites

Nesting occurs in Fiji, PNG, Vanuatu. Nesting declining in Vanuatu.

14.1.2 Marine areas

Pelagic foraging grounds in multiple islands, benthic foraging in Vanuatu, Palau, and American Samoa.

14.2 Other biological data

Data exists on genetics and satellite tracking in PNG and Solomon Islands and mark recapture in Vanuatu and Solomon Islands.

14.3 Threats

14.3.1 Nesting sites

Harvest of turtles and eggs (Vanuatu, PNG, Solomon Islands), pollution (RMI, Vanuatu), and climate change multiple islands.

14.3.2 Marine areas

Industrial and artisanal fisheries multiple islands quantified in US territories, New Zealand, Vanuatu, RMI, Fiji.

14.4 Conservation

Laws to protect turtles in all islands except PNG exist. Protected marine areas in multiple islands, protected nesting sites in Fiji. Fisheries bycatch mitigation in multiple islands.

14.5 Research

Data exists on genetics and satellite tracking in PNG and Solomon Islands and mark recapture in Vanuatu and Solomon Islands.

15. RMU: Flatback turtle (*Natator depressus*) - Southwest Pacific

Countries/Islands contributing to this summary: PNG

Countries in which nesting of this RMU also occurs: NA

15.1 Distribution, abundance, trends

15.1.1 Nesting sites

N/A

15.1.2 Marine areas

PNG, no trend data.

15.2 Other biological data

None.

15.3 Threats

15.3.1 Nesting sites

Intentional take.

15.3.2 Marine areas

Industrial bycatch.

15.4 Conservation

No protection under national law.

15.5 Research

None.

Table 1. Biological data for green turtles in OCEANIA

	Chelonia mydas - Green turtle							
RMU	**CM-NC PAC**	Country Chapters from which the info is taken	**CM-SC PAC**	Country Chapters from which the info is taken	**CM-WC PAC**	Country Chapters from which the info is taken	**CM-SW PAC**	Country Chapters from which the info is taken
Occurrence - Countries reporting (see Table 1 for abbreviation list)	**US-HI**		**CK, FJ, KI, NZ, NU, PN, WS,TK, TO, FR-PF, US-AS, US-RI, NR, US-P**		**KI, NZ, US-P, MH, FM, US-MP, US-GU, PW**		**NZ, TV, VU, FR-NC, PG, SB**	
Nesting sites	Y	US-HI	Y	FJ, FR-PF, CK, KI, PN, TO, TK, US-AS, US-P	Y	FM, MH, KI, US-GU, US-MP, PW	Y	FR-NC, PG, TV, VU, SB
Pelagic foraging grounds	J	US-HI	Y	TO, NZ, NU, FR-PF, US-AS	Y	MH, NZ, US-GU, PW	Y	NZ, PG, SB

Benthic foraging grounds	JA	US-HI	Y	TO, TK, WS, KI, PN, NZ, NU, CK, FJ, NR, FR-PF, US-AS, US-RI, US-P	Y	MH, NZ, KI, US-MP, US-GU, PW	Y	FR-NC, TV, NZ, VU, SB
Key biological data								
Nests/yr: recent average (range of years)	14840 (2009-2012)	US-HI	0-990	CK, KI, FJ, TO, TK, FR-PF, US-AS, US-P	0-200 (1998-2016)	FM, US-MP, US-GU, KI, PW	30	VU
Nests/yr: recent order of magnitude	10000-20000	US-HI	<1-295 (2016-2017, Tetiaroa only)	FR-PF, US-P	11-<200	US-MP, US-GU, US-P, KI, PW	10	VU
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	7	US-HI	0-3	CK, FJ, KI, TK, PN, FR-PF, US-AS, US-P	0-4	MH, FM, US-MP, US-GU_US-P, KI, PW	2-3	VU, SB

Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	5	US-HI	1-9	CK, FJ, KI, TK, PN, FR-PF, US-AS, US-P	3-20	MH, FM, US-MP, US-GU_US-P, KI, PW	3-27	VU, SB
Nests/yr at "major" sites: recent average (range of years)	15344 (2009-2012)	US-HI	40-1500	CK, FJ, FR-PF, US-AS	0-50	US-MP, US-GU, KI, PW	11	VU
Nests/yr at "minor" sites: recent average (range of years)	40 (2010-2012)	US-HI	<1-40	CK, FJ, US-AS, US-P	<10-36	US-MP, US-GU, US-P, KI	3	VU
Total length of nesting sites (km)	113	US-HI	1.9-15	CK, PN, FR-PF, US-AS	15.53 - 440	US-MP, PW	n/a	ALL
Nesting females / yr	3846	US-HI	20-440	CK, PN, TK, FR-PF	10-22	US-MP, US-GU	n/a	ALL
Nests / female season (N)	4	US-HI	2-9	FR-PF	1-7	MH, US-MP	n/a	ALL
Female remigration interval (yrs) (N)	4 yrs	US-HI	n/a	ALL	1-6	US-MP	n/a	ALL
Sex ratio: Hatchlings (F / Tot) (N)	n/a	US-HI	n/a	ALL	F (89 nests)	US-MP	n/a	ALL

Sex ratio: Immatures (F / Tot) (N)	1/1 (132)	US-HI	n/a	ALL	n/a	ALL	n/a	ALL
Sex ratio: Adults (F / Tot) (N)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL
Min adult size, CCL or SCL (cm)	89.3 cm SCL	US-HI	83-90 cm CCL	FJ, FR-PF, US-AS	81-83 cm CCL	MH, US-MP	89.9 cm CCL	FR-NC
Age at maturity (yrs)	23 yrs	US-HI	n/a	ALL	17	US-MP	n/a	ALL
Clutch size (n eggs) (N)	92.4 eggs	US-HI	69-71	CK, FR-PF, US-AS	93	US-MP	n/a	ALL
Emergence success (hatchlings/egg) (N)	0.71	US-HI	54-95%	CK, FR-PF, US-AS	78%	US-MP	n/a	ALL
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	US-HI	49-95%	CK, FR-PF	70%	US-MP	n/a	ALL
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	Up (1973-2012)	US-HI	declining (FJ, TK), Up (FR-PF 2007-2017)	FJ, TK, FR-PF	declining, steady (PW only)	MH, FM, US-MP, PW	decline	VU

Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	US-HI	n/a	ALL	declining, 493 (US-MP, MH, PW), increasing (US-GU)	MH, US-MP, US-GU, PW	n/a	ALL
Oldest documented abundance: nests/yr (range of years)	not quantified (1778-1950)	US-HI	24-170 (1973-2012)	KI, CK, US-AS	24 (1995)	US-MP	Y (1976-1977)	SB
Published studies								
Growth rates	Y	US-HI	N	ALL	Y	US-MP, US-GU	Y	FR-NC
Genetics	Y	US-HI	Y	CK, FJ, FR-PF, NZ, US-AS, US-P	Y	MH, FM, US-MP, PW, US-GU, US-P	Y	FR-NC, PG, VU
Stocks defined by genetic markers	Y	US-HI	Y	FR-PF, US-AS, US-P	Y	MH, FM, US-MP, PW, US-GU, US-P	Y	FR-NC, PG, VU
Remote tracking (satellite or other)	Y	US-HI	Y	FJ, FR-PF, US-AS, US-P	Y	MH, FM, US-MP, US-GU, US-P	Y	VU

Survival rates	Y	US-HI	N	ALL	N	US-MP	N	ALL
Population dynamics	Y	US-HI	Y	US-RI	Y	FM, US-MP	N	ALL
Foraging ecology (diet or isotopes)	Y	US-HI	N	ALL	Y	MH, US-MP	N	ALL
Capture-Mark-Recapture	Y	US-HI	Y	US-AS, US-P	Y	MH, FM, US-MP, US-GU, US-P	Y	VU, SB
Threats								
Bycatch: presence of small scale / artisanal fisheries?	FP, SN	US-HI	Y (PLL, DLL, MT, SN, OTH)	NZ, KI, TO, TK, CK, NU, US-AS, NR	Y	MH, FM, US-GU, KI, NZ, PW	Y (OTH)	NZ, TV, VU, FR-NC, SB
Bycatch: presence of industrial fisheries?	LL	US-HI	Y (PLL, DLL, MT, SN, FP, PT, OTH)	NZ, FJ, KI, TK, CK, NU, US-AS, US-RI, US-P	Y (PLL, PS)	MH, FM, US-GU, US-P, KI, NZ, PW	Y	NZ, VU, FR-NC
Bycatch: quantified?	Y (LL)	US-HI	Y (PLL)	NZ, FJ, US-AS, US-RI, US-P	Y (PS)	MH, US-P, NZ	Y	NZ, VU, FR-NC

Take. Intentional killing or exploitation of turtles	N	US-HI	Y	CK, FJ, KI, TO, TK, WS, FR-PF	Y	MH, FM, US-MP, US-GU, KI, PW	Y	TV, VU, PG, FR-NC, SB
Take. Egg poaching	N	US-HI	Y	KI, TO, TK, CK, FR-PF	Y	MH, US-MP, US-GU, KI,PW	Y	TV, VU, PG, SB
Coastal Development. Nesting habitat degradation	N	US-HI	Y	KI, CK, FR-PF, US-AS, NR	Y	MH, US-MP, US-GU, KI, PW	Y	VU
Coastal Development. Photopollution	N	US-HI	Y	FR-PF, US-AS, NR	Y	MH, US-MP, US-GU	n/a	ALL
Coastal Development. Boat strikes	Y	US-HI	Y	NZ, KI, TK, FR-PF	Y	MH, US-MP, NZ, US-GU, KI	Y	NZ, FR-NC
Egg predation	N	US-HI	Y	CK, KI, TK, FR-PF	Y	MH, FM, US-MP, US-GU, KI, PW	Y	SB
Pollution (debris, chemical)	Y	US-HI	Y	NZ, KI, CK, PN, NU, FR-PF, US-AS, NR	Y	MH, US-MP, NZ, US-GU, KI, PW	Y	NZ, VU
Pathogens	Y	US-HI	Y	NZ	Y	US-MP, KI, NZ	Y	NZ, FR-NC

Climate change	Y	US-HI	Y	NU, CK, KI, TK, FJ, US-AS, US-RI, NR	Y	MH, US-MP, US-GU, KI	Y	TV, VU, SB
Foraging habitat degradation	Y	US-HI	Y	KI, CK, US-AS, NR	Y	MH, US-MP, US-GU, KI, PW	n/a	ALL
Other	N	US-HI	Y	NZ, CK, NR	Y	MH, US-MP, NZ	Y	NZ, VU
Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	Y (1973-2012)	US-HI	Y (1985-present, US-AS)	FR-PF, US-AS, US-P	Y (2006-present)	US-MP, US-GU, US-P	Y (1991-present)	FR-NC, SB
Number of index nesting sites	1	US-HI	1-2	FR-PF, US-AS	0-5	MH, US-MP, US-GU, KI	2-4	FR-NC, SB
Monitoring at foraging sites (period: range of years)	Y (1973-2012)	US-HI	Y (2002-present)	US-RI, US-P	Y (2006-present)	US-MP, US-GU, US-P	Y (2004-2008, 2009-ongoing)	FR-NC, SB
Conservation								

Protection under national law	Y	US-HI	Y	CK, KI, NZ, WS, FJ, PN, NU, FR-PF, US-AS, US-RI, US-P	Y	MH, FM, US-MP, US-GU, US-P, KI, NZ	Y	NZ, VU, FR-NC, SB
Number of protected nesting sites (habitat preservation) (% nests)	90	US-HI	0-2 (100%)	KI, TK FJ, CK, FR-PF, US-AS	0-all beaches	MH, US-MP, US-GU, KI, PW	n/a	ALL
Number of Marine Areas with mitigation of threats	1	US-HI	0-3	TK, WS, KI, NZ, FR-PF, US-AS, US-RI, US-P	1-7	MH, US-MP, US-GU, US-P, KI, NZ, PW	1-2	NZ, TV, SB
N of long-term conservation projects (period: range of years)	1 (1973-2012)	US-HI	0-1 (2010-present , CK)	KI, TK, FJ, CK, FR-PF, US-AS	0-3	MH, US-MP, US-GU, KI, PW	1-2 (2007-present)	FR-NC, SB
In-situ nest protection (eg cages)	N	US-HI	Y (Tetiaroa)	FR-PF	Y	US-GU	n/a	ALL
Hatcheries	N	US-HI	Y?	FR-PF	N	MH, US-MP, US-GU	Y	FR-NC
Head-starting	N	US-HI	N	FR-PF	Y	FM	Y	FR-NC

By-catch: fishing gear modifications (eg, TED, circle hooks)	LL - CIRCLE HOOKS	US-HI	Y	US-AS	Circle Hook (PLL)	MH, US-GU	Y	SB
By-catch: onboard best practices	Y	US-HI	Y	NZ, WS, US-AS, US-RI, US-P	Y	MH, FM, US-GU, US-P, NZ	Y	NZ
By-catch: spatio-temporal closures/reduction	N	US-HI	N	FR-PF	Y	MH	n/a	ALL
Other	N	US-HI	Y	TK, NU, CK, FR-PF	Y	FM	n/a	ALL

Table 2. Biological data for Hawksbill turtles in OCEANIA

	Eretmochelys imbricata - Hawksbill turtle									
RMU	**EI-NC PAC**	Country Chapters from which the info is taken	**EI-SC PAC**	Country Chapters from which the info is taken	**EI-SW PAC**	Country Chapters from which the info is taken	**EI-WC PAC**	Country Chapters from which the info is taken	**EI-UnID**	Country Chapters from which the info is taken
Occurrence - Countries reporting (see Table 1 for abbreviation list)	**US-HI**		**CK, FR-NC, FR-PF, TK, WS, NU, FJ**		**PG, VU, TV, SB**		**TO, NR, US-RI, US-AS, US-GU, US-MP, FM, MH, CK, PW**		**KI, NZ, PN, US-P**	
Nesting sites	Y	US-HI	Y	FJ, TK, WS, FR-PF	Y	PG, VU, SB	Y	FM, TO, US-AS, MH, PW	Y	US-P
Pelagic foraging grounds	J	US-HI	Y	NU, FR-PF	Y	PG, VU, SB	Y	TO, US-AS, MH	Y	PN
Benthic foraging grounds	JA	US-HI	Y	CK, FJ, FR--PF, FR-NC, NU, TK, WS	Y	TV, SB	Y	CK, NR, TO, US-AS, US-GU, US-MP, MH, PW	Y	PN, KI, US-P

Key biological data										
Nests/yr: recent average (range of years)	35 (1988-2009)	US-HI	4-47 (2003-2014)	WS, FJ	51 (2006-2014)	VU	0-9.4 (2009-2013)	US-GU, US-MP, US-AS, PW	n/a	ALL
Nests/yr: recent order of magnitude	50	US-HI	1	WS	10's	VU	0 -<10	US-GU, US-MP, US-AS, PW	n/a	ALL
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	1	US-HI	2	FJ	2-5	VU, SB	0	MH, US-GU, US-AS, PW	n/a	ALL
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	1	US-HI	1-6	TK, WS, FJ	5-14	VU, SB	0-9.4 (2009-2013)	MH, US-GU, US-AS, PW	n/a	ALL
Nests/yr at "major" sites: recent average (range of years)	0	US-HI	41 (2009-2014)	FJ	25 (2006-2014)	VU	3.6	US-AS	n/a	ALL
Nests/yr at "minor" sites: recent average (range of years)	40 (1993-2012)	US-HI	3-4	WS, FJ	3 (2006-2014)	VU	<10	PW	n/a	ALL
Total length of nesting sites (km)	3	US-HI	n/a	ALL	n/a	ALL	n/a	ALL	n/a	ALL

Nesting females / yr	3-18	US-HI	n/a	ALL	n/a	ALL	n/a	ALL	n/a	ALL
Nests / female season (N)	3.3 (1-6)	US-HI	n/a	ALL	4-5	SB	n/a	ALL	n/a	ALL
Female remigration interval (yrs) (N)	3.5 (2-10)	US-HI	n/a	ALL	2-7	SB	n/a	ALL	n/a	ALL
Sex ratio: Hatchlings (F / Tot) (N)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL	n/a	ALL
Sex ratio: Immatures (F / Tot) (N)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL	n/a	ALL
Sex ratio: Adults (F / Tot) (N)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL	n/a	ALL
Min adult size, CCL or SCL (cm)	72 cm SCL	US-HI	75-100 CCL	WS, FJ	n/a	ALL	77.5 CCL	US-AS	n/a	ALL
Age at maturity (yrs)	17-22 yrs	US-HI	n/a	ALL	n/a	ALL	n/a	ALL	n/a	ALL
Clutch size (n eggs) (N)	175.2 (78-274 eggs)	US-HI	116	FJ	n/a	ALL	114	US-AS	n/a	ALL
Emergence success (hatchlings/egg) (N)	0.719	US-HI	98.6	FJ	n/a	ALL	75%	US-AS	n/a	ALL

Nesting success (Nests/ Tot emergence tracks) (N)	n/a	US-HI	n/a	ALL	n/a	ALL	36%	US-AS	n/a	ALL
Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)	stable (1993-2009)	US-HI	decline	FJ, WS, TK	Decline (VU), increase (1991-2012 - SB)	VU, SB	decline (MH), extripated (guam)	MH, US-GU	n/a	ALL
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	US-HI	n/a	ALL	n/a	ALL	decline (MH, PW), increase (US-GU, US-MP)	MH, US-GU, US-MP, PW	n/a	ALL
Oldest documented abundance: nests/yr (range of years)	n/a	US-HI	100 (1970s)	FJ	Y (1976-1977)	SB	0	US-MP	n/a	ALL
Published studies										
Growth rates	Y	US-HI	N (n/a)	ALL	n/a	ALL	Y	US-MP, US-AS	N	ALL

Genetics	N	US-HI	N (n/a)	ALL	Y	SB	n/a	ALL	N	ALL
Stocks defined by genetic markers	N	US-HI	N (n/a)	ALL	Y	PG, SB	n/a	ALL	N	ALL
Remote tracking (satellite or other)	Y	US-HI	Y	FJ	Y	SB	Y	US-MP, US-AS	Y	PN
Survival rates	N	US-HI	N (n/a)	ALL	Y	SB	n/a	ALL	N	ALL
Population dynamics	N	US-HI	N (n/a)	ALL	Y	SB	Y	US-MP	N	ALL
Foraging ecology (diet or isotopes)	Y	US-HI	N (n/a)	ALL	Y	SB	Y	US-MP	N	ALL
Capture-Mark-Recapture	N	US-HI	N (n/a)	ALL	Y	VU, SB	Y	US-MP, US-AS	Y	US-P
Threats										
Bycatch: presence of small scale / artisanal fisheries?	FP, SN	US-HI	Y	NU,	Y (OTH)	VU, SB	Y (SN, OTH)	US-AS, US-GU, MH, FM, TO, PW	Y	KI, NZ
Bycatch: presence of industrial fisheries?	LL	US-HI	Y	NU, TK, WD	Y	VU	Y (PLL)	US-AS, US-RI, FM	Y (PLL, DLL, MT, SN, FP, PT, OTH)	KI, NZ, US-P

Bycatch: quantified?	0 (LL)	US-HI	n/a	ALL	Y	VU	Y (PLL)	US-AS, US-RI	Y	NZ, US-P
Take. Intentional killing or exploitation of turtles	N	US-HI	Y (OTH)	FR-PF, TK, FJ	Y	VU, PG, SB	Y	MH, TO, PW	N	KI, US-P
Take. Egg poaching	N	US-HI	Y	TK	Y	VU, PG, SB	Y	US-MP, US-GU, MH, TO, FM	N	US-P
Coastal Development. Nesting habitat degradation	Y	US-HI	n/a	ALL	Y	VU	Y	US-AS, MH	N	US-P
Coastal Development. Photopollution	Y	US-HI	Y	FR-PF	n/a	ALL	Y	US-AS, MH	N	US-P
Coastal Development. Boat strikes	Y	US-HI	Y	FR-PF	n/a	ALL	Y	US-GU, MH, PW	Y	KI
Egg predation	Y	US-HI	n/a	ALL	Y	SB	Y	MH	N	NZ, US-P
Pollution (debris, chemical)	Y	US-HI	Y	NU, FR-PF	Y	VU	Y	US-MP, US-AS, MH	Y	NZ, KI
Pathogens	N	US-HI	n/a	ALL	n/a	ALL	n/a	ALL	Y	NZ

Climate change	Y	US-HI	Y	NU, TK,	Y	VU, SB	Y	US-AS, MH	Y	KI
Foraging habitat degradation	Y	US-HI	n/a	ALL	n/a	ALL	Y	US-MP, US-AS, US-GU, MH, PW	Y	KI
Other	Y (see text)	US-HI	Y	CK	Y	VU	Y	CK, NR	N	US-P
Long-term projects (>5yrs)										
Monitoring at nesting sites (period: range of years)	1988-2012	US-HI	Y (2005-present)	FJ	Y (1991 - ongoing)	SB	Y (2006-present)	US-MP	Y	US-P
Number of index nesting sites	3	US-HI	2	FJ	4	SB	0-5	MH, US-MP	n/a	ALL
Monitoring at foraging sites (period: range of years)	Y (1973-2012)	US-HI	n/a	ALL	n/a	ALL	Y (2002-present)	US-RI, US-GU, US-MP	Y	US-P
Conservation										
Protection under national law	Y	US-HI	Y	NU, FR-PF, FR-NC, WS, FJ	Y	VU, SB	Y	US-MP, US-AS, US-GU, US-RI, MH	Y	US-P, KI, NZ, PN

Number of protected nesting sites (habitat preservation) (% nests)	1	US-HI	0-2	TK, WS, FJ	n/a	ALL	0-100%	US-MP, US-AS, US-GU, MH	n/a	ALL
Number of Marine Areas with mitigation of threats	1	US-HI	0-3	FR-PF, FR-NC, TK	2	SB	1-7	US-MP, US-AS, MH, US-RI, PW	1-2	US-P. KI, NZ
N of long-term conservation projects (period: range of years)	1 (1988-2012)	US-HI	0-1 (2010-2014)	FR-NC, TK, FJ	1	SB	0-1(1999-present)	US-MP, US-AS, US-GU, MH, PW	n/a	ALL
In-situ nest protection (eg cages)	N	US-HI	N (n/a)	ALL	Y	SB	N (n/a)	ALL	n/a	ALL
Hatcheries	N	US-HI	N (n/a)	ALL	n/a	ALL	N (n/a)	ALL	n/a	ALL
Head-starting	N	US-HI	N (n/a)	ALL	n/a	ALL	N (n/a)	ALL	n/a	ALL
By-catch: fishing gear modifications (eg, TED, circle hooks)	N	US-HI	Y	WS	N	SB	Y (circle hook)	US-AS, US-GU, MH	N	NZ
By-catch: onboard best practices	Y	US-HI	Y	WS	n/a	ALL	Y	US-AS, US-GU, MH, US-RI	Y	US-P, NZ

By-catch: spatio-temporal closures/reduction	N	US-HI	N (n/a)	ALL	n/a	ALL	N (n/a)	ALL	N	NZ
Other	N	US-HI	Y	NU, FR-PF	n/a	ALL	N (n/a)	ALL	N	NZ

Table 3. Biological data for loggerhead and olive ridley turtles in OCEANIA

	Caretta caretta - Loggerhead turtle				*Lepidochelys olivacea* - Olive ridley turtle			
RMU	**CC-N PAC**	Country Chapters from which the info is taken	**CC-S PAC**	Country Chapters from which the info is taken	**LO-W PAC**	Country Chapters from which the info is taken	**LO-E PAC**	Country Chapters from which the info is taken
Occurrence - Countries reporting (see Table 1 for abbreviation list)	**US-HI**		**TO, TV, WS, FJ, TK, NZ, MH, KI, FR-PF, FR-NC, VU, PG, SB**		**FM, FR-PF, FR-NC, KI, MH, NZ, PG, VU, PW, US-HI, US-P, US-RI, US-AS, SB**		**US-HI, US-P, KI**	
Nesting sites	N	US-HI	Y	VU, FR-NC, PG, TK	Y	SB	N	US-HI, US-P, KI
Pelagic foraging grounds	J	US-HI	Y	FR-PF, MH, PG, NZ, VU, US-AS. KI	Y	FM, FR-NC, MH, PG, US-AS, US-HI, VU	JA	US-HI
Benthic foraging grounds	N	US-HI	Y	VU, NZ, FJ, FR-NC	Y	VU, KI, PW	N	US-HI, US-P, KI

Key biological data								
Nests/yr: recent average (range of years)	n/a	US-HI	1-182 (2006-2014)	VU, FR-NC	n/a	ALL	n/a	ALL
Nests/yr: recent order of magnitude	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	US-HI	0-7	VU, FR-NC	n/a	ALL	n/a	ALL
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	US-HI	1-51	TK, VU, FR-NC	n/a	ALL	n/a	ALL
Nests/yr at "major" sites: recent average (range of years)	n/a	US-HI	182 (2006-2014)	FR-NC	n/a	ALL	n/a	ALL
Nests/yr at "minor" sites: recent average (range of years)	n/a	US-HI	1	VU	n/a	ALL	n/a	ALL
Total length of nesting sites (km)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL

Nesting females / yr	n/a	US-HI	44 (2006-2014)	FR-NC	n/a	ALL	n/a	ALL
Nests / female season (N)	n/a	US-HI	4.1	FR-NC	n/a	ALL	n/a	ALL
Female remigration interval (yrs) (N)	n/a	US-HI	2.84	FR-NC	n/a	ALL	n/a	ALL
Sex ratio: Hatchlings (F / Tot) (N)	n/a	US-HI	0.99	FR-NC	n/a	ALL	n/a	ALL
Sex ratio: Immatures (F / Tot) (N)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL
Sex ratio: Adults (F / Tot) (N)	n/a	US-HI	0.75	FR-NC	n/a	ALL	n/a	ALL
Min adult size, CCL or SCL (cm)	n/a	US-HI	83 CCL	FR-NC	n/a	ALL	n/a	ALL
Age at maturity (yrs)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL
Clutch size (n eggs) (N)	n/a	US-HI	112	FR-NC	85 (N=1)	SB	n/a	ALL
Emergence success (hatchlings/egg) (N)	n/a	US-HI	0.80	FR-NC	48% (N=1)	SB	n/a	ALL

Nesting success (Nests/ Tot emergence tracks) (N)	n/a	US-HI	0.60	FR-NC	n/a	ALL	n/a	ALL
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	US-HI	rare (TK), Decline (VU), Increase (FR-NC)	TK, VU, FR-NC	n/a	ALL	n/a	ALL
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL
Oldest documented abundance: nests/yr (range of years)	n/a	US-HI	125 (2006)	FR-NC	n/a	ALL	n/a	ALL
Published studies								
Growth rates	N	US-HI	Y	FR-NC	N (n/a)	ALL	N (n/a)	ALL
Genetics	N	US-HI	Y	FR-NC	Y	US-AS	N (n/a)	ALL

Stocks defined by genetic markers	N	US-HI	N (n/a)	ALL	Y	US-AS	N (n/a)	ALL
Remote tracking (satellite or other)	N	US-HI	Y	MH, FR-PF, FR-NC	Y	FR-PF	N (n/a)	ALL
Survival rates	N	US-HI	N (n/a)	ALL	N (n/a)	ALL	N (n/a)	ALL
Population dynamics	N	US-HI	N (n/a)	ALL	N (n/a)	ALL	N (n/a)	ALL
Foraging ecology (diet or isotopes)	N	US-HI	N (n/a)	ALL	N (n/a)	ALL	N (n/a)	ALL
Capture-Mark-Recapture	N	US-HI	Y	VU	N (n/a)	ALL	N (n/a)	ALL
Threats								
Bycatch: presence of small scale / artisanal fisheries?	N	US-HI	Y (PLL, MT)	FJ, NZ, VU, FR-NC	Y (PLL, MT)	FM, NZ, VU	N (n/a)	ALL
Bycatch: presence of industrial fisheries?	LL	US-HI	Y (PLL, DLL, MT, PT, OTH)	FJ, NZ, MH. KI, VU, FR-NC	Y (PLL, DLL, MT, PT, OTH)	KI, FM, MH, NZ, PG, VU, US-P, US-RI, US-AS, US-HI, PW	Y (PLL, OTH)	US-HI, US-P, KI

Bycatch: quantified?	Y (LL)	US-HI	Y (PLL, BT, OTH)	FJ, NZ, MH, VU, FR-NC	Y (OTH)	MH, VU, US-P, US-RI, US-AS, US-HI	Y	US-HI, US-PI
Take. Intentional killing or exploitation of turtles	N	US-HI	Y	FJ, VU, PG	Y	PG, VU, SB	N (n/a)	ALL
Take. Egg poaching	N	US-HI	Y	VU, FR-NC	N (n/a)	ALL	N (n/a)	ALL
Coastal Development. Nesting habitat degradation	N	US-HI	Y	VU, FR-NC	N (n/a)	ALL	N (n/a)	ALL
Coastal Development. Photopollution	N	US-HI	N (n/a)	ALL	N (n/a)	ALL	N (n/a)	ALL
Coastal Development. Boat strikes	N	US-HI	Y	FR-NC	N (n/a)	ALL	N (n/a)	ALL
Egg predation	N	US-HI	Y	FR-NC	N (n/a)	ALL	N (n/a)	ALL
Pollution (debris, chemical)	N	US-HI	Y	NZ, MH, VU	Y	MH, NZ, VU	N (n/a)	ALL
Pathogens	N	US-HI	Y	NZ	Y	NZ	N (n/a)	ALL

Climate change	N	US-HI	Y	TK, MH, VU, FR-NC	Y	MH	N (n/a)	ALL
Foraging habitat degradation	N	US-HI	N (n/a)	ALL	N (n/a)	ALL	N (n/a)	ALL
Other	N	US-HI	Y	VU	Y	VU	N (n/a)	ALL
Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	n/a	US-HI	Y (2006-present)	FR-NC	n/a	ALL	n/a	ALL
Number of index nesting sites	n/a	US-HI	3	FR-NC	n/a	ALL	n/a	ALL
Monitoring at foraging sites (period: range of years)	n/a	US-HI	n/a	ALL	n/a	ALL	n/a	ALL
Conservation								
Protection under national law	Y	US-HI	Y	FJ, NZ, MH, VU, FR-PF, FR-NC, SB	Y	FR-PF, FR-NC, MH, NZ, VU, US-P, US-RI, US-AS,	Y	US-HI, US-P

						US-HI, SB		
Number of protected nesting sites (habitat preservation) (% nests)	n/a	US-HI	0	TK, FJ, MH	0	FR-NC, MH	n/a	ALL
Number of Marine Areas with mitigation of threats	1	US-HI	0-3	TK, MH, FR-PF	0-3	FR-PF, FR-NC, MH, US-P, US-RI, US-HI, PW	1	US-HI, US-P
N of long-term conservation projects (period: range of years)	n/a	US-HI	0->1	TK, MH, FR-NC	0	MH, PW	n/a	ALL
In-situ nest protection (eg cages)	n/a	US-HI	N (n/a)	ALL	N (n/a)	ALL	n/a	ALL
Hatcheries	n/a	US-HI	Y	FR-NC	N (n/a)	ALL	n/a	ALL
Head-starting	n/a	US-HI	Y	FR-NC	N (n/a)	ALL	n/a	ALL

By-catch: fishing gear modifications (eg, TED, circle hooks)	LL - circle hooks	US-HI	LL- circle hooks	FJ, WS, MH	LL - circle hooks	MH, US-HI, US-AS	LL- circle hooks	US-HI
By-catch: onboard best practices	Y	US-HI	Y	FJ, WS, NZ, MH	Y	MH, NZ, US-P, US-RI, US-AS, US-HI	Y	US-HI, US-P
By-catch: spatio-temporal closures/reduction	Y	US-HI	N (n/a)	ALL	Y	US-HI	Y	US-HI
Other	N	US-HI	Y	FR-PF	Y	FR-PF	N (n/a)	ALL

Table 4. Biological data for leatherback and flatback turtles in OCEANIA

	Dermochelys coriacea – Leatherback turtle		*Natator depressor* – Flatback turtle	
RMU	**DC-W PAC**	Country Chapters from which the info is taken	**ND-SW PAC**	Country Chapters from which the info is taken
Occurrence - Countries reporting (see Table 1 for abbreviation list)	**US-P, US-AS, US-GU, US-RI, HI, FM, NZ, KI, PG, VU, FJ, WS, TV, FR-NC, FR-PF, TO, MH, PW, SB**		**PG**	
Nesting sites	Y	FJ, PG, VU, SB	n/a	PG
Pelagic foraging grounds	Y	FM, FR-NC, FR-PF, MH, PG, VU, US-GU, US-AS, KI, HI, NZ, SB	Y	PG
Benthic foraging grounds	Y	VU, US-AS, PW	n/a	PG

Key biological data				
Nests/yr: recent average (range of years)	5-306 (2002-2013)	VU, PG	n/a	PG
Nests/yr: recent order of magnitude	n/a	ALL	n/a	PG
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	1 (2002-2003)-3	VU, SB	n/a	PG
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	4-8	VU, SB	n/a	PG
Nests/yr at "major" sites: recent average (range of years)	36 (2002-2003)	VU	n/a	PG
Nests/yr at "minor" sites: recent average (range of years)	2 (2002-2013)	VU	n/a	PG
Total length of nesting sites (km)	19.6-34.86	PG	n/a	PG

Nesting females / yr	n/a	ALL	n/a	PG
Nests / female season (N)	2-6	SB	n/a	PG
Female remigration interval (yrs) (N)	n/a	ALL	n/a	PG
Sex ratio: Hatchlings (F / Tot) (N)	n/a	ALL	n/a	PG
Sex ratio: Immatures (F / Tot) (N)	n/a	ALL	n/a	PG
Sex ratio: Adults (F / Tot) (N)	n/a	ALL	n/a	PG
Min adult size, CCL or SCL (cm)	90.0 CCL	PG	n/a	PG
Age at maturity (yrs)	25-180	PG	n/a	PG
Clutch size (n eggs) (N)	66 (n=11)	SB	n/a	PG
Emergence success (hatchlings/egg) (N)	42.1 (N=1)	SB	n/a	PG

Nesting success (Nests/ Tot emergence tracks) (N)	n/a	ALL	n/a	PG
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	Decline (VU)	VU	n/a	PG
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	ALL	n/a	PG
Oldest documented abundance: nests/yr (range of years)	Y (1976-1977)	SB	n/a	PG
Published studies			n/a	PG
Growth rates	N (n/a)	ALL	n/a	PG
Genetics	Y	PG, SB	n/a	PG

Stocks defined by genetic markers	Y	PG, SB	n/a	PG
Remote tracking (satellite or other)	Y	SB	n/a	PG
Survival rates	N (n/a)	ALL	n/a	PG
Population dynamics	N (n/a)	ALL	n/a	PG
Foraging ecology (diet or isotopes)	N (n/a)	ALL	n/a	PG
Capture-Mark-Recapture	Y	VU	n/a	PG
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y (SN, MT, PLL)	FM, NZ, VU	n/a	PG
Bycatch: presence of industrial fisheries?	Y (PLL, DLL, MT, SN, FP, PT, OTH)	FM, HI, US-RI, US-GU, US-P, US-AS, MH, FJ, WS, NZ. KI, VU, PG, PW	Y	PG

Bycatch: quantified?	Y (PLL, DN, OTH)	HI, US-RI, US-P, US-AS, MH, FJ , NZ, VU, SB	n/a	PG
Take. Intentional killing or exploitation of turtles	Y	VU, PG	Y	PG
Take. Egg poaching	Y	VU, PG	n/a	PG
Coastal Development. Nesting habitat degradation	Y	VU, PG	n/a	PG
Coastal Development. Photopollution	N (n/a)	ALL	n/a	PG
Coastal Development. Boat strikes	N (n/a)	ALL	n/a	PG
Egg predation	Y	PG, SB	n/a	PG
Pollution (debris, chemical)	Y	MH, VU	n/a	PG
Pathogens	N (n/a)	ALL	n/a	PG

Climate change	Y	MH, VU, PG, SB	n/a	PG
Foraging habitat degradation	N (n/a)	ALL	n/a	PG
Other	Y	VU	n/a	PG
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	Y	SB	n/a	PG
Number of index nesting sites	3	SB	n/a	PG
Monitoring at foraging sites (period: range of years)	n/a	ALL	n/a	PG
				PG
Conservation				PG
Protection under national law	Y	HI, US-RI, US-GU, US-P, US-AS, MH, FJ, NZ, VU, FR-PF,	N	PG

		FR-NC, PG, SB		
Number of protected nesting sites (habitat preservation) (% nests)	0	FJ	n/a	PG
Number of Marine Areas with mitigation of threats	0-3	HI, US-RI, MH, US-P, NZ, FR-PF, FR-NC, PW, SB	n/a	PG
N of long-term conservation projects (period: range of years)	0	US-GU, MH, FR-NC, PW	n/a	PG
In-situ nest protection (eg cages)	Y	SB	n/a	PG
Hatcheries	Y	SB	n/a	PG
Head-starting	N (n/a)	ALL	n/a	PG

By-catch: fishing gear modifications (eg, TED, circle hooks)	LL- circle hooks	HI, US-GU, US-AS, MH, FJ, WS	n/a	PG
By-catch: onboard best practices	Y	HI, US-RI, US-GU, US-P, US-AS, MH, FJ, WS, NZ	n/a	PG
By-catch: spatio-temporal closures/reduction	Y	HI	n/a	PG
Other	Y	FR-PF	n/a	PG

AMERICAN SAMOA

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1 RMU: Green turtle (*Chelonia mydas*) - South Central Pacific

1.1 Distribution, abundance, trends

American Samoa is an unincorporated territory of the United States located in the South Pacific Ocean, southeast of Samoa. American Samoa consists of five main islands and two coral atolls. The largest island is Tutuila, with Ta'u, Ofu and Olosega making up the Manuʻa Islands, and and the two coral atolls, Rose Atoll and Swains Island are also included in the territory. All islands except for Swains Island are part of the Samoan Archipelago. The population primarily located on Tutuila is approximately 55,690. The Manu'a Islands have small permanent populations. Rose Atoll is uninhabitated and designated as a National Wildlife Refuge by the U.S. Fish and Wildlife Service. Swains Island, part of the Tokelau Archipelago, is privately owned and inhabitated by a few plantation workers.

1.1.1 Nesting sites

Rose Atoll

The main nesting site for the South Central Pacific green sea turtles within American Samoa is Rose Atoll which is a Wildlife Refuge co-managed by the American Samoa Department of Marine and Wildlife Resources (DMWR) and the U.S. Fish and Wildlife Service (USFWS). Rose Atoll is remote and located 275 km from the main population center on Tutuila in American Samoa (2,3,4,5,6,7). Historic records suggest this population is small (8) (24-36 females per year) but recent estimates suggest the nesting population may be 10 times this size.

An inter-agency collaborative effort to characterize nesting at Rose Atoll has been conducting annual visits since 2012. The DMWR, NOAA Fisheries/Pacific Islands Fisheries Science Center (PIFSC), and the USFWS are the key collaborators, with assistance from the National Park Service. Annual visits to Rose Atoll are conducted in December where nests and nesting females are counted, and satellite transmitters are applied to nesting green sea turtles. No formal reports presenting and assessing abundance levels have yet been published, however, during the 2013 site visit, 12-28 unique adult females were observed nesting over a 3 day period (9).

PIFSC scientists extrapolated these values to estimate that 72-112 green turtles nested at Rose Atoll over the 2013-2014 nesting season, and that the population size is approximately 216-336 adult females (Tables 1 and 2).

Tutuila

Tuato'o-Bartley et al. (8) interviewed locals to gain an understanding of general historical trends in turtles. From these surveys an estimated 50 adult females (green and hawksbills combined) used nesting beaches at Tutuila in 1990-1991. If this number is accurate, current sighting levels of nesting females would indicate that the population has declined dramatically (10).

A recent survey of nesting beaches on Tutuila identified 15 active nesting beaches with an additional 14 described as having high potential for nesting (11). While only hawksbill turtles have been observed to use these nesting beaches, there is evidence that green turtles nest on Tutuila as well (11) (Tables 1 and 2).

Swains Island

Green turtle nesting is known to occur at Swain's Island, but it has not been quantified (12).

Ofu & Olosega Island

From 2009 to 2013, 3 green sea turtles were observed nesting on Ofu/Olosega Islands (13) (Tables 1 and 2).

1.1.2 Marine areas

Satellite tracking

Craig et al. (2) summarized post-nesting migration patterns for turtles from Rose Atoll based on 7 satellite tagged females and recaptures of flipper tagged females. Six of the seven satellite tagged turtles migrated west to Fiji and the seventh migrated east to French Polynesia.

Recently, satellite transmitters applied to nesting green sea turtles at Rose Atoll have provided information on foraging areas for this nesting population. As of 2014, of 21 turtles with transmitters applied, 14 migrated to Fiji, 3 to Samoa, 1 to New Caledonia, 1 to Papua New Guinea and 1 to the Solomon Islands[14]. During the December 2015 trip, 6 turtles were tagged, 2 migrated to Fiji, 1 to French Polynesia, 1 to Samoa, 2 to New Caledonia[5].

Satellite transmitters were deployed on 1 sub-adult green turtle (11). The turtle did not leave the waters around Tutuila for the duration of the deployment (Table 1).

Mark & Recapture

Craig et al. (2) released 46 flipper tagged post-nesting green turtles at Rose Atoll, three were recovered and all traveled to the west, two to Fiji where they were harvested for food and one was found dead in Vanuatu (Table 1).

16 green turtles were flipper tagged in waters around Tutuila in 2006 (11) (Table 1).

In-water observations, captures, recovered strandings

Between 1995 and 2002, 81 sea turtles were captured or recovered around Tutuila, of which 17 were green sea turtles. 43% of the turtles were caught in fishing gear, include lines, traps, and nets. Most of the turtles were alive, with only 9 of the 81 recovered dead (10) (Table 1).

In-water snorkel surveys were conducted around Tutuila from 2005 to 2008 although only presence/absence was noted. Juvenile and adult green turtles were routinely sighted. In 2008, surveys were conducted around Ofu where juvenile and adult green turtles were sighted (11) (Table 1).

Green turtles were observed in the nearshore waters around Swains Island during a site visit in 2009 (12) (Table 1).

In the pelagic, green turtles interact with the American Samoa Longline fleet, from 2017 to 2019 a total of 12 interactions were observed, which equates to approximately 6837 interactions when percent observer coverage is taken into account (15,24). NMFS anticipates that up to 20 green sea turtles will interact with the American Samoa Longline fleet annually (Table 1).

Becker et al. (23) summarize the results of sea turtle observations from U.S. National Marine Fisheries Service (NMFS) towed-diver surveys throughout the U.S. Pacific Islands. They estimated the annual population growth rate at 0.04 (± 0.136). The abundance of green sea turtles in American Samoa is estimated at 82 and size class distributions are depicted in Fig. 2.

1.2 Other biological data

Dutton et al (16) analyzed genetic samples from green sea turtle rookeries throughout the Pacific Island region, including American Samoa, and the American Samoa rookeries were genetically distinct from other rookeries, including the closest ones sampled at New Caledonia and French Polynesia (Table 1).

Tissue samples were collected from 17 green turtles and send to NOAA/SWFSC for analysis (11).

Genetic samples are taken from excavated nests (17). DMWR maintains a stranding program (17). Dead stranded sea turtles are routinely necropsied, sampled for genetics and abnormalities noted along with cause of death if known.

1.3 Threats

1.3.1 Nesting sites

- Erosion of nests from storm surges (4) (Table 1).
- Potential predation from feral pigs and rats (12) (Table 1).
- Disorientation of hatchlings and adults from light pollution (11,13) (Table 1).

1.3.2. Marine areas

Fishery Interactions

From the strandings data, MacDonald (17) estimates that for approximately 25% of recovered dead sea turtles, cause of death is related to entanglement in debris such as fishing gear (Table 1).

Green and hawksbill sea turtles are known to be caught in artisanal fisheries such as gill nets, small numbers are found in strandings with apparent spear holes in the head (11,15) (Table 1).

In the pelagic, green turtles interact with the American Samoa Longline fleet, from 2011 to 2015 a total of 6 interactions were observed, which equates to approximately 37 interactions when percent observer coverage is taken into account (15). NMFS anticipates that up to 20 green sea turtles will interact with the American Samoa Longline fleet annually (Table 1).

Coastal development/beach hardening

In conjunction with the National Marine Sanctuary of American Samoa, EcoAdapt conducted a rapid vulnerability assessment for American Samoa marine resources (18). One of the conclusions of the assessment was that continued beach armoring can be anticipated with increasing sea levels, and that this would result in nesting beach habitat degradation for sea turtles (Table 1).

Pollution

Toxins from non-point source, land-based sources have been detected in coastal streams at levels known to cause toxicity in aquatic animals (19) (Table 1).

Marine debris, including derelict fishing gear, poses entanglement and drowning hazards for sea turtles (17) (Table 1).

Climate Change

EcoAdapt's rapid vulnerability assessment determined that sea turtles would be sensitive to climate change impacts including sea level rise, increased air temperatures that may change hatchling sex ratio, increased storm severity, and decreased coral reef habitat quality from bleaching and acidification (18) (Table 1).

1.4. Conservation

All of the areas covered in this chapter are part of the U.S. and required to adhere to provisions of the U.S. Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 *et seq*.), which lists all sea turtle species as either threatened or endangered. Green sea turtles in the South Central Pacific RMU are listed as endangered under the ESA. The ESA prohibits unauthorized 'take' of listed species which is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. § 1532(18)). Exceptions to the 'take' prohibition are permitted, on an individual basis, for scientific research or when take is incidental to an otherwise lawful activity such as longline fishing, providing that the level of take will not jeopardize the existence of the species in the wild or appreciably reduce the likelihood of recovery in the wild. Generally, NOAA Fisheries has the lead responsibility for enforcing the ESA in the marine environment while the USFWS has jurisdiction in the terrestrial environment (i.e. nesting beaches and strandings). Both NOAA Fisheries and USFWS have dedicated enforcement divisions to handle violations of the ESA (Table 3).

The waters surrounding Rose Atoll are part of the Rose Atoll Marine National Monument which was established by President George W. Bush in 2009 and is part of the National Marine Sanctuary of American Samoa and co-managed between the American Samoa Government, NOAA, and USFWS. The atoll is a National Wildlife Refuge and managed jointly by DMWR and USFWS; it is uninhabited, and access is by permit only through the USFWS. The USFWS makes regular trips to Rose to monitor resources and control invasives (3,4,5,6,7) (Table 3).

DMWR maintains an active education and outreach program for the conservation of sea turtles in American Samoa.

Local Policies specific to American Samoa that protect sea turtles include:

- American Samoa Administrative Code (Chapter 09 Fishing Title 24 Ecosystem Protection and Development 24.0959 Sea Turtles)
- Executive Order 005-2003

A village with an identified nesting beach was approached for establishing a vegetation barrier to the beach and for light reduction (11). Seedlings for the vegetation barrier were planted in Tula Village in 2008; however, no progress was made with the light reduction.

A Sea Turtle Hotline was implemented in 2007 for emergency responses to strandings and other wildlife emergencies (11).

The American Samoa longline fleet is required to maintain observer coverage of at least 20% of trips in order to characterize bycatch by the fishery. NOAA also promotes the reduction of bycatch through the development and implementation of different gear such as hook shape, and a better understanding of the distribution of turtles and the key environmental characteristic that influence variability in distribution (15).

1.5. Research Priorities

Synthesize movement and genetic information to gain a better understanding of the population structure and connectivity.

As the nesting population at Rose Atoll may be a key nesting site for the RMU, an understanding of the population size and trends is critical.

2. RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central West Pacific

2.1. Distribution, abundance, trends

2.1.1 Nesting sites

Tutuila

Tuato'o-Bartley et al. (8) interviewed locals to gain an understanding of general historical trends in turtles. From these surveys an estimated 50 adult females (green and hawksbills combined) used nesting beaches at Tutuila in 1990-1991. If this number is accurate, current sighting levels of nesting females would indicate that the population has declined dramatically (10) (Tables 1 and 2).

A recent survey of nesting beaches on Tutuila identified 15 active nesting beaches for hawksbill turtles with an additional 14 described as having high potential for nesting (11). Six of these were highlighted in Tagarino et al (11) as active beaches (Tables 1 and 2).

Ofu & Olosega

From 2009 to 2013, 33 hawksbill females were observed nesting on beaches in Ofu and Olosega (13) (Tables 1 and 2).

2.1.2 Marine areas

Satellite tracking

Tagarino (13) satellite tagged 12 juvenile and adult hawksbills from 2006-2011. Turtles were captured in-water or intercepted on nesting beaches on Tutuila and Ofu/Olosega. Three juvenile hawksbills and one juvenile green remained in the nearshore waters of Tutuila, however the largest of the hawksbills (initially measured at 51.5 cm CCL) migrated to the Cook Islands after 17 months. Seven adult females were satellite tagged after nesting, however only five provided useful data. Two of the turtles remained nearshore of Tutuila, one migrated to Samoa, one to Tonga, and one to French Polynesia. In addition, one adult male hawksbill was tagged and remained with in territorial waters before being recovered dead in Pago Pago Harbor (Table 1).

Satellite transmitters were deployed on 3 sub-adult and 2 nesting female hawksbill turtles (11). The 3 sub-adult turtles did not leave the waters around Tutuila for the duration of their tags. For the post-nesting females, one migrated to Samoa and the other towards the Cook Islands (Table 1).

Mark & Recapture

19 hawksbill turtles were flipper tagged in waters around Tutuila in 2006 (11) (Table 1).

Grant et al (20) tagged 36 hawksbills (all but one from Tutuila), subsequently recapturing 5 on 6 occasions. Growth rates from two of the recaptures suggest a mean growth rate of 4.5 cm/yr (Table 1).

One juvenile hawksbill was hand capture from the lagoon at Rose (20) (Table 1).

In-water observations, captures, recovered strandings

One juvenile hawksbill was hand capture from the lagoon at Rose (20) (Table 1).

Between 1995 and 2002, 81 sea turtles were captured or recovered around Tutuila, of which 63 were hawksbill sea turtles. 43% of the turtles were caught in fishing gear, include lines, traps and nets. Most of the turtles were alive, with only 9 of the 81 recovered dead (10) (Table 1).

In-water snorkel surveys were conducted around Tutuila from 2005 to 2008 although only presence/absence was noted. Juvenile and adult Hawksbill turtles were routinely sighted. In 2008, surveys were conducted around Ofu where only one juvenile hawksbill was sighted (11) (Table 1).

In the pelagic, hawksbill turtles interact with the American Samoa Longline fleet, from 2017 to 2019 a total of 2 interactions were observed, both of which occurred in 2018. This equates to approximately 11 interactions when percent observer coverage is taken into account (15,24). NMFS anticipates that up to 14 hawksbill sea turtles may interact with the American Samoa Longline fleet annually (25; Table 1).

Becker et al. (23) summarize the results of sea turtle observations from U.S. National Marine Fisheries Service (NMFS) towed-diver surveys throughout the U.S. Pacific Islands. American Samoa had the highest densities of hawksbill sea turtles within these regions, size class distributions are depicted in Fig. 2.

2.2 Other biological data

Tissue samples collected from 36 hawksbill turtles and sent to NOAA/SWFSC for analysis (11).

Genetic samples taken from excavated nests (17). DMWR maintains a stranding program. Dead stranded sea turtles are routinely necropsied, sampled for genetics and abnormalities noted along with cause of death if known.

2.3 Threats

2.3.1 Nesting sites

- Erosion of nests from storm surges (4) (Table 1).
- Potential predation from feral pigs and rats (12) (Table 1).
- Disorientation of hatchlings and adults from light pollution (11,13) (Table

2.3.2 Marine areas

Fishery Interactions

From the strandings data, MacDonald (17) estimates that for approximately 25% of recovered dead sea turtles, cause of death is related to entanglement in debris such as fishing gear (Table 1).

Hawksbill sea turtles are known to be caught in artisanal fisheries such as gill nets, small numbers are found in strandings with apparent spear holes in the head (11,13) (Table 1).

Coastal development/beach hardening

In conjunction with the National Marine Sanctuary of American Samoa, EcoAdapt conducted a rapid vulnerability assessment for American Samoa marine resources (18). One of the conclusions of the assessment was that continued beach armoring can be anticipated with increasing sea levels, and that this would result in nesting beach habitat degradation for sea turtles (Table 1).

Pollution

Toxins from non-point source, land-based sources have been detected in coastal streams at levels known to cause toxicity in aquatic animals (19) (Table 1).

Climate Change

EcoAdapt's rapid vulnerability assessment determined that sea turtles would be sensitive to climate change impacts including sea level rise, increased air temperatures that may change hatchling sex ratio, increased storm severity, and decreased coral reef habitat quality from bleaching and acidification (18) (Table 1).

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All of the areas covered in this chapter are part of the U.S. and required to adhere to provisions of the U.S. Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 *et seq.*), which lists all sea turtle species as either threatened or endangered. Hawksbill turtles in the West Central Pacific RMU are listed as endangered under the ESA. The ESA prohibits unauthorized 'take' of listed species which is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. § 1532(18)). Exceptions to the 'take' prohibition are permitted, on an individual basis, for scientific research or when take is incidental to an otherwise lawful activity such as longline fishing, providing that the level of take will not jeopardize the existence of the species in the wild or appreciably reduce the likelihood of recovery in the wild. Generally, NOAA Fisheries has the lead responsibility for enforcing the ESA in the marine environment while the USFWS has jurisdiction in the terrestrial environment (i.e. nesting beaches and strandings). Both NOAA Fisheries and USFWS have dedicated enforcement divisions to handle violations of the ESA (Table 3).

The waters surrounding Rose Atoll are part of the Rose Atoll Marine National Monument which was established by President George W. Bush in 2009 and is part of the National Marine Sanctuary of American Samoa and co-managed between the American Samoa Government, NOAA, and USFWS. The atoll is a National Wildlife Refuge and managed jointly by DMWR and USFWS; it is uninhabited, and access is by permit only through the USFWS. The USFWS makes regular trips to Rose to monitor resources and control invasives (3,4,5,6,7) (Table 3).

DMWR maintains an active education and outreach program for the conservation of sea turtles in American Samoa, including school programs, TV interviews and media releases (11).

Local Policies specific to American Samoa that protect sea turtles:

- American Samoa Administrative Code (Chapter 09 Fishing Title 24 Ecosystem Protection and Development 24.0959 Sea Turtles)
- Executive Order 005-2003

A village with an identified nesting beach was approached for establishing a vegetation barrier to the beach and for light reduction (11). Seedlings for the vegetation barrier were planted in Tula Village in 2008; however, no progress was made with the light reduction.

A Sea Turtle Hotline was implemented in 2007 for emergency responses to strandings and other wildlife emergencies (11).

The American Samoa longline fleet is required to maintain observer coverage of at least 20% of trips in order to characterize bycatch by the fishery. NOAA also promotes the reduction of bycatch through the development and implementation of different gear such as hook shape, and a better understanding of the distribution of turtles and the key environmental characteristic that influence variability in distribution (15).

2.5 Research Priorities

Synthesize movement and genetic information to gain a better understanding of the population structure and connectivity.

An understanding of the population size and trends for hawksbills in American Samoa is critical to gaining an understanding of the status of this RMU.

3. RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

There is very little information about leatherback sea turtles in waters around American Samoa. In 1993, a juvenile leatherback (39.3 cm SCL) was recovered dead after being hooked by a longline fishing vessel just south of Swains Island (21) (Table 1).

In the pelagic, leatherback turtles interact with the American Samoa Longline fleet, from 2017 to 2019 a total of 3 interactions were observed, which equates to approximately 17 interactions when percent observer coverage is taken into account (15,24). NMFS anticipates that up to 30 leatherback sea turtles will interact with the American Samoa Longline fleet annually (Table 1).

During in-water surveys around Swains Island a juvenile leatherback was sighted nearshore on the northwest side of the island (12) (Table 1).

3.2 Other biological data

NONE

3.3 Threats

3.3.1 Nesting sites

NONE

3.3.2 Marine areas

The key threat to leatherbacks in American Samoa is bycatch in fisheries, especially the longline fishery (15) (Table 1).

3.4 Conservation

All of the areas covered in this chapter are part of the U.S. and required to adhere to provisions of the U.S. Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 *et seq*.), which lists all sea turtle species as either threatened or endangered. Leatherback sea turtles in the West Pacific RMU are listed as endangered under the ESA. The ESA prohibits unauthorized 'take' of listed species which is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. § 1532(18)). Exceptions to the 'take' prohibition are permitted, on an individual basis, for scientific research or when take is incidental to an otherwise lawful activity such as longline fishing, providing that the level of take will not jeopardize the existence of the species in the wild or appreciably reduce the likelihood of recovery in the wild. Generally, NOAA Fisheries has the lead responsibility for enforcing the ESA in the marine environment while the USFWS has jurisdiction in the terrestrial environment (i.e. nesting beaches and strandings). Both NOAA Fisheries and USFWS have dedicated enforcement divisions to handle violations of the ESA (Table 3).

The American Samoa longline fleet is required to maintain observer coverage of at least 20% of trips in order to characterize bycatch by the fishery. NOAA also promotes the reduction of bycatch through the development and implementation of different gear such as hook shape, and a better understanding of the distribution of turtles and the key environmental characteristic that influence variability in distribution (15).

3.5 Research Priorities

An improved understanding the distribution of all life stages of leatherback sea turtles, and the environmental factors that affect distribution, may provide information that would enable managers to mitigate fishery interactions.

4. RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

Olive ridley sea turtles are rare in American Samoa waters, however given that they are a pelagic species, any observations of them are opportunistic. At least two olive ridleys have been recovered as dead strandings, with an additional observation of a live olive ridley (10) (Table 1).

In the pelagic, olive ridley turtles interact with the American Samoa Longline fleet, from 2017 to 2019 a total of 7 interactions were observed, which equates to approximately 40 interactions when percent observer coverage is taken into account (15,24). NMFS anticipates that up to11 olive ridley sea turtles will interact with the American Samoa Longline fleet annually (Table 1).

4.2 Other biological data

Tissue samples collected from 2 olive ridley turtles and sent to NOAA/SWFSC for analysis (11).

Dead stranded sea turtles are routinely necropsied, sampled for genetics and abnormalities noted along with cause of death if known.

4.3 Threats

4.3.1 Nesting sites

NONE

4.3.2 Marine areas

The key threat to olive ridleys in American Samoa is bycatch in fisheries, especially the longline fishery (15) (Table 1).

4.4 Conservation

All of the areas covered in this chapter are part of the U.S. and required to adhere to provisions of the U.S. Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 *et seq*.), which lists all sea turtle species as either threatened or endangered. Olive ridley sea turtles in the West Pacific RMU are listed as threatened under the ESA. The ESA prohibits unauthorized 'take' of listed species which is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. § 1532(18)). Exceptions to the 'take' prohibition are permitted, on an individual basis, for scientific research or when take is incidental to an otherwise lawful activity such as longline fishing, providing that the level of take will not jeopardize the existence of the species in the wild or appreciably reduce the likelihood of recovery in the wild. Generally, NOAA Fisheries has the lead responsibility for enforcing the ESA in the marine environment while the USFWS has jurisdiction in the terrestrial environment (i.e. nesting beaches and strandings). Both NOAA Fisheries and USFWS have dedicated enforcement divisions to handle violations of the ESA (Table 3).

The American Samoa longline fleet is required to maintain observer coverage of at least 20% of trips in order to characterize bycatch by the fishery. NOAA also promotes the reduction of bycatch through the development and implementation of different gear such as hook shape, and a better understanding of the distribution of turtles and the key environmental characteristic that influence variability in distribution (15).

4.5 Research Priorities

An improved understanding the distribution of all life stages of olive ridley sea turtles, and the environmental factors that affect distribution, may provide information that would enable managers to mitigate fishery interactions.

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in American Samoa

RMU	CM -SC PAC	Ref #	EI - WC Pac	Ref #	LO-W Pac	Ref #	DC-W Pac	Ref #
Occurrence								
Nesting sites	Y	2,13	Y	2,13	n/a	n/a	n/a	n/a
Pelagic foraging grounds	Y	15	Y	15	Y	15	Y	15,21
Benthic foraging grounds	Y	13,20	Y	13,20	n/a	n/a	Y	12
Key biological data								
Nests/yr: recent average (range of years)	0.86/year Ofu 2009-2013	13	9.4 (2009 - 2013)	13	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20	1 (Rose Atoll)	9	0	13	n/a	n/a	n/a	n/a

nests/yr AND >10 nests/km yr)								
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	5 (Ofu/Olosega)	13	5 (Ofu/Olosega); 15 (Tutuila)	11,13	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	72-112	9	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	0.86 (2009-2013)	13	9.4 (2009 - 2013)	13	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	3.6 total, 1.6 surveyed	n/a	3.6 total, 1.6 surveyed	13	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	86.5 CCL	20.00	77.5 CCL	20	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	69 (3)	13	114 (33)	13	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	54 % (3)	13	75 % (33)	13	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	36%	13	n/a	n/a	n/a	n/a
Trends								

Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	0.04 (2002 to 2014)	23	nd	23	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	24 to 36 nests/yr (1991)	8	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	N	n/a	Y	20	N	n/a	N	n/a
Genetics	Y	16	N		Y	11	N	n/a
Stocks defined by genetic markers	Y	16	N	n/a	Y	11	N	n/a
Remote tracking (satellite or other)	Y	2,13	Y	13	N	n/a	N	n/a
Survival rates	N	n/a	N	n/a	N	n/a	N	n/a

Population dynamics	Abundance and size class distribution	23	Abundance and size class distribution	23	N	n/a	N	n/a
Foraging ecology (diet or isotopes)	N	n/a	N	n/a	N	n/a	N	n/a
Capture-Mark-Recapture	Y	20,11	Y	20,13	N	n/a	N	n/a
Threats								
Bycatch: presence of small scale / artisanal fisheries?	Y (SN, OTH (spearfishing))	11,13	Y (SN, OTH (spearfishing))	11,13	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	Y (PLL)	15,24,25	Y (PLL)	15,24,25	Y (PLL)	15,24,25	Y (PLL)	15,24,25
Bycatch: quantified?	Y (PLL)	15	Y (PLL)	15	Y (PLL)	15	Y (PLL)	15
Take. Intentional killing or exploitation of turtles	N	n/a	N	n/a	n/a	n/a	n/a	n/a

Take. Egg illegal harvest	N	n/a	N	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	Y	11	Y	11	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	Y	11	Y	11	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	19	Y	19	n/a	n/a	n/a	n/a
Pathogens	n/a		n/a		n/a	n/a	n/a	n/a
Climate change	Y	18	Y	18	n/a	n/a	n/a	n/a
Foraging habitat degradation	Y	18	Y	18	n/a	n/a	n/a	n/a
Other	N	n/a	N	n/a	N	n/a	N	n/a
Long-term projects (>5yrs)								

Monitoring at nesting sites (period: range of years)	Y (1985-ongoing)	9	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	2	9	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	Y (2002 to 2015)	23	Y (2002 to 2015)	23	n/a	n/a	n/a	n/a
Conservation								
Protection under national law	Y	22	Y	22	Y	22	Y	22
Number of protected nesting sites (habitat preservation) (% nests)	100%	22	100%	22	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	0		2	11	n/a	n/a	n/a	n/a
N of long-term conservation	1	9	1	11	n/a	n/a	n/a	n/a

projects (period: range of years)								
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	N	n/a	N	n/a	n/a	n/a	n/a	n/a
Head-starting	N	n/a	N	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	15	Y	15	Y	15	Y	15
By-catch: onboard best practices	Y	15	Y	15	Y	15	Y	15
By-catch: spatio-temporal closures/reduction	N	n/a	N	n/a	N	n/a	N	n/a
Other	N		N		N		N	

Table 2. Sea Turtle Nesting Beaches in American Samoa

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Length (km)	% Monitored	Reference #
				Long	Lat	Long	Lat			
Green sea turtles – Pacific, South Central										
Rose Atoll	yes	72-112 (2013)	n/a	-168.1718	-14.54026	-168.13950	-14.54844	n/a	n/a	9
Toaga, Ofu	n/a	n/a	n/a	-169.65573	-14.179458	-169.64010	-14.17020	2	n/a	13
Mafafa, Ofu	n/a	n/a	n/a	-169.6417	-14.167475	-169.64398	-14.16781	0.25	n/a	13
Asaga, Ofu	n/a	n/a	n/a	-169.63256	-14.168407	-169.63390	-14.16737	0.185	n/a	13

Vaoto, Ofu	n/a	n/a	n/a	-169.67412	-14.18323	-169.63390	-14.18408	1	n/a	13
Olosega Village, Olosega	n/a	n/a	n/a	-169.61903	-14.183973	-169.61795	-14.18532	0.2	n/a	13
Hawksbill sea turtles, Pacific, West Central										
Maloata, Tutuila	n/a	n/a	n/a	-170.81778	-14.30386	-170.81556	-14.30335	0.3	n/a	11
Sailele, Tutuila	n/a	n/a	n/a	-170.59806	-14.25621	-170.59361	-14.25830	0.52	n/a	11
Amalau, Tutuila	n/a	n/a	n/a	-170.65917	-14.25263	-170.65861	-14.25295	0.08	n/a	11
O'a, Tutuila	n/a	n/a	n/a	-170.64417	-14.25193	-170.64222	-14.25325	0.26	n/a	11

Tula, Tutuila	n/a	n/a	n/a	-170.56472	-14.25056	-170.56194	-14.25806	0.92	n/a	11
Amanave, Tutuila	n/a	n/a	n/a	-170.83306	-14.32466	-170.82917	-14.32756	0.51	n/a	11
Toaga, Ofu	n/a	n/a	n/a	-169.65573	-14.17946	-169.64010	-14.17020	2	100%	13
Mafafa, Ofu	n/a	n/a	n/a	-169.64170	-14.16748	-169.64398	-14.16781	0.25	100%	13
Asaga, Ofu	n/a	n/a	n/a	-169.63256	-14.16841	-169.63390	-14.16737	0.185	100%	13
Vaoto, Ofu	n/a	n/a	n/a	-169.67412	-14.18323	-169.63390	-14.18408	1	100%	13
Olosega Village, Olosega	n/a	n/a	n/a	-169.61903	-14.18397	-169.61795	-14.18532	0.2	100%	13

Table 3. Conventions applicable to green (CM), hawksbill (EI), leatherback (DC) and olive ridley (LO) sea turtles in American Samoa.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
American Samoa						
Secretariat of the Pacific Regional Environment Programme (SPREP)	S	Y	nd	CM, EI, DC, LO	Promotes community awareness of conservation issues	Develops and implements initiatives for sea turtle conservation
Western and Central Pacific Fisheries Commission (WCPFC)	S	Y	Y	CM, EI, DC, LO	Promote the development and use of fishing gear that reduces sea turtle bycatch or post hooking mortality rates	Promote the development and use of fishing gear that reduces sea turtle bycatch or post hooking mortality rates

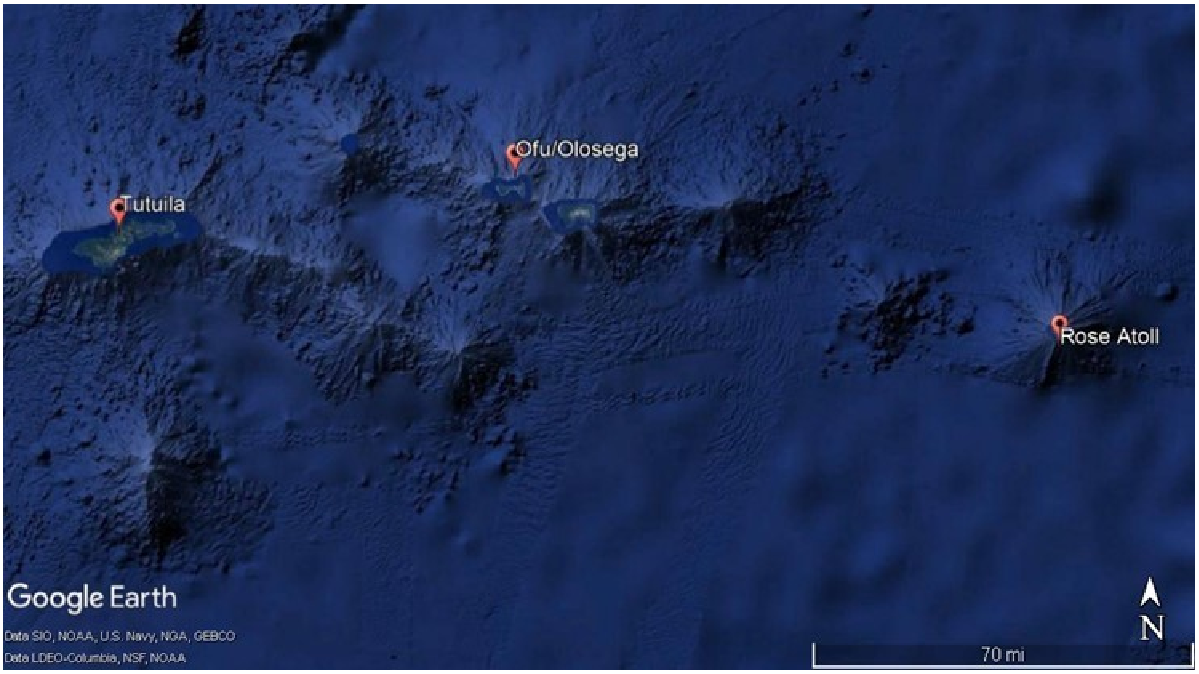
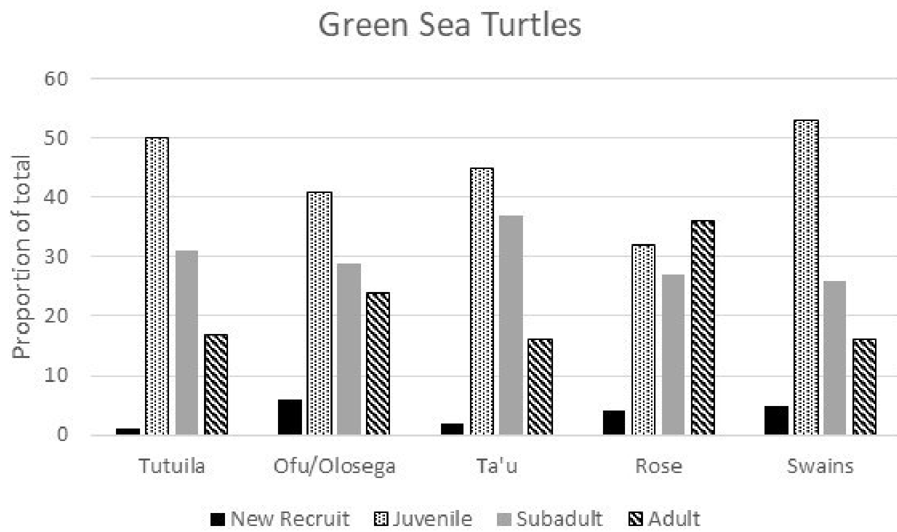


Figure 1. Green sea turtle (*Chelonia mydas*) nesting at Rose Atoll, American Samoa in relation to Tutuila, Ofu and Olosega.



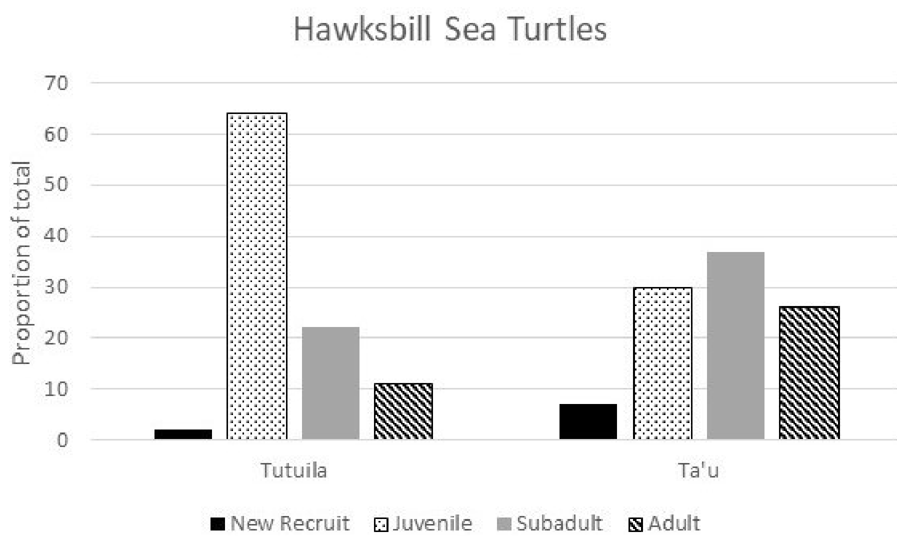


Figure 2. Size class distributions of green and hawksbill sea turtles in waters around the islands and atolls of American Samoa.

Figure 3. Green sea turtle (*Chelonia mydas*) and hawksbill sea turtle (*Eretmochelys imbricata*) nesting at Ofu and Olosega in American Samoa.

Figure 4. Hawksbill sea turtle (*Eretmochelys imbricata*) nesting sites on Tutuila in American Samoa.

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COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS (CNMI)

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1 RMU: Green turtle (*Chelonia mydas*) - Central West Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

This study included five index sites on each island, plus various non-index sites per island (Figure 1). Index sites were selected based on anecdotal reports of nesting activity levels.

On Saipan, index sites included Bird Island, Wing Beach, Tank Beach, Obyan Beach, and LaoLao Bay. Saipan had eleven non-index sites, including Marine Beach, Coral Ocean Point, Ladder Beach, Mañagaha Island, Micro Beach, Boy Scout Beach, Jeffrey's Beach, DanDan Beach, Old Man by the Sea, Pau Pau Beach, and Tuturam Beach. Marine Beach was monitored regularly until 2008, when persistent lack of activity prompted a reduction in survey effort. Tinian's index sites included Dangkolo Beach, Chulu Beach, Leprosarium Beach, Barcinas Cove, and Tachogna Beach; non-index beaches were Kammer, Babui, Chiget, Masålok, LamLam, and Turtle Cove (Swimming Hole). On Rota, index sites included Apanon Beach, Sagua Beach, Teteto Beach, Tatgua Beach, and Mochong Beach; non-index sites were Okgok, Gagani, and Guata beaches.

There was evidence of year-round green turtle nesting in the CNMI (e.g., direct observations of nests, hatchlings, and nesting females), but no evidence of other marine turtle species (e.g., hawksbill turtles) nesting in the area. Peak nesting occurred between March and July (91% of 364 total nests observed on Saipan) with a mean of

6.5 nests per month (sd = 4.5; range = 1-18) during peak months. Based on our observations, nest deposition starts in mid-November of one calendar year and ends late August of the next, with hatchlings emerging into early November. There were 364 nests observed on Saipan throughout the study period with a mean of 36 nests per year (sd = 15; range = 18-64; excludes 2008 due to missing survey effort in peak months), 156 nests on Tinian from 2009 onward (22 nests per year; sd = 15; range = 1-42), and 113 on Rota from 2009 (16 nests per year; sd = 12; range = 4-36) (Table 1). A total of 199 non-nesting emergences (NNEs) were observed on Saipan (22 NNEs per year; sd = 16; range = 2-48), 47 on Tinian (8 NNEs per year; sd = 6; range = 1-14), and 31 on Rota (6 NNEs per year; sd = 3; range = 4-11) (Table 1). Numbers for Tinian and Rota are likely biased low compared to Saipan due to lower levels of survey effort. For example, in years with frequent or intense tropical storms/typhoons we found little to no evidence of nesting on Tinian or Rota, as most signs of nesting had been inundated by high water by the time beaches were surveyed. Nester abundance is addressed in the section below. We measured and tagged a total of 39 nesters on Saipan (n = 34), Tinian (n = 3), and Rota (n = 2). Mean SCL was 95.6 cm (sd = 4.5; range = 81.0 – 103.6 cm; n = 39), mean SCW was 75.0 cm (sd = 4.6; range = 59.2 – 85.0; n = 29), mean CCL was 102.2 cm (sd = 4.7; range = 87.1 – 111.3; n = 38), and mean CCW was 92.5 cm (sd = 4.9; range = 76.7 – 103.2; n = 38). Ten nesters were recaptured on Saipan between March 2010 and July 2016 (initial SCL: mean = 95.6; sd = 2.6; range = 91.2 – 99.8) and exhibited a mean absolute growth rate of 0.26 cm/yr (sd = 0.22; range = 0 – 0.67).

Over 11 years, we recorded a total of 78 nesters on Saipan (8 nesters per year; sd = 3; range = 4-12), 25 nesters on Tinian (3 nesters per year; sd = 2; range =1-6), and 14 nesters on Rota (3 nesters per year; sd = 1; range = 1-5) (Table 1). Similar to the numbers of nests and non-nesting emergences, nester abundance estimates for Tinian and Rota are likely biased low due to the relative infrequency of survey effort. Illegal harvesters removed 25 females from Saipan (32%) and at least 3 from Tinian (12%); no illegal harvest of nesters was documented on Rota (Table 1). Attempts to illegally harvest at least 2 additional nesters from Saipan and 1 from Tinian were thwarted (Table 1). The annual number of neophyte nesters (previously untagged) ranged from 40% to 100%, with an overall average 69.2% across all years and 59.1% for 2010-2016 only, after one remigration interval to pass. The estimated PGR for Saipan's nesting population was 7.4% per year when factoring in observed levels of illegal harvest for 2006-2016 ($p = 0.019$; $R2 = 0.52$) (Figure 2). Adding the illegally harvested nesters back to the population at the average remigration interval of 4.6 years led to an increased PGR of 11.4% ($p = 0.001$; $R2 = 0.74$) (Figure 2). The difference of 4.0% in

PGR between these two estimates represents the negative impact illegal harvest has had on this recovering population (Figure 2).

1.1.2 Marine areas

This study characterizes the size class distribution, growth rates, habitat use, behavior, diet, and site fidelity of foraging aggregations of green and hawksbill turtles in near-shore habitats of Saipan, Tinian, and Rota in the Commonwealth of the Northern Mariana Islands (CNMI). Between August 2006 and February 2014, we captured 642 turtles (493 green and 36 hawksbill turtles). Straight carapace length (SCL) ranged from 32.5 to 91.6 cm, with juveniles comprising the majority of captures (mean SCL = 50.7 cm). Four of the green turtles were adults (SCL ≥ 81 cm) with SCLs of 84.2 to 91.6 cm. All 36 hawksbill turtles were juveniles (SCL < 78.6 cm). Most captures occurred in coral habitats where turtles were foraging and resting. Diet samples from 47 green turtles included Amansia sp., Gelidiella sp., Hypnea sp., and Ceramium sp. Green turtle growth rates ranged from 0.3 to 7.8 cm yr-1. Estimated mean residency time was 17 years. Size distributions of captured green and hawksbill turtles suggest the near-shore waters of the CNMI provide developmental and foraging habitat for these species. The results of this mark-recapture study also corroborate findings from previous towed-diver surveys around Saipan, Tinian, and Rota, where juvenile turtles dominated observations (Kolinski et al. 2001, 2004, 2006). Shallow lagoon and barrier/patch reef systems are encountered most often along leeward sides of Saipan (with the exception of Lao Lao Bay), Tinian, and Rota and provide suitable developmental habitat for juveniles.

Abundance indexes not currently available.

1.2 Other biological data

See additional Tables.

1.3 Threats

1.3.1 Nesting sites

Our results suggest that illegal harvest is the most serious threat to this nesting population, potentially posing an imminent risk of extirpation. The 32% harvest rate of the average 8 nesters/yr on Saipan is alarming, especially because without the monitoring efforts in this study, it would certainly be higher, possibly 100% based on historical practices and cultural use of green turtles on Saipan. Without consistent monitoring research, which often prevents and interrupts illegal harvest on Saipan and triggers enforcement efforts, it is feasible that illegal harvesters could eliminate the population within one generation (20-40 years). Although we document other anthropogenic threats, adult females have a high reproductive value when compared to eggs and hatchlings, and thus their loss has the greatest impact to the population. For example, beach driving is one threat that impacts nests, hatchlings, and adults. The threat has largely been eliminated through beach barricades and a "walk it, don't drive it" campaign let by the CNMI Bureau of Environmental and Coastal Quality; however, on a few non-barricaded nesting beaches on Tinian and Rota and on Saipan beaches where barricades have been removed or recently washed away by super typhoons, there remains a "drive in" illegal harvest opportunity to exploit nesting turtles. Egg illegal harvest accounted for the loss or partial loss of at least 30 nests on Saipan (8% of 364 total nests), 6 nests on Tinian (4% of 156 total nests), and 2 nests on Rota (2% of 113 total nests). Direct take of a hatchling was also documented when a juvenile green turtle (CCL = 17.5 cm) was surrendered to wildlife enforcement by a Saipan resident in March 2008. The turtle had been taken from a Saipan beach and raised as a family pet from hatchling size. These egg and hatchling illegal harvest observations should be interpreted as minimum values. Nest excavations revealed low levels of egg predation. Crabs depredated 5% of nests (14 on Saipan, 3 on Rota, 1 on Tinian), destroying an average of 3 eggs per nest (sd = 3; range = 0-13). Ants impacted 3% of nests (6 on Saipan, 4 on Tinian), consuming 16 eggs on average (sd = 32; range = 0-94). Monitor lizards depredated 2% of nests (8 on Rota), devouring an average of 17 eggs per nest (sd = 22; range = 0-57). One percent of nests (2 on Saipan, 2 on Rota) showed evidence of egg predation by an unknown source, with 4 eggs lost per nest (sd = 6; range = 1-13). Inundation and accompanying erosion from tropical storms, typhoons, and storm-water drainage impacted 9% of nests excavated on Saipan (26 of 291), resulting in decreased average emergence success of 37% (sd = 34%; range = 0-96%). The impacted nests were found on several beaches (23% on Wing Beach, 19% on Obyan Beach, 15% each on Bird Island, Tank Beach, and LaoLao Bay, and 4% each on Boy Scout Beach, Marine Beach, and Old Man by the Sea). Inundation of excavated nests was not characterized on Tinian and Rota. Nests that were completely washed out by storms comprised 2% of nests observed on Saipan (7 of 364), 3% on Rota (3 of 113), and 8% on Tinian (13 of 156), as documented through the diurnal surveys. These numbers represent a minimum number of nests that were completely destroyed by storms, leaving no opportunity for excavation. On Saipan, we observed hatchlings trapped inside the nest under introduced vegetation (i.e., Leucaena leucocephala, Cassytha filiformis, Casuarina equisetifolia, and Cynodon nlemfuensis) or coral rubble in 10% of excavated nests (30 of 291 nests). This problem affected an average of 26 hatchlings per nest (sd = 24; range = 1-101) or 28% of the clutch (sd = 23%; range = 1-92%). Emergence success for these nests was 53% (sd = 26%; range 3-90%). Frequency of occurrence was higher on particular beaches (37% of the impacted nests were on Bird Island, 30% on Tank Beach, 20% on Obyan Beach, 10% on Wing Beach, and 3% on Ladder Beach). Entrapment observations were not typically possible on Tinian or Rota due to the lower survey frequency, but there was one documented case of entrapped hatchlings on Tinian (Chulu Beach). Coral rubble, rocky substrate, and roots also impacted nesters by impeding their excavation of egg chambers. Abandoned egg chambers accounted for 29% of NNEs on Saipan (58 of 199 NNEs), 40% on Tinian (19 of 47 NNEs), and 32% on Rota (10 of 31 NNEs). Two extreme cases were observed on Babui Beach, Tinian and Obyan Beach, Saipan where seven and eleven abandoned egg chambers (respectively) were documented within a single crawl each. Human disturbance of nesters was observed in association with several activities, including camping, building bonfires, driving on the beach, using flashlights, and fishing nearshore with submersible lights. At least one type of disturbance was recorded during 8% of nocturnal surveys on Saipan (40 of 485 total surveys). Typically, these disturbances prevented nesters from emerging on their expected return dates and caused them to nest after the activity was no longer a threat or to nest on adjacent (smaller) pocket beaches with sub-optimal habitat. On a few occasions, a nester was disturbed on the beach or could not find suitable habitat during nesting attempts (i.e., impedance by rocks or roots) and switched to a different nesting beach within a season. Most nesters, however, demonstrated strong site fidelity to a single nesting beach.

Our finding that the average nest temperature of green turtles in the CNMI is 30.9°C is concerning when compared to known pivotal temperatures for sex determination and embryonic death. This average is above 29.0°C, the threshold beyond which a clutch becomes female biased (Standora and Spotila 1985, Mrosovsky 1994, Ackerman 1997, Godfrey and Mrosovsky 2006). Furthermore, it is above 30.3°C, a temperature which produces a minimum of 90% females in green turtle nests (Standora and Spotila 1985, Spotila et al. 1987). Our results provide strong evidence that the current generation of green turtles produced in the CNMI is already female-biased. This idea could be tested by determining sex for a sample of juvenile turtles on their foraging grounds (Allen et al. 2015). And while the expected female bias could boost the nesting population initially, this could become a problem if there are eventually too few males to sustain the breeding population (Layton 2011). The average nest temperature of 30.9°C for CNMI green turtle nests currently falls below the pivotal threshold of 33.0°C for embryonic death (Packard et al. 1977, Miller 1985). However, the average maximum temperature of 33.5°C across all nests in this study creates cause for concern and further investigation. Generally, it is the prolonged exposure to temperatures above 33.0°C that leads to increased hatchling mortality, but the exact critical temperature and exposure time needed to induce mortality in the CNMI is unknown. Projected increases in temperatures could lead to higher rates of embryonic death in the near future. Our modeling results suggest a decrease in hatching success and corresponding increase in embryonic death beyond a maximum nest temperature of 34°C. Additionally, embryonic death appears to be triggered beyond a mean nest temperature of 31°C, which is only slightly higher than the mean nest temperature we measured. Warm temperatures resulting in embryonic death likely played a role in bringing the hatching success down from 100% to 77.9%. With rising global temperatures leading to rising sand temperatures, we can expect the hatching success of CNMI green turtle nests to continue declining. This negative population impact may potentially offset recovery gains from the increase in nesting females.

1.3.2 Marine areas

More than a decade (April 2005 to September 2016) of salvage and stranding recoveries (live and dead turtles) are summarized for the islands of Saipan and Tinian, Commonwealth of the Northern Mariana Islands (CNMI) which provide insight into patterns of anthropogenic-derived sea turtle injury and mortality. Gross external examination and necropsy of dead turtles was used to infer stranding causes. Eighty-nine stranded turtles were recovered, 92% were green, 6% were hawksbill, 1% were olive ridley, and 1% unknown; of these recoveries 80% were juveniles, 16% were adults, and 4% were unknown. Trauma related to illegal harvest was the primary cause of stranding and accounted for 79% of CNMI sea turtle injuries and mortalities. The remaining 21% of stranding causes were attributed to: marine debris entanglement, shark bite, boat strike, emaciation, and infectious disease. Incidents of sea turtle injury and mortality were concentrated within a two-kilometer (km) radius of boat ramps or leeward and lagoon/bay protected beach accesses. We also present nesting green turtle harvest rates for Saipan for the period of April 2006 to September 2016. Twenty-five out of 78 total nesting females were illegally harvested; resulting in the removal of 1/3 of the reproductive females from the Saipan nesting population within the past decade. Most nesters were removed from beaches with easy vehicle and pedestrian access and those located within a two km radius to village centers. This study provides the first comprehensive characterization of cause-specific sea turtle injury and mortality in the CNMI, and concludes persistent human exploitation is the single most significant threat to the population. Key management recommendations demand intensive outreach, amplified enforcement and prosecution efforts, and continued research and monitoring.

1.4 Conservation

All sea turtle species occurring in U.S. territorial waters of the Western Pacific region are protected under the U.S. Endangered Species Act (ESA).

Government: CNMI Department of Lands & Natural Resources Sea Turtle Program; CNMI Division of Fish & Wildlife Enforcement Section; NGO: Micronesia Islands Nature Alliance (MINA)

Adult Nesting Population: In the short term, conservation efforts to address the illegal harvest issue are the most imperative. Secondarily, efforts could be directed toward (i) removing non-native vegetation on nesting beaches to aid in hatchling emergence, (ii) reducing illegal harvest of eggs from nests, and (iii) reducing human disturbance on beaches (e.g., bonfires and fishing lights) during nesting season. In the longer term, feminization of the population and high rates of embryonic death will likely become a conservation concern, and it could benefit managers to consider those impacts in recovery planning.

Juvenile Foraging Population: CNMI green turtles may remain resident for 17 years (13-24 years; 95% confidence) and local populations of both species are juvenile dominated with high site fidelity, which could lead to repeated exposure to anthropogenic threats. Unfortunately, populations with delayed maturation and long residency times could take many years to recover, despite complete protection (Seminoff et al. 2003). However, within the Mariana Archipelago there is evidence for potential recovery of once-exploited sea turtle populations given adequate protections and enforcement, with localized increases observed on Guam (Martin et al. 2016). While diurnal enforcement and youth education efforts have been prevalent in the CNMI since 2006, future efforts should focus on nocturnal/holiday enforcement patrols and long-term conservation outreach strategies which target adult communities in local villages.

1.5 Research

Abundance index for foraging juvenile population

Satellite telemetry data for nesting female migratory corridors and foraging juveniles currently in draft manuscript format and/or pending writing once final telemetry results are compiled.

CNMI nesting and threats manuscripts currently in review & pending publication.

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in the Commonwealth of the Northern Marianas Islands.

	CM-WC PAC	Ref #	**EI-WC PAC**	Ref #
Occurrence				
Nesting sites	Y	1, 4, 5, 6, 12	N	1
Pelagic foraging grounds	n/a	n/a	n/a	
Benthic foraging grounds	J	2, 3, 5, 6, 10, 11, 12	J	2, 3, 5
Key biological data				
Nests/yr: recent average (range of years)	74 (2006-2016) Saipan, Tinian, & Rota	1	0 (2006-2016)	1
Nests/yr: recent order of magnitude	49-119	1	0 (2006-2016)	1
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	0	1	n/a	1

Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	3	1	n/a	1
Nests/yr at "major" sites: recent average (range of years)	0	1	n/a	1
Nests/yr at "minor" sites: recent average (range of years)	36 nests per year 2006-2016 (Saipan), 22 nests per year 2009-2016 (Tinian), 16 nests per year 2009-2016 (Rota)	1	n/a	1
Total length of nesting sites (km)	15.53	table 2	n/a	1
Nesting females / yr	10-20 females/yr	1	n/a	1
Nests / female season (N)	7 (28)	1	n/a	1
Female remigration interval (yrs) (N)	1.9-5.9 years (10); mean 4.6 yrs	1	n/a	1
Sex ratio: Hatchlings (F / Tot) (N)	F (89 nests)	1	n/a	1

Sex ratio: Immatures (F / Tot) (N)	n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a	
Min adult size, CCL or SCL (cm)	81.0 (cm SCL)	1	n/a	1
Age at maturity (yrs)	17 (range 13-24)	2	n/a	1
Clutch size (n eggs) (N)	93 (396)	1	n/a	1
Emergence success (hatchlings/egg) (N)	77.9 % (396)	1	n/a	1
Nesting success (Nests/ Tot emergence tracks) (N)	.7 (910)	1	n/a	1
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	annual population growth rate down from 11.4% to 7.4% due to 32% of nesters illegally harvested	1	n/a	1

	(Saipan only; 2006-2016)			
Recent trends (last 20 yrs) at foraging grounds (range of years)	493 captures (Aug 2006- Feb 2014)	2	36 captures (Aug 2006- Feb 2014)	2
Oldest documented abundance: nests/yr (range of years)	24 nests/yr (1995 - Tinian only) 6 nesters tagged; 2 illegally harvested	6	0	6
Published studies				
Growth rates	Y	1, 2	Y	2
Genetics	Y	7, 8	N	n/a
Stocks defined by genetic markers	Y	7, 8	N	n/a
Remote tracking (satellite or other)	Y	4, 20, 21	Y	20, 21

Survival rates	N	n/a	N	n/a
Population dynamics	Y	1, 2, 9, 11, 12	Y	1, 2
Foraging ecology (diet or isotopes)	Y	2, 9, 10, 11, 12	Y	2
Capture-Mark-Recapture	Y	1, 2, 4, 6, 20, 21	Y	2
Threats				
Bycatch: presence of small scale / artisanal fisheries?	N	n/a	N	n/a
Bycatch: presence of industrial fisheries?	N	n/a	N	n/a
Bycatch: quantified?	N	n/a	N	n/a
Take. Intentional killing or exploitation of turtles	Y	1, 5	Y	5
Take. Egg illegal harvest	Y	1	N	n/a
Coastal Development. Nesting habitat degradation	Y	18	N	n/a

Coastal Development. Photopollution (bonfires, submersible fishermen lights, etc)	Y	1	N	n/a
Coastal Development. Boat strikes	Y	5	N	n/a
Egg predation	Y	1	N	n/a
Pollution (debris, chemical)	Y	5	Y	5
Pathogens	Y	5	N	n/a
Climate change	Y	1	N	n/a
Foraging habitat degradation	Y	2	Y	2
Other (non-native vegetation, inundation & erosion from typhoons, etc.)	Y	1, 5	N	n/a
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	Y (2006-ongoing)	1	Y (2006-ongoing)	1
Number of index nesting sites	5	1	5	1
Monitoring at foraging sites (period: range of years)	Y (2006-ongoing)	2	Y (2006-ongoing)	2
Conservation				

Protection under national law	Y	8, 14, 15	Y	13, 15
Number of protected nesting sites (habitat preservation) (% nests)	0		0	
Number of Marine Areas with mitigation of threats	7	16	7	16
N of long-term conservation projects (period: range of years)	1 (1999-ongoing)	17	1 (1999-ongoing)	17
In-situ nest protection (eg cages)	N	n/a	N	n/a
Hatcheries	N	n/a	N	n/a
Head-starting	N	n/a	N	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	N	n/a	N	n/a
By-catch: onboard best practices	N	n/a	N	n/a
By-catch: spatio-temporal closures/reduction	N	n/a	N	n/a
Other				

Table 2. Sea Turtle Nesting Beaches in the Commonwealth of the Northern Marianas Islands.

RMU / Nesting beach name	Index site	Nests /yr: recent average (range of years)	Crawls /yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitor	Ref #	Monitor Level (1-2)	Monitor Protocol(A-F)
CM-WC PAC														
Tank Beach, Saipan	Y	11.45 (2006-2016)	8.63 (2006-2016)	15.17659	145.785	15.172	145.7883	15.174783	145.785774	0.45	100	1	1	B
Obyan Beach, Saipan	Y	6.1 (2006-2016)	3.18 (2006-2016)	15.10643	145.733	15.105	145.7409	15.106115	145.737199	0.88	100	1	1	B
Bird Island, Saipan	Y	5.81 (2006-2016)	2.81 (2006-2016)	15.26007	145.8134	15.261	145.8157	15.260861	145.814522	0.28	100	1	1	B
LaoLao Bay, Saipan	Y	2.36 (2006-2016)	0.81 (2006-2016)	15.15951	145.7503	15.163	145.7659	15.161938	145.757802	0.70	100	1	1	B

Wing beach, Saipan	Y	5.18 (2006-2016)	1.54 (2006-2016)	15.26791	145.7877	15.272	145.7932	15.270325	145.790065	0.78	100	1	1	B
Marine Beach, Saipan	N	3.5 (2016-2017)	2 (2016-2017)	15.18501	145.7804	15.183	145.7816	15.183946	145.78099	0.26	100	1	2	D
Coral Ocean Point, Saipan	N	2.5 (2006, 2011)	0 (2006, 2011)	15.11531	145.701	15.111	145.7065	15.113164	145.703818	0.80	100	1	2	D
Ladder Beach, Saipan	N	8 (2013)	2 (2013)	15.10788	145.7162	15.108	145.7172	15.107965	145.716662	0.11	100	1	2	D
Managaha Island, Saipan	N	4 (2014)	3 (2014)	15.24067	145.7116	15.24	145.7132	15.240169	145.712356	0.21	100	1	2	D
Micro Beach, Saipan	N	2 (2016)	1 (2016)	15.21268	145.7154	15.219	145.7171	15.216146	145.715798	0.78	100	1	2	D
Boy Scout Beach, Saipan	N	3 (2009, 2015)	1 (2009, 2015)	15.10048	145.7448	15.099	145.7454	15.099748	145.745189	0.17	100	1	2	D

Jeffrey's Beach, Saipan	N	0 (2013)	0 (2013)	15.21561	145.7809	15.216	145.7814	15.215821	145.781287	0.07	100	1	2	D
DanDan Beach, Saipan	N	3 (2016)	3 (2016)	15.12542	145.7482	15.125	145.7483	15.125342	145.748184	0.10	100	1	2	D
Old Man by the Sea Beach, Saipan	N	2 (2009)	0 (2009)	15.20957	145.7782	15.21	145.7784	15.209892	145.778231	0.05	100	1	2	D
Pau Pau Beach, Saipan	N	0 (2009, 2016)	0 (2009, 2016)	15.25039	145.7703	15.258	145.7818	15.252343	145.77611	1.52	100	1	2	D
Tuturam Beach, Saipan	N	n/a**	n/a**	15.13777	145.741	15.134	145.7424	15.135696	145.741884	0.27	100	1	2	D
Dangkolo Beach, Tinian	Y	9.5 (2009, 2011-2013, 2015-2016)	2.67 (2009, 2011-2013, 2015-2016)	15.04333	145.6471	15.033	145.6488	15.037757	145.64762	1.11	100	1	2	D

Chulu Beach, Tinian	Y	4.33 (2009, 2012-2016)	0.83 (2009, 2012-2016)	15.07121	145.6151	15.072	145.6159	15.071566	145.615536	0.12	100	1	2	D
Leprosarium Beach, Tinian	Y	6.75 (2009, 2013-2015)	2 (2009, 2013-2015)	14.98528	145.6098	14.982	145.613	14.983104	145.611713	0.31	100	1	2	D
Barcinas Cove Beach, Tinian	Y	1.5 (2009, 2015)	1 (2015)	14.99198	145.6006	14.992	145.6012	14.991984	145.600922	0.06	100	1	2	D
Tachogna Beach, Tinian	Y	3 (2009)	0 (2009)	14.95607	145.6305	14.952	145.6318	14.954244	145.631122	0.53	100	1	2	D
Kammer Beach, Tinian	N	0 (2010, 2013)	0 (2010, 2013)	14.96572	145.6238	14.963	145.6269	14.965058	145.625369	0.44	100	1	2	D
Babui Beach, Tinian	N	4 (2012-2013, 2015-2016)	1.5 (2012-2013, 2015-2016)	15.07712	145.6202	15.079	145.6228	15.078056	145.621382	0.08	100	1	2	D

Chiget Beach, Tinian	N	0 (2014-2016)	0 (2014-2016)	15.0611	145.655	15.061	145.6552	15.061133	145.655077	0.02	100	1	2	D
Masalok Beach, Tinian	N	5.5 (2012-2013, 2015-2016)	2.5 (2012-2013, 2015-2016)	15.02027	145.6557	15.02	145.6565	15.019838	145.65598	0.07	100	1	2	D
LamLam Beach, Tinian	N	0 (2012-2016)	0.4 (2012-2016)	15.08733	145.6327	15.087	145.6328	15.087375	145.632752	0.01	100	1	2	D
Turtle Cove (Swimming Hole) Beach, Tinian	N	0.5 (2013, 2015)	0 (2013, 2015)	14.98767	145.6092	14.988	145.6092	14.987774	145.609176	0.02	100	1	2	D
Apanon Beach, Rota	Y	8.38 (2009-2016)	2.38 (2009-2016)	14.11504	145.1916	14.115	145.1958	14.115166	145.193685	0.45	100	1	2	D
Sagua Beach, Rota	Y	1.5 (2009-2016)	0.25 (2009-2016)	14.13103	145.1632	14.131	145.1638	14.130967	145.163494	0.08	100	1	2	D

Teteto Beach, Rota	Y	1.25 (2009-2016)	0.38 (2009-2016)	14.17178	145.1879	14.174	145.1915	14.172671	145.189699	0.45	100	1	2	D
Tatgua Beach, Rota	Y	1.25 (2009-2016)	0.38 (2009-2016)	14.17562	145.2003	14.177	145.2042	14.176708	145.202727	0.46	100	1	2	D
Mochong Beach, Rota	Y	0.75 (2009-2016)	0 (2009-2016)	14.19689	145.234	14.197	145.2661	14.19991	145.249708	3.59	100	1	2	D
Okgok Beach, Rota	N	8 (2013)	3 (2013)	14.11625	145.1845	14.116	145.1855	14.116247	145.185017	0.11	100	1	2	D
Gagani Beach, Rota	N	n/a**	n/a**	14.11858	145.1695	14.117	145.1695	14.118061	145.169432	0.13	100	1	2	D
Guata Beach, Rota	N	0 (2009, 2014-2015)	0.33 (2009, 2014-2015)	14.17393	145.1961	14.174	145.1966	14.173966	145.196462	0.06	100	1	2	D

Table 3. Conventions and Treaties signed by the Commonwealth of the Northern Marianas Islands.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Y	Y	n/a	ALL		Trade (import/export) in any sea turtle products or meat between CNMI (US Territory) and other Micronesian islands or countries is illegal.

Table 4. Projects and Databases for the Commonwealth of the Northern Marianas Islands

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private
T4.1	CM-WCPAC	CNMI	Central Western Pacific	Northern Mariana Islands In-water Capture/Turtle Nesting Season FY 2006-2016	Inwater, nesting, Northern Mariana Islands	2006	2016	Secretariat of the Pacific Regional Environment Programme	Public
T4.2	CM-WCPAC	CNMI	Central Western Pacific	CNMI Sea Turtle Program satellite tacked green turtles 2011	Pacific Islands, Northern Mariana Islands, *Chelonia mydas*	2011	2011	State of the World's Sea Turtles (SWOT)!	Public

T4.3	CM-WCPAC	CNMI	Central Western Pacific	Sea turtle tagging in the Mariana Islands training and testing (MITT) study area	Tracking; Fastloc GPS tag; Splash tag; Guam, Tinian, Saipan	2013	2017	NOAA Pacific Islands Fisheries Science Center	Public

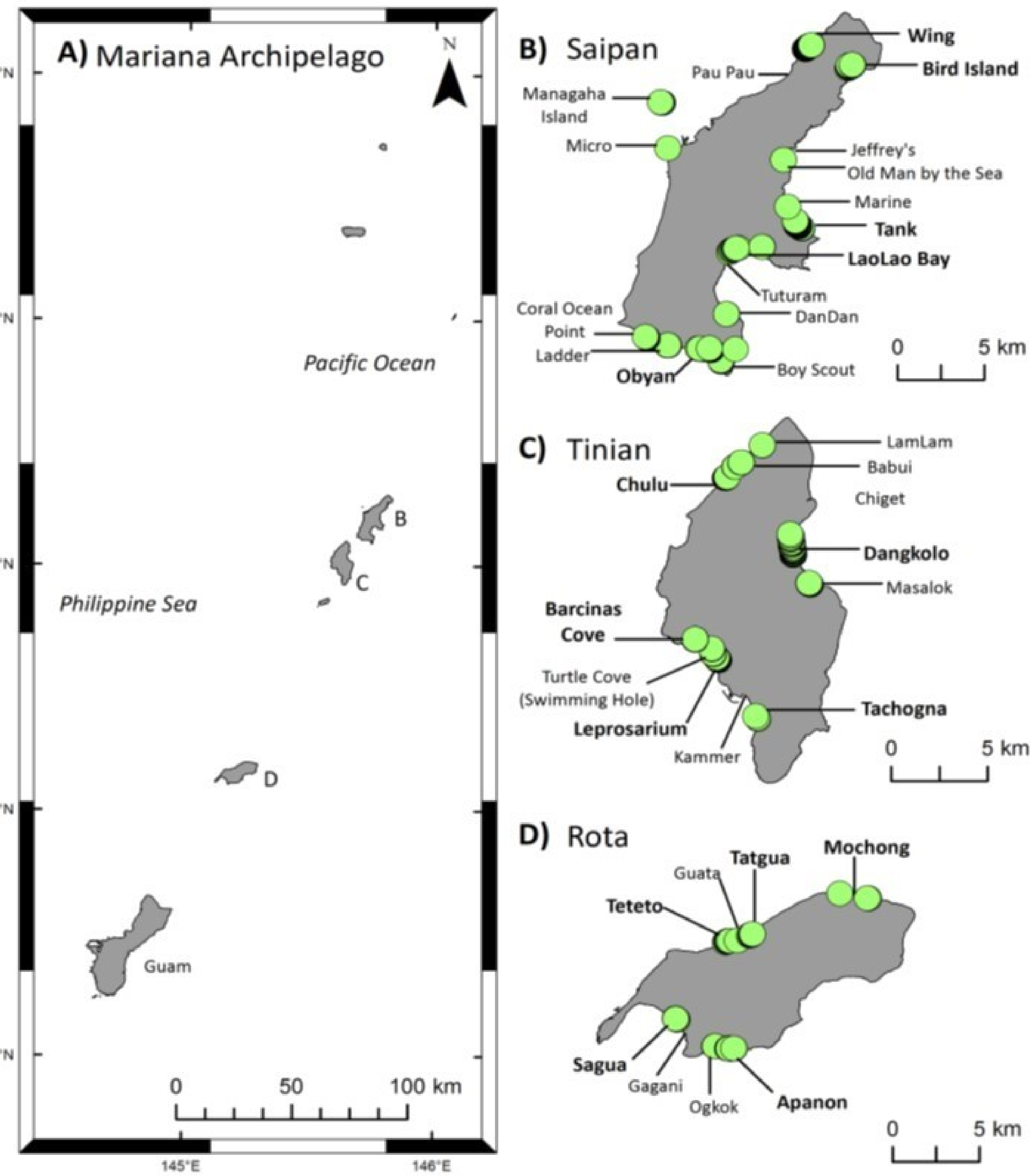
Table 4. continued.

Collaboration with	Reports / Information material	Current Sponsors	Primary Contact (name and Email)	Other Contacts (name and Email)
SPREP, CNMI DLNR/DFW	https://www.sprep.org/thetreds http://www.sprep.org/	SPREP	sprep@sprep.org	tammymaesummers@yahoo.com
SWOT, CNMI DLNR/DFW	http://seamap.env.duke.edu/swot	SWOT & OBIS-SEAMAP	http://www.seaturtlestatus.org	tammymaesummers@yahoo.com
NOAA/PIFSC, NAVY/NAVFAC MAR, Guam DAWR, CNMI DLNR	PIFSC Data Report DR-17-025; Reef-dwelling turtles of the Mariana Archipelago: Fine-scale habitat use revealed by in-water surveys and GPS telemetry (Draft manuscript & 38th Annual Sea Turtle symposium poster presentation)	NOAA/PIFSC & Navy/NAVFAC MAR: Interagency Agreement NMFS-PIC-16-008	Dr. T.Todd Jones, todd.jones@noaa.gov	Dr. Summer Martin, summer.martin@noaa.gov

Database available	Name of Database	Names of sites included (matching Table B, if appropriate)	Beginning of the time series	End of the time series	Track information	Nest information	Flipper tagging	Tags in STTI-ACCSTR?	PIT tagging	Remote tracking	Ref #

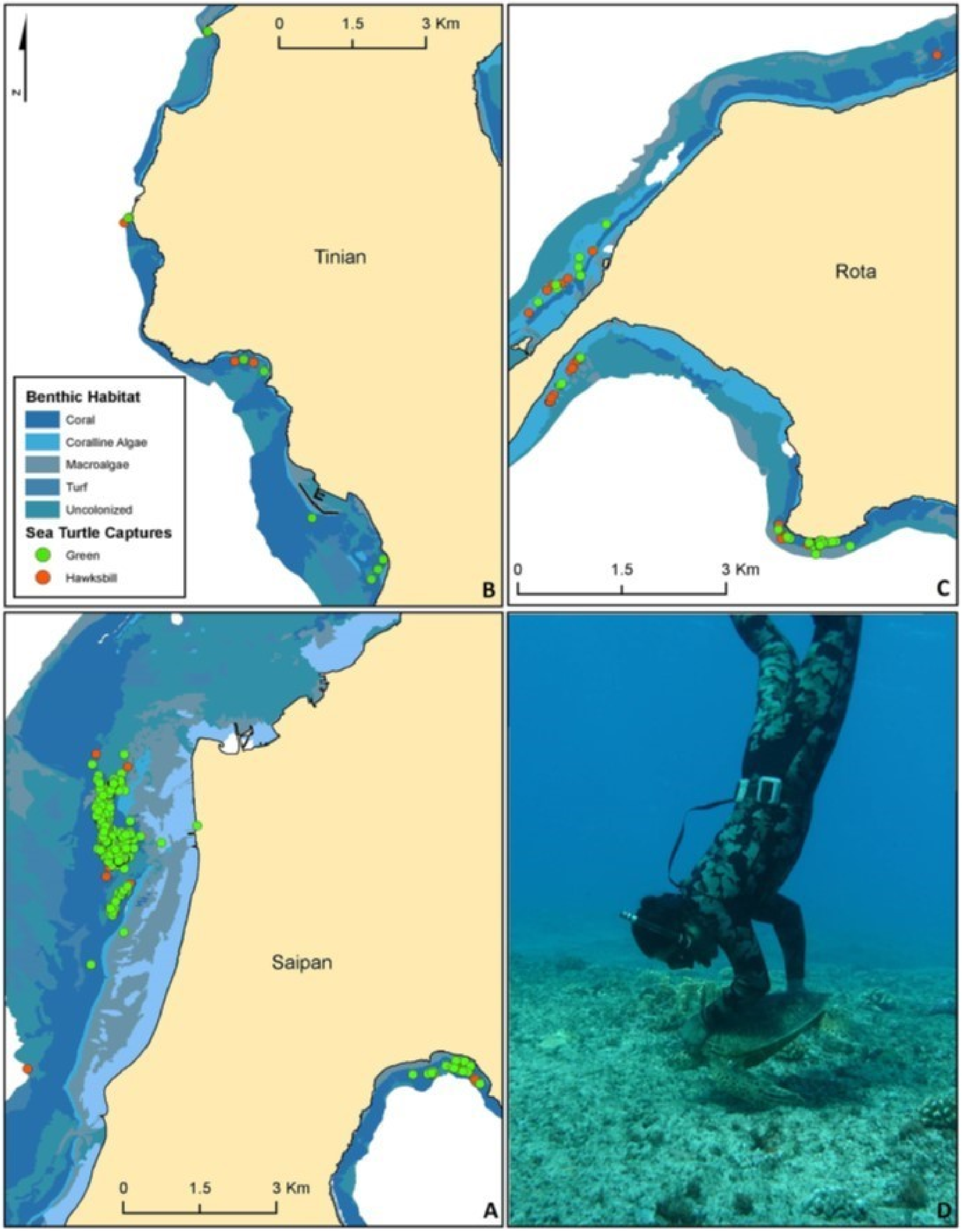
Y	TREDS		2006	2016	N	Y	Y	N	Y	N	6
Y	OBIS-SEAMAP		2011	2011	Y	N	Y	N	Y	Y	19
Y	Animal Telemetry Network		2013	2017	Y	N	Y	Y	Y	Y	20, 21

Figure 1 Maps of the study area and green turtle (*Chelonia mydas*) nesting activity. (A) The Mariana Archipelago includes Guam at the southern end and the Commonwealth of the Northern Mariana Islands (CNMI) to the north. This study focuses on the southern CNMI islands of Saipan, Tinian, and Rota (B – D) where the majority of the CNMI human population lives. (B – D) Locations of index beaches (bold) and non-index beaches surveyed for nesting activity from 2006 through 2016. Green circles indicate locations of nests or other evidence of nesting activity recorded during beach surveys.



A) Mariana Archipelago
N
17°N
16°N
15°N
14°N
13°N
145°E
146°E
Pacific Ocean
Philippine Sea
B
C
D
Guam
0
50
100 km
B) Saipan
Wing
Bird Island
Pau Pau
Managaha Island
Micro
Jeffrey's
Old Man by the Sea
Marine
Tank
LaoLao Bay
Tuturam
Coral Ocean Point
DanDan
Ladder
Obyan
Boy Scout
0
5 km
C) Tinian
LamLam
Babui
Chulu
Chiget
Dangkolo
Masalok
Barcinas Cove
Turtle Cove (Swimming Hole)
Leprosarium
Tachogna
Kammer
0
5 km
D) Rota
Guata
Tatgua
Mochong
Teteto
Sagua
Gagani
Ogkok
Apanon
0
5 km

Figure 2. Clockwise from bottom left: nearshore capture locations in relation to benthic habitat of (A) Saipan, (B) Tinian, and (C) Rota, and (D) an image of the free diver hand capturing a juvenile green turtle. Green and orange dots depict capture locations for green and hawksbill turtles, respectively. Shading indicates benthic habitat.


0
1.5
3 Km
N
Tinian
Benthic Habitat
Coral
Coralline Algae
Macroalgae
Turf
Uncolonized
Sea Turtle Captures
Green
Hawksbill
B
Rota
C
Saipan
A
D

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THE COOK ISLANDS

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1 RMU: Green turtle (*Chelonia mydas*) - South Central Pacific

1.1 Distribution, abundance, trends

Kuki Airani [8º to 23º South; 156º to 167º West] is a Large Ocean State covering 2 million km^2 of the Central South Pacific Ocean, comprised of 15 islands with a total land area of 241 km^2 divided into a Northern and a Southern Group (Fig. 1). Suwarrow, Manuae and Takutea are uninhabited. About 85% of the population lives on Rarotonga, which is the only cash-economy (based mainly on tourism, see 7). Outer Islands are mostly subsistence realities gathering daily resources directly from nature, but with a few local government jobs. Aitutaki bridges both: a few hotels so tourists can experience a second island, and remoter villages largely subsistence.

There is a large diaspora of Cook Islanders, notably in Cairns QLD, and Auckland, Aotearoa (NZ). Trend for emigration is roughly linear, current national population is about 13,000; several islands only have 50-70 residents.

1.1.1 Nesting sites

i) Northern Group consists of five low-lying coral atolls and a coral cay with no lagoon.

Tongareva Atoll [9º South; 158º West] is by far the most important sea turtle nesting site nationally (30); and of significant importance in the region (www.seaturtlestatus.org). *Chelonia mydas* nest year-round on Mangarongaro (an uninhabited *motu* or islet) (30, 33-34,43). Nesting surveys have been conducted several times each month since January 2014 and are ongoing; nests have been laid in every month since August 2014 (Tables 2 & 3). The rookery seems stable (about 550 nests per annum 2014-2016), but now increasing (1374 nests in 2017; 1767 nests in 2018; 781 nests to 31st July 2019). Egg success is high (95%) and there are no terrestrial predators (rats are present but eat flowers, coconuts and small marine crustaceans). The narrow 9 km beach is a dynamic habitat: some years all the sand is stripped away; in those times turtles dig egg-chambers in the forest. Occasionally nests are laid on other motu (e.g. in 2015 two nests were laid at *Te Tautua* ~ the first in over 30 years; perhaps this is evidence of natal homing as individuals born decades ago reached maturity).

Rakahanga Atoll [10º South; 161º West] has four suitable nesting beaches: south, southeast, northeast and north; the first nests (n=4) were reported by the school on the southern beach in 2011. A subsequent survey in 2012 found 27 older nests at various sites (36). Egg-laying does not occur annually.

Manihiki Atoll [10º South; 160º West] is largely unsuitable for nesting, although egg-laying does occasionally occur along the northwestern shore (*pers. com.* JeanMarie Williams, 2010). All of the southern part of the atoll is tiny motu or ahua (often treeless banks). A long eastern motu *Ngake* has a rocky coastline. The most suitable beach (west side near original boat wharf) is sand mined for building materials (30).

Nassau [11º South; 165º West] is a coral cay with no lagoon. Nesting occurs occasionally around the island. The crawl over the reef-top can be long (300+ metres) especially at low water; eggs are often laid in kirikiri (coral rubble). White (30) reports some findings.

Pukapuka Atoll [10º South; 165º West] consists of three motu and an extended sandy spit. Green turtles nest occasionally (30).

Suwarrow Atoll [13º South; 163º West] is an uninhabited National Park (1978) administered by the Prime Minister's Office at Rarotonga. A warden is resident between May-October the six months outside the cyclone season. The atoll is a popular anchorage for yachts and cruise liners. Green and hawksbill turtles are present in the lagoon but there is little dry land. One motu is called *Turtle Island* (18). Data are inconsistent: some wardens are good, others less so. White (30) noted a few nests.

ii) The Southern Group consists of raised coral islands (*makatea*): *Ngaputoru* (Atiu, Mauke and Mitiaro) and *Mangaia* (the oldest island in the Pacific). Rarotonga is volcanic with a fringing reef; Takutea is a sandy cay; Palmerston and Manuae are atolls and Aitutaki is an almost-atoll (it still has one small mountain: *Maungapu* 124m).

Palmerston Atoll [18º South; 163º West] had been reported as being the most important nesting site in the Cook Islands based on surveys from around 1970 (2, 21); this status was reflected in subsequent scientifc literature (14, 19). White (32) showed this to be incorrect, but Palmerston remains the most important Southern Group rookery, and the second largest nationally after Tongareva (32, 34). Centre for Cetacean Research did a 25-day survey in 2000 that found seven nests (3). White and colleagues found 187 nests in 2012 ~ some 5 years old. Possibly about 100 nests are laid per annum, usually on Cooks, Primrose, Toms and Home islets, and occasionally on small motu such as Kitsap Bank and Dickie Boys. Egg-laying is seasonal with a non-nesting period usually between April and October (30).

Manuae Atoll [19º South; 158º West] belongs to the people of Aitutaki and minor nesting has been found on both motu; surveys are infrequent as the atoll is difficult to access (28). A planned visit was cancelled because of Cyclone Pat in 2010 (30).

Aitutaki [18º South; 159º West] does support occasional nesting on *Maina* and *Tapuaetai* (One-foot) motu; *Rapota* and *Moturakau* are dynamic so in some years there is sand and others none (30). The main motu has resorts built along the northwestern shore, so those areas are unavailable. Adjacent to the northern runway is a beach that can have good sand depth; unusually, tiny pockets of sand along the rocky eastern margin of the runway have had nests (30). The other motu tend to be rockier, or water-logged. A large accreting sandbank 'Honeymoon Isle' may become available for nesting in decades to come (White *pers. obs.* 2010).

Takutea belongs to the people of Atiu and is uninhabited. In 1903 it was gazetted as a bird sanctuary and then again in 1950, under *Aronga Mana*, when the Atiu Trust was established. An unbroken reef fringes the cay, which does have suitable turtle egg-laying sites. Present nesting status is unknown.

The other southern islands are generally unsuitable for nesting but might occasionally have a nest. Several *C. mydas* nests were reported from small coves on Mauke (June Hosking *pers. com.* 2010); (30); these sites are dynamic, sometimes gaining sand but being unavailable in other years.

Rarotonga [21º South; 159º West] has been lost as a nesting habitat, assuming that nesting did occur historically, because the entire coastal zone has been destroyed for tourism development (31). High mountains occupy all the central area and there is a 32 km circumference coastal road. The northern and eastern coastlines are rocky with the fringing reef abutting the land; the western and southern lagoonal shores are sandy with hotels, resorts, restaurants and various watersports. Light pollution is ubiquitous along with people, cars and motorbikes meaning there are few quiet places anywhere along the shore. Some potentially suitable sandy areas are submerged at high water (30, 31).

1.1.2 Marine areas

Tongareva lagoon is the most important developmental habitat for *C. mydas* and frequent sightings are made year-round. Green turtle mating is commonly observed at

Omoka Wharf and in Taruia Passage (30, 32, 33, 34), making this atoll a critical habitat.

Rakahanga Atoll's outer reef has large green turtles, especially females, foraging year-round (30, 33, 36). As little nesting occurs on Rakahanga, Manihiki, Nassau or Pukapuka it seems likely that these adults may also use Tongareva for egg-laying (distance is 350 km between Rakahanga and Tongareva).

It is unclear if Manihiki still has *C. mydas* in the lagoon: this appears to be degraded due to artisanal black-pearl farming that supplies Rarotonga's tourist trade (30, 34).

Suwarrow lagoon is still in good condition: green adults and juveniles were observed (30).

Palmerston Atoll: Greens and juvenile hawksbills were observed in the lagoon and on the outer reef (30). Loggerheads *Caretta caretta* have been reported from the lagoon, but no evidence of them nesting (Bill Marsters *pers. Com.* 2009) (30).

Aitutaki has *C. mydas* in the lagoon and large turtles are known to rest in shallow areas (2 m depth) along the southernmost sector (30).

Manuae has green turtles in the lagoon and on the outer reef. The status of hawksbills is unclear as they used to be present but may now have gone (Clive Baxter *pers. Com) (30*).

Rarotonga: *C. mydas* and *E. imbricata* are on the outer reef and in the southern lagoon (30-31).

Other southern islands have greens and occasionally hawksbills in their coastal waters, but there are no data. Woodrom Rudrud (41) noted sea turtles present everywhere apart from Mitiaro.

1.2 Other biological data

In October 2016 White saw what appeared to be a large black turtle *Chelonia agassizii* in Tongareva lagoon, it was a very brief encounter (about 2 seconds) and not photographed.

It was thought that sea turtles did not reside in the Cook Islands, but instead migrated from foraging grounds in Fiji to nest in the Cooks (16). White (30) showed that sea turtles were present year-round and, indeed, could complete their entire life cycle in the Cook Islands.

Lamont (11) described traditional lifestyles on Tongareva, including the ritual consumption of sea turtles. Allen (1) describes the long relationship between islanders of Oceania and sea turtles. Te Rangi Hiroa (27) repeated some of Lamont's findings and added new ethnological insights.

White (33) collected the first live DNA samples from *C. mydas* in the Cook Islands: haplotypes were CmP65 (shared with Samoa); CmP77 (shared with Federated States of Micronesia); a likely Eastern Pacific rookery (Dr Peter Dutton suggested Galapagos Archipelago *pers. com.* 2015); and a novel haplotype.

Key Tongarevan findings were shared with the National Environment Service, Rarotonga, a new National Biodiversity Strategic Action Plan is in preparation; the previous one was 17 years ago (17).

Tongareva data were also included in Seminoff et al 2015 (25).

Encounter data had been uploaded to TREDS (www.sprep.org), but then technical difficuties occurred (26, 29). Now annual data go to SWOT.

1.3 Threats

1.3.1 Nesting sites

Tongareva: Atoll is the worst affected by climate change in the country (32-35, 37-40). Large areas of forest died as a result of climate impacts (higher temperatures, increased irradiance, high levels of wind-borne salt, limited rainfall, occasional wave overwash; *El Niño*) (42). Loss of the forest canopy, and in some areas loss of all trees, means much of the main nesting beach is exposed to full sun all day long now, whereas previously it was shaded in the morning; this makes embryonic feminisation more likely. Davenport (4) describes the *greenhouse effect* on sea turtles.

In mid-January 2015 the atoll was overwashed from the west: Omoka Village (Moananui motu) was flooded for two days and a juvenile green turtle was washed into the graveyard; tagged and released.

Traditional hunting happens occasionally, mostly random encounters (30, 32, 34; 36). There is a noticeable generational shift as younger people prefer western junk food instead of an entirely island food diet. Sea turtle egg-take has practically disappeared in the Cook Islands: 40 years ago, most nests would have been harvested (30, 32, 34; 36). Only two clutches have been taken at Tongareva since 2010: 1 in January 2011, 1 in October 2015 (30, 32-34).

Cyclones affect all of the Cook Islands (20). Palmerston experiences the most (due to the northwest-southeast track of such storms) and Rarotonga would suffer the greatest financial loss as it is a cash-based economy; the Outer Islands are mainly subsistence-based lifestyles. There is a relationship between ENSO patterns and cyclones with the stronger and more frequent events occurring in *El Niño* years (5). Northern atolls are in the marginal zone, but occasionally are badly affected (Cyclone Martin in 1987 had a 10-metre high tidal surge; Cyclone Pat in 2010 damaged many buildings, especially at Tongareva and Aitutaki (30).

Plastics are ubiquitous in the ocean and along all Cook Islands coastline. (6, 9, 12, 24). Maso et al (15) identify plastic debris as a vector for harmful algal blooms. Tongareva Atoll receives anthopogenic debris from both the North and South Pacific *great garbage patches* (34). Discarded industrial fishing gear is also found regularly stranded along Tongareva's shores.

1.3.2 Marine areas

i. Sea temperature rise (Fig 3)

Tongareva suffered a major coral bleaching event during El Niño in 2016: all lagoonal patch reefs and the entire outer reef (77 km) bleached, many corals and 95% of *Tridacna maxima (*giant clams) died (34-35); lagoon water was 38º C for weeks. Rongo (23) conducted a rapid coral survey in 2016 and confirmed all northern atolls had bleached: Tongareva was the worst affected (23). Many fish left, especially tuna and flying fish; most large seabirds migrated, presumably following their food supply. By November 2017 many corals had recovered during the cooler *La Niña*, mainly because the habitats at Tongareva were near-pristine, however, there are very few clams remaining; seabirds also returned to breed (White *pers. obs.* 2017).

A new coral bleaching event is in progress during 2019: this time the cause is increased solar irradiance; SSTs are normal with no El Niño effect (39). Greenhouse gas emissions, especially bromines & chlorines, degrade the stratospheric ozone layer allowing more u/v radiation through. ENSO is presently in neutral phase, but El Niño is forecast as the most likely scenario.

ii. Ocean acidification

Cook Islands is the country most at risk globally as ocean pH decreases (10).

iii. Deoxygenation

Unquantified, but likely implicated in tropical fish species migrating to higher latitudes: as species reach their thermal tolerance limits; and the reduced availablity of oxygen in warmer waters.

iv. El Niño and more frequent extreme weather events

Severe El Niño's were unknown in nature before about 1992; since then several have occurred (1997-1998 event led to massive bleaching of the Great Barrier Reef; 2002 caused yet more coral bleaching events and wildfires in Australia and SE Asia; 2015-2016 was the longest event ~ lasting over a year) (13).

v. Rarotonga dredging and terrestrial run-off

In 2012 Avarua harbour, at Rarotonga, was dredged and spoilings blanketed the adjacent reef and polluted the water column: this forced the resident green turtles to leave and all water-related tourist activities to be curtailed; local businesses sued the government. Southern Rarotonga has problems with land-based run-off polluting the lagoon, especially at Muri: local community groups are trying to reduce and resolve this problem. Greens and hawksbills use that habitat.

vi. Industrial foreign fisheries heavily target Northern Cooks sea areas, but licence fees go to Rarotonga. Vessels are diesel-powered, worsening the greenhouse gas effect. By-catch is supposedly monitored, but onboard observers had mostly been on Cook Islands vessels, of which there are few, instead of the USA and Chinese ships. Purse seine fishing by Spanish (EU) vessels was permitted by the Rarotongan government in March 2017, despite massive public protests, petitions, and a court injunction not to allow it. The Traditional Leaders and People lost the initial court case; but the NZ Court of Appeal in 2018 upheld it and found against the government on all counts. It ordered the Cook Islands Party government to conduct, apply and comply with an Environmental Impact Assessment within 12 months.

vii. A potential risk arises from deep seabed mining for polymetallic nodules (depth 5000 metres). The Seabed Commissioner (Paul Lynch) has adopted a cautious approach to mining this non-renewable resource. Exploratory licences have been issued, but extraction is some years away; leaving the benthic nodules undisturbed remains an option. A proper EIA is essential. The author reviewed the 2019 Seabed Minerals Act.

1.4 Conservation

Environment Act 2003 applies to three Southern Islands (Rarotonga, Aitutaki, Mangaia) and supposedly protects turtles at sea and on the foreshore (inland of the 30 metre line from MHW). Two more Southern Islands adopted regulations based on this Act: Atiu in respect of Takutea 2008; and Mitiaro 2008. In both cases turtles and their nests are not to be disturbed but traditional take is allowed.

Marine Resources Act 2005 & iterations applies throughout the EEZ, regarding turtles as 'fish' and protecting them and their habitats (including on land to MHW). White (30) noted the legislative void from MHW to 30 metres inland.

Cook Islands uses circle hooks (Marine Resources Longline Fishery Regulations 2008) and bycatch reduction measures (including safe release of seabirds & turtles); dumping in known fishery areas is prohibited. Regional Fishery Management Organisation is Western and Central Pacific Ocean.

Prevention of Marine Pollution Act 1998 is unenforceable (2 million km^2 EEZ).

Marae Moana Act 2017 creates a multi-use marine park throughout the EEZ that allows industrial fishing and deep seabed mining for polymetallic nodules in most sea areas; there is a 50 nautical mile buffer zone around each island where these activities are prohibited (buffer zones can be extended and new sites added). Rarotonga is now attempting to permit Chinese fisheries trans-shipment to occur in the nearshore waters of Tongareva. This is inside the prohibited zone. The government has not done an EIA and a legal injunction to prevent this activity is in preparation.

Seabed Minerals Act 2019: repeals the 2009 Act and incorporates key elements of 2015 regulations. It also amends the 2003 Environment Act ~ particularly strengthening Environmental Impact Assessments.

UN Framework Convention on Climate Change (Paris Agreement 2015)

Majuro Declaration of Highly Ambitious Countries (Climate change, 2015)

UN Sustainable Development Goals 2015: *Transforming our World: Agenda 2030*.

Hakono Hararanga Incorporated is the main sea turtle conservation entity nationally; in July 2015 it absorbed Honu Kuki Airani (www.honucookislands.com). We conduct year-round research and conservation activities, including occasional science lessons and fieldwork at Hapii Omoka (village school). We restore failed forest habitats (SDG15: Life on land), especially behind the main nesting beach (GEF SGP grant 2018-2019) (38, 40); regular beach cleans (SDG14: Life below water). In 2019 we secured a grant from the Australian High Commission in Wellington, NZ, to export our collected oceanic plastics to Rarotonga for reprocessing, a first for the country). We are actively working on deep decarbonization of Tongareva (SDG13: Climate action) (37, 38, 40): hydrocarbon fuels come from Auckland or Honolulu leading to massive shipping carbon impacts. To reduce monthly carbon footprints of emissions, we are switching to electric scooters, and have a solar-powered outboard motor from the GEF SGP grant.

A new organization *'Te Ara o te Onu'* is just being Incorporated in Rarotonga by Ariki Holidays with an aim of coordinating all sightings from turtle-related tourism (Scuba, snorkeling, glass-bottom boats etc). They are co-operating with a Ridge-to-Reef project (R2R) at the National Environment Service and note presence, size classes, photo-recognition, behaviour, interaction with tourists. They plan to write an ethical guide to turtle watching for local businesses.

Pulea reviewed Environmental Law in 1992 (22).

COOK ISLANDS is a Party to the Convention on Biological Diversity, the Kyoto Protocol, the Montreal Protocol, Ramsar, Apia, SPREP, Prohibition of long driftnets, Barbados Plan of Action, Desertification, Cartagena Protocol; and UN Conventions on the Law of the Sea, Climate Change. Compliant with CITES. Now looking at Areas Beyond National Jurisdiction, especially for deep-sea mining. Ms Alex Herman is the new Seabed Minerals Commissioner (2020). A policy of transparency & public consultation. Good media releases and stakeholder engagement. On 30 June 2020, the Seabed Minerals Amendment Act 2020 (Amendment Act) was passed by Parliament. Seabed Minerals (Exploration) Regulations 2020 are in final review. Strengthened need for EIAs; licencing committee separate from Parliament, serving MPs not allowed to hold shares in permitted prospecting companies. Alighment with Marae Moana Act

1.5 Research

There is no sea turtle expertise in government. Hakono Hararanga Incorporated (HHI) at Tongareva conducts in-depth year-round research, including anecdotal reports from indigenous people on their turtle encounters or use. Honu Cook Islands (2012-2015) merged with HHI in July 2015.

Tongareva

i. Develop understanding of the effects of *El Niño/La Niña* cycle, especially coral bleaching and forest loss. (13).

ii. Prepare a justification for a 100-nm no-take zone between Tongareva and Rakahanga: effectively closing the gap between these atolls. The other Northern atolls have a similar idea: if implemented this would create a *no-take zone* around the entire Northern Group, including Suwarrow.

iii. End fossil fuel use and make all activities climate safe: i.e. carbon neutral.

iv. Remove plastics from the ocean (Honolulu Strategy 2012).

v. Use www.globalfishingwatch.org to monitor illegal fishing activities in the buffer zones.

Suwarrow

Collate and review existing nesting and in-water data, resurvey as needed.

Takutea and Manuae

Review status of nesting on both islands.

Southern Group

i. Create local sea turtle education programmes and gather in-water and incidental nesting data.

ii. Widen Marine Stewardship Council sustainable fishery certification to all industrial fisheries in Cook Islands waters; at present only Luen Thai longlining is MSC certified.

iii. Quantify industrial fishery bycatch.

iv. Prevent terrestrial run-off entering Rarotonga's and Aitutaki's lagoons.

2. RMU: Hawksbill turtle (*Eretmochelys imbricata*) - South Central Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

None known

2.1.2 Marine areas

Foraging hawksbills can be regularly found on Rarotonga's reefs and less frequently in its lagoons: White (30-31) noted about one Ei to every two Cm. There are no seagrass beds in Kuki Airani. Maybe now lost from many sea areas: present at Manuae Atoll before 2006 (30); 3 juveniles seen at Palmerston Atoll (30); Tongareva Atoll: 1 adult female seen in 2010, only 2 juveniles since 2012.

2.2 Other biological data

NONE

2.3 Threats

2.3.1 Nesting sites

NONE

2.3.2 Marine areas

Threats in marine areas include entanglement in marine debris and plastic ingestion; and forage habitat destruction through dredging and sand-mining; water pollution near all urbanized areas; Rarotonga's Muri Lagoon is particularly bad. Coral bleaching & climate change impacts.

2.4 Conservation

A new organization *'Te Ara o te Onu'* is just being Incorporated in Rarotonga by Ariki Holidays with an aim of coordinating all sightings from turtle-related tourism (Scuba, snorkeling, glass-bottom boats etc). They are co-operating with a Ridge-to-Reef project (R2R) at the National Environment Service and note presence, size classes, photo-recognition, behaviour, interaction with tourists.

Suwarrow Atoll was declared a National Park in 1978 and is administered through the PM's Office at Rarotonga. It is uninhabited but a warden lives there (May-October) and is withdrawn for the cyclone season: it is a popular anchorage for yachts and cruise ships; juvenile *Ei* were present (30).

2.5 Research

Eretmochelys imbricata nesting remains unconfirmed in the Cook Islands (30-34): this critically endangered species may still be present at Tongareva, but very rare now (1 sighting in 2015, 1 in 2016, and a possible in 2018).

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

Transient and rare visitor to the waters of Kuki Airani. Only known from occasional industrial fishery sightings.

3.2 Other biological data

NONE

3.3 Threats

3.3.1 Nesting sites

NONE

3.3.2 Marine areas

Threats in marine areas include entanglement in, and ingestion of, marine debris, and interaction with pelagic longline fleets.

3.4 Conservation

NONE

3.5 Research

NONE

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Cook Islands - Kuki Airani.

Occurrence RMU	**CM-SC PAC**	**#Ref**	**EI-SC PAC**	**#Ref**	**EI-WC PAC**	**#Ref**
Nesting sites	Y	30-34, 36	n/a	n/a	n/a	n/a
Pelagic foraging grounds	n/a		n/a	n/a	n/a	n/a
Benthic foraging grounds	Y (J/A)	30-34, 36	Y	n/a	Y	n/a
Key biological data						
Nests/yr: recent average (range of years)	990 (2014-2018)	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	2	30, 34	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	6	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	600 (2014-2016) 1500 (2017-2018)	30, 34	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	40 (2015-2018)	30, 34	n/a	n/a	n/a	n/a

Total length of nesting sites (km)	15	30	n/a	n/a	n/a	n/a
Nesting females / yr	137-440	30, 34	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	81-171	30, 34	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	95.00%	30, 34	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	99.00%	30, 34	n/a	n/a	n/a	n/a
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a

Oldest documented abundance: nests/yr (range of years)	2012	30	n/a	n/a	n/a	n/a
Published studies						
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	1	33	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a
Cultural anectodes	Y	30-40	n/a	n/a	n/a	n/a
Biodiversity action plan	Y	17	n/a	n/a	n/a	n/a
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y	30-40	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	Y	30-40	n/a	9	n/a	9
Bycatch: quantified?	n/a	n/a	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	Y (now rare)	30-40	n/a	n/a	n/a	n/a

Take. Egg illegal harvest	Y (very rare)	30-40	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	Y	30-31	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	Y	30-31	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	rare	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	30, 32-34,36	n/a	n/a	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	Y	30, 32-40	n/a	5,6,42	n/a	5,6,42
Foraging habitat degradation	Y	30, 32-40	n/a	n/a	n/a	n/a
Other - Tortoise shell	Y	7	Y	7	Y	7
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	1 (2010 ongoing)	30, 32-34	n/a	n/a	n/a	n/a
Number of index nesting sites	1	30, 32-34	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	1 (2010 ongoing)	30, 32-34	n/a	n/a	n/a	n/a
Conservation						

Protection under national law	Y	n/a	n/a	n/a	n/a	n/a
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	1 (2010 ongoing)	30, 33	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	n/a	n/a	n/a	n/a	n/a
By-catch: onboard best practices	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Nesting beaches in the Cook Islands – Kuki Airani.

RMU / Nesting beach name	Index site	Nests/yr: recent ave (range of years)	Crawls /yr: recent ave (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Ref #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CM South Central Pacific				**Long**	**Lat**	**Long**	**Lat**	**Long**	**Lat**					
Tongareva	N	550 (2014-2017)						-9	-158			37,39		
Rakahanga	N	4-27(2011,2012)						-10	-161			43		
Manihiki	N	Rare						-10	-160			37		
Nassau	N	Rare						-10	-165			37		
Pukapuka	N	Occasional						-11	-165			37		
Suwarrow	N	Few						-13	-163			37		

Palmerston	N	25-100 (2000,2012)						-18	-163			2,4,19,24, 26,37		
Manuae	N	Some						-19	-158			34,37		
Aitutaki	N	Rare						-18	-159			37		

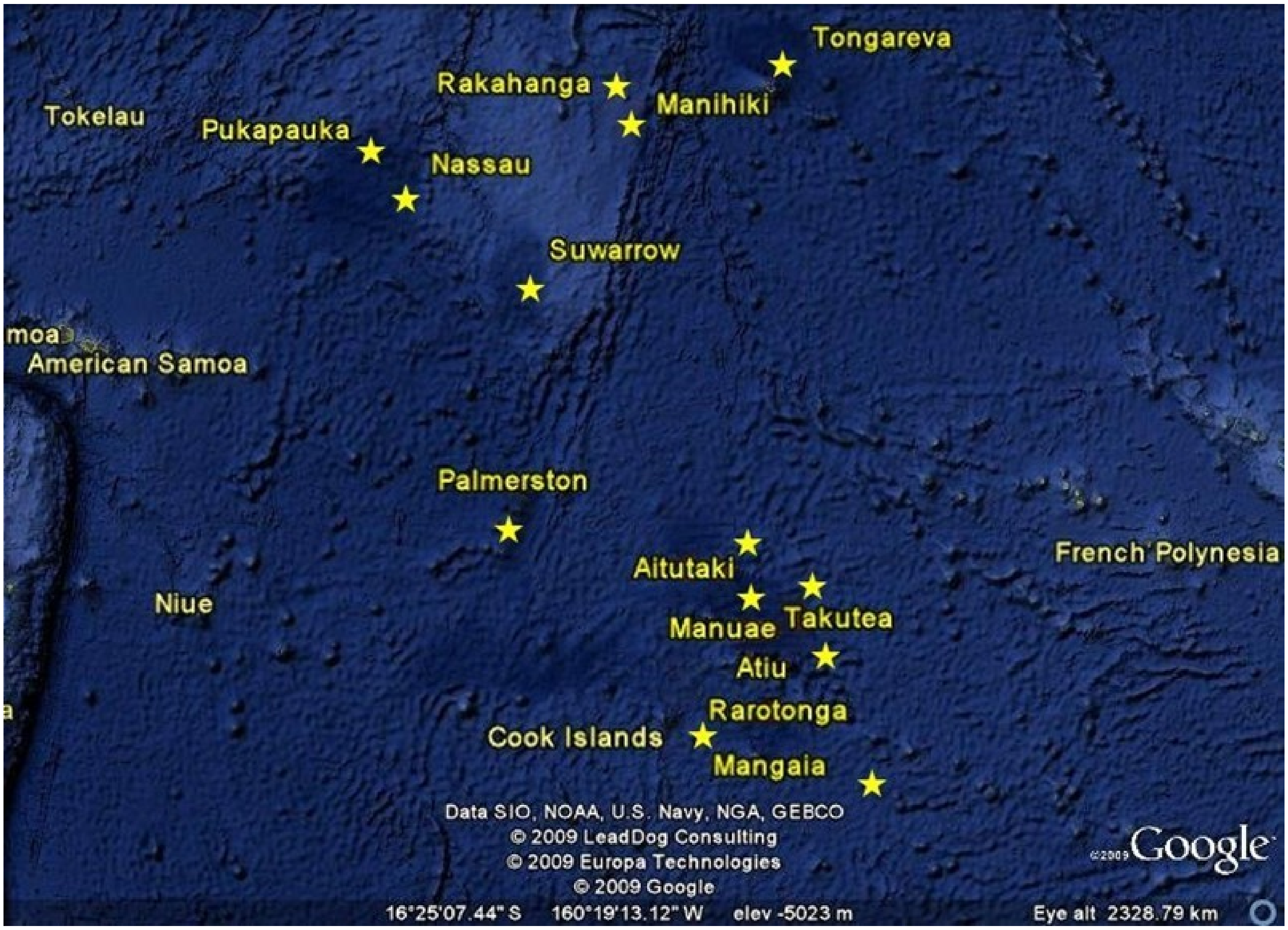

Figure 1. Kuki Airani (Cook Islands)

Figure 2. Tongareva Atoll. There are two villages: Omoka (pop. 150), Te Tautua (pop. 45). Sea turtle nesting occurs year-round on the uninhabited motu ~ Mangarongaro. Outer reef circumference is 77 km; lagoon area 233 km^2. The atoll is seriously impacted by climate change, including coral bleaching and tree loss. We are overwhelmed with oceanic plastics and industrial fishing gear. Life is mainly subsistence based.

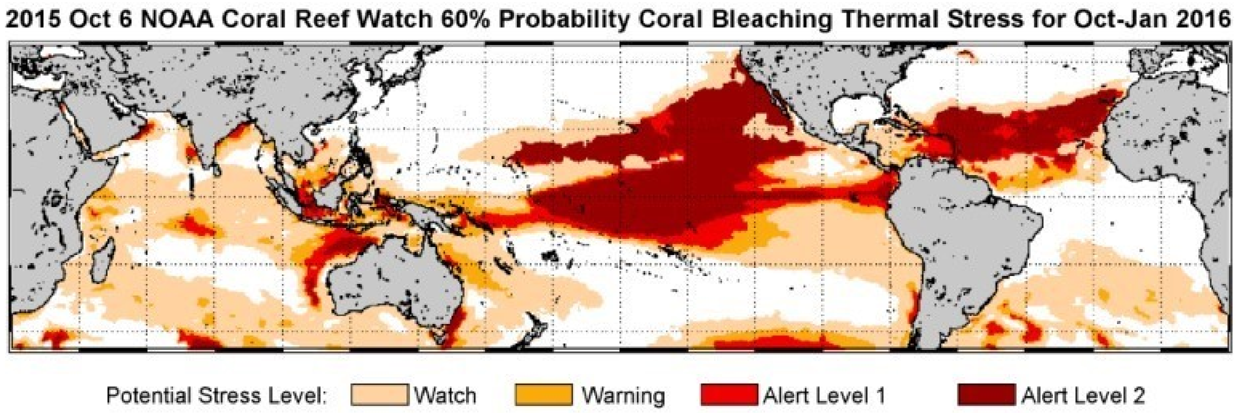

Figure 3. Probability for Thermal Stress for corals.

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Appendices

MTSG_Oceania_Kuki Airani. Appendix Table 1: Nests at Mangarongaro, Tongareva (January 2014 – December 2016). Nesting zone is split in three: Mahera (3 km); Tetoto (2 km); Akasusa (3 km): beach is often only a few metres wide and highly dynamic. Egg-laying has occurred in all months since August 2014. November 2016 was the largest monthly total (n = 189). *NOTE January 2015 the atoll was overwashed for two days.*

Month	2014 Mahera	2014 Tetoto	2014 Akasusa	2014 Tally	2015 Mahera	2015 Tetoto	2015 Akasusa	2015 Tally	2016 Mahera	2016 Tetoto	2016 Akasusa	2016 Tally
January	62	28	0	**90**	60	7	3	**70**	2	0	11	**13**
February	22	37	80	**139**	23	10	21	**54**	4	3	11	**18**
March	20	10	6	**36**	5	2	18	**25**	4	0	8	**12**
April	9	0	0	**9**	4	0	1	**5**	8	1	0	**9**
May	8	9	1	**18**	5	2	0	**7**	14	2	13	**29**
June	0	0	0	**0**	2	0	0	**2**	11	2	0	**13**
July	0	0	0	**0**	25	0	0	**25**	6	3	0	**9**
August	4	0	4	**8**	5	9	0	**14**	8	23	1	**32**
September	27	11	8	**46**	5	35	5	**45**	20	70	18	**108**
October	41	7	0	**48**	24	37	3	**64**	45	27	N/S	**72**
November	76	16	5	**97**	44	77	54	**175**	57	88	44	**189**
December	24	17	2	**43**	46	17	6	**69**	18	17	26	**61**
Totals	**293**	**135**	**106**	**534**	**248**	**196**	**111**	**555**	***197***	***236***	***132***	***565***

MTSG_Oceania_Kuki Airani. Appendix Table 2: Nests at Mangarongaro, Tongareva (January 2017 – 20th May 2019). Nesting zone is split in three: Mahera (3 km); Tetoto (2 km); Akasusa (3 km): beach is often only a few metres wide and highly dynamic. Egg-laying has occurred in all months since August 2014. December 2017 was the largest monthly total (n = 455). It can be clearly seen that egg-laying at this undisturbed site has significantly increased since regular surveys began in January 2014. [2019 has 781 nests until 31st July].

	2017				2018				2019			
Month	Mahera	Tetoto	Akasusa	Tally	Mahera	Tetoto	Akasusa	Tally	Mahera	Tetoto	Akasusa	Tally
January	22	7	22	51	200	0	55	255	31	143	51	225
February	0	0	6	6	18	0	18	36	21	96	1	118
March	12	0	0	12	0	15	21	36	43	19	12	74
April	5	8	N/S	13	0	1	28	29	38	29	5	72
May	11	3	22	36	2	1	5	8	28	22	46	96
June	6	9	15	30	24	3	0	27	36	40	22	98
July	1	13	36	50	53	12	14	79	47	12	39	98
August	2	N/S	37	39	93	38	15	146				
September	17	28	44	89	176	93	52	321				
October	82	101	28	211	185	84	33	302				
November	214	62	106	382	111	95	5	211				
December	205	89	161	455	111	177	29	317				
Totals	577	320	477	1374	973	519	275	1767				

FIJI

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1 RMU: Green turtle (*Chelonia mydas*) - South Central Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

No comprehensive study of green turtles nesting activity has been done in the country [1]. According to recent available information, green turtles nest in Hatana Island [2], and within the Hemskercq Reef and the Ringgold Reef systems [3,4] (Fig. 1). The latter systems host index nesting sites [3,4], where a total of 40 nests were noted during the most recent survey of the area [5]. No green turtles' nesting activity has been recently recorded at historical nesting sites of Makogai Island, Namena-lala Island, and Vatoa Island. The most recent national estimation of the size of the green turtle nesting population is 50-75 adult females [4]. Additional available information is reported in Table 1.

1.1.2 Marine areas

Recent satellite tracking and tag recovery data show that Fiji is a foraging area for adult green turtles nesting in the Cook Islands [4], French Polynesian [6] and Australia [7,8]. A recent genetic study identified the shallow coastal waters of Yadua Island and Makogai Island (Fig. 1) as foraging grounds for juvenile green turtles from American Samoa, New Caledonia and French Polynesia [1]. Green turtles also reportedly feed on the seagrass beds off the easternmost point of Vanua Levu [4].

1.2 Other biological data

Minimum curved carapace length of green turtles nesting in Fiji is 90 cm [4].

1.3 Threats

1.3.1 Nesting sites

Interviewees from Rotuma Island identified erosion linked to tropical depressions and cyclones as current major threat to the nesting sites. This likely affects the rest of the green turtle nesting sites in Fiji.

1.3.2 Marine areas

Illegal capture of green turtles has been occasionally reported in coastal waters [2,9–12], but never quantified. Offshore bycatch of green turtles in the industrial longline fisheries (deep and shallow altogether) is known [13]. Based on observer program data, cumulative interactions from 1989 to 2015 reportedly ranged between 0.000071-0.000758 green turtle interactions per 100,000 hooks to 0.018871-0.037867 green turtle interactions per 100,000 hooks. Overexploitation from subsistence and industrial fisheries, together with by-catch, are perceived as major threats [12]. Climate change, in particular its effects on primary green turtles' habitats such as seagrass beds, have been identified as likely threats [14].

1.4 Conservation

All sea turtles in Fiji are currently protected under the national law "Regulation 5 of the Offshore Fisheries Management Regulations 2014" [15], which applies to all internal, inshore and offshore areas of Fiji, and that does not allow for exemption on sea turtles harvest. Previously, sea turtles were protected under a "Moratorium on molesting, taking or killing of turtles" (2004-2008 [16] and 2008-2018 [17]). The Moratorium acknowledged the traditional and spiritual role of sea turtles in the ceremonies, and the Fiji Department of Fisheries could approve special requests of sea turtles' harvest [18].

Fiji has signed several international conventions that have a nexus to conservation of all sea turtle species (Table 3) and, in 2017, has also signed a United Nations Ocean Conference voluntary commitment to formulate a National Sea Turtle Conservation Regulation by 2019 and to fully implement the Fiji Sea Turtle Recovery Plan (see https://oceanconference.un.org/commitments/?id=19909#intro).

In order to reduce sea turtles bycatch in the longline fishery, Fiji Fisheries Offshore Division has encouraged the use of circle hooks, de-hookers and line cutters [19].

1.5 Research

Literature review shows missing key information for green turtles in Fiji, as little is known about their nesting and foraging activities. Publication of at least two sets of unpublished data would help filling this knowledge gaps; green turtles' satellite tracks (currently with different stakeholders) will help in the identification of possible migratory routes and potential benthic foraging areas, while publication of recent data on green turtles' catch and by-catch in the longline fisheries will help understanding the magnitude of these threats on the offshore, commercial fishery.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - South Central Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

Hawksbill turtles are known to nest on several beaches of the islands of Fiji [3,4,11,12,20] (Fig. 2). Available data recorded in the last 20 years are summarized in Table 2. A severe drop in the number of nests laid at historically known sites of Namena-lala Island, which is the only index site for hawksbill, and at Makogai Island, has been reported [4]. The most recent national estimation of the size of the hawksbill turtle nesting population is 150-200 adult females [4]. Additional available information is reported in Table 1.

2.1.2 Marine areas

Recent satellite tracking shows that Fiji is a foraging area for adult hawksbill turtles nesting in American Samoa [21]. Hawksbill turtles feed on the several Fijian coral reefs, among which the Great Sea Reef [10], however no survey to collect abundance indexes has been performed in the Country in the last twenty years. Hawksbill turtles reportedly feed on the seagrass beds off the easternmost point of Vanua Levu [4].

2.2 Other biological data

Minimum curved carapace length of hawksbill turtles nesting in Fiji is 75 cm [4]. Average clutch size and average emergence success calculated from available data [10,11,22,23] are 116 eggs and 98.36% hatchlings/eggs, respectively.

2.3 Threats

2.3.1 Nesting sites

No threat has been specifically reported for hawksbill nesting sites, however, as for the green turtle, flooding and erosion linked to tropical depressions and cyclones are likely the current major threats.

2.3.2 Marine areas

Illegal capture of hawksbill turtles in shallow coastal waters has been occasionally reported [9–12], but not quantified.

2.4 Conservation

All sea turtles in Fiji are currently protected under the national law "Regulation 5 of the Offshore Fisheries Management Regulations 2014" [15], which applies to all internal, inshore and offshore areas of Fiji, and that does not allow for exemption on sea turtles harvest. Previously, sea turtles were protected under a "Moratorium on molesting, taking or killing of turtles" (2004-2008 [16] and 2008-2018 [17]). The Moratorium acknowledged the traditional and spiritual role of sea turtles in the ceremonies, and the Fiji Department of Fisheries could approve special requests of sea turtles' harvest [18].

Fiji has signed several international conventions that have a nexus to conservation of all sea turtle species (Table 3) and, in 2017, has also signed a United Nations Ocean Conference voluntary commitment to formulate a National Sea Turtle Conservation Regulation by 2019 and to fully implement the Fiji Sea Turtle Recovery Plan (see https://oceanconference.un.org/commitments/?id=19909#intro).

The only long-term conservation project of which the authors are aware of was carried out from 2010 to 2014 by SPREP, WWF South Pacific Programme and National Trust of Fiji [12].

2.5 Research

Literature review shows missing key information for hawksbill turtles in Fiji, as little is known about their nesting and foraging activities. Publication of hawksbill turtles' satellite tracks (currently with different stakeholders) will help in the identification of possible migratory routes and potential benthic foraging areas.

3 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific (CC-S PAC)

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

No nests of loggerhead has ever being reported for Fiji [4].

3.1.2 Marine areas

Loggerheads reportedly form foraging aggregations in shallow waters of the Great Sea Reef, the Hemskercq Reef and the Ringgold Reef systems, Central and Southern Lau group, and along Suva and Kaba peninsulas [4].

3.2 Other biological data

None available.

3.3 Threats

3.3.1 Nesting sites

Not applicable.

3.3.2 Marine areas

Loggerhead are incidentally captured on gillnets and, in some areas, targeted with set turtle nets [4], but never quantified. Offshore bycatch of loggerhead turtles in the industrial longline fisheries (deep and shallow altogether) is known [24]. Based on data from the observer program, cumulative interactions from 1989 to 2015 ranged between 0.000231-0.001165 loggerhead turtle interactions per 100,000 hooks to 0.017685-0.041279 loggerhead turtle interactions per 100,000 hooks [24].

3.4 Conservation

See Section 1.4

3.5 Research

Literature review shows missing key information for loggerhead turtles in Fiji. Publication of loggerhead turtles' satellite tracks (currently with different stakeholders) will help in the identification of migratory routes and potential benthic foraging areas.

4. RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

No nesting activity of leatherbacks has been reported in the last twenty years [4]. The most recent national estimation of the size of the leatherback turtle nesting population is 20-30 adult females, which are considered sporadic nesters from other rookeries [4]. Additional available information is reported in Table 1.

4.1.2 Marine areas

It is suggested that leatherbacks are present in low numbers in Fiji pelagic water [4].

4.2 Other biological data

None available.

4.3 Threats

4.3.1 Nesting sites

Not applicable.

4.3.2 Marine areas

Offshore bycatch of leatherback turtles in the industrial longline fisheries (deep and shallow altogether) is known [24]. Based on data from the observer program, cumulative interactions from 1989 to 2015 ranged between 0.004308-0.010064 leatherback turtle interactions per 100,000 hooks to 0.000160-0.000826 leatherback turtle interactions per 100,000 hooks [24].

4.4 Conservation

See Section 1.4.

4.5 Research

Literature review shows that virtually no information is available for leatherback turtles in Fiji. Publication of leatherback turtles' satellite tracks (currently with different stakeholders) will help in the identification of migratory routes.

Table 1. Biological and conservation information about sea turtle Regional Management Units in Fiji.

RMU	**CM-SC PAC**	Ref #	**EI- SC PAC**	Ref #	**CC-S PAC**	Ref #	**DC-W PAC**	Ref #
Occurrence								
Nesting sites	Y	[3,2,5,12,1]	Y	[3,4,11,20,12]	N	[4]	Y	[4]
Pelagic foraging grounds	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a
Benthic foraging grounds	Y	[1,4,6–8]	Y	[4,10]	Y	[4]	n/a	n/a
Key biological data								
Nests/yr: recent average (range of years)	21 (2007-2010)	[5]	47 (2003-2014)	[2,23,25,12]	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	1	[5]	2	[25,12]	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	2	2,3,21	5	[2,25,12]	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	40 (2010)	[5]	41 (2009-2014)	[23,25,12]	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	7 (2007, 2010)	3,21	3 (2003-2014)	[12]	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Nesting females / yr	50-75	[4]	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	90 CCL	[4]	75 CCL	[4]	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	116 (N=26 nests)	[10,11,22,23]	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	98.6 (N=20 nests)	[10,11,22,23]	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	N	n/a	N	n/a	N	n/a	N	n/a
Genetics	Y	[1]	n/a	n/a	N	n/a	N	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a	N	n/a	N	n/a
Remote tracking (satellite or other)	Y	[7,4,8,6]	Y	[21]	n/a	n/a	n/a	n/a
Survival rates	N	n/a	N	n/a	N	n/a	N	n/a
Population dynamics	n/a	n/a	N	n/a	N	n/a	N	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	N	n/a	N	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a	N	n/a	N	n/a
Threats								
Bycatch: presence of small scale / artisanal fisheries?	n/a	n/a	n/a	n/a	Y	[4]	n/a	n/a
Bycatch: presence of industrial fisheries?	Y (PLL)	[13,12]	n/a	n/a	Y	[24]	Y	[24]
Bycatch: quantified?	Y	[13]	n/a	n/a	Y	[24]	Y	[24]
Take. Intentional killing or exploitation of turtles	Y	[2,9–12]	Y	[9–12]	Y	[4]	n/a	n/a

Take. Egg illegal harvest	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Coastal Development. Photopollution	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Pollution (debris, chemical)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	Y	[14]	n/a		n/a		n/a	
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	N	n/a	Y (2005-ongoing)	see table 4	n/a		n/a	
Number of index nesting sites	N	n/a	2	[12,25]	n/a		n/a	
Monitoring at foraging sites (period: range of years)	N	n/a	N		n/a		n/a	
Conservation								

Protection under national law	Y	[17,18,15]	Y	[17,18,15]	Y	[17,18,15]	Y	[15,17]
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	N	n/a	1 (2010-2014)	[12]	N	n/a	n/a	n/a
In-situ nest protection (eg cages)	N	n/a	N	n/a	N	n/a	n/a	n/a
Hatcheries	N	n/a	N	n/a	N	n/a	n/a	n/a
Head-starting	N	n/a	N	n/a	N	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	circle hooks (PLL)	[19,26]	n/a	n/a	circle hooks (PLL)	[19,26]	circle hooks (PLL)	[19,26]
By-catch: onboard best practices	Y	[19,26]	n/a	n/a	Y	[19,26]	Y	[19,26]
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Green and hawksbill turtles nesting sites reported for Fiji in the last twenty years. (Note: central point refers to the island, not the single beach).

RMU / Nesting beach name	**Index site**	**Nests/yr: recent average (range of years)**	**Crawls/yr: recent average (range of years)**	**Central point**		**Length (km)**	**% Monitored**	**Reference #**	**Monitoring Level (1-2)**	**Monitoring Protocol (A-F)**
CM-SC PAC										
Hemskercq Reef	Y	n/a	n/a	-16.7208	-179.4417	n/a	n/a	[3]	n/a	n/a
Ringgold Reef	Y	40 (2010)	14 (2010)	-16.3000	-179.4083	n/a	n/a	[5]	n/a	n/a
Mali	N	1 (2009-2010)	n/a	-16.3433	-179.3254	n/a	n/a	[12]	n/a	n/a
Hatana Island	N	13 (2007)	n/a	-12.4795	-176.9658	n/a	n/a	[2]	n/a	n/a
EI-SC PAC										

Namena Lala Island	Y	8 (1995-1999)	n/a	-17.1121	-179.0972	n/a	n/a	[3]	n/a	n/a
Makogai Island	N	1 (1999-2000)	n/a	-17.4479	-178.9650	n/a	n/a	[3]	n/a	n/a
Makogai Island	N	3 (1995-1999)	n/a	-17.4479	-178.9650	n/a	n/a	[3]	n/a	n/a
Leluvia & Caqalai Islands	N	3 (1995-1999)	n/a	-16.8152	-178.3012	n/a	n/a	[3]	n/a	n/a
Yadua Islands	N	14.5 (2009-2011)	5 (2009-2011)	-16.7413	-178.5281	n/a	100	[11,20,12]	n/a	n/a
Koroinasolo	N	0 (2009-2010)	1 (2009-2010)	-16.5908	-178.5896	n/a	n/a	[12]	n/a	n/a
Yaqaga	N	8 (2009-2010)	n/a	-16.5908	-178.5896	n/a	n/a	[12]	n/a	n/a
Druadrua	N	5 (2009-2010)	n/a	-16.1998	-179.6161	n/a	n/a	[12]	n/a	n/a

Mali	N	1 (2009-2010)	n/a	-16.3433	-179.3254	n/a	n/a	[12]	n/a	n/a
Katawaqa	N	44.5 (2009-2011)	n/a	-16.1942	-179.5593	n/a	n/a	[20,12]	n/a	n/a
Nukuci	N	2 (2009-2011)	n/a	-16.4977	-178.8462	n/a	n/a	[20,12]	n/a	n/a
Kia	N	1.5 (2009-2011)	1 (2009-2010)	-16.2344	-179.0940	n/a	n/a	[20,12]	n/a	n/a
Hatana Island	N	8 (2007)	n/a	-12.4795	-176.9658	n/a	n/a	[2]	n/a	n/a

Table 3. International conventions protecting sea turtles and signed by Fiji.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention on Migratory Species	Y	N	n/a	ALL	Protection of all the migratory species in Fiji waters.	Sea turtles are one of the migratory species that CMS ensures is protected by different range states as well.
Convention on International Trade of Endangered Species	Y	Y	Y	ALL	Scheduling of the EPS Act 2002 and Amended Act of 2017 as a national legislation which included species that trade was regulated for.	Turtles are listed under the Act, thus trade was not allowed and illegal exports or imports of any turtle product has been monitored.
Convention on Biological Diversity	Y	Y	n/a	ALL	The establishment of the National Biodiversity Strategic Action Plan Working Groups. One of the thematic areas was Species which looked at all the protection and management of all species under threat. The compilation and implementation of the Fiji Sea Turtle Recovery Plan.	All species of turtles are protected in Fiji and the working group under the NBSAP looked at protection and management of sea turtles.

Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean	Y	Y	Y	ALL	Regulatory measures in place such as the use of specific types of gears that ensures, effective management and the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean.	Turtles are one of the by-catch species that are frequently caught and having observers on vessels and certain regulated hooks to be used minimizes the bycatch of turtles and enhances reporting.
United Nations Framework Convention on Climate Change	Y	Y	n/a	ALL	The Convention looks at reducing the emission of harmful gasses by nations that alters the composition of the global atmosphere in a destructive manner, which is aimed at reducing temperatures and sea level rise.	The rise in beach temperature, which is nesting grounds for turtles, will affect the gender of the hatchlings that are produced causing an imbalance. The rise in sea temperatures might also affect the seagrass production which is green turtle diet.
United Nations Convention on the Law of the Sea	Y	Y	n/a	ALL	UNCLOS looks at defining boundaries for national countries to govern and manage their marine resources and Fiji declared a Turtle Moratorium in its waters.	The Moratorium regulates any harvest or engagement of turtle or turtle products.

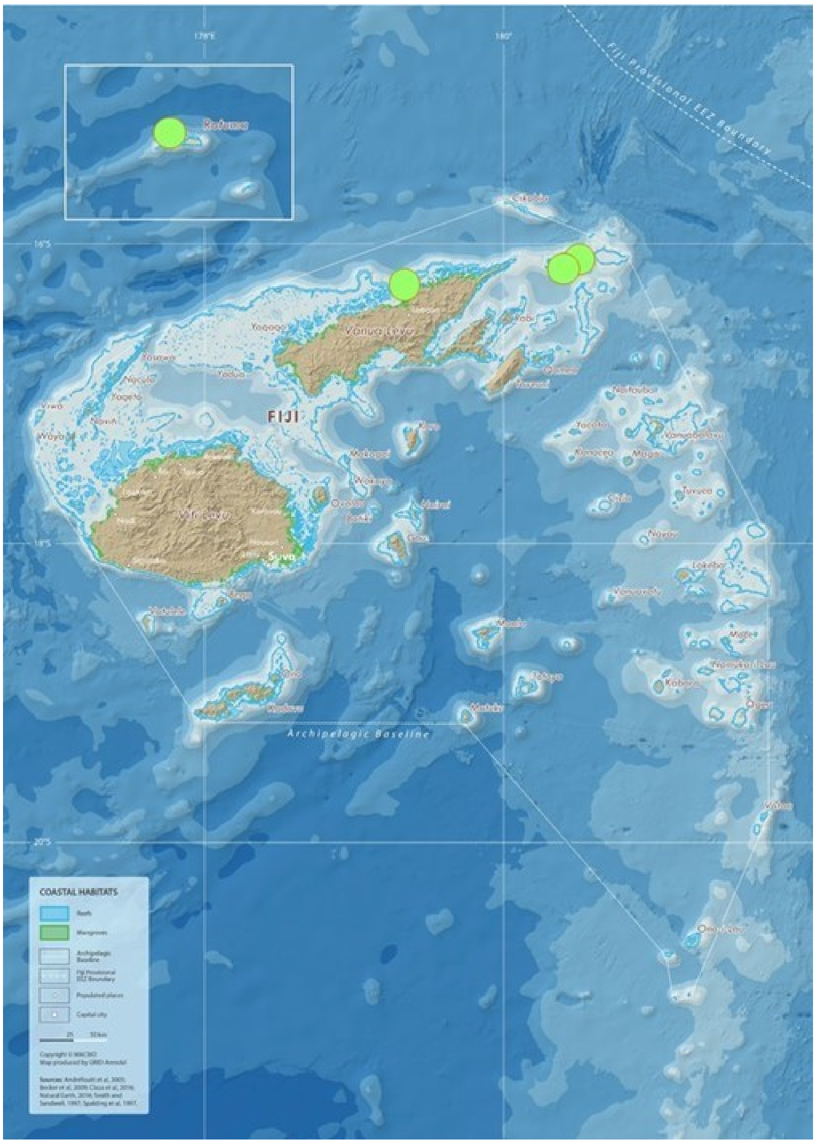

Figure 1. Green turtle active nesting sites, as per literature review (from 27 MacBio).

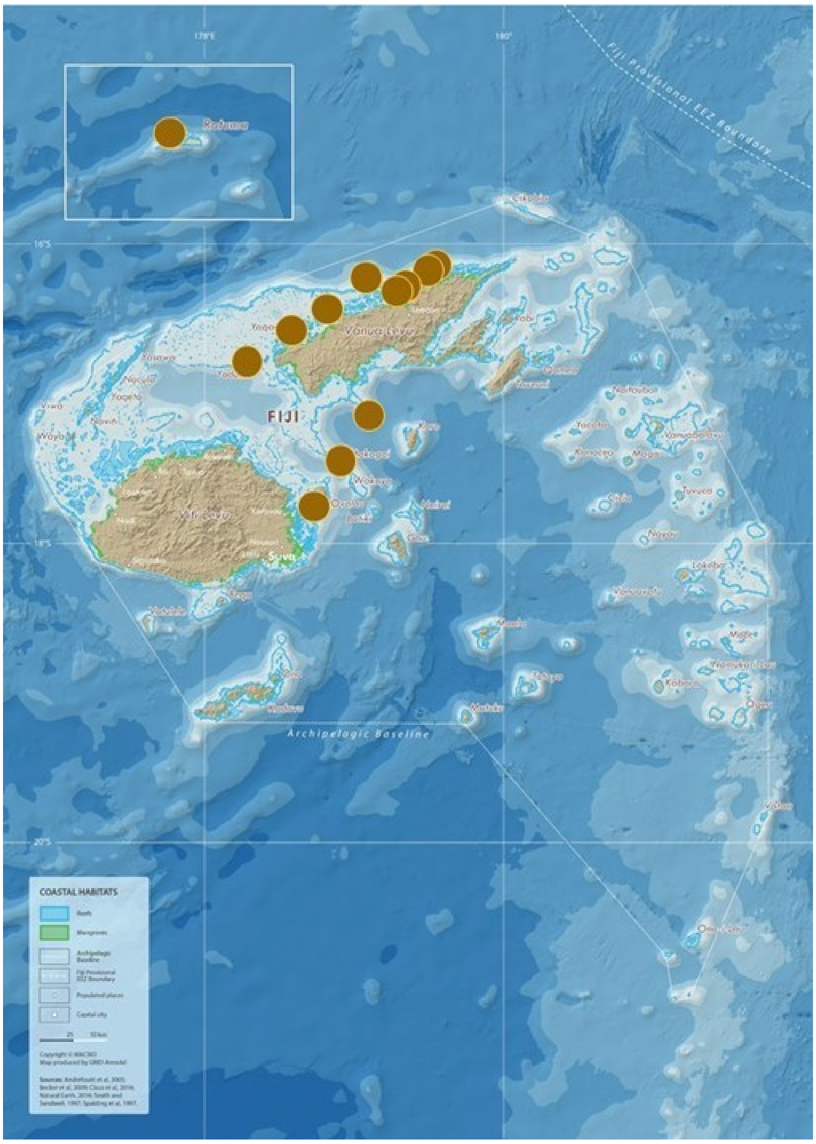

Figure 2. Hawksbill turtle active nesting sites, as per literature review (from 27 MacBio).

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FRENCH POLYNESIA

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1 RMU: *Chelonia mydas,* South Pacific (CM-S PAC)

Data provided in this report contain only numbers provided by C. Gaspar for Te Mana O Te Moana program. Notes are provided from Miri Tatarata for overall sea turtle program managed by Direction of Environment of French Polynesia (DIREN)

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

The green turtle (*Chelonia mydas*) is one of the confirmed species of sea turtle coming to lay evenly in French Polynesia (FP, Fig 1). However, the spatial geographies of FP Islands are making difficult to evaluate of the distribution of nesting events in the Polynesian islands and archipelagoes. Several nesting sites of green turtles have been described in the past in French Polynesia, the major sites being in the Society Islands, including Scilly, Motu One (also called Bellinghausen) and Mopelia (4), and Tetiaroa. Because of the presence of Te Mana O Te Moana teams since 2004, and the high number of clutches observed every year, Tetiaroa is one of the sites where most episodes of green turtle nesting have been reported throughout Polynesia (1). Other sites of lesser importance have also been described in other archipelagos, such as Tikehau (5), Maupiti, Fakarava (Te Honu Tea Association) or Tupai (1). On these islands, nesting surveys were too episodic and far apart in time or described too few events to observe a reliable trend on spatial-temporal distribution and evolution of these events (and therefore to interpret the population stocks). To overcome this lack of information, the Direction of the Environment of French Polynesia has launched a nesting monitoring program before 2000 in order to identify precisely nesting sites and estimate the sizes of nesting populations. Field missions are organized and undertaken by the Bora Bora Turtle Center –managed by the Meriden resort- on Mopelia atoll before 2016 but no data are available to us as to date.

In the Society Islands, Tetiaroa atoll is the only site where an annual monitoring is conducted, led annually by the foundation Te mana o te moana since 2007 with the agreement of the Direction of the Environment of French Polynesia. In view of the results obtained from 2007 to 2017 and anecdotal observations from other islands, it now appears that the atoll of Tetiaroa is amongst the important nesting areas for green turtles in the Society Islands (1, 2).

Although the results from this long-term study are yet to be published, the data collected provides unique and precious information about time and space nesting distribution, female identification, stock evolution and ecological parameters on green turtles nesting in French Polynesia. From 2007 to 2016, most surveys were undertaken during the day: teams of biologists and volunteers walked around the islets to count for tracks, but the nesting success for each track could not be confirmed. Since 2016, surveys are undertaken in addition to daytime, in the nighttime, so that the females can be observed, measured and tagged, and nesting success can be evaluated. In the 2016-2017 season, 601 tracks were recorded, and 17 females identified, flipper tagged, and skin sampled for genetic surveys. Since 2010 a total 61 females (and a larger number in the on-going season) have been tagged over the year on 3 different islets of Tetiaroa, the genetic sampled taken have been given to the Direction of Environment of further studies. None of these females have been re-sighted over the years at the time of this report.

Note from Tatarata M., Direction of Environment DIREN.:

- *there have been more nesting studies developed by DIREN, but the geographical dispersion of islands is making the studies difficult*
- *there have been more nesting studies on Scilly than on Tetiaroa atoll overall*
- *the conservation program for sea turtles has been launched in the 90's and was then emphasize by DIREN. It includes nesting monitoring, satellite tracking, flipper tagging and genetic studies. Bora Bora Meridian has done previous missions before 2016 for nesting survey in Mopelia*
- *In addition, DIREN is doing regular revision of legal texts and laws concerning sea turtles*

1.1.2 Marine areas

Green turtles are frequently observed foraging in coastal areas (1). Tonga and Fiji are important foraging areas for green turtles that nest at sites in French Polynesia (14, 12).

Manta tow in water population assessment in 2010-2011 has provided observation of 47 green sea turtles on 6 islands barrier reef survey (Tetiaroa, Moorea Maiao, Bora Bora, Maupiti, Tupai) on 3 annual transects (0.076 ind/km for green turtles). Mean green turtle ccl is 74,9 ± 24,66cm, with minimum size of 40 cm and maximum size of 120 cm. (1)

Note from Tatarata M., Direction of Environment DIREN.:

We have proved now with satellite tracking that some adult green sea turtle are resident to French Polynesia waters

1.2 Other biological data

In summary of the 10 years of survey by te mana o te moana on Tetiaroa atoll:

- Nesting interval has been confirmed to be 12-13 days, female size CCL range from 83 cm to 118 cm
- Nesting season is usually from October till March, the longer season: 278 days (2015-2016) the shorter season: 128 days (2009-2010), earliest track: July 16th, latest track: June 29th and pick of nesting season: November-January.
- More than 2440 tracks counted in 10 years and over 862 nests with eggs witnessed for a total of over 70.000 eggs laid in 10 years (2007-2017)- not counting season 2017-2018 currently in progress. Nesting attempts from 3 to 11 times per season per female
- The record is the female *Remu* in 2016-2017 who made 9 true nests out of 10 crawls for a total of 652 hatchling and an average of 82,1 live hatchling per nest
- Over 70.000 hatchling in 10 years
- 79,0 hatched eggs/nest
- 94,95 % of hatchling success
- 4,2 un-hatched eggs/nest
- Average depth of nest: 61,3 cm
- Incubation from 51 days to 80 days
- Over 300 very bad condition hatchlings found blocked in the nest have been sent to Moorea sea turtle rehabilitation center over the 10 years for treatment and around 40% have been able to be rehabilitated and released
- 7 tracking satellite programs showing direct tracks to the west and mainly around Fiji from 2011 to 2015

1.3 Threats

1.3.1 Nesting sites

The main natural predators are crabs and hermit crabs. Egg collection from nests is very occasional, but and hunting of adult green sea turtles for consumption and sale occurs still even if prohibited in French Polynesia. The capture is mainly done using fishing guns. Reproduction season seems to correspond to the pic of illegal harvest activities.

1.3.2 Marine areas

Threats are similar than in non-protected areas due to difficulty for enforcement and not higher frequency of monitoring programs on sea turtles in these areas.

1.4 Conservation

Marine Protected area exist in French Polynesia like inside the PGEM in Moorea or Reserve de Biosphere or protected area managed by Code of Environment in Fakarava, Teahuupo area in Presqu'ile, and the Reserve Territoriale of Scilly (Manuae) and Bellinghausen.

French Polynesian government is protecting all 5 species of sea turtles that can be found in its EEZ (see code of environment of French Polynesia). All turtles are under annex A, except green turtles that have been classified under annex B for their nesting specificities. Legal sea turtle protection has evolved lately but was first set up early, in 1971 by FP government.

The French Government is signatory of CMS and CITES conventions.

A conservation plan for sea turtle has been set up by the government (13) who is funding some inventory/ research programs

Since 2006, sea turtle rehabilitation centers have agreements from the government: Le Meridian hotel in Bora Bora, who is employing staff to manage it and the InterContinental Resort in Moorea who has given Te Mana O Te Moana foundation the role for its management.

The Moorea sea turtle care center has received over 151 adults, sub adults and juvenile turtles over the past 12 years that presented sickness or wound. Four species are represented 85 green 85 hawksbill, 4 olive ridley, 1 loggerhead; amongst which at least 60 were injured due to voluntary illegal harvest (10).

1.5 Research

Thermologgers in partnership with Dr. Jacques Olivier Laloe. Thermologgers have been deployed for the 3rd season and parameters are currently analyzed

The Direction of Environment has been doing continuous training for several islands on sea turtle tagging (providing flippers tags for more than 10 islands), nesting inventories, genetic samples and is funding some of these actions but no reports are available to us at the time of this report.

The research priorities are defined by the Direction of Environment and research authorization are given by the DIREN with accordance to its conservation priorities.

Genetic structure of the turtle population is crucial for future conservation strategy.

Some genetic study of green turtle population was made with George Balazs, then with Boulet Colomb d Hauteserre F., 2013 with samples from BoraBora, Moorea, Scilly, Tetiaroa, Tikehau, and Dutton et al, 2014 (9 samples form Mopelia)

More genetic studies are currently in progress and managed by DIREN

Te mana o te moana has provided over 400 samples of green turtles in 2012 and over 1400 in 2017.

Note from Tatarata M., Direction of Environment DIREN.:

Genetic program is run by DIREN on all marine species of sea turtles

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - South Central Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

One confirmed nesting area has been identified within French Polynesia.

Note from Tatarata M., Direction of Environment DIREN.:

Confirmed nesting and hatchling has *been validated by DIREN for Hawksbill turtles (Eretmochelys imbricata) on Reao atoll in Tuamotu archipelago– more information may be available at the Direction of Environment.*

2.1.2 Marine areas

Hawksbill turtles are commonly seen foraging and resting throughout French Polynesia. Tagging data suggest that Hawksbill turtles are more resident to local islands and do not undertake long migration. However, more studies are necessary to better understand their life cycle with only one confirmed nesting site in Reao in Tuamotu and very few Hawksbill adult male turtles encountered during the manta tow survey on the outer slope of barrier reef of 6 islands in 2010.

Manta tow in water population assessment in 2010-2011 has provided observation of 243 hawksbills turtles on 6 islands barrier reef survey (Tetiaroa, Moorea Maiao, Bora Bora, Maupiti, Tupai) on 3 annual transects (0.396ind/km for Hawksbill turtles). Mean hawksbill ccl size is 61,74 ± 13.74cm, with minimum size of 30 cm and maximum of 95 cm (1)

2.2 Other biological data

NONE

2.3 Threats

2.3.1 Nesting sites

See section 1.3.1

2.3.2 Marine areas

Threats are similar than in non-protected areas due to difficulty for enforcement and not higher frequency of monitoring programs on sea turtles in these areas.

2.4 Conservation

See Section 1.4.

2.5 Research

See Section 1.5.

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

Vagrant, Ocean transient.

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

The leatherback turtle (*Dermochelys coriacea* are rarely observed and are seen in the open ocean (1).

3.2 Other biological data

NONE

3.3 Threats

3.3.1 Nesting sites

Not Applicable

3.3.2 Marine areas

Threats are similar than in non-protected areas due to difficulty for enforcement and not higher frequency of monitoring programs on sea turtles in these areas.

3.4 Conservation

See Section 1.4.

3.5 Research

See Section 1.5.

4 RMU: Loggerhead turtle (*Caretta caretta*) – South Pacific

4.1 Distribution, abundance, trends

Vagrant, Ocean transient.

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

The loggerhead turtle (*Caretta caretta* are rarely observed and are seen in the open ocean (1).

4.2 Other biological data

NONE

4.3 Threats

4.3.1 Nesting sites

Not Applicable.

4.3.2 Marine areas

Threats are similar than in non-protected areas due to difficulty for enforcement and not higher frequency of monitoring programs on sea turtles in these areas.

4.4 Conservation

See section 1.4

4.5 Research

See Section 1.5.

5 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

5.1 Distribution, abundance, trends

Vagrant, Ocean transient.

5.1.1 Nesting sites

NONE

5.1.2 Marine areas

The olive Ridley turtle (*Lepidochelys olivacea)* are rarely observed and are seen in the open ocean (1).

5.2 Other biological data

NONE

5.3 Threats

5.3.1 Nesting sites

Not Applicable.

5.3.2 Marine areas

Threats are similar than in non-protected areas due to difficulty for enforcement and not higher frequency of monitoring programs on sea turtles in these areas.

5.4 Conservation

See Section 1.4.

5.5 Research

See Section 1.5.

Table 1. Key biological data for sea turtles near French Polynesia

RMU	**CM-SC PAC**	Ref #	**EI-SC PAC**	Ref #	**CC-S PAC**	Ref #	**LO-W PAC**	Ref #	**DC-W PAC**	Ref #
Occurrence										
Nesting sites	Y	1.2	EI one nest and hatchling observation in reao atoll Tuamotu 2016 pers. comm	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pelagic foraging grounds	JA	1, PS	JA	1,PS	n/a	n/a	n/a	n/a	n/a	3
Benthic foraging grounds	J	n/a	JA	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Key biological data										

Nests/yr: recent average (range of years)	170 IN PAST 4 YEARS FOR TETIAROA ONLY	PS	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	295 confirmed nests in 2016-2017 FOR TETIAROA ONOY	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	2 TETIAROA AND MOPELIA	PS	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	6	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	170 IN PAST 4 YEARS FOR TETIAROA ONLY	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	15 KM FOR TETIAROA	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	20_60 FOR TETIAROA	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	2_9	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	83 CCL	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	90.4 (289)	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	94% (295)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	49% 5(601)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)	Up (2007-2017)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance:	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

nests/yr (range of years)										
Published studies										
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	Y	6,7, 15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	Y	7,15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	Y 19	11	Y 5	11	Y1	11	Y1	11	N	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Threats										

Bycatch: presence of small scale / artisanal fisheries?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: quantified?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	Y(SPEAR GUN FOR MEAT)	n/a	Y(SPEAR GUN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	Y (OCCASIONNAL)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Egg predation	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)										
Monitoring at nesting sites (period: range of years)	Y (2004_ongoing) TETIAROA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Conservation										
Protection under national law	Y	n/a	Y	n/a	Y	n/a	Y	n/a	Y	n/a
Number of protected nesting sites (habitat preservation) (% nests)	1 TETIAROA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	3	n/a	3	n/a	3	n/a	3	n/a	3	n/a
N of long-term conservation projects (period: range of years)	1 TETIAROA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	Y Tetiaroa	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	hatchling treatment moorea	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

(eg, TED, circle hooks)										
By-catch: onboard best practices	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	Y (see turtles rehabilitation centers)	n/a	Y (see turtles rehabilitation centers)	n/a	Y (see turtles rehabilitation centers)	n/a	Y (see turtles rehabilitation centers)	n/a	Y (see turtles rehabilitation centers)	n/a

Table 2. Nesting Beaches in French Polynesia.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
				Long	Lat					
Beach A TETIAROA ONETAHI	Y	30 (2014_2017)	58 (2014_2017)	-149.3547608	-17.113163	3.00	100	12	1	B D
Beach B TETIAROA TIARAUNU	Y	86(2014_2017)	172 (2014_2017)	-149.352503	-16.5928418	7.60	100	2	1	B D
Beach C TETIAROA OROATERA	Y	53 (2014_2017)	122 (2014_2017)	-149.3223566	-16.592403	5.80	100	2	1	B D

Table 3. Conventions and Treaties for sea turtles in French Polynesia

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
CITES	Y	Y	see French Polynesian government	ALL	SEE FRENCH POLYNESIA GOUVERNEMENT CONSERVATION PLAN FOR SEA TURTLES	
CMS	y	y	see French Polynesian government	ALL	SEE FRENCH POLYNESIA GOUVERNEMENT CONSERVATION PLAN FOR SEA TURTLES	

Table 4. Research for sea turtles in French Polynesia

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private
T4.1	CM-S PAC	FRENCH POLYNESIA	windwards islands	Study of migrations of nesting green turtles in French Polynesia	Tracking; Fastloc GPS tag; Nesting female; South Pacific	2010	2011	Te mana o te moana: gouvernement FP/ NOAA	Private Public
T4.2	CM-S PAC	FRENCH POLYNESIA	windwards islands	Dual research program on sea turtles of the Society Archipelago French Polynesia	Tracking; Manta tow; Nesting monitoring; South Pacific	2010	2011	Te mana o te moana	Private public
T4.3	CM-S PAC	FRENCH POLYNESIA	windwards islands	Green turtle nesting monitoring program on Tetiaroa	Nesting monitoring; tagging; Green sea turtles	2007	on-going	Te mana o te moana	PrivatePublic
T4.4	CM-S PAC	FRENCH POLYNESIA	windwards islands	Photo-identification of sea turtles on Moorea	Photo-identification; Citizen science; Moorea	2016	on-going	Te mana o te moana	Private

T4. 5	CM-S PAC	FRENCH POLYNESIA	French Polynesia	Monitoring of marine mammals and other pelagic megafauna by aerial surveys	Aerial surveys; Marine megafauna; South Pacific	2011	2011	Agence des Aires Marines Protégées	Public
T4. 6	CM-S PAC	FRENCH POLYNESIA	French Polynesia	Emblematic Species Observatory of French Polynesia	Citizen science; Observatory; hei moana	2011	on-going	Te mana o te moana	Private public
T4. 7	CM-S PAC	FRENCH POLYNESIA	French Polynesia	Sea turtle care centers (Bora Bora and Moorea)	rehabilitation centers for injured and sick turtles	2000 Bora Bora and 2004 Moorea	on-going	Meridien Hotel in Bora Bora and te mana o te moana Moorea	Private public

Table 4. Continued

Collaboration with	**Reports / Information material**	**Current Sponsors**	**Primary Contact (name and Email)**	**Other Contacts (name and Email)**	**Database available**
Direction of Environnement	PDF ANNUAL REPORTS		CECILE GASPAR cecile.gaspar@gmail.com		on request

Critical Ecosystem Partnership Fund, French Ministry of Ecology, Sustainable development, Transport and Housing, French National Assembly, Planète Urgences Foundation,	PDF ANNUAL REPORTS	CRITICAL ECOSYSTEM PARTNERSHIP FUND	CECILE GASPAR cecile.gaspar@gmail.com		on request
Direction of environment, Tetiaroa Society, The Brando Society	PDF ANNUAL REPORTS	TETIAROA SOCIETY _ DIRECTION OF ENVIRONEMENT	CECILE GASPAR cecile.gaspar@gmail.com		on request
	PDF ANNUAL REPORTS	VILEBREQUIN	CECILE GASPAR cecile.gaspar@gmail.com		on request
Université de la Rochelle, CNRS	http://www.temanaotemoana.org/wp-content/uploads/2012/02/RapportFinal-Remmoa-PF2013.pdf		CECILE GASPAR cecile.gaspar@gmail.com		http://www.temanaotemoana.org/wp-content/uploads/2012/02/RapportFinal-Remmoa-PF2013.pdf
Direction of Environnement	PDF ANNUAL REPORTS	BEST EUROPEAN FUNDS	CECILE GASPAR cecile.gaspar@gmail.com		ON GOING

Direction of Environnement	PDF ANNUAL REPORTS for moorea	VILEBREQUIN	CECILE GASPAR cecile.gaspar@gmail.com		yes, all inventory of turtle received for Moorea

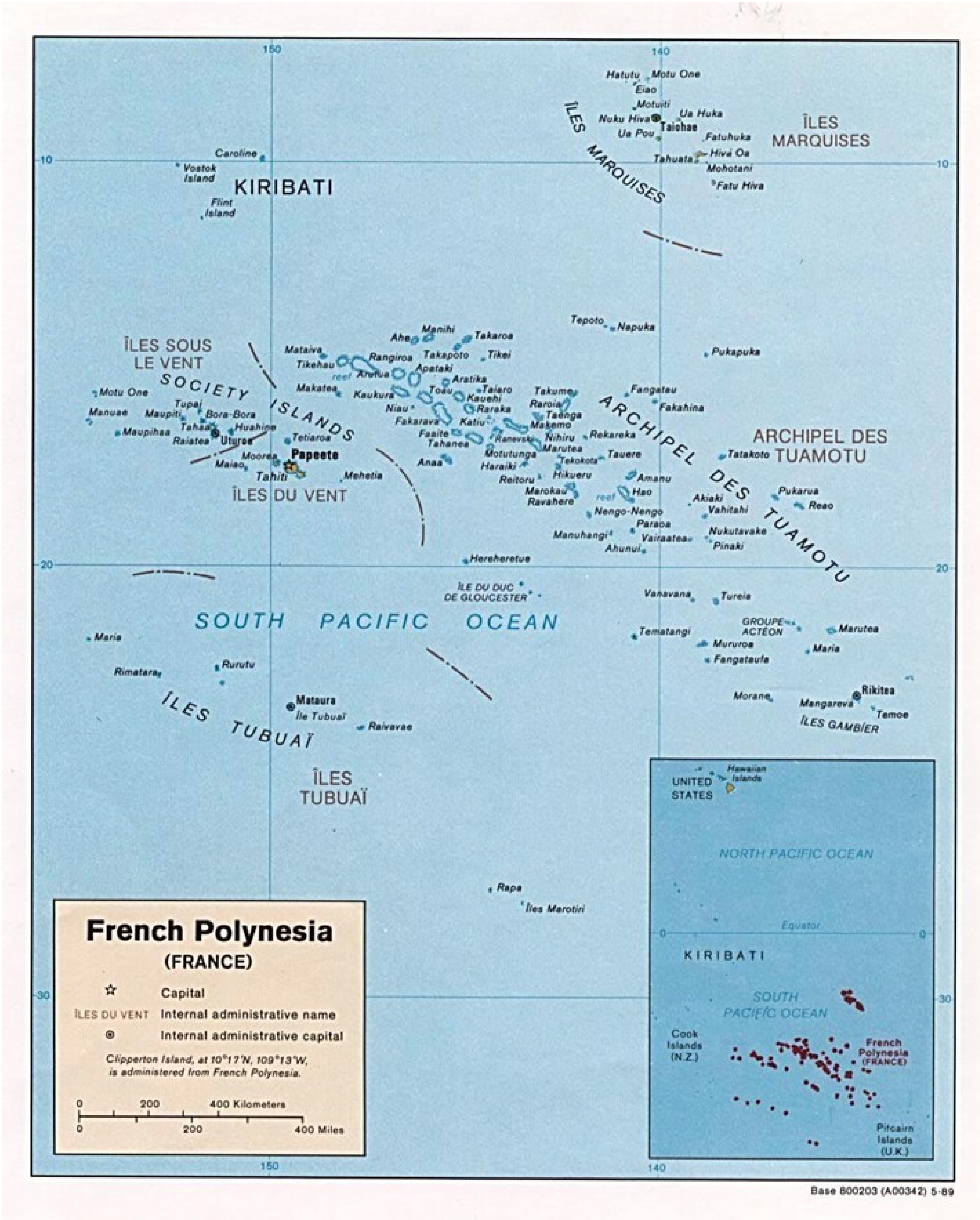

Figure 1. Map of the area of French Polynesia (downloaded from Orangesmile.com).

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FEDERATED STATES OF MICRONESIA

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1 RMU: *Chelonia mydas,* Central West Pacific (CM-CW PAC)

1.1 Distribution, abundance, trends

The Federated States of Micronesia (FSM) lies in the western and central Pacific Ocean, stretching from approximately 135 degrees E to approximately 165 degrees E longitude and from just below the equator to approximately 12 degrees N latitude. The Exclusive Economic Zone encompasses an area of 3,010,627 sq km. Geographically, it has been identified as being in the Western Caroline Islands (Yap State) and exclusively comprising the Eastern Caroline Islands (Chuuk, Pohnpei, and Kosrae States).

1.1.1 Nesting sites

Of the four FSM states nesting of *C. mydas* takes place primarily on uninhabited atolls and single raised coralline islands in Yap State. In Fig. 1 from West to East they are:

- Ngulu atoll: 8.50º N 137.50º E. Lathow and Meseran islands in the far northern part of the atoll are thought to support most of the nesting within the atoll. The one inhabited island is at the far southern end of the atoll and residents only rarely visit the two northern islands. A team from Yap State Marine Resources Management Division undertook two tagging exercises at Lathow and Meseran resulting in a total of 70 nesting turtles tagged from May through July 1992 and 75 tagged from April through July 1993 (17, cited in 22).
- Gielop island: 9.95° N 139.9 E is one of two islands in an atoll adjacent to Ulithi atoll. Traditionally owned by the people of Falalop island in Ulithi atoll, all turtles are said to be the property of the chiefs of the paramount island in the atoll, Mogmog (21). A sustained tagging and census project was undertaken by Yap Marine Resources Management Division 2005-2008. A total of 888 individual nesting green

turtles and one nesting hawksbill turtle were tagged on Gielop between 2005 and 2007. In 2008 a total of 66 nesting green turtles and three male green turtles were tagged and assessed (8).

- Gaferut island: 9.23º N 145.38º E is an uninhabited small (0.1 sq. km), raised coralline island with a fringing reef. It is rarely visited by its traditional owners, the people of Faraulep atoll. Occasionally (about one to three times per year) FSM government ships stop for the purpose of capturing turtles (n= 8 to 10 depending on abundance at the site) to be taken to the traditional owners. A depression in the fringing reef is said to be a resting place for females waiting to nest (23).
- Olimarao atoll 7.86º N 145.83º E is an uninhabited atoll sometimes visited by inhabitants from nearby Elato and Lamotrek atolls who are the traditional owners. These occasional voyages are undertaken to capture turtles, fish and to make copra. Tagging and monitoring of breeding turtles (including turtles observed courting, mating, or attempting to nest) was undertaken at Olimarao between April and September, 1990.
- Elato atoll: 7.45º N 146.15º E. Uninhabited islands of Falipiy, Toas, and Ulor in Elato atoll and nearby Nomoniur atoll, also traditionally owned by the people of Elato are known to host occasional nesting. Two tagging efforts were carried out at Elato where 36 nesting green turtles were observed from July through September, 1992 and 41 nesters from May through August, 1993 (17 cited in 22).
- West Fayu atoll: 8.00º N 146.80º E. Often visited by its traditional owners, the people of Satawal island. Turtles are taken while nesting as well as captured in the sea (23).
- Pikelot island: 8.16º N 147.50º E. An uninhabited coralline island that rises approximately 15 meters above sea level. It is often visited by people from the Western (Namonibetiu) islands of Chuuk state and less often by its traditional owners, the people of Satawal island. It is well known by its owners and the people of the Chuuk Western Islands as a turtle rookery. Voyages previously undertaken by sailing canoe are now more commonly undertaken by larger, powered craft including small ships based in Chuuk lagoon.
- East Fayu island: 8.78º N 151.24º E. consists of two small coral islands with a fringing reef. It is often visited by its traditional owners, the people of the Hall Islands in Chuuk State. It is located 36 km to the west of Nomwin atoll and 104 km north of Chuuk lagoon.
- Oroluk atoll: 7.55º N 155.57º E. Located midway between Pohnpei and Chuuk and politically a part of Pohnpei State. Previously uninhabited, it became an occasional camp and later semi-permanent residence of people from Pohnpei, usually numbering not more than 10 or 15. The harvesting of turtles and eggs and the construction of living quarters and pig pens on or immediately adjacent to nesting beaches probably has contributed to diminished numbers of turtles in recent decades

(4). In the 1990s, juvenile green turtles were known to be present in the lagoon (26 and 4).

Nesting by *C. mydas* may also rarely occur on one or more of the inhabited islands and atolls in FSM. In Yap State, atolls where turtles are most often known to nest are Ulithi atoll (10.00º N 139.67º E) with numerous uninhabited islands, and the only occasionally inhabited Sorol atoll (8.15º N 140.42º E).

Kosrae, the easternmost island in FSM, is a volcanic island with a fringing reef and shallow lagoon. Turtles have reportedly been known to nest rarely at one beach on the southern coast of the island near Utwe village in the past (14). There is no current information available on nesting status at that site. According to Pritchard (28, cited in 21) nesting sites in Chuuk State in addition to East Fayu include Fananu in Nomwin atoll and Murilo Atoll.

The lack of sustained and systematic surveys makes it difficult to quantify declines in turtle populations. While there are no current figures on the numbers of nesting green turtles at Oroluk, the inhabitants have complained of a decline in numbers with estimates of nesting females per year ranging from 40 to 100 individuals (23). Observations in 1985 indicated turtle nesting averaged 2.3 nests per month and in 1986 3.4 nests per month (9). This is considerably fewer than the 9 to 15 nests *per night* reported just 10 years before (27).

1.1.2 Marine areas

Foraging is believed to occur on the high islands: Yap, the islands of Chuuk lagoon, Pohnpei, and Kosrae. All of these islands have varying degrees of mangrove forest. Green and hawksbill turtles are two most common turtles in Pohnpei. Foraging is also known to occur in Elato atoll, Yap State. Sub-adult turtles are sometimes captured in Chuuk lagoon by fishermen that use outboard motors to chase the turtles over sand flats or shallow reef areas where they are either speared or captured by hand.

According to results of a survey by Buden and Edward (7) local islanders hunt turtles regularly and take opportunistically while fishing, often disregarding size limits, closed seasons and other restrictions. Leatherbacks have been recorded from time to time, mainly outside the reef. Buden and Edward also report inhabitants of a relatively remote village on the main island using baited bundles of seaweed or seagrass to attract turtles that are then captured.

1.2 Other biological data

Moritz and Limpus (25, cited in 17) demonstrated that green turtles breeding in Yap State form a population separate from those of other sampled areas in the Pacific. Their study also suggests that turtle populations of Ngulu and Elato atolls (590 km distant) are separate.

Genetic samples collected during monitoring efforts suggest nesting green turtles in Yap are comprised of one genetic stock distinguishable from other Pacific nesting populations, although additional samples and analysis are needed to provide increased resolution (21).

Kolinski (17) reported on the geographic distribution of recaptured turtles tagged in Yap State (see Table 3).

Post-nesting migrations of 13 green turtles tagged at Gielop Island, Yap State were tracked by satellite transmitters in 2005-2007. Eight of the turtles travelled west to the Philippines with an average distance of 2,600 km. One turtle migrated nearly 6,000 km through Philippine and Vietnamese waters to Malaysia, and three migrated north to Japan (18).

1.3 Threats

1.3.1 Nesting sites

Sea level rise: has not been documented at nesting sites in FSM but is highly likely to severely affect the single coralline islands as they typically have very small fringing reefs that might serve as buffers to sea level rise.

Climatic events: Islands in Chuuk State and particularly Yap State lie within the typhoon belt of the Western Pacific. Tropical low-pressure events (tropical storms, typhoons) can occur during any month of the year and can cause beach erosion. There has been an increase in the severity of typhoons during the past few decades that has been attributed to climate change.

Anthropogenic effects: Use of motorboats and large ships in place of canoes enable access to turtle nesting sites that might otherwise not be available (22, 27). Turtles captured at nesting sites and within the lagoon are sold in Chuuk for human consumption, particularly for feasts and parties.

Monitor lizards: Varanid lizards were introduced to most of the islands in Yap State during the Japanese administration period, 1920-1945, purportedly as a means of controlling the rat population (which they failed to do). Buden (6) reported that turtle nests on Sorol atoll suffered predation from monitor lizards. Monitors are not present on the inhabited islands of Lamotrek and Elato, nor on the uninhabited islands of West Fayu, Gaferut, Pikelot.

The 2014 FSM report to the Convention on Biological Diversity states that overexploitation of biological resources is the most significant threat to biodiversity with FSM. The report explains that "...people are overexploiting marine and terrestrial resources for subsistence and financial reasons, not necessarily because they do not understand the long-term impact of their actions" (24). Lessa (20) cited the main danger to the green turtle lies in the decline of the restraining power of myth and ritual in the harvesting, killing, and distribution of turtles.

1.3.2 Marine areas

Drifting fish aggregating devices (FADs) are commonly used in tuna purse seine fishing in the Western and Central Pacific Ocean during an open "FAD season". Drifting FADs are known to attract turtles as well as other oceanic fauna and may be captured during the fishing process. FSM has its own fleet of 16 purse seiners that fish in FSM and elsewhere, and the FSM government licenses up to 150 or more purse seiners from distant water fishing nations to fish in its EEZ. Turtles caught incidentally to fishing operations are required to be released (29), however mortality can occur particularly when turtles become entangled in a FAD's appendages. Analysis from the Western and Central Pacific Ocean showed that the CPUEs for green turtles caught incidentally in FSM of 0.006983 – 0.018870 (SPC 2017).

Reviewing data for the entire WCPO a workshop in 2017 convened by the Western and Central Pacific Fisheries Commission concluded that interaction rates of olive ridley, loggerhead and green turtles with deep set longlines were highest for those hooks closest to floats. Interaction rates of leatherback turtles were not influenced by how close the hook is to the float. At-vessel mortality rates were influenced by turtle species, with the lowest mortality rates for leatherback and loggerhead turtles. At-vessel mortality rates also increased with increased fishing depths, as measured by both hooks per basket and float length (30).

1.4 Conservation

Current FSM Code sections regarding sea turtles contains the same language as those laws applicable during the administration of the Trust Territory of the Pacific Islands and going back as far as the administration of the US Navy in the 1950s. Current law establishes minimum size limits for hawksbills and green turtle (27 inches and 34 inches CCL respectively), closed seasons (June 1 to August 31 and December 1 to January 31. It is important that jurisdiction of the national government covering sea turtles has been found to be applicable only beyond 12 miles in the Exclusive Economic Zone (13) and thus for practical purposes does not cover most of the turtle-related activities undertaken in the country.

Yap State: Yap State Code prohibits the commercial sale of sea turtle meat and eggs (21). Although taboos related to turtles and some beliefs held by Yap outer islanders were often based on superstition, many of these beliefs formed a buffer between man and his environment, preventing him from destroying his island or its resources (11, 22). The introduction of laws and regulations in the modern day, particularly as they apply to isolated islands and atolls where turtles are utilized in subsistence cultures, rarely has any material impact on the take of turtles or eggs. An exception is the expressed ownership of turtles in Ulithi by the Ulithi chiefs and their ability to withhold authorization for any activities related to turtles, including take (20, 8). In 2014 the Yap State Environmental Protection agency enacted two regulations under laws passed by the state legislature. EPA Regulation No. 2014-4 and EPA Regulation No. 2014-5 ban the shipment of any seafood, including turtles, from the Yap outer islands to Yap mainland. The ban also limits sea turtle catch to one per vessel per week, and prohibits catch form the months March to August inclusive (cited in 1). The efficacy of these regulations has not been evaluated.

Kosrae State: The contents of the Kosrae State Code relating to turtles applies the minimum CCL length of 27 inches to any turtle. Closed harvest seasons mirror FSM national law (19).

Pohnpei State: Pohnpei State laws governing turtles are said to mirror the FSM national laws with respect to minimum size and closed harvest seasons (21).

The municipality of Sapwuahfik, an atoll about 90 miles southwest of Pohnpei Island, placed a ban on the hunting of turtles as a public health measure following two incidents of chelonitoxication resulted in the death of several people on the island (5).

In 2004 the municipality of Mwoakiloa received a grant from the Micronesia Conservation Trust to tag sea turtles, protect and rehabilitate turtle nesting sites and conduct community education and awareness programs as part of is approved project, "Community Based Sea Turtle Conservation Program" (10).

1.5 Research

The Yap Institute of Natural Science has at various times supported and participated in sea turtle research in Yap State since 1975. It currently has no ongoing research projects relating to sea turtles. The government of each State in FSM has its own marine resources department or division. There are no ongoing activities integral to regular work programs addressing sea turtles at either the state or national level.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central West Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

E. imbricata nesting is believed to be rare in FSM. As what is thought to be a typical example, just one hawksbill was reported nesting on Losiep and Gielop islands in Ulithi during the period 2005-2008 when a total of 880 nesting green turtles were seen.

Anecdotal information on two nests of hawksbill turtles, one on a barrier reef island and one at nearby Ant atoll was included in Buden and Edward (7) who used the results of a survey of fishermen and others in Pohnpei (n=43) focused on green turtles. The general response to the survey was that nesting by turtles is rare since the island is ringed with mangrove and there are limited potential nesting beaches on islands within the lagoon.

2.1.2 Marine areas

Known to forage on near shore reefs. Little documented evidence.

2.2 Other biological data

NONE

2.3 Threats

2.3.1 Nesting sites

Human illegal harvest of nests.

2.3.2 Marine areas

Fishermen using spears and/or nets will typically retain any caught hawksbill turtle with the expectation that the shell will have pecuniary value.

2.4 Conservation

One island in the central Carolines (Satawal located at 7.35° N 147.03° E) was known as a source of hawksbill shell for use in implements and ornaments. Prior to conversion to Christianity in the 1950s traditional practice of the inhabitants included a prohibition against the taking of *E. imbricata* on the island, even though the shell was highly useful. People from other islands visiting Satawal who took this species were required to camp on the beach away from other human habitation. People from Satawal were not prohibited from obtaining hawksbill carapace shells or using implements or ornaments made of hawksbill shell, however they must have been harvested by others or brought from another island (source: author's knowledge).

Current FSM Code sections regarding sea turtles contains the same language as those laws applicable during the administration of the Trust Territory of the Pacific Islands and going back as far as the administration of the US Navy in the 1950s. Current law establishes minimum size limits for hawksbills and green turtle (27 inches and 34 inches CCL respectively), closed seasons (June 1 to August 31 and December 1 to January 31. It is important that jurisdiction of the national government covering sea turtles has been found to be applicable only beyond 12 miles in the Exclusive Economic Zone (13) and thus for practical purposes does not cover most of the turtle-related activities undertaken in the country.

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Pohnpei State: Pohnpei State laws governing turtles are said to mirror the FSM national laws with respect to minimum size and closed harvest seasons (21).

The municipality of Sapwuahfik, an atoll about 90 miles southwest of Pohnpei Island, placed a ban on the hunting of turtles as a public health measure following two incidents of chelonitoxication resulted in the death of several people on the island (5).

2.5 Research

NONE

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

Satellite tagging studies have shown that leatherbacks from the Bird's Head region of West Papua (2) and Papua New Guinea (3) transit ocean regions in and near FSM on their journeys to/from areas near North America. The leatherback is reported occasionally in Micronesia and is recognized by the name *miring* in Chuuk (27). A young leatherback was captured near Satawal in 1972 where it is recognized in several atolls of the central Carolines by the local name *wongerau* or *wongeras,* meaning "turtle like a whale" (22). Pritchard (27) and Buden and Edward (7) recount instances where a leatherback or leatherbacks were captured or seen in Pohnpei's main island.

3.2 Other biological data

NONE

3.3 Threats

3.3.1 Nesting sites

NONE

3.3.2 Marine areas

Threats in marine areas include entanglement in marine debris particularly fish aggregating devices (FADs) in the purse seine fishery that employ rafts and suspended netting, and interaction with pelagic longline fleets.

3.4 Conservation

NONE

3.5 Research

NONE

4 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

No nesting of olive ridleys has been observed or documented in FSM and individuals of the species present in FSM are considered transients.

4.1.2 Marine areas

Transient and rarely seen in FSM waters. Anecdotal evidence of bycatch in the pelagic tuna longline fishery. Olive ridleys were first recorded in Micronesia by Falanruw et al. (12). The authors described a mating pair outside the M'il channel on the main islands of Yap proper as well as noting the incidental capture by a research vessel in 1974 and visual inspection of a carapace from Lamotrek Island in the eastern part of Yap State.

4.2 Other biological data

NONE

4.3 Threats

Since the collection and analysis of onboard fishery observer data from longline vessels operating in FSM began in the 1990s, it has been found that olive ridleys are perhaps far more numerous in FSM and surrounding waters than first thought. Analysis of longline data from distant water longline fishing fleets 1989 to 2015 showed that the CPUE of 0.1001 – 0.3704 for olive ridleys in a 5° square covering eastern Palau and western FSM was the highest CPUE in the entire Western and Central Pacific Ocean. The life stages for those turtles caught (interactions) were roughly equally divided into juvenile, intermediate, and unknown. (30).

4.3.1 Nesting sites

NONE

4.3.2 Marine areas

Threats in marine areas include entanglement in marine debris, and interaction with pelagic longline fleets. Information from the Western and Central Pacific Fisheries Commission showed that for commercial longline fishing, the CPUE for olive ridley turtles in one 5° square covering part of FSM is the highest in the WCPO at 0.1001 – 0.3704 (30).

4.4 Conservation

NONE

4.5 Research

NONE

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Federated States of Micronesia

RMU	**CM-PWC**	Ref #	**EI-PWC**	Ref #	**LO-PW**	Ref #	**DC-PW**	Ref #
Occurrence								
Nesting sites	Y	7,14, 21,29	Y	7,14,21 ,29	N	7,14,21 ,29	N	7,14,21 ,29
Pelagic foraging grounds	JA	17,18, 26,27	n/a	n/a	JA	11,30	JA	2,3,23, 28
Benthic foraging grounds	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Key biological data								
Nests/yr: recent average (range of years)	200 (1990 - 2008)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr	3	n/a	n/a	n/a	n/a	n/a	n/a	n/a

AND >10 nests/km yr)								
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	5	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	Decline	10,24, 28	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

grounds (range of years)								
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	Y	9,17, 21,26, 33	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	9,32, 33	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	Y	19	n/a	n/a	n/a	n/a	n/a	2,3
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	Y	21	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	Y	21	n/a	n/a	n/a	n/a	n/a	n/a

Threats								
Bycatch: presence of small scale / artisanal fisheries?	Y	20,23, 25,28	Y	25	Y	25	Y	25
Bycatch: presence of industrial fisheries?	Y	30,31	Y	30,31	Y	30,31	Y	30,31
Bycatch: quantified?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	Y	n/a	n/a	n/a	Y	11,30	n/a	n/a
Take. Egg illegal harvest	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Developmen t. Nesting habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Developmen t. Photopollutio n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Developmen t. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Egg predation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitor lizard predation nest	Y	6	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Conservation								
Protection under national law	Y	13,19, 21	n/a	n/a	n/a	n/a	n/a	n/a
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	Y	9	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

By-catch: onboard best practices	Y	1	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cultural practices	Y	11,12, 15,20, 23	n/a	n/a	n/a	n/a	n/a	n/a
Ban due to Chelonitoxin	Y	5	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Nesting Beaches for *Chelonia mydas* (green turtle) in the Federated States of Micronesia

RMU / Nesting beach name	Index site	Turtles (range of years)	Crawls (year)	Central point		Length (km)	% Monitored	Reference #
				Longitude	Latitude			
Ngulu Atoll	N	70-75(1992-1993)	n/a	137.5	08.5	n/a	0	18,23
Gielop Island	N	66-888 (2005-2008)	n/a	139.9	09.95	n/a	0	8, 17, 18
Gaferut Island	N	8-10	n/a	145.38	09.23	n/a	0	17
Olimarao Atoll	N	Unknown N (1990)	n/a	145.83	07.86	n/a	0	17
Elato Atoll	N	36-41 (1992-1993)	n/a	146.15	07.45	n/a	0	17
West Fayu Atoll	N	Unknown N	n/a	146.8	08.00	n/a	0	24
Pikelot Island	N	Unknown N	n/a	137.5	08.16	n/a	0	23
East Fayu Island	N	Unknown N	n/a	151.24	08.78	n/a	0	24

Oroluk Atoll	N	10-15	n/a	155.17	07.55	n/a	0	10, 27

Table 3. Geographic Distribution of Recaptured Turtles (CM-CW PAC) Tagged in Yap State

(SSR = same-season recapture of turtles breeding outside tagging areas; SBR = subsequent breeding season recapture of breeding turtles.

Post Breeding Recaptures						SSR	SBR	
Sex	Number tagged	Yap State	Papua New Guinea	Philippines	Marshall Islands	Yap State	Yap State	Total
Male	13	2	0	1	0	0	1	4
Female	553	1	1	7	1	4	1	15
Total	566	3	1	8	1	4	2	19

Source: Kolinski (18)

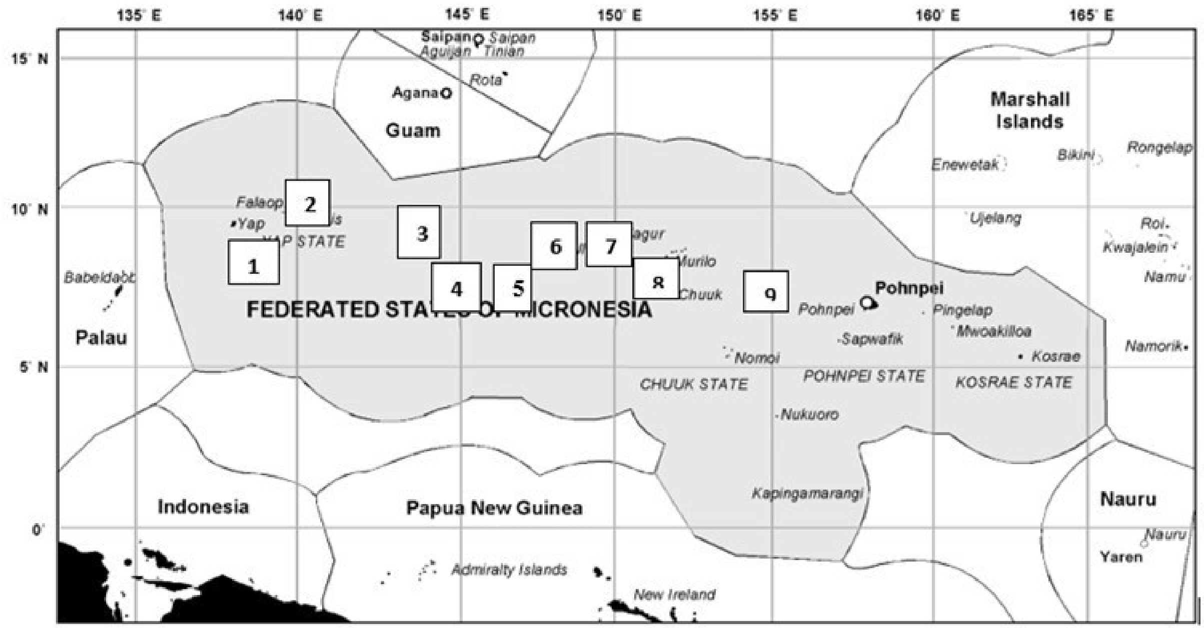

Figure 1. *Chelonia mydas* Nesting Sites in FSM: 1-Ngulu Atoll, 2-Gielop Island, 3-Gaferut Island, 4-Olimarao Atoll, 5-Elato Atoll, 6-West Fayu Atoll, 7-Pikelot Island, 8-East Fayu Island, 9-Oroluk Atoll

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GUAM

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1 RMU: *Chelonia mydas*, Central West Pacific (CM-CW PAC)

1.1 Distribution, abundance, trends

Guam (13°28' N, 144°47' E) is the largest and southernmost island of the Mariana Islands Archipelago located 1,600 kilometers (km) south of Japan and 2,400 km east of the Philippines, with a total land mass of 549 square km (Fig 1). Guam is a U.S. territory that supports various military installations that comprise approximately 29% of the total area of the island (1). The Guam Department of Agriculture, Division of Aquatic and Wildlife Resources (DAWR) is the agency with vested authority and responsibility for the conservation of protected species on Guam (4). Under the Endangered Species Act (ESA), a recent global green turtle status review placed Guam within the "endangered" Central West Pacific (CWP) distinct population segment (DPS) with a green turtle nesting population consisting of approximately 22 females (2). DAWR sea turtle monitoring activities on Guam dates back to the 1990s (3), but nesting beach surveys have been opportunistic and sporadic over time, so a green turtle nesting trend is unknown (2,4).

1.1.1 Nesting Sites

Guam contains approximately 125 km of coastline including beaches that may provide suitable nesting habitat. There is regular, low density green turtle nesting on Guam that appears to occur year-round with a more concentrated nesting season from May through August (4, 5, 6, 8). Guam nesting beaches are managed and monitored via a consortium of local government and U.S. federal partners including DAWR, U.S. Fish and Wildlife (Refuges), Airforce, and Navy. As a result, many agency reports contain duplicate reports of nesting activity (e.g., DAWR grant reports to NOAA may also reference similar nesting activity that Naval Base Guam reports).

Documented nesting beaches include: Ritidian National Wildlife Refuge, Urunao, Jinapsan, Tumon Bay, Cabras Island, Cocos Island, Acho Bay, Nomña Bay, four primary beaches of Naval Base Guam (NBG; including Spanish Steps, Haputo, Kilo Warf, and Sumay), and five beaches within Andersen Air Force Base (AAFB): Tarague, Scout, Sirena, Pati, and Explosive Ordnance Disposal (EOD) area (1, 5, 7, 9, 10). Two large stretches of beach occur in northern Guam. The longest strip runs from Falcona Beach eastward to Tagua Point (15 km), and Bijia Point to Hilaan (4km) which encompasses beaches of AAFB and Ritidian National Wildlife Refuge (1, 11). Historically, approximately 75% of green turtle nesting activity was believed to have occurred in Northern Guam at Jinapsan beach (11, Table 2).

Additional NBG beaches that may have historically supported nesting activity and are surveyed as potential nesting locations, but do not typically support nesting activity: Dadi, Double Reef, Gab Gab, Polaris Point, San Luis, and Tipilao (7, 10). However, Dadi beach became active in 2013 (12). The Navy monitored NBG beaches opportunistically beginning in 2004 primarily at Spanish Steps and Haputo. Since 2010, Navy surveys have become standardized with regular consistent surveys at 8 to 10 NBG beaches (13).

Prior to 2014, monitoring efforts were unstandardized and opportunistic, therefore it is not possible to accurately conclude how many nests may have been laid per year at specific beaches in Guam. For example, between August 1, 2006 through July 31, 2008, 54 green turtle nests were recorded during opportunistic surveys at six Guam beaches: Cocos Island, Spanish Steps, Ritidian, Ipan, Jinapsan, and AAFB Explosive Ordnance Division (28). In 2014, Cocos Island was designated as an index beach and regular surveys have been conducted since then by DAWR staff which resulted in documentation of 45 nests laid per year (between 2015 and 2017; n = 179 nests recorded) (47). Standardized surveys at AAFB beaches began in 2015 when all five beaches were surveyed resulting in 49 nests documented, and 83 nests recorded in 2016 (1). While a small number of nests are laid on Scout, Sirena, and Tarague beaches, the majority of nesting activity occurs at EOD beach which is emerging as the AAFB index beach (1).

Based on the information available for this report, Cocos Island (monitored by DAWR), Spanish Steps (monitored by NBG), AAFB/EOD beaches (monitored by AAFB), and possibly Jinapsan beach (due to historic value, monitored by DAWR) are the index nesting beaches on Guam.

1.1.2 Marine Areas

Green turtles forage in nearshore neritic waters of Guam (8, 11, 16). Satellite telemetry shows that post-nesting green turtles migrate to areas within and outside of Guam, with strong connectivity to the East-Indian Western Pacific region. For example, 17 satellite tracks of post-nesting green turtles from Guam and CNMI show animals moving to foraging habitats in the Philippines, Taiwan and Japan (14). In 2000 and 2007, two post-nesting green turtles were satellite tagged on Guam and traveled to the Philippines and Japan, respectively (4, 9). In 2016, one post-nesting green sea turtle at AAFB was satellite tagged and traveled to the Philippines (8), and in 2017 two post-nesting green sea turtles from Cocos Island and Spanish Steps were satellite tagged and traveled to the Philippines and Indonesia, respectively (14).

Aerials surveys provide valuable information on sea turtles in Guam. Aerial survey data from the 1970s and 1980s suggested that sea turtle numbers had been reduced over that time period (11); however, during the 1990s aerial survey sightings appeared to gradually increase from year to year (3). Historically, sea turtles were known to be highly abundant at several locations including off the northern and eastern coasts with groups of 40 to 50 individuals often observed between Ritidian Point and Pati Point during aerial surveys (11). Sea turtles have also been commonly observed inside Apra Harbor (15). Wiles (11) reported that green turtles represented 87% of observations during aerial surveys between 1989 and 1991. Martin (16) analyzed semimonthly aerial survey data collected over a 32-year period, from 1963 to 2012, which consisted of 632 flights covering the nearshore marine environment of Guam (70.16km^2) that recorded sea turtles, elasmobranchs, and cetaceans. Surveyors recorded 10,622 sea turtle observations over this time period and found that observations had increased over time with the mean annual population growth rate of sea turtles (mostly green turtles) was 7.0 % since 1963, and 10 % since 1989 (16). This increase in turtle observations varied spatially, with the highest densities occurring along the south, east, and north coasts, particularly in areas having low human density. High turtle density areas include waters inside Apra Harbor near San Luis, Gab Gab, out to Spanish Steps including Dadi and Tipalao beaches outside of the harbor, as well as Cocos Lagoon and Achang Bay (16, 17). Mean abundance estimates for 2008–2012 were 138–299 green turtles (16).

Research to better understand sea turtles in their foraging habitats in Mariana Islands in habitats of Apra Harbor, Cocos Lagoon, Tinian and Saipan has been implemented since 2013 in partnership with U.S. Navy PACFLEET and NAVAC and local government offices of Guam and CNMI (17, 18, 19). Preliminary assessment from 73 turtles (88% green turtles and 12% hawksbill turtles) outfitted with satellite tags (23 Saipan, 23 Tinian, 27 Guam) revealed high site fidelity and limited movements for both green and hawksbill turtles while residents in coastal habitats of Guam, Tinian, and Saipan (18,19). The core habitat area was geographically concentrated for green turtles (mean = 0.51 km^2; range = 0.03 – 2.58 km^2), the home range average area was 3.20 km2 (range = 0.07 – 18.17 km^2), with a slightly larger home range on Guam (mean = 4.20 km^2) and Tinian (mean = 3.09 km^2) than on Saipan (mean = 2.26 km^2) (17, 18, 19). While the majority of tagged turtles remained within a 1-3 km^2 area for the entire life of the tag, there were a few long-range movements which indicate there is some diversity in nearshore habitat use and movements around the Mariana Islands. Martin (19) conclude that movement patterns, residency times, and thus exposure to nearshore threats, likely vary throughout an individual's life, with smaller juvenile turtles potentially spending most of their time in a localized reef areas and larger mature turtles having intermittent periods of residency as they move between foraging and breeding grounds. Data obtained by PIFSC in-water studies (17, 18, 19) are consistent with the analysis of over 500 in-water captures from 2006 to 2014 in CNMI (20). Green turtles recruit to the nearshore waters of the Mariana Islands around 34-36 cm SCL and depart to adult foraging and nesting grounds around 78-81 cm SCL, remaining in the nearshore waters for an estimated 17 years (13 – 28 years: 95% confidence interval) between recruitment and maturity (20). In-water green turtle density in the Marianas Archipelago is mostly restricted to juveniles (mean SCL = 50.7 cm) with a growth rate from 0.3 to 7.8 cm per year (19, 20, 21).

1.2 Other biological data

None - see Table 1.

1.3 Threats

1.3.1 Nesting Sites

Previous studies have linked the low abundance of sea turtle populations to historical harvests that occurred throughout the Pacific Islands (22, 23, 24, 32) which includes harvest of sea turtles in Guam (15, 25, 26, 27). Human harvest of eggs and of turtles remains a significant threat to sea turtles on Guam (2, 9, 28, 29, 30, 31).

AAFB (1) reports that primary threats to nesting turtles are anthropogenic influence (trash and marine debris, driving on beaches, beach fires, dogs, etc.), predation of nests (monitor lizards, pigs, and ghost crabs), and water inundation (storms and Typhoons). At Naval Base Guam beaches, monitor lizards and hermit crabs were identified as nest predators (7; 15, 36, 37). In 2017, 65% of nests laid at Spanish Steps were depredated by monitor lizards (34). Of Naval Base Guam (NBG), the Kilo Warf site has been altered and is no longer considered to have suitable nesting habitat (7).

1.3.2 Marine Areas

Guam is a strategic stopping point for ships and aircraft, and Apra Harbor is one of the largest protected deep-water harbors in the Western Pacific Ocean. Given its position with respect to the Far East, the island has become a political, economic, and military stronghold of national and international significance (1, 15, 35).

The terrestrial and nearshore marine environment around Guam has been degraded by impacts from intense combat during WWII which also resulted in the loss of numerous terrestrial species (11). Spanish Steps is at the mouth of Apra Harbor has been heavily modified, particularly since World War II (38). Additional impacts include shoreline development, sediment-laden runoff, pollution, invasive species, and years of poorly treated wastewater effluent (11, 15, 35). Other marine threats include tourism (i.e., grabbing and handling of turtles in the water), boat strike, and human harvest of turtles of all size/age classes (DAWR 28, 29, 30, 31).

1.4 Conservation

As a U.S. territory, green turtles in Guam are protected under the U.S. federal Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 *et seq.*). Under the ESA, green turtles in Guam (occur within the Central West Pacific DPS) are listed as endangered. The ESA prohibits unauthorized "take" of listed species which is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. § 1532(18)). Turtles are also protected by the Endangered Species Act of Guam which adopts the same definitions and status designations as the federal ESA and carries additional penalties for violations at the local government level (4). Other Guam resource agencies, such as the Bureau of Statistics and Plans (BSP), also have specific mandates in relation to sea turtle conservation. The BSP administers the Guam Coastal Management Plan through the Coastal Zone Management Act of 1972 (Guam Public Law 92-583 and Public Law 94-370). The GCMP guides the use, protection, and development of land and ocean resources within Guam's coastal zone, which includes all non-Federal property and all submerged lands and waters out to 3 nm (5.6 km) from the shoreline (4).

AAFB (1) attributes decreased human presence, the ease of beach access for nesting, and greater surface area of shoreline vegetation could all account for the variability in nesting activity. Educational signage has been installed at Tarague beach to increase awareness and reduce the number of dogs brought to the beach that could negatively impact nesting activity. Additional management activities include installation of turtle-safe lights at Tarague in 2012, and repair of lights at the volleyball court in 2016 which has resulted in decreased light pollution on nesting beaches (1).

Trash and debris can impede nesting success and endanger hatchlings therefore at AAFB coordinates community volunteer bi-annual beach clean-ups at all public beaches which are scheduled to occur every April on Earth Day and every September on the International Coastal Clean-up day (1). DAWR provides educational outreach to schools upon request, provides Haggan-watch training to volunteers, and is often present at community events to provide information to the public (DAWR 28, 29, 30, 31).

Naval Base Guam has implemented a nesting beach habitat enhancement program via their Joint Region Marianas Integrated Natural Resource Management Plan (INRMP) that includes removal of invasive vegetation and marine debris, and trapping/removal of monitor lizards to prevent predation at Spanish Steps (33, 34). Between September 2015 and October 2016, 5 monitor lizards were removed (three females, of which one had 11 eggs), 1 male, and 1 (sex unknown). The lizards were captured via noose traps and air rifle (33). Additionally, NBG has begun utilizing self-releasing screens placed on all estimated clutch locations at Spanish Steps to prevent depredation of nests/hatchlings by monitor lizards, and have placed barricades (10-20' lengths) at six access points along Dadi Beach which will allow pedestrian access but restrict vehicular access to protect sea turtle nests (34).

The U.S. is also party to several (binding) international agreements related to sea turtles, including: the Inter-American Convention for the Protection and Conservation of Sea Turtles, the Western and Central Pacific Fisheries Commission, the Inter-American Tropical Tuna Commission, and the Convention on International Trade in Endangered Species (CITES) which prohibits international trade of marine turtles and marine turtle derived products (4). The U.S. is also signatory to non-binding arrangements such as the Convention on Biological Diversity, the Indian Ocean South-East Asian Sea Turtle Memorandum of Understanding, and the Secretariat of the Pacific Regional Environment Program (4).

1.5 Research

Research, conservation and management activities in Guam occurs via a consortium of local government (DAWS) and U.S. federal partners including NOAA Fisheries, U.S. Fish and Wildlife (Refuges), Airforce, and Navy. In general, standardized, consistent surveys of index nesting beaches is necessary to gather long-term nesting trend data, and each federal or local government partner is encouraged to monitor their properties consistently and via standardized techniques to obtain baseline and nesting trend information. Primary index nesting beaches for Guam (Cocos Island, Spanish Steps, EOD beach (AAFB), and Jinapsan beach) are important index beaches for focused standardized survey effort. The following research activities include:

- DAWR and federal stakeholders (Navy, USFWS, Airforce, etc) to meet annually to compile and consolidate data and draft one comprehensive annual nesting activity report.
- Improved staff capacity to identify nests to help with accurate data recording and in order to better quantify nesting success and reproductive output per year.
- A DAWR volunteer program manager would be of value to ensure that Haggan-watch volunteers are coordinated and directed to provide comprehensive and consistent monitoring activities at beaches.
- Continue marine population demographic research to assess fine-scale habitat use, abundance and distribution. Provide training to Guam personnel to maintain in-water monitoring efforts over time (DAWR has a NOAA permit for marine capture activities).
- Social-science research could be applied to better understand and assess target audiences, develop tools and messaging for target audiences, and draft a communication plan to address and reduce sea turtle harvest or other in-water threats.
- Continue to implement nesting beach conservation measures to reduce predation and other anthropogenic threats and assess the success of these conservation measures.
- Compile stranding data over time to gather a comprehensive inventory and assess the spatial dynamics of marine threats and impacts.
- Continue to work with the military to ensure federal activities do not jeopardize the continued existence of sea turtles in Guam and the Marianas.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central West Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

Hawksbill turtles occur in Guam (8, 11). The first reported hawksbill turtle nest on Guam was in November 1991[1] (8). In 1997 a suspected hawksbill nest was reported from a beach near Sumay Cove, however no additional activity was observed at this location (10). In 2008, four nesting events were attributed to hawksbills at Dikiki Beach within Spanish Steps (10), but no nesting activity has been documented since.

2.1.2 Marine areas

Hawksbill sea turtles occur in foraging habitats of Guam (8, 16, 18, 19) and within the Mariana Archipelago (20). In CNMI, the sea turtle program captured 642 sea turtles during marine mark-recapture activities between August 2006 and February 2014, of which 36 juvenile hawksbill turtles (< 78.6 cm SCL) were captured, representing approximately 6 percent of captures (20). Aerial sea turtle surveys found that 15% of turtles in marine habitats of Guam are hawksbills, with mean abundance estimates of 101 to 196 hawksbills found between 2008 and 2012 (16). Preliminary assessment from 73 satellite tagged sea turtles (88% green turtles and 12% hawksbill turtles) revealed high site fidelity and limited movements for both green and hawksbill turtles while residents in coastal habitats of Guam, Tinian, and Saipan (19).

In Guam, hawksbill turtles spend little time at the surface (2.9% to 5.6% of their time at 0–2m) and the rest of their time at depth (16), in contrast to green turtles which spent 10.7% of total recorded behavior at the surface. Further, Martin (19) found that while both green and hawksbill turtles made dives down to 100 m; hawksbill turtles spent more time in deeper waters than green turtles, with an average depth of 15.5 m compared to 11.2 m (for greens) and an average dive depth maximum of 21.8 m compared to 13.1 m, respectively. Similarly, hawksbill turtles had longer dive durations of 51 minutes compared to 31 minutes for green turtles (19).

2.2 Other biological data

None.

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[1] Beach location unspecified

2.3 Threats

The primary threat to hawksbill sea turtles globally has been the direct exploitation and harvest of turtles for their shells ('tortoiseshell') and eggs (39, 40, 41). Hawksbill sea turtles have been traded internationally perhaps longer and more intensively than any other marine species, and tortoiseshell has been valued by many cultures for millennia and is derived from the carapace scutes of the hawksbill sea turtle that are then carved into decorative or other functional objects (42, 43). While nearly all CITES signatories have agreed to an international trade ban, legal domestic exploitation of hawksbill turtles still exists in several countries (23), as does illegal wildlife trafficking of hawksbill turtle products throughout Southeast Asia (41, 42, 43).

2.3.1 Nesting sites

Hawksbill turtle nesting activity has not been documented since 2008 (10).

2.3.2 Marine areas

NOAA surveyed 52 areas across the Pacific Islands Region, green turtles represented 90.1% and hawksbills 8.3% of observations (21). This suggests that green turtles are nearly 11 times more abundant than hawksbills across the entire survey area, providing further empirical evidence of the rarity and conservation plight of hawksbills (21).

2.4 Conservation

Hawksbill turtles are globally listed as endangered under the ESA and critically endangered under the IUCN red list. See Section 1.4, conservation for both green and hawksbill turtles are similar in Guam.

2.5 Research

See Section 1.5 for a summary of research activities that may relate also to hawksbill turtles.

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

Leatherback sea turtles have been sighted in marine waters around Guam and may occasionally transit through the deep, pelagic waters of the Marianas archipelago, although only a few occurrence records exist (8, 32, 44, 45). In nearshore waters, Eldredge (8) noted a rescue in 1978 of a 249 lb (112.9 kg) leatherback from waters southeast of Cocos Island, Guam. Between 1987 and 1989, divers reported seeing leatherbacks in the waters off Harmon Point, Rota (15). During aerial surveys (October 1989-April 1991), 2.6 % of the turtles recorded were identified as leatherback turtles (8, 15); however, recent analysis of survey results covering 1963 to 2012 did not mention or include leatherback turtles (16).

3.2 Other biological data

NONE

3.3 Threats

3.3.1 Nesting sites

NONE

3.3.2 Marine areas

Threats in marine areas include entanglement in marine debris, and interaction with pelagic longline fleets (46).

3.4 Conservation

NONE

3.5 Research

NONE

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Guam.

RMU	**CM-CW PAC**	Ref #	**EI-CW PAC**	Ref #	**DC-W PAC**	Ref #
Occurrence						
Nesting sites	Y	4,5,7	N	n/a	N	n/a
Pelagic foraging grounds	Y	n/a	N	n/a	Y	45
Benthic foraging grounds	Y	n/a	Y	n/a	N	n/a
Key biological data						
Nests/yr: recent average (range of years)	54 nests (8/1/2006 to 5/31/2008)	28	0	10	n/a	n/a
Nests/yr: recent order of magnitude	<200 nests	1, 7, 10-12, 28-31, 47	0	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	2-3	1, 28-31, 47	0	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	10	1, 28 - 31, 47	0	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	~ 50 nests/yr	1, 28 - 31, 47	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	<10 nests/yr	1, 28 - 31, 47	n/a	n/a	n/a	n/a

Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	22	2	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	unknown	2	extirpated	10	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	increasing	16, 17, 21	increasing	16	n/a	n/a

Oldest documented abundance: nests/yr (range of years)	unknown	2	n/a	n/a	n/a	n/a
Published studies						
Growth rates	Y	18, 19, 20	n/a	n/a	n/a	n/a
Genetics	Y	2	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	Y	2	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	Y	14, 47	n/a	n/a	n/a	n/a
Survival rates	n/a		n/a	n/a	n/a	n/a
Population dynamics	n/a		n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a		n/a	n/a	n/a	n/a
Capture-Mark-Recapture	Y	18, 19, 20	n/a	n/a	n/a	n/a
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y	n/a	Y	n/a	N	n/a
Bycatch: presence of industrial fisheries?	Y	n/a	N	n/a	Y	n/a
Bycatch: quantified?	N	n/a	N	n/a	N	n/a
Take. Intentional killing or exploitation of turtles	Y	2, 4, 11	Y	n/a	n/a	n/a
Take. Egg illegal harvest	Y	2, 4, 11	Unk	n/a	n/a	n/a

Coastal Development. Nesting habitat degradation	Y	2	N	n/a	n/a	n/a
Coastal Development. Photopollution	Y	2	N	n/a	n/a	n/a
Coastal Development. Boat strikes	Y	2	Y	n/a	n/a	n/a
Egg predation	Y	2	N	n/a	n/a	n/a
Pollution (debris, chemical)	Y	2	N	n/a	n/a	n/a
Pathogens	Unk	n/a	N	n/a	n/a	n/a
Climate change	Y	2	N	n/a	n/a	n/a
Foraging habitat degradation	Y	2	Y	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	Y	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	4-5	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	Y	n/a	Y	n/a	n/a	n/a
Conservation						
Protection under national law	Y	n/a	Y	n/a	Y	n/a

Number of protected nesting sites (habitat preservation) (% nests)	All (ESA protected)	n/a	All (ESA protected)	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	1	16	1	16	n/a	n/a
N of long-term conservation projects (period: range of years)	1-3 (2007 – 2017)	1, 10, 12, 28-31	0	n/a	0	n/a
In-situ nest protection (eg cages)	Y	n/a	n/a	n/a	n/a	n/a
Hatcheries	N	n/a	N	n/a	N	n/a
Head-starting	N	n/a	N	n/a	N	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	n/a	Y	n/a	Y	n/a
By-catch: onboard best practices	Y	n/a	Y	n/a	Y	n/a
By-catch: spatio-temporal closures/reduction	N	n/a	N	n/a	N	n/a

Table 2. Nesting beaches occurring in Guam.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Reference #
CM-CW PAC			
AAFB - (Tarargue Basin, Scout, Serina, Pati, and EOD)	Y	144 (2014-2016)	4,5,6,8,1,11
Agat	N	n/a	4,5,6,8,1,11
Cabras Island	N	n/a	4,5,6,8,1,11
Cetti/ Sella Bay	N	n/a	4,5,6,8,1,11
Cocos Island	Y	179 (2015-2017)	4,5,6,8,1,11
Falcona Beach	N	n/a	4,5,6,8,1,11
Haputo Beach	N	n/a	4,5,6,8,1,11
Inarajan	N	n/a	4,5,6,8,1,11
Ipan	N	n/a	4,5,6,8,1,11
Jinapsan	N	131 (1985-1992)	4,5,6,8,1,11
Spanish Steps*	Y	94 (2007-2017)	4,5,6,8,1,11
Urunao/Coco Palm	N	n/a	4,5,6,8,1,11
USFWS Ritidian Refuge	N	n/a	4,5,6,8,1,11
* Spanish Steps likely underrepresented in DAWR database as Naval Base Guam reports consistent nesting at this location.			

Figure 1. Map of the Island of Guam and surrounding area of Pacific Ocean.

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Appendices

Appendix Table 1. Guam beaches with documented sea turtle nesting activity from 2000 to 2017 (47).

Location	‘00	‘02	‘04	‘05	‘06	‘07	‘08	‘09	‘10	‘11	‘12	‘13	‘14	‘15	‘16	‘17
Tarague Basin	X			X	X		X	X	X	X	X	X	X	X	X	X
Agat																X
Cabras Island					X	X					X				X	
Cetti/ Sella Bay					X		X	X	X	X					X	X
Cocos Island				X	X	X	X	X	X	X			X	X	X	X
Falcona Beach							X									
Haputo Beach							X									X
Inarajan				X				X								
Ipan				X												
Jinapsan			X		X	X	X	X		X	X	X			X	X
Spanish Steps*						X	X								X	X
Urunao/ Coco Palm					X		X									

USFWS Ritidian Refuge		X			X			X	X	X		X	X			X

* Spanish Steps likely underrepresented in DAWR database as Naval Base Guam reports consistent nesting at this location.

Appendix Table 2. Green turtle index nesting beaches and estimated number of nests, Guam.

Nesting Site	**Years (# of Nests)**	**Estimated Nester Abundance**
Spanish Steps	2007 to 2017 (94 nests)	Unk
Cocos Island	2015 to 2017 (179 nests)	Unk
AAFB beaches (including EOD beach)	March 2014 December 2016 (144 nests)	Unk
Jinapsan beach	1985 – 1992 (131 nests)	Unk

HAWAII

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1 RMU: Green turtle (*Chelonia mydas*) - Central North Pacific

1.1 Distribution, abundance, trends

Green turtles forage and nest in the Hawaiian Islands, in the Central North Pacific. The isolation of the Hawaiian Island chain has led to a distinct genetic stock of green turtles in the Central North Pacific (16). The Hawaiian archipelago spans over 1,500 miles with 8 main islands in the southeastern end of the archipelago, 7 of which are inhabited – Ni'ihau, Kaua'i, O'ahu, Moloka'i, Lana'i, Kaho'olawe, Maui, and Hawai'i, and 9 uninhabited islands and atolls at the archipelago's northwestern end – Nihoa, Necker, French Frigate Shoals, Gardner Pinnacles, Laysan, Lisianski, Pearl and Hermes Atoll, Midway Atoll, and Kure Atoll (Fig1). The total human population of Hawaii was approximately 1.42M in 2018 and nearly 7 million tourists visit the state each year.

1.1.1 Nesting sites

The majority (96%) of green turtle nesting in Hawaii occurs at French Frigate Shoals in the Northwest Hawaiian Islands, but nesting activity has been documented on all of the northwestern and main islands (Fig 2). In the Northwest Hawaiian Islands, the annual average number of nests ranges from 12 – 14,840, but in the Main Hawaiian Islands the annual average number of nests is much lower and ranges from 4 – 96 (Table 2) (2). Systematic annual nesting surveys have been conducted at East Island, French Frigate Shoals since 1973, with the exception of 2013 when no survey was conducted. Researchers studying birds and monk seals in the Northwest Hawaiian Islands also report turtle nesting activity on other islands and atolls. This RMU is geographically and chronologically well-sampled. Undocumented nesting locations are unlikely.

1.1.2 Marine areas

Post-hatchling green turtles spend up to six years in an pelagic developmental phase (31). Immature green turtles recruit to coastal habitats and forage on seagrass and algae in nearshore waters throughout the Hawaiian Islands (22, 28). Adults live and forage in the Main Hawaiian Islands (30).

1.2 Other biological data

See Table 1.

1.3 Threats

1.3.1 Nesting sites

Nesting is concentrated at one site in the Northwest Hawaiian Islands, East Island, French Frigate Shoals (1, 28). The low-lying coral atoll is vulnerable to erosion and sea level rise and has already suffered significant loss of nesting habitat (25). Hurricane Walaka nearly washed away East Island, French Frigate Shoals in October 2018. After hurricane Walaka, Tern Island was the only remaining island to support green turtle nesting within French Frigate Shoals. The loss of nesting habitat remains a significant threat for this RMU.

The Main Hawaiian Islands have beaches suitable for green turtle nesting and a few nests are documented annually on each island (1, 24). These beaches are threatened by development, other human related activities, and climate change.

1.3.2 Marine areas

Threats in marine areas include foraging habitat degradation due to development and land-based sources of pollution and increased human activity, entanglement in marine debris, vessel strikes, and incidental capture in recreational and commercial fishing gear (1, 21). Some foraging pastures in the Main Hawaiian Islands are showing signs of nearing their carrying capacity for green turtles as the green turtle population continues to recover (26).

1.4 Conservation

Green turtles were once plentiful in Hawaii, but the harvest of turtles for subsistence and commercial trade, dating back to the 1800s, decimated the population. Harvest of green turtles has been illegal in Hawaii since they were listed under the ESA in 1978.

State of Hawaii Law also protects green turtles. Illegal take occurs throughout the Main Hawaiian Islands, but the extent of such take is unknown (1). The primary nesting habitat at French Frigate Shoals is within the Northwestern Hawaiian Islands Marine National Monument (also called Papahanaumokuakea Marine National Monument) which received World Heritage Status in 2010 (23).

NOAA's Pacific Islands Regional Office implemented a multi-agency Fishing Around Sea Turtles program to increase awareness and promote best practices to reduce sea turtle bycatch and mortality in coastal hook and line fisheries (48).

1.5 Research

NOAA's Pacific Islands Fisheries Science Center, Marine Turtle Biology and Assessment Program conducts research on sea turtles in Hawaii and the US Pacific Territories. The Hawaii Preparatory Academy on Hawai'i Island conducts research on green turtles on foraging grounds.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central North Pacific

2.1. Distribution, abundance, trends

2.1.1 Nesting sites

Fewer than 20 hawksbills nest annually in Hawaii (10). The majority of nesting activity occurs on the Island of Hawai'i, but low levels of nesting also occur on Mau'i and Moloka'i. Monitoring coverage at nesting sites varied from 1989 – 2009. Continuous nightly monitoring at beaches where nesting was confirmed during a nesting season began in 1993 (2). Typical nesting beaches are small pocket coves covered in crushed coral substrates. Nest detection is difficult due to substrate, vegetation, and inaccessibility of remote beaches. There are likely unidentified nesting sites in the Main Hawaiian Islands (48).

2.1.2 Marine areas

Hawksbills feed primarily on sponges, invertebrates, and algae in Hawaii's nearshore waters (30). Key foraging habitats are along the Hamakua coast of Hawai'i island and the waters off west Maui, but hawksbills are found around all of the Main Hawaiian Islands (30, 48). Hawksbills are not common in the waters of the Northwest Hawaiian Islands (12).

2.2 Other biological data

See Table 1.

2.3 Threats

2.3.1 Nesting sites

Primary threats to nest and hatchling success, all of which have been significantly addressed, are non-native mammalian predators, alien plants, artificial lights, hatchling stranding, vehicular traffic, and incompatible recreational use of nesting beaches. Volcanism remains an uncontrollable threat (2, 48).

2.3.2 Marine areas

Threats in marine areas include entanglement in marine debris, bycatch in nearshore fisheries, vessel strikes, and foraging habitat degradation (48). Climate change also poses a threat to coral reef and seagrass habitats where hawksbills reside.

2.4 Conservation

Numerous management and conservation actions have been implemented and are ongoing in Hawai'i to protect and conserve hawksbills. Hawai'i Volcanoes National Park established a hawksbill monitoring program in 1989, which grew into the Hawai'i Island Hawksbill Turtle Recovery Project. The project is a partnership between federal, state, and county agencies, the Pacific Cooperative Studies Unit – University of Hawai'i Manoa, non-profit organizations, educational institutions, and private land owners to monitor and protect hawksbills and their nesting habitat on Hawai'i Island. Many of the threats to nesting hawksbills are addressed through this conservation monitoring program (2).

On Maui, USFWS and Hawaii Wildlife Fund installed a two-mile fence to prevent nesting females from wandering onto the road and being struck by vehicles.

NOAA's Pacific Islands Regional Office implemented a multi-agency Fishing Around Sea Turtles program to increase awareness and promote best practices to reduce sea turtle bycatch and mortality in coastal hook and line fisheries (48).

2.5 Research

NOAA's Pacific Islands Fisheries Science Center, Marine Turtle Biology and Assessment Program conducts research on sea turtles in Hawaii and the US Pacific Territories (48). The Hawai'i Island Hawksbill Turtle Recovery Project conducts nesting research on hawksbills on Hawai'i Island. The Hawai'i Wildlife Fund conducts research and monitoring of hawksbills on the island of Maui.

3 RMU: Loggerhead turtle (*Caretta caretta*) - North Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

Transient and rare visitor to the nearshore waters of Hawaii, but more common on the high seas.

3.2 Other biological data

NONE

3.3 Threats

3.3.1 Nesting sites

NONE

3.3.2 Marine areas

Threats in marine areas include entanglement in marine debris, and interaction with pelagic longline fleets.

3.4 Conservation

The Hawaii-based longline fishery operates under regulatory measures to reduce sea turtle bycatch. Fishing is prohibited within a 50 -75 nm radius from the geographical centers of each island and atoll in the Northwest Hawaiian Islands. In addition, bycatch reduction measures have been implemented (e.g., mandatory use of circle hooks and mackerel-type bait, dehooking and resuscitation training, and annual interaction limits for loggerhead and leatherback turtles) and have significantly reduced bycatch up to 90% (44). Additionally, time and area closures are implemented when annual interaction limits are reached.

3.5 Research

Studies have been conducted on the movements and habitat use of juvenile loggerheads released into the North Pacific Ocean (36, 37).

4 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

Transient and rare visitor to the nearshore waters of Hawaii, but more common on the high seas.

4.2 Other biological data

NONE

4.3 Threats

4.3.1 Nesting sites

NONE

4.3.2 Marine areas

Threats in marine areas include entanglement in marine debris, and interaction with pelagic longline fleets.

4.4 Conservation

The Hawaii-based longline fishery operates under regulatory measures to reduce sea turtle bycatch. Fishing is prohibited within a 50 nm radius from the geographical centers of each island and atoll in the Northwest Hawaiian Islands. In addition, bycatch reduction measures have been implemented (e.g., mandatory use of circle hooks and mackerel-type bait, dehooking and resuscitation training, and annual interaction limits for loggerhead and leatherback turtles) and have significantly reduced bycatch up to 90% (44). Additionally, time and area closures are implemented when annual interaction limits are reached.

4.5 Research

NONE

5. RMU: Olive ridley turtle (*Lepidochelys olivacea*) - East Pacific

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

NONE

5.1.2 Marine areas

Transient and rare visitor to the nearshore waters of Hawaii, but more common on the high seas. Polovina et al. (2003, 2004) tracked 10 olive ridleys caught in the Hawaii-based pelagic longline fishery. Olive ridleys caught in the Hawaii-based pelagic longline fishery and identified as originating from the eastern Pacific populations, were tracked with satellite tags and stayed south of major currents in the central North Pacific-southern edge of the Kuroshio Extension Current, North Equatorial Current, and Equatorial Counter Current.

5.2 Other biological data

NONE

5.3 Threats

5.3.1 Nesting sites

NONE

5.3.2 Marine areas

Threats in marine areas include entanglement in marine debris, and interaction with pelagic longline fleets.

5.4 Conservation

The Hawaii-based longline fishery operates under regulatory measures to reduce sea turtle bycatch. Fishing is prohibited within a 50 nm radius from the geographical centers of each island and atoll in the Northwest Hawaiian Islands. In addition, bycatch reduction measures have been implemented (e.g., mandatory use of circle hooks and mackerel-type bait, dehooking and resuscitation training, and annual interaction limits for loggerhead and leatherback turtles) and have significantly reduced bycatch up to 90% (44). Additionally, time and area closures are implemented when annual interaction limits are reached.

5.5 Research

NONE

6 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

6.1 Distribution, abundance, trends

6.1.1 Nesting sites

NONE

6.1.2 Marine areas

Transient and rare visitor to the nearshore waters of Hawaii, but more common on the high seas. Olive ridleys caught in the Hawaii-based pelagic longline fishery and identified as originating from the western Pacific were tracked with satellite tags and associated with major currents in the central North Pacific-southern edge of the Kuroshio Extension Current, North Equatorial Current, and Equatorial Counter Current (36, 37).

6.2 Other biological data

NONE

6.3 Threats

6.3.1 Nesting sites

NONE

6.3.2 Marine areas

Threats in marine areas include entanglement in marine debris, and interaction with pelagic longline fleets.

6.4 Conservation

The Hawaii-based longline fishery operates under regulatory measures to reduce sea turtle bycatch. Fishing is prohibited within a 50 nm radius from the geographical centers of each island and atoll in the Northwest Hawaiian Islands. In addition, bycatch reduction measures have been implemented (e.g., mandatory use of circle hooks and mackerel-type bait, dehooking and resuscitation training, and annual interaction limits for loggerhead and leatherback turtles) and have significantly reduced bycatch up to 90% (44). Additionally, time and area closures are implemented when annual interaction limits are reached.

6.5 Research

NONE

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Hawaii, USA.

RMU	**CM-CN PAC**	Ref #	**EI-CW PAC**	Ref #	**CC – N PAC**	Ref #	**DC-W PAC**	Ref #	**LO-E PAC**	Ref #	**LO – W PAC**	Ref #
Occurrence												
Nesting sites	Y	1, 24, 29	Y	2	N		N		N		N	
Pelagic foraging grounds	J	8	J	4	J	9, 21	JA	21	JA	21	JA	21
Benthic foraging grounds	JA	22, 28, 31	JA	7, 30	N		N		N		N	
Key biological data												
Nests/yr: recent average (range of years)	14840 (2009-2012)	1	35 (1988-2009)	2	n/a		n/a		n/a		n/a	
Nests/yr: recent order of magnitude	10000-20000	1	50	2	n/a		n/a		n/a		n/a	

RMU	CM-CN PAC	Ref #	EI-CW PAC	Ref #	CC – N PAC	Ref #	DC-W PAC	Ref #	LO-E PAC	Ref #	LO – W PAC	Ref #
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	7	1	1	2	n/a		n/a		n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	5	1	1	2	n/a		n/a		n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	15344 (2009-2012)	1	0	2	n/a		n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	40 (2010-2012)	1	40 (1993-2012)	2	n/a		n/a		n/a		n/a	
Total length of nesting sites (km)	113	24	3	2	n/a		n/a		n/a		n/a	
Nesting females / yr	3846	1	3-18	2	n/a		n/a		n/a		n/a	
Nests / female season (N)	4	1	3.3 (1-6)	2	n/a		n/a		n/a		n/a	
Female remigration interval (yrs) (N)	4 yrs	1	3.5 (2-10)	2	n/a		n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a		n/a		n/a		n/a	

RMU	CM-CN PAC	Ref #	EI-CW PAC	Ref #	CC – N PAC	Ref #	DC-W PAC	Ref #	LO-E PAC	Ref #	LO – W PAC	Ref #
Sex ratio: Immatures (F / Tot) (N)	1/1 (132)	33	n/a		n/a		n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a		n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	89.3 cm SCL	20	72 cm SCL	2	n/a		n/a		n/a		n/a	
Age at maturity (yrs)	23 yrs	19	17-22 yrs	3	n/a		n/a		n/a		n/a	
Clutch size (n eggs) (N)	92.4 eggs	1	175.2 (78-274 eggs)	2	n/a		n/a		n/a		n/a	
Emergence success (hatchlings/egg) (N)	71%	1	71.9%	2	n/a		n/a		n/a		n/a	
Nesting success (Nests/Tot emergence tracks) (N)	n/a		n/a		n/a		n/a		n/a		n/a	
Trends												
Recent trends (last 20 yrs) at nesting sites (range of years)	Up (1973-2012)	1	stable (1993-2009)	2, 10	n/a		n/a		n/a		n/a	

RMU	CM-CN PAC	Ref #	EI-CW PAC	Ref #	CC – N PAC	Ref #	DC-W PAC	Ref #	LO-E PAC	Ref #	LO – W PAC	Ref #
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a		n/a		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	not quantified (1778-1950)	41	n/a		n/a		n/a		n/a		n/a	
Published studies												
Growth rates	Y	22	Y	3	N		N		N		N	
Genetics	Y	8, 16	N		N		N		N		N	
Stocks defined by genetic markers	Y	16	N		N		N		N		N	
Remote tracking (satellite or other)	Y	31	Y	6, 7, 30	N		N		N		N	
Survival rates	Y	20	N		N		N		N		N	
Population dynamics	Y	28	N		N		N		N		N	

RMU	CM-CN PAC	Ref #	EI-CW PAC	Ref #	CC – N PAC	Ref #	DC-W PAC	Ref #	LO-E PAC	Ref #	LO – W PAC	Ref #
Foraging ecology (diet or isotopes)	Y	34, 35	Y	30	N		N		N		N	
Capture-Mark-Recapture	Y	19	N		N		N		N		N	
Threats												
Bycatch: presence of small scale / artisanal fisheries?	FP, SN	1	FP, SN	1	N		N		N		N	
Bycatch: presence of industrial fisheries?	LL	1, 32	LL	4	LL	32	LL	32	LL	32	PLL	32
Bycatch: quantified?	Y (LL)	5, 21, 32	0 (LL)	4	Y (LL)	32	Y (LL)	32	Y (LL)	32	Y (LL)	32
Take. Intentional killing or exploitation of turtles	N	15	N	2	N		N		N		N	
Take. Egg illegal harvest	N		N	2	N		N		N		N	
Coastal Development. Nesting habitat degradation	N		Y	2	N		N		N		N	

RMU	**CM-CN PAC**	Ref #	**EI-CW PAC**	Ref #	**CC – N PAC**	Ref #	**DC-W PAC**	Ref #	**LO-E PAC**	Ref #	**LO – W PAC**	Ref #
Coastal Development. Photopollution	N		Y	2	N		N		N		N	
Coastal Development. Boat strikes	Y	1	Y	4	N		N		N		N	
Egg predation	N		Y	2	N		N		N		N	
Pollution (debris, chemical)	Y	13, 18	Y	4	N		N		N		N	
Pathogens	Y	42	N		N		N		N		N	
Climate change	Y	1, 25	Y	10	N		N		N		N	
Foraging habitat degradation	Y	13, 34, 35	Y	10	N		N		N		N	
Other	N		Y (volcanism, vehicles, invasive plants)	2	N		N		N		N	

RMU	CM-CN PAC	Ref #	EI-CW PAC	Ref #	CC – N PAC	Ref #	DC-W PAC	Ref #	LO-E PAC	Ref #	LO – W PAC	Ref #
Long-term projects (>5yrs)												
Monitoring at nesting sites (period: range of years)	Y (1973-2012)	1	1988-2012	2	N/A		N/A		N/A		N/A	
Number of index nesting sites	1	1	3	2	N/A		N/A		N/A		N/A	
Monitoring at foraging sites (period: range of years)	Y (1973-2012)	22, 43	Y (1973-2012)	22	N/A		N/A		N/A		N/A	
Conservation												
Protection under national law	Y	1, 23	Y	10	Y	45	Y	46	Y	47	Y	47
Number of protected nesting sites (habitat preservation) (% nests)	90	1	1	2	N/A		N/A		N/A		N/A	
Number of Marine Areas with mitigation of threats	1	21, 23	1	21	1	21	1	21	1	21	1	21

RMU	CM-CN PAC	Ref #	EI-CW PAC	Ref #	CC – N PAC	Ref #	DC-W PAC	Ref #	LO-E PAC	Ref #	LO – W PAC	Ref #
N of long-term conservation projects (period: range of years)	1 (1973-2012)	1	1 (1988-2012)	2	N/A		N/A		N/A		N/A	
In-situ nest protection (eg cages)	N		N		N/A		N/A		N/A		N/A	
Hatcheries	N		N		N/A		N/A		N/A		N/A	
Head-starting	N		N		N/A		N/A		N/A		N/A	
By-catch: fishing gear modifications (eg, TED, circle hooks)	LL - CIRCLE HOOKS	17	N		LL - CIRCLE HOOKS	17	LL - CIRCLE HOOKS	17	LL - CIRCLE HOOKS	17	LL - CIRCLE HOOKS	17
By-catch: onboard best practices	Y		Y		Y	17, 21, 39	Y	17, 21, 39	Y	17, 21, 39	Y	17, 21, 39
By-catch: spatio-temporal closures/reduction	N		N		Y	17, 21, 39	Y	17, 21, 39	Y	17, 21, 39	Y	17, 21, 39

Table 2a. Green Turtle Nesting Beaches in Hawaii, USA (1)

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CM-CN PAC							
KURE ATOLL	N	UNKNOWN	N/A		1	2	INFREQUENT
LANAI	N	4 (2010-2012)	N/A		1	2	INFREQUENT
KAHOOLAWE	N	4 (2010-2012)	N/A		1	2	INFREQUENT
HAWAII	N	4 (2010-2012)	N/A		1	2	INFREQUENT
MIDWAY ATOLL	N	12 (2011)	N/A		1	2	INFREQUENT
MAUI	N	16 (2010-2012)	N/A		1	2	INFREQUENT
OAHU	N	44 (2010-2012)	N/A		1	2	INFREQUENT
LISIANSKI ISLAND	N	60 (2011)	N/A		1	2	INFREQUENT
KAUAI	N	64 (2010-2012)	N/A		1	2	INFREQUENT
LAYSAN ISLAND	N	96 (2011)	N/A		1	2	INFREQUENT

MOLOKAI	N	96 (2011)	N/A		1	1	B
PEARL AND HERMES	N	1244 (2011)	N/A		1	2	INFREQUENT
FRENCH FRIGATE SHOALS (EAST ISLAND)	Y	14840 (2009-2012)	N/A	100%	1	1	E

Table 2b. Hawksbill Turtle Nesting Beaches in Hawaii, USA (1)

RMU / Nesting beach name	**Index site**	**Nests/yr: recent average (range of years)**	**Crawls/yr: recent average (range of years)**	**% Monitored**	**Reference #**	**Monitoring Level (1-2)**	**Monitoring Protocol (A-F)**
EI-CN PAC							
‘Āpua Point	Y	7.0 (1988-2009)	N/A	variable	2	1	B
Keauhou	N	0.8 (1997-2009)	N/A	variable	2	2	B
Halapē	Y	2.3 (1989-2009)	N/A	variable	2	1	B
Kākīwai	N	N/A	N/A	variable	2	2	INFREQUENT
Kamehame	Y	20.2 (1990-2009)	N/A	variable	2	1	B
Punalu‘u	N	0.6 (1989-2009)	N/A	variable	2	1	B
Horseshoe	N	0.1 (1989-2009)	N/A	variable	2	2	INFREQUENT
Koloa	N	1 (2003-2009)	N/A	variable	2	2	INFREQUENT

Nīnole	N	0.1 (1990-2009)	N/A	variable	2	2	INFREQUENT
Kāwā	N	N/A	N/A	variable	2	2	INFREQUENT
Ka‘ili‘ili	N	1.1 (1992-2008)	N/A	variable	2	2	INFREQUENT
Kahakahakea	N	0 (2005-2009)	N/A	variable	2	2	INFREQUENT
Pōhue Bay	N	5.3 (1993-2009)	N/A	variable	2	1	B
Humuhumu Point	N	0 (2008-2009)	N/A	variable	2	2	INFREQUENT
‘Āwili Point	N	0.7 (2003-2009)	N/A	variable	2	2	INFREQUENT
Manuka	N	N/A	N/A	variable	2	2	INFREQUENT

Figure 1. The Hawaiian Archipelago.

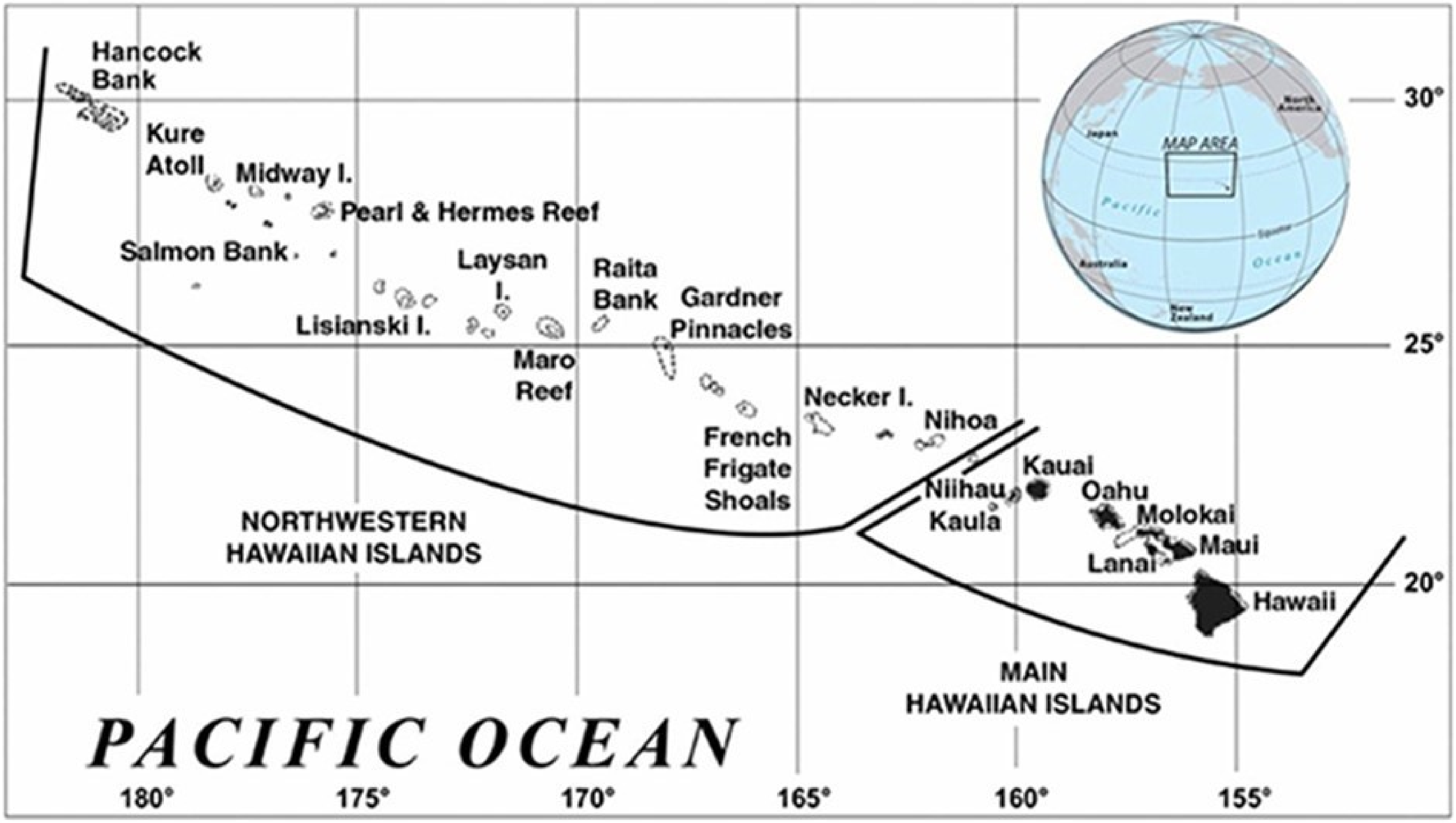


Figure 2. Green Turtle Nesting Sites (24, Maps by D.M. Parker).

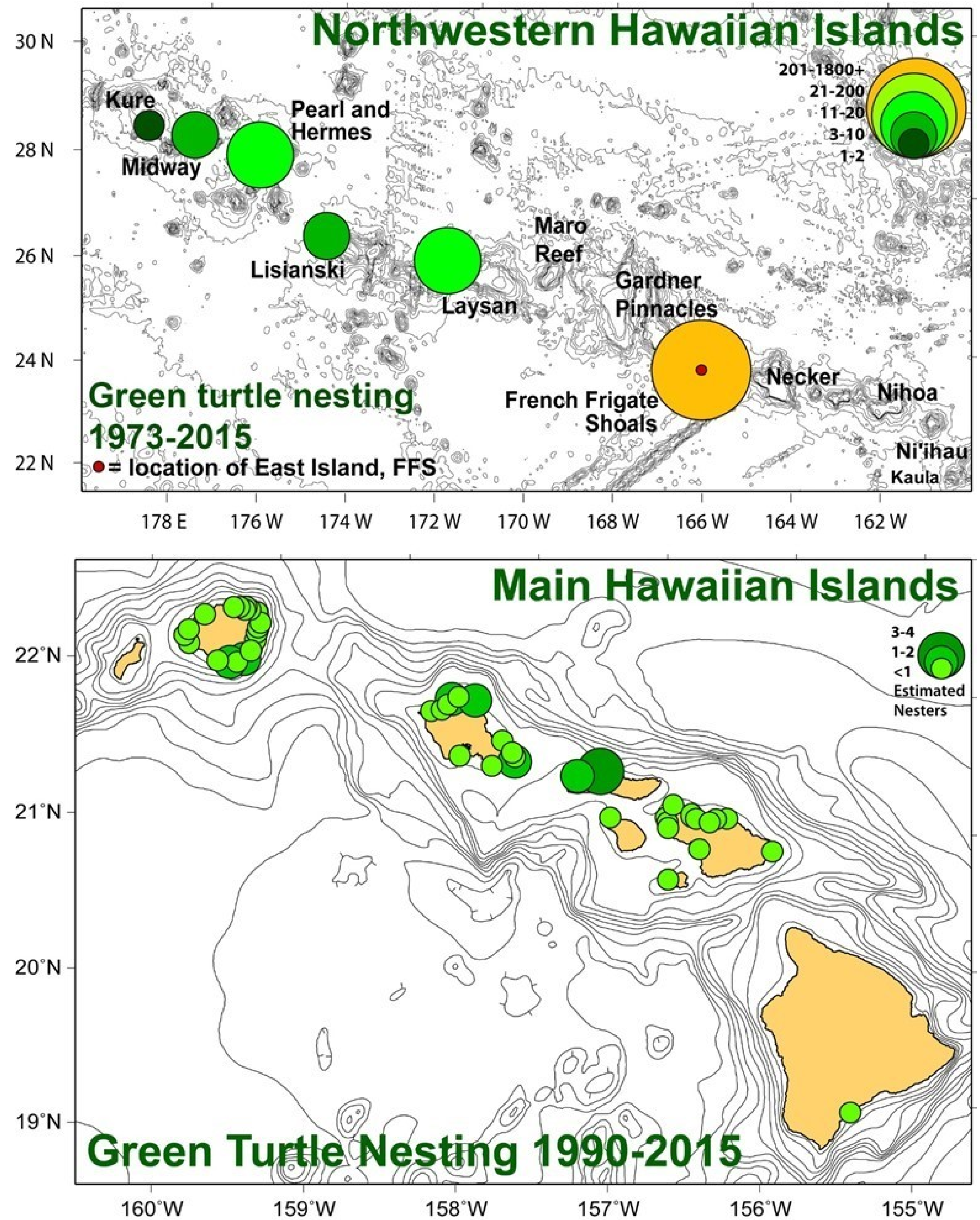
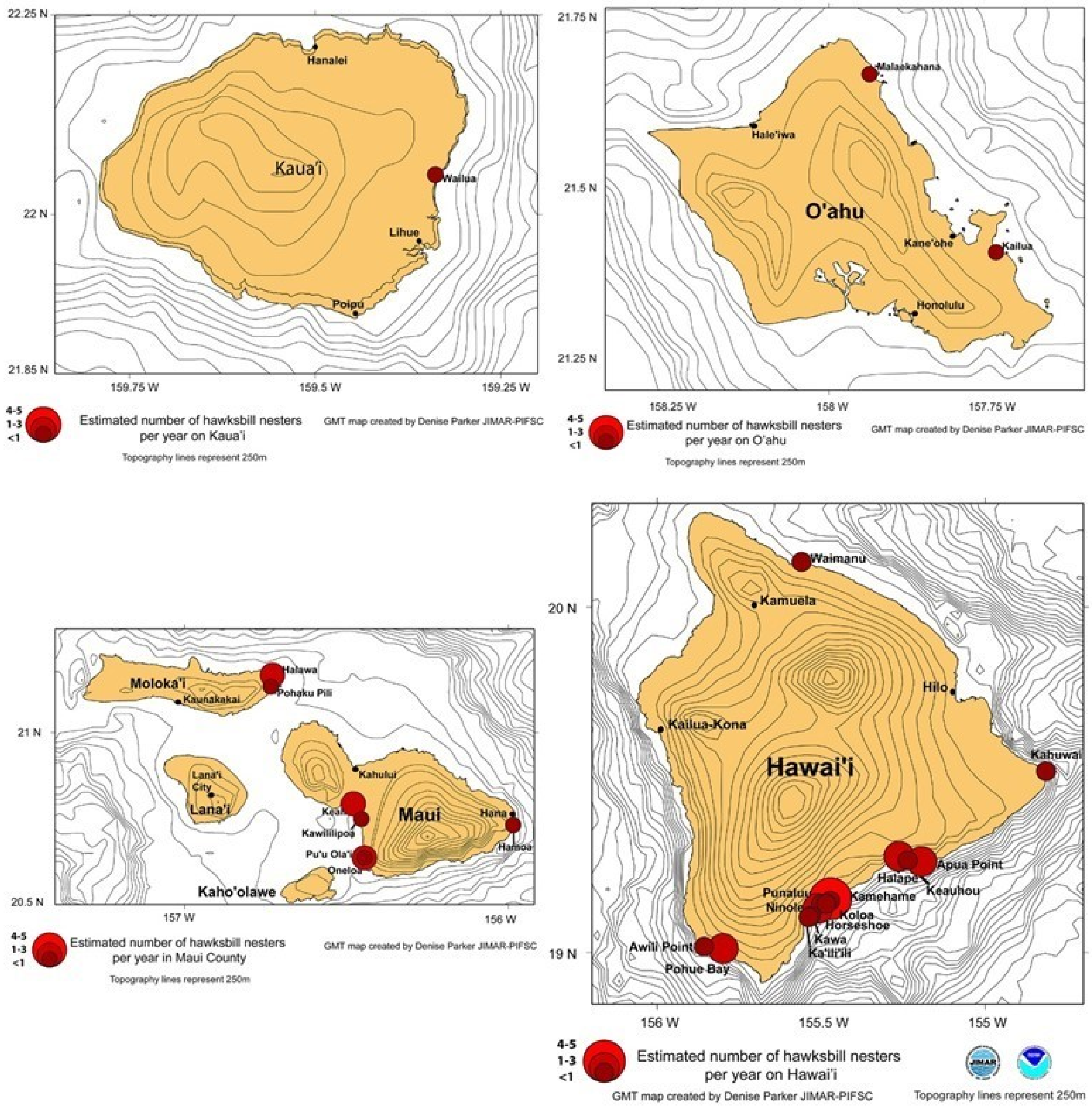


Figure 3. Hawksbill Nesting Sites (24, Maps by D.M. Parker).



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KIRIBATI

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Geographic overview

Kiribati is an island nation consisting of 32 atolls and one raised coral island separated into three distinct chains, dispersed over 3.5 million square kilometers (Figure 1; 1, 4). The three island chains are the Gilbert Islands, Phoenix Islands, and Line Islands (1,4). The westernmost of these are the Gilbert Islands, comprising of 16 atolls and coral islands including Tawara (capital of Kiribati), Makin, Abaiang, Butaritari, Marakei, Maiana, Abemama, Kuria, Aranuka, Nonouti, Tabiteuea, Beru, Onotoa, Tamana and Arorae. The Phoenix Islands are located in the center, consisting of eight low coral islands and atolls of Kanton (Canton), Enderbury, Birnie, Rawaki (Phoenix), McKean, Manra (Sydney), Orona (Hull) and Nikumaroro (Gardner). The Line Islands are located at the eastern end of Kiribati, and include Teraina, Tabuaeran, Kiritimati (Christmas), Malden, Starbuck, Caroline, Vostok and Flint. Geographically, U.S. possessions of Howland and Baker Islands are part of the Phoenix Islands, and U.S. possessions of Palmyra, Kingman, and Jarvis are part of the Line Islands (1).

All eight of Kiribati's low coral islands and atolls of the Phoenix Islands and their surrounding waters encompassing 397,447 square kilometers are part of the Phoenix Islands Protected Area (PIPA) (5). The Kiribati government declared PIPA in 2006 and legally established PIPA in 2008 under the PIPA Regulations.

1. RMU: Green turtle (*Chelonia mydas*) - West Central/South Central Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

The green turtle (*Chelonia mydas*) is known to nest throughout Kiribati, although available nesting data are from brief, non-continuous surveys, and no reliable trend data are available (4). A small number of green turtles nest in the Gilbert and Line

Islands chains, and a larger number of nets are observed in the Phoenix Islands. Available nesting information are summarized by the three island chains below.

Nesting season in Kiribati cannot be clearly determined. However, available records indicate that nesting occurs from late September to June-July, with an indication of peak nesting around October-November and May-July (4, 7).

Gilbert Islands

- A survey in Tarawa from October 2007-2008 recorded a total of 19 nests at two beaches (4). All recorded nests were dug up and eggs presumed consumed (4).
- Turtle Research and Monitoring Database System (TREDS) held at the Secretariat of the Pacific Regional Environment Program (SPREP) has five records of turtle nesting on Tarawa, Nonuouti, and Tabiteuea for the 1973-2016 period (8). These records only reflect nesting reported in TREDS and are not based on systematic surveys.

Phoenix Islands

- Balazs summarized early accounts of turtle observations in the Phoenix Islands in the 1800s and early 1900s, which indicated that turtles were present on Orona, Kanton, Nikumaroro, Manra, and Enderbury (7).
- The earliest survey of nesting sea turtles in Kiribati was conducted at Kanton Island over a one-week period in February 1973 (7). More than 170 body pits not older than 2-3 months were observed at four nesting areas on the island. All confirmed reports of turtles were identified as the green turtle.
- Nest count surveys conducted in June 2002 recorded a total of 267 old and new nests in the Phoenix Islands (3). Of these, Enderbury had the most nests with 160 old nests recorded, Nikumaroro had a total of 69 nests (41 old and 18 new), and Kanton had 35 total nests (30 old and 5 new). Less than 10 nests each were recorded at Orona, Phoenix, Birnie, and Manra Islands.

Line Islands

- Nest monitoring survey conducted at Kiritimati Island in 2008-2009 and 2009-2010 seasons resulted in 22 and 8 nests, respectively (4). The 2009-2010 season was affected by heavy rainfall with strong wind and flooding; thus the nest counts may have been underreported.
- Turtle monitoring conducted in March-April 2010 in Malden, Flint, and Starbuck resulted in observation of 9 old nests on Malden, 8 new nests on Flint, and no nests on Starbuck (4).

1.1.2 Marine areas

Limited information is available on green turtles foraging in waters of Kiribati. Historical accounts indicate that 200-300 green turtles were taken from shallow waters and on the beaches of Kiritimati Island over an 8-day period in 1777 when Captain Cook visited the island (4).

In the Phoenix Islands, interviews with personnel familiar with Kanton Island during a survey in 1973 found that green turtles were commonly seen throughout the year both inside the lagoon and immediately outside of a major pass located on the western side of the island (7). Most of the turtles were large adults (>90cm carapace length) but smaller juveniles (<60cm carapace length) were occasionally observed (7). SCUBA dive surveys conducted in May 2000 and June 2002 at all islands of the Phoenix Islands recorded 86 green turtles and 66 green turtles, respectively (3). A resource assessment conducted at Kanton Island in June 2017 recorded 25 green turtles, of which 14 were observed at oceanic sites outside the lagoon and 11 were observed inside the lagoon (6).

In the Line Islands, small number of in-water green turtle sighting and capture reports are available from Starbuck and Kiritimati Islands (4).

Information on in-water green turtles is not available for the Gilbert Islands.

1.2 Other biological data

Size frequency for green turtles is available in TREDS. Of the 188 curved carapace length (CCL) measurement records for green turtles in Kiribati held in TREDS, 145 records have CCL less than 60.0cm, of which 63 records have CCL of 45.0-49.9cm (8). The remaining records fall in the range of 60.0-114.9cm.

Three flipper tags from other countries have been recaptured in the Gilbert Islands in Kiribati (8). Of these, a post-nesting adult female was initially tagged at Bikar Atoll in Marshall Islands and later recovered at Aranuka Atoll. Additionally, a male sub-adult green turtle released from captivity on Upolu Island, Samoa, was later recaptured in Tabiteuea North Atoll, and a juvenile green turtle released from Maleivona Island, Solomon Islands, was later recaptured in Abemama Island(8).

The curved carapace length (CCL) measurements of the two hawksbill records are 30.0cm and 69.9cm (8). No tag recapture or genetic data are available to determine the source beaches of the in-water hawksbill population.

No genetic data from green turtles in Kiribati is available.

1.3 Threats

1.3.1 Nesting sites

Unsustainable harvest of turtles and eggs has been identified as a single major threat to marine turtles in Kiribati (4), particularly on Tarawa in the Gilbert Islands. Other threats include nest depredation, incidental capture in commercial fishing, degradation of habitat, pollution, marine debris, boat strikes and climate change (2, 4).

Known predators to eggs and hatchlings such as ghost crab (*Ocypode sp.*), hermit crab (*Coenobita sp.*), rodents, seabirds and sharks were observed at nesting beaches at Kanton Island during a preliminary survey conducted in 1973 (7).

1.3.2 Marine areas

See section 1.3.1.

1.4 Conservation

The Wildlife Conservation Ordinance (Laws of the Gilbert Islands 1977) fully protects green turtles on certain islands outside of the Gilbert Islands chain (Birnie, Phoenix, McKean, Manra, Orona, and Nikumaroro in the Phoenix Islands; Kiritimati, Malden, Starbuck, Caroline, Vostock, and Flint in the Line Islands) (1). Green turtle harvest is not regulated in the Gilbert Islands chain.

In the Phoenix Islands, capture, harvest or disturbance of all wildlife including turtles are prohibited within PIPA. The prohibition applies to all commercial fishing within PIPA, with the exception of a designated subsistence fishing zone for the Kanton community and its surrounding waters out to 12 nautical miles (5). Commercial fishing in PIPA is no longer permitted as of January 1, 2015 (5). Kanton 's Sustainable Resource Use planning is addressing the reported subsistence taking of green turtle eggs and adults (5). Additional details regarding the management of PIPA are available in the 2015-2020 Management Plan (5).

Kiribati is not a participating party to CITES (1)

1.5 Research

Bell et al. (4) identified the following research needs for marine turtles in Kiribati:

- Monitor turtle nesting at key index beaches (track nest/counts, flipper tagging)
- Assessment of level of turtle consumption, which may be incorporated in current fisheries survey, if one exists
- Sample tissue for genetic analysis for stock identification
- Deploy satellite tags
- Utilize TREDS

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) –Unassigned RMU

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

No nesting records of hawksbill turtle (*Eretmochelys imbricata*) in Kiribati are available (3).

2.1.2 Marine areas

Hawksbills are less abundant than green turtles in Kiribati. During SCUBA surveys conducted in the Phoenix Islands, 3 and 5 hawksbill turtles were observed over 11 days in May 2000 and over 21 days in June 2002, respectively (3). Hawksbill turtles were not observed during a resource assessment conducted at Kanton Island in June 2017 (6).

Two records of hawksbill turtles are available in TREDS. The curved carapace length (CCL) measurements of the two hawksbill records are 30.0cm and 69.9cm (8). No tag recapture or genetic data are available to determine the source beaches of the in-water hawksbill population.

2.2 Other biological data

No biological data is published from Kiribati regarding this species (Table 1).

2.3 Threats

2.3.1 Nesting sites

Not applicable.

2.3.2 Marine areas

Threats to marine turtles in Kiribati include incidental capture in commercial fishing, degradation of habitat, pollution, marine debris, boat strikes and climate change (4).

2.4 Conservation

See section 1.4.

2.5 Research

None identified.

3 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - East Pacific or West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

NONE. Reports of olive ridley turtles in nearshore environments of Kiribati are likely misidentifications (3).

3.2 Other biological data

NONE.

3.3 Threats

3.3.1 Nesting sites

Not applicable.

3.3.2 Marine areas

Not applicable.

3.4 Conservation

See section 1.4.

3.5 Research

NONE

4 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

There is only one known report of a likely leatherback turtle that was incidentally captured by local fishermen (9). No other records of this species is available in Kiribati.

4.2 Other biological data

NONE

4.3 Threats

4.3.1 Nesting sites

Not applicable

4.3.2 Marine areas

See section 2.3.2.

4.4 Conservation

See section 1.4.

4.5 Research

NONE

5 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

NONE.

5.1.2 Marine areas

NONE. Reports of loggerhead turtles in nearshore environments of Kiribati are likely misidentifications (3).

5.2 Other biological data

NONE.

5.3 Threats

5.3.1 Nesting sites

Not applicable

5.3.2. Marine areas

Not applicable

5.4 Conservation

See section 1.4.

5.5 Research

NONE

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Kiribati.

RMU	**CM-SC/WC-PAC**	**Ref #**	**EI-unassigned**	**Ref #**	**LO - E PAC or W PAC**	**Ref #**	**DC- W PAC**	**Ref #**	**CC- S PAC**	**Ref #**
Occurrence										
Nesting sites	Y	3,4,7	N	4	N	4	N	4	N	4
Pelagic foraging grounds	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Benthic foraging grounds	Y	3,4,6,7	Y	3,6	N	4	N	4	n/a	n/a
Key biological data										
Nests/yr: recent average (range of years)	see Table 2	3,4,7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	see Table 2	3,4,7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	3	3,7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	9	3,4,7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Nests/yr at "major" sites: recent average (range of years)	see Table 2	3,4,7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	see Table 2	3,4,7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	>170 body pits (Phoenix Is. only; 1973)	7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies										
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Threats										
Bycatch: presence of small scale / artisanal fisheries?	Y	6, 10	Y	6, 10	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	PLL, purse seine	10	PLL, purse seine	10	PLL, purse seine	10	PLL, purse seine	10	PLL, purse seine	10
Bycatch: quantified?	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Take. Intentional killing or exploitation of turtles	Y	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	Y	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	identified as potential threat, but extent unknown	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	N	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	identified as potential threat, but extent unknown	4	identified as potential threat, but extent unknown	4	n/a	n/a	n/a	n/a	n/a	n/a

Egg predation	identified as potential threat, but extent unknown	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	identified as potential threat, but extent unknown	4	identified as potential threat, but extent unknown	4	n/a	n/a	n/a	n/a	n/a	n/a
Pathogens	N	4	N	4	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	identified as potential threat, but extent unknown	4	identified as potential threat, but extent unknown	4	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	identified as potential threat, but extent unknown	4	identified as potential threat, but extent unknown	4	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects										
Monitoring at nesting sites	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites	N	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Conservation										
Protection under national law	Y (in some areas)	1	Y (in some areas)	1	n/a	n/a	n/a	n/a	n/a	n/a
Number of protected nesting sites (habitat preservation)	11	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	2	1,5	2	1,5	n/a	n/a	n/a	n/a	n/a	n/a
Long-term conservation projects (number)	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: onboard best practices	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Summary of Available Nesting Data in Kiribati.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)[1]	Reference #
CM-WC/SC PAC			
Enderbury (Phoenix Is.)	N	160 (June 2002)	3
Nikumaroro (Phoenix Is.)	N	69 (June 2002)	3
Kanton (Phoenix Is.)	N	35 (June 2002)	3
Kanton (Phoenix Is.)	N	>170 body pits assumed to be less than 2-3mo old (Feb 1973)	7
Orona (Phoenix Is.)	N	8 (June 2002)	3
Phoenix (Phoenix Is.)	N	6 (June 2002)	3
Birnie (Phoenix Is.)	N	5 (June 2002)	3
Manra (Phoenix Is.)	N	2 (June 2002)	3
Noto Village, Tarawa (Gilbert Is.)	N	19 (Sept 2007-May 2008)	4
Kiritimati, Bay of Wrecks (Line Is.)	N	22 (Oct 2008-May 2009); 8 (Oct 2009-May 2010)	4
Banana NE beach (Line Is.)	N	1 (April 2010)	4
Malden (Line Is.)	N	9 (March-April 2010)	4
Flint (Line Is.)	N	8 (March-April 2010)	4
Starbuck (Line Is.)	N	0 (March-April 2010)	4

[1]No annual average data available in Kiribati. Data shown are number of nests observed during surveys for the date period indicated. See source reference for survey effort information.

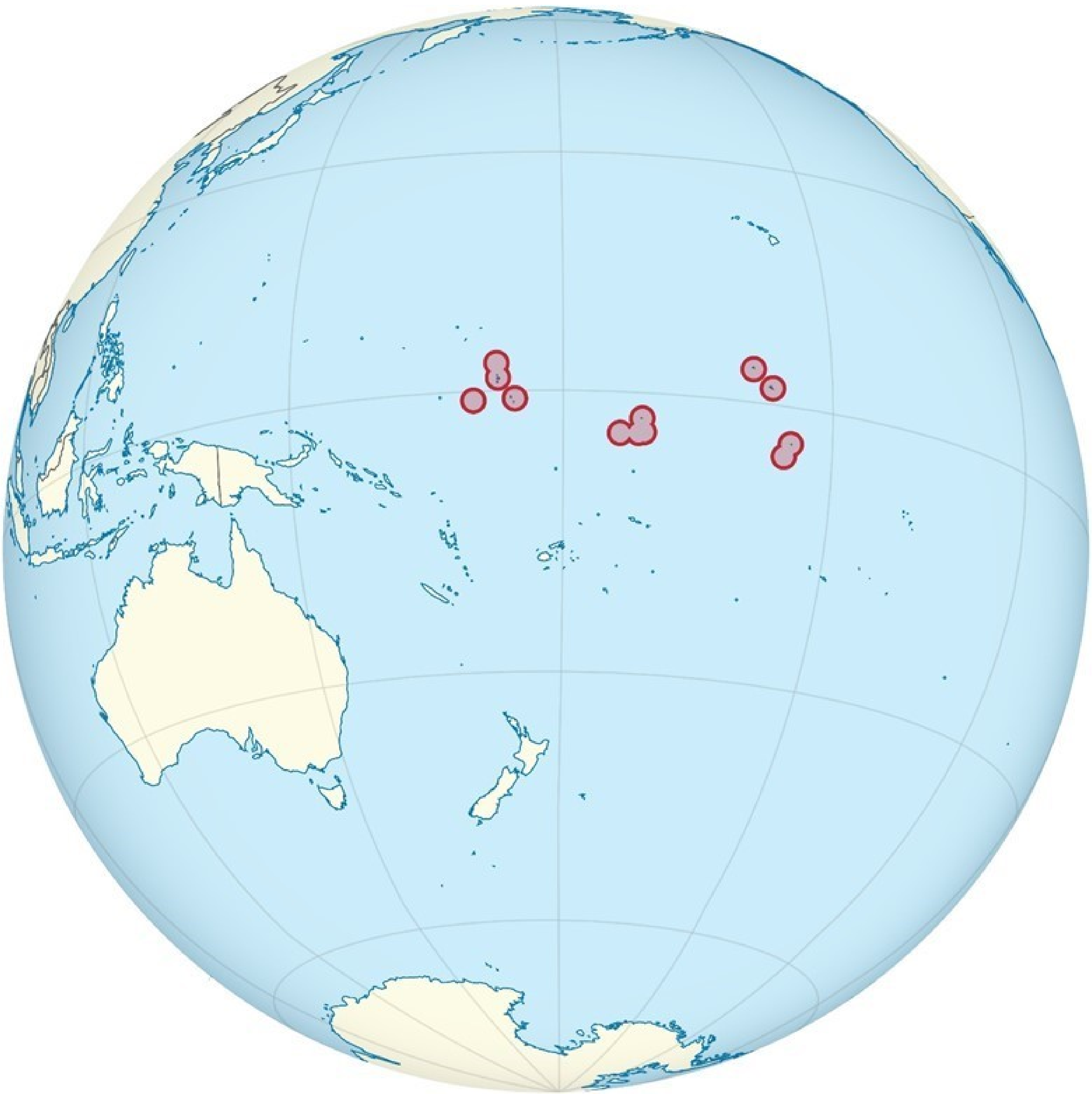

Figure 1. Map of Kiribati.

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NAURU

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1 RMU: Green Turtle (*Chelonia mydas*) - Central South Pacific

1.1 Distribution, abundance, trends

Nauru [0º 30 South; 166º 56 East] is a raised coral island in the central Western Pacific with an area of 21 km^2. The island has been heavily impacted by over a century of phosphate mining, which has resulted in the landscape being one of the most severely modified in the world.

1.1.1 Nesting sites

There are no known nesting sites, although local anecdotes do mention occasional nesting these are un-substantive and lack detail (3). In 1915 Hambruch (7) referred to green *Chelonia mydas*, but the illustrations are unidentifiable to species level (3).

Thaman and Hassall (19) stated that green turtles are occasionally present, and some beaches were reportedly once nesting areas, but this is no longer the case.

There are no data in www.seaturtlestatus.org

1.1.2 Marine areas

No data, but presumably C. mydas are occasionally present (1,2,12,15,17,19,20).

1.2 Other biological data

In 1936 Stephen (18) wrote of Nauruan customs and beliefs (based on Ernest Stephen being marooned on Nauru in the 1870s and remaining there for much of his life) *"that turtles rarely visit the island and, initially, Nauruans would not eat turtles: believing them to be the spirits of their ancestors"*.

1.3 Threats

1.3.1 Nesting sites

There are some sandy beaches, but no data. Land is alkaline and has high levels of phosphorous. Groombridge and Luxmore (6) record that Customs Officers at Fiji found a small amount of worked 't*ortoiseshell'* imported from Nauru in 1978.

1.3.2 Marine areas

Terrestrial silt and phosphate run-off are likely to have had a strong negative impact on the marine environment.

Oceanic plastics and discarded fishing gear (5,8,9,11,13,16).

Industrial fishing is being introduced, so bycatch needs to be monitored. Threats in marine areas include entanglement in marine debris, climate change, increased storms. (4, 14).

1.4 Conservation

Nauru is party to CBD; UNCLOS; Paris Agreement, and Marine Dumping Conventions etc.

https://en.wikipedia.org/wiki/Category:Treaties_of_Nauru

1.5 Research

None stated, but likely climate change mitigation and adaptation measures.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Pacific West Central

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

NONE. In 1915 Hambruch (7) referred to hawksbill *Eretmochelys imbricata*, but the illustrations are unidentifiable to species level (3). Thaman and Hassall (19) stated that hawksbills are occasionally present.

2.1.2 Marine areas

Possible forage areas for hawksbill turtles in coral habitats.

2.2 Other biological data

Groombridge and Luxmore (6) record that Customs Officers at Fiji found a small amount of worked 't*ortoiseshell*' imported from Nauru in 1978.

2.3 Threats

2.3.1 Nesting sites

Habitat degradation from mining and increased storms (14).

2.3.2 Marine areas

Threats in marine areas include entanglement in marine debris, fisheries and climate change (bleaching, acidification etc) (4, 5, 8, 9, 10, 11, 13, 16).

2.4 Conservation

See Section 1.4 above.

2.5 Research

None stated.

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Nauru

RMU	CM-SC PAC	Ref #	EI-WC PAC	Ref #
Occurrence				
Nesting sites	N	3,7	n/a	n/a
Pelagic foraging grounds	n/a	n/a	n/a	n/a
Benthic foraging grounds	n/a	n/a	n/a	n/a
Key biological data				
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a

Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a
Published studies				
Growth rates	n/a	n/a	n/a	n/a
Genetics	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a

Remote tracking (satellite or other)	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a
Other	Y	3,7	Y	3,7
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y	20	n/a	n/a
Bycatch: presence of industrial fisheries?	n/a	n/a	n/a	n/a
Bycatch: quantified?	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	N	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	Y	n/a	n/a	n/a
Coastal Development. Photopollution	Y	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	n/a	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a

Climate change	Y	4,14	Y	4,14
Foraging habitat degradation	Y	n/a	Y	n/a
Other	Y	6	Y	6
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	n/a	n/a	n/a	n/a
Conservation				
Protection under national law	n/a	n/a	n/a	n/a
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a

By-catch: onboard best practices	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a

Figure 1. Island of Nauru.

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NEW CALEDONIA

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N.B. *the information presented here is taken out of the New Caledonia Turtle Conservation Action Plan - Phase 1, Diagnostic. November 2018.*

The different government bodies [2] of New Caledonia exercise their respective authorities over vast marine expanses representing a total area of nearly 1.4 M.km² extending over 1 500km from east to west (16° longitude) and 1 200 km from North to South (11° latitude). (Figure 1).

The land masses include the main Island (Grande Terre) which is a long (400 km) narrow (40 km) high island with nickel rich soil, the Loyalty Island to the East, the Chesterfield islands to the West, the Ilse of Pines to the South and the Belep archipelago to the North, all inhabited, save for the Chesterfield.

There are 3 additional uninhabited islands: Walpole located in the extension of the Loyalty Island ridge and the volcanic islets of Matthew and Hunter on the southern end of the Vanuatu arc.

There are several sizeable, submerged reefs and sandy shoals like but not exclusive of: The Astrolabe, Petrie, Beautemps-Beaupré and d'Entrecasteaux.

The country harbors the second largest barrier reef and the largest enclosed lagoon in the world (24,000 km²).

Green turtles and loggerhead turtles are present in New Caledonia waters; they feed and nest there. The hawksbill turtle is also regularly observed, nesting is suspected but has yet to be confirmed. Leatherback turtle sightings are rare, but telemetry tracking results reveal their passage through New Caledonian waters (1). A fifth species, the olive Ridley,

2 The 3 provinces (North, South and Island) cover territorial waters whereas the government covers the EEZ and the islands and shoals within.

has been reported via incidental catch of long liners and stranding's (2; Aquarium des lagons pers.com.).

1 RMU: Green turtle (*Chelonia mydas*) - Southwest Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

The major nesting sites for green turtles in New Caledonia are located on the more remote islands and shoals that are part of the Coral Sea Nature Parc (Fig. 2, Appendix Table 1):

- d'Entrecasteaux shoals: Fabre, Huon and Leleizour islets that have been monitored since 2007. A recent study estimates that there are 50 000 ascents per season, all shoals included (Direction des Affaires Maritimes / Service Pêche et Environnement, comm. Pers. 2018).

- Chesterfield islands: Long Islanders, Reynard and Bampton have been monitored since 2012. The same recent study estimates that there are 110,000 ascents per season overall.

N.B. *The analysis and interpretation of these data are yet to be confirmed, as monitoring is subject to logistics and field conditions (remote sites, difficulty of access, availability vessels and personnel) and the spawning peak has not yet been accurately documented.*

There are also nesting sites in the Loyalty Islands:

- Ouvéa: Northern Pleiades, Southern Pleiades and North of the island (Honyi) where it has been estimated that between 50-100 females nest there

- Beautemps-Beaupré between 100 and 500 nesting females

- Maré: Dudune Island and Northeast Coast of Maré: 1 to 10 nesting females

In the Northern province, all beaches and islets have been prospected Between 2010 and 2013. The identified breeding sites are mainly spread out over the different Islets of the northern lagoon accounting for between 50 and 100 nesting females.

The green turtles of New Caledonia come from several genetic groups, mainly those of d'Entrecasteaux Reefs (independent), and the Coral Sea, including turtles that nest on

Chesterfield Atolls, and those of the northern and southern Great Barrier Reef. However, there is very little connection between these different groups.

There is strong nesting site fidelity during the same season (a female lays eggs several times during a season), but also between successive seasons. The inter-season gap is estimated at an average of 8.35 ± 3.30 years.

Exchanges have been documented between foraging grounds and nesting sites in Australia and New Caledonia, suggesting the existence of migration corridors not only between the two countries, but also within the waters of New Caledonia (Fig.3 and 4) (8). In fact, 61% of the green turtles in the southern lagoon (GLS - Grand Lagoon Sud) come from d'Entrecasteaux Reefs nesting sites, 24% from Australia and less than 5% from the Chesterfield/Coral Sea area (9).

1.1.2 Marine areas

In New Caledonia, the areas occupied by seagrass beds (dense to diffuse) shallow water (0-5 m) are 398.17 km^2, the dense strands representing only 126.64 km^2 (Fig. 5). These values are very conservative and the high value encompassing very diffuse seagrass areas has been estimated at 936.35 km2. Deep seagrasses, generally very sparse, occur in the southwestern lagoon and may occupy 16% of the soft bottom (890 km2) (10).

The largest seagrass beds are located in North Province, around Balabio (northeast), Voh and Bay of Nehoué. In the South, dense, shallow seagrass beds are in the Moindou-Poya area and around Cape Goulevain in Bourail.

In the context of her thesis (11), Read studied the diet and the use of the feeding zone in the Great Southern Lagoon. Her results indicate a predilection for algae, specifically four kinds of algae (representing 50% of the total dry weight): Hypnea, Ulva, Caulerpa and Codium. The study indicates a variation in the diet of green turtles according to feeding sites.

On the basis of 7 tagged green turtle (three adults and four juveniles) the vital area has been estimated at 54.28 km^2 (± 2.42).

If some estimates of nesting populations are available (see previous section), no estimate is available for the foraging turtle populations (2). Some reports from fishers mention an increase in the green turtle abundance to the point that it is perceived as negatively affecting other species (excessive consumption of giant clams in the North province) but there are no data to support these claims.

1.2 Other biological data

Other data are collected on the d'Entrecasteaux reefs (12) give the size of individuals breeders (104.9 cm ± 5.39 cm) and inter-season fidelity (8.35 ± 3.3 years on average).

The size frequency of the GLS population is unbalanced with a high prevalence of juveniles (88%) and the absence of adults is a concern. This imbalance is due to the high recruitment of new animals, which are easily identified by the color of their plastron.

1.3 Threats

Each type of pressure / threat is located in a large geographical area defined on the basis of the Eco-Regions drawn in the context of the eco-regional marine analysis of New Caledonia (10) including sites of nesting foraging and movement and similar pressures / threats (Appendix Table 2).

The 7 ecoregions are shown in Figure 6:

- A: Southern Lagoon
- B: Lagoon of the Greater Nouméa
- C: Western Lagoon
- D: Northwestern Lagoon
- E: Eastern Lagoon
- F: Loyalty Islands
- G: PNMC: Natural Parc of the Coral Sea (including remote islands)

1.3.1 Nesting sites

Considering the remoteness of the main nesting sites, the main threats are linked to climate change.

Shoreline variations have been studied in New Caledonia by the Division of Industry, Mines and Energy since 2013 (OBLIC project - Observatoire du Littoral of New Caledonia). OBLIC has identified several sites of interest (in Southern Province, Province of the Islands and North Province) which pose problems (erosion, submersion). In 2013, three major issues have been identified (13):

- Mobility of coral islets;

- Erosion and retreat of the coastline on the large islands and Grande-Terre;

- Hazards and submersion risk (hydrometeorological and tsunami)

Rises in t° may also affect the sex ratio of the hatchlings and in turn the whole population.

Sailboats and fishermen may also visit the sites. The islets of the atolls of Chesterfield and d'Entrecasteaux are the most accessible to landing. Currently, these atolls are accessible all year round. According to maritime affairs division, an increase in reporting is foreseeable for the period from September to December 2017 (Direction des Affaires Maritimes / Service Pêche et Environnement, 2017, pers.com)

It is however mandatory to declare landing: In 2017, there were 56 declarations of yachts (on average 2 to 3 people per boat, up to 10 people maximum) to go on Chesterfield and 22 for d'Entrecasteaux.

For professional charters, an approval is required: In 2017, 3 of the 9 approved companies went to d'Entrecasteaux (5 people on each cruise).

There is egg illegal harvest at nesting sites reported within the Loyalty Islands

1.3.2 Marine areas

The green turtle is the species most affected by standings. The first cases of fiibropapillomatosis have also been reported (Figs. 7 and 8). But the most important cause is illegal harvest in 49% of cases mainly located in Pouembout but also in the South, North-Western and Eastern lagoons.

Collisions also represent significant pressure in foraging grounds in the Grand Nouméa lagoon due to the heavy recreational use of the area, and to a lesser extent in the South and West lagoons.

As the Grand Nouméa lagoon is subject to significant urbanization, the threats to the foraging areas with regard to pollution are significant.

Bycatch in the nets is an existing pressure in the southern province and the northern province but has not been quantified. It seems that the majority of the turtles caught in the nets are eaten by the fishermen since they are generally found drowned (14). For the Northern and Southern Provinces, the data from the online database report 6 cases (including 4 in 2016) of turtles accidentally caught in nets (3 *Chelonia mydas* and 3 *Eretmochelys imbricata*, one of which is assumed), Nouméa, La Foa and Pouembout.

In the EEZ of New Caledonia, between 2012 and 2016, the on-board observers reported 5 catches of sea turtles (4 *Chelonia mydas*, 1 *Lepidochelys olivacea*), by longline fishing (15).

Since 2001, all vessels have been equipped with bent hooks to limit bycatch and professional fishermen are trained to release live turtles caught accidentally.

1.4 Conservation

All sea turtles are listed in Appendix I of CITES. The trade, the transport, the detention of an animal classified in this category are prohibited except derogation

In the Northern and Southern province, marine turtles are fully protected under regulatory acts: fishing, consumption and intentional disturbance is totally prohibited. However, special permits may be granted for traditional feasts (cultural value). In the Islands province, turtles are not the harvested for customary reasons because they are sacred in nature and shall not be eaten.

Currently, special permits are not based on scientific abundance data. About 114 animals are granted on average per year, for 140 requested in North Province; • In the Southern province about 60 permits are granted on average per year, for 77 requested.

The Northern province has restricted theses special authorizations to animals under 100 cm only.

The game wardens enforce the regulation together with the gendarmerie for the control of the special permits. Since 2016, the Southern Province has initiated a consultation process with the customary authorities to reconcile conservation issues and socio-cultural issues specific in each customary area.

The World Heritage sites of New Caledonia come under management committees which carry out conservation measures. At present, 13 spawning sites are monitored.

All 4 government agencies share an online data base to report stranding. The French version of SPREP database "TREDS" is not functional so to-date each agency keeps its own records.

Although the 4 government agencies all have their conservation objectives, a national action plan has been adopted to increase collaborations and synergies between the different initiatives, in areas such as research or communication.

The action plan (all marine turtles) covers the following areas (*cf.* SPREP nomenclature):

- Theme 1: Information, Awareness / Education and Communication
- Theme 2: Capacity Building
- Theme 3: Threat Reduction
- Theme 4: Laws, Policies and Management / Recovery Plans
- Theme 5: Traditional Knowledge and Customary Practices
- Theme 6: Research & monitoring
- Theme 7: Sustainable development
- Theme 8: Collaboration and partnership

1.5 Research

The most recent research efforts on green turtles in New Caledonia have been and are:

- A thesis on the population of the Great Southern Lagoon (11)
- Satellite tracking that confirmed in country migrations from d'Entrecasteaux to the GLS (ADL)
- Further satellite tracking from nesting populations in d'Entrecasteaux and Chesterfield (WWF)

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - South Central Pacific

2.1 Distribution, abundance, trends

Eretmochelys imbricata, the hawksbill turtle, occurs in the lagoons of New Caledonia. It is the least abundant of the three species present in these waters.

2.1.1 Nesting sites

There has been no nesting observed in New Caledonia, but some still believe that there may be some occurring North of the Loyalty Islands in Beautemps Beaupré.

2.1.2 Marine areas

Information regarding distribution, ages and numbers of hawksbills in New Caledonia are lacking.

During her thesis, Read recorded 17 individuals in the Greater Southern Lagoon indicating that it is a feeding area for this species (16), but no study has been carried out to date in New Caledonia.

No information is available on pelagic movements or the migration of resident adult population.

2.2 Other biological data

Not available

2.3 Threats

Hawksbill turtles are under pretty much the same general threats as other species save for illegal harvest and nesting site degradations. (Appendix Table 3)

2.3.1 Nesting sites

N/A

2.3.2 Marine areas

N/A

2.4 Conservation

The same regulations (all 4 government bodies) apply for the hawksbill turtles (cf. chapter on green turtles) (Appendix Table 3).

The hawksbills are not targeted for customary feasts.

They are covered by the national action plan for the conservation of marine turtles of New Caledonia

2.5 Research

The NGO WWF-France in New Caledonia plans (2018-2019) to support the implementation of a project to acquire genetic knowledge on hawksbill populations in Oceania (regional connectivity, breeding, feeding, in partnership with NOAA, WWF-Australia and local stakeholders (eg Aquarium des Lagons in New Caledonia). Genetic samples already collected will be processed shortly.

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

The leatherback (*Dermochelys coriacea*) is an intermittent visitor or vagrant within the waters of New Caledonia. Leatherback turtle sightings are rare, but telemetry tracking results reveal their passage through New Caledonian waters (1).

3.2 Other biological data

No biological data is published from New Caledonia regarding this species

3.3 Threats

3.3.1 Nesting sites

Not applicable

3.3.2 Marine areas

The leatherback turtle crosses the Coral Sea in a north-south direction, between nesting sites in the equatorial zone (Papua New Guinea and Solomon Islands in particular), to feeding areas located in the south (New Zealand and Southeast Australia). These migration patterns across the Coral Sea have been highlighted by the analysis of satellite tracking data of 126 individuals (1, 2). Turtles do not show any distinct corridor of migration so far, some regions seem to be more crowded than others, such as the western sector of the Coral Sea (Appendix Table 4).

No bycatch has been reported by the observer program on the longline fleet of New Caledonia.

3.4. Conservation

Basic mitigation in longline fleets and release by observers if captured by pelagic fisheries, but otherwise included in the existing regulations on marine turtles and the national action plan for conservation of marine turtles in New Caledonia

3.5 Research

No research planned

4 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

4.1 Distribution, abundance, trends

The Olive Ridley has been reported via incidental catch of long liners and stranding's (2; Aquarium des lagons pers.com.).

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

The olive ridley turtle is one of the bycatch of longline fishing activity in the Coral Sea, particularly in New Caledonia, suggesting that it crosses this area to feed or reproduce on Australian coasts (2).

4.2 Other biological data

No biological data is published from New Caledonia regarding this species

4.3 Threats

4.3.1 Nesting sites

Not applicable

4.3.2 Marine areas

Impact from international and local commercial fisheries.

4.4 Conservation

Not applicable

4.5 Research

Not applicable

5 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

The major nesting site for loggerhead turtles is on the Grande Terre in the heart of the Roche Percée Nature Reserve and in… Turtle Bay (article 213-30 of the Environmental Code of Southern Province).

Nesting season is monitored by an NGO, Bwärä tortues marines, which has recorded 305 tracks (± 70) on average per year with a spawning success of 182 (± 38) clutches during the period extending between November 15 and March 15.

According to recent surveys, 345 tracks have been recorded on the islets of the Southern Lagoon (Nouméa on down to the Southern tip of the main Island) with an estimation of 80 – 172 nesting females all together which is about as much as the Roche Percée/baie des tortues sites. The Roche Percée site was considered until then the second most important nesting site for loggerhead after Australia (4,17) (Appendix Table 1).

Loggerhead turtles in the Pacific Ocean are divided into two genetically different populations, one in the North Pacific and the other in the South Pacific.

Recent genetic analysis has confirmed that loggerhead turtles nesting on the beach of Roche Percée belong to the same population as the turtles at Mon Repos in Queensland and therefore the Australian ("southwestern pacific stock") genetic group (18).

On the other hand, the same authors have demonstrated connectivity between Southwestern pacific breeding female populations ("southwestern pacific"). stock ", and hence from New Caledonia) and immature fish caught near the shores of South America.

5.1.2 Marine areas

As with other species, large ocean currents play a vital role in the circulation of juvenile loggerhead turtles. Recent research (18) has demonstrated genetic connectivity between Southwest Pacific female breeding populations and immature fish caught near the South American coastline. Young turtles would use the East Australian Current to move away from the coast before returning with the South Equatorial Current (Figure 9).

During this pelagic phase, the loggerhead turtle actively feeds on Sargassum. After 7 to 10 years, it gets closer to the littoral zones, where it feeds on the benthic zones with hard or soft bottoms (19). The fidelity of females to their nesting site and their feeding zone (19) explains the long migrations made by individuals and the complex structuring of populations. Adults use different migration corridors depending on the individual. Each adult migrates with a high degree of fidelity between his feeding area and his nesting area, a group frequenting the same feeding area can then migrate to very different nesting areas, as well as individuals frequenting the same site. Spawning and feeding can occur in very different places (17, 19).

Of the three females satellite tracked between 2008 and 2012, two left their Bourail spawning site to reach a feeding area on the other side of the Coral Sea in northeastern Australia on both sides of the Torres Strait; the third moved to Papua New Guinea in the Solomon Sea (Figure 12).

Several studies have been carried out in the region, mark / recapture operations on both sides of the Coral Sea, as well as telemetry monitoring by the New Caledonian actors (Aquarium of lagoons in collaboration with Bwara marine turtle and NOAA, WWF) have been able to highlight the exchanges and certain routes traveled by sea turtles (adults and juveniles) in the New Caledonian maritime area (Figure 10 and 11).

5.2 Other biological data

Not applicable

5.3 Threats

5.3.1 Nesting sites

The main threats are anthropogenic due to the induced phenomena like sea level rise and erosion that are likely to lead to the loss of breeding grounds. In the western Pacific, projections point to a sea level rise ranging from 28 cm to more than one meter by 2100.

This development could make most of the remote islets disappear (2) when as much nesting is occurring there than on the major site of La Roche Percée…

5 islets of the Great Southern Lagoon have been studied: Amédée, Larégnère, Signal, Ténia and Kondoyo (more to the north). They are all affected on at least one of their shorelines by visibly intense erosion. Along with this erosion, other sides of the islet can be accreted. These opposing phenomenon (erosion and accretion) on both sides of the islands lead, in the long term, to their spatial displacement that is called mobility. Islets can be very mobile at very short time scales; it is likely that the same is true for multi-decadal time scales. The mobility of these islands raises questions, in particular on the durability of islands and associated ecosystems in the current context and on the impact of climate change on the fate of these islets (sea level rise, but also changes climates of winds and waves).

The evolution of the coastline, whether through development work and sand removal modifying sedimentary processes, climatic hazards or phenomena related to climate change, is a risk of disappearance of more nesting sites.

Temperature rise which alters the sex ratio of turtles with a feminization of populations and can also influence the size of newborns and their physical capacity. At Roche Percée beach, the measured temperature of the nests is generally higher than the pivot threshold for the East-Australian genetic group (28.6 ° C) (20, 21).

The destruction of loggerhead nests by dogs is a major pressure in New Caledonia, although it is difficult to have figures. At the Roche Percée site, a nest protection project (cages) had been effective between 2006 and 2011. The protection has reduced this pressure, but it still persists: 10 % of nests were impacted in 2013, (14) and less than 4% in 2016 (Bwärä tortues, 2016, pers.com.). On some sites in the Great Southern Lagoon (WWF pers comm, 1 nest was dug in 2017,)

Dogs can also attack turtles on the way nesting: an adult *Caretta caretta* was found dead from her wounds after being attacked by two dogs at La Roche Percée in 2012 (14). The Northern province is also affected by this significant pressure (as pers North province) but we do not have quantified information.

Finally, light pollution has also been identified as a disruptive factor. In the northern province, individuals (adults and juveniles) have been found several times in a hotel pool of a near a nesting site.The Roche Percée site is subject to light pollution issues. The management of the site has made it possible to limit this impact (re-vegetation creating a natural buffer zone, limitation of the use of flashlight by supervision of observations and monitoring of the site by the eco-guards) (Appendix Table 6).

5.3.2 Marine areas

Climate change will probably also impact loggerhead foraging grounds

5.4 Conservation

Loggerhead fall under the same regulations as other sea turtles, save for the special permits for customary feasts as they are not eaten.

They are also included in the New Caledonia Action plan and covered as such.

A local NGO (Bwärä tortue) has been monitoring the main nesting beach for the last 12 years.

For the last three years, the Southern province has commissioned the Aquarium des Lagons to oversee a turtle watching activity during the nesting season at La Roche Percée. Visitors are greeted at night fall in a temporary camp site where instructions are given for the evening. Outreach activities are then carried out until spotters warn of upcoming females crawling out to spawn. A small group is then ushered to the nest when she has started laying her clutch to observe. The visitors have to remain in the back of the animal and all sources of lighting are prohibited. The amount charged goes to conservation.

5.5 Research

Identification of nesting sites is still going on (Northern province, WWF). WWF/ADL are also carrying out more satellite tagging at different nesting sites to better understand population structure. Additional genetics will also be required.

Table 1. Biological and conservation information about sea turtle Regional Management Units in New Caledonia.

	CC-S PAC	Ref #	CM-SW PAC	Ref #	DC-W PAC	Ref #	LO- W PAC	Ref #	EI-SC PAC	Ref #
Occurrence										
Nesting sites	Y	n/a	Y	n/a	N	n/a	N	n/a	N	n/a
Pelagic foraging grounds	n/a	n/a	n/a	n/a	Y	n/a	Y	n/a	n/a	n/a
Benthic foraging grounds	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	Y	n/a
Key biological data										
Nests/yr: recent average	182 (2006-2014)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

(range of years)										
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	7	UNP	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	51	UNP	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	182 (2006-2014)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	44 (2006-2014)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	4.1 (856)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	2.84 (75)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	0.99 (10)	18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	0.75 (35)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	83 CCL	8	89.9 CCL	19	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	112 (856)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings /egg) (N)	0.80 (851)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot	0.6 (856)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

emergence tracks) (N)										
Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)	Up (2006-2014)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	125 (2006)	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Published studies										
Growth rates	Y	8	y	20	N	n/a	N	n/a	N	n/a
Genetics	Y	18	Y	9,20,22, 23	N	n/a	N	n/a	N	n/a
Stocks defined by genetic markers	Y	18	Y	9,20,22, 23	N	n/a	N	n/a	N	n/a
Remote tracking (satellite or other)	Y	n/a	N	20	N	n/a	N	n/a	N	n/a
Survival rates	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Population dynamics	N	n/a	N	20	N	n/a	N	n/a	N	n/a
Foraging ecology (diet or isotopes)	N	n/a	N	20	N	n/a	N	n/a	N	n/a

Capture-Mark-Recapture	N	n/a	N	20	N	n/a	N	n/a	N	n/a
Threats										
Bycatch: presence of small scale / artisanal fisheries?	Y	CPS	Y	CPS	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	Y	CPS	Y	CPS	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: quantified?	Y	CPS	y	CPS	n/a	n/a	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	N	n/a	y	9	n/a	n/a	n/a	n/a	n/a	n/a

Take. Egg illegal harvest	Y	18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	N	in review	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	Y	n/a	y	not published	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	Y	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pathogens	n/a	n/a	Y	20	n/a	n/a	n/a	n/a	n/a	n/a

Climate change	Y	18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	N/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)										
Monitoring at nesting sites (period: range of years)	Y (2006-ongoing)	8	y (2007-ongoing)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	3	n/a	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period:	n/a	n/a	2012-2015	20	n/a	n/a	n/a	n/a	n/a	n/a

range of years)										
Conservation										
Protection under national law	Y	n/a	Y	n/a	Y	n/a	Y	n/a	Y	n/a
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a	0	n/a	0	n/a	0	n/a
N of long-term conservation projects (period:	>1 (2006-ongoing)	8	2 (2007-ongoing)	7;19	0	n/a	0	n/a	0	n/a

range of years)										
In-situ nest protection (eg cages)	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: onboard best practices	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	N/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Other	N	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Nesting beaches in New Caledonia

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Central point	Length (km)	% Monitored	Reference #	
CC-SP				Long	Lat			
La Roche Percée	Y	182 (2008-2014)	305 (2008-2014)	165.46297	-21.61318	1.6	100	8
Ilot Tiam Bouènne	N	16 (2010-2015)	n/a	n/a	n/a	n/a	n/a	n/a
Ilot Neba	N	21 (2010-2015)	n/a	163.93304	-20.16202	5.4	n/a	PNORD
Ilot Ti-Ac	N	7.25 (2010-2015)	n/a	164.08347	-20.3672	0.54	n/a	PNORD
Ilot Hiengha	N	1 (2010-2015)	n/a	n/a	n/a	n/a	n/a	
Ilot Hiengabat	N	2 (2010-2015)	n/a	164.98725	-20.64551	0.68	n/a	PNORD
Ilot Atire	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Koko	N	n/a	n/a	n/a	n/a	n/a	n/a	

Ilot Redika	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot N'Da	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Améré	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Uaterembi	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Puemba	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Uié	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Kouaré	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Kié	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot N'gé	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Ugo	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Téré	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Ua	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Maitre	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Larégnère	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Signal	N	n/a	n/a	n/a	n/a	n/a	n/a	
ACPV beach	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Ténia	N	n/a	n/a	n/a	n/a	n/a	n/a	

La Baie des tortues	N	n/a	n/a	165.45409	-21.60731	0.25	n/a	8
Ilot Contrariété	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Nägèè	N	1 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Bois de fer	N	2.3 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Tibarama	N	0.33 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Cocotier	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Faux Tabac	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Hienghene	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Thigit	N	n/a	n/a	164.91794	-20.62531	0.31	n/a	PNORD
Ouenghip beach	N	n/a	n/a	n/a	n/a	n/a	n/a	
Kua beach	N	0.5 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Agué	N	0.25 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Karu	N	n/a	n/a	n/a	n/a	n/a	n/a	
Pwiriwa beach	N	n/a	n/a	n/a	n/a	n/a	n/a	

Ilot Nani	N	n/a	n/a	n/a	n/a	n/a	n/a	
Neo Gorowa beach	N	n/a	n/a	n/a	n/a	n/a	n/a	
We Moru beach	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Mouac	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Yava	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Paaio	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Nendiale	N	n/a	n/a	n/a	n/a	n/a	n/a	
Baie de Tiabet	N	n/a	n/a	n/a	n/a	n/a	n/a	
Presqu'ile Tebane	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Devers	N	3 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Ouanne	N	2.25 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Kendec	N	1 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Double	N	1 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Yan' dagouet	N	2.33 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Table	N	n/a	n/a	n/a	n/a	n/a	n/a	

Presqu'île de Babouillat	N	1 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Carrey	N	n/a	n/a	n/a	n/a	n/a	n/a	
CM-SW PAC								
Ilot Huon	Y	n/a	98 (2007-2014) but only for 8 nights	162.95868	- 18.04025	2.58	n/a	19
Ilot Le Leizour	N	n/a	72 (2007-2014) but only for 8 nights	163.04190	- 18°28531	0.98	n/a	19
Ilot Fabre	N	n/a	69 (2007-2014) but only for 8 nights	163.00917	- 18.29537	0.81	n/a	19
Ilot Surprise	N	n/a	57 (2007-2014) but only for 8 nights	163.08478	- 18.48359	0.61	n/a	19
Ilot Bampton	N	n/a	16.5 (2012-2015) but for 6 nigths	n/a	n/a	n/a	n/a	
Ilot Skeleton	N	n/a	n/a	n/a	n/a	n/a	n/a	7
Ilot Reynard	N	n/a	11 (2012-2015) but for 6 nigths	n/a	n/a	n/a	n/a	7

Ilot Avon Sud	N	n/a	0.25 (2012-2015) but for 6 nigths	158.24973	-19.51351	0.26	n/a	7
Ilot Avon Nord	N	n/a	n/a	158.23675	-19.53364	0.22	n/a	7
Ile Longue	N	n/a	49.75 (2012-2015) but for 6 nigths	158.30441	-19.86923	3.43	n/a	7
Ilot du Mouillage 1	N	n/a	n/a	158.3065	-19.87040	1.85	n/a	7
Ilot du Mouillage 2	N	n/a	n/a	158.33385	-19.89089	0.77	n/a	7
Ilot du Mouillage 3	N	n/a	n/a	158.35733	-19.90451	0.32	n/a	7
Ilot du Mouillage 4	N	n/a	n/a	158.37906	-19.91183	0.45	n/a	7
Beautemps-Baupré	N	n/a	n/a	166.14203	-20.40491	1	n/a	7
Ilot Hnyeekon Puu	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Motu Veiloa	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Unyee	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Gée	N	n/a	n/a	n/a	n/a	n/a	n/a	

Ilot Angenemëëe	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Anémata	N	n/a	n/a	n/a	n/a	n/a	n/a	
Huli Cöu beach	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Maitre	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Amede	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Contrariété	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Nägèè	N	10 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Bois de fer	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Tibarama	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Faux Tabac	N	n/a	n/a	n/a	n/a	n/a	n/a	
Ilot Hiengène	N	6.5 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Agué	N	4.25 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Yava	N	6.5 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Neba	N	3 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Devers	N	n/a	n/a	n/a	n/a	n/a	n/a	

Ilot Ouanne	N	0.25 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Yan' dagouet	N	n/a	n/a	n/a	n/a	n/a	n/a	
Gio beach	N	1 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot GU		1 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Nani		1 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Canala Bay		2 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Nakety Bay		3 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Neni		1.25 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Ilot Karu		0.75 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD
Lindéralique beach		4 (2010-2015)	n/a	n/a	n/a	n/a	n/a	PNORD

Table 3. International Conventions Applicable in New Caledonia.

La convention sur le commerce international des espèces menacées de la faune et de la flore sauvage, ou convention de Washington, ou encore CITES (Washington, 1973).

La convention sur la conservation des espèces migratrices appartenant à la faune sauvage ou convention de Bonn ou CMS (Bonn, 1979)

Other international agreements contribute indirectly to the protection of turtle species through the protection of their habitats, ecosystems and biodiversity:

- La convention de Ramsar (1971), relative aux zones humides d'importance internationale,
- La convention sur le patrimoine mondial (1972),
- La convention des Nations Unies sur le droit de la mer (1982),
- La convention sur la diversité biologique ou CDB (1992) Objectif d'Aichi (2010),
- Convention d'Apia (1976)
- Convention de Nouméa (1986)

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention on International Trade in Endangered Species of Wild Fauna and Flora	Y	Y	?	ALL	no turtle trade	No international trading of sea turtles

Convention on migratory species	Y	Y	?	ALL	protection of all migratory species	Protect sea turtles and all their habitats
Convention on Conservation of Nature in the South Pacific	Y	Y	?	ALL	Need to create marine parks	Creation of turtle sanctuaries
172Convention for the protection of the Natural Resources and Environment of the South Pacific Region	Y	Y	?	ALL	Protection and managment of all marine areas	Management strategies to be put in place
Convention on Conservation of Nature in the South Pacific	Y	Y	?	ALL	Regional cooperation	Regional management of sea turtles
Single Species Action Plan for the Loggerhead Turtle in the South Pacific Ocean	Y	N	?	CC	Prioritise loggerhead protection	South Pacific genetic stock critically endangered

Table 4. Summary of Research Projects in New Caledonia

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private	Collaboration with	Primary Contact (name and Email)	Other Contacts (name and Email)
T4.1	CC-SP	France	New Caledonia, Bourail	Bwara Tortues Marines	Nesting female, loggerhead, South Pacific	2006	ongoing	Bwärä Tortues Marines	Private	South Province, WWF, Aquarium	Dominique Lafage, jackdaniels@lagoon.nc	
T4.2	CM-SW	France	New Caledonia, Great Lagoon South	Thesis Grand Lagon Sud	foraging, Fastloc GPS, genetics, time-depth recorder	2012	2015	Griffith University	Private	Aquarium, South Province	Tyffen Read tyffen.read@aquarium.nc	Richard.farman@aquarium.nc
T4.3	CC-SP; CM SW	France	New Caledonia	Opérations Tortues NC	aeriel survey, ground truthing, tagging, GPS	2006	ongoing	WWF	private	South Province	Marc Oremus <moremus@wwf.nc>	Hubert Geraux <hgeraux@wwf.nc>
T4.4	CM-SW	France	New Caledonia	D'Entrecasteaux satellite tracking	GPS tagging, nesting female, migration	2015	ongoing	Aquarium des Lagons	Private	Maritime authorities of New Caledonia, NOAA	Richard Farman Richard.farman@aquarium.nc	
T4.5	CM-SW	France	New Caledonia, Chesterfields Reefs	Chesterfields track surveys	beach survey, track count, nesting female	2012	ongoing	Maritime authorities of New Caledonia	Public	WWF, Aquarium	Christophe Fonfreyde christophe.fonfreyde@gouv.nc	julie-anne.kerandel@gouv.nc
T4.6	CC-SP; CM SW	France	New Caledonia, D'Entrecasteaux Reefs	D'Entrecasteaux track surveys	beach survey, track count, nesting female	2007	ongoing	Maritime authorities of New Caledonia	Public	ASNNC, WWF, Aquarium	Christophe Fonfreyde christophe.fonfreyde@gouv.nc	julie-anne.kerandel@gouv.nc

T4.7	CC-SP	France	New Caledonia, Bourail	Turtle Watching	ecotourism, turtle tours, tagging	2016	ongoing	Aquarium des Lagons	Public	South Province, Bwara Tortues Marines	Tyffen Read tyffen.read@aquarium.nc	Richard.farman@aquarium.nc
T4.8	CC-SP; CM SW	France	New Caledonia	Action Plan for sea turtles of NC	action plan, prioritise	2017	ongoing	DAFE	Public	3 Provinces, Aquarium, Bwara, NC gov, WWF, CEN, AMP NC, IRD	CONNAN Franck <franck.connan@dafe.nc>	
T4.9	CC-SP	France	New Caledonia, Bourail	ZCO feeding ground study	foraging, CMR	2016	ongoing	Aquarium des Lagons	Public	Caretta Bourail ONG	Tyffen Read tyffen.read@aquarium.nc	Richard.farman@aquarium.nc
T4.10	CC-SP; CM SW	France	New Caledonia, North Province	Survey of nesting	track counts, tagging	2012	ongoing	North Province	Public		Jean-Jerome Cassan jj.cassan@province-nord.nc	

FIGURES

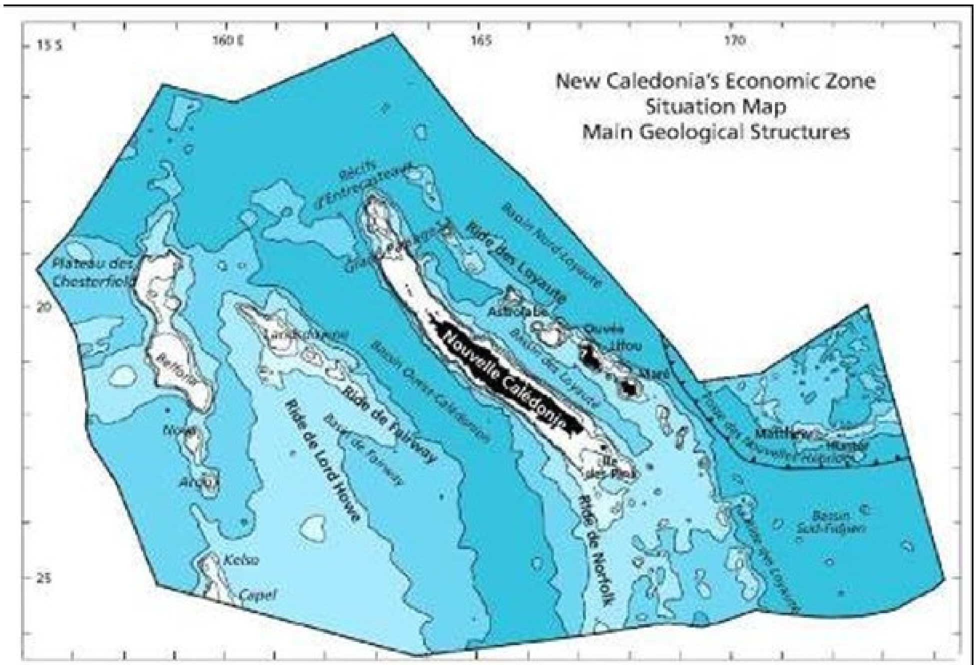

Figure 1: Maritime area of New Caledonia

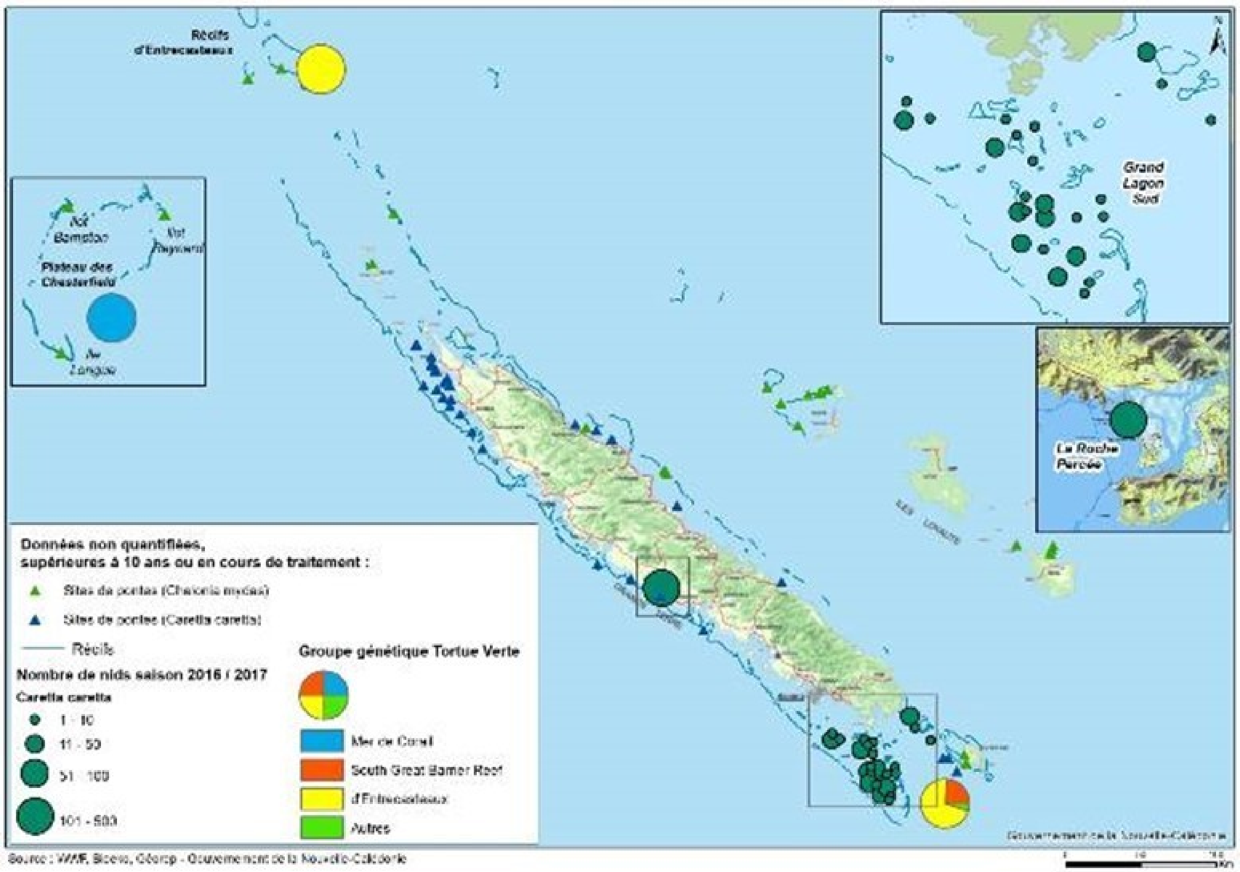

Figure 2: Main known breeding sites and number of estimated nests (2016-17 season) for *Chelonia mydas* and *Caretta caretta*, genetic group for *Caretta caretta*. Data: WWF 2007 and 2016-17, BWARA Sea Turtle 2016-17, Lagoon Aquarium 2015

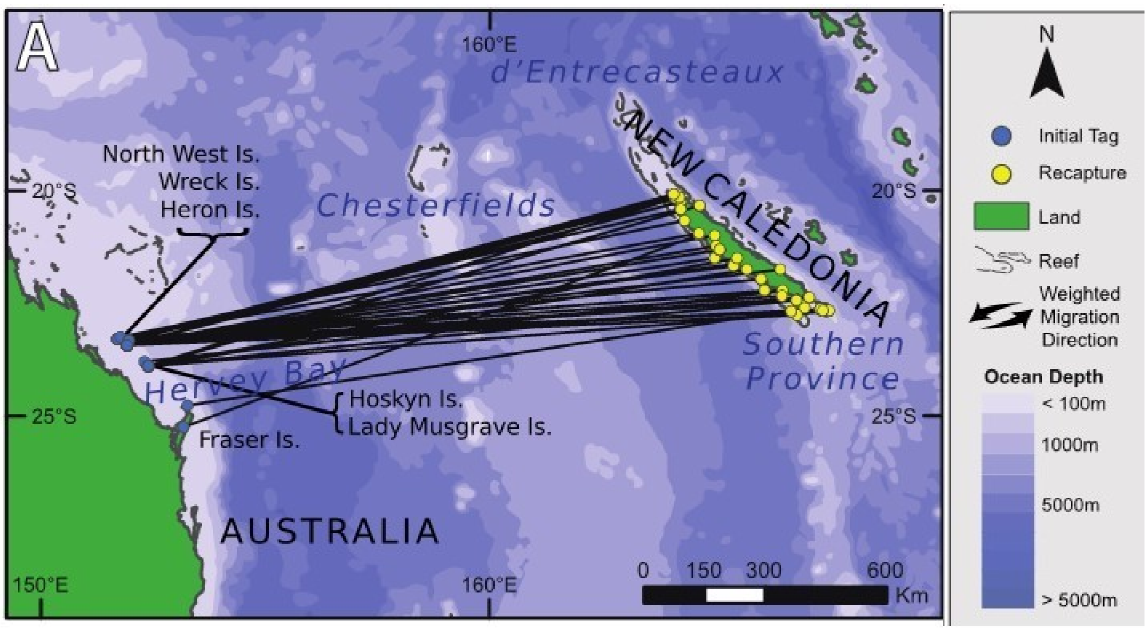

Figure 3: Map of trajectories from tag / recapture data for *Chelonia mydas* between Australia and New Caledonia (from 8).

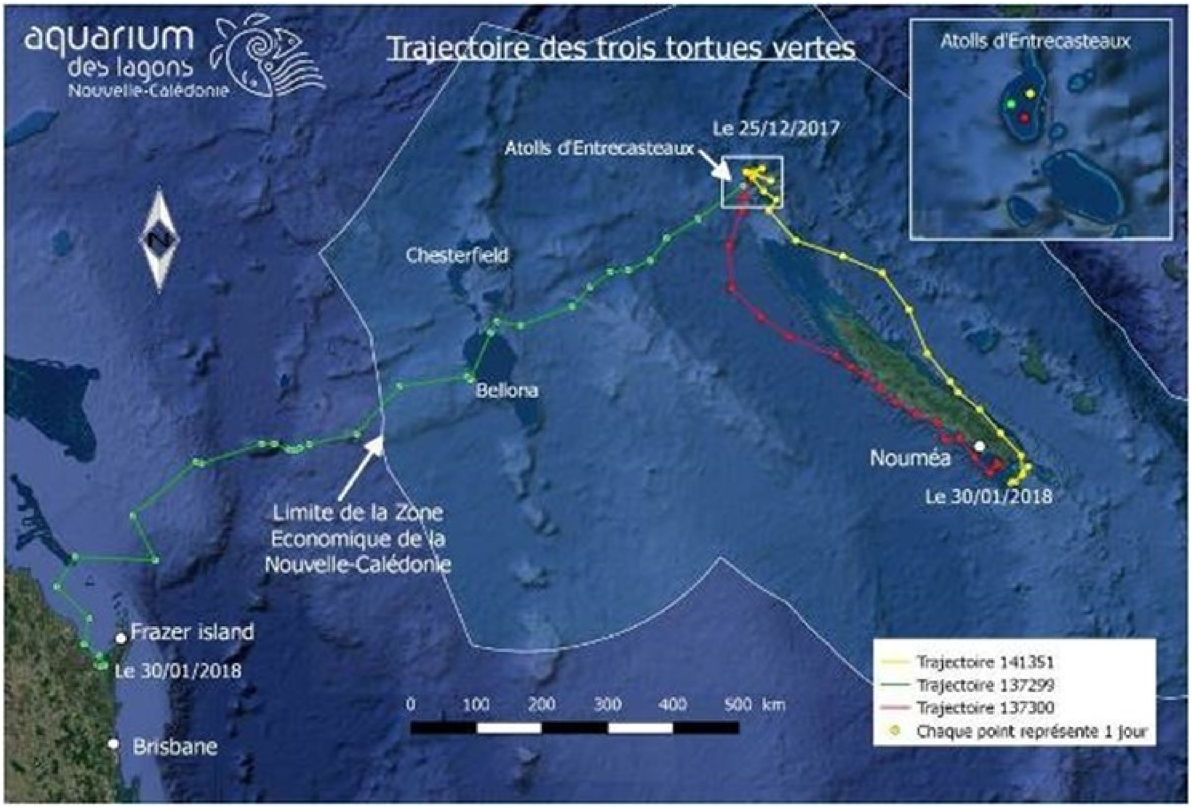

Figure 4: Map of trajectories from satellite tracks of 3 *Chelonia mydas* two of them within the waters of New Caledonia Australia and. (source: Aquarium des Lagons, 2017)

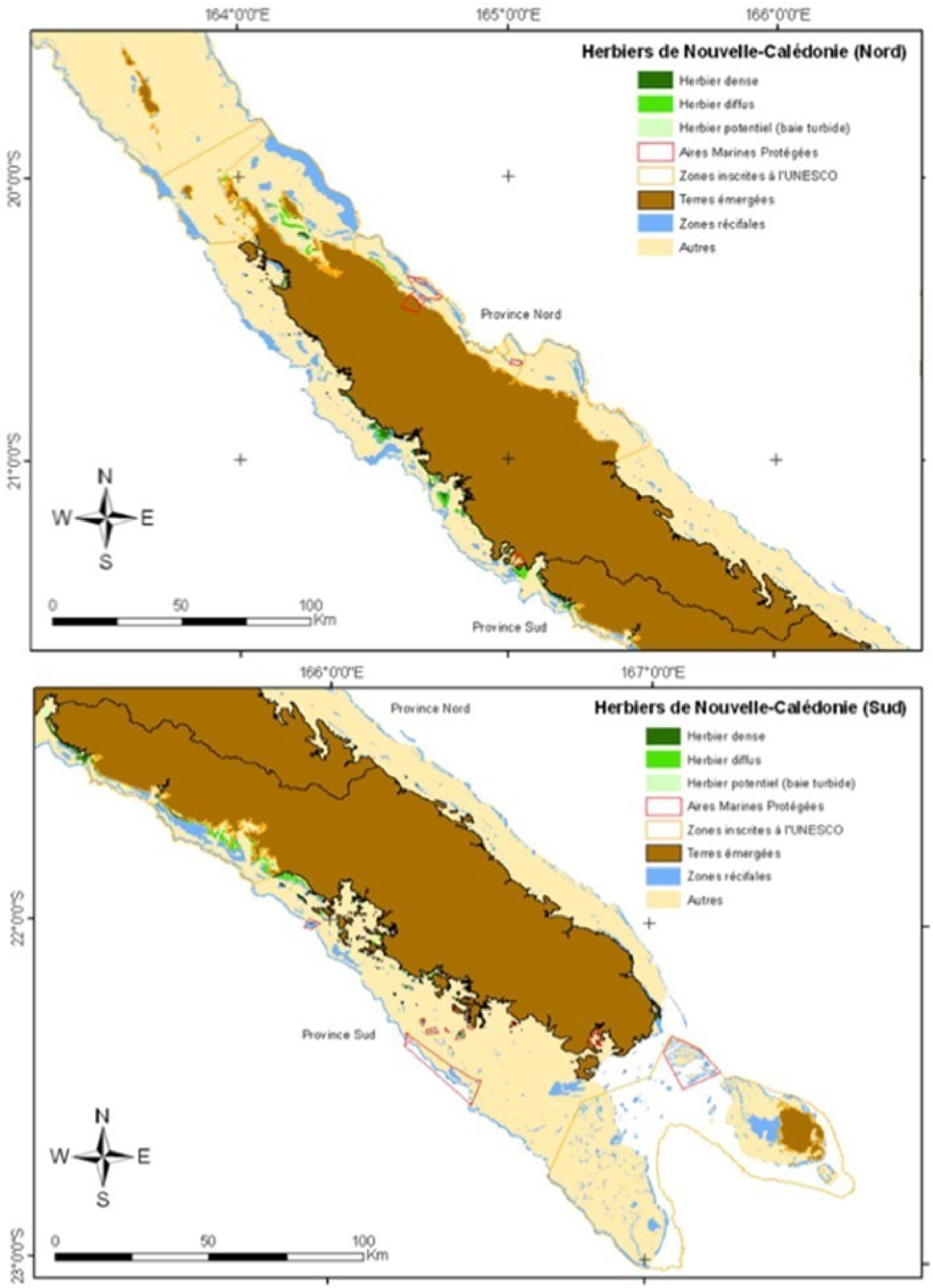

Figure 5: Distribution of seagrass beds and coral reefs in southern and northern New Caledonia (S. Andréfouët & M. Hamel, 2010 cited by 10).

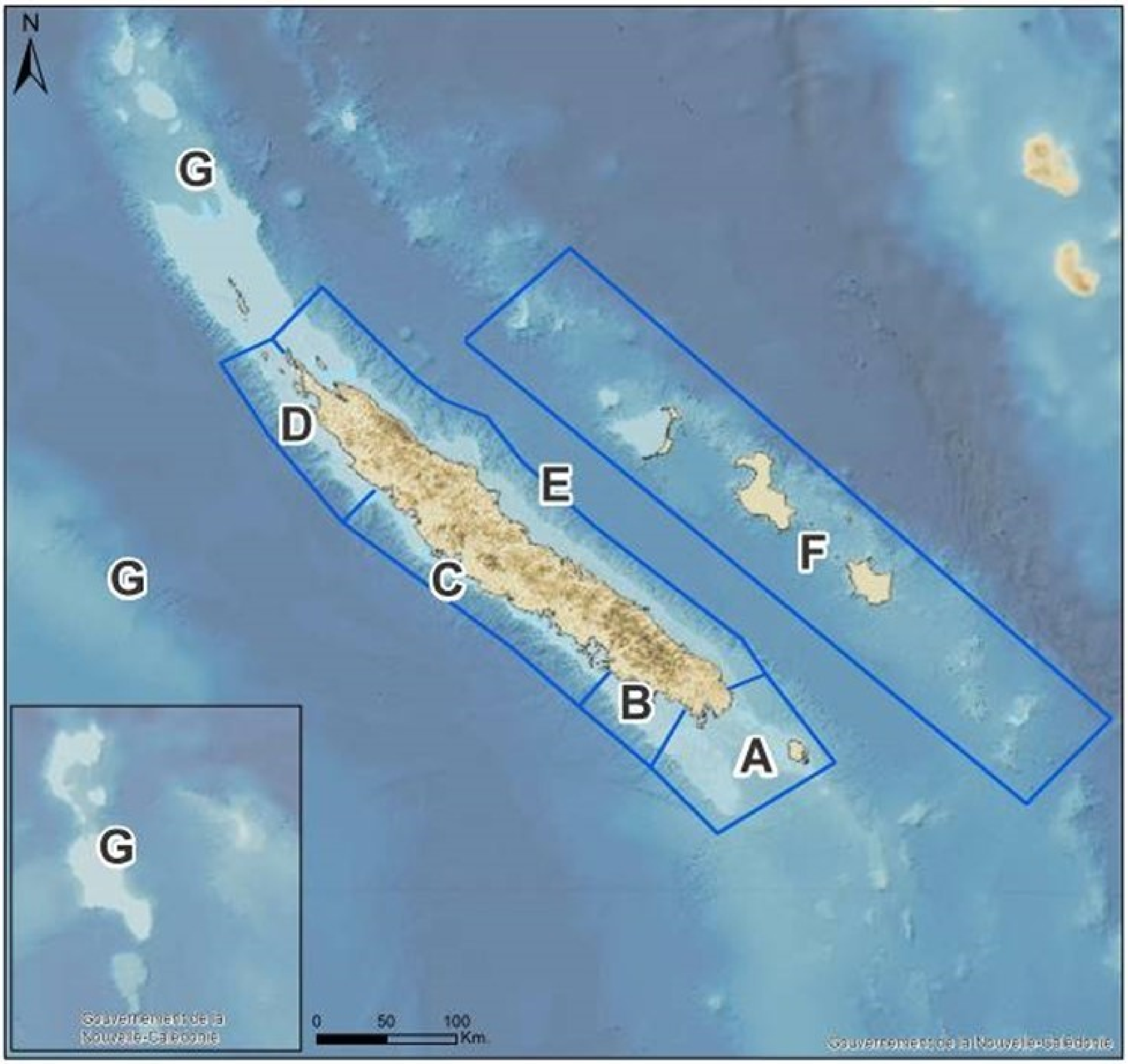

Figure 6: Delineation of the areas used for the synthesis of the categorization of pressures / threats. A: Southern Lagoon; B: Large lagoon Nouméa; C: West Lagoon; D: Northwest Lagoon, E: East Lagoon; F: Loyalty Islands; G: PNMC: Coral Sea Nature Park (encompassing remote islands)

Figure 7: Location of dead / stranded / injured marine turtles and identified causes. (Source: Northern, Southern Province, Lagoons Aquarium Database, Bwara, 2017).

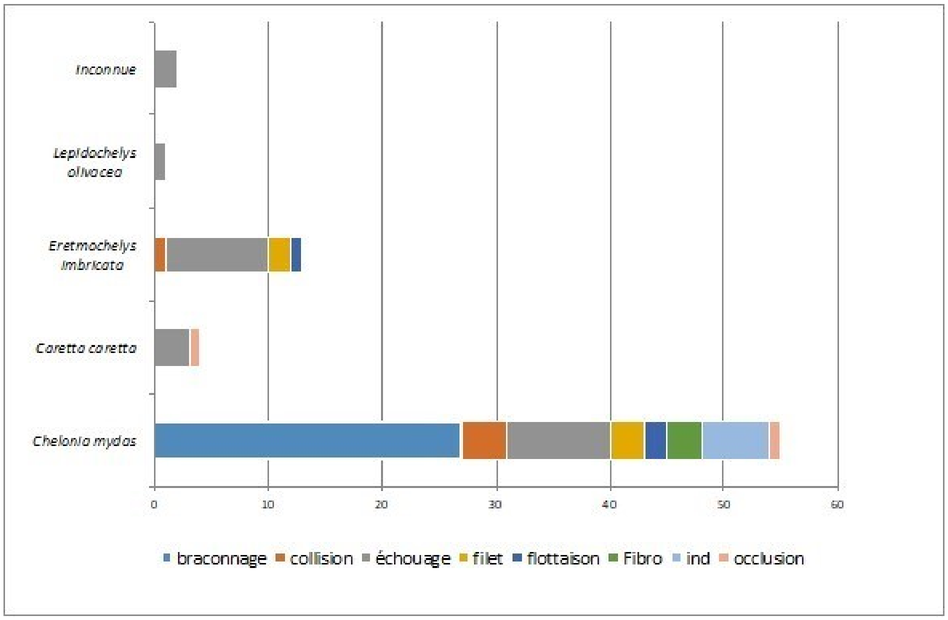

Figure 8: Distribution by species and by cause of dead / stranded / wounded sea turtles (Source: North, South shared database, Lagoon Aquarium, Bwara, 2017).

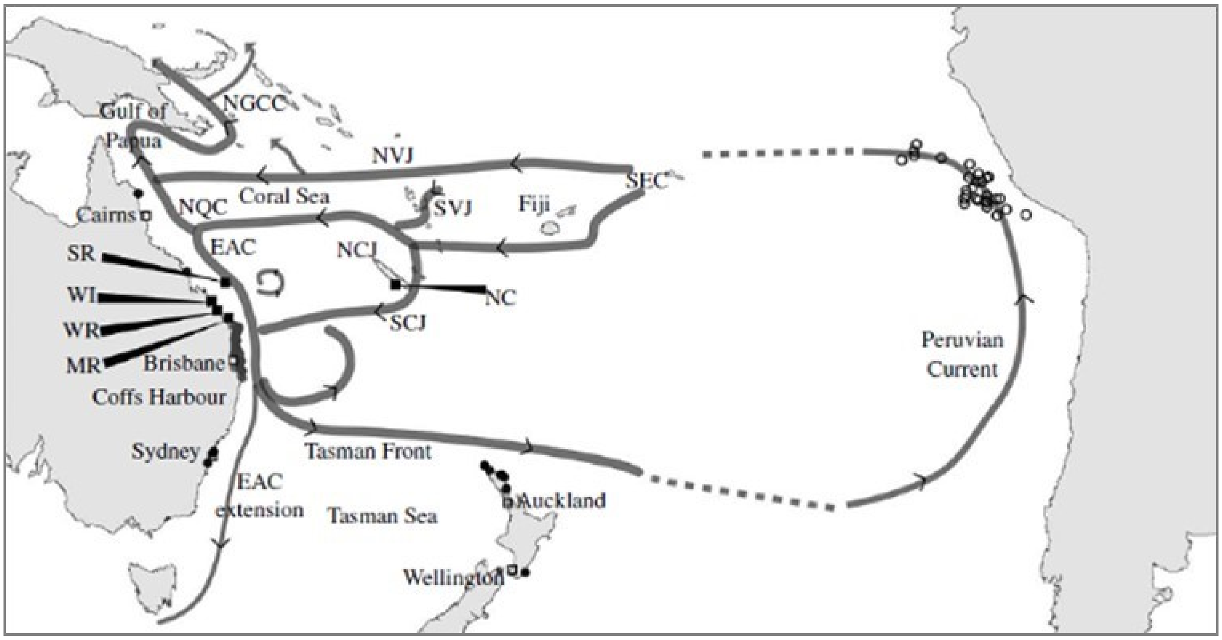

Figure 9: Distribution of observations of juvenile Big-headed turtles in the South Pacific, major surface currents and populations of breeding females sampled for genetic analysis. Square: breeding site sampled; full circles: newborns stranded; open circles: newborns caught by longlines. Sampled sites include WR = Wreck Rock; SR = Sawain Reefs; WI = Wreck Island; MR = My rest; NC = New Caledonia. The currents include the Southern Equatorial Current (SEC), the North Vanuatu Jet (NVJ), the South Vanuatu Current (SVJ), the North Caledonian Jet (NCJ) and the South Caledonian Jet (SCJ), the East Australian Current (EAC). , the North Queensland Current (NQC) and the New Guinea Coastal Current (CCGS) (from 18).

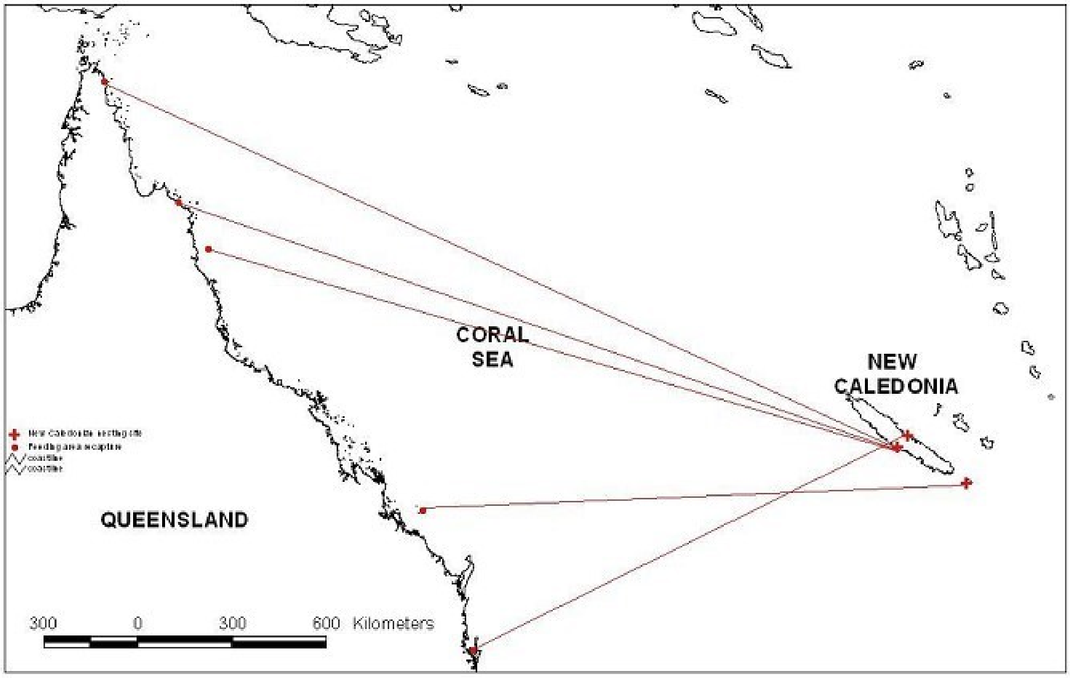

Figure 10: capture / recapture data between New Caledonia (cross) and feeding sites in Australia (round) for *Caretta caretta*. Map cited by (16)

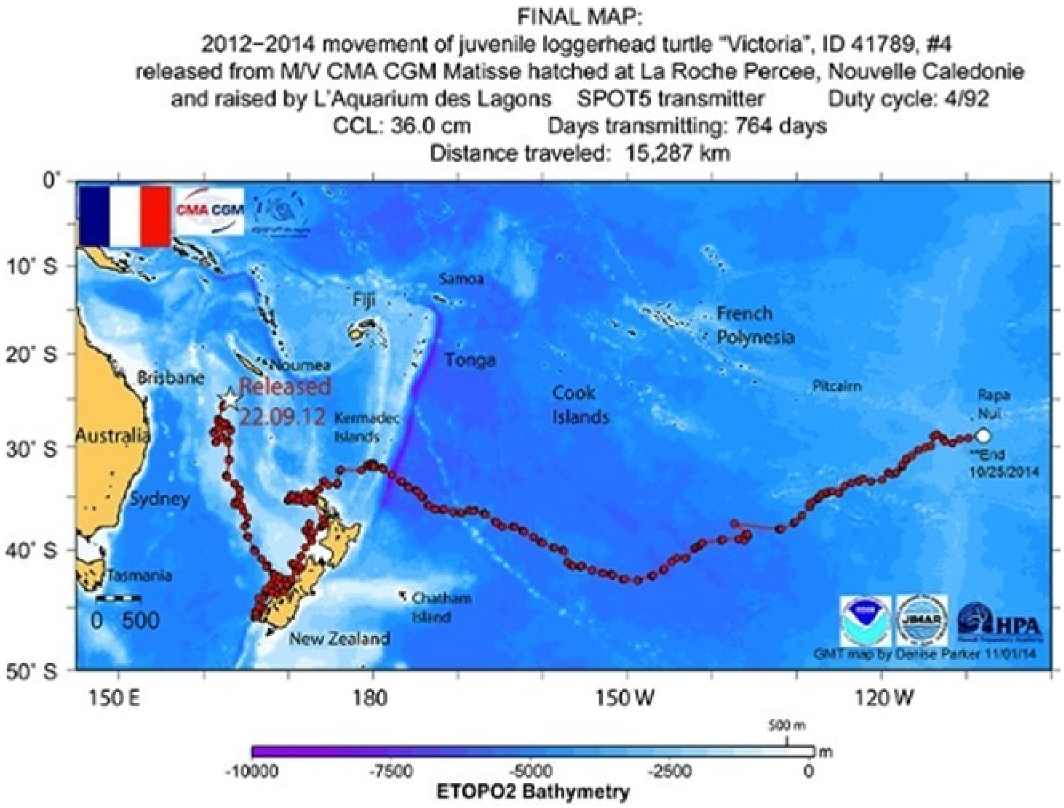

Figure 11: Journey of a juvenile *Caretta caretta* turtle tagged in New Caledonia. (source: Lagoon Aquarium, 2014; cited in 16).

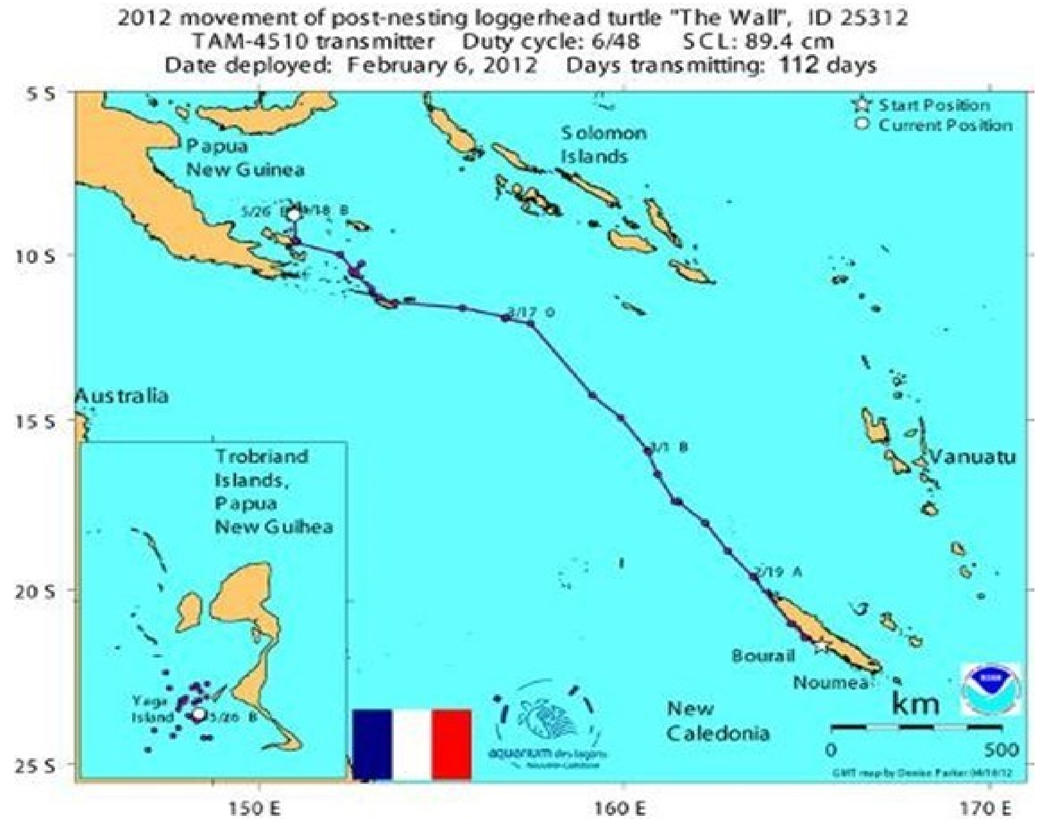

Figure 12: Satellite tracking of a female turtle with a large head during its oceanic return trip between its Bourail spawning beach and the Solomon Sea (source Aquarium of the lagoons)

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Appendix.

Appendix Table 1: Summary of monitoring data of nesting in New Caledonia. TV: Green Turtle (*Chelonia mydas*). TGT: Loggerhead turtle (*Caretta caretta*). Source: (2, 3, 4, 5, 6 et 7 ; Bwärä tortues, pers. Com.)

	Nouvelle-Calédonie		**Province Sud**			**Province Nord**								**Espace maritime Nouvelle-Calédonie (PNMC)**		**Province des îles Loyautés**		
			Roche Percée	**Grand Lagon Sud**		**Koumac /Poum - Ponerihouen - Poindimié**		**Poum : îlot Neba**			**Hienghene**			**Récifs d'Entrecasteaux**	**Plateau des Chesterfields**	**Ouvéa**	**Beautemps-Beaupré**	**Maré**
	TV	TGT	TGT	TV	TGT	TV	TGT	Ind.	TV	TGT	Ind.	TV	TGT	TV	TV	TV	TV	TV
Population pondeuse estimée	**1500 à 2000** *(2003-04)*	**150 à 200** *(2003-04)*	Non estimé		**80 à 172** *(2016-17)*	Tortue Verte: **50 à 100** *(2003-04)* Tortue Grosse tête: **50** *(2003-04)*										entre **50 et 100** *(2003)*	entre **100 et 500** *(2006)*	entre **1 et 10** *(2006)*
Fréquentation des sites: Nb de ponte ou Nb de trace (dernière saison de donnée disponible recueillie)			Nb de ponte: **378** *(2016-17)*	Nb de Trace: **1** *(2016-17)*	Nb de ponte: **345** *(2016-17)*	Nb de trace indéterminées. : **154*** *(2013-14)*	Nb de ponte: **52** *(2013-14)* Nb de trace indéterminées. : **14*** *(2013-14)*	Nb de ponte: **21** *(2013-14)*	Nb de ponte: **12** *(2013-14)*	Nb de ponte: **29** *(2013-14)*	Nb de ponte: **10** *(2013-14)*	Nb de ponte: **17** *(2013-14)*	Nb de ponte: **7** *(2013-14)*	Nb de trace de montée **par saison: 50 000 à 100 000** *(2018)*		non fourni		
Pic de ponte			déc-janv	ind	déc-janv (estimé)	décembre-janvier (évalué en 2010)								décembre-janvier estimé				
Prospection des plages	95% en 2006 (survol+vérité terrain)		95% en 2006 (mission survol+vérité terrain) Grand Lagon Sud: 29 ilots en 2016-17			100% en 2010-13								100% en 2007	100% en 2012			

Appendix Table 2: Summary of pressures and threats for *Chelonia mydas* in New Caledonia

TORTUES VERTES – *Chelonia mydas*							
Catégories des pressions et menaces en Nouvelle-Calédonie	**Lagon Sud**	**Lagon Grand Nouméa**	**Lagon Ouest**	**Lagon Nord Ouest**	**Lagon Est**	**PNMC**	**Iles loyautés**
SITES DE PONTE							
PRESSIONS							
Terrestrial predators	**-**	**-**	**-**	∅	**+**	**-**	**-**
Egg illegal harvest	**?**	**?**	**-**	∅	**+**	**-**	**++**
Nesting site disturbances	**+**	**+**	**-**	∅	**-**	**-**	**-**
Light pollution	**-**	**+**	**-**	∅	**-**	**-**	**-**
MENACES							
Evolution du littoral *(mobilité des îlots, érosion et recul du trait de côte, submersion)*	**+**	**+**	**-**	∅	**+**	**+**	**++**
Changements climatiques *(élévation du niveau de la mer, augmentation de la température des nids, augmentation des évènements extrêmes)*	**+**	**+**	**-**	∅	**+**	**+**	**+**
ALIMENTATION / DEVELOPPEMENT / DEPLACEMENTS							
PRESSIONS							
Authorized captures	**++**	**-**	**-**	**++**	**++**	∅	∅

Illegal harvest of adults and young adults	**++**	**+**	**+**	**++**	**++**	**-**	∅
Accidental catch	**+**	**+**	**+**	**+**	**+**	**-**	**?**
Collision	**+**	**++**	**+**	**-**	**-**	**-**	**-**
MENACES							
Dégradation des habitats	**-**	**++**	**+**	**-**	**+**	**-**	**-**
Pollution/déchets marins/agent pathogène	**+**	**++**	**+**	**+***	**+**	**-**	**-**

The following code has been used to categorize them: ?: unknown; Ø: Not concerned; **-**: low; **+**: moderate, **++**: strong

Appendix Table 3: Summary of pressures and threats for *Eretmochelys imbricata* in New Caledonia. The following code has been used to categorize them: ?: unknown; Ø: Not concerned; **-**: low; **+**: moderate, **++**: strong

TORTUES IMBRIQUEE – *Eretmochelys imbricata*							
Catégories des pressions et menaces en Nouvelle-Calédonie	**Lagon Sud**	**Lagon Grand Nouméa**	**Lagon Ouest**	**Lagon Nord Ouest**	**Lagon Est**	**PNM C**	**Iles loyautés**
SITES DE PONTE							
PRESSIONS	*Les pontes de tortues imbriquées sont fortement suspectées en Nouvelle-Calédonie mais pas encore confirmé. Dans l'hypothèse de sites de nidification, il est supposé que les menaces seraient similaires à celle pesant sur les autres espèces nidifiantes (vertes et grosse tête) selon les sites correspondants.*						
Prédateurs terrestres							
Prises irrégulières des œufs							
Fréquentation des sites de ponte							
Pollution lumineuse							
MENACES							
Evolution du littoral							
Changements climatiques							
ALIMENTATION / DEVELOPPEMENT / DEPLACEMENTS							
PRESSIONS							
Prises autorisées	∅	∅	∅	∅	∅	∅	∅
Prises irrégulières des adultes et jeunes adultes	∅	∅	∅	∅	∅	∅	∅
Prises accidentelles	**+**	**+**	**+**	**+**	**+**	**-**	**?**
Collision navire	**+**	**++**	**+**	**-**	**-**	**-**	**-**

MENACES							
Dégradation des habitats	**-**	**++**	**+**	**-**	**+**	**-**	**-**
Pollution/déchets marins/agent pathogène	**+**	**++**	**+**	**-**	**+**	**-**	**-**

AppendixTable 4: Summary of pressures and threats for *Dermochelys coriacea* in New Caledonia: ?: unknown; Ø: Not concerned; **-**: low; **+**: moderate, **++**: strong.

TORTUES LUTH – *Dermochelys coriacea*							
Catégories des pressions et menaces en Nouvelle-Calédonie	**Lagon Sud**	**Lagon Grand Nouméa**	**Lagon Ouest**	**Lagon Nord Ouest**	**Lagon Est**	**PNMC**	**Iles loyautés**
SITES DE PONTE							
PRESSIONS							
Prédateurs terrestres	∅						
Prises irrégulières des œufs							
Fréquentation des sites de ponte							
Pollution lumineuse							
MENACES							
Evolution du littoral							
Changements climatiques							
ALIMENTATION / DEVELOPPEMENT / DEPLACEMENTS							
PRESSIONS							
Prises autorisées						∅	∅

Prises irrégulières des adultes et jeunes adultes	∅	∅	
Prises accidentelles		**-**	
Collision navire		**-**	
MENACES			
Dégradation des habitats		∅	
Pollution/déchets marins/agent pathogène		**-**	

Appendix Table 5: Summary of pressures and threats for *Lepidochelys olivacea* in New Caledonia; ?: unknown; Ø: Not concerned; **-**: low; **+**: moderate, **++**: strong.

TORTUES OLIVATRE – *Lepidochelys olivacea*							
Catégories des pressions et menaces en Nouvelle-Calédonie	**Lagon Sud**	**Lagon Grand Nouméa**	**Lagon Ouest**	**Lagon Nord Ouest** **++**	**Lagon Est**	**PNMC**	**Iles loyautés**
SITES DE PONTE							
PRESSIONS							
Prédateurs terrestres							
Prises irrégulières des œufs							
Fréquentation des sites de ponte				∅			
Pollution lumineuse							
MENACES							
Evolution du littoral							
Changements climatiques							
ALIMENTATION / DEVELOPPEMENT / DEPLACEMENTS							
PRESSIONS							
Prises autorisées	∅	∅	∅	∅	∅	∅	∅
Prises irrégulières des adultes et jeunes adultes	∅	∅	∅	∅	∅	∅	∅

Prises accidentelles	**-**	**-**	**-**	**-**	**-**	**-**	**?**
Collision navire	**-**	**-**	**-**	**-**	**-**	**-**	**?**
MENACES							
Dégradation des habitats	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Pollution/déchets marins/agent pathogène	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Appendix Table 6: Summary of pressures and threats for *Caretta caretta* in New Caledonia; ?: unknown; Ø: Not concerned; **-**: low; **+**: moderate, **++**: strong.

TORTUES GROSSE TÊTE – *Caretta caretta*							
Catégories des pressions et menaces en Nouvelle-Calédonie	**Lagon Sud**	**Lagon Grand Nouméa**	**Lagon Ouest**	**Lagon Nord Ouest**	**Lagon Est**	**PNMC**	**Iles loyautés**
SITES DE PONTE							
PRESSIONS							
Prédateurs terrestres	**-**	**?**	**-**	Ø	**+**	**-**	**-**
Prises irrégulières des œufs	**-**	**-**	**+**	**+**	**+**	Ø	**+**
Fréquentation des sites de ponte	**+**	**?**	**+**	**-**	**-**	Ø	**-**
Pollution lumineuse	**-**	**?**	**+**	**-**	**-**	Ø	**-**
MENACES							
Evolution du littoral *(mobilité des îlots, érosion et recul du trait de côte, submersion)*	**++**	**+**	**++**	**++**	**++**	Ø	**++**
Changements climatiques *(élévation du niveau de la mer, augmentation de la température des nids, augmentation des évènements extrêmes)*	**+**	**+**	**++**	**+**	**+**	Ø	**+**
ALIMENTATION / DEVELOPPEMENT / DEPLACEMENTS							
PRESSIONS							
Prises autorisées	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Prises irrégulières des adultes et jeunes adultes	Ø	Ø	Ø	Ø	Ø	Ø	Ø

Prises accidentelles	**-**	**-**	**-**	**?**	**?**	**-**	**?**
Collision navire	**-**	**-**	**+**	**-**	**-**	**-**	**-**
MENACES							
Dégradation des habitats	**-**	**+**	**+**	**-**	**+**	**-**	**-**
Pollution/déchets marins/agent pathogène	**+**	**+**	**+**	**-**	**+**	**-**	**-**

NEW ZEALAND

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1 RMU: Green turtle (*Chelonia mydas*) - Southwest Pacific, Central South Pacific, Pacific West Central, Pacific East.

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

No nesting has been reported in New Zealand, including the sub-tropical Kermadec Islands, ca. 900 km northeast of the mainland at ~30° S (25; 13). Some anecdotal information suggests turtle tracks have been reported from beaches of the Far North (e.g. Spirits Bay), yet these have never been substantiated (13).

1.1.2 Marine areas

In New Zealand, 194 sighting, stranding and incidental capture (commercial and recreational bycatch) records have been documented from 1895 to 2013 (25; 13; 22; D. Godoy, unpubl. data). Green turtle records extend from the Kermadec islands (c. 30° S) south to Canterbury (c. 43° S) (13; 22), with this species found year-round across New Zealand's northern regions of the North Island, ca. 34°–38° S (22) and the Kermadec Islands (25, 13).

1.2 Other biological data

Recent research has described the New Zealand population as a discrete assemblage of post-pelagic immature juveniles to large subadults present year-round in its northern waters (c. 34°–38° S) (22). Satellite telemetry data of 11 rehabilitated immature green turtles between 2004 and 2016 have shown that, post-release, nine remained within New Zealand's oceanic and neritic waters (Godoy unpubl. data). Transmission times ranged between 91 and 606 days. One sub-adult turtle (85.3 CCL) migrated directly to New Caledonia upon release and remained near Noumea until transmissions ceased after 259 days. Another turtle (55.2 CCL) departed New

Zealand's neritic waters after approximately three months and was last recorded in oceanic waters 1000 km west of New Zealand.

Unpublished genetic analysis of 42 stranded immature green turtles identified 15 haplotypes, including one orphan haplotype: CmP80.4 (18). This mixed stock foraging aggregation represents a distributional overlap of 14 recognised Management Units (MU) originating from rookeries of the southwest Pacific (sGBR, Coral Sea, New Caledonia), west central Pacific (Marshall Islands, Micronesia, Palau, Guam/CNMI), south central Pacific (American Samoa), and east Pacific (Revillagigedo, Michoacan, Costa Rica, Galapagos Islands).

Unpublished diet component analysis shows green turtles are foraging in New Zealand's northern neritic habitats (20). The examination of gut contents from 34 stranded and incidentally caught immature and sub-adult green turtles show they consume a variable diet of macroalgae, seagrass, mangrove and benthic macro-invertebrates.

1.3 Threats

1.3.1 Nesting sites

Not applicable

1.3.2 Marine areas

Within New Zealand's Exclusive Economic Zone (EEZ), green turtles are infrequently bycaught in fisheries (30, 8, 28, 29, 6). Bycatch analysis of commercial fisheries data from 2008 to 2015 (16) suggests green turtles were captured in relatively low numbers. Bycatch comprised 10% (n = 12) of the total marine reptile bycatch over the eight-year period, with an average bycatch of two turtles per fishing year (SD = 0.8, range = 1-3). Although bycatch risk is considered moderately low, data suggests that both oceanic phase juvenile turtles and post-settlement neritic resident turtles are at risk from fisheries activities in New Zealand, particularly those individuals occupying northern inshore regions.

Other anthropogenic threats to green turtles in New Zealand include the ingestion and entanglement in synthetic marine debris, incidental capture in recreational fishery activities, and vessel strike (13; 23; Godoy unpubl. data).

1.4 Conservation

Under New Zealand legislation, green turtles are fully protected under the Wildlife Act 1953 and have been assessed according to the New Zealand Threat Classification System (NZTCS; Table 1). Other conventions and agreements to which New Zealand adopt or are signatory to include the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Bonn Convention of Migratory Species (CMS), and the Regional Marine Turtle Conservation Programme (RMTCP) which runs under the auspice of the South Pacific Regional Environmental Programme (SPREP).

The Western and Central Pacific Fisheries Commission (WCPFC) recommend commission members (including New Zealand) to implement measures to reduce marine turtle bycatch in shallow-set longline fisheries (3). As part of conservation and management measure CMM2008-03 (8), WCPFC commission members are to adopt the United Nations Food and Agriculture Organisation (FAO) Guidelines to Reduce Sea Turtle Mortality where appropriate (32).

1.5 Research

Given that New Zealand lies on the southern boundary of the distributional range for green turtles in the south-western Pacific, little consideration has been given to their occurrence here. Recent research has shown that New Zealand's waters are occupied by marine turtles year-round (22, Godoy unpubl. data). Research has also shown that the green turtle aggregation is genetically linked to several distinct stocks from across the Pacific region. Therefore, research to date highlights several knowledge gaps that still exist, including investigations into regional connectivity, migratory corridors, threats and habitat use for green turtles in New Zealand.

2 RMU Leatherback turtle (*Dermochelys coriacea*) - Pacific West.

2.1 Distribution, abundance, and trends

2.1.1 Nesting sites

No nesting has been reported in New Zealand, including the sub-tropical Kermadec Islands, ca. 900 km northeast of the mainland at ~30° S (25; 13).

2.1.2 Marine areas

Leatherback turtles are widely distributed in oceanic and continental waters from the Kermadec Islands to Foveaux Strait (c. 47° S), and eastward to the Chatham Islands – 800 km east of New Zealand at 44° S, 176° W (3; 4; 27; 11; 13; 20; 24; 25; D. Godoy, unpubl. data). Between 1892 to 2015 288 leatherback sighting, stranding and incidental capture (commercial and recreational bycatch) records have been documented in New Zealand waters (13; 20; D. Godoy unpubl. data). From the limited information available, data suggests a seasonal influx of adult turtles (μ = 152.1 cm CCL, SD 19.1 cm, range 91.0-195.0 cm, n = 13), with about 75% of leatherbacks reported off the North Island during the warmer summer months of January-May (13; 20; 16).

2.2 Other biological data

Despite having a long history of records and a wide distribution in New Zealand, very little local population information exists for this species. However, preliminary genetic analysis indicates at least some individuals originate from the West Pacific Ocean subpopulation (D. Godoy, unpubl. data). The possible connectivity to west Pacific rookeries is also supported by recent satellite telemetry studies (2). Benson et al. (2011) have shown some post-nesting western Pacific females migrate south from their nesting beaches in Papua New Guinea and Solomon Islands into foraging grounds around northern New Zealand. Accordingly, the observed influx and genetic link suggests New Zealand may be an important seasonal foraging ground for adult leatherback turtles from the West Pacific Ocean.

2.3 Threats

2.3.1 Nesting sites

Not applicable

2.3.2 Marine areas

Within New Zealand's Exclusive Economic Zone (EEZ), leatherback turtles are the most vulnerable species to fisheries bycatch, comprising 75% (n = 90) of all marine reptile captures from 2008 to 2015 (16). Leatherback turtles are most at risk from surface long line activities targeting swordfish and tunas, which accounted for 82% (n = 74) of leatherback bycatch in New Zealand. On average, 13 turtles were captured each fishing year (SD = 7.2, range = 2-21, n = 89). Of further concern, leatherback bycatch was highest during summer and autumn off northeastern North Island, a period that coincides with foraging adult leatherback turtles migrating south into highly productive temperate waters around New Zealand (2, 16). Given the bycatch rate of adult leatherback turtles, the lack of population information in New Zealand, and, the critical population status of Pacific leatherbacks in general, their risk to fisheries bycatch in New Zealand is considered high.

Although limited data is available, other anthropogenic threats to leatherback turtles in New Zealand include the entanglement in synthetic marine debris, incidental capture in recreational fishery activities, and vessel strike (13; Godoy unpubl. data).

2.4 Conservation

Under New Zealand legislation, leatherback turtles are fully protected under the Wildlife Act 1953 and have been assessed according to the New Zealand Threat Classification System (NZTCS; Table 1). Other conventions and agreements to which New Zealand adopt or are signatory to include the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Bonn Convention of Migratory Species (CMS), and the Regional Marine Turtle Conservation Programme (RMTCP) which runs under the auspice of the South Pacific Regional Environmental Programme (SPREP).

The Western and Central Pacific Fisheries Commission (WCPFC) recommend commission members (including New Zealand) to implement measures to reduce marine turtle bycatch in shallow-set longline fisheries (3). As part of conservation and management measure CMM2008-03 (8), WCPFC commission members are to adopt the United Nations Food and Agriculture Organisation (FAO) Guidelines to Reduce Sea Turtle Mortality where appropriate (32). Despite these guidelines, in some cases marine turtle bycatch rates exceed the WCPFC recommended minimal marine turtle interaction rate of 0.019 turtles per 1000 hooks for shallow-set longline fisheries (16). Further, because New Zealand allocates very low observer coverage (5.8%) and management to these high-risk fisheries where leatherback turtles at most at risk, it is recommended that appropriate mitigation actions be considered. For example, area/time closures have been shown to significantly reduce marine turtle bycatch in the Hawaiian shallow-set longline fishery and the U.S. west coast (9; 15). Thus, suitably tailored closures could be employed in New Zealand Fisheries Management Areas (FMA) where interaction rates exceed prescribed limits.

2.5 Research

Very limited research has been undertaken on leatherback turtles in New Zealand. Leatherback sighting, stranding and incidental capture is collected as part of the New Zealand marine turtle sighting and stranding database (private database curated by D Godoy). Resourcing for marine turtle research and conservation in New Zealand is non-existent, therefore, there are significant limitations to maintaining and developing research and promote conservation. Nevertheless, New Zealand comprises a potentially important seasonal foraging ground for Pacific leatherbacks, thus further research initiatives into regional connectivity, migratory corridors, threats and habitat are warranted.

3 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - RMU unassigned

3.1 Distribution, abundance, and trends

3.1.1 Nesting sites

No nesting has been reported in New Zealand, including the sub-tropical Kermadec Islands, ca. 900 km northeast of the mainland at ~30° S (13).

3.1.2 Marine areas

Fifty-three sighting, stranding and incidental capture (commercial and recreational bycatch) records have been documented from 1949 to 2015 (12; 31, 13; Godoy unpubl. data). Hawksbill records extend from the Kermadec islands (c. 30^{o} S) south to Palliser Bay, Wellington (c. 41^{o} S), yet its distribution is mostly concentrated off northeastern North Island, with a significant temporal peak in strandings during winter (July-September) and sightings of free-ranging animals during the warmer summer months (13; Godoy unpubl. data).

3.2 Other biological data

Almost no local population information exists for this species in New Zealand. However, observations and unpublished diet component analysis show that hawksbill turtles forage in benthic and pelagic habitats in New Zealand (Godoy unpubl. data). In addition, from the limited data available, the observed size structure suggests hawksbill turtles in New Zealand are juvenile to large sub-adults (μ = 53.2 cm CCL, SD 14.5 cm, range 35.0-90.0 cm, n = 23). No information exists in terms of ecology, regional connectivity, or genetic origin.

3.3 Threats

3.3.1 Nesting sites

Not applicable

3.3.2 Marine areas

Within New Zealand's Exclusive Economic Zone (EEZ), between 2008 and 2015, only six unvalidated hawksbill turtles were bycaught in fisheries activities (16). Therefore, the risk to hawksbill turtles from fisheries activities in New Zealand is considered low given the very low reported capture rate, the low numbers of hawksbill turtles recorded in New Zealand overall, and that these species are primarily restricted to tropical regions.

Although limited data is available, other anthropogenic threats to hawksbill turtles in New Zealand include the ingestion and entanglement in synthetic marine debris, incidental capture in recreational fishery activities, and vessel strike (13; Godoy unpubl. data).

3.4 Conservation

As with all other marine turtle species in New Zealand, hawksbills are fully protected under the Wildlife Act 1953 and have been assessed according to the New Zealand Threat Classification System (NZTCS; Table 1). Other conventions and agreements to which New Zealand adopt or are signatory to include the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Bonn Convention of Migratory Species (CMS), and the Regional Marine Turtle Conservation Programme (RMTCP) which runs under the auspice of the South Pacific Regional Environmental Programme (SPREP).

3.5 Research

Very limited research has been undertaken on hawksbill turtles in New Zealand. Hawksbill sighting, stranding and incidental capture is collected as part of the New Zealand marine turtle sighting and stranding database (private database curated by D Godoy). Resourcing for marine turtle research and conservation in New Zealand is non-existent, therefore, there are significant limitations to maintaining and developing research and promote conservation. Nevertheless, New Zealand data and samples have been collected for analysis and research since 2007, including tissue samples for isotope and genomic studies, thus, thus further research initiatives into regional connectivity, migratory corridors, threats and habitat are warranted.

4 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - Pacific West

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

No nesting has been reported in New Zealand, including the sub-tropical Kermadec Islands, ca. 900 km northeast of the mainland at ~30° S (13).

4.1.2 Marine areas

The olive ridley is widely dispersed across New Zealand between northland and Stewart Island, ca. 34°–46° S. The olive ridley has also been reported from the Chatham Islands (44º S, 176º W). Despite their wide distribution, only 29 sighting and stranding records have been documented from 1956 to 2015, with most strandings occurring during winter (July-September) (10; 13; 14; Godoy unpubl. data).

4.2 Other biological data

Almost no local population information exits for this species in New Zealand. However, from the limited data available from stranded individuals, the observed size structure suggests olive ridley turtles in New Zealand are sub-adult or mature adults (μ = 64.7 cm CCL, SD = 1.7, range = 52.5–85.0 cm, n = 16). No information exists in terms of ecology, regional connectivity or genetic origin.

4.3 Threats

4.3.1 Nesting sites

Not applicable

4.3.2 Marine areas

Within New Zealand's Exclusive Economic Zone (EEZ), no incidental capture (commercial and recreational bycatch) has been reported (13; 16). Although limited data is available, other anthropogenic threats to olive ridley turtles, including the ingestion and entanglement in synthetic marine debris, incidental capture in recreational fishery activities, and vessel strike have not been observed in New Zealand (13; Godoy unpubl. data).

4.4 Conservation

As with all other marine turtle species in New Zealand, olive ridleys are fully protected under the Wildlife Act 1953 and have been assessed according to the New Zealand Threat Classification System (NZTCS; Table 1). Other conventions and agreements to which New Zealand adopt or are signatory to include the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Bonn Convention of Migratory Species (CMS), and the Regional Marine Turtle Conservation Programme (RMTCP) which runs under the auspice of the South Pacific Regional Environmental Programme (SPREP).

4.5 Research

Very limited research has been undertaken on olive ridley turtles in New Zealand. Olive ridley sighting, stranding and incidental capture is collected as part of the New Zealand marine turtle sighting and stranding database (private database curated by D Godoy). Resourcing for marine turtle research and conservation in New Zealand is non-existent, therefore, there are significant limitations to maintaining and developing research and promote conservation. Nevertheless, New Zealand data and samples have been collected for analysis and research since 2007, including tissue samples for isotope and genomic studies, thus, thus further research initiatives into regional connectivity, migratory corridors, threats and habitat are warranted.

5 RMU: Loggerhead turtle (*Caretta caretta*) - Pacific South.

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

No nesting has been reported in New Zealand, including the sub-tropical Kermadec Islands, ca. 900 km northeast of the mainland at ~30° S (13).

5.1.2 Marine areas

In New Zealand, 55 sighting, stranding and incidental capture (commercial and recreational bycatch) records have been documented from 1885 to 2015 (13; D. Godoy, unpubl. data). Despite being rarely reported, Loggerhead records are widely dispersed, extending from the Kermadec islands (c. 30° S) south to Stewart Island (c. 47° S), yet, most records are concentrated around the North Island throughout the year (1; 13; Godoy unpubl. data). Recently, a confirmed loggerhead sighting was reported in oceanic waters (ca. 300 m depth) over the Kermadec Ridge (ca. 32º 28' S, 179º 17' W).

5.2 Other biological data

Almost no local population information exits for this species in New Zealand. However, the observed size structure based on limited samples suggests all turtles are small juveniles to large sub-adults (μ = 40.9 cm CCL, SD 29.1 cm, range 8.0-80.0 cm, n = 16). No information exists in terms of ecology, regional connectivity, or genetic origin.

5.3 Threats

5.3.1 Nesting sites

Not applicable

5.3.2 Marine areas

Within New Zealand's Exclusive Economic Zone (EEZ), only two reports of incidental capture in commercial fisheries activities have been documented for this species (16). The low bycatch rate suggests that risk from fisheries activities for this species in New Zealand is low. Although limited data is available, other anthropogenic threats to loggerhead turtles in New Zealand include the ingestion and entanglement in synthetic marine debris, incidental capture in recreational fishery activities, and vessel strike (13; Godoy unpubl. data).

5.4 Conservation

As with all other marine turtle species in New Zealand, loggerheads are fully protected under the Wildlife Act 1953 and have been assessed according to the New Zealand Threat Classification System (NZTCS; Table 1). Other conventions and agreements to which New Zealand adopt or are signatory to include the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Bonn Convention of Migratory Species (CMS), and the Regional Marine Turtle Conservation Programme (RMTCP) which runs under the auspice of the South Pacific Regional Environmental Programme (SPREP).

5.5 Research

Very limited research has been undertaken on loggerhead turtles in New Zealand. loggerhead sighting, stranding and incidental capture is collected as part of the New Zealand marine turtle sighting and stranding database (private database curated by D Godoy). Resourcing for marine turtle research and conservation in New Zealand is non-existent, therefore, there are significant limitations to maintaining and developing research and promote conservation.

Table 1. List of marine reptile species recorded in New Zealand waters. International (IUCN) and National (NZTCS) Status with qualifiers and criteria included. NZTCS qualifiers: TO – Threatened Overseas; DP – Data Poor; SO – Secure Overseas.

Name and Authority	**Common name**	**NZTCS Status and Qualifiers**	**IUCN Category and Criteria**
Dermochelys coriacea (Vandelli, 1761)	Leatherback turtle	Migrant - TO	Vulnerable (globally) Critically endangered (Pacific Ocean) A2bd ver. 3.1
Chelonia mydas (Linnaeus, 1758)	Green turtle	Migrant - TO	Endangered A2bd ver. 3.1
Eretmochelys imbricata (Linnaeus, 1766)	Hawksbill turtle	Vagrant – TO	Critically Endangered A2bd ver. 3.1
Caretta caretta (Linnaeus, 1758)	Loggerhead turtle	Vagrant – TO	Vulnerable A2b ver. 3.1
Lepidochelys olivacea (Eschscholtz, 1829)	Olive Ridley turtle	Vagrant – TO	Vulnerable A2bd ver. 3.1

Table 2. Summary of the biology and conservation for marine turtle species known to occur in New Zealand. Regional Management Units (RMU) are included where known.

RMU	**CM-SW PAC, SC PAC, WC PAC, E PAC**	Ref #	**DC-W PAC**	Ref #	**EI-Unknown**	Ref #	**LO-W PAC**	Ref #	**CC-S PAC**	Ref #
Occurrence										
Nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pelagic foraging grounds	Y	PS, Manuscript in prep: Godoy, D.A., Betty, E. L. Teuthida squid in the diet of oceanic stage green turtles: an insight into	Y	PS, Based on personal database and unpublished research.	n/a	n/a	n/a	n/a	n/a	n/a

		habitat association in the southwestern Pacific Ocean.								
Benthic foraging grounds	Y	20, Manuscript in prep: Godoy, D.A., and Pawley, M.D.M. The diet of green turtles (*Chelonia mydas*) at a temperate foraging ground of the southwestern Pacific.	n/a	n/a	Y	PS, Based on personal database and unpublished research.	n/a	n/a	Y	PS, Based on personal database and unpublished research.
Key biological data										

Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

(range of years)										
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies										
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	Y	16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Threats										
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, DLL, MT)	15	Y (PLL, SN, MT)	15	Y (PLL)	15, Possible species mis-iendification	Y (PLL, MT)	15	Y (PLL, MT)	15
Bycatch: presence of industrial fisheries?	Yes (PLL, DLL, MT, SN, FP, PT)	15	Yes (PLL, DLL, MT, SN, FP, PT)	15	Yes (PLL, DLL, MT, PT)	15	Yes (PLL, DLL, MT, PT)	15	Yes (PLL, DLL, MT, PT)	15
Bycatch: quantified?	0.0002 /yr (PLL), Y (DLL), Y (MT)	15, Very low interaction rate	0.0197 /yr (PLL), Y (MT), Y (SN)	15, The New Zealand PLL fishery exceeds the proposed annual minimal marine turtle	Y (PLL)	15, Very low interaction rat	Y (PLL), Y(BT)	15, Very low interaction rate	Y (PLL), Y(BT)	15, Extremely low interaction rate

				interaction rate (prescribed in the CMM2008-03) in certain Fisheries Management Areas (FMA)						
Take. Intentional killing or exploitation of turtles	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Take. Egg illegal harvest	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Coastal Development. Nesting habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Coastal Development. Boat strikes	Y	22	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Pollution (debris, chemical)	Y	20	n/a	n/a	Y	PS, Based on personal database and unpublish ed research.	Y	PS, Based on personal database and unpublish ed research.	Y	PS, Based on personal database and unpublish ed research.
Pathogens	Y	PS, Current PhD study into "managin g marine turtle strandings in New Zealand; evaluating pathologic and diagnostic indicators for prognosis and	n/a	n/a	Y	PS, Current PhD study into "managin g marine turtle strandings in New Zealand; evaluating pathologic and diagnostic indicators for prognosis and	Y	PS, Current PhD study into "managin g marine turtle strandings in New Zealand; evaluating pathologic and diagnostic indicators for prognosis and	Y	PS, Current PhD study into "managin g marine turtle strandings in New Zealand; evaluating pathologic and diagnostic indicators for prognosis and

		treatment success. Collaboration between Massey University - Auckland, New Zealand; Auckland Zoo, and Murdoch University - Perth, Australia				treatment success. Collaboration between Massey University - Auckland, New Zealand; Auckland Zoo, and Murdoch University - Perth, Australia		treatment success. Collaboration between Massey University - Auckland, New Zealand; Auckland Zoo, and Murdoch University - Perth, Australia		treatment success. Collaboration between Massey University - Auckland, New Zealand; Auckland Zoo, and Murdoch University - Perth, Australia
Climate change	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	Y	PS, Satellite tracking project led by D. Godoy into habitat use and	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

		movement of green turtles in New Zealand.								
Long-term projects (>5yrs)										
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Conservation										
Protection under national law	Y	15, 16	Y	15, 16	Y	15, 16	Y	15, 16	Y	15, 16
Number of protected	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

nesting sites (habitat preservation) (% nests)										
Number of Marine Areas with mitigation of threats	1	n/a, Kermadec Islands Marine Reserve: The waters around all the islands and rocks, out to the edge of the Territorial Sea (12 nautical miles) are a marine reserve. All marine life in this area is totally protected. All fishing and other extractive	1	n/a, Kermadec Islands Marine Reserve: The waters around all the islands and rocks, out to the edge of the Territorial Sea (12 nautical miles) are a marine reserve. All marine life in this area is totally protected. All fishing and other extractive	1	n/a, Kermadec Islands Marine Reserve: The waters around all the islands and rocks, out to the edge of the Territorial Sea (12 nautical miles) are a marine reserve. All marine life in this area is totally protected. All fishing and other extractive	n/a	n/a	1	n/a, Kermadec Islands Marine Reserve: The waters around all the islands and rocks, out to the edge of the Territorial Sea (12 nautical miles) are a marine reserve. All marine life in this area is totally protected. All fishing and other extractive

		activities are prohibited.		activities are prohibited .		activities are prohibited .				activities are prohibited
N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	N	n/a	N	15, Proposed in bycatch report.	N	n/a	N	n/a	N	n/a
By-catch: onboard best practices	Y	15, Development of best practice mitigation underway following provision	Y	15, Development of best practice mitigation underway following	Y	15, Development of best practice mitigation underway following	Y	15, Development of best practice mitigation underway following	Y	15, Development of best practice mitigation underway following

		of bycatch report. Assessment of outcomes required.		provision of bycatch report. Assessment of outcomes required		provision of bycatch report. Assessment of outcomes required.		provision of bycatch report. Assessment of outcomes required.		provision of bycatch report. Assessment of outcomes required.
By-catch: spatio-temporal closures/reduction	N	n/a	N	15, Proposed in bycatch report.	N	n/a	N	n/a	N	n/a
Other	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a

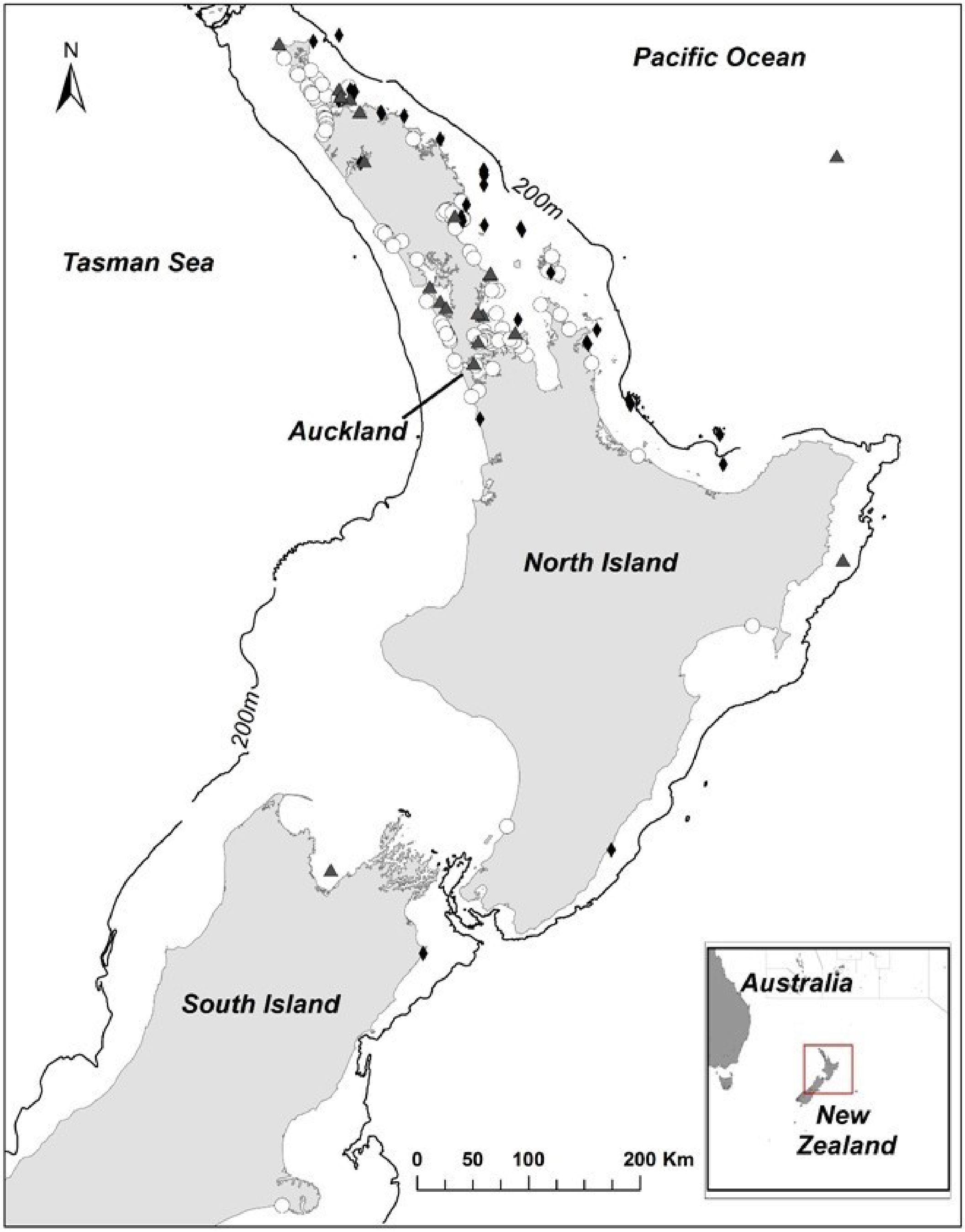

Figure 1. Distribution of green turtle records from New Zealand from 1895 to July 2013 (n = 194)

Stranded turtles (○); Sightings (♦); Incidental captures (▲); (from Godoy, D.A., Smith, A.N.H., Limpus, C.J., and Stockin, K.A., 2016.)

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NIUE

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1 RMU: Green turtle (*Chelonia mydas*) - South Central Pacific

1.1 Distribution, abundance, trends

Niue [19º 04 South; 169º 52 West] is a raised coral island covering 264 km^2 with an EEZ of 390,000 km^2 in the Central South Pacific Ocean.

1.1.1 Nesting sites

There appear to be no reported nesting sites, but perhaps some small coves might be nestable following suitable sediment deposition. There are no data in www.seaturtlestatus.org

1.1.2 Marine areas

Green turtles, *Chelonia mydas,* frequent marine areas around Niue (1, 2, 6,15,18).

1.2 Other biological data

The legend of Mataginifale, a hiapo-making woman from Fetuna, tells how she rode on the back of a male sea turtle to see beyond the horizon. When she needed to eat, the turtle told her to crack open a coconut on his head; which is why green turtles have a short head.

1.3 Threats

1.3.1 Nesting sites

None stated, but presumably stranding oceanic plastic and climate change impacts occur.

1.3.2 Marine areas

Climate change impacts, including ocean warming, acidification and deoxygenation. Degradation of the planktonic layer due to increased irradiance.

Threats in marine areas include entanglement in marine debris, and increased storms. (4, 6).

Niue is in the cyclone belt and every 7-10 years has a major hit: 21 serious events between 1900-1990, and about 60 close approaches (within 100-km). *Cyclone Heta* in 2004 caused extensive island-wide damage: see de Scally 2008 for a tracking map (19).

1.4 Conservation

FAO (2002) explains all fishing activities and legislation for Niue (5).

Domestic Fishing Act 1995 bans the take or export of sea turtles.

Department of Agriculture, Forestry and Fisheries of Niue (DAFF)

http://www.tevakamoana.org/member/the-department-of-agriculture-forestry-and-fisheries-of-niue

Niue is an affiliated signatory to the Paris Agreement on Climate Change (2015), also CBD and UNCLOS.

https://en.wikipedia.org/wiki/Category:Treaties_of_Niue

1.5 Research

None stated, but presumably climate change mitigation and adaptation.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - South Central Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

NONE

2.1.2 Marine areas

Hawksbill *Eretmochelys imbricata,* frequent marine areas around Niue (6,18).

2.2 Other biological data

NONE

2.3 Threats

2.3.1 Nesting sites

NONE

2.3.2 Marine areas

Climate change impacts, including ocean warming, acidification and deoxygenation. Degradation of the planktonic layer due to increased irradiance.

Threats in marine areas include entanglement in marine debris, and increased storms. (4, 6).

Niue is in the cyclone belt and every 7-10 years has a major hit: 21 serious events between 1900-1990, and about 60 close approaches (within 100-km). *Cyclone Heta* in 2004 caused extensive island-wide damage: see de Scally 2008 for a tracking map (19).

2.4 Conservation

See Section 1.4

2.5 Research

See Section 1.5

3. RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

Jessica Cramp (Pacific Sharks) asked the author to identify a sea turtle caught on film during a shark research expedition to Niue. The team used BRUVs (Baited Remote Underwater Video) with fresh tuna in a bait canister in view of a Go-Pro camera deployed on the seafloor. The animal was a loggerhead *Caretta caretta* with ID based on large size and shape of head, two claws on each limb, five pairs of costal scutes ~ with the anterior pair (CL1 & CR1) touching the nuchal scute. Dr White explained that *Cc* are carnivorous/omnivorous so fresh tuna would be an attractant. (See photos in Appendix below).

3.2 Other biological data

NONE

3.3 Threats

3.3.1 Nesting sites

NONE

3.3.2 Marine areas

Climate change impacts, including ocean warming, acidification and deoxygenation. Degradation of the planktonic layer due to increased irradiance.

Threats in marine areas include entanglement in marine debris, and increased storms. (4, 6). Niue is in the cyclone belt and every 7-10 years has a major hit: 21 serious events between 1900-1990, and about 60 close approaches (within 100-km). *Cyclone Heta* in 2004 caused extensive island-wide damage: see de Scally 2008 for a tracking map (19).

3.4 Conservation

See Section 1.4

3.5 Research

See Section 1.5

Figure 1. Map of Niue.

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Niue

RMU	CM-SC PAC	Ref #	EI-SC PAC	Ref #
Occurrence				
Nesting sites	N	n/a	N	n/a
Pelagic foraging grounds	Y	5,6	Y	5,6
Benthic foraging grounds	Y	5,6	Y	5,6
Key biological data				
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a

Nests / female season (N)	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a
Published studies				

Growth rates	N	n/a	N	n/a
Genetics	N	n/a	N	n/a
Stocks defined by genetic markers	N	n/a	N	n/a
Remote tracking (satellite or other)	N	n/a	N	n/a
Survival rates	N	n/a	N	n/a
Population dynamics	N	n/a	N	n/a
Foraging ecology (diet or isotopes)	N	n/a	N	n/a
Capture-Mark-Recapture	N	n/a	N	n/a
Other - Biodiversity action plan	Y	6	Y	6
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y	5	Y	5
Bycatch: presence of industrial fisheries?	Y	5	Y	5
Bycatch: quantified?	(not known)	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	n/a	n/a	n/a	n/a

Coastal Development. Photopollution	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	4,8,9,11,12,16	Y	4,8,9,11,12,16
Pathogens	n/a	n/a	n/a	n/a
Climate change	Y	3,14,19	Y	3,14,19
Foraging habitat degradation	n/a	n/a	n/a	n/a
Other -Tortoise shell	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	n/a	n/a	n/a	n/a
Conservation				
Protection under national law	Y	5,6	Y	5,6
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a

Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a
By-catch: onboard best practices	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a
Other - Fishing regulations	Y	5	Y	5

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Appendix

Loggerhead at BRUVs site, Niue. Courtesy of Jessica Cramp, Pacific Sharks, 2018.

PALAU

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1. RMU: Green turtle (*Chelonia mydas*) - Central West Pacific

1.1. Distribution, abundance, trends

The Republic of Palau is a small island nation comprised of 340 separate islands. There are 8 inhabited islands with a total population of 17,666 people according to a 2015 census (22). The archipelago is approximately 700 miles long and has a land area of 500 Km2 and a total exclusive economic zone of approximately 616,000 Km2 (22, 20). Palau consists of 16 states: Kayangel, Ngarchelong, Ngaraard, Ngardmau, Ngiwal, Ngeremlengui, Ngatpang, Melekeok, Aimeliik, Ngchesar, Airai, Koror, Peleliu, Angaur, Sonsorol and Hatohobei. The 8 inhabited islands are Kayangel, Babeldaob, Koror, Peleliu, Angaur, Sonsorol, Pulo Anna, Hatohobei and Helen's Reef.

1.1.1. Nesting sites

Nesting sites within the Republic of Palau have been noted (nest counts from 2005) at Pulo Anna Island (1 nest), Kayangel Atoll (6 nests), Ngeruangl Islet, Ngarchelong State (5 nests), Ngerechur Island (6 nests), Helen's Reef (301 nests) and Merir Island, Sonsorol State (331 nests) (21, 9, 15) (Figure 1, Table 2, Appendix Table 1). Current nesting turtle counts from Helen's Reef are shown in the table and graph below (Appendix Table 2, Figure 2). This data was collected and compiled by the Helen's Reef Resource Management Program. While there is information from Merir Island showing 331 green turtle nests in 2005 and there are an estimated 441 nesters per year at Merir, Sensorol State (21) no new data has been uncovered. The other 4 nesting sites mentioned by Seminoff (21) have such small numbers and are so intermittent that they are not of much interest to conservationists. As far as I have found, there have been no turtle nesting surveys of Pulo Anna Island, Kayangel Atoll, Ngeruangl Islet, and Ngerechur Island since 2005.

1.1.2. Marine areas

Very little information exists on the range of green turtles foraging at Palau, although Helen's Reef provides an important foraging area. Because Palau contains excellent seagrass and algal beds (10), green turtles are probably found throughout the area. Specific foraging areas have been noted at Helen Atoll, Angaur Island, Peleliu Island, off the Southern Lagoon, and off major seagrass beds at Babeldaob, south of Oreor and Sar Passage. Exceptionally large seagrass meadows occur off northern Babeldaob and northeast of Peliliu Island in Palau. The Palau Southwest Islands and Kayangel Atoll in Palau also support small seagrass flats (21).

1.2. Other biological data

NONE.

1.3. Threats

1.3.1. Nesting sites

Threats to nesting green in Palau include human illegal harvest of nests, killing for human consumption, nest predation by pigs and monitor lizards, forage habitat destruction through sand mining and dredging, and water pollution near Malakal Harbor and urbanized areas. (4, 6)

1.3.2. Marine areas

Threats in marine areas include entanglement in marine debris, and nesting habitat degradation from tourism, development, and increased storms. (4, 6)

1.4. Conservation

Palau domestic fishing laws (24 PNCA 1201) specify minimum size limits for green turtles (34 inches carapace length) and closed seasons from June 1 to August 31, and December 1 to January 31 (Secretariat of the Pacific Community and Bureau of Marine Resources Palau, 2007). Taking of eggs or female turtles while onshore is prohibited at all times. In addition, two nationally mandated protected areas (Ngerukewid Islands Wildlife Preserve and Ngerumekaol Spawning Area) within Koror State provide additional protection to green turtles through restrictions placed on entry and fishing within established boundaries. Nesting habitat, nesting turtles, and eggs are also afforded protection within the Ngerukewid Islands Wildlife Preserve (7). Other conservation efforts include the creation of the Ngeruangel Reserve

Management Plan, which restricts harvest levels and circumstances under which turtles can be harvested from Ngeruangel Atoll in Kayangel State, and the implementation of no-fishing and limited public access areas that offer some protection to turtles in the water, as well as nesting turtles and eggs, in Koror State. However, many of Palau's states do not have sufficient funds, infrastructure, and motivation to implement and enforce these initiatives (21). In 1994, the Palau Conservation Society (PCS) was established and has worked to promote conservation and educate the public about conservation issues. Green turtles are listed as targeted priority species by the PCS. In 2005, the government of Palau committed to meeting the "Micronesia Challenge" which requires conserving at least 30% of Palauan near-shore marine resources and 20% of Terrestrial resources by 2020. The Bureau of Marine Resources in cooperation with the NOAA Pacific Islands Region Office has an on-going project to establish a monitoring system for sea turtles. While this has produced data from 2005-2006, I have not been able to establish the state of this project through the Republic of Palau, Bureau of Marine Resources contacts or web site (NOAA Fisheries web site). In 2015, the Palau National Marine Sanctuary was created covering about 500,000 Km2 and protecting 80% of the nation's maritime territory. Palau is a State Member of the IUCN, a signatory to CITES, and is part of the Convention on Biological Diversity, the Kyoto Protocol, the Montreal Protocol and the UN Conventions on the Law of the Sea, Climate Change and Desertification.

1.5. Research

It appears that there are a number of agencies, NGOs and community groups that are interested and working on sea turtle conservation (Palau Conservation Society, Helen's Reef Management Program, Mechesil Belau, The Nature Conservancy, The World Wildlife Fund, etc.). The Palauan Government has several initiatives that promote sea turtle conservation (the establishment of MPAs, the acceptance of the Micronesian Challenge and the establishment of the Palau National Marine Sanctuary). The main challenges that seem to come to the surface are: 1) Coordination and collaboration with respect to the various initiatives (Helen's Reef Management Program seems to have established a robust program for monitoring this important nesting beach. On the other hand, I have been unable to find any information on the even more important nesting beaches at Merir Island in Sonsorol State). 2) Establish a monitoring and management program at Merir Island. 3) The Rock Islands Southern Lagoon seems to be the main nesting area for Palauan hawksbill turtles but there appears to be relatively little and certainly intermittent monitoring of this nesting area. 4) The moratorium on hawksbill take for eggs, meat and shell is in place but there appears to be little in the way of enforcement (note the 50% nest illegal harvest during the 2014-2015 nesting season on the monitored islands).

2. RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central West Pacific

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

Recent surveys of nesting around Palau as indicated that hawksbill turtles' nest in small numbers on a few Rock Islands as indicated in Figure 3 (27).

2.1.2. Marine areas

Forage areas for hawksbill turtles include the seagrass beds and the extensive shallow coral reef habitat surrounding all of the islands of the Republic of Palau. Foraging hawksbills can be regularly found in lagoons and associated reefs, but an apparent steady decline in the population over the years has made it less likely that a snorkeler or scuba diver will observe a hawksbill in the wild. The highest concentrations of foraging hawksbills were reported from the Helen's Reef lagoon and the lagoon of the Rock Islands (5). I have personally observed juvenile and subadult hawksbill turtles foraging in the dive areas of Blue Corner and German Channel (Rice, 2000, personal observation).

2.2. Other biological data

NONE

2.3. Threats

2.3.1. Nesting sites

Threats to nesting hawksbills in Palau include human illegal harvest of nests, killing for human consumption, nest predation by pigs and monitor lizards, nesting habitat degradation from tourism, development, and increased storms. (4, 6)

2.3.2. Marine areas

Threats in marine areas include entanglement in marine debris, and forage habitat destruction through sand mining and dredging, and water pollution near Malakal

Harbor and urbanized areas. Hawksbill turtles also are highly prized for their shell (Toluk) by Palauan culture (4, 6).

2.4. Conservation

Palau domestic fishing laws (24 PNCA 1201) specify minimum size limits for hawksbills (27 inches carapace length) and closed seasons from June 1 to August 31, and December 1 to January 31 (Secretariat of the Pacific Community and Bureau of Marine Resources Palau, 2007). Taking of eggs or female turtles while onshore is prohibited at all times. In addition, two nationally mandated protected areas (Ngerukewid Islands Wildlife Preserve and Ngerumekaol Spawning Area) within Koror State provide additional protection to green turtles through restrictions placed on entry and fishing within established boundaries. Nesting habitat, nesting turtles, and eggs are also afforded protection within the Ngerukewid Islands Wildlife Preserve (7). Other conservation efforts include the creation of the Ngeruangel Reserve Management Plan, which restricts harvest levels and circumstances under which turtles can be harvested from Ngeruangel Atoll in Kayangel State, and the implementation of no-fishing and limited public access areas that offer some protection to turtles in the water, as well as nesting turtles and eggs, in Koror State. However, many of Palau's states do not have sufficient funds, infrastructure, and motivation to implement and enforce these initiatives (21). In 1994, the Palau Conservation Society (PCS) was established and has worked to promote conservation and educate the public about conservation issues. The hawksbill is listed as targeted priority species by the PCS. In 2005, the government of Palau committed to meeting the "Micronesia Challenge" which requires conserving at least 30% of Palauan near-shore marine resources and 20% of Terrestrial resources by 2020. The Bureau of Marine Resources in cooperation with the NOAA Pacific Islands Region Office has an on-going project to establish a monitoring system for sea turtles. While this has produced data from 2005-2006, I have not been able to establish the state of this project through the Republic of Palau, Bureau of Marine Resources contacts or web site (NOAA Fisheries web site). In 2015, the Palau National Marine Sanctuary was created covering about 500,000 Km2 and protecting 80% of the nation's maritime territory. PALAU is a State Member of the IUCN, a signatory to CITES, and part of the Convention on Biological Diversity, the Kyoto Protocol, the Montreal Protocol and the UN Conventions on the Law of the Sea, Climate Change and Desertification.

2.5. Research

It appears that there are a number of agencies, NGOs and community groups that are interested and working on sea turtle conservation (Palau Conservation Society, Helen's Reef Management Program, Mechesil Belau, The Nature Conservancy, The World Wildlife Fund, etc.). The Palauan Government has several initiatives that promote sea turtle conservation (the establishment of MPAs, the acceptance of the Micronesian Challenge and the establishment of the Palau National Marine Sanctuary). The main challenges that seem to come to the surface are: 1) Coordination and collaboration with respect to the various initiatives (Helen's Reef Management Program seems to have established a robust program for monitoring this important nesting beach. On the other hand, I have been unable to find any information on the even more important nesting beaches at Merir Island in Sonsorol State). 2) Establish a monitoring and management program at Merir Island. 3) The Rock Islands Southern Lagoon seems to be the main nesting area for Palauan hawksbill turtles but there appears to be relatively little and certainly intermittent monitoring of this nesting area. 4) The moratorium on hawksbill take for eggs, meat and shell is in place but there appears to be little in the way of enforcement (note the 50% nest illegal harvest during the 2014-2015 nesting season on the monitored islands).

3. RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1. Distribution, abundance, trends

3.1.1. Nesting sites

NONE

3.1.2. Marine areas

Transient and rare visitor to the waters of Palau.

3.2. Other biological data

NONE.

3.3. Threats

3.3.1. Nesting sites

NONE.

3.3.2. Marine areas

Threats in marine areas include entanglement in marine debris, and interaction with pelagic longline fleets.

3.4. Conservation

See Section 1.4.

3.5. Research

NONE.

4. RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

4.1. Distribution, abundance, trends

4.1.1. Nesting sites

NONE.

4.1.2. Marine areas

Transient and rare visitor to the waters of Palau.

4.2. Other biological data

NONE.

4.3. Threats

4.3.1. Nesting sites

NONE

4.3.2. Marine areas

Threats in marine areas include entanglement in marine debris, and interaction with pelagic longline fleets.

4.4. Conservation

See Section 1.4.

4.5. Research

NONE

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Palau

RMU	**CM-WC PAC**	Ref #	**EI-WC PAC**	Ref #	**DC-W PAC**	Ref #	**LO-W PAC**	Ref #
Occurrence								
Nesting sites	Y	2,8,9, 13,14, 15,21	Y	27	N	n/a	N	n/a
Pelagic foraging grounds	Y	2,8,9, 13,14, 15,21	N	27	N	n/a	N	n/a
Benthic foraging grounds	Y	2,8,9, 13,14, 15,21	Y	27	A	n/a	A	n/a
Key biological data								
Nests/yr: recent average (range of years)	42 (2005-2016)	2,8,9, 13,14, 15,21	<10	27	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	30-80	2,8,9, 13,14, 15,21	<10	27	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	2	2,8,9, 13,14, 15,21	0	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	6	2,8,9, 13,14, 15,21	5-6	27	n/a	n/a	n/a	n/a

Nests/yr at "major" sites: recent average (range of years)	42 (2005-2016)	2,8,9, 13,14, 15,21	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	<10	27	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	440 (Merir Is. 2016)	2,8,9, 13,14, 15,21	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

emergence tracks) (N)								
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	steady	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	decreasing	n/a	decreasing	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	unk	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	Y	28, 29	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	Y	28,29	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Threats								

Bycatch: presence of small scale / artisanal fisheries?	Y	n/a	Y	n/a	N	n/a	N	n/a
Bycatch: presence of industrial fisheries?	Y (PLL)	n/a	N	n/a	Y (PLL)	n/a	Y (PLL)	n/a
Bycatch: quantified?	N	n/a	N	n/a	N	n/a	N	n/a
Take. Intentional killing or exploitation of turtles	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	Y	n/a	N	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	Y	n/a	N	n/a	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	N	n/a	N	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	N	n/a	Y	n/a	n/a	n/a	n/a	n/a
Egg predation	Y	n/a	N	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	n/a	N	n/a	n/a	n/a	n/a	n/a
Pathogens	N	n/a	N	n/a	n/a	n/a	n/a	n/a
Climate change	Y	n/a	N	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	N	n/a	N	n/a	n/a	n/a	n/a	n/a
Conservation								
Protection under national law	N	n/a	N	n/a	N	n/a	N	n/a
Number of protected nesting sites (habitat preservation) (% nests)	1 (50%)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	1	n/a	1	n/a	1	n/a	1	n/a
N of long-term conservation projects (period: range of years)	0	n/a	0	n/a	0	n/a	0	n/a
In-situ nest protection (eg cages)	N	n/a	N	n/a	N	n/a	N	n/a
Hatcheries	N	n/a	N	n/a	N	n/a	N	n/a
Head-starting	N	n/a	N	n/a	N	n/a	N	n/a
By-catch: fishing gear modifications	N	n/a	N	n/a	N	n/a	N	n/a

(eg, TED, circle hooks)								
By-catch: onboard best practices	N	n/a	N	n/a	N	n/a	N	n/a
By-catch: spatio-temporal closures/reduction	N	n/a	N	n/a	N	n/a	N	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Sea Turtle Nesting Beaches in Palau

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CM-WC PAC				Long	Lat	Long	Lat	Long	Lat					
Helen's Reef	N	301 (2005)	not counted	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	9, 15,21	n/a	n/a
Merir Island	N	331 (2005)	not counted	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	9, 15,21	n/a	n/a
Pulo Anna Island	N	1 (2005)	not counted	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	9, 15,21	n/a	n/a
Kayangel Atoll	N	6 (2005)	not counted	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	9, 15,21	n/a	n/a
Ngeruangl Islet	N	5 (2005)	not counted	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	9, 15,21	n/a	n/a
Ngerechur Island	N	6 (2005)	not counted	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	9, 15,21	n/a	n/a
											0	9, 15,21		

EI-WC PAC				Long	Lat	Long	Lat	Long	Lat					
Kmekumer	N	nd	nd	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	27	n/a	n/a
Ulong Island	N	nd	nd	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	27	n/a	n/a
Ngeanges Island	N	nd	nd	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	27	n/a	n/a
Such Beach	N	nd	nd	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	27	n/a	n/a

Table 3. International conventions protecting sea turtles and signed by Palau.

International Conventions	Signed	Bindin g	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
IUCN	n/a	n/a	n/a	n/a	n/a	n/a
CITES	n/a	n/a	n/a	n/a	n/a	n/a
Convention on Biological Diversity	n/a	n/a	n/a	n/a	n/a	n/a
Kyoto Protocol	n/a	n/a	n/a	n/a	n/a	n/a
Montreal Protocol	n/a	n/a	n/a	n/a	n/a	n/a
UN Conventions on the Law of the Sea, Climate Change and Desertification	n/a	n/a	n/a	n/a	n/a	n/a

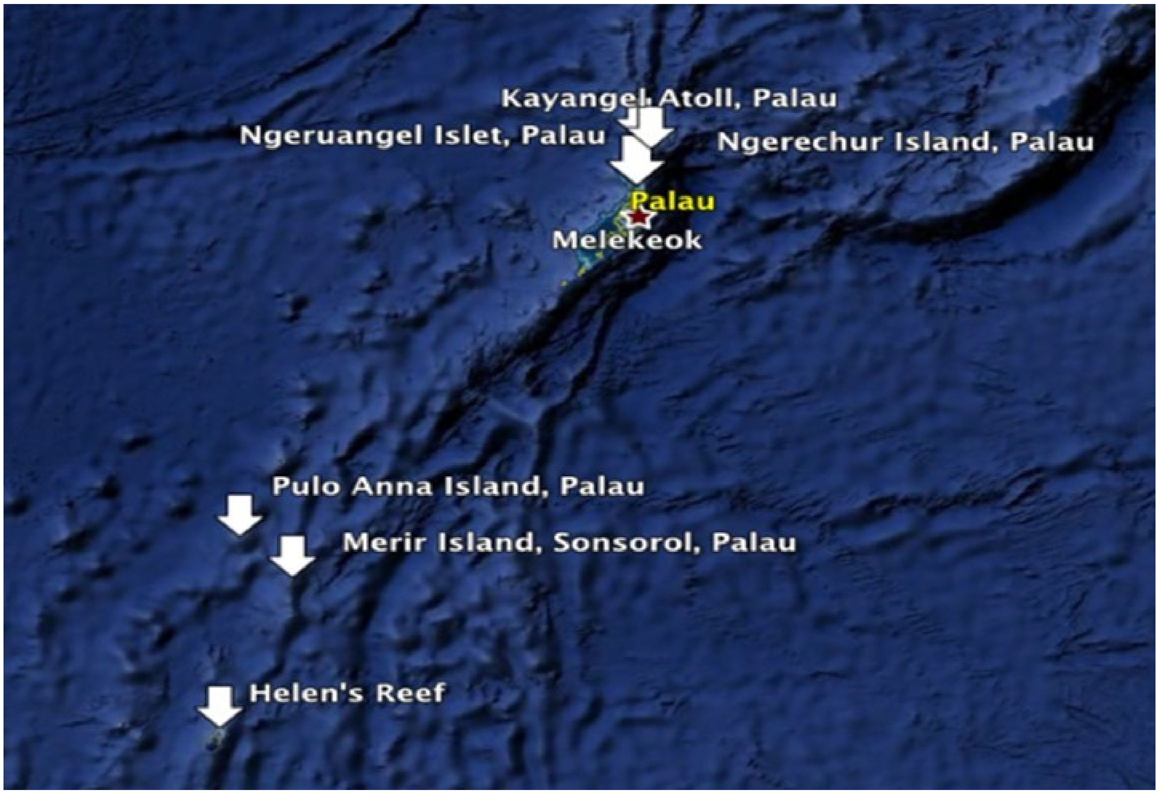

Figure 1. Republic of Palau green turtle (*Chelonia mydas*) nesting sites.

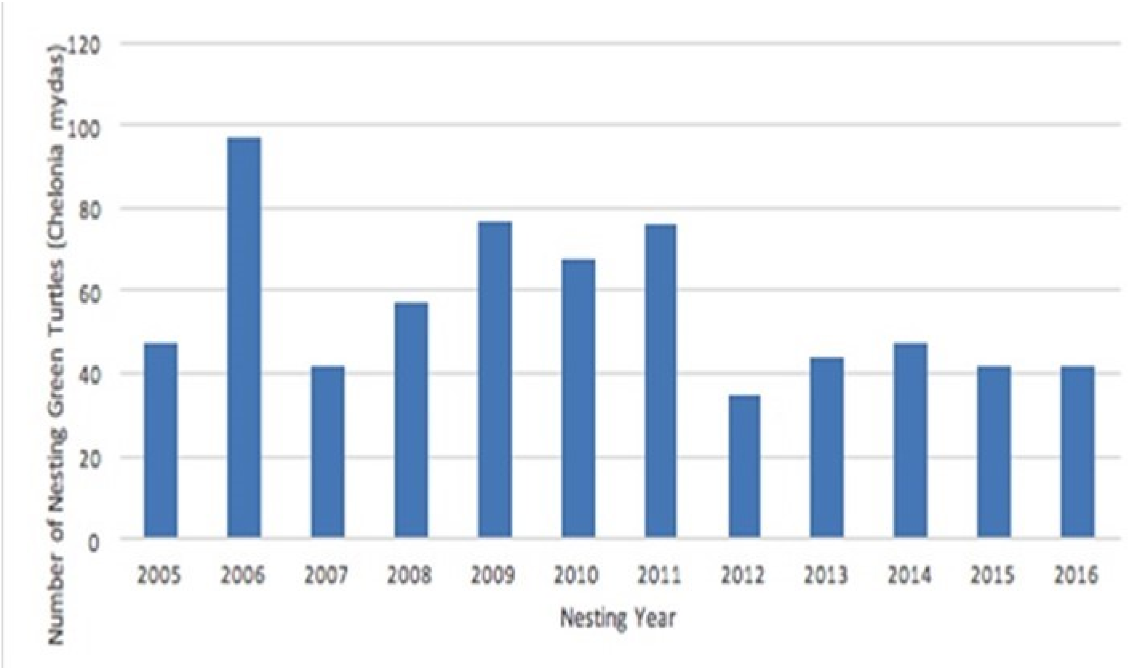

Figure 2. Number of nesting green turtle (*Chelonia mydas*) at Helen Island from 2005 to 2016. Data provided by the Helen Reef Resource Management Program.

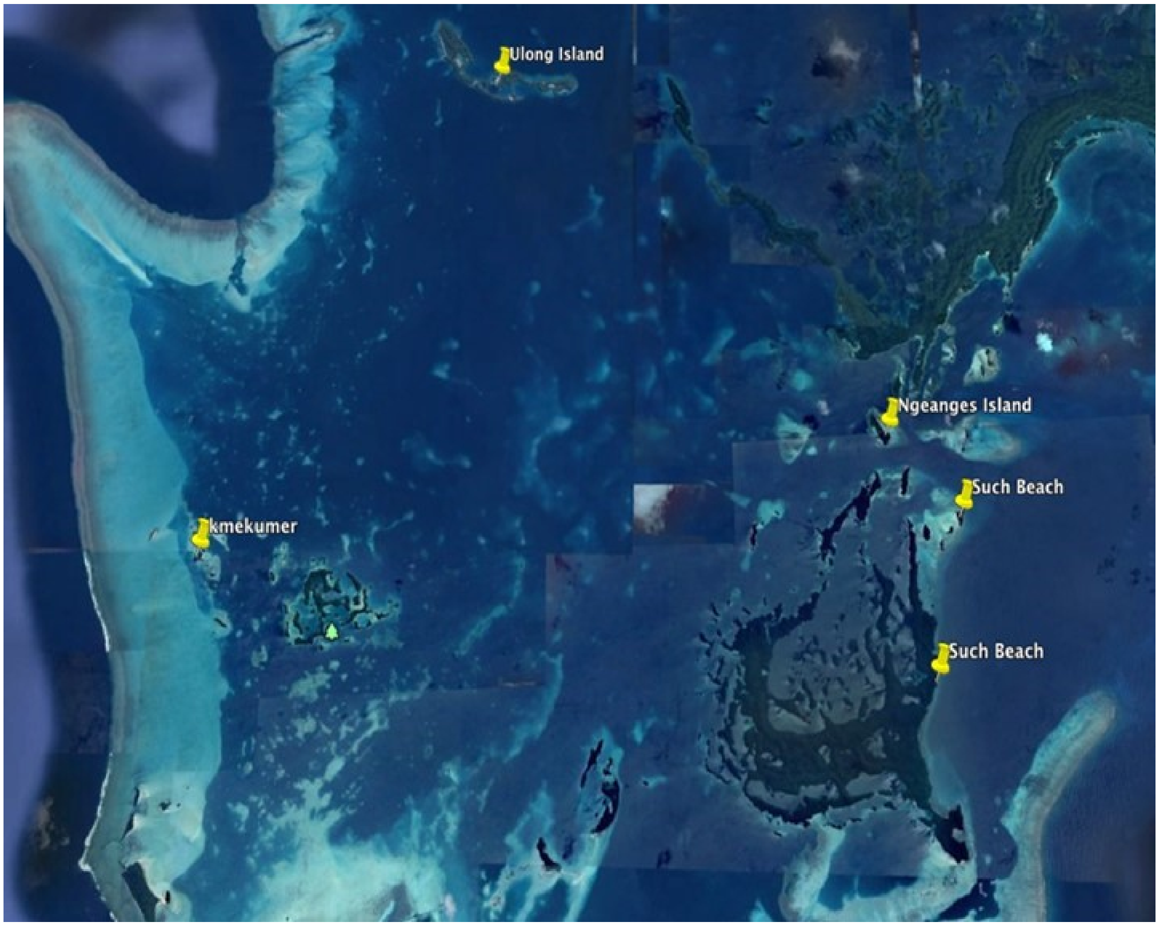

Figure 3. Five nesting sites in the area of the “Rock Islands” of Palau where hawksbill nest have been observed and monitored (from 27)

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Appendices

Appendix Table 1. Green turtle nesting locations and estimated number of nests, Republic of Palau. (2,21)

Nesting Site	Years (# of Nests)	Estimated Nester Abundance
Pulo Anna Island	2005 (1)	1
Kayangel Atoll	2005 (6)	6
Ngeruangel Atoll	2005 (6)	_
Ngerechur Island	2005 (6)	6
Helen's Reef	2005 (301)	141
Merir Island, Sonsorol State	2004-2005 (331)	441

Appendix Table 2. Number of green turtles (*Chelonia mydas*) nesting on Helen Island from 2005 to 2016 as compiled by the Helen Reef Resource Management Program (https://hrrmp.wordpress.com/).

Helen Reef	
Year	**Number**
2005	47
2006	97
2007	42
2008	57
2009	77
2010	68
2011	76
2012	35
2013	44
2014	47
2015	42
2016	42

PALMYRA ATOLL

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Geographic overview

Palmyra Atoll is part of the U.S. Pacific Remote Island Areas (PRIAs), which are spread widely throughout the Pacific and also include Wake, Johnston Atoll, Kingman Reef, and Jarvis, Howland and Baker Islands (1). Geographically, Palmyra is located within the Northern Line Islands, with Kingman Reef to the north and three islands of the Republic of the Kiribati to the south. Palmyra Atoll is currently uninhabited except for restricted access by research and management staff (Figure 1; 3,5). The atoll was occupied by U.S. military during World War II, during which time extensive dredging, connection, and expansion of islets occurred (3).

In 2001, the U.S. Secretary of the Interior established the Palmyra Atoll National Wildlife Refuge, which includes submerged lands and associated waters out to 12 nautical miles from the atoll and is managed by the U.S. Fish and Wildlife Service. The Pacific Remote Islands Marine National Monument (PRIMNM) was established in 2009, and includes waters surrounding Palmyra Atoll extending out to 50 nautical miles from the mean low water lines (2). The PRIMNM waters surrounding Palmyra are cooperatively managed by the U.S. Secretary of Commerce (NOAA) and the U.S. Secretary of the Interior (USFWS). Marine fisheries resources out to the 200 nautical mile extent of the U.S. Exclusive Economic Zone (EEZ) are managed by the U.S. Department of Commerce through the Western Pacific Regional Fishery Management Council and the NOAA National Marine Fisheries Service pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. Commercial fishing is prohibited within the 50 nautical mile boundary of the PRIMNM around Palmyra (8).

1 RMU: Green turtle (*Chelonia mydas*) - West Central/South Central Pacific RMU

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

Palmyra Atoll is not a substantial nesting site for green turtles or other sea turtle species. Low-level nesting activities at Palmyra (mostly at North Beach) were reported in 1987, 2001-2002, and in 2006 (3, 7), but surveys conducted from 2005 to 2011 between the months of June and September resulted in no signs of nesting or crawls observed (3). Information on past recorded nesting activity and surveys providing further evidence that Palmyra is not a substantial green turtle nesting site are summarized in Sterling et al. (3).

1.1.2 Marine areas

The green turtle (*Chelonia mydas*) is known to forage in the waters around the islands of Palmyra Atoll (1). During in-water surveys conducted from 2008 to 2011, 211 green turtles ranging from post-pelagic juveniles to adults were captured (weight: mean = 44.6 kg, range = 7.2–146.3 kg; curved carapace length (CCL): mean = 69.7 cm, range = 41.0–113.6 cm) (3). Green turtles at Palmyra Atoll are less abundant in the lagoons than on shallow reef flats, and there appears to be a size-specific preference in habitat utilization (3). Of the 211 green turtles captured, 3 had coloration and carapace shape consistent with turtles of eastern Pacific origin (3). Flipper and satellite tagging data indicate that green turtles captured in-water at Palmyra Atoll have high site fidelity and small home ranges (5). Of the 18 turtles satellite tagged between 2008 and 2012, only one turtle departed the atoll and made a near-circular loop covering a total distance of approximately 5,600 km (5). Of the 555 turtles flipper tagged in the same period, one female was recovered in Kiritimati, Northern Line Islands (approximately 690 km away), and another subadult was recovered in Kosrae, Micronesia (approximately 3,800 km away) (5).

1.2 Other biological data

Genetic analysis of green turtles captured in-water at Palmyra from 2008 to 2012 indicates that the Palmyra green turtles' natal origins are almost exclusively from West Central and South Central Pacific combined RMU (4).

Body condition indices and the absence of observed fibropapilloma tumors indicate that Palmyra Atoll green turtles are on average in very good condition (3, 6).

1.3 Threats

1.3.1 Nesting sites

Not applicable.

1.3.2 Marine areas

Limited threats exist in the marine areas surrounding Palmyra Atoll due to low human population density (3) and the 50 nautical mile boundary of the Palmyra Atoll PRIMNM. However, efforts to restore the lagoon system previously impacted by the U.S. military during World War II may have the potential to negatively impact marine turtles (3).

Predation by sharks is thought to be an important driver of Palmyra Atoll's marine turtle population structure, as the density of sharks at the atoll is one of the highest in the world (3).

A small number of green turtle interactions have been observed in the Hawaii deep-set longline fishery when operating around Palmyra Atoll (7). The Hawaii deep-set longline vessel owners and operators are required to annually complete a protected species workshop and are required to carry and use specific equipment and follow certain procedures for handling and releasing sea turtles (9). Since 2009, commercial fishing has been prohibited within the 50 nautical mile boundary around Palmyra Atoll due to the establishment of the PRIMNM, which has likely reduced the potential for interaction with the longline fishery inside the EEZ. There are no non-U.S. fisheries operating in the EEZ around Palmyra Atoll.

1.4 Conservation

Palmyra Atoll is part of the U.S. and is subject to the Endangered Species Act (ESA). West Central and South Central Pacific RMUs overlap with the Central West Pacific and Central South Pacific distinct population segment designations under the ESA, respectively, which are both listed as endangered.

Waters surrounding Palmyra Atoll extending out to 50 nautical miles from the mean low water lines are part of the PRIMNM, which prohibit commercial fishing (8). Recreational fishing may be permitted by the Secretaries of Commerce and Interior upon request in accordance with the Presidential Proclamation establishing PRIMNM. Palmyra Atoll and waters out to 12 nautical miles are part of the National Wildlife Refuge managed by the U.S. Fish and Wildlife Service.

1.5 Research

Research needs for Palmyra Atoll identified through literature include the following:

- Continued monitoring for nesting activity on appropriate beaches to determine the extent to which nesting may occur into the future (3)
- Further work on surveys, recaptures, and tracking to determine estimates of green turtle population size and whether the population is open, with different turtles coming and going between seasons (3)
- Additional region-wide mark-recapture, satellite, and genetic data collection to better discern the migratory behavior of all Palmyra turtles (5)

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - RMU Unassigned

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

Palmyra Atoll is not a substantial nesting site for hawksbill turtles. Information on past recorded nesting activity and surveys providing further evidence that Palmyra is not a substantial marine turtle nesting site are summarized in Sterling et al. (3).

2.1.2 Marine areas

Hawksbills are less abundant than green turtles at Palmyra. During in-water surveys conducted from 2008 to 2011, 2 juvenile hawksbills were captured (weight = 11.2 kg, 16.3kg; CCL = 50.5cm, 57.0cm) (3). No tag recapture or genetic data are available to determine the source beaches of the in-water hawksbill population.

2.2 Other biological data

No biological data is published from Palmyra Atoll regarding this species (Table 1).

2.3 Threats

2.3.1 Nesting sites

Not applicable.

2.3.2 Marine areas

Limited threats exist in the marine areas surrounding Palmyra Atoll due to low human population density (3) and the 50 nautical mile boundary of the Palmyra Atoll PRIMNM. However, efforts to restore the lagoon system previously impacted by the U.S. military during World War II have the potential to negatively impact marine turtles (3). Alteration of coral reef foraging habitat from climate change is a general concern for hawksbill turtles (3).

Predation by sharks is thought to be an important drive of Palmyra Atoll's marine turtle population structure, as the density of sharks at the atoll is one of the highest in the world (3).

Hawksbill turtles have not been observed interacting in the Hawaii deep-set longline fishery (7).

2.4 Conservation

See section 1.4.

2.5 Research

Research needs for Palmyra Atoll identified through literature include the following:

- Additional region-wide mark-recapture, satellite, and genetic data collection to better discern the migratory behavior of all Palmyra turtles (5)

3 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - East Pacific or West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

The olive ridley turtle is likely an intermittent visitor to the EEZ around Palmyra Atoll, based on a small number of observed interactions in the Hawaii deep-set longline fishery (7). No other observations in near-shore waters are known.

3.2 Other biological data

No biological data is published from Palmyra Atoll regarding this species (Table 1).

3.3 Threats

3.3.1 Nesting sites

Not applicable

3.3.2 Marine areas

Limited threats exist in the marine areas surrounding Palmyra Atoll due to low human population density (3) and the 50 nautical mile boundary of the Palmyra Atoll PRIMNM. A small number of olive ridley turtle interactions have been observed in the Hawaii deep-set longline fishery when operating around Palmyra Atoll (7). The Hawaii deep-set longline vessel owners and operators are required to annually complete a protected species workshop and are required to carry and use specific equipment and follow certain procedures for handling and releasing sea turtles (9). Since 2009, commercial fishing has been prohibited within the 50 nautical mile boundary around Palmyra Atoll due to the establishment of the PRIMNM, which has likely reduced the potential for interaction with the longline fishery inside the EEZ. There are no non-U.S. fisheries operating in the EEZ around Palmyra Atoll.

3.4 Conservation

See section 1.4.

3.5 Research

NONE

4 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

The leatherback turtle is likely an intermittent visitor to the EEZ around Palmyra Atoll, based on a small number of observed interactions in the Hawaii deep-set longline fishery (7). No other observations in near-shore waters are known.

4.2 Other biological data

No biological data is published from Palmyra Atoll regarding this species (Table 1).

4.3 Threats

4.3.1 Nesting sites

Not applicable

4.3.2 Marine areas

Limited threats exist in the marine areas surrounding Palmyra Atoll due to low human population density (3) and the 50 nautical mile boundary of the Palmyra Atoll PRIMNM. A small number of leatherback turtle interactions have been observed in the Hawaii deep-set longline fishery when operating around Palmyra Atoll (7). The Hawaii deep-set longline vessel owners and operators are required to annually complete a protected species workshop and are required to carry and use specific equipment and follow certain procedures for handling and releasing sea turtles (9). Since 2009, commercial fishing has been prohibited within the 50 nautical mile boundary around Palmyra Atoll due to the establishment of the PRIMNM, which has likely reduced the potential for interaction with the longline fishery inside the EEZ. There are no non-U.S. fisheries operating in the EEZ around Palmyra Atoll.

4.4 Conservation

See section 1.4.

4.5 Research

NONE

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Palmyra Atoll.

RMU	CM-SC/WC-PAC	Ref #	EI-	Ref #	LO -	Ref #	DC-	Ref #
Occurrence								
Nesting sites	Y	3,7	Y	3	N	3	N	3
Pelagic foraging grounds	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Benthic foraging grounds	Y	3	Y	3	N	3	N	3
Key biological data								
Nests/yr: recent average (range of years)	<1 (2005-2011)	3	<1 (2005-2011)	3	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	<1	3	<1	3	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	0	3	0	3	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	1	3	0	3	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	3	n/a	n/a	n/a	n/a	n/a	n/a

Nests/yr at "minor" sites: recent average (range of years)	<1 (2005-2011)	3	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends								

Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	Y	4	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	Y	4	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	Y	5	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	Y	3	Y	3	n/a	n/a	n/a	n/a
Threats								

Bycatch: presence of small scale / artisanal fisheries?	N	n/a	N	n/a	N	n/a	N	n/a
Bycatch: presence of industrial fisheries?	PLL, purse seine	n/a	PLL, purse seine	n/a	PLL, purse seine	n/a	PLL, purse seine	n/a
Bycatch: quantified?	unpublished observer data	n/a	unpublished observer data	n/a	unpublished observer data	n/a	unpublished observer data	n/a
Take. Intentional killing or exploitation of turtles	N	n/a	N	n/a	N	n/a	N	n/a
Take. Egg illegal harvest	N	n/a	N	n/a	N	n/a	N	n/a
Coastal Development. Nesting habitat degradation	N	n/a	N	n/a	N	n/a	N	n/a
Coastal Development. Photopollution	N	n/a	N	n/a	N	n/a	N	n/a
Coastal Development. Boat strikes	N	n/a	N	n/a	N	n/a	N	n/a
Egg predation	N	n/a	N	n/a	N	n/a	N	n/a
Pollution (debris, chemical)	N	n/a	N	n/a	N	n/a	N	n/a
Pathogens	N	n/a	N	n/a	N	n/a	N	n/a
Climate change	N	n/a	N	n/a	N	n/a	N	n/a
Foraging habitat degradation	N	n/a	N	n/a	N	n/a	N	n/a

Other	N	n/a	N	n/a	N	n/a	N	n/a
Long-term projects								
Monitoring at nesting sites	Y	3	Y	3	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites	Y	3	Y	3	n/a	n/a	n/a	n/a
Conservation								
Protection under national law	Y	2	Y	2	Y	2	Y	2
Number of protected nesting sites (habitat preservation)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	1	8	1	8	1	8	1	8
Long-term conservation projects (number)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

By-catch: onboard best practices	Y	9	Y	9	Y	9	Y	9
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

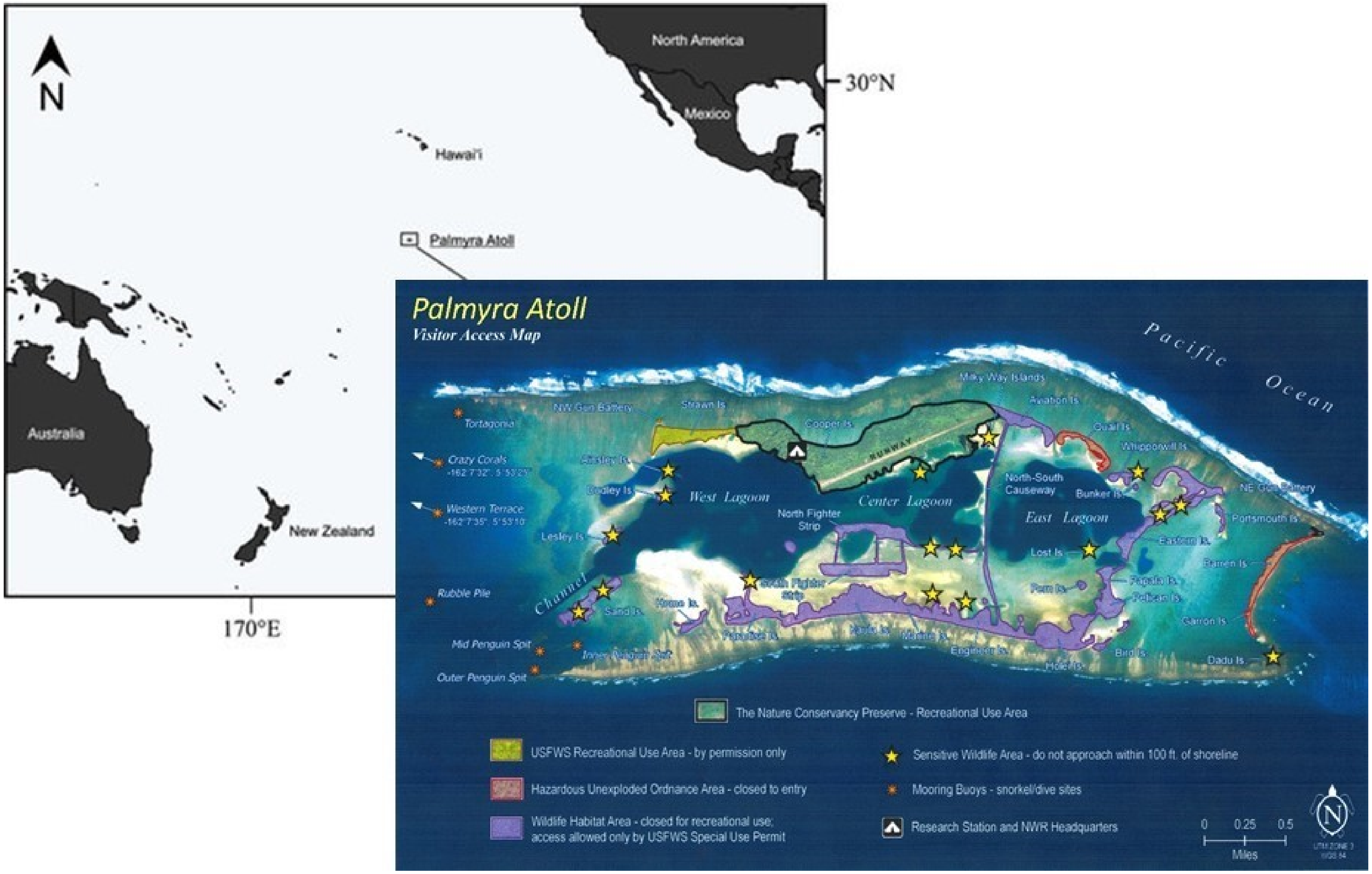

Figure 1. Map of Palmyra Atoll

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PITCAIRN ISLANDS

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1 RMU: Green turtle (*Chelonia mydas*) - Central South Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

Green turtles are the only species to have been recorded nesting at the Pitcairn Island group (7; Figure 1). Of the four islands within the group (Pitcairn Island, Henderson Island, Ducie Atoll and Oeno Atoll), only Henderson Island has records of turtle nesting (4; 3; 2; 9). At Pitcairn Island and Ducie Atoll, the substrates are considered unsuitable for nesting, and despite the terrain appears suitable on Oeno Atoll, no nesting has been recorded (3). On Henderson Island the East Beach (approximately 1900 m long) is the major nesting beach for green turtles, while infrequent records of individual turtles going ashore have been observed at North Beach and North-West Beach (3; 9). The nesting season extends between January to March (14; 2) and comprises an estimated annual nesting cohort of 30 adult females (3, 12). During a field survey of Henderson Island in 1991-1992, 10 females laid eggs which was estimated at ca. 1% of the French Polynesian population (6; 3).

1.1.2 Marine areas

Early work suggested there was no evidence that the occurrence of turtles around Pitcairn and Henderson was more than sporadic (10). Since 1983, eight confirmed sightings of green turtles (6) have been recorded. Some observations of mating pairs off East Beach at Henderson Island have been documented, while immature turtles (possibly green turtles) have been seen within the lagoon of Ducie Atoll during a 1991 field survey (3; 9). No data exist for Oeno Atoll, however a 1987 report by the Secretariat of the Pacific Community noted that the Atoll encloses a "turtle nursery of international interest" (9).

1.2 Other biological data

No other published data exist.

1.3 Threats

Archaeological studies reveal substantial exploitation of turtles and eggs on Henderson

Island at ca. AD 1000 (14; 1). In contrast, Rudrud (2010) inferred that traditional law most likely restricted the consumption of turtle meat to only Chiefs. It remains unclear how the low abundance of turtle nesting at East Beach at present was affected by early exploitation, however, it is likely the population has been altered in similar way to other areas of Oceania (14). More recently, Groombridge & Luxmoore (1989) reported that over a 15-year period, up to 5 turtles were harvested, with at least one eaten and the remainder killed for their carapaces. Annual CITES reports indicated no trade in any sea turtle products from Pitcairn had occurred (6). Brooke (1995) reported the Henderson Island population is no longer exploited, however, Seminoff et al. (2015) has reported the inadequacy of regulation regarding the harvesting of juveniles and adults for traditional practices remains a threat.

The threat of synthetic marine debris is likely to be a considerable threat to any turtles that occupy or nest on Henderson Island (including East Beach) or Ducie Atoll, where high densities of stranded debris have noted (5; 2).

1.3.1 Nesting sites

Archaeological evidence shows adults and eggs were exploited by humans (14), however, despite no apparent modern harvesting (3), Seminoff et al. (2015) identified inadequate regulation remains a threat.

1.3.2 Marine areas

The threat of synthetic marine debris is likely to be a considerable threat to any turtles that occupy the waters of Henderson Island or Ducie Atoll, where high densities of stranded debris have noted (5; 2).

1.4 Conservation

Regarding International legislation and agreements, the Pitcairn Islands are included in the United Kingdom ratification of the Convention on Trade in Endangered Species (CITES), World Heritage Convention, Ramsar Convention, Convention for the Protection of the Natural Resources and Environment for the South Pacific Region (signed June 1988) and Convention on the Conservation of Migratory Species (CMS). Local legislation includes the Fisheries Zone Ordinance and the Local Government Regulations 1971 (Part IV). Under the Local Government Regulations, Chapter XI (Local Government Ordinance), Part IV

(Animals and Wildlife), Section 5, of the Laws of Pitcairn, Henderson, Ducie and Oeno Islands (Revised edition 2010), states that no person shall take, hunt, fish, capture, harass or intentionally kill, or attempt to take, hunt, fish, capture, harass or kill, any marine turtle; however, there can be exceptions for scientific purpose or traditional subsistence use (12).

1.5 Research

Information about marine turtles within the Pitcairn Archipelago is very poor (3; 9). No research priorities have been stated, however, genetic connectivity and stock resolution, population abundance and nesting surveys, in water surveys for foraging areas, climate change impacts, exploitation regulation, and marine debris effects should be considered a minimum.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - RMU unassigned.

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

No nesting has been reported at the Pitcairn Island group.

2.1.2 Marine areas

Information regarding the occurrence of marine turtles in the waters of the Pitcairn group is very limited, however, hawksbill turtles have been reported (9). More recently, Tagarino & Saili (2013) satellite tagged a post nesting hawksbill in American Samoa that transmitted its last position near Pitcairn Island.

2.2 Other biological data

No other published data exist.

2.3 Threats

2.3.1 Nesting sites

Not applicable.

2.3.2 Marine areas

The threat of synthetic marine debris is likely to be a considerable threat to any turtles that occupy the waters of Henderson Island or Ducie Atoll, where high densities of stranded debris have noted (5; 2).

2.4 Conservation

Regarding International legislation and agreements, the Pitcairn Islands are included in the United Kingdom ratification of the Convention on Trade in Endangered Species (CITES), World Heritage Convention, Ramsar Convention, Convention for the Protection of the Natural Resources and Environment for the South Pacific Region (signed June 1988) and Convention on the Conservation of Migratory Species (CMS). Local legislation includes the Fisheries Zone Ordinance and the Local Government Regulations 1971 (Part IV). Under the Local Government Regulations, Chapter XI (Local Government Ordinance), Part IV (Animals and Wildlife), Section 5, of the Laws of Pitcairn, Henderson, Ducie and Oeno Islands (Revised edition 2010), states that no person shall take, hunt, fish, capture, harass or intentionally kill, or attempt to take, hunt, fish, capture, harass or kill, any marine turtle; however, there can be exceptions for scientific purpose or traditional subsistence use (12).

2.5 Research

Information about marine turtles within the Pitcairn Archipelago is very poor (3; 9). No research priorities have been stated, however, genetic connectivity and stock resolution, population abundance and nesting surveys, in water surveys for foraging areas, climate change impacts, exploitation regulation, and marine debris effects should be considered a minimum.

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - RMU Unassigned.

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

No nesting has been reported at the Pitcairn Island group.

3.1.2 Marine areas

No information on the occurrence of leatherback turtles at the Pitcairn Island group has been published, however, this species is likely to occupy the pelagic habitat, at least intermittently, around this territory.

3.2 Other biological data

No published data exist.

3.3 Threats

3.3.1 Nesting sites

Not applicable.

3.3.2 Marine areas

No information on the threat to leatherback turtles at the Pitcairn Island group has been published.

3.4 Conservation

Regarding International legislation and agreements, the Pitcairn Islands are included in the United Kingdom ratification of the Convention on Trade in Endangered Species (CITES), World Heritage Convention, Ramsar Convention, Convention for the Protection of the Natural Resources and Environment for the South Pacific Region (signed June 1988) and Convention on the Conservation of Migratory Species (CMS). Local legislation includes the Fisheries Zone Ordinance and the Local Government Regulations 1971 (Part IV). Under the Local Government Regulations, Chapter XI (Local Government Ordinance), Part IV (Animals and Wildlife), Section 5, of the Laws of Pitcairn, Henderson, Ducie and Oeno Islands (Revised edition 2010), states that no person shall take, hunt, fish, capture, harass or intentionally kill, or attempt to take, hunt, fish, capture, harass or kill, any marine turtle; however, there can be exceptions for scientific purpose or traditional subsistence use (12).

3.5 Research

Information about marine turtles within the Pitcairn Archipelago is very poor (3; 9), and with no information in relation to leatherback turtles, no priorities have been established.

4 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - RMU unassigned.

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

No nesting has been reported at the Pitcairn Island group.

4.1.2 Marine areas

No information on the occurrence of olive ridley turtles at the Pitcairn Island group has been published, however, this species may occupy the pelagic habitats around this territory.

4.2 Other biological data

No published data exist.

4.3 Threats

4.3.1 Nesting sites

Not applicable.

4.3.2 Marine areas

No information on the threat to olive ridley turtles at the Pitcairn Island group has been published.

4.4 Conservation

Regarding International legislation and agreements, the Pitcairn Islands are included in the United Kingdom ratification of the Convention on Trade in Endangered Species (CITES), World Heritage Convention, Ramsar Convention, Convention for the Protection of the Natural Resources and Environment for the South Pacific Region (signed June 1988) and Convention on the Conservation of Migratory Species (CMS). Local legislation includes the Fisheries Zone Ordinance and the Local Government Regulations 1971 (Part IV). Under the Local Government Regulations, Chapter XI (Local Government Ordinance), Part IV (Animals and Wildlife), Section 5, of the Laws of Pitcairn, Henderson, Ducie and Oeno Islands (Revised edition 2010), states that no person shall take, hunt, fish, capture, harass or intentionally kill, or attempt to take, hunt, fish, capture, harass or kill, any marine turtle; however, there can be exceptions for scientific purpose or traditional subsistence use (12).

4.5 Research

Information about marine turtles within the Pitcairn Archipelago is very poor (3; 9), and with no information in relation to olive ridely turtles, no priorities have been established.

5 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific.

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

No nesting has been reported at the Pitcairn Island group.

5.1.2 Marine areas

No information on the occurrence of loggerhead turtles at the Pitcairn Island group has been published, however, transpacific migrations of this species from the southwestern Pacific through the territory is possible.

5.2 Other biological data

No published data exist.

5.3 Threats

5.3.1 Nesting sites

Not applicable.

5.3.2 Marine areas

No information on the threat to loggerhead turtles at the Pitcairn Island group has been published.

5.4 Conservation

Regarding International legislation and agreements, the Pitcairn Islands are included in the United Kingdom ratification of the Convention on Trade in Endangered Species (CITES), World Heritage Convention, Ramsar Convention, Convention for the Protection of the Natural Resources and Environment for the South Pacific Region (signed June 1988) and Convention on the Conservation of Migratory Species (CMS). Local legislation includes the Fisheries Zone Ordinance and the Local Government Regulations 1971 (Part IV). Under the Local Government Regulations, Chapter XI (Local Government Ordinance), Part IV (Animals and Wildlife), Section 5, of the Laws of Pitcairn, Henderson, Ducie and Oeno Islands (Revised edition 2010), states that no person shall take, hunt, fish, capture, harass or intentionally kill, or attempt to take, hunt, fish, capture, harass or kill, any marine turtle; however, there can be exceptions for scientific purpose or traditional subsistence use (12).

5.5 Research

Information about marine turtles within the Pitcairn Archipelago is very poor (3; 9), and with no information in relation to loggerhead turtles, no priorities have been established.

Table 1. Summary of the biology and conservation for marine turtle species known to occur in the Pitcain Island group. Regional Management Units (RMU) are included where known.

RMU	CM-CS PAC	Ref #	EI-Unknown	Ref #
Occurrence				
Nesting sites	Henderson Is	2, 3, 4, 7	n/a	n/a
Pelagic foraging grounds	n/a	n/a	Y	12
Benthic foraging grounds	Henderson Is, Ducie Atoll	2, 9	n/a	n/a
Key biological data				
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	1	11	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	2	2, 9	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	1.9	3	n/a	n/a
Nesting females / yr	30	11	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a

Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a
Published studies				
Growth rates	n/a	n/a	n/a	n/a
Genetics	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	1	12
Survival rates	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a
Threats				
Bycatch: presence of small scale / artisanal fisheries?	n/a	n/a	n/a	n/a

Bycatch: presence of industrial fisheries?	n/a	n/a	n/a	n/a
Bycatch: quantified?	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	5	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a
Climate change	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	n/a	n/a	n/a	n/a
Conservation				
Protection under national law	Y	6, 11	Y	6, 11
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a

N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a
By-catch: onboard best practices	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a

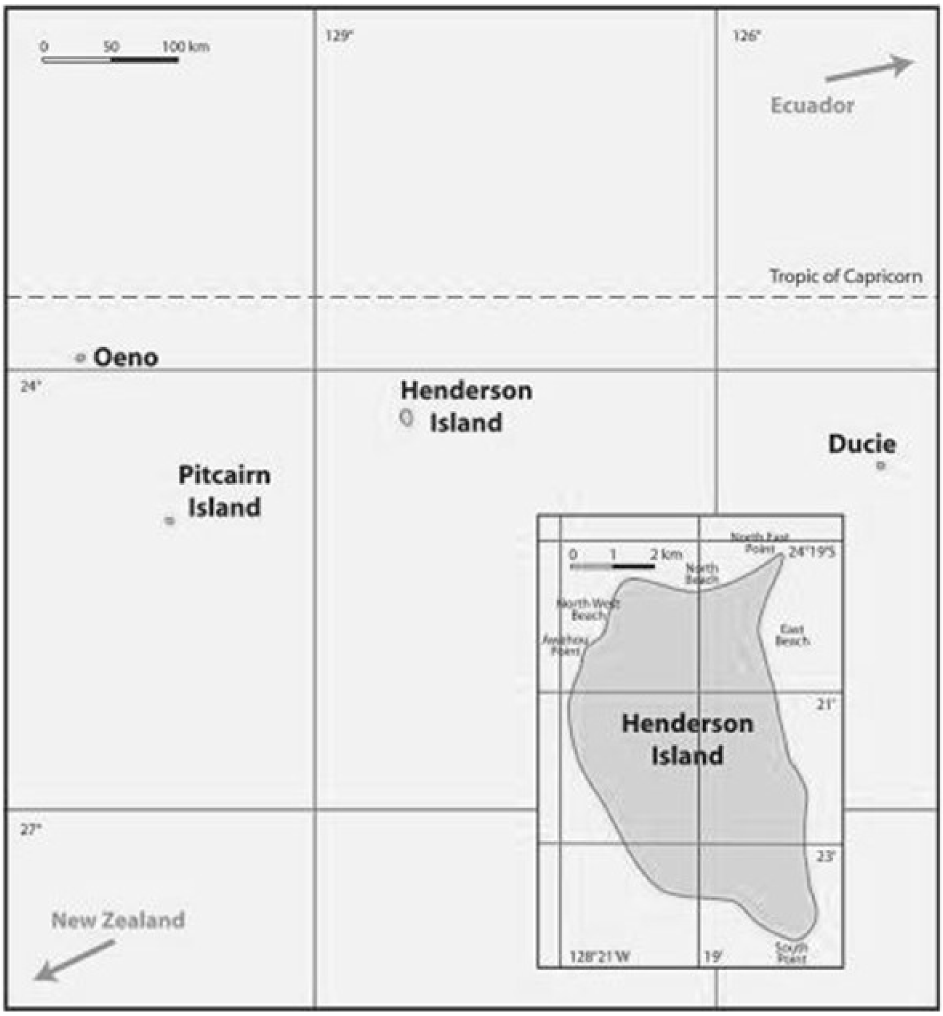

Figure 1. The Pitcairn Island group: Pitcairn Island, Henderson Island, Ducie Atoll and Oeno Atoll. Inset map: Henderson Island.

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PAPUA NEW GUINEA

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Introduction

Of the seven sea turtle species that live in the world's oceans, six species are known to occur in the waters of Papua New Guinea's (PNG's) Economic Exclusive Zone (EEZ) which is estimated to be about 3,120,000 km^2 (Fig 1), with maritime borders shared with Australia, the Solomon Islands, Palau, and Indonesia (which also shares a land border). The six species of sea turtles that can be found in PNG include the following:

Green turtle (*Chelonia mydas*);

Hawksbill turtle (*Eretmochelys imbricata*);

Leatherback turtle (*Dermochelys coriacea*);

Loggerhead turtle (*Caretta caretta*);

Flatback turtle (*Natator depressus*); and

Olive Ridley turtle (*Lepidochelys olivacea*).

Sea turtles globally have a priority for conservation action through their listing in the respective texts or appendices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Other international instruments, including the United Nations Convention on Law of the Sea (UNCLOS), the FAO Code of Conduct for Responsible Fisheries, the International Convention for the Prevention of Pollution from Ships (MARPOL), and the Convention on Biological Diversity (CBD), are also relevant to the conservation of marine turtles and their habitats.

Across the world, 42 Countries and Territories permit the direct take of sea turtles which has been estimated to be in excess of 42,000 turtles per year with PNG accounting for an estimated 36 percent of this total or around 15,217 turtles per year, with mainly green turtles, small catches of hawksbill turtles and lesser numbers of the remain species (1). Limpus (2) previously thought that the harvest of green turtles in PNG was between 10,000-20,000 per year.

Sea turtle harvesting in the PNG is a traditional fishery undertaken by islanders for turtle meat and eggs for consumption and trade; utilitarian items such as needles and limes spatulas; decoration such as earrings and bracelets; and ceremonial purposes.

Inititial investigations into turtle population distribution and take first begun after 1975 in the post-Independence with surveys conducted by postal census or excursions to various Provinces around PNG (see 3, 4, 5, 6, 7, 8, 9, 10, 11, 12) but these were largely anecdotal. In the late-1980s, market surveys and some ethnographic work were carried out in the Western and Gulf Provinces (see 13, 14, 15, 16, 17) with these surveys concentrating on green and hawksbill turtles. The most substantial assessments of nesting and take have occurred in the West Calvados Chain of the Milne Bay Province for green and hawksbill turtles (18, 19, 20, 21); and along the Huon Coast in the Morobe Province for leatherback turtles (22, 23, 24, 25; 26, 27; 28; 29, 30; 31, 32, 33, 34, 35, 36, 37, 38, 39, 40; 41, 42). Additional surveys for leatherback turtles have also occured on Lihir Island in the New Ireland Province (43), the now Autonomous Region of Bougainville (44) and the north coast of the Madang Province (45). In addition, a market survey of the hawksbill turtle shell (bekko) trade was conducted in major Provincial centres (46), and Rei (47) also conducted market surveys in three markets in the PNG Capital of Port Moresby.

Overall, an accurate estimate of take in PNG is complicated because the majority of harvesting is centred in remote areas, where little government presence is visible and subsequently, there have been no rigorous assessments of the impact of harvesting of turtles in PNG. Complicating things further, is that sea turtles are also taken across the jurisdictions of Australia, Indonesia, PNG and the Solomon Islands (1).

Subsequently, there is a large paucity of data on sea turtles in PNG regarding their nesting, foraging and migratory locations and estimates of harvesting levels of both turtles and their eggs.

1 RMU: Green turtle (*Chelonia mydas*) - Southwest Pacific

1.1 Distribution, abundance, trends

Green turtles are found widespread in the waters of PNG, but overall densities are unknown.

1.1.1 Nesting sites

Green turtles are known to nest across PNG, with Spring (9) citing several uninhabited island groups in Manus Province, and Long Island in the Madang Province as major nesting areas. Pritchard (11) visited several areas of PNG in the late-1970s and reported green turtle nesting to occur in the following locations:

East Sepik Province at Kwala Village, Wom Point, Musschu Island, Kairuru Island, Wuvulu Island, and Kaniet Island;

Manus Province at Tulu Village on the north coast, Ponam Island, Pak Island, Los Reyes Islands, Harengan Island, Bipi Island, and the Ninigo Group of Islands;

New Ireland Province in the Boloma Group of Islands; Emirau, Mussau, and Emananusa Islands; Eloaue Island, and the Tanga Islands;

West New Britian Province on the islands off Provincial Capital of Hoskins;

East New Britian at Nuguria;

Madang Province on the north coast and at Long Island; and in

Western Province along the whole coast.

Green turtle nesting areas identified in TREDS have more than 50 nesting records from Long Island in the Madang Province (n = 179) from surveys that were carried out on Long Island in 1980, 1981 and 1991 (48).

In the nothern end of the New Ireland Province, green turtles nest at Nago, Atmago, Nusalaman, Usen and Lemus Islands (49). In the past, green turtles also used beaches on Limanak, Limalam and Nusailas Islands to nest although they are no longer in use due to an increase in human populations on these islands and associated harvesting pressure (49).

The only detailed nesting program for green turtles has been in the West Calvados Chain and the Conflict Group in the Milne Bay Province (Fig 2). Kinch (18) recorded a total of 27 green turtle nesting crawls on Panayayapona Island during the period the 22nd-27th of January 2003 and eight green turtle nesting crawls on neighbouring Panadaludalu Island during the period of the 25th-27th of January 2003. Both of these islands are in the Jomard Passage area. Sixteen nests were successful deposited on Panayayapona Island and four nests were successfully laid on Panadaludalu Island.

Wangunu et al. (20) record a total of 120 adult green turtles encountered whilst nesting during a survey from the 1st-21st of December 2003 at the Conflict Group and Jomard Passage. In the Conflict Group, 20 nesting green turtles were recorded at Irai Island, 10 at Tobiki Island and 29 on Lunn Island. In the Jomard Passage area, 27 green turtles were recorded nesting at Panalailai Island, nine at Enivala Island and 25 at Panayayapona Island.

During a nesting survey in the Conflict Group of Islands from the 10th-20th of December 2009, Aigoma (21) notes nine green turtles tagged during that period, three at Irai Island, three at Reef Island No. 2, and three at Pananiu Island.

The Conflict Island Conservation Initiative located in the Conflict Group of Islands started a turtle monitoring program in 2017 with the aim are to create a baseline dataset on the population of green turtles resources in the Conflict Group of Islands. Surveys were conducted in the 2017-2018 and 2018-2019 nesting seasons but due to discrepencies in the collected data is not reported here.

1.1.2 Marine areas

Green turtles migrate large distances across the Pacific Islands Region. Green turtles tagged while nesting in New Caledonia have been recaptured as foraging turtles in PNG (50). Spring (9) reports five green turtles tagged on Long Island in the Madang Province that were later recaptured in the now West Papua Province of the Republic of Indonesia. Hirth (51) also reports of a green turtle tagged off Wuvulu Island in the East Sepik Province which was also later recaptured in West Papua.

From the Turtle Research and Monitoring Database System (TREDS) that is managed by the Secretariat of the Pacific Regional Environment Program, of the 27 green turtles recorded as tagged in French Polynesia, two were later recaptured in PNG; of the 29 green turtles tagged in the Federated States of Micronesia, one was later recaptured in PNG; of the nine green turtles tagged in the RMI, three turned up in PNG (48). Tag recovery of a green turtle that was tagged initially in PNG was also reported from the Aru Islands in West Papua.

1.2 Other biological data

Genetic studies conducted on the Long Island green turtle rookery in the Madang Province is dominated by the A3 allele, which is common throughout the Pacific and also has the C7 allele, which is only known to occur in PNG, in low frequency (52). Genetic samples (n=18) analysed from the Long Island green turtle rookery in the Madang Province were dominated (n = 16) by the CmP20.1 (A3) haplotype, which is common in the Oceania but not in the Great Barrier Reef rookeries (78-79).

During the survey conducted by Kinch (18) in the Jomard Passage area of the Milne Bay Province, Curved Carapace Length (CCL) and Curved Carapace Width (CCW) of green turtles encountered whilst nesting (n = 5) ranged from 102.5 to 109.5 cm and 92.5 to 103.0 respectively.

The mean CCL for green turtles encountered during the surveys conducted by Wangunu et al (20) in the Jomard Passage area and the Conflcit Group of Islands in the Milne Bay Province was 104.6 cm (range = 98.2 cm to 118.0 cm, n = 117) and the mean CCL for foraging turtles was 47.3 cm (range = 46.6 cm to 47.9 cm, n = 2).

1.3 Threats

As noted in the Introduction, harvesting of all sea turtles and their eggs within PNG is widespread and largely undocumented and difficult to accurately quantify.

Threats to green turtles in PNG include the increasing human population which advertently also places more people on the sea and in situations whereby green turtles will be encountered. Modernisation of equipment especially the use of the motorised canoe allowing for ease of access to nesting places or the ability to ‘ rodeo’ green turtles in the water. Technology is also contributing to the demise due to the ability now of better telecommunications to ring up and place orders especially during the end of year school closing and Christian celebrations over the Christmas and New Year period which also corresponds with the peak green turtle nesting season in most areas of PNG. Another contributing also, is the apparent breakdown of traditional beliefs in some areas and the increasing fluidity of local marine tenure arrangements. Taste preference also plays a part as people show a strong preference for large female turtles, especially breeding females because of their perceived better taste and higher fat content. Finally green turtles are occasionally caught in fishing nets during regular fishing activities (26).

1.3.1 Nesting sites

Levels of predation of green turtle nests are unknown at present for all of PNG, though it is considered to be widespread with eggs taken when nests are encountered. The exception to this is the research conducted by Jeff Kinch during his PhD anthropology fieldwork on Brooker Island in the West Calvados Chain of the Milne Bay Province during the years 1998-1999 whereby it was recorded that over the period from September 1998 to May 1999, a total of 371 green turtle nests had there eggs taken from the various islands within Brooker Islanders’ sea territory with the most popular areas for harevsting being the Jomard Passage area including the Bramble Haven Group of Islands. Eggs are a constantly sought after food. Average turtle eggs per nest for green turtle was 123 (n = 22) equating to just over 45,600 green turtle eggs taken in one season by Brooker Islanders.

1.3.2 Marine areas

Previous estimates in the early-1990s, Hirth and Rohovit (17) suggested that approximately 6,000 green turtles were sold in coastal markets around PNG. Estimates of take for PNG side of the northeastern area of the Torres Strait Protected Zone in the Western Province, have reported a minimum harvest by the Kiwai people estimated at 953-1,363 turtles annually during the years of 1985-1987 with an estimated 94–98 % of this take being green turtles (15, 53). An independent study based in Tureture village on the western coast of Western Province during 1986 provides a larger estimate by almost double of the harvest by the Kiwai (14). This harvest centred and still does on Daru, the former Capital of the Western Province and villages along the adjacent coast.

During more recent assessements conducted in Daru by the Australian Commwealth Science and Industry Research Organisation, villagers in Daru were reported to have caught and sold at the Daru market an estimated 222 green turtles in the 2012-2013 season, which was lower than previous estimates (see above) with the greatest decline in catches being observed on the home-reefs around the PNG Islands and reefs adjacent to the villages (54). Previously, green turtles sold at the market in Daru were exclusively taken during dedicated hunting expeditions, while in 2012-2013 season, about 50 % of turtles sold were caught as by-catch during fishing trips whose main target were other species which aslo has a resultant change in harvesting technology from mostly using harpoons previously to a great use of nets (54). Green turtles recorded at the Daru market in the 2012-2013 season were only a small fraction of the total quantities of turtles that would have been hunted by PNG inhabitants along the Western Province coast. Stock composition of this PNG harvest in the Western Province is similar to that described for the Torres Strait Islands with approximately 90 % of the harvested green turtles originating from Queensland rookeries in northern Australian waters (52). During a survey in 1985-1987, Kwan (53) noted that 17 green turtles caught in the Western Province that were tagged at Raine Island, in the far north of Queensland in Australia.

In PNG's Capital of Port Moresby, Hirth and Rohovit (17) conducted a market survey at Koki Market. Unfortunately, they did not record actual numbers of green turtles sold but noted that most of the green turtles sold in Koki Market and other smaller markets were caught in the vicinity of Fishermen's Island (17). During a four-month survey from December 2008 to March 2009 in Port Morseby markets which were monitored three days per week, 166 green turtles were recored in

December 2008, 58 in January 2009, 56 in February 2009, and 37 in March 2009, with the majority of these green turtles on sale being sub-adults or juveniles (47).

During Jeff Kinch's PhD anthropology fieldwork on Brooker Island in the West Calvados Chain of the Milne Bay Province during the years 1998-1999, it was recorded that over the period from September 1998 to May 1999, a total of 142 green turtles were taken from the various islands within Brooker Islanders' sea territory with the most popular areas for harevsting being the Jomard Passage area including the Bramble Haven Group of Islands.

1.4 Conservation

Green turtles are not protected in PNG despite their vulnerability to anthropogenic impacts during all life stages, as well as increasing impacts of human induced environmental change (e.g. climate changes, coastal developments, effluents and pollution).

The taking of green turtles by Papua New Guineans within Australia's EEZ (i.e. the Torres Strait Protected Zone) is allowed under the 1985 Torres Strait Treaty as long as they are traditional inhabitants of 'Treaty' Villages though each Party should to its best endeavours identify and protect fauna that are or may become threatened with extinction.

International intruments applicable to green turtles in PNG are listings on :

Appendix 1 of CITES, and

Appendices II of CMS.

Green turtles are also listed as Endangered (Criteria A2bd) on the IUCN Redlist.

1.5 Research

There is no systematic monitoring programmes to determine harvesting levels of green turtles or their eggs, their nesting or foraging sites.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Southwest Pacific

2.1 Distribution, abundance, trends

Hawksbill turtles are found widespread in the waters of PNG, but overall densities are unknown.

2.1.1 Nesting sites

Spring (7) reports that hawksbill turtles have been recorded nesting on Tabar and Anir Islands in the New Ireland Province. Pritchard (11) visited several areas of PNG in the late-1970s and reported hawksbill turtle nesting to occur in the following locations:

East Sepik Province at Laboin Island, Musschu Island, Kairuru Island, Wuvulu Island, and Kaniet Island;

Manus Province at Pak Island, Los Reyes Islands, Harengan Island, Paluwak Island, Bipi Island, and the Ninigo Group of Islands;

New Ireland Province in the Boloma Group of Islands; Emirau and Mussau Islands; and the Tanga Islands;

East New Britian at Nuguria;

Madang Province on the north and south coasts and at Long Island; and in

Western Province along the whole coast.

The TREDS database records one hawksbill turtle nesting in Wide Bay of East New Britian Province and one hawkbill turtle on Suau Island on the south coast of the Milne Bay Province (48).

The only detailed nesting program for green turtles has been in the West Calvados Chain and the Conflict Group in the Milne Bay Province. Kinch (18) recorded a total of eight hawksbill turtle nesting crawls on Panayayapona Island during the period the 22nd-27th of January 2003 and no hawksbill turtle nesting crawls on neighbouring Panadaludalu Island during the period of the 25th-27th of January 2003. Both of these islands are in the Jomard Passage area. Four nests were successful deposited on Panayayapona Island.

Wangunu et al. (20) record a total of 20 adult hawksbill turtles and two sub-asult hawksbill turtles encountered whilst nesting during a survey from the 1st-21st of December 2003 at the Conflict Group and Jomard Passage. In the Conflict Group, six nesting hawksbill turtles were recorded at Irai Island, and three on Lunn Island. In the Jomard Passage area, six hawksbill turtles were recorded nesting at Panalailai Island and seven at Panayayapona Island with two of these being sub-adults.

During a nesting survey in the Conflict Group of Islands from the 10th-20th December 2009, Aigoma (21) notes three hawksbill turtles tagged during that period, one at Irai Island and two at Pananiu Island.

The Conflict Island Conservation Initiative located in the Conflict Group of Islands started a turtle monitoring program in 2017 with the aim are to create a baseline dataset on the population of hawksbill turtles resources in the Conflict Group of Islands. Surveys were conducted in the 2017-2018 and 2018-2019 nesting seasons but due to discrepencies in the collected data is not reported here.

2.1.2 Marine areas

Nesting hawksbill turtles from the northern Great Barrier Reef in Australia are known to migrate to the Northern Territory, also in the Australia, to the southern coast of the West Papua Province of the Republic of Indonesia and to PNG (56). Hawksbill turtles that forage on the Great Barrier Reef migrate to neighbouring countries including Papua New Guinea, Vanuatu, and the Solomon Islands (56, 57).

TREDS records that one hawksbill turtles that was tagged in Samoa was later reported as a tag recovery in PNG; similarly, three hawksbill turtles that were tagged in Australia were later reported as tag recoveries in PNG (48). Other tagging data shows that an adult female hawksbill turtle that was tagged at Kerehikapa in the Arnavon Group of the Solomon Islands in December 1976 was later killed on its foraging grounds at Fisherman's Island, Central Province, PNG in February 1979 (58). Similarly, other hawksbill turtles tagged at Kerehikapa in July 2001, was later found in mid-September 2001 on its foraging grounds at Tagula Island in the far south-eastern end of the Milne Bay Province. These tag returns show that hawksbill turtles in Australia, PNG and the Solomon Islands are a shared resource (56, 57).

More recently, in April 2016 and May 2017, The Nature Conservancy placed satellite trackers on 20 female hawksbill turtles that were nesting within the Arnavons Community Marine Park between Isabel and Choisel Islands in the Solomon Islands with 18 of these 20 turtles surviving the nesting seasons and migrating back to their foraging grounds (57). One turtle returned to its nearby foraging grounds in the Solomon Islands and one turtle returned to foraging grounds in the Milne Bay Province. The remaining hawksbill turtles migrated back to the Great Barrier Reef and the Torre Straits Islands in Australia and of these hawksbill turtles, 50 % of them migrated through the Milne Bay Province before swimming across the Coral Sea to Australia, again highlighting the shared nature of these resources.

2.2 Other biological data

During the survey conducted by Kinch (18) in the Jomard Passage area of the Milne Bay Province, Curved Carapace Length (CCL) and Curved Carapace Width

(CCW) for the one hawksbill turtle encountered whilst nesting was 83.0 cm and 71.5 cm respectively.

The mean CCL for green turtles encountered during the surveys conducted by Wangunu et al (20) in the Jomard Passage area and the Conflcit Group of Islands in the Milne Bay Province was 81.6 cm (range = 71.5 cm to 91.7 cm, n = 16) and the mean CCL for foraging turtles was 73.7 cm (range = 73.5 cm to 73.9 cm, n = 2).

2.3 Threats

As noted in the Introduction, harvesting of all sea turtles and their eggs within PNG is widespread and largely undocumented and difficult to accurately quantify.

Threats to hawksbill turtles in PNG include the increasing human population which advertently also places more people on the sea and in situations whereby green turtles will be encountered. Modernisation of equipment especially the use of the motorised canoe allowing for ease of access to nesting places or the ability to 'rodeo' hawksbill turtles in the water. Technology is also contributing to the demise due to the ability now of better telecommunications to ring up and place orders especially during the end of year school closing and Christian celebrations over the Christmas and New Year period which also corresponds with the peak hawksbill turtle nesting season in most areas of PNG, noting that hawksbill turtles are known to be in some instances poisonous (59, 60, 61). Another contributing also, is the apparent breakdown of traditional beliefs in some areas and the increasing fluidity of local marine tenure arrangements.

The main threat however to hawksbill turtles is the use of the shell in the 'bekko' trade for the production of jewellery, ornaments and other artefacts (46). There is a long history of hawksbill turtle shell being used by coastal and island villagers in PNG for a variety of utilitarian, decorative and ceremonial purposes. However, with the arrival of Eurpoeans, the use of hawksbill turtleshell became a valuable trade commodity between coastal and island and European traders.

Hirth and Rohovit (17) monitored several markets, hotels and supermarkets in Port Moresby for tortoiseshell products over 36 days from February 1989 to January 1990 with regular inspections at the Boroko Market saw on average one to six women vendors selling tortoiseshell earrings, bracelets and combs with unworked scutes and juvenile carapaces (unworked and polished) were also observed on rare occasions. At this time, the turnover in tortoise shell products was not considered high (17).

A more comprehensive survey of the hawksbill turtle shell trade across PNG was conducted by Jeff Kinch in May and August 2007 (46). The hawksbill turtleshell trade in PNG is centred on the manufacture of jewellery and motifs (decorative designs or patterns, such as Chinese dragons or bird-of-paradise) for domestic sale particularly targeting the international tourist market. In total, 1,437 hawksbill turtleshell products were observed for sale in retail outlets during this study with the majority being jewellery items (94.2%), particularly earrings (50.6%) and bangles (22.5%).

2.3.1 Nesting sites

Levels of predation of hawksbill turtle nests are unknown at present for all of PNG, though it is considered to be widespread with eggs taken when nests are encountered. The exception to this is the research conducted by Jeff Kinch during his PhD anthropology fieldwork on Brooker Island in the West Calvados Chain of the Milne Bay Province during the years 1998-1999 whereby it was recorded that over the period from September 1998 to May 1999, a total of 178 hawksbill turtle nests had there eggs taken from the various islands within Brooker Islanders' sea territory with the most popular areas for harevsting being the Jomard Passage area including the Bramble Haven Group of Islands. Eggs are a constantly sought after food. Average turtle eggs per nest for green turtle was 145 (n = 6) equating to 25,810 hawksbill turtle eggs taken in one season by Brooker Islanders.

2.3.2 Marine areas

During the 1970s and 1980s, several market surveys were conducted in PNG to determine the levels of trade in hawksbill turtles. Between February 1979 and December 1981, daily surveys at Koki Market in Port Moresby recorded a total of 154 hawksbill turtles for sale (unpublished data, cited in 62).

Kwan (15) estimated that from 1985 to 1987, Hawksbill Turtles accounted for 2-5 % of the catch in the turtle meat fishery in Daru, Western Province. During a longer-term survey in the New Ireland Province during the early-1980s, less than five percent of all marine turtles harvested for sale were Hawksbill Turtles (63).

In Milne Bay Province, between two and eight live juvenile Hawksbill Turtles were regularly cited on sale in the Alotau town market (18). During a four month survey from December 2008 to March 2009 in Port Morseby markets which were monitored three days per week, 23 hawksbill turtles were recored in December 2008, 10 in January 2009, four in February 2009, and six in March 2009, with the majority of these green turtles on sale being sub-adults or juveniles (47).

During Jeff Kinch's PhD anthropology fieldwork on Brooker Island in the West Calvados Chain of the Milne Bay Province during the years 1998-1999, it was recorded that over the period from September 1998 to May 1999, a total of 48 hawksbill turtles were taken from the various islands within Brooker Islanders' sea territory with the most popular areas for harevsting being the Jomard Passage area including the Bramble Haven Group of Islands.

2.4 Conservation

Hawksbill turtles are not protected in PNG despite their vulnerability of to anthropogenic impacts during all life stages, as well as increasing impacts of human induced environmental change (e.g. climate changes, coastal developments, effluents and pollution).

The taking of hawksbill turtles by Papua New Guineans within Australia's EEZ (i.e. the Torres Strait Protected Zone) is allowed under the 1985 Torres Strait Treaty as long as they are traditional inhabitants of 'Treaty' Villages though each Party should to its best endeavours identify and protect fauna that are or may become threatened with extinction.

International intruments applicable to green turtles in PNG are listings on :

Appendix 1 of CITES, and

Appendices II of CMS.

Hawksbill turtles are also listed as Ctitically Endangered (Criteria A2bd) on the IUCN Redlist.

2.5 Research

There is no systematic monitoring programmes to determine harvesting levels of hawksbill turtles or their eggs, their nesting or foraging sites.

The issue of vulnerability of hawksbill turtles and the relationships as a shared stock between various countries was highlighted in the 'Regional Hawksbill Crisis Workshop' which was organised by the Australian chapter of the World Wide Fund for Nature (WWF) in October 2016 (64). The outcomes of this workshop has resulted in a 'Bring Back the Hawksbills Partnership Prospectus' which is to be used as a blueprint to bring hawksbill turtles back from the brink of extinction in Australia and the Asia-Pacific region,

A PhD research program by Christine Hof of WWF started in 2018 and will look at identifying and describing the migration paths and foraging grounds of hawksbill turtles originating from major nesting sites in north-eastern Australia and PNG. The results of this research will then be used to address major threats impacting hawksbill turtles and provide recommendations for policy and conservation management outcomes and sustainable livelihood alternatives to protect hawksbill turtle populations in north-eastern Australia and PNG and to encourage recovery of hawksbill turtle populations.

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

Leatherback turtles are found widespread in the waters of PNG, but overall densities are unknown.

3.1.1 Nesting sites

Leatherback turtle nesting in PNG has been reported to occur widely along the north coast of PNG in the East Sepik Province at Kwala Village, Wom Point, Aitape, Vanimo, and Ataliklikun Bay (11) and the Madang Province (11, 46); on the islands of the New Guinea Islands Region, these being Tulu Village on the north coast of Manus, Ponam Island, Rambuso Island, mainland coast opposite Harengan Island, and Lou Island in the Manus Province (11); on Tanga, Lambon Island, and the South Kapit Beach on Lihir Island in the New Ireland Province (Pritchard, 1978; 43); on the islands off Hoskins in the West New Britain Province (11); Kambubu Village, and the south Gazelle Coast in the East New Britain Province (11); the now Autonomus Region of Bougainville (29, 31, 44) and around Cape Pierson on north Normanby Island, Woodlark and Misima Islands, and near Vivigani Village on Goodenough Island in the Milne Bay Province (11). There have also been reported cases of leatherbacks nesting on the south coast of PNG (65). The largest leatherback nesting area however in PNG is along the Huon Coast of the Morobe Province and is thought to be the second largest nesting population in the western Pacific. All leatherback turtles that nest in PNG are likely to be from the western Pacific genetic stock that nests in northwest Papua, northern Papua New Guinea, the Solomon Islands and Vanuatu (29, 30, 31).

Along the Huon Coast, nesting beach surveys began at Labu Tali and Busama in the early-1980s. Quinn et al. (22) identified 286 nesting leatherback turtles at Maus Buang (a site approximately 2 km in length) between November 1982 and January 1983. Based on these results, they estimated that 15 turtles nest per night between Labu Tale and Busama, with a breeding female population estimated in the range of 1,250. Quinn and Kojis (24) and then Bedding and Lockhart (66) later estimated that 10 turtles nested each night from November to January between Labu Tale and Busama, with estimates of annual nesting ranging from 200-300 each year, respectively (extrapolated from an estimated 5 renesting events per season). Additionally, Hirth et al. (26) in his survey of 725 meters of beach at Labu Tale, during 15 days of December 1989, tagged 34 turtles and recorded 79 nests.

In the early-2000s, the Western Pacific Regional Fisheries Management Council (WPRFMC) bagan supporting a more intensive monitoing program under Huon Coast Leatherback Turtle Conservation Project (HCLTCP), which also involved other communities along the Huon Coast at Salus, Lababia (Kamiali), Paiawa, Sapa and Kobo Villages (Figure 3). The majority of nesting is located on beaches withing the Kamiali Wildlife Management Area (WMA) at Lababia Village. The total number of nesting females at the Kamiali WMA was reported to have ranged from 41 to 71 between 2000-2001 and 2003-2004, with an average inter-nesting interval of 11 days (29).

There are some caveats required in interpreting the variability in leatherback turtle monitoring efforts over the years. For instance, at Lababia (inclusive of the Kamiali WMA) the initial (1999 to 2004) data reflects a monitored beach length of only 1 km. In the 2004-2005 season this expanded to 2 km, and from the 2005-2006 season onwards a further 1 km, for a total of three. In the 2006-2007 and 2007-2008 season is was extended to approximately 6-8 km and then set at 7.48 km in the rest of the years up until 2013-2014 when moniroing ceased. The differences in length affects the counts of adults recorded, and thus an estimate of the number of turtles that might have nested. Similarly, the beach length at Busama increased significantly in 2006-2007 (more than double) and therefore the apparent increase in number of tracks could be misleading without acknolwedgeing these increases in beach monitoring length (33).

As noted above, aerial censuses of leatherback turtle nesting areas has been undertaken in PNG with assistance of the National Oceanic and Atmospheric Agency (NOAA). The first of these aerial surveys was conducted along the north coast of PNG from the 13th-20th of January 2004, just after the peak of the austral summer nesting season. The area of coverage included the north coast of PNG, from the Indonesian border eastward through the West Sepik, East Sepik, Madang, and Morobe Provinces. Additional surveys were conducted along the entire coast of New Britain Island and the northeast coasts of Goodenough, Fergusson, and Normanby Islands in the Milne Bay Province (29). During this survey, nearly 2800 km of coastline was surveyed with 415 nests counted. Of these 415 nests counted, 71 % of nests were found along the Huon Gulf coast in the Kamiali WMA and Busama 'index' areas (29).

Another aerial survey was conducted during the period, 15th-21st of January 2005 whereby 284 leatherback turtle nests were counted over a distance of 2,692 km of coastline, including the Madang, Morobe, and Oro Provinces on the north coast of PNG, and the West and East New Britain Provinces, the Autonomous Region of Bougainville, and the south-western coast of the New Ireland Province (67). During this survey, 47 % of all nests recorded were found along the Huon Gulf coast, with 53 % of all nests recorded for this area being inside of the two index beaches at Busama and the Kamilai WMA. Outside of the Huon Gulf, the greatest nesting aggregations were encountered on south-facing beaches of New Britain Island with 54 nests recorded, while 41 nests were encountered at the previously unsurveyed Bougainville Island. A total of 1,195 leatherback nests were estimated for the surveyed area during entire the 2004-2005 season, after applying the error coefficients to the aerial survey results (67).

The only other area within PNG that has had any detailed survey work is the Autonomous Region of Bougainville. This survey was to essentially ground truth the result of previous aerial surveys undertaken during 2005-2007. The aerial survey on the 20th of January 2005 indicated that beaches on Bougainville Island accounted for about 14% of leatherback turtle nesting activity in PNG for this year with 41 nests recorded, with the survey on the 20th of January 2006 recording 107 nests, and the survey on the 11th of January 2007 recorded 57 nests (44) (Fig 4). Thus, leatherback turtle nesting on Bougainville Island represents a significant but variable proportion of total nesting activity during the austral summer.

From the 19th-26th of January 2009, Kinch et al (44) conducted a survey of 389 km of coastline by running parallel to the beach in a 23 ft fiberglass dinghy at a distance of 20-50 m at a speed of 8-15 km/h, depending on sea conditions. Of this 389 km, 38 km was surveyed physically by walking the beaches, and of this 38 km, 28 km was walked during the daytime, and 10 km was walked during night surveys (the distance is actually 20 km in total, because the return leg was over the same distance). A total of 46 leatherback nests and one false crawl were recorded during the survey, with the highest concentration of leatherback nesting located along a 5.4 km stretch between the hamlets of Papona and Naboi on the central west coast with 19 nests and the one false crawl recorded in this area and accounted for approximately 43 % of all leatherback turtle nesting activity observed on Bougainville Island during the survey (Fig 5). The second area of concentrated leatherback turtle nesting (n = 13) were the beaches south of Mamerego Point, covering an area of 34.7 km. Leatherback turtles nesting in other areas were sparse and sporadic, due in part to unsuitable beach or offshore morphology. When the results of the aerial survey and the physical survey are compared, there is consistency in locations of primary nesting activity (44).

3.1.2 Marine areas

Leatherback turtles are often sighted floating in the deep sea in PNG waters. Between 2001-2003, satelitte transmitters were attached to 19 leatherback turtles that had nested at the Kamiali WMA during consecutive nesting seasons. Nine were attached during December 2001, and 10 were attached during February 2003 (29). The distance travelled by these tagged turtles ranged from 123 to 9,438 km before the harnesses released or transmissions stopped with track durations ranging from 6 to 240 days (29).

Post-nesting leatherbacks initially travelled east and southeast once they had moved away from the Huon Gulf nesting beaches and out into the Solomon Sea. Most leatherback turtles that were harnessed with satellite transmitters moved in a route over the New Britain Trench, moving southeast from the Solomon Sea and traversing the eastern edge of the Coral Sea as they continued to move in a south-eastern direction. Only six of the original 19 transmitters remained active to 20 degrees south latitude. Four of these six continued to move southeast between the islands of New Caledonia and Vanuatu, over the New Hebrides Trench, while two others moved in a southerly direction through the Coral Sea. Only one leatherback turtle continued into the high latitudes of the productive Southern Transition waters, where she remained for over five weeks before moving northward back into tropical latitudes with the track ending near the islands of Tonga (29; see also 68).

3.2 Other biological data

Steckenreuter et al (41) investigated the sex ratio of leatherback turtle hatchlings along the Huon Coast from January to March 2007. Results from this research showed that the leatherback turtle nesting population was predominantly producing male hatchlings throughout the peak of the nesting season. The long-term decline of leatherback nesting along the Huon coast, in conjunction with the highly male-biased sex ratio, presents serious challenges for the management and recovery of the western Pacific leatherback meta-population.

Appendix Tables 1-5 list details of leatherback turtle nesting under the WPRFMC supported HCLTCP from 2006-2013 (32, 33, 34, 35, 36, 37, 38, 39, 40).

From the monitoring surveys that were supported by the WPRFMC to the HCLTP (32, 33, 34, 35, 36, 37, 38, 39, 40), data on the size of nesting leatherback turtles and size of egg clutches is detailed in Appendix Tables 6 and 7.

During the WPRFMC's interventions along the Huon Coast, it is estimated that from 2006-2013, a total of 87,805 leatherback turtle hatchlings were successfully hatched in the areas where the HCLTP was active (see 32, 33, 34, 35, 36, 37, 38, 39 for annual estimates).

The HCLTCP during its time in operation obtained near-saturation tagging along the Huon Coast, though there was still some influx and steady encounters with previously-unrecorded nesters (Appendix Table 8) (33, 34, 35, 36, 37, 38, 39).

The average renesting interval for leatherback turtles nesting along the Huon Coast has been estimated to be between 15 days (35) and 16 days (34).

Overall, the long-term data from the WPRFMC supported HCLTCP shows that leatherback turtles nesting in along the Huon Coast are able to nest over four consecutive seasons, with intervals being as short as ten and a half months between seasons; are able to lay at least two clutches per season; and can be reproductively active for at least nine years (37).

3.3 Threats

Human activities that threaten leatherback turtles populations directly or indirectly in the Western Pacific include human and animal take of eggs and/or turtles, destruction and modification of nesting habitats (e.g.: logging, mining, village and urban expansion), incidental mortality from fishing gears (longlines, coastal gillnets and trawls), pollution (e.g. ingestion of plastics and other synthetic material and toxins), disease, and insensitive tourism (28). In PNG, leatherback turtles have been consumed in different areas of Madang, Morobe, Manus, East Sepik, East New Britain, Milne Bay and Central Provinces (9, 10, 11, 69). In some areas, they were part of the subsistence diet or were utilized in extending social relationships through trade, but in general it appears that the consumption of leatherback turtles was not widely practiced because their oily flesh is considered unpalatable (23; Pritchard, 1979), although direct harvest does occur, as done incidental killings not for subsistence purposes. The only utilitarian use of leatherback turtles recorded in PNG is a mention that their oil was used in lamps in Manus (11).

Along the Huon coast, three leatherbacks were reportedly killed at Kobo in 2003; Ewa village, south of Kobo, killed at least 2 leatherbacks in 2005-06; Sapa village documented 17 adults killed from 2001 to 2005; two leatherbacks were taken in Maiama, one each in Salus and Busama in 2006 (28). More recently, Pilcher (39) reports three leatherback turtles killed along the Huon Coast.

3.3.1 Nesting sites

Levels of predation of leatherback turtle nests are unknown at present for all of PNG. However, egg harvesting was/is however widely practiced, partly because the beaches where leatherback turtles nest are also used as pathways for local people that go to and from their gardens, or to visit neighbouring residential areas, and because local fishers use the beaches at night to catch fish. Previously all eggs laid along sections of the Huon Coast were taken soon after laying (22, 28).

Turtle eggs are either consumed immediately or distributed through clan and kin networks or sold at market to generate income for things such as school fees, medical expenses, or church commitments (9, 10). In historical periods, egg exploitation along the Huon Coast would have likely had a reduced impact on the leatherback turtle populations, as the villages were small and scattered, with little access to markets. After World War II, egg exploitation increased, with leatherback turtle eggs changing from a protein supplement to a commercialized commodity, and it has been suggested that all turtle eggs laid along sections of the Huon Coast were taken soon after laying (22, 66, 70). For example, Quinn et al. (22) witnessed the harvest of all nests laid during their survey period. It is entirely possible that the leatherback population in PNG has experienced near total egg loss for some 40+ years.

Predators upon leatherback eggs include monitor lizards (*Varanus indicus*), local dogs (*Canis familaris*) and ghost crabs (*Ocypode cordimanus*). Predation by dogs occurs as the hatchlings are digging to the surface (two to three days after initial hatching as hatchlings are digging to the surface, but not after oviposition or during incubation). Crocodiles (*Crocodylus porosus*) have also been documented to occasionally kill leatherback turtles as they emerge to nest (22, 26, 71). One fatal attack by a saltwater crocodile on a leatherback was reported on Duse Beach, southwest Bougainville, in 1999 (44).

Along the Huon Coast in the Morobe Province, narrow nesting beaches are subject to seasonal or storm-related erosion and accretion cycles, resulting in leatherback turtle nests being lost. Rivers frequently breach at different times of the year at different sites and nests located close to the river bank and other natural drainage systems are exposed. Nests are also destroyed during high tides (11, 22). During the 2004-05 nesting season, approximately 40% of nests at the Lababia were lost to erosion (27). At Paiawa all nests laid were washed away during the 2005-2006 season, and erosion has continued to be an issue (28). During a 25-km beach survey undertaken during the period of the 20th-23rd of January 2006 from Labu Tale to Busama, many nests were observed to have been washed over in several locations, and considerable flotsam was observed covering nests, suggesting periodic inundation (28). In addition, strong storms and tidal surges have resulted in substantial erosion of nests and changes in beach shape, for example, much of the original Labu Tale monitoring section has now been lost to erosion (39).

Appendix Tables 9-11 list details of leatherback turtle nesting loss under the WPRFMC supported HCLTCP from 2006-2013 (32, 33, 34, 35, 36, 37, 38, 39, 40).

3.3.2 Marine areas

As noted in Section 4.1.2, leatherback turtles are often sighted floating in the deep sea in PNG waters. Pritchard (11) reports a leatherback turtle caught at sea off Mapua Island in the New Ireland Province. A female leatherback turtle with a carapace length of 147.5 cm was reported caught off Port Moresby in 1979 (17).

Given that the WPRFMC interventions on the leatherback turtle nesting beaches was to assist with recovery of the Hawaii-based longline fishery to reduce sea turtle interactions (28) it is probable that some leatherback turtles in PNG waters are also caught in the longline or purse-seine tuna fishery.

3.4 Conservation

The leatherback turtle is the only sea turtle in PNG that is protected under the 1976 Fauna and Flora Protection and Control Act (amended in 2014), which stipulates that any person who knowingly buys, sells, offers or consigns for sale, or has in possession or control of a protected animal is guilty of an offence and a penalty is K 500.00 (USD 152.00).

As the Huon Coast in the Morobe Province has the largest leatherback turtle nesting area in PNG, and given this area's proximity to Lae, the Morobe Provincial Capital, conservation initiatives were initiated at Busuama and Labu Tale in the early-1980s but lacked sufficient funding and commitment to maintain their objectives for more than a few years (24, 66).

At Lababia, more consistent efforts for conservation began in 1998 at the Kamiali WMA under the Kamiali Integrated Conservation Development Group (KICDG). In October 2003, following concern over the financial accountability by the KICGD, the WPRFMC rejuvenated conservation activities under the HCLTCP which began monitoirng and conservation activities in the Kamiali WMA and later expanded to incorporate other communities along the Huon Coast.

The HCLTCP employed a community-based approach which involve local communities in monitoring activities, beach management and conservation initiatives focussed on reducing nesting beach impacts and to optimize hatchling production and bolster leatherback turtle population recovery overall. Community incentives were also offered with support for specific projects within respective communities such as assistance with school or church activities and infrastructure.

Nest and hatchling protection measures were developed during the HCLTCP which involved the construction and deployment of locally-made bamboo grids over leatherback turtle nests which prevented predation by dogs and a disincentive to humans to harvest eggs, though egg harvesting continued in areas that were not under the HCLTCP. The bamboo grids are a low-cost solution to protecting nests and have effectively bolstered hatchling production and population recruitment.

Operations of the HCLTCP was not easy with community conflict a continual concern (28). The dependence of participating communities relying on the WPRFMC also raised questions on the financial sustainability of these projects along the Huon Coast as nesting beach protection depends on long-term support with local communities. Unfortunately, looking down from a historical vantage point and viewing the present and looking towards the future, the WPRFMC will need to find long-term funding or provide input into the development of a trust fund to ensure leatherback turtle recovery projects along the Huon Coast continue, because there is a real risk that when the funding for the leatherback turtle recovery projects run out or if the WPRFMC focus changes, so will the participation from the communities.

This is in fact has happened and the HCLTCP stopped moniroing in 2013 due to funding issues and increasing community conflict over both economic opportunities from the program but also a finer demarcation of tenureship boundaries on beaches where monitoring was occurring.

For example, Pilcher (38, 40) reports that at Busama and Labu Tale, the community cut down on their beach length in response to the reduced incentive, and the reduced coverage resulted in nesting events being missed and a reduction in the quality and quantity of data recorded. Reduction in effort by communities due to reduced incentives, also resulted in a substantial number of leatherback turtle nests being illegally harvested by outsiders and neighbouring villages along participating project beaches, and it is becoming harder for the communities involved in the project to deal with the incoming groups of people using the coastline. In addition to this is increasing conflict amongst different groups migrating to the coast, in part due to growing human populations. Adding to all this is more civil unrest and land disputes.

International intruments applicable to leatherback turtles in PNG are listings on :

Appendix 1 of CITES, and

Appendices II of CMS.

Leatherback turtles are also listed as Endangered (Criteria A2bd) on the IUCN Redlist.

3.5 Research

Given the difficulty of enforcing species-specific conservation regulations in PNG and the lack of resources by the PNG Government to operate effectively, recovery measures for leatherback turtles will continue to lay with communities with support from external agencies. However, for leatherback turtle conservation projects such as those funded by the WPRFMC in PNG adequate capacity, awareness and funding needs to be made available. Factors that needs to be considered include the institutional capacity of communities and external agencies to regulate both consumptive and non-consumptive use, as well as the cultural and social impacts of any interventions, and the overall economic importance of leatherback turtles that nest in the territorial domain of participating communities.

4 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

4.1 Distribution, abundance, trends

Data not available.

4.1.1 Nesting sites

Data not available.

4.1.2 Marine areas

A loggerhead turtle tagged while nesting on Mon Repos on the southern Queensland coast in Australia in January 1969 was recovered 63 days later in the Trobriand Islands in the Milne Bay Province (72). Other tag recoveries recorded in TREDS shown that four post-nesting females initially tagged in Queensland, Australia was later reported as tag recoveries in PNG with the suggestion that the Milne Bay Province is used as a foraging ground for loggerhead turtles originating from Australia (48).

4.2 Other biological data

Data not available.

4.3 Threats

As noted in the Introduction, harvesting of all sea turtles and their eggs within PNG is widespread and largely undocumented and difficult to accurately quantify.

4.3.1 Nesting sites

Levels of predation of loggerhead turtle nests are unknown at present for all of PNG.

4.3.2 Marine areas

Pritchard (11) reported one loggerhead turtle collected at Tabayari Reef and sold at Daru Market in Western Province. In the 1985-1987 survey, Kwan (53) noted two loggerhead turtles that were caught in Western Province waters were originally tagged at Mon Repos and Wreck Island in Queesnsland, Australia respectively.

4.4 Conservation

Loggerhead turtles are not protected in PNG despite their vulnerability of to anthropogenic impacts during all life stages, as well as increasing impacts of human induced environmental change (e.g. climate changes, coastal developments, effluents and pollution).

The taking of loggerhead turtles by Papua New Guineans within Australia's EEZ (i.e. the Torres Strait Protected Zone) is allowed under the 1985 Torres Strait Treaty as long as they are traditional inhabitants of 'Treaty' Villages though each Party should to its best endeavours identify and protect fauna that are or may become threatened with extinction.

International intruments applicable to loggerhead turtles in PNG are listings on:

Appendix 1 of CITES, and

Appendices II of CMS.

The South Pacific Sub-population of loggerhead turtles is also listed as Critically Endangered (Criteria A2b) on the IUCN Redlist.

4.5 Research

There is no systematic monitoring programmes to determine harvesting levels of loggerhead turtles or their eggs, their nesting or foraging sites.

5 RMU: Flatback turtle (*Natator depressus*) - Southwest Pacific

5.1 Distribution, abundance, trends

Data not available.

5.1.1 Nesting sites

Flatback turtles are thought to nest only in Australia and forage over the Australian continental shelf into continental waters off PNG and Indonesia (9), however, Pritchard (11) reports flatbback turtles nesting at Vanimo in the East Sepik Province.

5.1.2 Marine areas

Post-hatchlings and young juveniles of flatback turtles are reported to remain on the Australian continental shelf from Hervey Bay to the Torres Strait in Queensland and up to the Gulf of Papua in PNG (73), however, Pritchard (11) reports sightings of a flatback turtle off Pak Island in the Manus Province.

5.2 Other biological data

Data not available.

5.3 Threats

As noted in the Introduction, harvesting of all sea turtles and their eggs within PNG is widespread and largely undocumented and difficult to accurately quantify.

The only major reported threat for flatback turtles are entanglement with fishing nets used in the prawn fishery in the Gulf of Papua in PNG (9, 11).

5.3.1 Nesting sites

Data not available.

5.3.2 Marine areas

In a 1985-1987 survey in Daru of Western Province, Kwan (53) noted flatback turtle being caught with estimates of maybe 18 flatback turtles being caught each year (74, 75).

During a four-month survey from December 2008 to March 2009 in Port Morseby markets which were monitored three days per week, two flatback turtles were recored in March 2009 (47).

5.4 Conservation

Flatback turtles are not protected in PNG despite their vulnerability of to anthropogenic impacts during all life stages, as well as increasing impacts of human induced environmental change (e.g. climate changes, coastal developments, effluents and pollution).

The taking of flatback turtles by Papua New Guineans within Australia's EEZ (i.e. the Torres Strait Protected Zone) is allowed under the 1985 Torres Strait Treaty as long as they are traditional inhabitants of 'Treaty' Villages though each Party should to its best endeavours identify and protect fauna that are or may become threatened with extinction.

International intruments applicable to flatback turtles in PNG are listings on :

Appendix 1 of CITES, and

Appendices II of CMS.

Flatback turtles are also listed as Data Deficient on the IUCN Redlist.

5.5 Research

There is no systematic monitoring programmes to determine harvesting levels of flatback turtles or their eggs, their nesting or foraging sites.

6 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

6.1 Distribution, abundance, trends

Data not available but is likely that there are shared olive-ridley stocks between Australia, Indonesia and PNG (76).

6.1.1 Nesting sites

Spring (9) has reported olive-ridley nesting sites the East Sepik, and the East and West New Britain Provinces.

6.1.2 Marine areas

Olive-ridley turtles have been reportedly sighted off Pak Island in the Manus Province (11) and in the waters of the Autonomous Region of Bougainville, the Milne Bay, and East and West New Britain Provinces Provinces (Spring, 1982).

6.2 Other biological data

The digestive tract of a olive-ridley turtle that had been drowned in a prawn trawl was examined by Spring and Gwyther (77). It had a CCL of 70.0 cm and a CCW of 50.0 cm and weighed 31 kg. The digestive tract under examination contained mainly shell material of which more than 98 % was gastropod shells. Of the gastropods, three species made up 96 % of the shell material in the digestive tract, these were Nassarius crematus, Nassarius vitiensis, and Turris crispa. Many of the intact gastropod shells (10 % of shell weight), and in particular those of Nassarius spp. contained the hermit crab Diogenes pallescens.

6.3 Threats

As noted in the Introduction, harvesting of all sea turtles and their eggs within PNG is widespread and largely undocumented and difficult to accurately quantify.

The only major reported threat for flatback turtles is entanglement with fishing nets used in the prawn fishery in the Gulf of Papua in PNG (9, 11, 77).

6.3.1 Nesting sites

Data not available.

6.3.2 Marine areas

Kinch and Burgess (46) report one olive-ridley carapace for sale in Madang Market in the Madang Province.

6.4 Conservation

Olive-ridley turtles are not protected in PNG despite their vulnerability of to anthropogenic impacts during all life stages, as well as increasing impacts of human induced environmental change (e.g. climate changes, coastal developments, effluents and pollution).

The taking of olive-ridley turtles by Papua New Guineans within Australia's EEZ (i.e. the Torres Strait Protected Zone) is allowed under the 1985 Torres Strait Treaty as long as they are traditional inhabitants of 'Treaty' Villages though each Party should to its best endeavours identify and protect fauna that are or may become threatened with extinction.

International intruments applicable to olive-ridley turtles in PNG are listings on:

Appendix 1 of CITES, and

Appendices II of CMS.

Olive-ridley turtles are also listed as Vulnerable (Criteria A2bd) on the IUCN Redlist.

6.5 Research

There is no systematic monitoring programmes to determine harvesting levels of olive-ridley turtles or their eggs, their nesting or foraging sites.

Conclusion

Currently, of the six sea turtle species found in PNG, only the leatherback turtle is protected under 1966 Flora and Fauna Protection and Control Act which stipulates that any person who knowingly buys, sells, offers or consigns for sale, or is in possession or in control of a protected animal is liable to a fine of PGK 500.00 (USD 152.00). This Act also provides for the establishment of WMAs. The establishment of a WMA requires the demarcation of social and spatial boundaries and a schedule of rules and penalties to be recognized in consultation with the Conservation and Environment Protection Authority (CEPA, formerly the Department of Environment and Conservation) and the respective Local Level Government (LLG) where the WMA will be established.

Other legislation in PNG that could also be applicable for sea turtle conservation and sustainable management include:

Customs (Prohibited Exports) Regulation (1963) regulates the export of flora and fauna from fishing, pastoral, agricultural and forestry industries;

Land Groups Incorporation Act (1974) allows for the formal recognition of social groups over their territory and natural resources;

Conservation Areas Act (1978), like the Flora and Fauna Protection and Control Act (1966, amended in 2014), allows for a variety of protective regimes on land and waters under customary tenure;

Firearms Act (1978) restricts the use of weapons and explosives;

International Trade (Fauna and Flora) Act (1979) regulates and restricts the export of CITES species;

International Trade (Fauna and Flora) (Fauna) Regulation (1982, amended in 2014) prescribes the documentation required to trade in CITES-listed fauna, to and from Papua New Guinea;

Village Courts Act (1989, amended in 2014) lists the 'prescribed offences' which can be dealt with in village courts;

Organic Law on Provincial Governments and Local-level Governments (1997) regulates the respective rights and obligations of the various levels of government in the field of resource management; allows for the development of Ward or Local Level legislation under Sections 42 and 44, which could be used to draw up local-level conservation laws that could potentially ban Hawksbill Turtle and egg take, and establish nesting beach closures; and the

Fisheries Management Act (1998, amended in 2016) provides the framework for policy and decision to promote the management and sustainable development of fisheries;

To ensure that sea turtle resources in PNG endure, there is a need to:

seek funding and technical support to review the status of the sea turtle species in PNG and change their status to a 'Protected Species' under the Fauna (Protection and Control) Act (1966, amended in 2014) if deemed applicable;

conduct an assessment of the subsistence and semi-commercial take to quantify and characterise sea turtle exploitation at the local, provincial and national level, including trade and marketing patterns, and the importance to livelihoods of the income derived from sea turtle exploitation;

provide support for the establishment of sea turtle monitoring programmes that aim to protect nesting and foraging areas, as well as limiting the take of animals and eggs; and to

implement an outreach strategy for the general public, with the aim of increasing awareness and appreciation of sea turtles, and the benefits of sustainable management.

The above listed activities are required as the conservation and management of sea turtles in PNG remains a complex challenge, particularly because knowledge of the factors that determine sustainable harvest rates (where the taking of sea turtles and their eggs occurs) is limited. In PNG, almost all nesting beaches (above the high-water mark) and marine habitats are owned by a large number of clan and sub-clan groups whose tenure rights are recognised in the National Constitution. Only the open seas, mineral resources, previously alienated land and protected fauna are vested in the State. Subsequently, any plans for the sustainable use or conservation of sea turtles in PNG requires innovative methods that recognise community rights to sea turtle resources and habitats, while attempting to conserve (and 'recover') these sea turtle species. Thus, there is a need to adopt an approach that strengthens local conservation practices on one hand, but also strengthens or develops appropriate legislative and policy frameworks.

The development of any sea turtle monitoring, management and conservation programmes in PNG however will not result in any reduction in harvesting of sea turtles and their eggs unless there is an improvement in the local economy for the many and mostly rural coastal and island people of PNG. This is particularly important, given the cultural value of both the protein sea turtles and their eggs provide and the additional benefits of handicraft production with regards to hawksbill turtle shells and the ability to capture them, which of course adds to their already significant economic value in dietary terms.

Sea turtle resources in Papua New Guinea are viewed as a subsistence resource and in some cases are also an integral component of many peoples of Papua New Guinea's cultural heritage. Harmonising international conservation priorities and turtle protection activities with local community development realities is required to simultaneously contribute to long-term sea turtle recovery and human wellbeing in low-income regions like Papua New Guinea.

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Papua New Guinea.

RMU	**CM-PAC SW**	Ref #	**EI-PAC SW**	Ref #	**DC-PAC W**	Ref #	**CC-PAC S**	Ref #	**ND-PAC SW**	Ref #	**LO-PAC W**	Ref #
Occurrence												
Nesting sites	Y	9, 11, 48, 49, 18, 20, 21,	Y	7, 11, 48, 18, 20, 21	Y	11, 45, 29, 31, 44, 66, 29, 30, 31, 22, 24, 67, 26, 32, 33, 34, 35, 36, 37, 38, 39, 40, 67,	Y ?	11	n/a	n/a	n/a	n/a
Pelagic foraging grounds	Y	50, 9, 51, 48	Y	56, 57, 48	Y	29, 68	Y	62, 71, 48	Y	9, 11	Y	9
Benthic foraging grounds	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Key biological data												
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a	306	32, 33, 34, 35, 36, 37, 38, 39, 40	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	~19.6-34.86	32, 33, 34, 35, 36, 37, 38, 39, 40	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	90.0-196.0	32, 33, 34, 35, 36, 37, 38, 39, 40	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	25-180	32, 33, 34, 35, 36, 37, 38, 39, 40	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Trends											
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	Y	52,78, 79	n/a	n/a	Y	29, 30, 31	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	Y	78,79	Y	57	Y	29, 68	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Threats												
Bycatch: presence of small scale / artisanal fisheries?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	n/a	n/a	n/a	n/a	Y	17	n/a	n/a	Y	9, 11	Y	77
Bycatch: quantified?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	Y	JK, 17, 15, 53, 14, 54, 52, 53, 47	Y	JK, 56, 57	Y	11, 17	Y	11, 52	Y	53, 74, 75	Y	46
Take. Egg illegal harvest	Y	JK	Y	JK	Y	22, 28,	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	n/a	n/a	n/a	n/a	Y	22, 28, 9, 10, 65, 69, 22	n/a	n/a	n/a	n/a	n/a	n/a

Coastal Development. Photopollution	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a	Y	22, 67, 72, 44	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	n/a	n/a	n/a	n/a	Y	11, 22, 27, 28, 32, 33, 34, 35, 36, 37, 38, 39, 40	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)												
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Number of index nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Conservation												
Protection under national law	N	n/a	N	n/a	Y	1966 Flora and Fauna (Protection and Control) Act	N	n/a	N	n/a	N	n/a
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: onboard best practices	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Nesting beaches in Papua New Guinea.

RMU / Nesting beach name	Index site	Year Monitored	Western limit		Eastern limit		Central point		Reference #
			Long	Lat	Long	Lat	Long	Lat	
CM-PSW	Conflict Group of Islands	2003-2004, 2017-2019	151.4035	10.4558	151.563	10.4835	151.4905	10.4655	20, CICI
	Jomard Groups of Islands	2003-2004	152.0755	11.155	152.1055	11			18
EI-PSW	Conflict and Jomard Group of Islands	2003-2004, 2017-2019	151.4035	10.4558	151.563	10.4835	151.4905	10.4655	
	Jomard Group of Islands	2003-2004	152.0755	11.155	152.1055	11			20, CICI
									18
DC-PW	Huon Coast	1980s, 2000-2013	146.58	6.445	148.1354	8.2835			22, 24, 66, 26, 29, 32, 33, 34, 35, 36, 37, 38, 39, 40

	Bougainville Island	2009	154.301	5.081	155.554	6.2958			44
CC-PS	n/a	n/a							

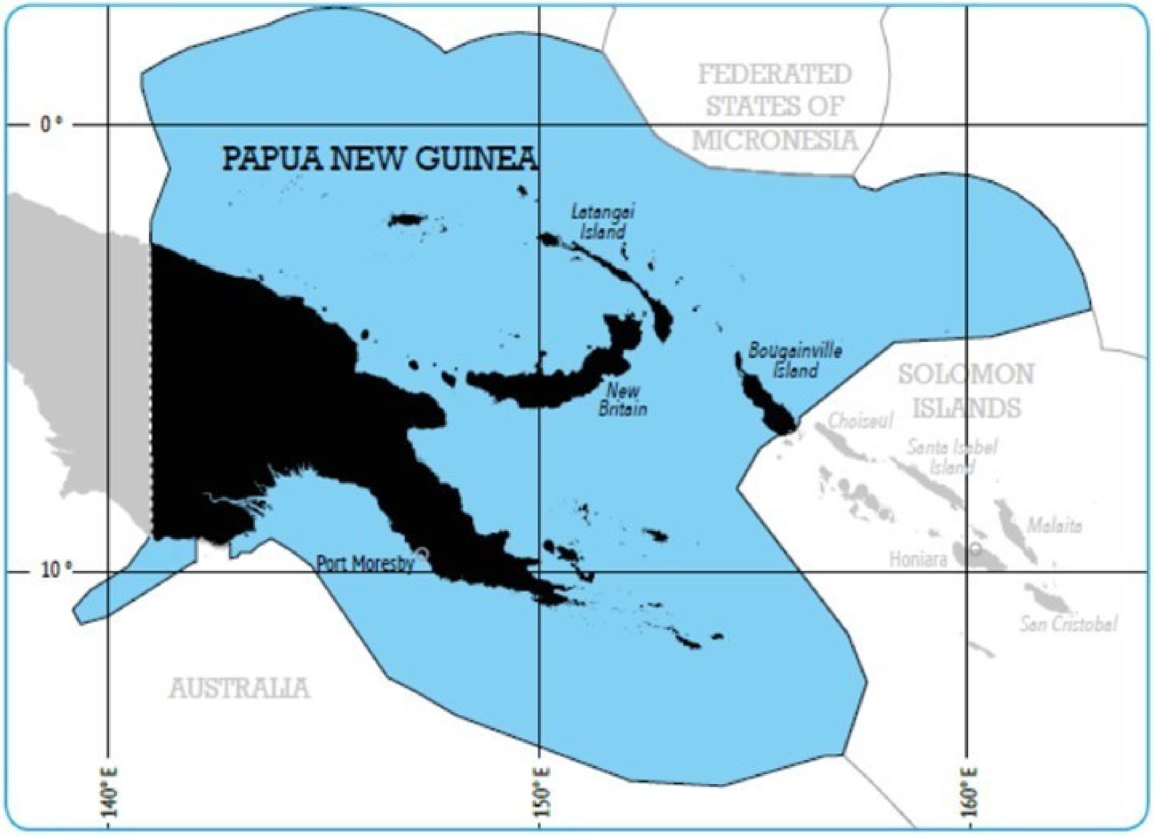

Figure 1. Area of Papua New Guinea and EEZ.

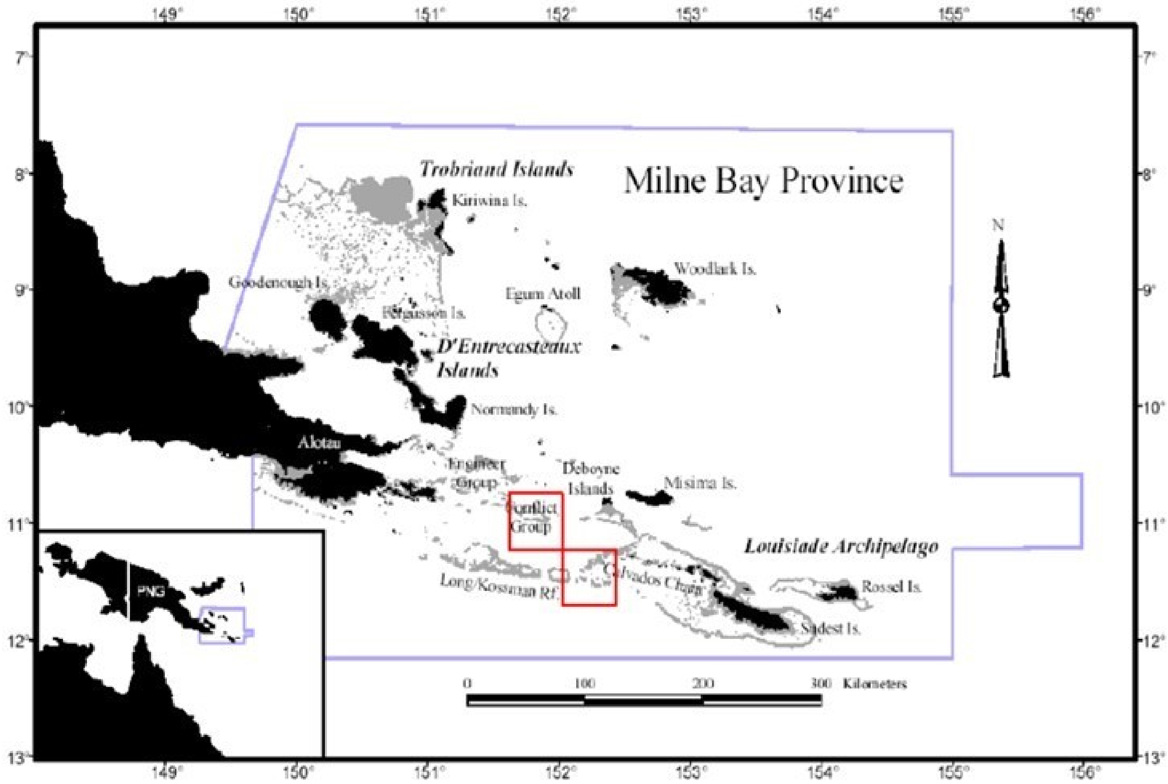

Figure 2: Location of the Conflict Group of Islands and the Jomard Group of Islands in the Milne Bay Province

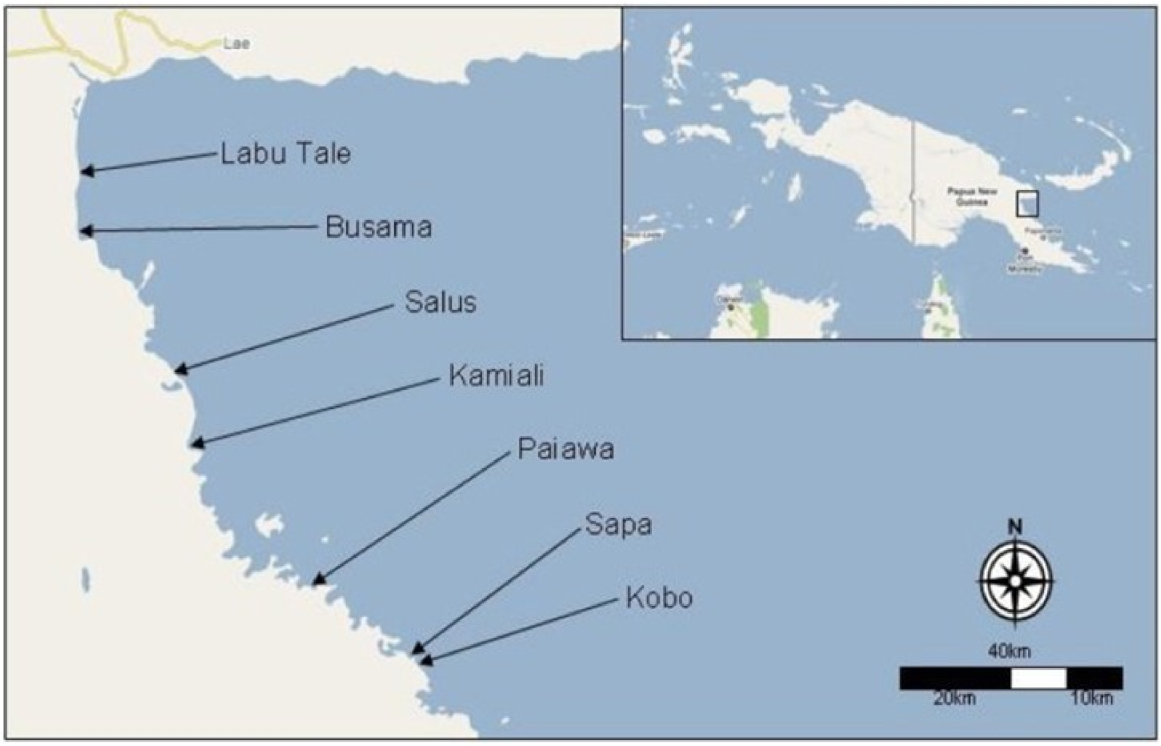

Figure 3: Location of leatherback turtles nesting sites along the Huon Coast in the Morobe Province

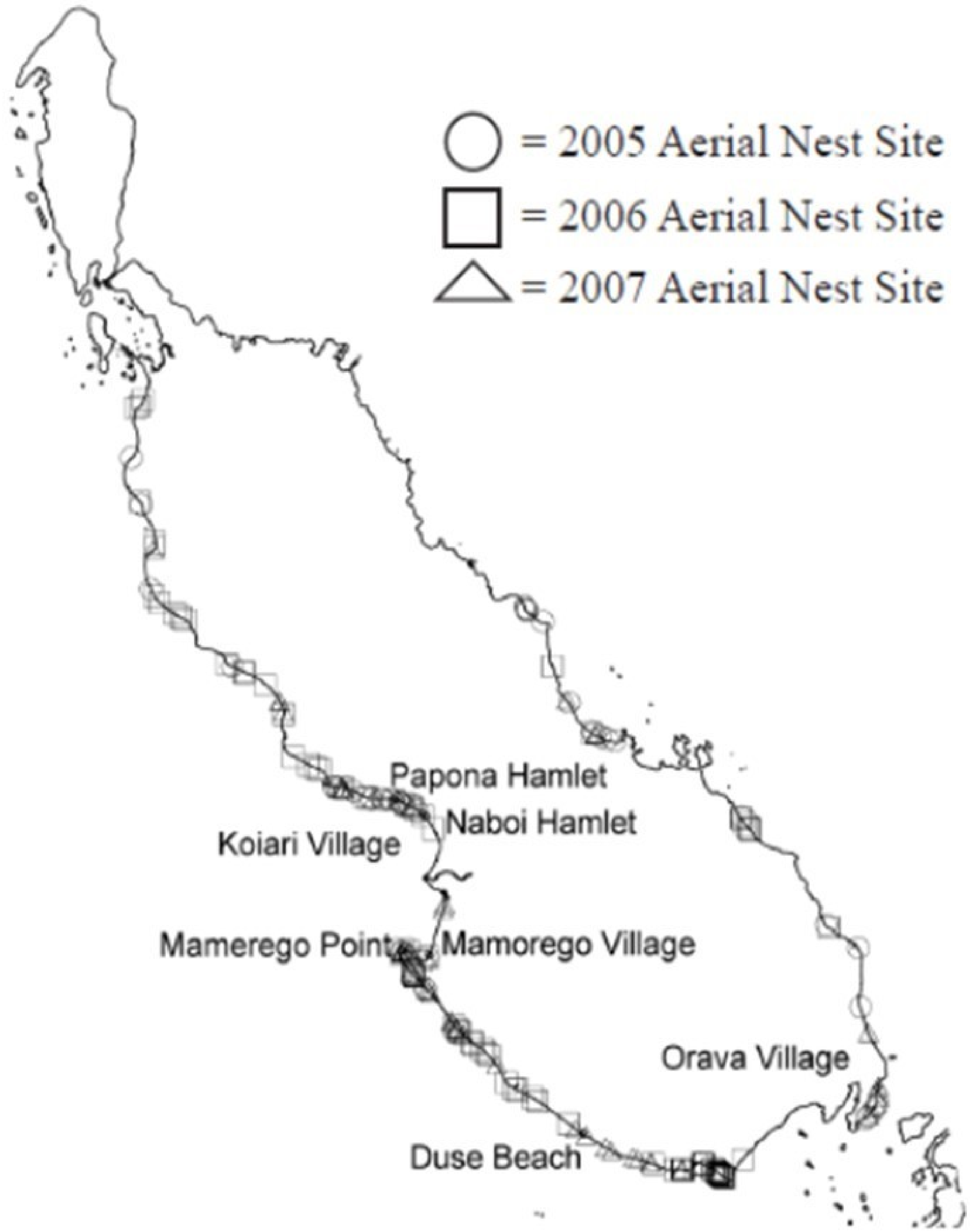

Figure 4: 2005-2007 aerial survey sites

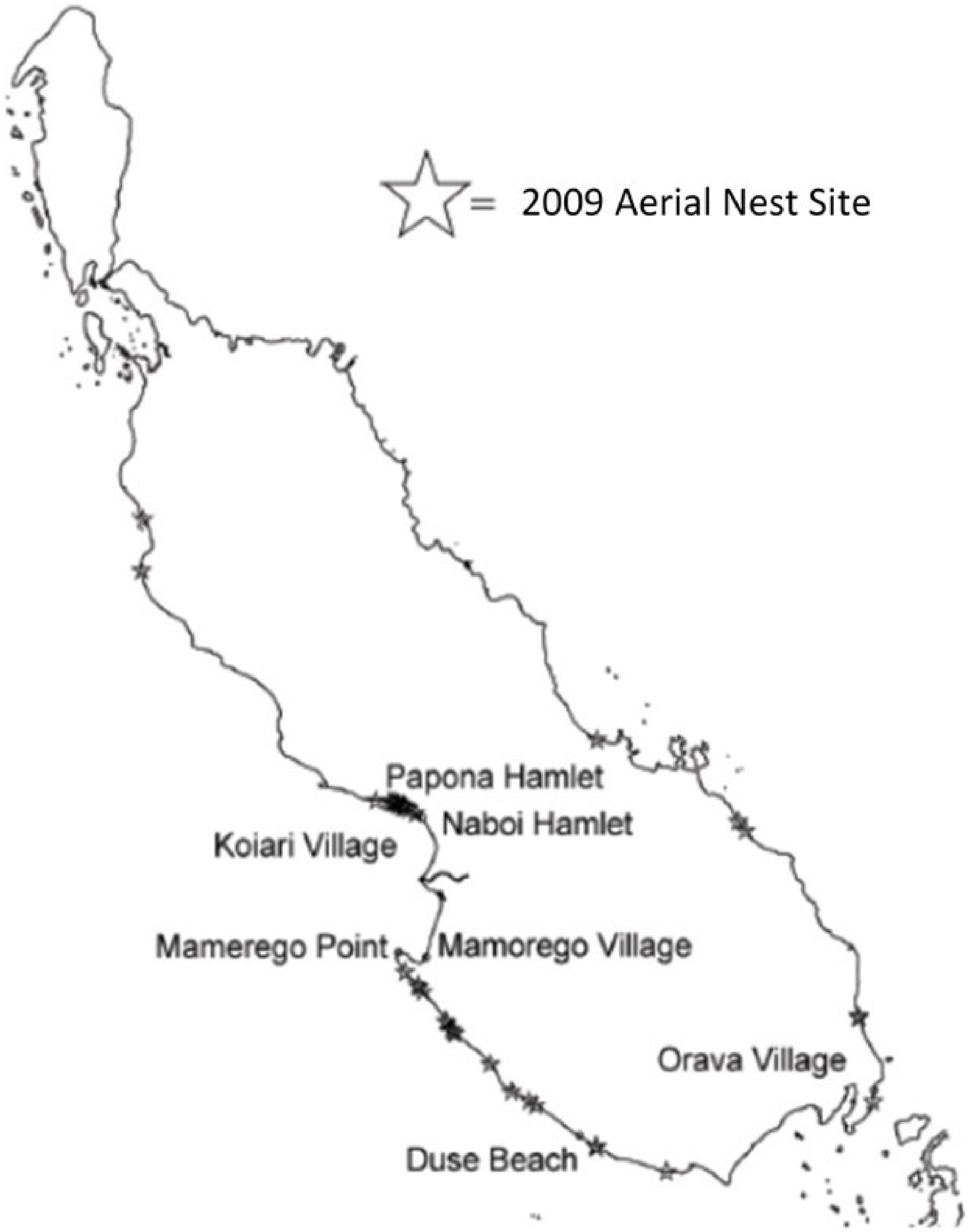

Figure 5: 2009 survey sites.

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Appendix

Appendix Table 1: Survey Length (km)

Year/Place	**Labu Tale**	**Busama**	**Lababia**	**Paiawa**	**Sapa**	**Kobo**	**Salus**
2006-2007	~ 1-2	~ 6-8	~ 6-8	~ 1-2	~ 1-2	~ 1-2	~ 1-2
2007-2008	~ 1-2	~ 6-8	~ 6-8	Nil	~ 1-2	~ 1-2	~ 1-2
2008-2009	3.19	6.94	7.48	1.86	7.7	2.16	Nil
2009-2010	3.19	6.94	7.48	1.86	7.7	2.16	5.07
2010-2011	3.19	6.94	7.48	1.86	7.7	2.16	Nil
2011-2012	3.19	6.94	7.48	1.86	7.7	2.16	Nil
2012-2013	3.19	6.94	7.48	Nil	7.7	2.16	Nil
2013-2014	No data collected						

Note: Nil denotes no monitoring.

Appendix Table 2. Census period.

Year/Place	**Labu Tale**	**Busama**	**Lababia**	**Paiawa**	**Sapa**	**Kobo**	**Salus**
2006-2007	01/Oct/06 - ??-??-??	01/Oct/06 - ??-??-??	end/Oct/06 - ??-??-??	01/Oct/06 - ??-??-??	01/Oct/06 - ??-??-??	01/Oct/06 - ??-??-??	??/Dec/06 - ??-??-??
2007-2008	01/Oct/07 - 01/Mar/08	01/Oct/07 - 01/Mar/08	01/Oct/07 - 01/Mar/08	Nil	01/Oct/07 - 01/Mar/08	01/Oct/07 - 01/Mar/08	01/Oct/07 - 01/Mar/08
2008-2009	01/Oct/08 - 30/Mar/09	01/Oct/08 - 30/Mar/09	01/Oct/08 - 30/Mar/09	01/Oct/08 - 30/Mar/09	01/Oct/08 - 30/Mar/09	01/Oct/08 - 30/Mar/09	Nil
2009-2010	01/Oct/09 - 01/Mar/10	01/Oct/09 - 01/Mar/10	01/Oct/09 - 01/Mar/10	01/Oct/09 - 01/Mar/10	01/Oct/09 - 01/Mar/10	01/Oct/09 - 01/Mar/10	01/Oct/09 - 01/Mar/10
2010-2011	01/Oct/10 - 07/May/11	01/Oct/10 - 04/Apr/11	01/Oct/10 - 30/Mar/11	01/Oct/10 - 30/Mar/11	01/Oct/10 - 30/Mar/11	01/Oct/10 - 30/Mar/11	Nil
2011-2012	01/Jan/11 - 29/Feb/12	01/Jan/11 - 29/Feb/12	01/Jan/11 - 29/Feb/12	01/Jan/11 - 29/Feb/12	01/Jan/11 - 29/Feb/12	01/Jan/11 - 29/Feb/12	Nil
2012-2013	01/Oct/12 - 30/Mar/13	01/Oct/12 - 30/Mar/13	01/Oct/12 - 30/Mar/13	Nil	01/Oct/12 - 30/Mar/13	01/Oct/12 - 30/Mar/13	Nil
2013-2014	No data collected						

Note: Nil denotes no monitoring.

Appendix Table 3: Number of nesting crawls

Year/Place	**Labu Tale**	**Busama**	**Lababia**	**Paiawa**	**Sapa**	**Kobo**	**Salus**
2006-2007	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
2007-2008	321 with no nesting at Paiawa						
2008-2009	35	157	38	23	0	5	Nil
2009-2010	54	132	36	7	20	17	5
2010-2011	63	311	84	45	34	21	Nil
2011-2012	43	112	47	0	6	0	Nil
2012-2013	37	73	80	Nil	5	16	Nil
2013-2014	No data collected						

Note: Nil denotes no monitoring.

Appendix Table 4: Number of nests laid

Year/Place	**Labu Tale**	**Busama**	**Lababia**	**Paiawa**	**Sapa**	**Kobo**	**Salus**
2006-2007	41	80	59	7	11	12	26
2007-2008	270 with no nesting at Paiawa						
2008-2009	28	119	35	23	0	5	Nil
2009-2010	41	96	25	7	17	13	5
2010-2011	59	284	84	45	34	21	Nil
2011-2012	39	101	47	0	6	0	Nil
2012-2013	35	68	78	Nil	4	14	Nil
2013-2014	No data collected						

Note: Nil denotes no monitoring.

Apppendix Table 5: Nesting success (%)

Year/Place	**Labu Tale**	**Busama**	**Lababia**	**Paiawa**	**Sapa**	**Kobo**	**Salus**
2006-2007	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
2007-2008	Unknown	Unknown	Unknown	Nil	Unknown	Unknown	Nil
2008-2009	80	76	92	100	0	100	Nil
2009-2010	76	73	69	100	85	76	100
2010-2011	94	91	100	100	92	95	Nil
2011-2012	91	90	100	0	100	0	Nil
2012-2013	95	93	98	Nil	80	88	Nil
2013-2014	No data collected						

Note: Nil denotes no monitoring.

Appendix Table 6: Curved-carapace-length data for leatherback turtles recorded nesting along the Huon Coast

Year/Details	Number	Range	Average
2005-2006	94	90.0-189.0	159.1
2006-2007	104	140.0-193.0	164.0
2007-2008	114	110.0-184.0	164.9
2008-2009	83	112.0-193.0	160.0
2009-2010	93	100.0-186.0	163.7
2010-2011	79	160.0-196.0	158.2
2011-2012	No data available		
2012-2013	Unknown	110.0-Unknown	127.1
2013-2014	No data collected		

Appendix Table 7: Egg clutch data for leatherback turtles recorded nesting along the Huon Coast

Year/Details	Number	Range	Average
2005-2006	94	31-180	90
2006-2007	95	47-209	101
2007-2008	113	25-180	106
2008-2009	87	47-144	98
2009-2010	72	57-137	97
2010-2011	196	48-135	94
2011-2012	No data available		
2012-2013	77	37-149	79
2013-2014	No data collected		

AppendixTable 8: Number of identified leatherback turtles and new nesters recorded nesting along the Huon Coast

Year/Details	Number	New nesters
2007-2008	65	48
2008-2009	89	36
2009-2010	59	14
2010-2011	79	15
2011-2012	No data available	
2012-2013	85	15

Appendix Table 9: Nests lost to erosion/flooding

Year/Place	**Labu Tale**	**Busama**	**Lababia**	**Paiawa**	**Sapa**	**Kobo**	**Salus**
2006-2007	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
2007-2008	Unknown	Unknown	Unknown	Nil	Unknown	Unknown	Nil
2008-2009	0	0	5	7	0	0	Nil
2009-2010	10	4	11	0	0	3	0
2010-2011	0	15	6	0	1	0	Nil
2011-2012	0	0	0	0	0	0	Nil
2012-2013	0	0	13	Nil	0	0	Nil
2013-2014	No data collected						

Appendix Table 10: Nests lost to predators

Year/Plac e	**Labu Tale**	**Busam a**	**Lababia**	**Paiawa**	**Sapa**	**Kobo**	**Salus**
2006-2007	Unknow n	Unknow n	Unknow n	Unknow n	Unknow n	Unknow n	Unknow n
2007-2008	Unknow n	Unknow n	Unknow n	Nil	Unknow n	Unknow n	Nil
2008-2009	0	0	0	1	0	0	Nil
2009-2010	0	0	0	0	0	0	0
2010-2011	0	0	0	0	1	1	Nil
2011-2012	0	0	0	0	0	0	Nil
2012-2013	0	0	0	Nil	0	0	Nil
2013-2014		No data collected					

Appendix Table 11: Nests lost to human take

Year/Place	**Labu Tale**	**Busama**	**Lababia**	**Paiawa**	**Sapa**	**Kobo**	**Salus**
2006-2007	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
2007-2008	Unknown	Unknown	Unknown	Nil	Unknown	Unknown	Nil
2008-2009	0	0	0	0	0	0	Nil
2009-2010	0	9	0	0	0	1	0
2010-2011	0	0	0	0	4	0	Nil
2011-2012	0	5	0	0	0	0	Nil
2012-2013	0	11	0	Nil	0	0	Nil
2013-2014	No data collected						

REMOTE PACIFIC ISLANDS: JARVIS, BAKER AND HOWLAND ISLANDS

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1 RMU: Green turtle (*Chelonia mydas*) - South Central Pacific

1.1 Distribution, abundance, trends

Jarvis, Baker and Howland Islands are part of the U.S. Pacific Remote Islands Marine National Monument (Fig. 1). Other islands that are part of the monument include Kingman Reef and Johnston, Palmyra and Wake Atolls and these areas are covered elsewhere in this report. Jarvis, Baker and Howland Islands are U.S. territories and are managed as National Wildlife Refuges by the U.S. Fish and Wildlife Service. They are currently uninhabited, although each has a history of settlement for guano mining and Baker and Howland Islands had U.S. military installations during World War II.

1.1.1 Nesting sites

NONE

1.1.2 Marine areas

Becker et al. (2) summarize the results of sea turtle observations from U.S. National Marine Fisheries Service (NMFS) towed-diver surveys throughout the U.S. Pacific Islands. Of all surveyed Pacific Islands, Jarvis Island had the highest densities of green sea turtles, Baker and Howland Island densities were also among the highest densities. Combined, the Pacific Remote Islands Area had an average of 268 turtle observations per 1000 tow segments (green and hawksbill sea turtles combined). In comparison, Jarvis Island had 822 green sea turtles per 1000 two segments. Conversely, the Pacific

Remote Islands Area had the lowest estimated annual population growth rate, estimated at 0.00 (± 0.199). The abundance of green sea turtles in the Pacific Remote Islands Area is estimated at 219 and size class distributions are depicted in Fig. 2.

1.2 Other biological data

NONE

1.3 Threats

1.3.1 Nesting sites

NONE

1.3.2 Marine areas

Degradation of coral reef habitat through climate change impacts including bleaching and acidification are the main threats to sea turtles in this region. Beyer et al (3) found that coral reefs in the central Pacific area generally have a lower chance of surviving projected climate change impacts relative to other reefs. Other threats include entanglement in marine debris, and interaction with pelagic fisheries include the West Central Pacific Ocean Purse Seine Fishery (5) (Table 1).

1.4 Conservation

All of the areas covered in this chapter are part of the U.S. and required to adhere to provisions of the U.S. Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 *et seq.*), which lists all sea turtle species as either threatened or endangered. Green sea turtles in the South Central Pacific RMU are listed as endangered under the ESA. The ESA prohibits unauthorized 'take' of listed species which is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. § 1532(18)). Exceptions to the 'take' prohibition are permitted, on an individual basis, for scientific research or when take is incidental to an otherwise lawful activity such as longline fishing, providing that the level of take will not jeopardize the existence of the species in the wild or appreciably reduce the likelihood of recovery in the wild. Generally, NMFS has the lead responsibility for enforcing the ESA un the marine environment while the USFWS has jurisdiction in the terrestrial environment (i.e. nesting beaches and strandings).

The waters surrounding Howland, Baker, Jarvis Islands and Wake Atoll are all part of the Pacific Remote Islands Marine National Monument which was established by

President George W. Bush in 2009 (4). The islands and atoll are all National Wildlife Refuges and managed by the U.S. Fish and Wildlife Service. They are uninhabited and access is by permit only through the U.S. Fish and Wildlife Service (Table 2).

1.5 Research Priorities

Continued tow-diver surveys for changes in abundance and distribution (2).

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central West Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

NONE

2.1.2 Marine areas

Hawksbill sea turtle may use reef habitat around Jarvis, Baker and Howland Islands, however they were not observed during NMFS towed-diver surveys (2).

2.2 Other biological data

NONE

2.3 Threats

2.3.1 Nesting sites

NONE

2.3.2 Marine areas

See Section 1.3.2

2.4 Conservation

See Section 1.4.

2.5 Research Priorities

Continued tow-diver surveys for changes in abundance and distribution (2).

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

There are no records of leatherback sea turtles although they may be transient visitors.

3.2 Other biological data

NONE

3.3 Threats

3.3.1 Nesting sites

NONE

3.3.2 Marine areas

The key threat to leatherbacks in this region is bycatch in pelagic fisheries (4) (Table 1).

3.4 Conservation

See section 1.4

3.5 Research Priorities

NONE

4 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

There are no records of olive ridley sea turtles although they may be transient visitors.

4.2 Other biological data

NONE

4.3 Threats

4.3.1 Nesting sites

NONE

4.3.2 Marine areas

The key threat to olive ridley sea turtles in this region is bycatch in pelagic fisheries (4) (Table 1).

4.4 Conservation

See section 1.4

4.5 Research Priorities

NONE

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Jarvis, Baker and Howland Islands

RMU	CM -South Central Pacific	Ref #	EI - West Central Pacific	Ref #	LO-West Pacific	Ref #	DC-West Pacific	Ref #
Occurrence								
Nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pelagic foraging grounds	nd	n/a	nd	n/a	nd	n/a	nd	n/a
Benthic foraging grounds	Y	23	N	23	n/a	n/a	n/a	n/a
Key biological data								
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Recent trends (last 20 yrs) at foraging grounds (range of years)	0.0 (2002 to 2015	2	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	Abundance and size distribution	2	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Threats								
Bycatch: presence of small scale / artisanal fisheries?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	Y	5	Y	5	Y	5	Y	5
Bycatch: quantified?	Y	5	Y	5	Y	5	Y	5
Take. Intentional killing or exploitation of turtles	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Coastal Development. Photopollution	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	nd	n/a	nd	n/a	nd	n/a	nd	n/a
Pathogens	nd	n/a	nd	n/a	nd	n/a	nd	n/a
Climate change	Y	3	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	nd	n/a	nd	n/a	nd	n/a	nd	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites	Y (2002 to ongoing)	2	Y (2002 to ongoing)	2	n/a	n/a	n/a	n/a

(period: range of years)								
Conservation								
Protection under national law	Y	6	Y	6	Y	6	Y	6
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	1	4	1	4	1	4	1	4
N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

modifications (eg, TED, circle hooks)								
By-catch: onboard best practices	Y	5	Y	5	Y	5	Y	5
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Conventions applicable to green (CM), hawksbill (EI), leatherback (DC) and olive ridley (LO) sea turtles (from 22) signed by Jarvis, Baker and Howland Islands.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Western and Central Pacific Fisheries Commission (WCPFC)	S	Y	Y	CM, EI, DC, LO	Promote the development and use of fishing gear that reduces sea turtle bycatch or post hooking mortality rates	Promote the development and use of fishing gear that reduces sea turtle bycatch or post hooking mortality rates

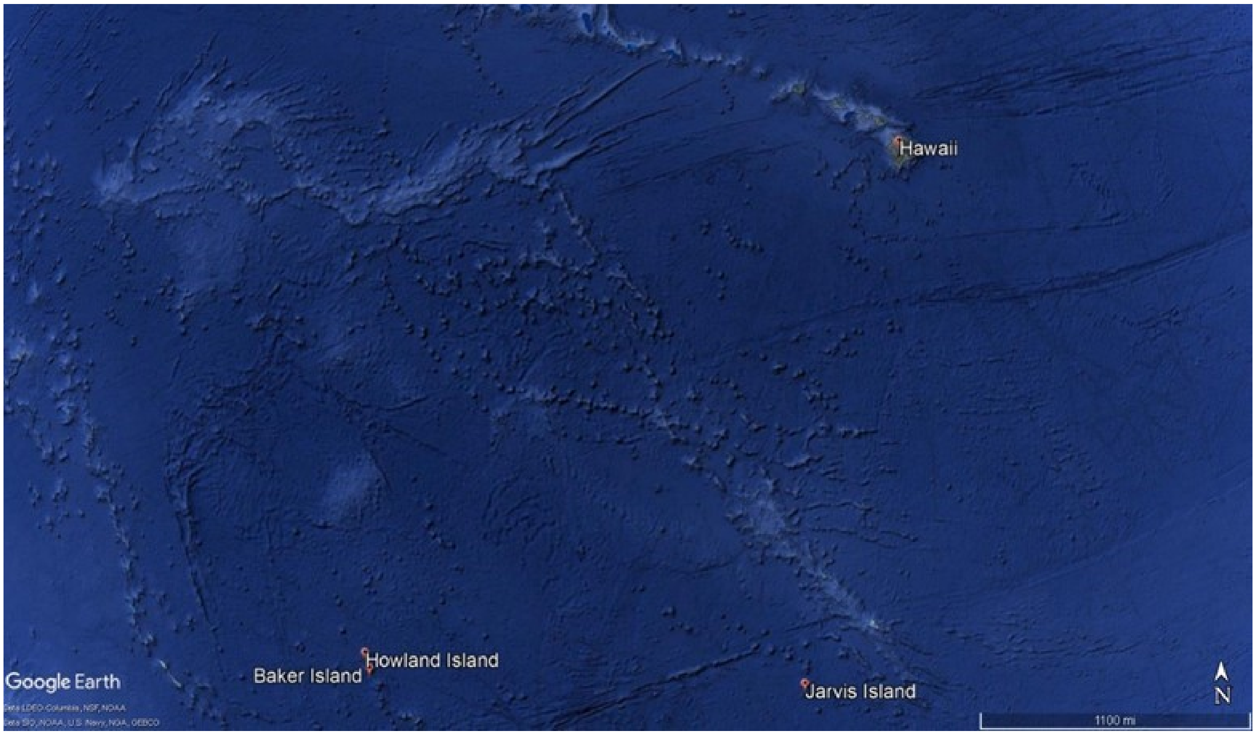

Figure 1. Locations of Jarvis, Baker and Howland Islands in relation to the island of Hawaii in the Hawaiian Archipelago.

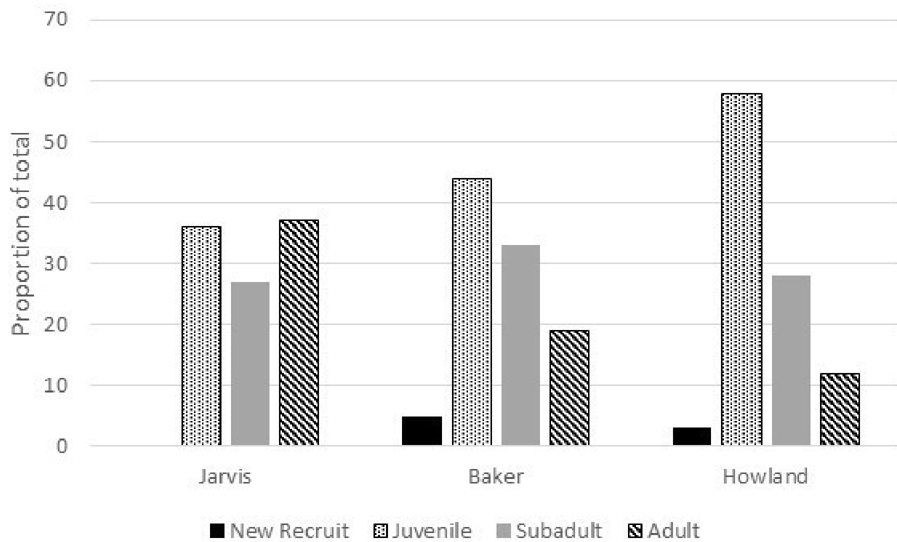

Figure 2. Green sea turtle (*Chelonia mydas*) size distributions at Jarvis, Baker and Howland Islands (from 23).

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REPUBLIC OF THE MARSHALL ISLANDS

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The Republic of the Marshall Islands (RMI) comprises 29 atolls and five isolated islands, with the total number of islands and islets being around 1,225. Twenty-two of the atolls and four of the islands are uninhabited (6). The atolls and islands form two groups: the Ratak (sunrise) and the Ralik (sunset). The two island chains lie approximately parallel to one another, running northwest to southeast, comprising about 750,000 square miles (1,900,000 km^2) of ocean but only about 70 square miles (180 km^2) of land mass (25, Fig 1). The RMI hosts five species of sea turtle which include *Chelonia mydas* (green turtle), *Eretmochelys imbricata* (hawksbill), *Caretta caretta* (loggerhead), *Lepidochelys olivacea* (olive ridley) and *Dermochelys coriacea* (leatherback), with only green turtles and hawksbills nesting within the RMI and the other 3 species being vagrant visitors (26,14). A summary of basic information known from the Republic of the Marshall Islands is shown in Table 1A and Table 1B.

1 RMU: Green turtle (*Chelonia mydas*) - Central West Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

Within the Republic of the Marshall Islands (RMI), sea turtles can nest year-round, however nesting mainly occurs between the months of May through November (14). Peak nesting has been recorded during the summer months of June to September, and it has been estimated that on Bikar about 75% of the annual nesting happens during this time (14, 27).

Three major sites, Bikar Atoll, Jemo Island and Erikub Atoll have been historically significant for green turtle (*Chelonia mydas*) nesting and were kept as game reserves for chiefs (iroij) and these three sites continue to be considered important nesting sites in the present day (Fig 2., Table 2, Table 5; 10,14,17,18,20). Bikar is considered the most important nesting area within the RMI, with estimates of 100-500 turtles nesting per year in 2004 (14, 15). Jemo Island and Erikub Atoll have estimates between 25-100 turtles nesting per year. Jemo historically has more nesting reported, while Erikub Atoll has been ranked third in number of nesting turtles (15, 20). M. McCoy indicated that Wotje, Taka, and Bikini are also significant nesting sites (14). Ailinginae, Rongelap and Rongerik atolls have been reported to have increased nesting due to having little to no habitation on these atolls after World War II due nuclear testing and other reasons (14). Bikini and Enewetak Atolls have also had low levels of nesting reported (14). In the literature, only 3 atolls were pointed out as having no recorded or reported nesting or nesting attempts on them, these included Ebon Atoll, Jabot Island, and Ujelang Atoll (14). Bokak Atoll is the northernmost atoll of RMI and had historical anecdotes of residents collecting fish and turtle eggs from this island as it was an historic game preserve for the Marshallese; however, during surveys in 1950 and 1989, Bokak was noted to have a total absence of marine turtles with regarding nesting activity (14). The names of other atolls for which nesting has been reported are included in Table 2 (Fig. 2). While local residents may indicate that all of these atolls and islands have nesting turtles, very little information is known about the basic biology of these turtles, including numbers of nesters or the status of these populations (9, 23, 21).

In McCoy (14), an estimate of Bikar's total nesting population was estimated at 771 adult females, calculated based on a survey done by Hendrickson in 1972 where he noted 38 nests created in 6 days. While many assumptions were used to create this estimate, Henrickson concluded that this population of adult females is relatively small and suggested that the overall turtle population within the RMI was not large. Studies on nesting turtles within the RMI have been few, but Eckert in 1992 counted nests on the islets of Erikub and reported a total of 205 nests made in a 2.5-month period (14). In Puleloa's study in 1992, 48 turtles were tagged in 12 days on Bikar, 8 turtles were tagged in one night on Jemo Island, and no turtles were captured from Erikub during day they stayed there, however 13 turtles had been captured nesting in the previous 2 months by residents with traditional rights to harvest from Erikub (20).

No other data is available at www.seaturtlestatus.org regarding the Republic of the Marshall Island green turtle populations. Surveys done on various atoll and conversations with local residents by McCoy, Puleloa, Eckert, and Hendrickson all suggest that the nesting populations of the RMI are decreasing (14, 20, 21, 23, 27).

Post-nesting adult females may also not stay within the EEZ of the RMI (19, see discussion in Marine Areas 1.1.2).

1.1.2 Marine areas

Foraging grounds are found throughout the atolls of the Republic of the Marshall Islands (RMI) (Fig. 3, Table 5; 14, 18).

Rudrud in 2008 states that green turtles have been reported from all atolls with the exception of Ujelang and Namdik (18). However, McCoy in 2004 stated that turtles were present on all atoll except Bokak (based on a 1989 study) and Jabot Island (14). McCoy also stated that the important nesting areas of Bikar Atoll and Jemo Island hosted fewer resident foraging turtles that other atolls (14). Almost nothing is known about early life-stage pelagic habitat for green turtles. The inshore or near shore habitat is where most Marshallese encounter sea turtles, and most local resident know where sea turtles are likely to be found, be it a foraging area such as seagrass beds, or resting areas on reefs (14). Surveys of islanders on multiple atoll indicate that turtles are important to their lifestyle and note they can often be found while diving on the reefs (14). While some dive companies and individuals on Majuro and Kwajalein and have records of where turtles were sighted during scuba diving and snorkeling excursions and some local fisherman can easily find and capture turtles for special events, there has been very little published on the abundance and distribution of juvenile, subadult and adult green turtles foraging around the RMI.

The foraging areas of adult females, or where they go after nesting within the RMI, has only been recently studied, during a project in which the Women United Together in the Marshall Islands (WUTMI) put satellite tags on 5 post-nesting females from Erikub atoll (19, P4.1). The results of this study suggested that some green turtles may spend a significant amount of time in pelagic environments, before settling down to forage near a specific atoll and that turtles nesting in the RMI may forage elsewhere as turtles traveled to Kiribati, the Federated States of Micronesia and the Philippines (19, Fig. 4).

Turtles that reside in the RMI may also come from other RMU areas based on the few flipper tag recoveries that have been reported recovered within the RMI. One tag recovered was from a turtle that had been previously tagged on the island of Moloka'i in Hawaii (which could be the North Central Pacific RMU rather than the West Central Pacific), while another tag recovery was from a turtle that had been previously tagged on Ulithi atoll in the Federated States of Micronesia. One person also reported a turtle captured on Majuro with a tag from "New Caledonia"; however, this was more likely a tag that was deployed during the 1992 study by Puleloa, who used SPREP tags with a New Caledonia return address to tag turtles on Bikar, Jemo, Wotje and Majuro (14, 20).

1.2 Other biological data

Not many studies have been done on basic biological data for sea turtles nesting in the Republic of the Marshall Islands (Table 1A). In 1992, Puleloa did take measurements of the nesting turtles they tagged on Bikar Atoll and Jemo Island, which suggested the size range of females nesting at the different nesting sites could also be different. The size range recorded at Bikar Atoll ranged from 83-120 cm CCL and the size range on Jemo island ranged from 96-106 cm CCL, which was slightly more limited than the range from Bikar Atoll (20). However, other information documenting numbers of nests or crawls, nesting intervals and other data is non-existent.

1.3 Threats

1.3.1 Nesting sites

Threats facing nesting sites include issues from both humans and nature. The major human impact comes from continued harvest of nesting turtles and their eggs (10, 14, 15 18, 21). Other human impacts include mining beach sand which is a problem on inhabited islands such as Majuro (7, 21), coastal construction on atolls like Kwajalein and other inhabited atolls, or more importantly if coastal construction expands to uninhabited atolls (2, 21), lighting pollution (21), environmental contamination from nuclear testing (7, 15, 21), and marine debris which washes up on shore (2, 7, 14, 20, 21, 36).

Natural threats include sea level rise due to climate change (7, 11,12,13, 21), beach erosion (natural and from event such as cyclones and hurricanes, 38, 39), and predators (20, 21). Climate change is already affecting the Republic of the Marshall Islands (RMI) as sea rise has increased to 3.5 mm rise per year (29), and this will increase beach erosion rates. Damage from cyclones, hurricanes and typhoons can be significant to atolls as shown by the loss of a major nesting beach in Hawaii due to hurricane damage (30). Typhoons are a common occurrence that causes beach erosion and reef damage (38, 39). A major predator of concern would be the Polynesian rat (*Rattus exulans*) which eat eggs are was reported to be nearly over running Bikar atoll in 1992 (20), but hatchlings are also taken by sand crabs and sea birds before they can reach the ocean.

1.3.2 Marine areas

Threats in the marine areas of Republic of the Marshall Islands (RMI) include human take both direct from nearshore reefs and indirect due to fishery interactions. Residents of the RMI still take turtles from nearshore reefs and seagrass beds where turtles forage for subsistence purposes. International pelagic fisheries include purse seine and longline mainly for tuna, where limited numbers of turtles are taken in the purse seine fishery the are reported by the Marshall Islands Marine Resource Authority (MIMRA) and capture 1-6 turtles annually, but mortality seems low in the purse seine fishery (11, 12, 13). Longline fisheries in other countries also affect RMI turtles (23). Nearshore artisanal fisheries such as stone fish traps can also incidentally capture turtles (14, 18, 21, 33). Dredging and filling can affect turtle resting and foraging sites and reduce habitat. (21). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (15, 21, 36). Degradation of marine corals may also impact critical resting areas for sea turtles (35, 38, 39).

Natural threats include predation from sharks (43), and loss of foraging habitat due to tropical storms (38, 39).

1.4 Conservation

The harvest of sea turtles in the Republic of the Marshall Islands is regulated by the Marine Resources Act (1997), which sets minimum size limits for greens (34 inches carapace length) and closed seasons from June 1 to August 31 and December 1 to January 31 (2, 9, 27). Egg collecting and take of turtles while they are onshore is prohibited at all times. However, there is limited protection as there is little to no monitoring and enforcement of these regulations.

The Marshall Islands Marine Resources Authority (MIMRA) is the entity with the responsibility of managing marine resources in the Marshall Islands. MIMRA trains fishery observers that go out on various international fishing fleets that are based in the RMI, which record number of interactions of sea mammals and sea turtles with the fishery fleet. A fisheries enforcement branch is active; however, it is unknown if there are clear steps for enforcing regulations.

The Republic of the Marshall Islands is not a participating party to CITES.

1.5 Research

Research needs to be set up to have monitoring of nesting beaches to gather basic biology for the nesting population throughout the Republic of the Marshall Islands, and also to get a baseline population estimate for current times as a documented survey of nesting beaches has not been done for at least 20 years. There should also be an effort to put flipper tags or satellite tags on more turtles to be able to track the distribution of RMI sea turtles throughout the RMI and Oceania. Critical habitat for sea turtles needs to be identified throughout the RMI. Surveys that included distribution and numbers of sub-adult and juvenile turtles in nearshore waters of the RMI would also be beneficial.

Many studies that have been done have not been published or have been published in grey literature, these include the study done for different agencies including those done by M. McCoy, W. Puleloa (P4.2), N. Vander Velde, and S. Eckert (14, 20, 46). Much information of sea turtles within the RMI comes from anecdotal comments from studies done on other things and are mainly published in Atoll Research Bulletin (32, 33, 34, 35), or from surveys of residents.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central West Pacific

2.1 Distribution, abundance, trends

Eretmochelys imbricata, the hawksbill sea turtle, is historically and culturally important to the Marshallese people. A few Marshallese legends regarding sea turtles are about Lijebake, a hawksbill called the Great Mother turtle, who gives power to her sons through her shell and rescues her granddaughter (18). "Jebake" is the name for the hawksbill in the Marshallese language (14,18).

2.1.1 Nesting sites

While hawksbill turtles are recognized as an important species within the Republic of the Marshall Islands (RMI), very little is known about numbers and nesting areas. Seven sites have reported as nesting sites or possible nesting sites for hawksbill turtles (14, 18, Table 2, Table 5). Nesting extends throughout the entire RMI range and is not isolated to a specific area within the RMI (Fig. 5, 14).

When hawksbills have been recorded nesting, they are usually in significantly lower numbers than green turtles and nesting is often mixed in with green turtle nesting, so no definite numbers have been recorded. L. Tobin estimated that about 30% of nesting on Rongerik and Ailinginae Atolls were hawksbill turtles (14). Wotje Atolls has been suggested as possible being the center of activity for hawksbill turtles (20), and both Wotje and Erikub atolls have recorded hawksbills nesting, but in lower numbers than green turtles.

2.1.2 Marine areas

Hawksbills reside mostly nearshore as they forage on sponges (16) and have been reported at least 17 atolls throughout the RMI (14, 18). Hawksbills have been commonly photographed by divers as they rest on reefs of many atolls throughout the RMI (42, 42, 44, 45) and are regularly seen off inhabited atolls such as Majuro and Kwajalein (pers. obs., 1999). An adult female hawksbill that was released from captivity from Kwajalein atoll did not stay near the atoll, but moved into pelagic waters; however, the transmitter stopped soon afterward the turtle left Kwajalein, so it is uncertain if this turtle stayed in pelagic waters, moved to another atoll, or perished (41). No information is available on pelagic movements or the migration of adult females and hatchlings from nesting beaches within the RMI. Information regarding distribution, ages and numbers of hawksbills in the RMI are severely lacking.

2.2 Other biological data

Very little information is published about the biology of hawksbill turtles (Table 1A).

2.3 Threats

2.3.1 Nesting sites

Threats facing nesting sites are like those of green turtles and include issues from both humans and nature. The major human impact comes from continued harvest of nesting turtles and their eggs (10, 14, 15 18, 21). Other human impacts include mining beach sand which is a problem on inhabited islands such as Majuro (7, 21), coastal construction on atolls like Kwajalein and other inhabited atolls, or more importantly if coastal construction expands to uninhabited atolls (2, 21), lighting pollution (21), environmental contamination from nuclear testing (7, 15, 21), and marine debris which washes up on shore (2, 7, 14, 20, 21, 36).

Natural threats include sea level rise due to climate change (7, 11,12,13, 21), beach erosion (natural and from event such as cyclones and hurricanes, 38, 39), and predators (20, 21). Climate change is already affecting the Republic of the Marshall Islands (RMI) as sea rise has increased to 3.5 mm rise per year (29), and this will increase beach erosion rates. Damage from cyclones, hurricanes and typhoons can be significant to atolls as shown by the loss of a major nesting beach in Hawaii due to hurricane damage (30). Typhoons are a common occurrence that causes beach erosion and reef damage (38, 39). A major predator of concern for hatchlings would be the Polynesian rat (*Rattus exulans*), sand crabs, and sea birds (20).

2.3.2 Marine areas

Threats in the marine areas of Republic of the Marshall Islands (RMI) include human take both direct from nearshore reefs and indirect due to fishery interactions. Residents of the RMI still take turtles from nearshore reefs where turtles forage for subsistence purposes. International pelagic fisheries include purse seine and longline mainly for tuna, where limited numbers of turtles are taken, however hawksbills may not be included in these numbers as there are no records of hawksbills as by-catch in pelagic fisheries (11, 12, 13). Nearshore artisanal fisheries such as stone fish traps which can capture turtles would be more of a threat (14, 18, 21, 33). Dredging and filling can affect turtle resting and foraging sites and reduce habitat. (21). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (15, 21, 36). Degradation of marine corals may also impact critical resting areas for sea turtles (35, 38, 39).

Natural threats include predation from sharks (43), and loss of foraging habitat due to tropical storms (38, 39).

2.4 Conservation

The harvest of sea turtles in the RMI is regulated by the Marine Resources Act (1997), which sets minimum size limits for hawksbills (27 inches carapace length) and closed seasons from June 1 to August 31 and December 1 to January 31 (2, 9, 27). Egg collecting and take of turtles while they are onshore is prohibited at all times (8).

The Marshall Islands Marine Resources Authority (MIMRA) is the entity with the responsibility of managing marine resources in the Marshall Islands. A fisheries enforcement branch is active; however, it is unknown if there are clear steps for enforcing regulations.

The Republic of the Marshall Islands is not a participating party to CITES. More clear protections are needed as well as enforcement ability.

2.5 Research

Only anecdotal information is available on hawksbill turtles within the Marshall Islands; however, Marshallese still consider the "jebake" to be an important species.

Research projects should include basic biological information including verification of nesting sites, an estimation of population size and distribution throughout the RMI. Information on nesting number, frequency and migration of adult females after nesting is also needed. Satellite tagging of adult females would be important to determine their distribution throughout the RMI and Oceania

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

The leatherback (*Dermochelys coriacea*) is an intermittent visitor or vagrant within the Republic of the Marshall Islands (RMI). Most reports have been of post-hatchling, juvenile and sub-adult turtles with a few reports of adult size turtles from anecdotal sightings (14, 18, Fig 6.).

Leatherback turtles have been reported in waters near seven atolls including Bikini, Rongelap, Rongerik, Arno, Ailinglaplap, Kili and Majuro (14, 18, Table 5). They are also present in pelagic fisheries (1, 2, 14).

3.2 Other biological data

No biological data is published from the Republic of the Marshall Islands regarding this species (Table 1B).

3.3 Threats

3.3.1 Nesting sites

Not applicable

3.3.2 Marine areas

Threats in the marine areas of Republic of the Marshall Islands (RMI) include human take due to fishery interactions. International pelagic fisheries include purse seine and longline mainly for tuna, where limited numbers of turtles are taken in the purse seine fishery the are reported by the Marshall Islands Marine Resource Authority (MIMRA) and capture 1-6 turtles annually, but mortality seems low in the purse seine fishery (11, 12, 13). Longline fisheries in other countries also affect RMI turtles (14, 23). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (15, 21, 36).

Natural threats include predation from sharks (43).

3.4 Conservation

Basic mitigation in longline fleets and release by MIRMA observers if captured by pelagic fisheries, but otherwise no other protection (1, 9, 11, 12, 13).

More specific protections should be created with defined penalties and better enforcement capabilities.

3.5 Research

Research and documentation of numbers and size range impacted by the pelagic longline fisheries would be a good starting point.

4 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

The olive ridley (*Lepidochelys olivacea*) is a rare vagrant to the Republic of the Marshall Islands (RMI). There has been one report of a turtle near Mili atoll (18, Fig 6., Table 5) and reports of olive ridley turtles from the international longline fleet (14). Mostly juvenile and subadult turtles were reported.

In 2016, the first documented stranding of an olive ridley in the RMI was reported on Arno Atoll (8). This turtle had a healed amputation of one front flipper which may have contributed to it ending up on shore as it limited the turtle's mobility.

4.2 Other biological data

No biological data is published from the Republic of the Marshall Islands regarding this species (Table 1B).

4.3 Threats

4.3.1 Nesting sites

Not applicable

4.3.2 Marine areas

Threats in the marine areas of Republic of the Marshall Islands (RMI) include human take due to fishery interactions. International pelagic fisheries include purse seine and longline mainly for tuna, where limited numbers of turtles are taken in the purse seine fishery the are reported by the Marshall Islands Marine Resource Authority (MIMRA) and capture 1-6 turtles annually, but mortality seems low in the purse seine fishery (11, 12, 13). Longline fisheries in other countries also affect RMI turtles (14, 23). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (15, 21, 36).

Natural threats include predation from sharks (43).

4.4 Conservation

Basic mitigation in longline fleets and release by MIRMA observers if captured by pelagic fisheries, but otherwise no other protection (1, 9, 11, 12, 13).

More specific protections should be created with defined penalties and better enforcement capabilities.

4.5 Research

Research and documentation of numbers and size range impacted by the pelagic longline fisheries would be a good starting point.

5 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

NONE

5.1.2 Marine areas

Loggerhead turtles (*Caretta caretta*) are a very rare vagrant to the Republic of the Marshall Islands (RMI).

As the RMI is in the northern hemisphere one would think that the loggerheads that frequent these waters would be from the North Pacific RMU. However, the RMU of one loggerhead from an unpublished satellite track indicates that loggerheads in the RMI might be mainly from the South Pacific RMU (3). Te mana o te moana released a rescued sub-adult loggerhead that traveled through the South Pacific and up into RMI water before returning to South Pacific waters (3, Fig 7). One other loggerhead turtle was reported from the lagoon of Bikini Atoll (18).

5.2 Other biological data

No biological data is published from the Republic of the Marshall Islands regarding this species (Table 1B).

5.3 Threats

5.3.1 Nesting sites

Not applicable

5.3.2 Marine areas

Threats in the marine areas of Republic of the Marshall Islands (RMI) include human take due to fishery interactions. International pelagic fisheries include purse seine and longline mainly for tuna, where limited numbers of turtles are taken in the purse seine fishery the are reported by the Marshall Islands Marine Resource Authority (MIMRA) and capture 1-6 turtles annually, but mortality seems low in the purse seine fishery (11, 12, 13). Longline fisheries in other countries also affect RMI turtles (14, 23). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (15, 21, 36).

Natural threats include predation from sharks (43).

5.4 Conservation

Basic mitigation in longline fleets and release by MIRMA observers if captured by pelagic fisheries, but otherwise no other protection (1, 9, 11, 12, 13).

More specific protections should be created with defined penalties and better enforcement capabilities.

5.5 Research

That loggerheads observed around the atolls of the Republic of the Marshall Islands have a mixed RMU is possible, genetic studies should be done to verify the RMU of this species, due to evidence from the unpublished satellite track from French Polynesia (3).

Table 1. Key Biological information for sea turtles Regional Management Units in the Republic of the Marshall Islands.

RMU	CM- CW PAC	Ref #	EI- CW PAC	Ref #	DC-W PAC	Ref #	CC-S PAC	Ref #	LO-W PAC	Ref #
Occurrence										
Nesting sites	Y	10,20,14,18,	Y	14,18	N	n/a	N	n/a	N	n/a
Pelagic foraging grounds	JA	20, 14, 18	JA	20, 14, 18	JA	14, 18, 20	J	3, unpub	J	8, 18
Benthic foraging grounds	Y	1,2, 14, 18,20, 21, 23	Y	n/a	N	n/a	N	n/a	N	n/a
Key biological data										
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	4	n/a	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	20	n/a	7	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	>1/yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	<83 cm CCL	20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)	decreasing	n/a	decreasing	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	decreasing	n/a	decreasing	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies										
Growth rates	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Genetics	Y	4,5	N	n/a	N	n/a	N	n/a	N	n/a
Stocks defined by genetic markers	Y	4,5	N	n/a	N	n/a	N	n/a	N	n/a

Remote tracking (satellite or other)	Y	19	N	n/a	N	n/a	Y	3	N	n/a
Survival rates	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Population dynamics	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Foraging ecology (diet or isotopes)	Y	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Capture-Mark-Recapture	Y	20	N	n/a	N	n/a	N	n/a	N	n/a
Threats										
Bycatch: presence of small scale / artisanal fisheries?	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	Y (PLL, PS)	n/a	n/a	n/a	Y(PLL , PS)	14	Y(PLL , PS)		Y(PLL , PS)	14,18
Bycatch: quantified?	Y (PS)	11,12,13	N	n/a	Y (PS)	11,12,1 3	Y (PS)	11,12,1 3	Y (PS)	11,12,1 3

Take. Intentional killing or exploitation of turtles	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	n/a	Y	n/a	Y	n/a	Y	n/a	Y	n/a
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	Y	29	Y	29	Y	29	Y	29	Y	29
Foraging habitat degradation	Y	n/a	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Other	Y (see text)	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Long-term projects										
Monitoring at nesting sites	N	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	0	n/a	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites	N	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Conservation										
Protection under national law	Y	9	Y	9	Y	9	Y	9	Y	9
Number of protected nesting sites (habitat preservation)	2	n/a	0	n/a	0	n/a	0	n/a	0	n/a
Number of Marine Areas with mitigation of threats	3	n/a	3	n/a	0	n/a	0	n/a	0	n/a

Long-term conservation projects (number)	0	n/a	0	n/a	0	n/a	0	n/a	0	n/a
In-situ nest protection (eg cages)	N	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	N	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	N	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	circle hook (PLL)	11,12,13	circle hook (PLL)	11,12,13	circle hook (PLL)	11,12,13	circle hook (PLL)	11,12,13	circle hook (PLL)	11,12,13
By-catch: onboard best practices	Y	11,12,13	Y	n/a	Y	n/a	Y	n/a	Y	n/a
By-catch: spatio-temporal closures/reduction	Y	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a

Table 2. Nesting Beaches for *Chelonia mydas* (green turtle) and *Eretmochelys imbricata* (hawksbill sea turtles) in the Republic of the Marshall Islands. * - most important nesting areas; ** - see Table 5. Central points are estimated from Google Earth (from 28).

RMU / Nesting beach name	Index site	Turtles (range of years)	Crawls(year)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #
CM-CW PAC				**Long**	**Lat**	**Long**	**Lat**	**Long**	**Lat**			
Bikar Atoll*	N	numerous (1992)	246 (1989)	n/a	n/a	n/a	n/a	170.1057	12.2453	n/a**	0	10, 14, 20
Jemo Island*	N	numerous (1992)	53 (1989), 8 (1992)	n/a	n/a	n/a	n/a	169.5416	10.0877	n/a**	0	10, 14, 20
Erikub Atoll*	N	numerous (1992)	n/a	n/a	n/a	n/a	n/a	170.0204	9.1423	n/a**	0	10, 14, 20
Taka Atoll	N	n/a	24 (1989)	n/a	n/a	n/a	n/a	169.6252	11.1467	n/a**	0	14,10
Wotje Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	170.0370	9.4450	n/a**	0	14

CM-CW PAC (reported)												
Ailinginae Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	166.4058	11.1410	n/a**	0	14,10
Rongerik Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	167.4945	11.3477	n/a**	0	14,10
Bokak Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	168.9727	14.6538	n/a**	0	10
Ainlinlaplap Atoll	N	5 (2004)	n/a	n/a	n/a	n/a	n/a	168.7736	7.3931	n/a**	0	14
Bikini Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	165.3883	11.5942	n/a**	0	14
Rongelap Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	166.7937	11.3141	n/a**	0	14
Kwajalein Atoll	N	(1997)	n/a	n/a	n/a	n/a	n/a	167.4900	9.1598	n/a**	0	14
Jaluit Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	169.5490	6.0043	n/a**	0	14
Wotho Atoll	N	low (1989, 1997)	n/a	n/a	n/a	n/a	n/a	165.9820	10.1061	n/a**	0	14
Ujae Atoll	N	1 (1990s)	n/a	n/a	n/a	n/a	n/a	165.6435	9.0674	n/a**	0	14
Lae Atoll	N	fewer (1990-2004)	n/a	n/a	n/a	n/a	n/a	166.2363	8.9376	n/a**	0	14

Lib Island	N	(1998)	n/a	n/a	n/a	n/a	n/a	167.3800	8.3132	n/a**	0	14
Namu Atoll	N	(2004)	n/a	n/a	n/a	n/a	n/a	168.1867	7.9351	n/a**	0	14
Kili Island	N	20 turtles/year	n/a	n/a	n/a	n/a	n/a	169.1230	5.6438	n/a**	0	14
Namdrik Atoll	N	low numbers	n/a	n/a	n/a	n/a	n/a	168.1137	5.6176	n/a**	0	14
Mejit Island	N	1 (2000)	n/a	n/a	n/a	n/a	n/a	170.8669	10.2921	n/a**	0	14
Likiep Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	169.1454	9.8920	n/a**	0	14
Maloelap Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	171.0555	8.7230	n/a**	0	14
Aur Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	171.0940	8.2649	n/a**	0	14
EI-CW PAC												
Ailinginae Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	166.4058	11.1410	n/a**	0	14,18
Mili Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	171.9266	6.1437	n/a**	0	14,18
Bikar Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	170.1057	12.2453	n/a**	0	14,18
Rongerik Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	167.4945	11.3477	n/a**	0	14,18

Kili Island	N	n/a	n/a	n/a	n/a	n/a	n/a	169.1230	5.6438	n/a**	0	14,18
Wotje Atoll	N	1 (1990)	n/a	n/a	n/a	n/a	n/a	170.0370	9.4450	n/a**	0	14,18
Erikub Atoll	N	n/a	n/a	n/a	n/a	n/a	n/a	170.0204	9.1423	n/a**	0	14,18

Table 3. Internationals Conventions signed by the Republic of the Marshall Islands.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
List of all International treaties at https://en.wikipedia.org/wiki/Category:Treaties_of_the_Marshall_Island	Y	Y	n/a	all	n/a	Unknown
Marine Resources Act of 1997	Y	n/a	N	CM, EI	Egg protection for EI, Size regulations, Sale restrictions	some protection, but not enforced.
National Environmental Protection Act of 1984	Y	n/a	n/a	n/a	coral reef and beach protections	nesting and foraging habitat conservation
Endangered Species Act 1975	Y	n/a	n/a	EI, DC	no exports, no commercial activity	some protection, but as of 2004 not enforced.
Convention for the Protection of the Natural Resources and	Y	n/a	n/a	all	information gathering,	conservation of turtles

Environment of the South Pacific Region (SPREP Convention)					institution building, research and management, traditional knowledge, conservation, education and publicity programs, and international efforts	and information gathering

Table 4. Marine Turtle Projects and Databases in the Republic of the Marshall Islands.

#	RMU	Country	Region / Location	Project Name or descriptive title
P4.1	CM-CWP	Republic of the Marshall Islands (RMI)	Erikup Atoll	Satellite tagging of post-nesting female green turtles
P4.2	CM-CWP	Republic of the Marshall Islands (RMI)	Bikar Atoll, Jemo Island, Wotje Atoll and Majuro Island	A Research Expedition to Bikar & Erikup Atolls, and Jemo Island
Key words	**Start date**	**End date**	**Leading organization**	**Public/Private**
Satellite tag, post-nesting, green turtle, Republic of the Marshall Islands	Jul-07	Jul-08	WUTMI, SPREP	Public?
Flipper tags, green turtles	1992	1992	MIMRA, SPREP	Public?
Collaboration with	**Reports / Information material**	**Current Sponsors**	**Primary Contact (name and Email)**	**Other Contacts (name and Email)**

NOAA	19		George H. Balazs (itsahonuworldinhawaii@hotmail.com)	
DLNR, HI	20		Anne Trevor (TREDS - SPREP)	Nena Kilma, MIMRA

Table 5. Use of the Republic of the Marshall Island Atolls by different sea turtle species, summarized from tables compiled by M. McCoy (from 14)

Atoll	Land Area of Atoll (sq. mi)	Species	Islets reporting Nesting	Historic Nesting (yr)	Current Nesting (yr)	Foraging/Resting	Report	Population trend	Protected
Ujelang	0.66	*Chelonia mydas*	n/a	n/a	n/a	Y	Y	n/a	n/a
Enewetak	2.25	*Chelonia mydas*	Ikuren	Y	N	Y	Y	decreased	n/a
		Eretmochelys imbricata	n/a	N	N	Y	Y	n/a	n/a
Bikini	2.33	*Chelonia mydas*	Bok-pata, Bikini, Aoemen, Eneu	Y	Y (2003)	Y	Y	n/a	Y
		Eretmochelys imbricata	n/a	n/a	n/a	Y	Y	n/a	Y
		Caretta caretta	n/a	N	N	N	Y	n/a	n/a
		Dermochelys coriacea	n/a	N	N	N	Y	n/a	n/a

Rongelap	3.00	*Chelonia mydas*	Rongelap, other small islets	Y	Y (2003)	Y	Y	n/a	Y
		Eretmochelys imbricata	n/a	N	N	Y	Y	n/a	Y
		Dermochelys coriacea	n/a	n/a	n/a	N	Y	n/a	n/a
Rongerik	0.81	*Chelonia mydas*	Eniwektak, Tarrowatt	Y	Y (2003)	Y	Y	n/a	Y
		Eretmochelys imbricata	n/a	N	Y (2003)	N	Y	n/a	Y
		Dermochelys coriacea	n/a	N	N	N	Y	n/a	n/a
Ailinginae	1.29	*Chelonia mydas*	Ailinginae, Sifo, Manchinkon	Y	Y (2002)	N	Y	n/a	Y
		Eretmochelys imbricata		Y	Y	N	Y	n/a	Y
Wotho	1.60	*Chelonia mydas*	Wotho, Mejurwon	Y (low; 1997)	n/a	Y	Y	n/a	n/a
Ujae	0.62	*Chelonia mydas*	Ujae	Y	n/a	Y	Y	n/a	n/a

Lae	0.60	*Chelonia mydas*	n/a	Y (1998)	Y	Y	Y	decreas ed	N
		Eretmochelys imbricata	n/a	n/a	n/a	Y	Y	decreas ed	N
Kwajalein	6.30	*Chelonia mydas*	Arbwâ, Wōnwōt, Pekram, Meik, Pikeej, Ane-koran	Y (1997)	n/a	Y	Y	n/a	N
		Eretmochelys imbricata	n/a	N	N	Y	Y	n/a	N
Lib Island	0.35	*Chelonia mydas*	n/a	Y (1998)	n/a	Y	Y	n/a	N
		Eretmochelys imbricata	n/a	n/a	n/a	Y	Y	n/a	N
Namu	2.40	*Chelonia mydas*	Āne-mok, Tokdik, Anil, Nalap, Bokaetoktok	Y	n/a	Y	Y	n/a	n/a
		Eretmochelys imbricata	n/a	N	N	n/a	Y	n/a	n/a
Ailinglapl ap	5.66	*Chelonia mydas*	Katiej	Y (2002)	n/a	Y	Y	n/a	n/a

		Dermochelys coriacea	n/a	N	N	n/a	Y	n/a	n/a
Jaluit	1.40	*Chelonia mydas*	Lijeron, islets between Piñlap & Meña, Mejatto, Jiktokan, between Jabwor & Jaluit	Y	Y (2003)	Y	Y	n/a	n/a
		Eretmochelys imbricata	n/a	n/a	n/a	n/a	Y	n/a	n/a
Kili Island	0.33	*Chelonia mydas*	Kili Island	Y	Y	Y	Y	n/a	n/a
		Eretmochelys imbricata	Kili Island	n/a	Y	Y	Y	n/a	n/a
		Dermochelys coriacea	n/a	N	N	N	Y	n/a	N
Namdrik	1.00	*Chelonia mydas*	Wonejo-en	Y	n/a	n/a	Y	n/a	n/a
Ebon	2.25	*Chelonia mydas*	n/a	Y	N	n/a	Y	n/a	n/a
		Eretmochelys imbricata	n/a	N	N	n/a	Y	n/a	n/a
Bikar	0.20	*Chelonia mydas*	Bikar, Jabwelo, Almani	Y	Y	n/a	Y	n/a	n/a

		Eretmochelys imbricata	n/a	Y	n/a	n/a	Y	n/a	n/a
Utdrik	0.20	*Chelonia mydas*	n/a	Y	n/a	n/a	n/a	n/a	N
Taka	1.32	*Chelonia mydas*	n/a	Y	Y (2003)	Y	Y	n/a	n/a
		Eretmochelys imbricata	n/a	n/a	n/a	Y	Y	n/a	n/a
Mejit Island	0.70	*Chelonia mydas*	n/a	Y	n/a	Y	Y	decreased	N
		Eretmochelys imbricata	n/a	N	n/a	n/a	Y	decreased	N
Ailuk	2.07	*Chelonia mydas*	n/a	Y	n/a	Y	Y	n/a	n/a
		Eretmochelys imbricata	n/a	N	N	n/a	Y	n/a	n/a
Jemo Island	0.06	*Chelonia mydas*	Jemo	Y	Y	n/a	Y	n/a	n/a
Likiep	4.00	*Chelonia mydas*	n/a	Y	Y	Y	Y	decreased	N
		Eretmochelys imbricata	n/a	N	N	Y	Y	decreased	N
Wotje	3.16	*Chelonia mydas*	Wonmej, Wotje	Y	Y	Y	Y	n/a	n/a

		Eretmochelys imbricata	n/a	Y	Y	Y	Y	n/a	n/a
Erikub	0.60	*Chelonia mydas*	Erikub, Loj, Aradojairen, Enego	Y	Y	n/a	Y	decreased	N
		Eretmochelys imbricata	n/a	Y	Y	n/a	Y	decreased	N
Maloelap	3.81	*Chelonia mydas*	Wonmak, Enebol, Loa	Y	Y	n/a	Y	n/a	N
Aur	2.17	*Chelonia mydas*	n/a	Y	Y	Y	Y	n/a	N
		Eretmochelys imbricata	n/a	N	N	Y	Y	n/a	N
Majuro	3.50	*Chelonia mydas*	n/a	Y	N	Y	Y	n/a	N
		Eretmochelys imbricata	n/a	N	N	Y	Y	n/a	N
		Dermochelys coriacea	n/a	N	N	n/a	Y	n/a	n/a
Arno	5.00	*Chelonia mydas*	Lonar	Y	n/a	Y	Y	n/a	n/a
		Eretmochelys imbricata	n/a	n/a	N	Y	Y	n/a	n/a

		Dermochelys coriacea	n/a	N	N	N	Y	n/a	n/a
		Lepidochelys olivacea	n/a	N	N	N	Y	n/a	N
Mili	6.00	*Chelonia mydas*	n/a	Y	n/a	Y	Y	decreas ed	N
		Eretmochelys imbricata	n/a	n/a	Y	Y	Y	decreas ed	N
		Lepidochelys olivacea	n/a	N	N	N	Y	n/a	N
Nadrikdri k (Knox)	0.38	*Chelonia mydas*	n/a	Y	n/a	n/a	Y	decreas ed	n/a
		Eretmochelys imbricata	n/a	Y	n/a	n/a	Y	decreas ed	n/a

FIGURES

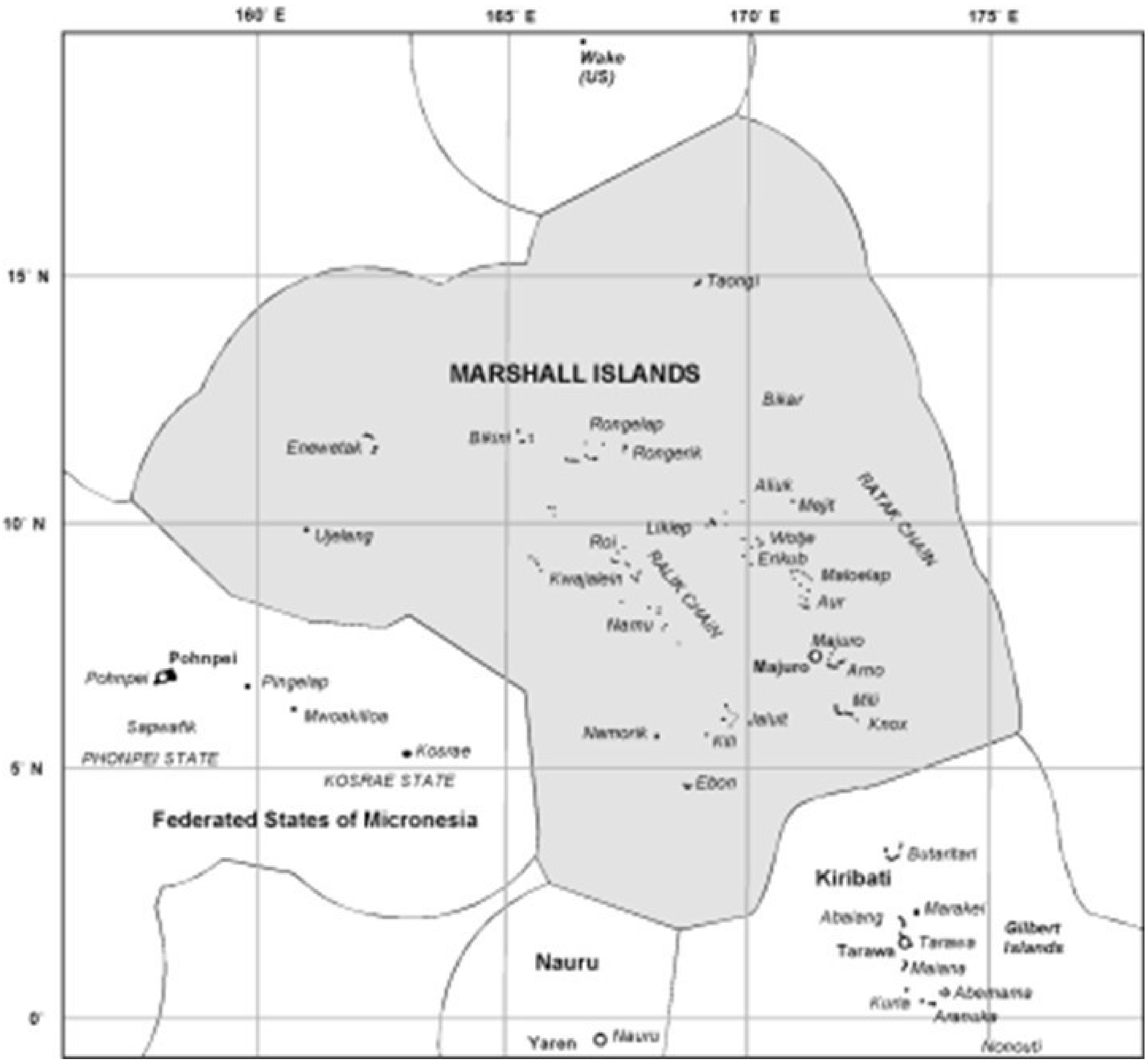

Figure 1. Estimation of EEZ for the Republic of Marshall Islands (source from 22). The grey area comprises about 750,000 square miles (1,900,000 km^2) of ocean (from 6, 47).

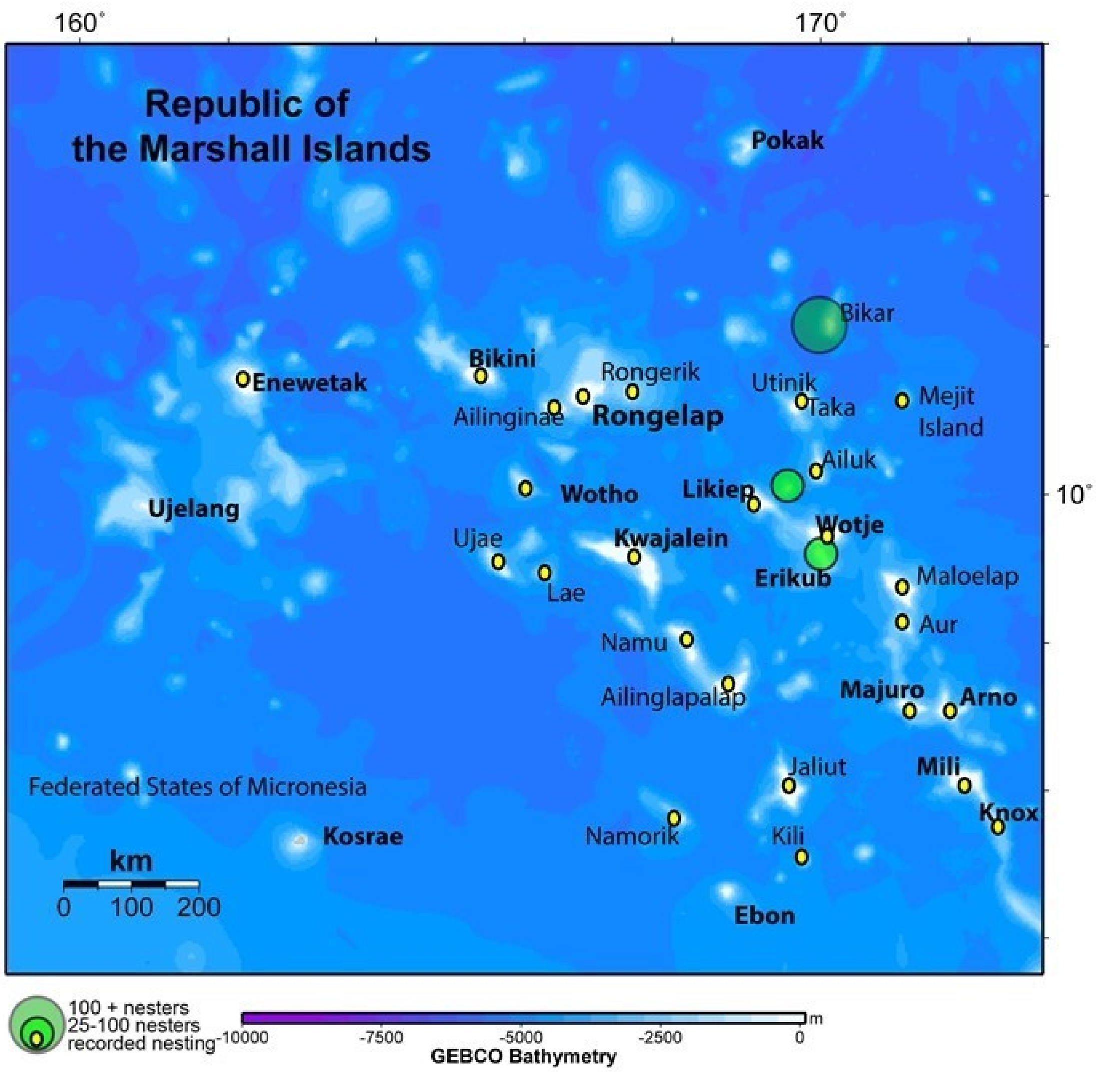

Figure 2. Distribution of green gurtle (*Chelonia mydas*) nesting sites (10, 14, 18). Size of circle is relative to approximate numbers of turtles nesting at that site.

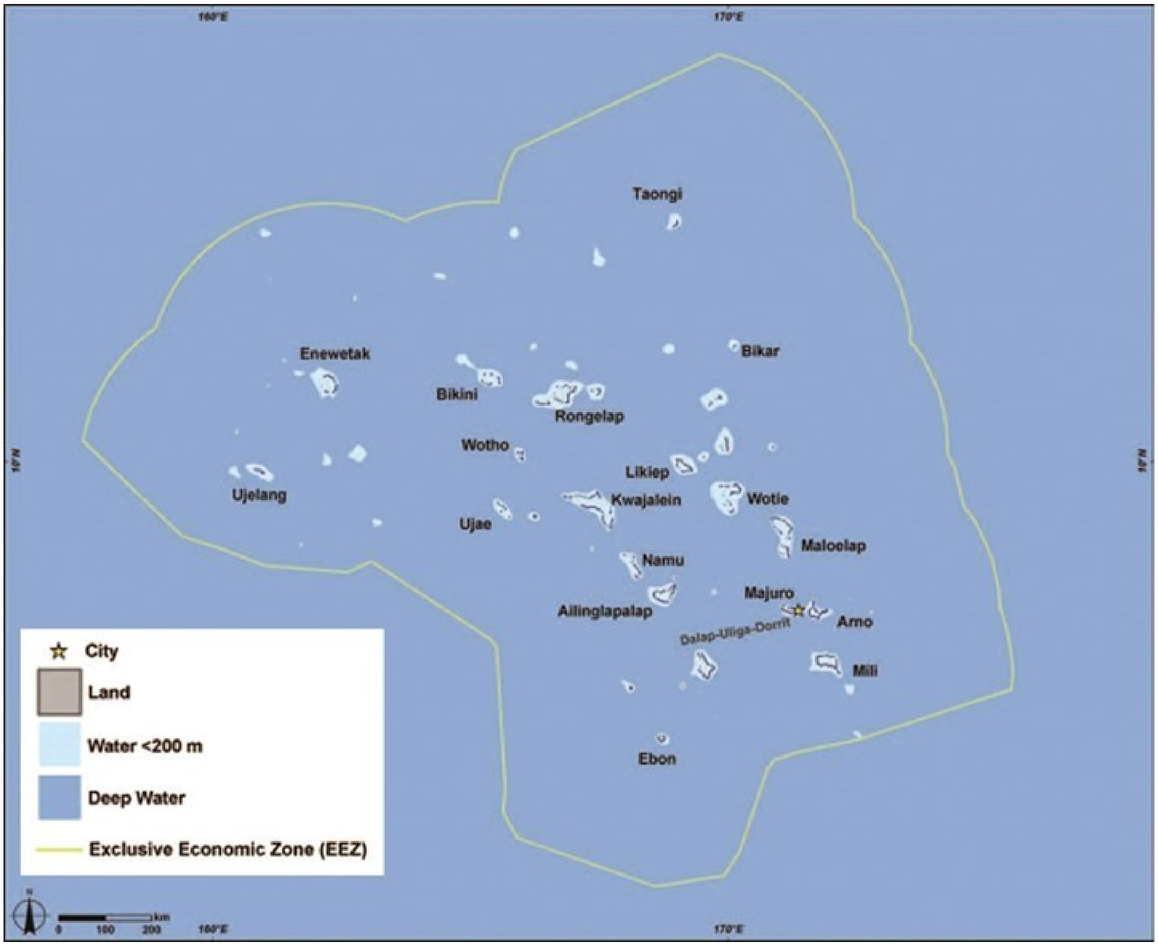

Figure 3. Green turtles (*Chelonia mydas*) can be found throughout the waters of the Republic of the Marshall Islands. Foraging and resting areas are in waters <200m, while pelagic foraging would happen in deeper waters (14, 18, 20, 25, 26, 27). The northern atoll of Taongi (Bokak) is the only atoll which currently was reported to not have green turtles, however, this status may have changed.

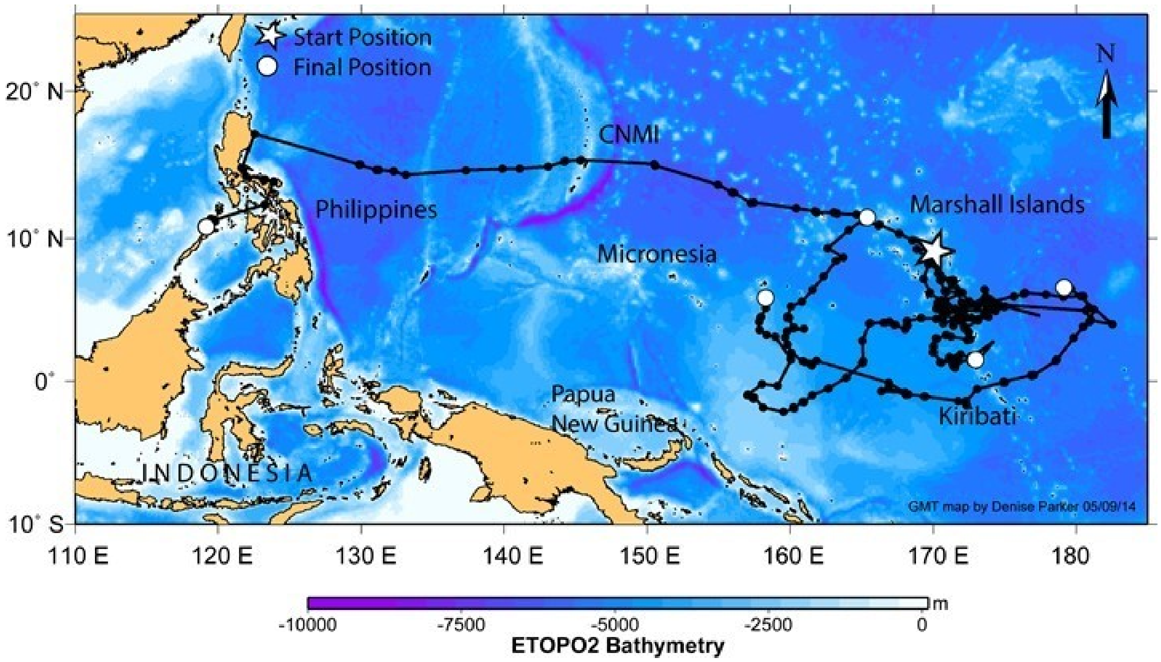

Figure 4. Distribution of post-nesting female green turtles (*Chelonia mydas*) after nesting at Loj islet, Erikub, in the Republic of the Marshall Islands (from 19).

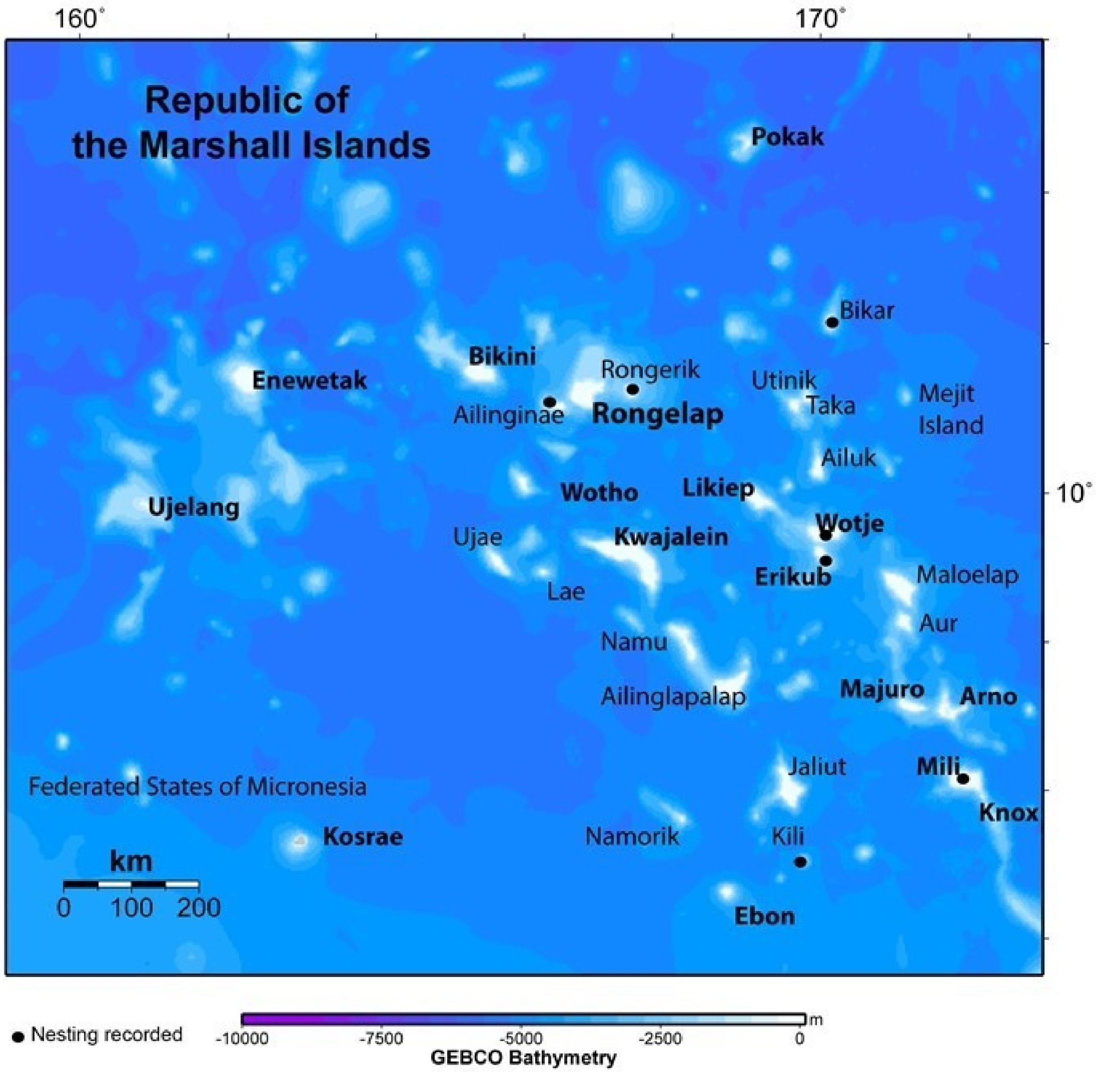

Figure 5. Distribution of nesting sites for the hawksbill turtle (*Eretmochelys imbricata*). Numbers of nesting turtles are not known, however, all indications are that numbers are low. (from 14, 18, 34, 35, 37).

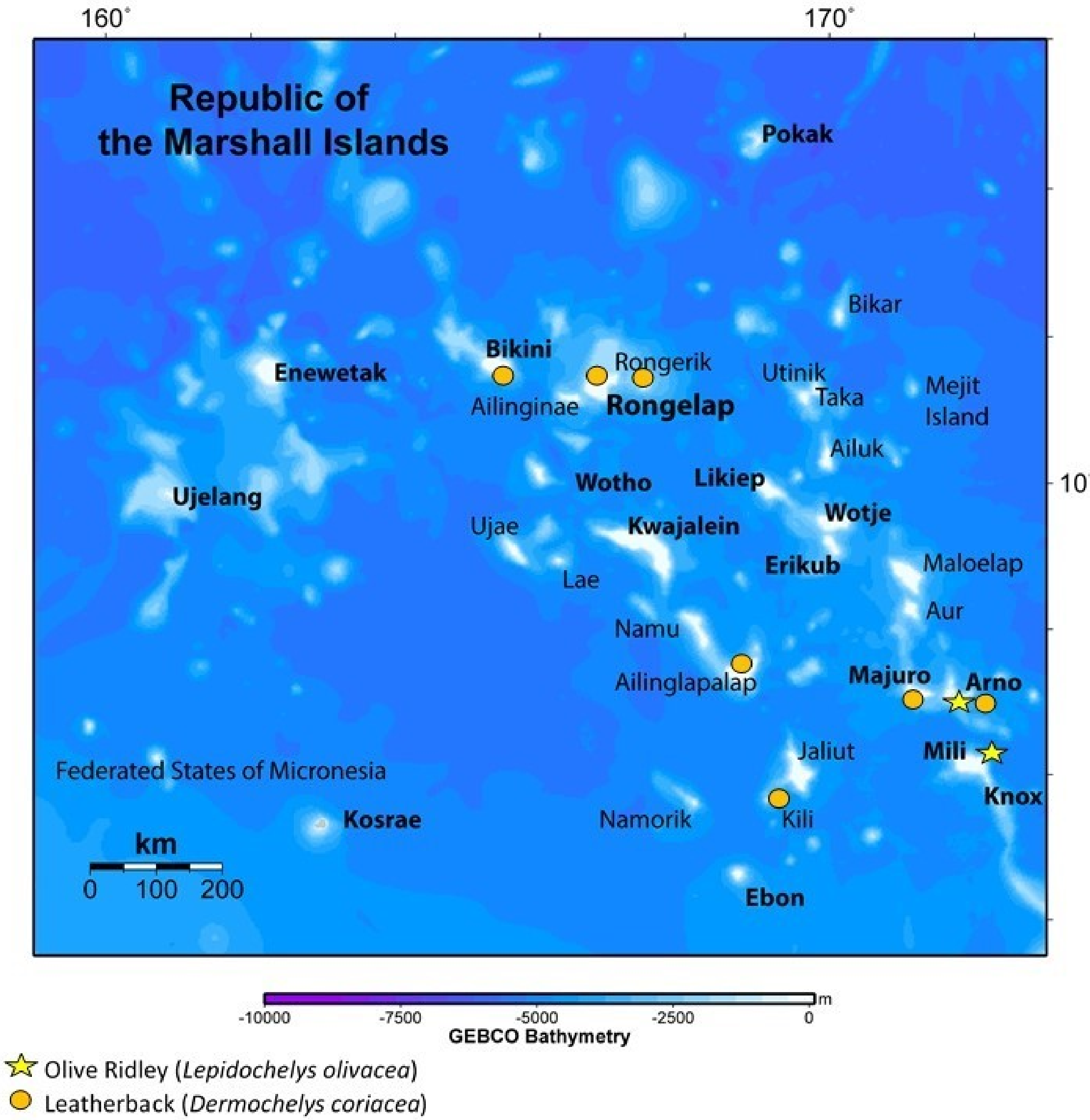

Figure 6. Distribution of reported sightings of leatherback (*Dermochelys coriacea*, orange circle) and olive ridley turtles (*Lepidochelys olivacea*, yellow star).

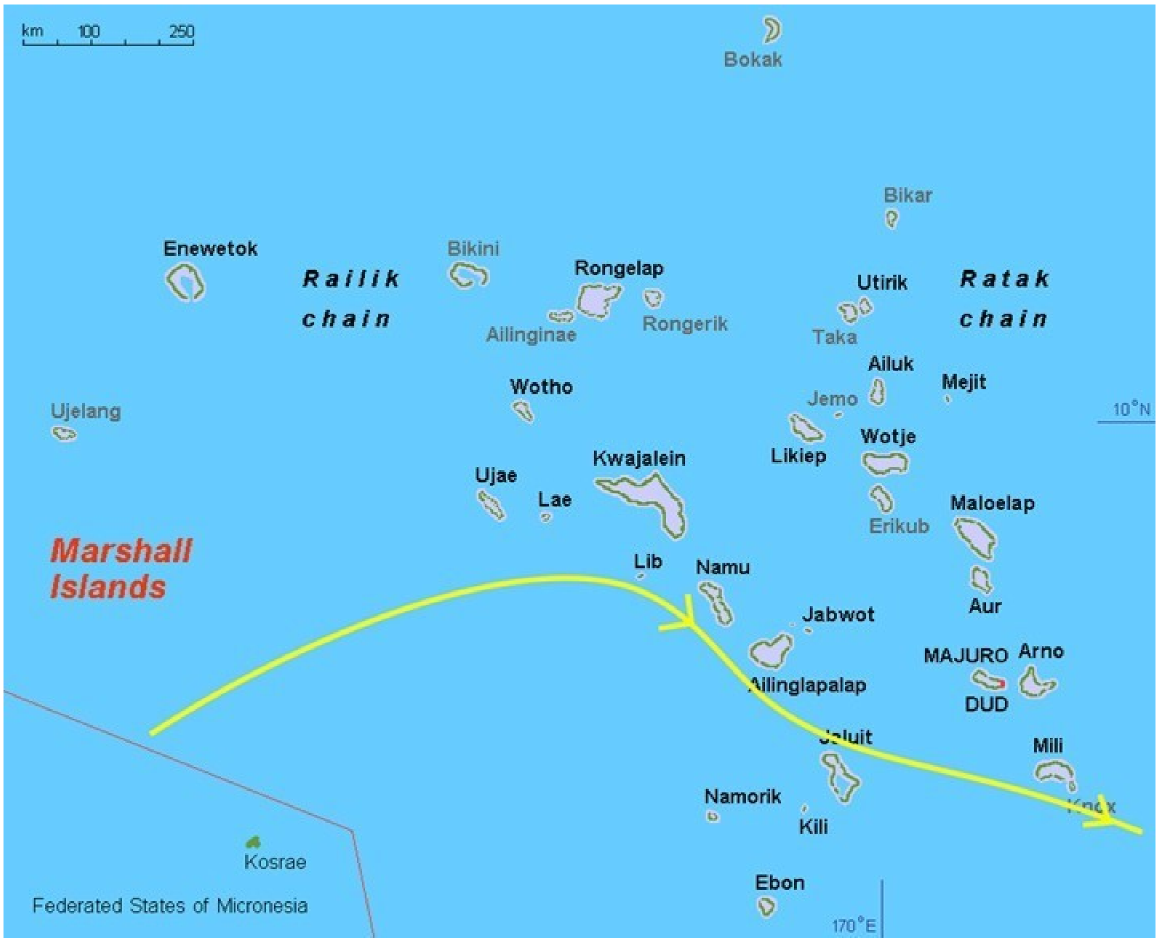

Figure 7. Approximate path of Ariti, sub-adult loggerhead turtle (*Caretta caretta*) satellite tracked by Te mana o te moana of French Polynesia (3, C. Gaspar, unpublished data).

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THE INDEPENDENT STATE OF SAMOA

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The Independent State of Samoa or Samoa consists of two main and seven small islands. The two main islands, Savaii (land area approximately 1,820 km^2) and Upolu (land area approximately 1,115 km^2 and home of the capital city, Apia), and two of the small islands, Manono (land area approximately 5 km^2) and Apolima (land area approximately 2 km^2), are inhabited. All islands are volcanic in origin and lie in the southwest Pacific between latitudes 13° 25' S and 14° 05' S, and longitudes 171° 23' W and 172° 48' W (5; Fig 1).

1 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central South Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

Hawksbill turtles are found in tropical, subtropical and temperate waters in all oceans of the world. However, nesting is confined to remote and obscure tropical beaches and occur in 70 countries (2, 8, 16, 17, 18, 19). Hawksbills that nest in Samoa are in the South Central Pacific DPS (1, 26).

Previous surveys have reported the months of September to July as the nesting period for hawksbill turtles with the months of January and February as the peak nesting months (Table 1). The Hawksbill turtle is the only species that nests in Samoa and their main nesting grounds are on the offshore islands of Aleipata on the eastern coast of Upolu. These offshore islands which are Namu'a, Nu'utele and Nu'ulua have been identified as the main nesting sites for the critically endangered hawksbill turtle (*Eretmochelys imbricata*; Fig 2). Namu'a Island has two beaches which cover approximately 820 m and only the beach on the eastern side has been identified as a nesting site. Nu'utele Island located approximately 1 mile from Upolu island consists of two main beaches; Nu'utele beach, on the eastern side, which has an estimated beach length of 430 m and Vini beach, on the western side, which has an estimated beach length of 690 m. Nu'ulua Island is furthest offshore at an approximately 2 miles from Upolu and has an estimated beach length of 445 m. (Table 2).

Over the surveyed years, monitoring has been sporadic and very limited due to the difficulty of accessing the nesting beaches and very limited funding. Thus, at this stage it is impractical to determine with absolute certainty the abundance or population trend of nesting Hawksbill turtles in Samoa. Nesting surveys conducted since 1993-94 to 2007-08 recorded low numbers of hatched nests. Throughout the surveyed years at least 2 hatched nests are found. The results for the 2009-2010 survey showed a relatively low number of recorded tracks and successful nests (Government of Samoa, Ministry of Natural Resources & Environment unpublished data). Witzell et al. (13) and Zann (14) suggested the nesting population of Samoan hawksbill turtles to be small, with no more than 45 females nesting annually on the Aleipata islands. It is unknown how many hawksbill turtles nested in 1993-94 but in 2003-04 and 2005-06 at least 1 turtle nested on the islands during the time of survey (10). During the 2007-08 survey, no hawksbill was documented nesting on the islands; however, one hawksbill was seen as it approached Tapana beach.

In analyzing the acquired data, there is clearly a declining trend in nesting activities throughout the years. As indicated in Figure 3, during the first three survey seasons (1971-72, 1992-93 and 2003-04) there were high numbers of nesting activity at Nu'ulua Island. However, in the 2005-06 season there was a steep decrease in nesting numbers (10). This level of has continued to the 2009-2010 season, except for the 2008-09 season. Similarly, this trend was the same for nesting activity at Vini beach, although there was a low activity recorded for the initial survey in the 1971-72 season. The trend for Nu'utele is like trends seen at Vini and Nu'ulua; except the initial numbers at this beach were much lower. As opposed to Vini, Nu'utele and Nu'ulua, Namu'a was the only nesting beach that recorded an increase in nesting activity during the 2005-06 season. But similarly, it has also experienced a declining trend ever since.

1.1.2 Marine areas

Hawksbills have been seen by divers on reefs around Samoa, mostly anecdotal sightings by dive tours (15, 20).

1.2 Other biological data

Other biological data are limited. The morphometric of one turtle recorded nesting on Vini beach is shown in Table 4.

1.3 Threats

1.3.1 Nesting sites

The greatest threat to the successful nesting of hawksbill turtles is human activity in the form of direct fishing or by-catch of turtles and the harvesting or illegal harvest of turtle eggs (2, 4, 5, 8, 11, 13, 14, 16). The possible harvesting of eggs from a confirmed nest that was located on Namu'a raises much concern on the ongoing unlawful activities by people which continue to hasten the declining trend of nesting activities of turtles. Another possible threat that would need substantial verification of its impacts is the newly established Aleipata Wharf. The possibility of harmful substances from travelling ships and the ship repair facility being discharged or escaping into the surrounding marine environment can potentially harm the health and the lives of the turtles and their foraging grounds that have been identified around the inshore area. Furthermore, the increase in ships and boats travelling within the area also increases the chance of turtles being struck which could lead to injury or fatality of these critically endangered creatures. There is also the threat of marine debris cluttering nesting beach areas (24, 25).

In addition to human threats, there are also natural factors or events that inevitably have an impact on the declining trend of nesting activity. The main natural threat is the presence of natural predators such as crabs, rats, and pigs. Fortunately, eradication processes have been carried out for rats and the capture and control of wild pigs has also seen the alleviation of these threats. The yellow crazy ant (*Anoplolepis gracilipes*) is another possible threat on the beaches of Vini, Nu'utele and Nu'ulua for the hatchlings and eggs. Another natural threat that was noticed is the impact of natural hazards such as the tsunami which led to the stranding of numerous turtles and the alteration of nesting habitats which may have impacted the number of successful nesting (5). The impacts of climate change with sea level rise and the increase in sea surface temperatures are also a threat, however, these impacts require in depth research and continuous monitoring in order to measure the scale of its effects (7, 9).

Natural threats have always existed, and turtles have always managed to adapt and survive for millions of years. However, the real concern lies with human threats because their impacts are more severe and immediate. Thus, attention should focus on addressing these human threats as they are threats that can be controlled and prevented, whereas the impacts of natural threats are not as severe and immediate. In addition, natural threats in many ways are inevitable, and sometimes attempts to control them may lead to more problems that are not always anticipated.

1.3.2 Marine areas

Threats in the marine areas of Samoa include human take both direct from nearshore reefs and indirect due to fishery interactions. Marine debris ingestion and entanglement can affect sea turtles by causing mortality (22, 24, 25). Interaction with pelagic commercial fisheries such as the international longline fishery are possible as post-nesting hawksbills may have extended pelagic phases when traveling from nesting beaches in Samoa to foraging areas on other island nations (27).

1.4 Conservation

Although illegal harvest of turtle eggs on the islands have been reported in the past, recent efforts by the Marine Conservation Section have been conducted to raise public awareness of the critical global population status of turtles and of the regulations which have been put in place to protect them. Furthermore, under the Marine Protected Areas Program that includes the Aleipata islands, regulations have been developed that includes the banning of the harvesting and consumption of turtle eggs (23). Local Fisheries Regulations in Samoa prohibits fishing for, possession or sale of hawksbill turtles under 70 cm Curved carapace length (CCL), as well as the disturbance or take of nests or eggs (23). While subsistence take is permitted, captivity of turtles without a permit is prohibited as well as commercial capture and sale of turtles. Sales of eggs are prohibited, and turtles caught during fishing activated are required to be released and reported (23).

Currently, there have been no studies done in Samoa on the impacts of climate change on the nesting population of hawksbill turtles and it is of a high priority that research must incorporate the impacts from climate change into their programs (28, 29).

Samoa is a signatory of CITES, CMS, and local laws are in place for protection of nests (Table 3).

1.5 Research

One satellite tagging study showed that post-nesting female hawksbill turtles can travel through many other island nations on their migratory routes between the nesting beaches and foraging areas (27), however more research should be done.

The ongoing monitoring is crucial in determining whether the decline in nesting activity observed is temporary and part of a natural reproducing cycle or an indication that hawksbill turtle population in Samoa is in critical danger.

More effort needs to be directed towards informing the public about the urgent need to protect our turtles and their active participation to save them from the dangers of extinction.

The following proposed recommendations are actions to be implemented in order to estimate the nesting population, understand nest ecology and success of hawksbill turtles in Samoa.

1) increase survey efforts and continue monitoring nesting beaches on the Aleipata islands during the nesting season of hawksbill turtles.

2) conduct research on the impacts of climate change on the nesting habitats.

3) encourage and involve communities, hotels and tour operators to monitor and report nesting activities on their beaches during nesting season.

4) continue to tag turtles and satellite tag nesting hawksbill to understand migration between foraging and nesting grounds.

5) continue the collection of tissue samples from all tagged turtles for analysis to provide information on identifying population groups or genetic stocks.

6) increase public awareness on the reporting of dead and entangled (alive or dead) turtles to allow for necropsy and sampling for genetic analysis.

7) secure funds to continue turtle research and monitoring surveys to keep track of the status of the nationally threatened nesting hawksbill turtles.

2 RMU: Green turtle (*Chelonia mydas*) - Central South Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

NONE

2.1.2 Marine areas

The green turtle (*Chelonia mydas*) is known to forage in the coastal waters around Samoa and is regularly sited by divers and fishermen in coastal areas (15, 20). Stranding information from Upolu Island for the 2009 Samoa Tsunami event indicate that green turtles are distributed along the South shore of Upolu Island with higher numbers found near the communities of Tafitoala and Malaela (5; Fig 4).

Adult green turtles are infrequently seen except between the months of December through February (12). It was conjectured that these adult turtles are part of the population that is nesting on nearby Rose Atoll, American Samoa (12).

2.2 Other biological data

No biological data is published from Samoa regarding this species (Table 1).

2.3 Threats

2.3.1 Nesting sites

Not applicable

2.3.2 Marine areas

Threats in the marine area of Samoa include human take due to fishery interactions. International pelagic fisheries include. Longline fisheries in other countries also affect turtles (22). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (24, 25).

Natural threats include predation from sharks or natural catastrophic events such as the 2009 Samoan tsunami (5).

2.4 Conservation

Samoa is a participating member of CITES (2, 23). Marine Wildlife Protecion Amendment Regulation 2018 prohibits fishing for, possession or sale of green turtles under 70 cm Curved carapace length (CCL), as well as the disturbance or take of nests or eggs (23). While subsistence take is permitted, captivity of turtles without a permit is prohibited as well as commercial capture and sale of turtles. Sales of eggs are prohibited, and turtles caught during fishing activated are required to be released and reported. (23).

More specific protections should be created with defined penalties and better enforcement capabilities.

2.5 Research

Some research ideas are as follow: 1) Research and documentation of numbers and size range of green turtles that forage around the islands of Samoa. 2) Tracking of juvenile and adult green turtle, by in-water capture and deployment of satellite tags to better understand the population dynamics of green turtles in the waters of Samoa.

3. RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1. Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

The leatherback (*Dermochelys coriacea*) is an intermittent visitor or vagrant within Samoa. This species has been captured in International and local fisheries within Samoan waters (22).

3.2 Other biological data

No biological data is published from Samoa regarding this species (Table 1).

3.3 Threats

3.3.1 Nesting sites

Not applicable

3.3.2 Marine areas

Threats in the marine area of Samoa include human take due to fishery interactions, both International pelagic fisheries and local fisheries (22). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (24, 25).

3.4 Conservation

Samoa is a participating member of CITES. Marine Wildlife Protection Amendment Regulation 2018 includes all turtle species found in Family Cheloniidae and Dermocheliidae so it covers both loggerheads and leatherbacks.

3.5 Research

Research and documentation of numbers and size range impacted by the pelagic longline fisheries would be a good starting point.

4 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

The loggerhead (*Caretta caretta*) is an intermittent visitor or vagrant Samoa. One sub-adult loggerhead tracked by Te mana o te moana traveled through the Samoan EEZ (21).

4.2 Other biological data

No biological data is published from Samoa regarding this species (Table 1).

4.3 Threats

4.3.1 Nesting sites

Not applicable

4.3.2 Marine areas

Threats in the marine area of Samoa include human take due to incidental fishery interactions (22). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (24, 25).

Natural threats include predation from sharks.

4.4 Conservation

Samoa is a participating member of CITES, and Marine Wildlife Protection Amendment Regulation 2018 includes all turtle species found in Family Cheloniidae and Dermocheliidae so it covers both loggerheads and leatherbacks.

4.5 Research

Research and documentation of numbers and size range impacted by the pelagic longline fisheries would be helpful to understand distribution of the South Pacific loggerhead.

Table 1. Key biological data for sea turtle species found near the Independent State of Samoa.

	EI-SC PAC	**Ref #**	**CM-SC PAC**	**Ref #**	**CC-S PAC**	**Ref #**	**DC-W PAC**	**Ref #**
Occurrence								
Nesting sites	Y		N		N		N	
Pelagic foraging grounds	n/a		JA		n/a		n/a	
Benthic foraging grounds	Y		Y		N		N	
Key biological data								
Nests/yr: recent average (range of years)	4 (2009-2010)		n/a		n/a		n/a	
Nests/yr: recent order of magnitude	Jan-22		n/a		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a		n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	6		n/a		n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a		n/a	

Nests/yr at "minor" sites: recent average (range of years)	4 (2009 - 2010)		n/a		n/a		n/a	
Total length of nesting sites (km)	2.4		n/a		n/a		n/a	
Nesting females / yr	n/a		n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	100cm		n/a		n/a		n/a	
Age at maturity (yrs)	n/a		n/a		n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a		n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a		n/a	

Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	Declining (report provided)		n/a		n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a		n/a	
Published studies								
Growth rates	N		N		N		N	
Genetics	N		N		N		N	
Stocks defined by genetic markers	N		N		N		N	
Remote tracking (satellite or other)	N		N		N		N	
Survival rates	N		N		N		N	
Population dynamics	N		N		N		N	
Foraging ecology (diet or isotopes)	N		N		N		N	
Capture-Mark-Recapture	N		N		N		N	

Threats								
Bycatch: presence of small scale / artisanal fisheries?	N		n/a		n/a		n/a	
Bycatch: presence of industrial fisheries?	Y		n/a		n/a		Y	
Bycatch: quantified?	N		n/a		N		N	
Take. Intentional killing or exploitation of turtles	N		Y		N		N	
Take. Egg illegal harvest	n/a		N		N		N	
Coastal Development. Nesting habitat degradation	n/a		n/a		N		N	
Coastal Development. Photopollution	n/a		n/a		N		N	
Coastal Development. Boat strikes	n/a		n/a		n/a		n/a	
Egg predation	n/a		N		N		N	
Pollution (debris, chemical)	n/a		n/a		n/a		n/a	
Pathogens	n/a		n/a		n/a		n/a	
Climate change	n/a		n/a		n/a		n/a	
Foraging habitat degradation	n/a		n/a		n/a		n/a	

Other	N		n/a		n/a		n/a	
Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	n/a		n/a		n/a		n/a	
Number of index nesting sites	n/a		n/a		n/a		n/a	
Monitoring at foraging sites (period: range of years)	n/a		N		n/a		n/a	
Conservation								
Protection under national law	Y		Y		n/a		n/a	
Number of protected nesting sites (habitat preservation) (% nests)	0		n/a		n/a		n/a	
Number of Marine Areas with mitigation of threats	n/a		0		n/a		n/a	
N of long-term conservation projects (period: range of years)	n/a		n/a		n/a		n/a	
In-situ nest protection (eg cages)	N		N		n/a		n/a	
Hatcheries	N		N		n/a		n/a	

Head-starting	N		N		n/a		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y		Y		Y		Y	
By-catch: onboard best practices	Y		Y		Y		Y	
By-catch: spatio-temporal closures/reduction	N		N		N		N	
Other	N		n/a		n/a		n/a	

Table 2. Nesting beaches for hawksbill turtles (*Eretmochelys imbricata*) in the Independent State of Samoa.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Central Point	
EI-SC PAC				**Long**	**Lat**
Beach Nu'ulua	Y	2 (2009-2010)	2 (2009-2010)	-14.07311	-171.40823
Beach Vini	Y	2 (2009-2010)	3 (2009-2010)	-14.05905	-171.42781
Beach Nu'utele	Y	0 (2009-2010)	1 (2009-2010)	-14.06326	-171.41899
Beach Namu'a	N	1 (2009-2010)	1 (2009-2010)	-14.02237	-171.41484

Table 3. Conventions and Regulations attended by the Independent State of Samoa.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention CITES	Y	Y	Y	CM, EI	banning the commerical sale of turtles, eggs, shells including export	Y
Convention CMS	Y	Y	Y	CM, EI	Protection of migratory turtles	Y
Convention CBD	Y	Y	n/a	CM, EI	critical habitats for turtles declared as protected	Y

Table 4: Morphometrics of the tagged Hawksbill nester on Vini beach.

Date	Location of beach		Flipper tags		CCL min (cm)	CCL Notch-tip (cm)	CCW (cm)
	Latitude	Longitude	Right	Left			
15/12/09	-14.0607	-171.4283	R39549	R39548	89	92	92.77

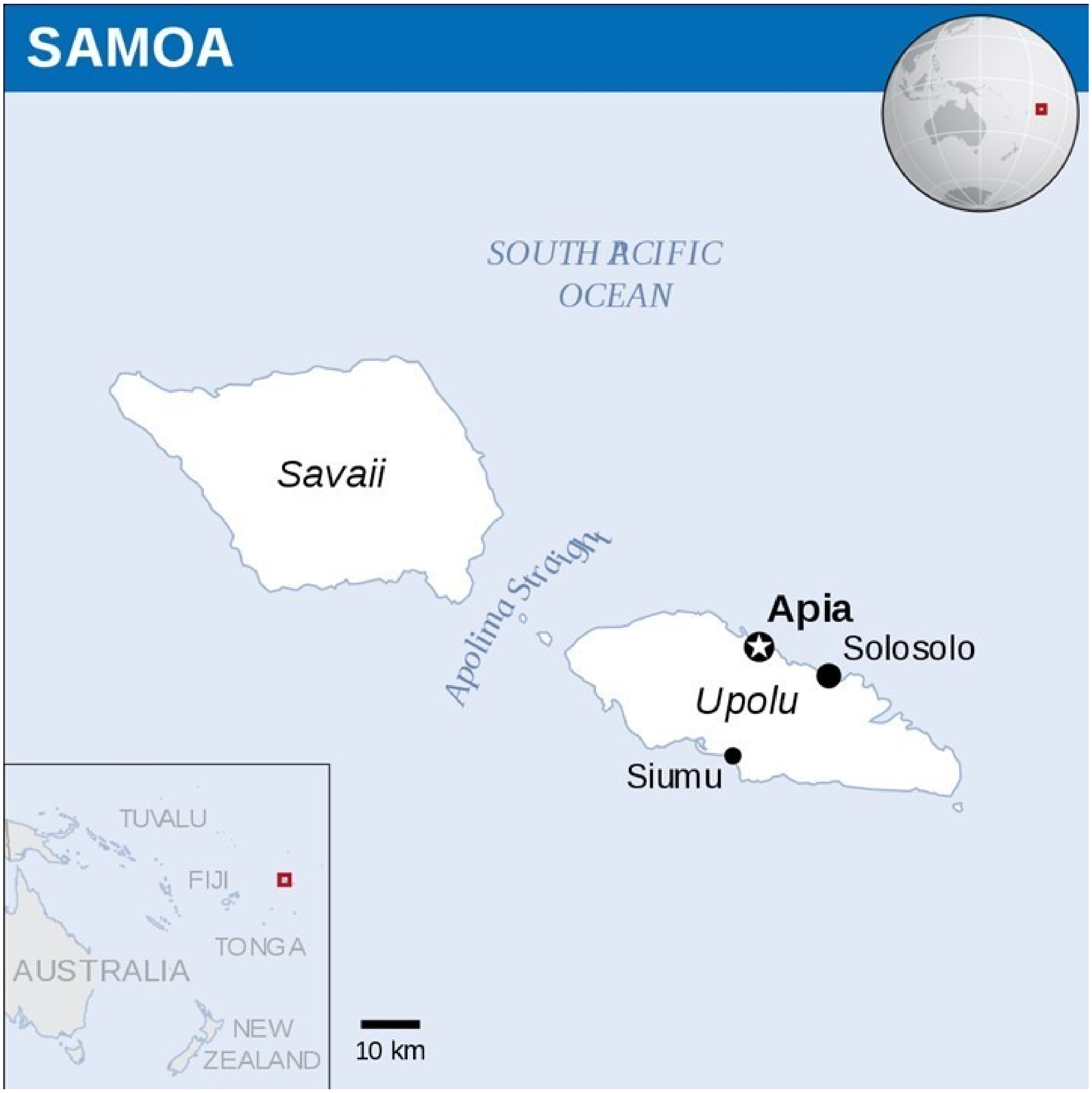

Figure 1. Map of the Independent State of Samoa. Credit: UN Office for the Coordination of Humanitarian Affairs (OCHA).

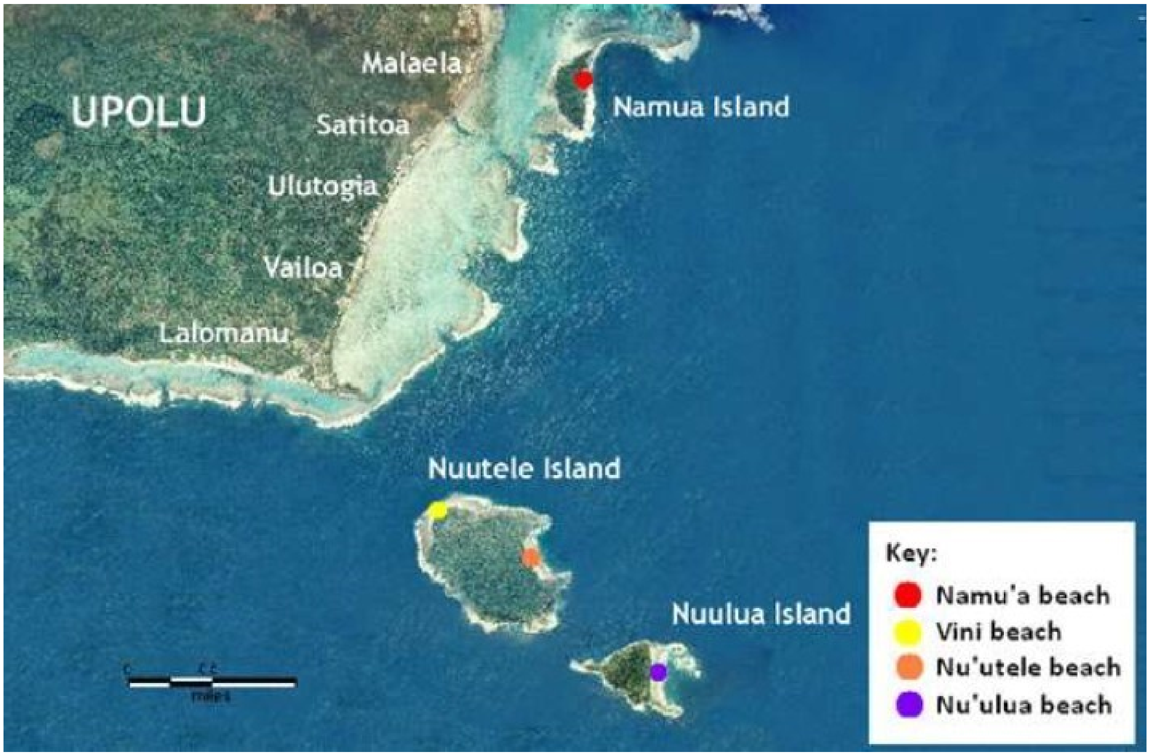

Figure 2. Location of the main nesting sites of the hawksbill turtles on the offshore islands of Aleipata: Namua, Nuutele and Nuulua which is located on the eastern coast of Upolu.

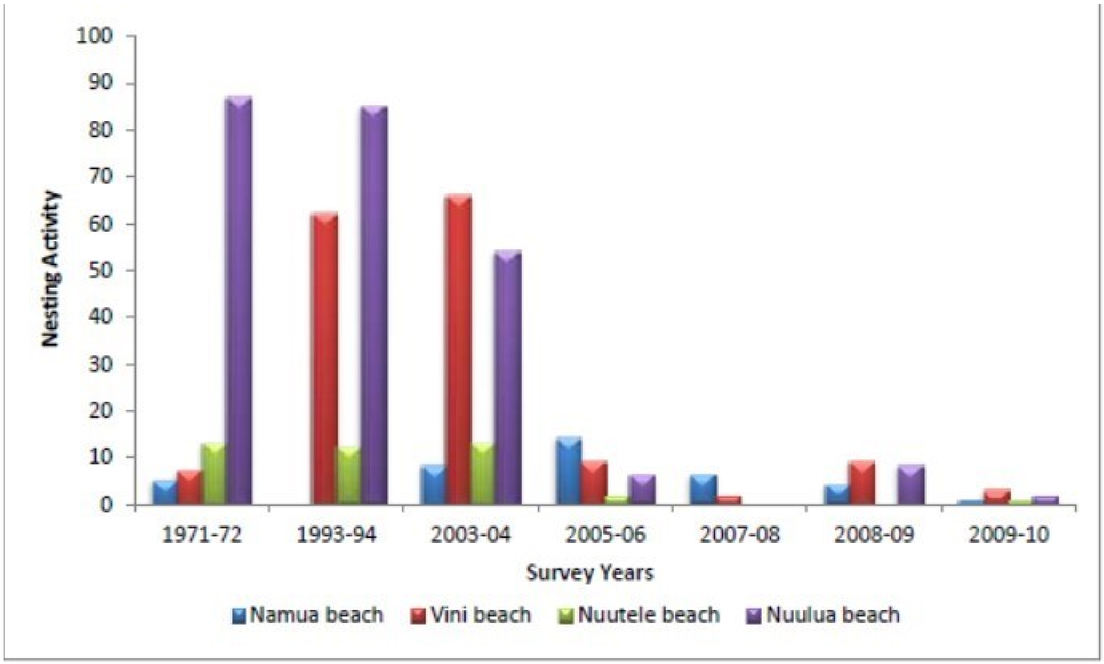

Figure 3. Nesting activities of the hawksbill turtle, *Eretmochelys imbricata*, which includes counts of tracks, hatched (successful, unsuccessful/undetermined) & abandoned nests on all the beaches.

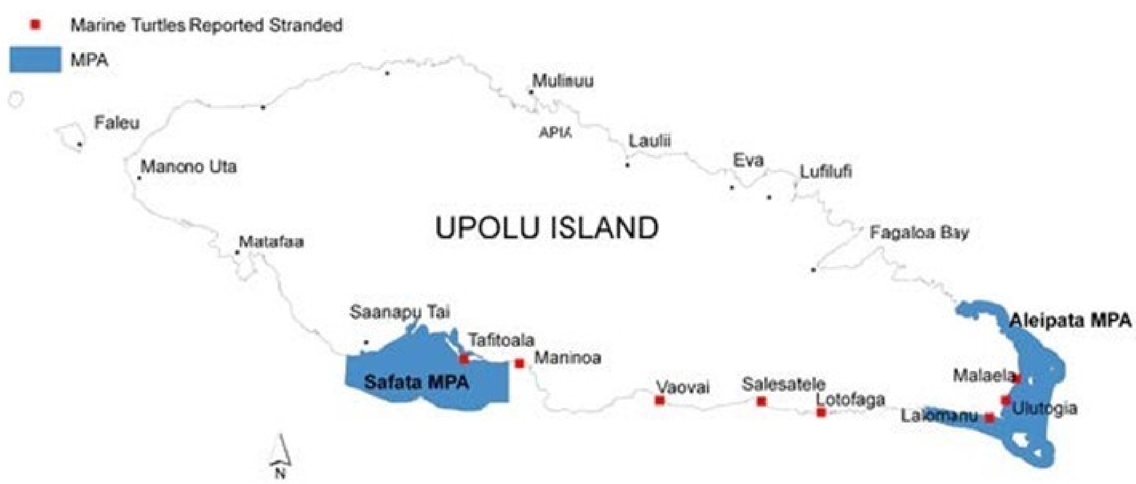

Figure 4. Map of Upolu Island in the Independent State of Samoa, with locations of stranded turtle from 2009. Credit: Bell et al. (from 5).

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SOLOMON ISLANDS

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1 RMU: *Chelonia mydas*, Southwest Pacific (CM-SW PAC)

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

Three major nesting sites have been identified based on the recent available information; they are in Arnavon Islands [1-2], Hakelake Island [1], and Kerihikapa Island [1]. No key biological data is available (Table 1). The ACMCA is the only nesting site in the Solomon Islands with consistent monitoring of nesting activities.

1.1.2 Marine areas

The green turtle feeding areas have been identified in Marovo Lagoon in New Georgia [3], Mbanika and Pavuvu in The Russell islands [3], Tetepare Islands [4] and Kolombangara [5]. A small number of juveniles has also been reported at Arnavon Marine Conservation Area (AMCA) [6]. In addition, SPREP flipper tags and recent satellite tagging have shown that green turtles migrate to forage in Australia and Papua New Guinea [6, 7]. Intentional exploitation of green turtles [4, 8-10], particularly with spear guns [8, 11] , have been noted but not quantified.

1.2 Other biological data

The mean curved carapace length of nesting green turtles is 96.5 cm (N =2) [4].

1.3 Threats

1.3.1 Nesting sites

The threats to the nesting sites are illegal harvest of eggs and nesters [4], natural predation which includes crabs, megapodes and iguanas [6], earthquake that impacted the beaches on Tetepare Islands [4], and erosion due to climate change impacts [12].

1.3.2 Marine areas

Green turtles are most commonly used for subsistence purposes, where they are consumed by the family of the fisher that captured the specimen/s [9-10]. Turtle catch/harvest is dominated by immature green turtles [10]. The use of underwater flashlights, spear guns and hooks has resulted in an increase of both catch and bycatch [11].

1.4 Conservation

All sea turtles in the Solomon Islands are currently protected under "The Wildlife Protection and Management Act 1998; Fisheries Regulation LN 43/1993". The main objectives of the Act are to provide for the protection, conservation and management of wildlife in Solomon Islands by regulating the export and import of certain animals and plants [13]. The fisheries regulation ensures protection of nesting turtles, their eggs and nests during the nesting season. The nesting beaches can be declared a protected area under the "Protected Area Act 2010". Solomon Islands has signed several international conventions that have a nexus to conservation of all sea turtle species (Table 3).

1.5 Research

Literature review shows missing key information for green turtles in the Solomon Islands, as little is known about their nesting and foraging activities.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Southwest Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

The recent available information reports that the main hawksbill turtle nesting sites are in Arnavon Islands [1, 2, 7], Big Maleivona Island, Kerihikapa Island, Sikopo

Island, and Small Maleivona [14,15]. Remigration period is quite broad, ranging from 2 to 7 years [15]. The ACMCA is the only nesting site in the Solomon Islands with consistent monitoring of nesting activities, and a long-term study revealed a growing population [15].

2.1.2 Marine areas

Marovo Lagoon in New Georgia [3] and Kolombangara are known foraging grounds for the hawksbill turtle [4]. Tag recovery has shown that adult hawksbills move between Solomon Islands and PNG, where they forage at Fishermen's Island and Tagula Island, as well as between Solomon Islands and Torres Strait and GBR in Australia. The latter is also a destination used by the juvenile hawksbills [14, 15]. Tag recovery and satellite tracking suggest that hawksbill turtles travel distances of 800 to 1650 km [15].

2.2 Other biological data

On average, each female produces 4 to 5 clutches in the same nesting season [14]. The remigration interval is quite broad, ranging from 2 to 7 years [15].

2.3 Threats

2.3.1 Nesting sites

The threats to the nesting sites are illegal harvest of eggs and adult turtles [9], natural predation which includes crabs, megapodes and iguanas [6], and erosion due to climate change impacts [12].

2.3.2 Marine areas

Hawksbill turtles are most commonly used for subsistence purposes and most likely consumed by the family of the fisher that captured the turtle/s [9-10]. Turtle catch/harvest using spear guns have been estimated in about 26% of the total artisanal fishery catch [10]. Interviewed fishers revealed that hawksbill turtle products are more likely to be illegally sold to local and international markets [10]. In addition, the use of underwater flashlights, spear guns and hooks has resulted in an increase of both catch and bycatch [8, 11].

2.4 Conservation

Same as 1.4.

2.5 Research

The hawksbill turtle has been the focus of several published papers reporting findings from molecular analyses [16, 17, 24], temporal and spatial distribution [15, 16], foraging ecology [18], and population dynamics and survival rates [15]. In particular, it is worth noting an increasing trend at nesting sites [15].

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

Three major leatherback nesting sites have been reported; on Sasakalo in Santa Isabel Island, where 27 nesters and 132 nests were recorded in 2000 nesting season [6], Tetepare Island [4, 7], and Zaira beach in Vangunu Island, where 23 nests were reported between 2011 to 2014 nesting season [19].

3.1.2 Marine areas

Satellite tracks shows that the female leatherbacks nesting in Solomon Islands forage at high latitude off Tasman Sea [20], Papua New Guinea, and Fiji [19].

3.2 Other biological data

Adult leatherback females nest 2 to 6 times per season [19]. The mean clutch size of a nest is 95 eggs (ranges 66 -124 eggs) [19]. The hatching success (60%) is available for only one wild nest [21], while in hatchery conditions the mean hatching success was 67% [19].

3.3 Threats

3.3.1 Nesting sites

The threats to the nesting sites include natural predation, e.g. from crabs, megapodes and iguanas [6], and erosion due to climate change impacts [12].

3.3.2 Marine areas

Driftnets (DN) and gillnets (OTH) fisheries may pose a significant threat to leatherback turtles [22].

3.4 Conservation

In addition to 1.4, which applies to all sea turtle species, the leatherback turtle is further protected under "Protection of certain turtles LN 112/1977" [13].

3.5 Research

Literature review shows limited information for leatherback turtles in Solomon Islands.

4 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

There is no record of the loggerhead sea turtle nesting in Solomon Islands [7, 23].

4.1.2 Marine areas

None available.

4.2 Other biological data

None available.

4.3 Threats

4.3.1 Nesting sites

Not applicable.

4.3.2 Marine areas

None available.

4.4 Conservation

Same as 1.4.

4.5 Research

Literature review shows that virtually no information is available for loggerhead turtles in the Solomon Islands.

5 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

Limited information is available, whereby one nest, one nesting activity, and two successful hatching events have been reported in total for Wiahau [5], Waihaoru beach in Makira [10], and Shortland Islands [23].

5.1.2 Marine areas

None available.

5.2 Other biological data

The clutch size and emergence success calculated from a single nest are 85 eggs and 48%, respectively [5].

5.3 Threats

5.3.1 Nesting sites

None available.

5.3.2 Marine areas

Intentional killing and exploitation of olive ridley for subsistence purposes in Kaonasugu and Wagina communities was estimated to be 0.5% of the total catch [10].

5.4 Conservation

Same as 1.4.

5.5 Research

Literature review shows that virtually no information is available for olive ridley turtles in the Solomon Islands.

Table 1. Biological and conservation information about sea turtle Regional Management Units in the Solomon Islands

RMU **(all RMUs of all species occurring in a Country or Region)**	**CM-SW PAC**	**Ref #**	**EI-SW PAC**	**Ref #**	**DC-W PAC**	**Ref #**	**CC-S PAC**	**Ref #**	**LO-W PAC**	**Ref #**
Occurrence										
Nesting sites	Y	[1,2,4,7]	Y	[2,3,6,7, 14,15]	Y	[2,4,6,7, 19,20,2 1]	N	[7,23]	Y	[2,5,10]
Pelagic foraging grounds	Y	[6,7]	Y	[15]	Y	[19,20]	n/a	n/a	n/a	n/a
Benthic foraging grounds	Y	[3,4,5,6, 7]	Y	[3,4,5,7, 14,15]	n/a	n/a	n/a	n/a	n/a	n/a
Key biological data										
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	3	[1,6]	5	[1, 2, 7, 14, 15]	3	[4,6,7,1 9]	n/a	n/a	n/a	n/a

Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	3	[4,7,14]	5	[7]	8	[4,6,7,19,21]	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	4 to 5	[14]	2 to 6	[19]	N	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	2 to 7	[15]	n/a	n/a	N	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	66 (N=11)	[19]	N	n/a	85 (N=1)	[5]

Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	42.1 (N=1 nest)	[21]	N	n/a	48% (N=1)	[5]
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	Y [1991-2012] Increasing	[15]	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	Y (1976-1977)	[24]	Y (1976-1977)	[24]	Y (1976-1977)	[24]	n/a	n/a	n/a	n/a
Published studies										
Growth rates	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Genetics	N	n/a	Y	[16, 24]	Y	[25]	N	n/a	N	n/a

Stocks defined by genetic markers	N	n/a	Y	[17, 24]	Y	[17,20,25]	N	n/a	N	n/a
Remote tracking (satellite or other)	N	n/a	Y	[15]	Y	[19,20]	N	n/a	N	n/a
Survival rates	N	n/a	Y	[15]	N	n/a	N	n/a	N	n/a
Population dynamics	N	n/a	Y	[15]	N	n/a	N	n/a	N	n/a
Foraging ecology (diet or isotopes)	N	n/a	Y	[18]	N	n/a	N	n/a	N	n/a
Capture-Mark-Recapture	Y	[4]	Y	[15,16]	N	n/a	N	n/a	N	n/a
Threats										
Bycatch: presence of small scale / artisanal fisheries?	Y (OTH)	[8,11]	Y (OTH)	[8]	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	n/a	n/a	n/a	n/a	Y (DN, OTH)	[22]	n/a	n/a	n/a	n/a
Bycatch: quantified?	N	n/a	N	n/a	N	n/a	N	n/a	N	n/a
Take. Intentional killing or exploitation of turtles	Y	[8,9,10]	Y	[8,9,10, 23]	n/a	n/a	n/a	n/a	Y	[10]
Take. Egg illegal harvest	Y	n/a	Y	[9]	n/a	n/a	N	n/a	n/a	n/a

Coastal Development. Nesting habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Coastal Development. Photopollution	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	Y	[6]	Y	[6]	Y	[6,21]	N	n/a	n/a	n/a
Pollution (debris, chemical)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	Y	[4,12]	Y	[12]	Y	[12]	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)										
Monitoring at nesting sites (period: range of years)	Y (1991-ongoing)	[2]	Y (1991-ongoing)	[2,15]	Y	[4]	n/a	n/a	n/a	n/a
Number of index nesting sites	4		4	n/a	3	[4,6,24]	n/a	n/a	n/a	n/a

Monitoring at foraging sites (period: range of years)	Y (2004-2008) (2009-ongoing)	[4]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Conservation										
Protection under national law	Y	[13]	Y	[13]	Y	[6]	Y	[13]	Y	[13]
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	2	[13]	2	[13,14]	1	[21]	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	1	[5]	1	[5]	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	Y	[5]	Y	[5]	Y	[19]	N	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	Y	[19]	N	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	N	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	N	[13]	N	[13]	N	[13]	N	[13]	N	[13]

By-catch: onboard best practices	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Green, hawksbill, leatherback, and olive ridley turtles nesting sites reported for Solomon Islands in the last twenty years. (Note: central point refers to the island, not the single beach).

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CM-SW PAC				**lat**	**long**	**lat**	**long**	**lat**	**long**					
Arnavon Islands, Isabel Province	Y	25 (1976-1977)	n/a	n/a	n/a	n/a	n/a	-8.05923	159.1447	n/a	n/a	[1,2]	n/a	n/a
Arnavon Islands, Isabel Province	Y	5	n/a	n/a	n/a	n/a	n/a	-8.05923	159.1447	n/a	n/a	[1,2]	n/a	n/a
Hakelake Island	Y	15 to 20	n/a	n/a	n/a	n/a	n/a	-7.89722	159.24222	n/a	n/a	[1]	n/a	n/a

Kaife beach,Tetepare Island	N	2 (2006)	n/a	n/a	n/a	n/a	n/a	-8.74128	157.55893	n/a	n/a	[4]	n/a	n/a
Kerehikapa Island	Y	53	n/a	n/a	n/a	n/a	n/a	-745468	158.02241	n/a	n/a	[1]	n/a	n/a
Tetepare Island	N	5	n/a	n/a	n/a	n/a	n/a	-8.74128	157.55893	n/a	n/a	[7]	n/a	n/a
Tirokofi beach,Tetepare Island	N	2 (2005)	n/a	n/a	n/a	n/a	n/a	-8.74128	157.55893	n/a	n/a	[4]	n/a	n/a
DC-W PAC				**lat**	**long**	**lat**	**long**	**lat**	**long**					
Rendova Island	N	1	n/a	n/a	n/a	n/a	n/a	-8.55093	157.30862	n/a	n/a	[7]	n/a	n/a
Haevo beach, Santa Isabel Island	N	1 (2020)	n/a	n/a	n/a	n/a	n/a	-7.6625	158.6201	n/a	n/a	[21]	n/a	n/a
Lilika Bay,Santa	N	10	n/a	n/a	n/a	n/a	n/a	-7.6625	158.6201	n/a	n/a	[7]	n/a	n/a

Isabel Island														
Litogahira beach, Santa Isabel Island	N	n/a	n/a	n/a	n/a	n/a	n/a	-7.6625	158.6201	n/a	n/a	[21]	n/a	n/a
Marungu beach,Vangunu Island	N	4 (2005-2006)	n/a	n/a	n/a	n/a	n/a	-8.65473	158.00005	n/a	n/a	[19]	n/a	n/a
Queru beach,Tetepare Island	N	n/a	n/a	n/a	n/a	n/a	n/a	-8.74128	157.55893	n/a	n/a	[4]	n/a	n/a
Sasakalo beach, Santa Isabel Island	Y	25 (1993)	n/a	n/a	n/a	n/a	n/a	-7.6625	158.6201	n/a	n/a	[6]	n/a	n/a
Sasakalo beach, Santa Isabel Island	Y	25(1995)	n/a	n/a	n/a	n/a	n/a	-7.6625	158.6201	n/a	n/a	[6]	n/a	n/a
Sasakalo beach, Santa	Y	27 (2000)	n/a	n/a	n/a	n/a	n/a	-7.6625	158.6201	n/a	n/a	[6]	n/a	n/a

Isabel Island														
Sasakalo beach, Santa Isabel Island	Y	n/a	n/a	n/a	n/a	n/a	n/a	-7.6625	158.6201	n/a	n/a	[21]	n/a	n/a
Sasakalo beach, Santa Isabel Island	Y	59	n/a	n/a	n/a	n/a	n/a	-7.6625	158.6201	n/a	n/a	[7]	n/a	n/a
Tetepare Island	Y	n/a	n/a	n/a	n/a	n/a	n/a	-8.74128	157.55893	n/a	n/a	[4]	n/a	n/a
Tetepare Island	Y	20	n/a	n/a	n/a	n/a	n/a	-8.74128	157.55893	n/a	n/a	[7]	n/a	n/a
Tofa beach,Tetepare Island	N	n/a	n/a	n/a	n/a	n/a	n/a	-8.74128	157.55893	n/a	n/a	[4]	n/a	n/a
Wanione Bay, San Cristobal Island	N	1	n/a	n/a	n/a	n/a	n/a	-10.57374	161.80969	n/a	n/a	[7]	n/a	n/a

Zaira beach,Vangunu Island	Y	23 (2011-2014)	n/a	n/a	n/a	n/a	n/a	-8.65473	158.00005	n/a	n/a	[19]	n/a	n/a
EI-SW PAC				**lat**	**long**	**lat**	**long**	**lat**	**long**					
Arnavon Islands, Isabel Province	Y	630 (1976-1977)	n/a	n/a	n/a	n/a	n/a	-8.05923	159.1447	n/a	n/a	[1]	n/a	n/a
Arnavon Islands, Isabel Province	Y	149	n/a	n/a	n/a	n/a	n/a	-8.05923	159.1447	n/a	n/a	[7]	n/a	n/a
Big Maleivona Island	Y	131 (1979-2000) (1991-2012)	n/a	n/a	n/a	n/a	n/a	-7.48361	158.05055	2.544	n/a	[14,15]	n/a	n/a
Choiseul Island	N	1	n/a	n/a	n/a	n/a	n/a	-7.05014	156.95114	n/a	n/a	[7]	n/a	n/a
Kerehikapa Island	Y	518 (1979-2000)	n/a	n/a	n/a	n/a	n/a	-7.45468	158.02241	1.484	n/a	[14,15]	n/a	n/a

		(1991-2012)												
Kia, Santa Isabel Island	N	1	n/a	n/a	n/a	n/a	n/a	-7.56669	158.44657	n/a	n/a	[7]	n/a	n/a
Nelua, Santa Cruz Island	N	1	n/a	n/a	n/a	n/a	n/a	-10.95654	166.36213	n/a	n/a	[7]	n/a	n/a
Obeani Island	N	18	n/a	n/a	n/a	n/a	n/a	-6.85027	156.18416	n/a	n/a	[7]	n/a	n/a
Sikopo Island	Y	321 (1979-2000) (1991-2012)	n/a	n/a	n/a	n/a	n/a	-7.44744	157.98068	5.042	n/a	[14,15]	n/a	n/a
Small Maleivona Island	Y	20(1979-2000) (1991-2012)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.346	n/a	[14,15]	n/a	n/a
Wagina Island	N	2	n/a	n/a	n/a	n/a	n/a	-7.44549	157.77352	n/a	n/a	[7]	n/a	n/a

LO-W PAC				**lat**	**long**	**lat**	**long**	**lat**	**long**					
Shortland Islands	N	n/a	n/a	n/a	n/a	n/a	n/a	-7.04522	155.73717	n/a	n/a	[23]	n/a	n/a
Waihaoru beach, San Cristobal Island	N	n/a	n/a	n/a	n/a	n/a	n/a	-10.57374	161.80969	n/a	n/a	[10,23]	n/a	n/a
Waihau, Malaita Island	N	n/a	n/a	n/a	n/a	n/a	n/a	-8.94461	160.90712	n/a	n/a	[10]	n/a	n/a

Table 3. International conventions that have a nexus to sea turtle conservation signed by the Solomon Islands

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention on Migratory Species	Y	N	n/a	ALL	Protection of all the migratory species in Solomon waters.	Sea Turtles are one of the migratory species that CMS ensures is protected by different range states as well.
Convention on International Trade of Endangered Species	Y	Y	n/a	ALL	The Wildlife Protection and Management Act, 1998; Fisheries Regulatin LN 43/1993 prohibits take of eggs/nesting turtles/management area or trade. Protection of certain turtles LN 112/1977 low population of leatherback ensures the species is protected.	Sea turtles are listed under the Act, thus trade was is not allowed for commercial purposes.
Convention on Biological Diversity	Y	Y	n/a	ALL	Fisheries Act(No. 6 of 1998) for protection and managing in a sustainable manner.	Five species of sea turtles have been reported within the Solomon waters.

					However does not accommodate for protection of turtle at foraging ground. The fishing gears and methods should be prohibited using appropriate provisions.	There is very minimal protection for these species.
Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPF Convention)	Y	Y	n/a	ALL	Regulatory measures in place such as the use of specific types of gears that ensures, effective management and the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean.	Sea turtles as by-catch species.
United Nations Framework Convention on Climate Change	Y	Y	n/a	ALL	The Convention looks at reducing the emission of harmful gasses by nations that alters the composition of the global atmosphere in a destructive manner, which is aimed at reducing	The rise in beach temperature, which is nesting grounds for sea turtles, will affect the gender of the hatchlings that are produced causing an imbalance. The rise in sea temperatures might also affect the seagrass

					temperatures and sea level rise.	production which is green turtle diet.
United Nations Convention on the Law of the Sea	Y	Y	n/a	ALL	UNCLOS looks at defining boundaries for national countries to govern and manage their marine resources	In the Solomon, sea turtles are generally considered a marine resource

Table 4. Projects and Databases for theSolomon Islands

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/ Private	Collaboration with	Reports / Information material	Current Sponsors	Primary Contact (name and Email)	Other Contacts (name and Email)

1	Dc Pacific West	Solomons	Tetepare Islands	Tetepare Conservation Project		1990s	ongoing	Tetepare Descendants Association (TDA)	Private	Critically Ecosystem Partnership Fund (CEPF); Solomon Islands Community Conservation Partnership (SICCP); European Union(EU); WWF; AusAID; the American Museum of Natural History; NZAID; Conservation Agreement Fund; Conservation Ark, Global Leadership Foundation; NOAA; Canadian University Services Overseas (CUSO)	https://www.tetepare.org/tetepare-research-and-monitoring.html	Critically Ecosystem Partnership Fund (CEPF); Solomon Islands Community Conservation Partnership (SICCP)		

2	Cm Pacific South west; Ei Pacific South west	Solomon	Kolombangara	Community Based Turtle Monitoring		2013	2014	Rufford Foundation	Private	Birdlife International/Conservation/Fauna & Flora International/Wildlife Conservation Society	https://www.rufford.org/projects/ferguson_vaghi			
3	Ei Pacific South west	Solomon	Arnavon Islands	Arnavon Community Marine Park (formerly Arnavons Community Marine Conservation Area) Project		1991	ongoing	The Nature Conservancy	Private	Communities Kia, Wagina and Katupika; TNC; The Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM); Isabel and Chiousel Provincial government	https://www.nature.org/en-us/about-us/where-we-work/asia-pacific/the-pacific-islands/stories-in-the-pacific-islands/communities-supporting-sea-turtles/	The Nature Conservancy		
4											https://www.nature.org/en-us/about-us/where-we-work/asia-pacific/asia-and-the-pacific-women-in-conservation/kawaki-women-s-group/			

5	Ei Pacific South west	Solomon	Malaulalo	Malaulalo Conservation Initiative		2010	2016	Rufford Foundation	Private		https://www.rufford.org/projects/dennis_marita		Dennis Marta (dennismarita@gmail.com)	
6	Dc Pacific West	Solomon	Malaita	Capacity building in the Solomon Islands to enhance leatherback sea turtle conservation (2014-2015)		2014	2015	Marine Research Foundation			https://www.mrf-asia.org/project/capacity-building-in-the-solomon-islands-to-enhance-leatherback-sea-turtle-conservation-2014-2015/	This project was funded via a NOAA-PIRO Grant along with additional funds from the Rufford Foundation and the Prince Bernhardt Foundation for Nature.		

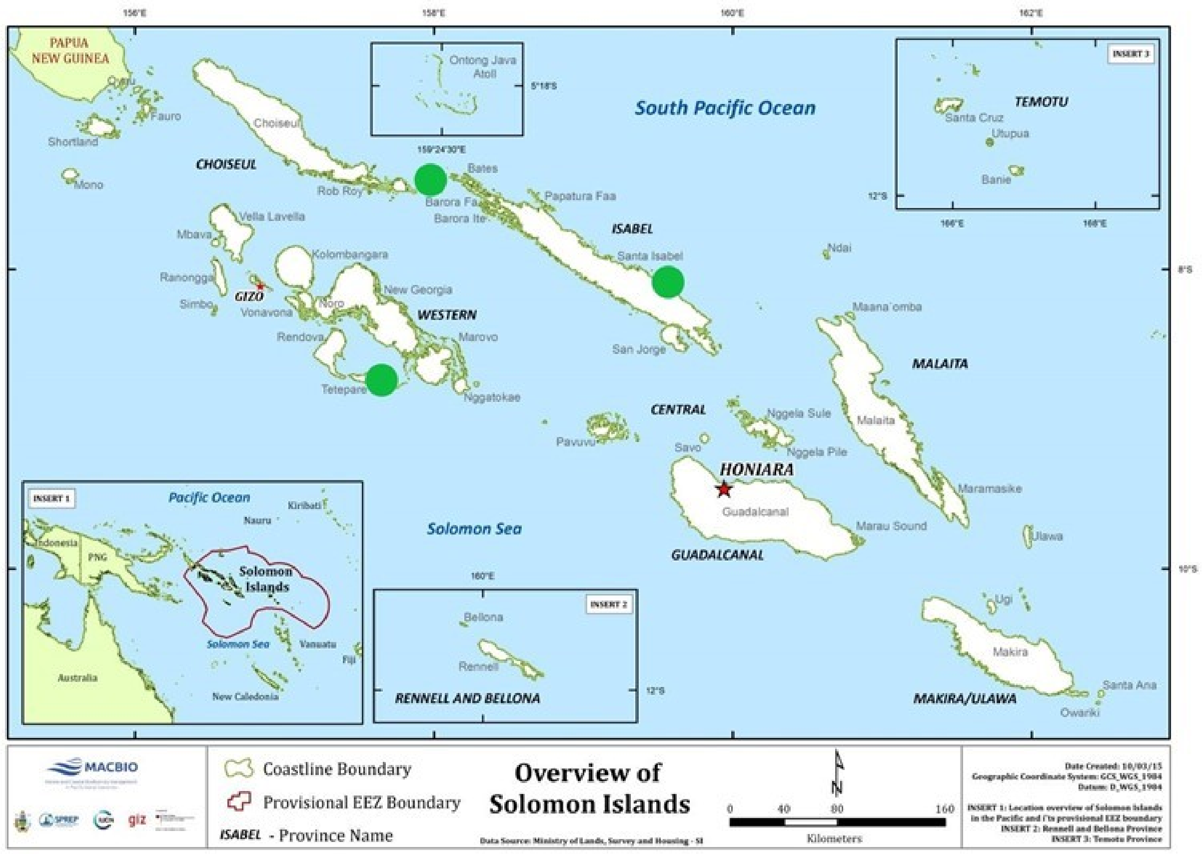

Figure 1. Green turtle active nesting sites, as per literature review. (Map of Solomon Islands from MACBIO project).

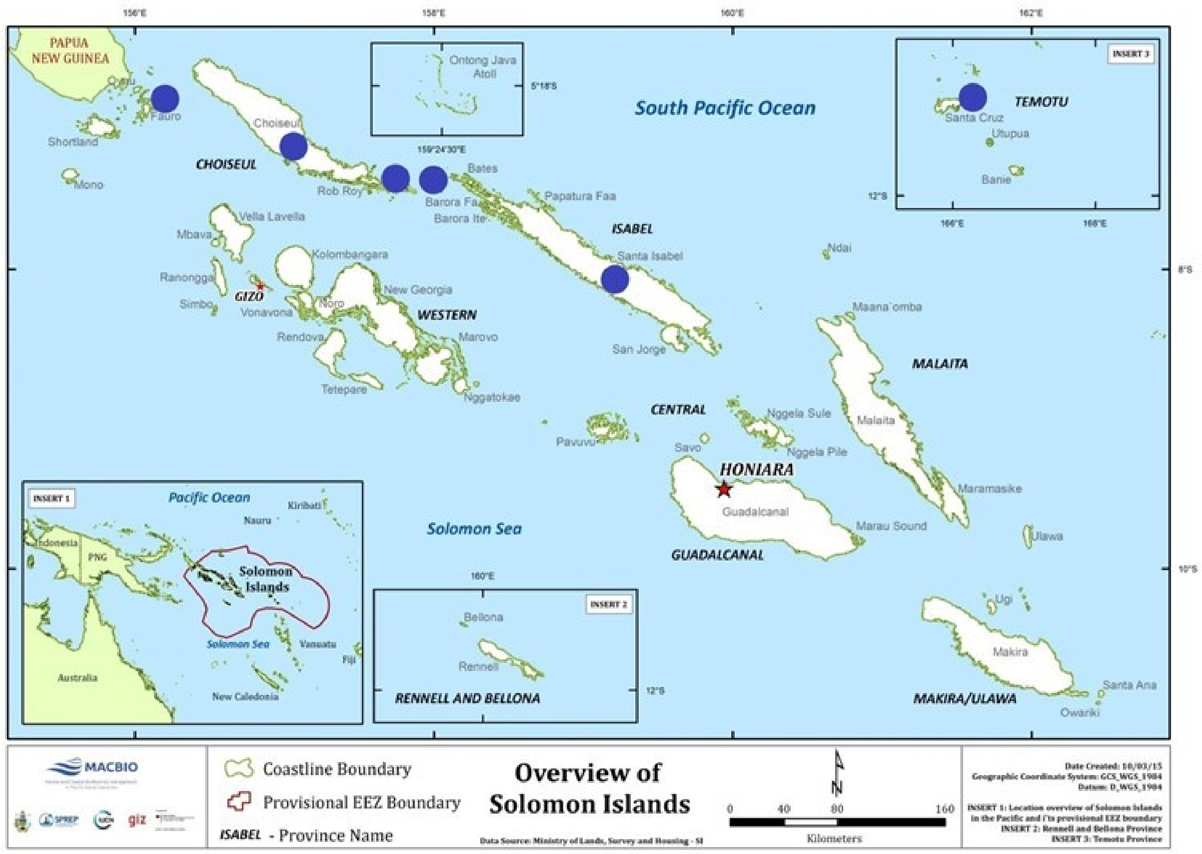

Figure 2. Hawksbill turtle active nesting sites, as per literature review. (Map of Solomon Islands from MACBIO project).

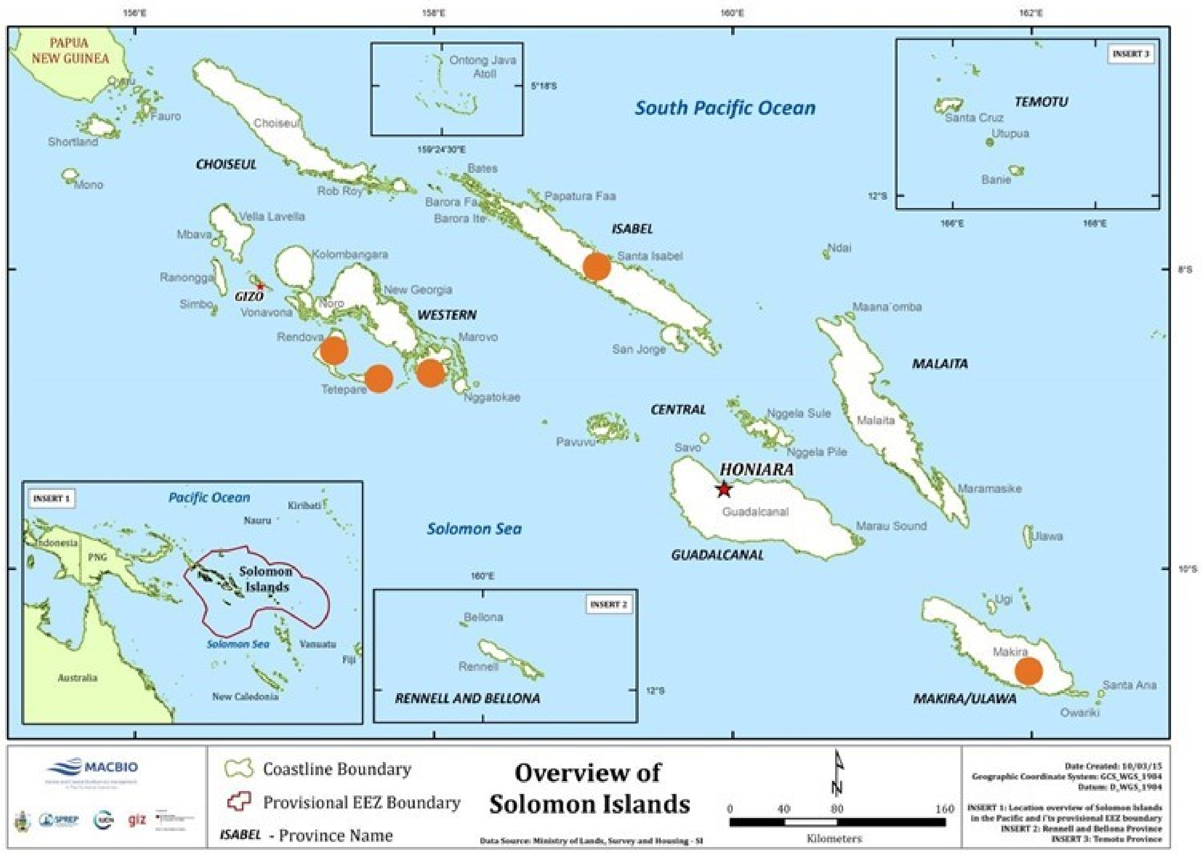

Figure 3. Leatherback turtle active nesting sites, as per literature review. (Map of Solomon Islands from MACBIO project).

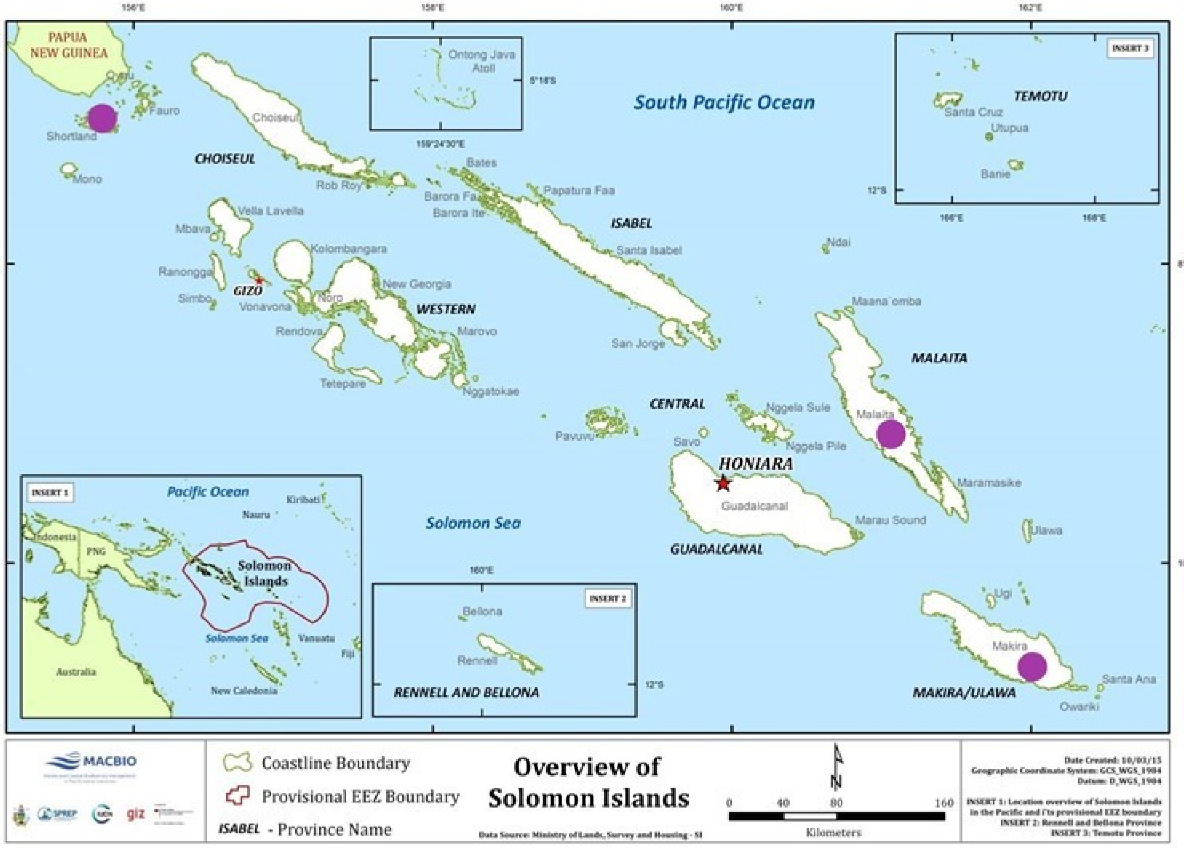

Figure 4. Olive ridley turtle active nesting sites, as per literature review. (Map of Solomon Islands from MACBIO project).

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TOKELAU

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Tokelau consists of three tropical coral atolls (Atafu, Nukunonu and Fakaofo), with a combined land area of 10 km^2 (4 mi^2). and a sea area of 290,000 km^2. The highest point is only 3 m above mean sea level (9). Three species of sea turtle have been reported in Tokelau—the green, hawksbill and loggerhead turtle (8).

1 RMU: Green turtle (*Chelonia mydas*) - Central South Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

Nesting occurs between September and November on all atolls, with the most nesting recorded on Nukunonu Atoll (2, 10, 16). Most nesting sites are reported along ocean facing beaches on the East and South sides of the atolls (2, 10). Specific beaches are not recorded (Table 2).

1.1.2 Marine areas

The green turtle (*Chelonia mydas*) is known to forage in the coastal waters around Tokelau and is regularly sited fishermen in coastal areas (2, 13, 14). Juvenile turtles between 40-60 cm in length are seen along the reefs and in the lagoons (2). These juvenile and sub-adult turtles are year-round residents.

1.2 Other biological data

No biological data is published from Tokelau regarding this species (Table 1). Size data for mature nesting adults are not known, but in 1981 four female turtle shells measured ranged from 102-105 cm CCL and one male shell was measured at 91 cm CCL (2). Limited demographic information is available for green turtles in the Central South Pacific DPS

1.3 Threats

1.3.1 Nesting sites

The greatest threat to the successful nesting of green turtles is human activity in the form direct take of turtles while nesting and the harvesting or illegal harvest of turtle eggs (2, 11, 12, 13, 14, 16). Adult turtles have been used as a food source from early colonization (11).

In Tokelau, identified predators that may constitute a terrestrial threat to turtles include hermit crabs, ghost crabs, Polynesian rats, frigate birds (*Fregata ariel, F. minor*), and reef herons (*Egretta sacra*) (2).

Climate change is another factor that has the potential to greatly affect green turtles. Potential impacts of climate change to green turtles include beach erosion from rising sea levels, repeated inundation of nests, skewed hatchling sex ratios from rising incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (6, 7, 17, 18). Tokelau, as an example, is very vulnerable to climate change and sea level rise owing partly to its small land mass surrounded by ocean, and its location in a region prone to natural disasters. The impact of climate change is expected to affect the physical and biological characteristics of the coastal areas, ecosystem structure and functioning. This will affect near-shore marine and coastal areas, many wetlands and mangroves and other trees by changes in sea level and storm surges (8, 9).

1.3.2 Marine areas

Threats in the marine area of Tokelau include human take due to fishery interactions. International pelagic fisheries include longline and purse seine fisheries (1). Another human threat is direct take of sea turtles while copulating during breeding season (2, 12, 13, 14). Marine debris ingestion and entanglement can affect sea turtles by causing mortality. (4, 15)

In the marine environment, sharks and other carnivorous fish (e.g., groupers) may prey on sea turtles.

1.4 Conservation

There is no country protection of sea turtles as rules and regulations are determined separately for each atoll and village of Tokelau (2, 10, 12). In 1981, Atafu Village was prohibiting the taking of eggs, however it is uncertain if these restrictions are still being upheld.

Aylesworth (1) states that Tokelau itself is not party to many international agreements because it is administered by New Zealand. Tokelau is a member of the Forum Fisheries Agency (FFA), the Western and Central Pacific Fisheries Commission (WCPFC), Secretariat of the Pacific Community (SPC) and the South Pacific Regional Environment Programme (SPREP). Tokelau is not a member of the FORUM Secretariat and not a signatory of the Convention on the International Trade of Endangered Species of Fauna and Flora (CITES), but New Zealand is.

1.5 Research

Research and documentation of numbers and size range of species. An extended survey should be done to see if green turtles continue to nest on the atolls of Tokelau. An observer program and documentation of sea turtle take should be implemented aboard longline and purse seine vessels licensed to fish around Tokelau.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central South Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

Hawksbill turtles (*Eretmochelys imbricata*) have been recorded nesting on Nukunonu Atoll in Tokelau in low numbers (2).

2.1.2 Marine areas

The hawksbill turtle is known to forage in the coastal waters around Tokelau in low numbers (2).

2.2 Other biological data

No biological data is published from Tokelau regarding this species (Table 1).

2.3 Threats

2.3.1 Nesting sites

The greatest threat to the successful nesting of turtles is human activity in the form direct take while nesting and the harvesting or illegal harvest of turtle eggs (2, 11, 12, 13, 14, 16). Adult turtles have been used as a food source since colonization (11).

Terrestrial predators that may constitute a threat to turtles include hermit crabs, ghost crabs, Polynesian rats, frigate birds (*Fregata ariel, F. minor*), and reef herons (*Egretta sacra*) (2).

Potential impacts of climate change include beach erosion and inundation of nests from rising sea levels, skewed hatchling sex ratios from rising incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (6, 7, 17, 18). Tokelau is vulnerable to climate change and sea level rise due to its small land mass surrounded by ocean, and its location in a region prone to natural disasters. The impact of climate change is expected to affect the physical and biological characteristics of the near-shore marine and coastal areas, many wetlands and mangroves and other trees by changes in sea level and storm surges (8, 9).

2.3.2 Marine areas

Threats in the marine area of Tokelau include human take due to fishery interactions. International pelagic fisheries include longline and purse seine fisheries (1). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (4, 15).

In the marine environment, sharks and other carnivorous fish may prey on sea turtles.

2.4 Conservation

There is no country protection of sea turtles as rules and regulations are determined separately for each atoll and village of Tokelau (2, 10, 12). In 1981, Atafu Village was prohibiting the taking of eggs, however these protections would not be valid on Nukunonu Atoll as they are governed by a different village group.

Tokelau is a member of the Forum Fisheries Agency (FFA), the Western and Central Pacific Fisheries Commission (WCPFC), Secretariat of the Pacific Community (SPC) and the South Pacific Regional Environment Programme (SPREP). Tokelau is not a member of the FORUM Secretariat and not a signatory of the Convention on the International Trade of Endangered Species of Fauna and Flora (CITES), but New Zealand, which administers Tokelau, is (1).

2.5 Research

Research and documentation of numbers and size range of species. Survey to document presence of hawksbill residing around Tokelau.

3 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific (CC-S PAC)

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

Loggerhead turtles are reported to nest on Nukunonu Atoll in Tokelau on rare occasion (2).

3.1.2 Marine areas

Tokelauans do not normally interact with pelagic loggerhead turtles; however, sub-adult loggerhead turtles do travel through the waters of Tokelau (Fig 2; 19).

3.2 Other biological data

No biological data is published from Tokelau regarding this species (Table 1).

3.3 Threats

3.3.1 Nesting sites

See section 1.3.1 as same threats apply.

3.3.2 Marine areas

Threats in the marine area of Tokelau include human take due to fishery interactions. International pelagic fisheries include longline and purse seine fisheries (1). Marine debris ingestion and entanglement can affect sea turtles by causing mortality (4, 15).

Natural threats include sharks and other carnivorous fish that may prey on sea turtles.

3.4 Conservation

Tokelau is a member of the Forum Fisheries Agency (FFA), the Western and Central Pacific Fisheries Commission (WCPFC), Secretariat of the Pacific Community (SPC) and the South Pacific Regional Environment Programme (SPREP). Tokelau is not a member of the FORUM Secretariat and not a signatory of the Convention on the International Trade of Endangered Species of Fauna and Flora (CITES), but New Zealand, which administers Tokelau, is (1).

3.5 Research

Research and documentation of numbers and size range impacted by the pelagic longline fisheries.

Table 1. Biological and conservation information about sea turtle Regional Management in Tokelau.

RMU	**CM-SC PAC**	Ref #	**EI-SC PAC**	Ref #	**CC-S PAC**	Ref #
Occurrence						
Nesting sites	Y	2	Y	2	Y	2
Pelagic foraging grounds	n/a		n/a		n/a	
Benthic foraging grounds	Y		Y		n/a	
Key biological data						
Nests/yr: recent average (range of years)	15 (1983)	2	n/a		n/a	
Nests/yr: recent order of magnitude	n/a		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	1 (pre 1980)	2, 16	n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	3	2	1	2	1	2
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a		n/a	
Total length of nesting sites (km)	n/a		n/a		n/a	
Nesting females / yr	210 (1970s Nukunonu),		n/a		n/a	

	90 (1970s Fakaofo)					
Nests / female season (N)	n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a		n/a		n/a	
Age at maturity (yrs)	n/a		n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	declining	2, 3, 10, 11, 12, 13, 14 ,15, 16	declining		rare	2
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a	

Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a	
Published studies						
Growth rates	N		N		N	
Genetics	N		N		N	
Stocks defined by genetic markers	N		N		N	
Remote tracking (satellite or other)	N		N		N	
Survival rates	N		N		N	
Population dynamics	N		N		N	
Foraging ecology (diet or isotopes)	N		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y		N		n/a	
Bycatch: presence of industrial fisheries?	Y		Y		n/a	
Bycatch: quantified?	N		N		n/a	
Take. Intentional killing or exploitation of turtles	Y		Y		n/a	
Take. Egg illegal harvest	Y		Y		n/a	
Coastal Development. Nesting habitat degradation	n/a		n/a		n/a	
Coastal Development. Photopollution	n/a		n/a		n/a	

Coastal Development. Boat strikes	Y		n/a		n/a	
Egg predation	Y		n/a		n/a	
Pollution (debris, chemical)	n/a		n/a		n/a	
Pathogens	n/a		n/a		n/a	
Climate change	Y		Y		Y	
Foraging habitat degradation	n/a		n/a		n/a	
Other	N		N		N	
Long-term projects						
Monitoring at nesting sites	n/a		n/a		n/a	
Number of index nesting sites	n/a		n/a		n/a	
Monitoring at foraging sites	n/a		n/a		n/a	
Conservation						
Protection under national law	N		N		N	
Number of protected nesting sites (habitat preservation)	0		0		0	
Number of Marine Areas with mitigation of threats	0		0		0	
Long-term conservation projects (number)	0		0		0	
In-situ nest protection (eg cages)	N		N		N	
Hatcheries	N		N		N	
Head-starting	N		N		N	

By-catch: fishing gear modifications (eg, TED, circle hooks)	N		N		N	
By-catch: onboard best practices	N		n/a		n/a	
By-catch: spatio-temporal closures/reduction	N		n/a		n/a	
Other	Y		N		N	

Table 2. Nesting beaches in Tokelau.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Central point		% Monitored	Ref #
CM-SC PAC				Long	Lat		
Nukunonu Atoll	N	n/a	7 (2012)	-171.82073	-9.16453	0	2,10
Fakaofo Atoll	N	n/a	n/a	-171.21845	-9.37162	0	2
Atafu Atoll	N	n/a	n/a	-172.49589	-8.55757	0	2
EI-SC PAC							
Nukunonu Atoll	N	n/a	n/a	-171.82073	-9.16453	0	2
CC-S PAC							
Nukunonu Atoll	N	n/a	n/a	-171.82073	-9.16453	0	2

Figure 1. Map of Tokelau. Credit: Mapsland (20))

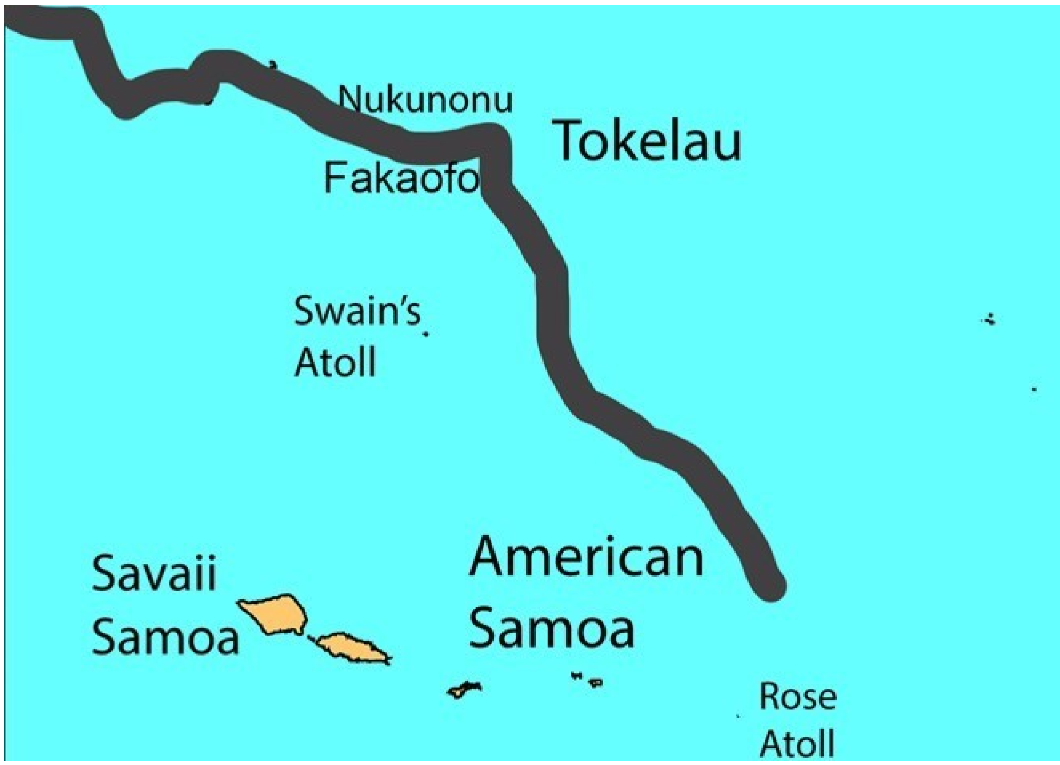

Figure 2. 2011-2012 Track of rescued loggerhead sea turtle (*Caretta caretta*) released from Tahiti-iti, French Polynesia, traveling through the waters of Tokelau. Unpublished data from Te mana o te moana, C. Gaspar, M. Girondot (19).

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TONGA

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1 RMU: Green turtle (*Chelonia mydas*) - Central South Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

Green sea turtles nest in Tonga, with the Ha'apai group, followed by the Vava'u group supporting the largest populations (7) (Fig. 1). Green turtles nest in low levels on islands in the Ha`apai and Vava`u Groups (2, 5). Green sea turtle nesting occurs from October to February, with a peak from December to January (1). There has been a declining trend in green sea turtle nesting, and based on anecdotal information from turtle hunters, there are currently an estimated annual 10 to 20 green turtle nests (4). Turtle nesting surveys were conducted in the Ha`apai Group in December 1971, December 1973, and from December 2007 to January 2008 (2, 5).

In the Vava'u group, the Vava'u Environmental Protection Association has conducted beach monitoring annually since 2012 (7). Sea turtle nesting has been relatively stable between 2012 and 2017 (pers. comm., Karen Stone, Vava'u Environmental Protection Association, 10 Oct. 2017).

1.1.2 Marine areas

The green turtle (*Chelonia mydas*) is known to forage in the coastal waters around Tonga and is regularly sited by divers and fishermen in coastal areas. Based on turtle sighting data from the Vava'u Turtle Monitoring Program, potential important sea turtle foraging habitat have been identified in the Vava'u island group. For green turtles, these important foraging sites are Hunga Lagoon, Foelifuka (also referred to as the Blue Lagoon) and the main channel into Neiafu harbor (7). A boat survey conducted in February 2014, covering 852 km during ca. 50 hours around coastal Vava'u, during which four turtles, all greens, were observed (0.5 turtles per 100 km)

(7). Tagging data suggest that Tonga is an important foraging area for green turtles that nest at sites in French Polynesia (6).

1.2 Other biological data

None identified.

1.3 Threats

1.3.1 Nesting sites

Egg collection from nests for consumption and sale occurs in Tonga (4, 7).

1.3.2 Marine areas

Adult turtles are hunted for consumption and sale in Tongan coastal waters (4, 7). Gillnet fisheries occur in areas identified as important foraging areas for green turtles, and result in the capture of sea turtles (7).

Natural threats include predation from sharks.

1.4 Conservation

Under regulations first adopted in 1994 (the Fisheries Conservation and Management Regulations), and subsequently amended (Fisheries Management Regulations 2008), female sea turtles of all species are protected year round, leatherback turtles are protected year round, male turtles of other species, with a minimum carapace length of 45 cm, can be caught between 1 February and 31 July, all nests and eggs are protected, and spear guns cannot be used to catch turtles (7). Enforcement and compliance with these sea turtle conservation rules is low (4, 7). Egg illegal harvest from nests and hunting large female green turtles for cultural events are large conservation concerns (7).

A successful rat eradication project was implemented on Maninita Islands of the Vava'u group in 2009 (7).

As a contracting party to the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the WCPF Convention, Table 2), Tonga is obligated to implement a WCPFC conservation and management measure on sea turtles, which prescribes measures to reduce sea turtle bycatch in purse seine and shallow-set pelagic longline fisheries. The measure also prescribes the use of handling and release methods to maximize the probability of post-release survival in purse seine and shallow-set pelagic longline fisheries (9).

Tonga issues licenses for longline vessels to fish in the Tonga EEZ, no other tuna fishing gears are used in Tongan waters (8). The Tonga-flagged vessels use circle hooks and "fish baits with less squid bait in longline fishing operations" as an approach to mitigate sea turtle bycatch (8). No information was identified on methods used to mitigate sea turtle bycatch by foreign-flagged longline vessels licensed to fish in the Tonga EEZ (8).

Tonga is a party to several international conventions that have a nexus to sea turtle conservation, summarized in Table 2. Tonga, however, is not a party to The Convention on International Trade in Endangered Species (CITES) or the Convention on Migratory Species (CMS).

1.5 Research

There is a need for continuous, rigorous surveys of nesting sites and marine habitat. Past nesting surveys in the Ha`apai Group have been sporadic and did not consistently distinguish turtles to the species level (2, 5). While surveys in the Vava'u group have been conducted annually since 2012, due to funding limitations, monitoring may not continue past the 2017 nesting season (pers. comm., Karen Stone, Vava'u Environmental Protection Association, 10 Oct. 2017). Sightings data collected by the Vava'u Turtle Monitoring Program have helped identify important marine habitat for sea turtles. Additional monitoring efforts of marine habitat use are needed using consistent survey methods to detect inter-annual variability and temporal trends in local abundance (3).

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*) - Central West Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

Hawksbill turtles nest in Tonga, with the Ha'apai group, followed by the Vava'u group supporting the largest populations (7) (Fig. 1). Turtle nesting surveys were conducted in the Ha`apai Group in December 1971, December 1973, and from December 2007 to January 2008 (2, 5).

In the Vava'u group, the Vava'u Environmental Protection Association has conducted beach monitoring annually since 2012 (7). Sea turtle nesting has been relatively stable between 2012 and 2017 (pers. comm., Karen Stone, Vava'u Environmental Protection Association, 10 Oct. 2017). Maninita, Fonua'one'one and Taula islands are likely important hawksbill turtle nesting sites.

2.1.2 Marine areas

Based on turtle sighting data from the Vava'u Turtle Monitoring Program, potential important sea turtle foraging habitat have been identified in the Vava'u island group. For hawksbills important foraging sites are Longomapu and the Split Rock dive site (7).

2.2 Other biological data

None.

2.3 Threats

2.3.1 Nesting sites

Egg collection from nests for consumption and sale occurs in Tonga (4, 7).

2.3.2 Marine areas

Adult turtles are hunted for consumption and sale in Tongan coastal waters (4, 7). Gillnet fisheries occur in areas identified as important foraging areas for hawksbill turtles, and result in the capture of sea turtles (7).

2.4 Conservation

See Section 1.4.

2.5 Research

See Section 1.5.

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

The leatherback (*Dermochelys coriacea*) is an intermittent visitor or vagrant within Tonga with recorded sightings (7).

3.2 Other biological data

None.

3.3 Threats

3.3.1 Nesting sites

Not applicable

3.3.2 Marine areas

Adult turtles are hunted for consumption and sale in Tongan coastal waters (4, 7). Although leatherbacks should be protected, enforcement and compliance with these sea turtle conservation rules is low (4, 7).

3.4 Conservation

See Section 1.4.

3.5 Research

See Section 1.5.

4 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

The loggerhead turtle (*Caretta caretta*) is an intermittent visitor or vagrant within Tonga with documented sightings (7).

4.2 Other biological data

None.

4.3 Threats

4.3.1 Nesting sites

Not applicable

4.3.2 Marine areas

Adult turtles are hunted for consumption and sale in Tongan coastal waters (4, 7).

4.4 Conservation

See Section 1.4.

4.5 Research

See Section 1.5.

Table 1. Biological and conservation information about sea turtle Regional Management in Tonga.

RMU	**CM-SC PAC**	Ref #	**EI-WC PAC**	Ref #	**DC-W PAC**	Ref #	**CC-S PAC**	Ref #
Occurrence								
Nesting sites	y	2,5,7	Y	2,5,7	n	n/a	n	n/a
Pelagic foraging grounds	y	2,5,7	Y	2,5,7	y	n/a	y	n/a
Benthic foraging grounds	y	2,5,7	Y	2,5,7	n	n/a	n	n/a
Key biological data								
Nests/yr: recent average (range of years)	15	4	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "major" sites:	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

recent average (range of years)								
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Threats								
Bycatch: presence of small scale / artisanal fisheries?	y	7	y	7	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?					n/a	n/a	n/a	n/a
Bycatch: quantified?	n	7,8	n	7,8	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	y	4,7	y	4,7	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	y	4,7	y	4,7	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	n	4,7	n	4,7	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	n	4,7	n	4,7	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n	4,7	n	4,7	n/a	n/a	n/a	n/a
Egg predation	n	4,7	n	4,7	n/a	n/a	n/a	n/a

Pollution (debris, chemical)	n	4,7	n	4,7	n/a	n/a	n/a	n/a
Pathogens	n	4,7	n	4,7	n/a	n/a	n/a	n/a
Climate change	n	4,7	n	4,7	n/a	n/a	n/a	n/a
Foraging habitat degradation	n	4,7	n	4,7	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Conservation								
Protection under national law	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

with mitigation of threats								
N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: onboard best practices	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. International treaties with a nexus to sea turtle conservation to which the Kingdom of Tonga is a party (10).

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPF Convention)	y	y		The convention applies to all species of highly migratory fish stocks (defined as all fish stocks of the species listed in Annex I of the 1982 Law of the Sea Convention occurring in the convention area and such other species of fish as the WCPFC may determine) within the Convention Area, except sauries. The Commission has adopted a binding measure applicable to sea turtle conservation	A binding measure prescribes measures to reduce sea turtle bycatch in purse seine and shallow-set pelagic longline fisheries. The measure also prescribes the use of handling and release methods to maximize the probability of post-release survival in purse seine and shallow-set pelagic longline fisheries (9	This regional fisheries management organization has the authority to adopt binding measures for tuna fisheries, including to manage bycatch of sea turtles.

				resulting from fisheries bycatch (9)		
United Nations Framework Convention on Climate Change	y					Relative sea level rise and changes in air and sea temperatures pose a threat to sea turtles.
Convention on Biological Diversity	y					As the convention title suggests.
United Nations Convention on the Law of the Sea	y	y				Under the 1982 Law of the Sea Convention, States are obligated to protect and preserve the marine environment (Article 192) and consider the effects of fishing on species associated with or dependent upon commercially exploited species (United Nations, 1982 [Article 119]). This is elaborated further in the 1995

						Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982, Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA), which requires States to minimize bycatch and impacts on associated and dependent species (United Nations, 1995 [Article 5(f)]).

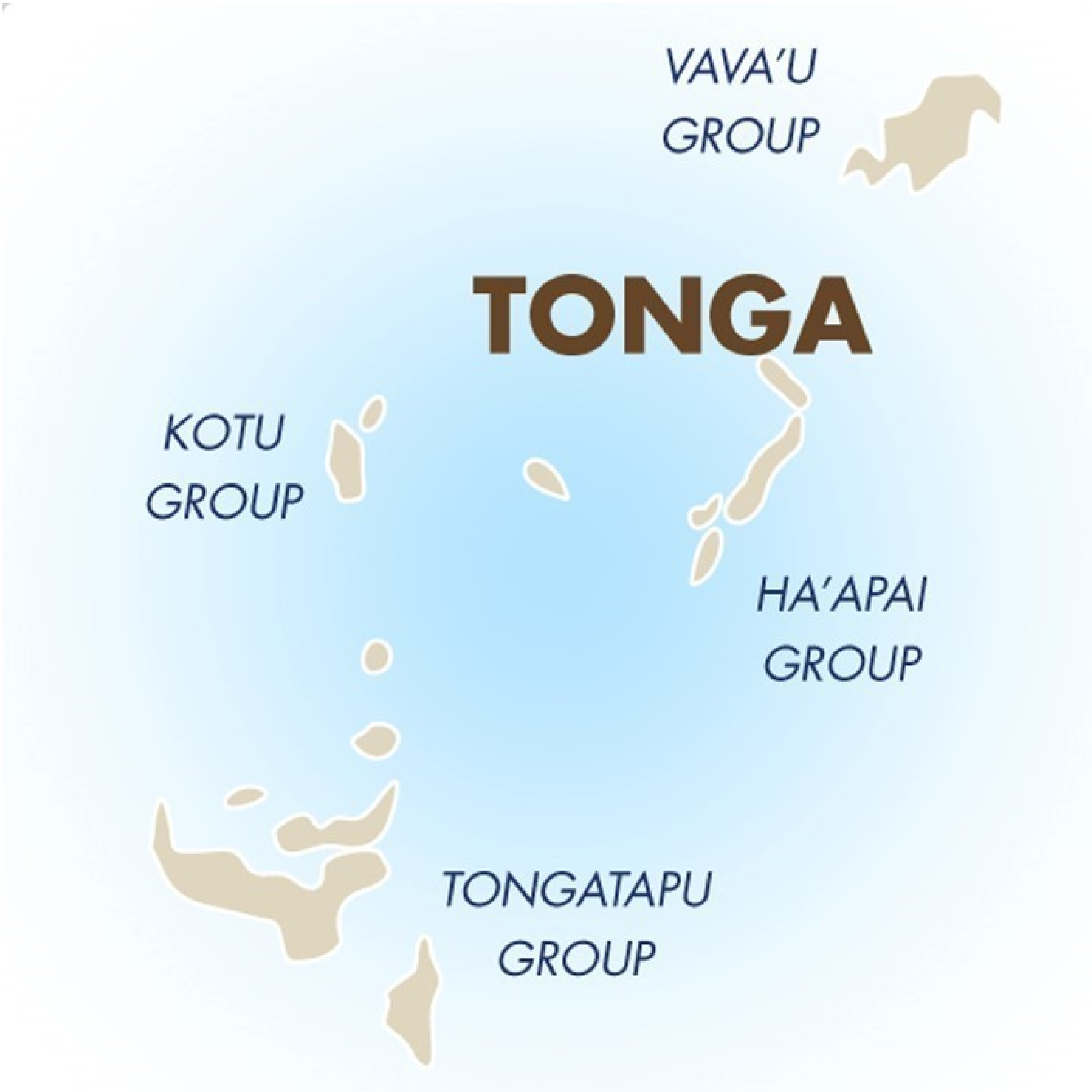

Figure 1. Tonga with island groups

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TUVALU

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Overview

Tuvalu Marine Life Project lists four species, although two (loggerhead and leatherback) are uncommon or rare (7). Only the green turtle nests with enough frequency to be documented. Hawksbills are occasionally seen in foraging areas but with no known nesting. RMUs are based on Wallace et al. (8).

1 RMU: Green turtle (*Chelonia mydas*) - Southwest Pacific

1.1 Distribution, abundance, trends

Tuvalu [5 - 10º South; 176 - 180º West] consists of three coral islands and six atolls with an area of 26 km^2 (Fig 1).

1.1.1 Nesting sites

Green turtle nest on the main island of Funafuti as well as scattered sites on outer islands (Table 2; 5, 6). The main nesting area is in the Funafuti Conservation Area on the western side of Tuvalu, where green turtles historically nested on the islets of Vasafua and Fuakea. Nesting trends and abundance are unclear as the only current information is from a 10-day survey in 2006 (1). However, nesting seems to be in steep decline due to harvest (1). According to Soseala Tinilau, director of the Department of the Environment, Funafuti Conservation Area hosts up to ten nesting green turtles in a good year.

1.1.2 Marine areas

TREDS reports green turtle foraging in Tuvalu, with n = 33 tags applied to foraging turtles. Green turtles are the most abundant species in Tuvalu based on TREDS records (7).

1.2 Other biological data

1.3 Threats

1.3.1 Nesting sites

Soseala Tinilau, director of the Department of the Environment gave the following assessment on December 2, 2017:

Turtle population is declining in alarming rate because people hunt them for food and meat and due to erosion of their nesting beach (in the Conservation Area) which then force them to nest out of the Funafuti Conservation Area, hence prone to illegal harvest. Green turtle nesting in islets of Funafuti is deteriorating due to two main reasons:

1. Hunting/illegal harvest turtles for meat before they nest (it's part of the culture).

2. Sudden disappear of nesting beaches by erosion. Vasafua is one of the islets where turtles used to nest and during Tropical Cyclone Pam in 2015, the islet was completely wiped out. Fuakea is another islet which is undergoing severe beach erosion.

Due to erosion the turtles may be shifting their nesting effort to the outer islands, especially Nukufetau. It had 20 nesters (green turtles) this year but all were eaten by people from the community and they also took all the eggs (Pers. Comm. Soseala Tinilau 12/2/17).

1.3.2 Marine areas

Turtle meat is not commonly eaten in the capital of Funafuti, but both nesting and feeding turtles are taken around outer islands (6). Humber et al. (4) estimate that less than 500 turtles (including all species) are taken annually in Tuvalu. However, the numbers reported by Department of Environment Director Soseala Tinilau are much lower, indicating a take of a few tens of turtles per year, primarily green turtle, due to overall scarcity.

Natural threats include predation from sharks.

1.4 Conservation

Wildlife Conservation Ordinance (1975) prohibits taking turtle on land except under a license granted by the Minister (3). However, illegal harvest is apparently widespread, taking the few remaining turtles nesting outside the conservation area.

Funafuti Conservation Area was the first marine protected area in Tuvalu, declared in 1996 with 33 km^2.

Reef and coastal habitats are declining due to pollution, runoff, and overfishing. The low-lying islands of Tuvalu are especially susceptible to sea level rise and storms.

More specific protections should be created with defined penalties and better enforcement capabilities.

1.5 Research

The most recent survey of sea turtles in Tuvalu was in 2006 (1). Resurvey to assess nesting trends should be a priority.

2 RMU: Hawksbill turtle (*Eretmochelys imbricata*,) - Southwest Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

NONE

2.1.2 Marine areas

TREDS records only 1 foraging hawksbill tag return from Tuvalu, although adjacent Vanuatu and Solomon Islands are potentially important foraging areas (7).

2.2 Other biological data

TREDS (7) recorded no hawksbill nesting in Tuvalu, although low nesting (10s of individuals) is reported at adjacent areas including locations in Solomon Islands and Vanuatu.

2.3 Threats

2.3.1 Nesting sites

Not applicable

2.3.2 Marine areas

See Section 1.3.2.

2.4 Conservation

See Section 1.4.

2.5 Research

See Section 1.5.

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

NONE

3.1.2 Marine areas

The leatherback (*Dermochelys coriacea*) is an intermittent visitor or vagrant within Tuvalu. Records are rare for this species.

3.2 Other biological data

TREDS (7) recorded no leatherback nesting in Tuvalu, although low nesting (10s of individuals) is reported at adjacent areas including locations in Solomon Islands and Vanuatu.

3.3 Threats

3.3.1 Nesting sites

Not applicable

3.3.2 Marine areas

See Section 1.3.2 for more information. International fishing fleets may interact with this species.

3.4 Conservation

See Section 1.4.

3.5 Research

See Section1.5.

4 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

NONE

4.1.2 Marine areas

The loggerhead (*Caretta caretta*) is an intermittent visitor or vagrant within Tuvalu. Records are rare for this species

4.2 Other biological data

TREDS (7) recorded no loggerhead nesting in Tuvalu, but very rare nesting is reported at adjacent areas including locations in Solomon Islands and Vanuatu

4.3 Threats

4.3.1 Nesting sites

Not applicable

4.3.2 Marine areas

See Section 1.3.2.

4.4 Conservation

See Section 1.4.

4.5 Research

See Section 1.5.

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Table 1. Biological and conservation information about sea turtle Regional Management in Tuvalu.

RMU	**CM-PAC SW**	Ref #	**EI-PAC SW**	Ref #	**DC-PAC W**	Ref #	**CC-PAC S**	Ref #
Occurrence								
Nesting sites	Y	n/a	N	n/a	N	n/a	N	n/a
Pelagic foraging grounds	N	n/a	N	n/a	n/a	n/a	n/a	n/a
Benthic foraging grounds	Y	n/a	Y	n/a	N	n/a	N	n/a
Key biological data								
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Threats								

Bycatch: presence of small scale / artisanal fisheries?	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: presence of industrial fisheries?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bycatch: quantified?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Intentional killing or exploitation of turtles	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Take. Egg illegal harvest	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Long-term projects								
Monitoring at nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of index nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Conservation								
Protection under national law	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of protected nesting sites (habitat preservation)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Long-term conservation projects (number)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: onboard best practices	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Nesting Beaches in Tuvalu.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Ref #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
				Long	Lat	Long	Lat	Long	Lat					
CM-SW PAC														
Funafuti	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,6	n/a	n/a
Vasafua	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Fuakea	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

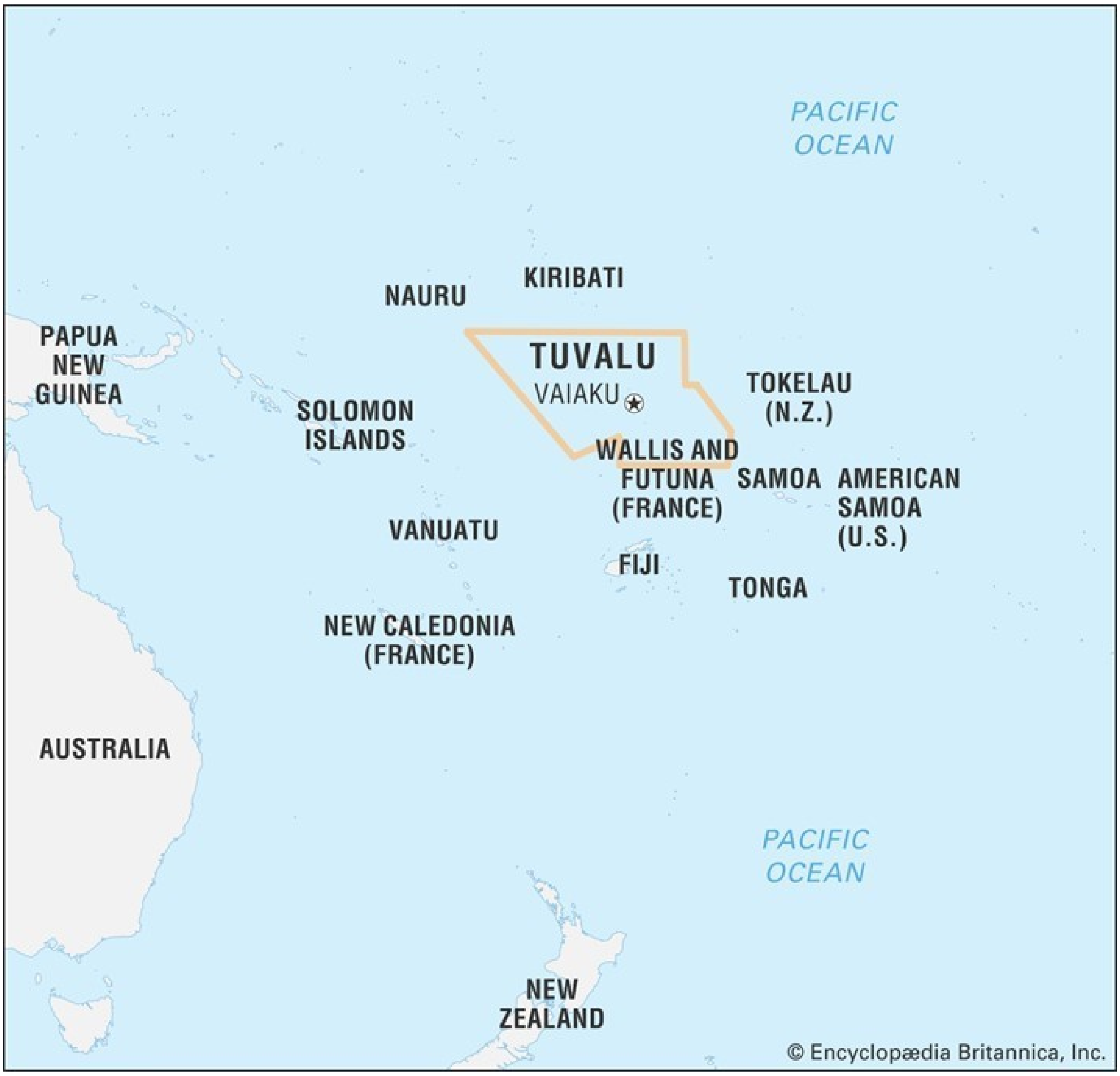

Figure 1. Location of Tuvalu and EEZ around Tuvalu. (Map from Encyclopedia Britannica, Downloaded 10 Dec 2019).

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VANUATU

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Introduction

Vanuatu is an archipelago in the SW Pacific with 82 inhabited islands of primarily volcanic origin and an EEZ of 680,000 km^2. An additional area of 230,000 km^2 surrounding the small-uninhabited southern islands of Matthew and Hunter is currently disputed with France. The population of Vanuatu is estimated to be 299,882, as of 2019 with nearly 80% of the population residing in rural areas and living a predominantly traditional lifestyle including agricultural, animal husbandry and fishing activities. Turtles have been targeted traditionally as food since the Lapita people first colonized Vanuatu some 3,000 ago and has continued in many areas of Vanuatu. Turtles also have important cultural values for many of the approximately 120 cultural-linguistic groups found today and there were also several traditional beliefs and practices that served to manage marine turtles (5, 6, 8).

The Vanuatu Environment Unit (VEU) initiated a postal survey in 1989 of turtles nation-wide and confirmed that at least four species of marine turtle were found in Vanuatu waters, including the green, hawksbill, loggerhead and leatherback turtles. Two species confirmed to breed and nest in Vanuatu were the green and hawksbill. The survey further revealed that turtles were subject to "...heavy exploitation in some islands like Malekula. While elsewhere there seems to be little or no pressure on these resources. Which were interpreted to mean "either these animals are declining in numbers, are rare or not being harvested due to custom or religious beliefs" (16).

Subsequent to the postal survey the VEU then initiated the first turtle tagging program of nesters with the support of SPREP at four key sites between 1992 and 1994. The results are given in Appendix Table 1. Key hawksbill, green and leatherback turtle sites have largely now been documented.

Nesting Site Data is compiled below from TREDS (Turtle Research and Monitoring Database System) coordinated by SPREP. Tagging is largely done by the NGO Wan Smol Bag, Vanua-tai community-based network and tagging data is compiled and submitted to SPREP for entry into the TREDS database. The other main tagging operation is Tranquility Resort on Moso Island that has a head-start program for hawksbill turtles. Summary reports are then provided by SPREP back to WSB and Vanuatu authorities.

Information collected at Wan Smolbag Vanua-tai workshops in 2007 and 2008 identified over 189 nesting sites on 33 islands of Vanuatu, with approximately 200 turtles (both green and hawksbill) nesting at Malekula island per year (Fletcher and Petro, unpublished 2009). Santo Island including the offshore island of Thion supports some 50 or more nesting turtles per year, and approximately 30 turtles nest annually at Tegua and Hiu islands in the Torres Group in northern Vanuatu. As survey coverage of Vanuatu's beaches is not yet comprehensive, total nesting activity is likely underestimated. Important sites that have emerged over the past few years as index sites include Bamboo Bay/Dixon Reef area on Malekula for green turtles, and Moso Island (off north Efate) and Wiawi on Malekula for hawksbills while Votlo on Epi is the main leatherback nesting beach (Appendix Tables 2-6).

1 RMU: Green turtle (*Chelonia mydas*) - Southwest Pacific

1.1 Distribution, abundance, trends

1.1.1 Nesting Sites

Green turtle nesting has been recorded in TREDS on the islands of Epi, Espiritu Santo, Malekula, Moso and Nguna, Pele (all islands off north Efate), Motalava, Pentecost, Aniwa and Tegua, Torres (Table 2). The highest numbers were recorded on Malekula Island due to surveys carried out at the key nesting site of Bamboo Bay in the SW Bay area, Malekula. Bamboo Bay nesting season is still surveyed annually by Vanua-tai community members, but not always with consistent effort, and no data summary from TREDS is available for the latest seasons. This site is now accessible by road from SW Bay, and two small bungalows have been built as of 2018 to house researchers.

Bamboo Bay on west Malekula is currently the area with the greatest number of green turtles nesting in Vanuatu where from monitoring between 2007-2012 averaged 99 green nesters annually at the 11 km stretch of beaches. As of late November 2017, there were 50 green nesting turtles enumerated at Bamboo Bay During the latest season from September 2018 to April 2019, a total of 247 green turtles nests were enumerated, although some would be re-nesting. ed, (D. J. Aromalo, pers comm). For the following season of 2019-2020, a total of 146 green turtle nests were enumerated, again, some being re-nesters (D. J. Aromalo, pers comm).

There is some green turtle nesting around the Maskelyne Islands, with one observed on Vulai Is. (22) during one of the early surveys of Maskelynes and supported by current observations of the Vanua-tai Monitors there (J. Leggat, pers comm.) Turtle nesting was estimated on Vulai by SPREP at 10-20 (all species) in 1992 and less than five on Sakao Island and their survey indicated Maskelynes was not a key turtle nesting site for Vanuatu. This is partially due to much of the coast covered in dense mangroves which make it difficult for turtles to access upslope beaches. Turtles are also known to nest on the beaches west of Hokai, on mainland Malekula, and in the Lutas village area (including Malaplap) on Uliveo, and at least formerly there was nesting on some of the uninhabited islands including Pakatel, Awei and Lamenmang (8). Uninhabited Vulai Island is currently the main nesting site for Maskelynes, along with west of Hokai village.

Moso Is. (north Efate) is also a green turtle nesting site, although most turtles nesting there are hawksbill turtles. Green turtles are also known to nest nearby at Takara on north Efate, along with small numbers of nesters at most other villages along north Efate. Reef Island (also known as Rowa), an uninhabited atoll in northern Vanuatu is important for green turtles. Extensive white sand beaches are found within the atoll but are regularly visited by fishers from surrounding islands and eggs and turtles often targeted for consumption (Hickey Field Trip Report 2012). On Aneityum, green turtle nest around Port Patrick (D. Aromalo, pers comm).

Tanna Island near Port Resolution also has some nesting beaches and some four nests (three nests species were undetermined) were observed by community members in October 2018; this was the first time in many years nesting had occurred there. One nester was observed to beand it was a green turtle (unpublished, Hickey Field Trip Report 2018).

1.2.1 Marine Areas

Southeast Vanua Lava in the Banks Group north from Port Patterson and Alget River north to Ravenga Island is an important green turtle foraging area over significant seagrass meadows.

Mesina Bay on south Vanua Lava has seagrass meadows foraged by green turtles, as well as relatively pristine nesting beaches.

Reef Is. (also known as Rowa), an uninhabited atoll in northern Vanuatu and the extensive reefs are less important for foraging by green turtle but there is very limited seagrass in the lagoon (1). There is limited recent turtle data for Reef Islands available, but it is likely fishers still occasionally harvest turtles and eggs from these islands due to their remoteness.

On Santo Island the area between Palekula Bay north to Turtle Bay is a good turtle foraging area with seagrass meadows and coral reefs protected from ocean swells by offshore islands.

Malekula has numerous good coral reef and seagrass meadows for foraging including the Uripiv and Uri Island areas including Port Stanley and South to Crab Bay (10). Also, the Maskelyne Islands of south Malekula have extensive seagrass seagrass meadows, mangroves and coral reefs for foraging (8). Green turtles are quite common around the Maskelyne Islands, as evidenced by the number collected during the New Yam Festival of February 2020 (F. Hickey, personal observation).

Epi Island on the west coast at Lamen Bay has extensive seagrass meadows (including extensive *Halophila ovalis* complex) including around Lamen Island that support green turtles as well as dugongs (unpublished, Hickey Field Report 2015).

North Efate has good turtle habitat in the form of seagrass meadows and coral reefs for green turtles. Seagrasses are especially abundant in the Siviri area, Undine Bay and the Paunganisu area. Also, seagrasses and reefs at Lelepa, Kagula, Emao, Nguna, Pele and Moso Islands. (8).

On Tanna Island in south Vanuatu, the main area with seagrass meadows is in Port Resolution and eastward around to Turtle Bay close to Captain Cook Rock. Both these areas are important green turtle foraging areas (unpublished, Hickey Field Report 2011).

Aneityum Island in southern Vanuatu around the offshore Mystery (Inyueg) Island has both seagrass and coral cover for foraging; seagrasses extend into adjacent Anelguahat Bay. Mystery Island area is a community conservation area with limited fishing and is an important tourism site receiving regular Cruise Ship visits. Port Patrick in the north of Aneityum also has extensive seagrass, coral reef and mangrove habitat for foraging. (unpublished Hickey 2011, Field Trip Report);

The TREDS 2015 Report (13) reports tag recoveries of turtles tagged outside and recaptured in Vanuatu (see Appendix Table 8 & 9).

1.2. Other biological data

See Table 1.

Size Range Data

A total of 642 green turtles have curved carapace length (CCL) measurement records in TREDS for Vanuatu. The size frequency graph below (Fig 2) shows 398 juveniles within the class size range of 25.0-64.9cm, 63 sub-adults within the class size range of 65.0-84.9cm and 181 adults in the class size range of 85.0-154.9cm. Siota (2010) reported 542 green turtles with CCL measurements and Siota (2011-2012) reported a total of 547 green turtles with CCL measurements for 2011 to

2012 report and Siota (2013-2014) reported 638 green turtles (Summary of size frequency data as reported from TREDS (13)).

Genetic Data

In a study published in 2015 (18), it was found that Vanuatu's green turtles were shown to form a separate RMU from the d'Entrecasteaux and Chesterfield–Coral Sea RMUs. Over 80 green turtle nesting beaches have been reported for Vanuatu and the sample for this study was from the largest known rookery at Bamboo Bay, Malekula Islands, with an estimated ~25–50 females nesting annually. Other reported nesting sites within the archipelago are scattered 100's of kilometers from Bamboo Bay. The study concluded that as Vanuatu has now been identified as a unique RMU, it is important that further sampling of other rookeries in Vanuatu is undertaken to determine whether they are also a part of the same RMU or are distinct.

1.3 Threats

1.3.1 Nesting Sites

Threats to nests include storm surges and floods, as well as crabs and feral animals, such as horses, cows, pigs, crabs, dogs (21). Some efforts have been undertaken by communities to protect nests from predators by covering them with bamboo grids.

Saltwater inundation due to sea-level rise has also been a problem in some areas and some communities under the direction of their Vanua-tai network members move eggs to higher beach areas to mitigate these impacts. To reduce egg illegal harvest in some areas, Vanua-tai members place traditional taboo markers at the nest (7, 10).

The entire turtle nesting season throughout the archipelago normally extends from August to early March, with green turtles peaking in late October to December with hawksbills and leatherbacks peaking in November to January. This season also coincides with an average of 2.6 tropical cyclones passing through Vanuatu often accompanied with coastal flooding associated with high rainfall and storm surges that may erode turtle nests.

The full nesting season also coincides with the traditional season to plant yams, an important staple throughout Vanuatu. A traditional management measure on most islands was that if anyone ate turtle or their eggs, they couldn't go to attend to their yam or other gardens for a few days, or it would ruin their crops (5, 6). This assisted to reduce fishing pressure on turtles during their most vulnerable period of nesting. Unfortunately, only older people still follow this traditional rule that assisted, along with other traditional taboos to protect turtle nests and turtles (ibid, 8). The erosion of these traditional beliefs and traditional practices thus poses additional threats to turtles and their nests.

Egg collection from nests and harvesting of sea turtles for consumption remains an issue in some areas. Adult turtles are also occasionally still harvested for consumption.

Limited capacity by central government to enforce existing legislation protecting turtles, nests and eggs throughout an archipelago with numerous rural villages remains a significant threat.

Light and noise pollution has been extended to many turtle nesting beaches that were formerly pristine, particularly on the islands of Santo and Efate that have two large urban centres and where coastal developments have experienced a significant boom over the last 20 years.

Adult green turtles are also caught or purchased for display in larger pools. Legislation to license these operations is under the auspices of a Fisheries research permit for educational purposes. However, to date, at least some of the facilities do not have permits to operate, and some facilities allow tourists to hold and swim with the turtles within the enclosures.

1.3.2 Marine Areas

Nearshore habitats have suffered considerable coastal development pressure over the last 20 years during a coastal development boom primarily for expatriate housing and tourism developments. Coastal forest clearance and foreshore dredging including the destruction of mangroves and seagrass meadows were part of these developments, accompanied by increased turbidity impacting nearshore corals reef and seagrass habitats (4). These coastal development impacts continue today given the limited capacity by central government to monitor coastal developments and implement the Foreshore Development Act and Environmental Impact Assessment legislation that are the primary legislation used to control coastal developments.

The number of small, motorized craft for pleasure and fishing has also increased considerably during this period that may lead to boat strikes, and/or disruptions to turtle foraging areas.

The periodic proliferation of Crown of Thorns (COTs) starfish has done extensive damage to reefs including around north Efate and its offshore islands where the COTs outbreak is still current as of late 2019. Also recently affected are various locations around Malekula Island including Maskylenes, Uri, Crab Bay and Leviam. Also, on SE Santo at Banban and the adjacent islands Aore and Malo. And Maevo island at Naone. Also, north Efate has been badly affected over the last couple of years including to Hideway Island at west Efate. (Jayven Ham, Department of Fisheries, pers comm). Residents of Shark Bay on south Efate report COTs damage to reefs circa 2011 (Tony Care, pers comm).

The use of single use plastic bag packaging is widespread, and up until recently, there was no effective waste management program put in place to handle disposal. Many of this plastic waste finds its way into coastal waters. However, the government implemented a ban on the use of single use plastic shopping bags, plastic straws and polystyrene take-away boxes as of July 1, 2018.

There is also a considerable amount of lost or discarded industrial fishing gear including nets found drifting in coastal areas that may entangle turtles and other marine life.

Artisanal and subsistence monofilament gillnet fisheries often occur in areas identified as important foraging areas for green and hawksbill turtles and result in the capture of sea turtles (8).

Observer coverage for longline vessels fishing Vanuatu's EEZ is very limited to record marine turtle by-catches, or report on marine disposal of plastics and other pollutants. Twenty-seven incidents of pollutant disposal by longliners within Vanuatu's EEZ were recorded by observers between 2013 and 2015 (12). The authors noted these estimates were conservative.

Information on turtle interactions are from the NPOA Turtle 2015 (15) and annual reports to the WCPFC for 2015 (2) and 2017 (3), see Appendix Table 13.

Appendix Table 14 indicates at least 54 turtles across five species were caught between 2012 and 2014.

1.4 Conservation

Given the long time it takes for turtles to sexually mature, and that turtle conservation has only really been initiated over the last 25 years in Vanuatu (and for the far northern and southern islands conservation efforts are really just arriving there in the last few years) it is difficult to indicate any clear trends on increases in nesting at this point. Compounding this is that sampling effort of sites has also not been very uniform for many nesting sites. However, as of the 2018/19 nesting season, there were 247 green nesting turtles returning to the Bamboo Bay rookery (D. Aromalo, pers. comm).

What was clearly observed in Vanuatu shortly after the awareness associated with the Year of the Turtle in 1995, was that when WSB turtle monitors started to work with community leaders around north Efate to impose a ten-year taboo on turtle consumption, most communities agreed it was necessary as they had witnessed the decline in turtles over the years. A survey estimating the changes in turtle consumption for this area in 2005 was that over 100 fewer turtles per year were consumed around north Efate. So, over the ten-year period from 1995 to 2005, over 1,000 fewer green and hawksbill turtles were estimated to have been consumed in this area (8).

Between the community-based conservation efforts since 1995 and more comprehensive legislation passed by the Fisheries Department that prohibits the killing of any of the three main species of turtle since 2009, it is clear that significantly less turtles are now consumed as compared to the 1980s and early 1990s when turtles and their eggs were consumed whenever possible. However, as turtles found nesting or foraging in Vanuatu migrate to other countries in the region, the stability and growth of these populations also depend on conservation efforts in those countries and on the high seas where pollution, entanglement, and bycatch from industrial fisheries take their toll.

As Vanuatu is now coming up to nearly 25 years of conservation efforts, we may start to see trends in recruitment as this is within the range of time it takes for turtles to sexually mature. This will also depend on how well the current turtle legislation is enforced to limit turtle harvests. To assist with enforcement, the Vanuatu Fisheries Department has recently initiated a program to train community members to act as Fisheries Authorized Officers to monitor and report fisheries infractions at the village level including for turtle related infractions.

With more consistent survey effort over more sites, population trends will become increasingly clearer. However, the other critical issue is now with increased coastal land development pressure continuing in Vanuatu, the importance to ensure that the government agencies responsible for monitoring and enforcing the environmental legislation in place can keep up with the pace of development and protecting habitat important to turtles (and other resources) throughout their lifecycle. However, even within the parameters of current legislation such as foreshore development permits and environmental impact assessments, coastal development of formerly pristine nesting beach areas continues for resort and tourism as well as coastal housing developments where light and noise pollution, seawalls, fences and domestic dogs may adversely affect nesting activities.

Vanuatu is a party to several international conventions that have a nexus to sea turtle conservation, summarized in Table 3.

The section below outlines the evolution of turtle related Fisheries legislation from 1993 to the current legislation of 2009 that prohibits harming, capturing or killing of any species of turtle, or the taking of turtle eggs.

The Fisheries Regulations Order No. 49 of 1983 states;

No person shall

i) disturb, take, have in his possession, sell or purchase any turtle eggs;

ii) interfere with any turtle nest;

iii) or sell, purchase or export any turtle or the shell thereof of the species Eretmochelys imbricata, known as the hawksbill turtle;

During the 1980s and 90s turtles were actively and opportunistically harvested, including for traditional purposes and for subsistence. The increased availability of snorkeling gear and spearguns in rural areas during the 1990's led to increased opportunistic catches of turtles by night divers targeting fish that came across sleeping turtles (8). Nesting turtles were also routinely harvested during this period as the 1983 legislation didn't specifically protect them, only the nests and eggs were protected. However, even this level of protection was very difficult to enforce in remote, rural areas and eggs and nesters were also routinely harvested during this period.

In 1995, SPREP sponsored the Year of the Turtle and the local NGO Wan Smol Bag (WSB) was commissioned by SPREP to create a drama performance (details of this event are given in detail in 8). This led to considerable awareness regarding threats to turtles, and the creation of a Turtle Monitor network initially on north Efate that eventually evolved into the Vanua-tai network to champion the community-based monitoring and conservation of turtles along with other natural resources. As access to turtles found along the nearshore reefs, along with nests and eggs are essentially controlled through customary land and marine tenure access rights, traditional leaders, clans and families have the traditional right to ban or control their harvests (7, 10, 8). There were a significant number of communities that enacted this right as the awareness program reached them since the mid-1990. There are also efforts to formalize some marine protected areas, and key ones established to date are listed in Annex 1.

To further support this work, and in response to the recognition of a declining turtle population and increasing international pressure to stem global declines, the following regulations (Fisheries Act No. 55 of 2005) pertaining to marine turtles were passed and gazetted in October 2005 while the above regulations were repealed.

38. Marine Turtles
(1) A person must not:
(a) take, kill, have in his or her possession, export, sell or purchase any turtles of the species Dermochelys coriacea known as leather back turtle; or
(b) take, have in his or her possession, sell, purchase or export any shell of the species referred to in

paragraph (a); or
(c) interfere with or disturb in any way a turtle nest or any turtle that is in the process of laying eggs; or
(d) take, have in his or her possession, export, sell or purchase any turtle egg; or
(e) use any weapon to harm, capture, kill or destroy any turtle species.
(2) Despite subclause (1), a person may apply to the Director for an exemption from all or any of the provisions under subclause (1) for the purposes of carrying out a customary practice.

The primary area that has an annual customary turtle harvest practice linked to their new yam harvesting ceremonies is the Maskelyne Islands off south Malekula Island. They formerly would consume well over 100 turtles annually including approximately 40, but often much more when available during new yam ceremonies (8). They continue to consume green and hawksbill turtles annually as part of new yam ceremonies under a Fisheries permit and consumed 23 in early 2017 (J. Legatt, Vanua-Tai, pers com). As of early 2018, the Fisheries Department has limited the consumption of turtles to one turtle per nasara (traditional descent lineage) for a total of 26 nasara's found in the Maskelyne area (W. Naviti, Director of Fisheries, pers comm.). Over the last decade, the number of turtles harvested at new yam has been variable, and sometimes difficult to control by authorities as this tradition remains quite ingrained to the people of the Maskelynes. During the latest yam festival held in February 2020, a total of 34 turtles were caught and consumed by the three villages on Uliveo Is., Maskelynes. The majority were green turtles (31 consumed), and with only 3 hawksbills consumed. The reason given for this was that hawkbills are more likely to bite divers, and about 15 years ago, a number of people from this island died from eating a hawksbill due to presumed chelonitoxism (F. Hickey, Field Report).

The amendment of 2005 also addressed the critically endangered leatherback concerns, as well as closed the loophole of consuming nesting turtles. It also restricted the catching of turtles to doing so by hand, as spearguns, spears, gaff hooks, (i.e. weapons) were no longer allowed. However, these new regulations were still not easily enforced in remote, rural areas.

In 2009 a further Fisheries Regulation amendment was introduced to prohibit the killing of all turtles as per;

59) Marine Turtles

(1) A person must not:

(a) take, kill, have in his or her possession, export, sell or purchase any or all of the following turtle of the species:

(i) Dermocheyles coriacea known as leatherback turtle, illustrated in Schedule 26;

(ii) Eretmochelys imbricata, known as the hawksbill turtle, illustrated in Schedule 26;

(iii) Chelonia mydas, known as the green turtle, illustrated in Schedule 26; or

(b) take, have in his or her possession, sell, purchase or export any shell of the turtle species referred to in paragraph (a); or

(c) interfere with or disturb in any way a turtle nest or any turtle that is in the process of preparing to nest or laying eggs; or

(f) take, have in his or her possession, consume, export, sell or purchase any turtle egg; or

(g) harm, capture, kill, consume, sell, purchase, export or destroy any turtle species (hatchlings, juveniles or adults) including by use of any weapon; or

(h) have in his or her possession any marine turtles that is held in captivity in any way.

(2) Despite subclause (1), a person may apply in writing to the Director for an exemption from all or any of the provisions under subclause (1) for the purposes of carrying out customary practices, educational and/or research purposes.

This effectively made the killing of the three main turtle species (the loggerhead and Olive Ridley were not included) illegal for the first time in Vanuatu's history. And it expanded the exemption to include not only for traditional purposes but also for educational and research purposes. With this provision, tourist operations that capture and rear turtles for educational purposes, or researchers that capture turtles for tagging or other research purposes could then act within the law with a valid permit.

In compliance with the latest Fisheries Act No. 10 of 2014, as well as to satisfy requirements of the WCPFC, a Vanuatu National Action Plan of Sea Turtles (NPOA Turtle) was completed in 2015 (15). The NPOA Turtle is a policy that seeks to protect, conserve and manage sea turtles in Vanuatu's waters and applies to all other jurisdictions where Vanuatu flag fishing vessels operate. As of 2014, Vanuatu had issued 134 International Authorization to Fish Certificates (including 86 longliners and 9 seiners) under various Regional Fisheries Management Organizations worldwide. This is up from 50 in 2010 (15; Appendix Table 12).

In 2012, Vanuatu was yellow carded by the European Union for failing to put effective control measures for the management of its Vanuatu flagged fishing fleet (15). This was resolved in 2013, but challenges remain to comply with all RMFOs including for turtle management.

The NPOA Turtle 2015 also reports that in 2010 there were 171 foreign, local and local-based longliner vessels licensed to fish in Vanuatu's EEZ. However, by 2014 this number was down to 78 (15).

Fishing effort continued to decrease from 2014 to 2015 from 65 vessels to 49 vessels but increased to 72 vessels in 2016. The reduction in the last few years was due to the shift in fishing effort towards the Solomon's and eastern Pacific where fishing was believed to be better, and after 2015 vessels started coming back to fish in the Vanuatu EEZ. (3).

As Vanuatu is a party to the WCPFC it is thus obligated to implement the provisions of the WCPFC CMM2008-03 on sea turtles. Accordingly, Vanuatu requires its flag vessels to, amongst other things, use mitigation measures identified in the Measure, record and report all turtle interactions, incidents and bycatch in its WCPFC Part 1 report annually to the Commission. Monitoring mechanisms such as observer and/or catch logs have been implemented on all licensed foreign and Vanuatu flag vessels. Offloading and transshipment in ports also provides for monitoring and verification on sea turtles bycatches (2)

1.5 Research

"One female green turtle ("Bamboo Lady") was equipped with a satellite tag in Vanuatu while nesting and came to New Caledonia to forage. Satellite telemetry revealed it took 12 days for the turtle to travel from Vanuatu to its feeding area in New Caledonia. The post-nesting migration of a female "Bamboo Lady" from Bamboo Bay in Vanuatu to its feeding ground in Voh (New Caledonia) is the first recorded migration of sea turtle between those two countries. New trajectories of megafauna in the Coral Sea are being recorded now that these secluded areas are starting to be investigated" (18). https://www.sprep.org/marine-turtles/marine-turtle-satellite-tracking.

"A small number of females have been found to travel from a rookery at Scilly atoll in French Polynesia to multiple distant feeding grounds (<2000 km) in Fiji, New Caledonia, Tonga, Vanuatu and Wallis and from the American Samoa to Fiji." (quoted from 18)

A male green turtle was tagged in Bora Bora, French Polynesia on Nov. 20, 2006 and migrated to Aneityum island in the south of Vanuatu. (Fig 3). Interestingly, this turtle was tracked inland a considerable distance once it arrived to Aneityum and the author was contacted by Lui Bell of SPREP to follow it up with the residents of Aneityum. It turned out that this turtle was eaten on the coast, and the tag was then disposed of up in the hills.

The most recent data available from the SPREP TREDS database covers 2017-2018. The 2016 data is currently missing. The 2017-2018 TREDS Report (19) indicates that out of the 15, 217 tags issued to Vanuatu since 1991, 4,705 tags have been entered into the TREDS and the green turtle was the second highest tagged species (n=777), with unidentified marine turtle species (n=144) being third (19).

The breakdown on turtles tagged in 2017-18 are as follows:

- 2017 71 green turtles were reported to be tagged and released from Malekula Island (51 green turtles), Epi Island (2 green), Vanu Lava Island (16 green) and Aniwa Island (1 green).

- 2018: A total of 9 green turtles were reported to be tagged and released from Malekula Island (3 green) and Vanua Lava Island (6 green).

Research Priorities for the Republic of Vanuatu are as follows:

1) To continue to monitor and tag turtles at key nesting sites to determine trends for the five species of marine turtles found in Vanuatu. As leatherbacks turtles remain critically endangered, sampling effort should increase for this species.

2) Training for Vanua-tai resource monitors in nest translocation techniques used where storm surges affect nests including impacts of altering nest temperatures on sex ratios.

3) Collect further information on other potential key and small nesting sites so as to confirm species, numbers and timing.

4) To continue to build the capacity of the Vanua-tai Resource monitors in monitoring, identifying and tagging turtles, especially for new members; and in refining data collection of turtle measurements, tag numbers, nesting and foraging population estimates.

5) Conduct further satellite tagging on nesting turtles of various species to determine where their foraging grounds are.

6) Conduct further genetic sampling from various rookeries to determine if Vanuatu's green turtles are one single MU?

7) Commence genetic sampling of hawksbill turtles to determine if they may also be a distinct MU.

8) Monitor key coastal and nesting habitats to document impacts from development, cyclones, storm surges and climate variability impacts.

9) Work closely with government to ensure existing turtle legislation is adequately monitored and enforced.

10) To bring tourism operations with turtle head-start programs into compliance with the Fisheries Act that provided permits to these operation so as to obtain data on hatchling species, source, mortality in captivity, adult species, source, and mortality so that data is obtained on an annual basis from all four existing facilities. Also, to propose limits on the overall number of these facilities and of the number of hatchlings held in captivity per facility for tourism/educational purposes as currently there are no limits and some facilities have 100's of hatchlings when only 20-30 are sufficient for educational purposes.

11) Continue to build capacity within government to monitor and enforce environmental protection of new developments that will further erode turtle foraging and nesting habitats.

2 RMU: Hawksbill (*Eretmochelys imbricata*) - Southwest Pacific

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

Overall, Vanuatu is estimated to have approximately 300 female hawksbills nesting annually (20). The hawksbill turtle nesting recorded in TREDS are on the islands of Ambrym, Efate, Epi, Espiritu Santo, Malekula, Moso (off north Efate) and Tegua, Torres (Table 2). The highest numbers, likely due to more intensive surveying on these two key hawksbill nesting sites, are from Moso Is. and Bamboo Bay (Malekula) during the 2006-2007, 2007-2008, 2009 - 2010 and 2011-2012 nesting seasons (Appendix Table 5).

Moso Island has numerous white beaches along its north shore, and these are key hawksbill nesting areas, and to a lessor extant for green turtles. Much smaller hawksbill rookeries are found along the beaches along north Efate including at Tuktuk Point, Kakula and Pele Islands with very limited nesting on Nguna Island. The beaches of Crab Bay on east Malekula are also known to have hawksbill nesting there, along with nesting in the areas just north of there around Uripiv Island and Port Stanley (9). Wiawi on Malekula is also an important hawksbill nesting site but hasn't been sampled as regularly as Bamboo Bay. During the season of 2018-2019, 23 hawksbill nests were enumerated, but sampling effort was limited. During the 2019-2020 season, 42 hawksbill nests were enumerated, although some would be re-nesting. (D.J. Aromalo, pers. comm.).

The Maskelynes Islands on south Malekula have extensive mangroves along much of their coast which limits turtle access to upslope beaches. But there are somehawksbill nesting beaches on various islets, many uninhabited, as well as on the main islands of Uliveo Sakao and Vulai and on the mainland west of Hokai village including nearby Lemenmang Islet (8,22). Aneityum Island has hawksbill nesting near Anelguahat; (D. Aromalo, pers comm). Reef Islands in the Banks Islands also have hawksbill nesting beaches. Extensive white sand beaches are found within the atoll but are regularly visited by fishers from surrounding islands and eggs and turtles often targeted for consumption (unpublished, Hickey Field Trip Report 2012).

2.1.2 Marine areas

Southeast Vanua-Lava in the Banks Group north from Port Patteson and Alget River north to Ravenga Island and seaward to the sea grass meadows are coral reefs and drop offs inhabited by hawksbill turtles. Also, Pakea Island reefs support hawksbills and beaches are used for nesting (species undetermined).

Reef Is. (also known as Rowa) an uninhabited atoll in northern Vanuatu and the extensive reefs are important for foraging by hawksbill. There is very little recent turtle data for Reef Islands available, but it is likely fishers still occasionally harvest turtles and eggs from this area due to their remoteness.

Malekula has numerous good coral reef for foraging including the Uripiv and Uri Island areas including Port Stanley and South to Crab Bay (10). Also, the Maskelyne Islands of south Malekula have extensive coral reefs for foraging and some beaches, including on uninhabited islands for nesting (8). However, extensive coverage of beaches by mangroves (Rhizophera spp.) makes access difficult for nesting turtles.

North Efate has good turtle habitat in the form of coral reefs for hawksbill. Including reefs at Lelepa, Kagula, Emao, Nguna, Pele, Emau and Moso Islands (8).

Aneityum Island in southern Vanuatu around the offshore Mystery (Inyueg) Island has extensive coral cover for foraging. Mystery Island area is a community conservation area with limited fishing and is an important tourism site receiving regular Cruise Ship visits.

Futuna Island also has hawksbill turtles present on its reefs, and with a recently placed Vanua-tai monitor there some have been flipper tagged.

The TREDS 2015 Report (13) reports tag recoveries of turtles tagged outside and recaptured in Vanuatu (see Appendix Table 8 & 9). Two hawksbills were found to have tags from other countries from near Lizard Island, Australia and the other from Upolu Island, Samoa. One turtle that was tagged at Bamboo Bay was recovered at Brooms head NSW Australia.

2.2 Other biological data

See Table 1.

A total of 1,454 hawksbill turtles have CCL measurement records in TREDS for Vanuatu. The size frequency graph shows 1,086 juveniles within the CCL size class range of 0.0-64.9cm, 23 sub-adults within the CCL size class range of 65.0-79.9cm and 345 adults within CCL size class range of 80.0-109.9cm (Fig 4). In 2010, Siota reported 870 hawksbill turtles with CCL measurements; In 2011-2012 1070 hawksbills with CCL measurements were reported and, 1,254 were reported in 2013-2014 (13).

2.3 Threats

2.3.1 Nesting sites

There are at least four head start programs around Efate that purchase hatchlings from communities to exhibit in tanks for tourists. These tend to be mainly hawksbill hatchlings and collected locally, although one facility occasionally sources them from other islands. Adult turtles are also caught or purchased for display in larger pools. Legislation to license these operations is under the auspices of a Fisheries research permit for educational purposes. However, to date, at least some or all of the facilities do not have permits to operate, and some facilities have been observed to have high mortalities of hatchlings, often related to poor water quality.

It would be useful to bring these facilities into compliance with the legislation to obtain permits with conditions on supplying data to the Fisheries Department. In this way, useful data on species and sources of hatchlings and adults purchased could be documented as well as mortalities, diseases and other issues so authorities have an idea on the impact these facilities have on local turtle populations. This data would also be useful to learn more about the location of the numerous small nesting areas around Efate, and in some cases other islands where hachlings are sourced. It may also be useful to cap the number of these facilities on Efate until more is known about their impact on turtle populations. Also, to limit the number of turtles held by them, as only a small number of turtles are really required to realize the educational benefit of these facilities, yet some facilities have hundreds of hatchlings held in captivity.

See Section 1.3.1 for more information.

2.3.2 Marine areas

See Section 1.3.2 for more information. Fishery interactions with longline and purse seine vessels (Appendix Table 12, 13 and 14).

2.4 Conservation

Given the long time it takes for turtles to sexually mature, and that turtle conservation has only really been initiated over the last 25 years in Vanuatu (and for the far northern and southern islands conservation efforts are really just arriving there in the last few years) it is difficult to indicate any clear trends on increases in nesting at this point. Compounding this is that sampling effort of sites has also not been very uniform for many nesting sites as well. However, during the latest nesting season of 2018/2019, the hawksbill nesters returning to Bamboo Bay totaled 170 (D. Aromalo, pers. comm).

What was clearly observed in Vanuatu shortly after the awareness associated with the Year of the Turtle in 1995 was that when WSB turtle monitors started to work with community leaders around north Efate to impose a ten-year taboo on turtle consumption, most communities agreed it was necessary as they had witnessed the decline in turtles over the years. A survey estimating the changes in turtle consumption for this area in 2005 was that over 100 fewer turtles per year were consumed around north Efate. So, over the ten-year period from 1995 to 2005, over 1,000 fewer green and hawksbill turtles were estimated to have been consumed in this area (8).

Between the community-based conservation efforts since 1995 and more comprehensive legislation passed by the Fisheries Department since 2009 that prohibits the killing of the three common species of turtle found in Vanuatu, it is clear that significantly less turtles are now consumed as compared to the 1980s and early 1990s when turtles and their eggs were consumed whenever possible. However, as turtles found nesting or foraging in Vanuatu migrate to other countries in the region, the stability and growth of these populations also depend on conservation efforts in those countries as well as on the high seas where pollution, entanglement, and bycatch from industrial fisheries take their toll.

As Vanuatu is now coming up to nearly 25 years of conservation efforts, we may start to see to trends in recruitment as this is within the range of time it takes for turtles to sexually mature. This will also depend on how well the current turtle legislation is enforced to limit turtle harvests. To assist with enforcement, the Vanuatu Fisheries Department has recently initiated a program to train community members to act as Fisheries Authorized Officers to monitor fisheries infractions at the village level including for turtle related infractions.

With more consistent survey effort over more sites, population trends will become increasingly clearer. However, the other critical issue is now with increased coastal land development pressure continuing in Vanuatu, the importance to ensure that the government agencies responsible for monitoring and enforcing the environmental legislation in place can keep up with the pace of development and protecting habitat important to turtles (and other resources) throughout their lifecycle. However, even within the parameters of current legislation such as foreshore development permits and environmental impact assessments, coastal development of formerly pristine nesting beach areas continues for resort and tourism as well as coastal housing developments where light and noise pollution, seawalls, fences and domestic dogs may adversely affect nesting activities.

Vanuatu is a party to several international conventions that have a nexus to sea turtle conservation, summarized in Table 3.

See Section 1.4 for more specific information on regulations.

2.5 Research

A hawksbill turtle was tagged on Moso November 22, 2007, and stayed in the general area for 75 days. https://www.sprep.org/marine-turtles/turtle-tracking-vanuatu

In mid-January 2018, three nesting hawksbill turtles were satellite tagged using Telonics (TAM 2638 ARGOS) satellite tags on north Moso Island off north Efate. This is a three-year program that was funded primarily by the Hawaii Prepatory Academy (HPA) led by MTSG Hawaii member Marc Rice (HPA Director, Sea Turtle Research Program) along with Laura R. Jim (HPA Deputy Director, Turtle Research Program) and a small group of HPA students and assisted by Moso island residents and the author. The summary data for the three nesters tagged is given in Appendix Table 10. As of March 30th, 2018, one turtle settled in at Nehoue Bay, northern New Caledonia, another in the Gladstone area of Queensland and the third still at sea heading for northern Australia. The tracking map is shown in Fig 5. and updates are available at http://akepa.hpa.edu/~mrice/turtle/Vanuatu/Vanuatu.html

In January 2019, a nesting hawksbill turtle (named Pua Lilia) was tagged on north Moso Island and it migrated to southern New Caledonia as shown in the tracking map below. This turtle was tagged with a Telonics TGW-4*7* Iridium GPS tag. This nester remained off north Moso for the following eight weeks and likely nested another four times at two-week intervals. Her inter-nesting home range was estimated to be less than 1.31 km^2. (Fig 6).

A genetic sample was also collected for DNA analysis from this nester, and more hawksbills will be sampled over the coming year.

Inter-nesting period one ran from January 10 to January 23, 2019 (Fig 7). During this 14-day period, Pua Lilia traveled a total linear distance of 23.7 km as measured from detection point to detection point. Her average rate of movement was 0.07 km/h. Inter-nesting period two ran from January 24 to February 6, 2019 and the total distance covered was 22.0 km at an average speed of 0.07 km/hr. During inter-nesting period four, Pua Lilia covered a total of 11.9 km at an average speed of 0.04 km/h. During inter-nesting period five, she covered a total distance of 14.6 km at a rate of 0.04 km/h (Figure 8a-d).

Post Nesting Migration: After nesting for what we believe was the 5th time, Pua Lilia departed the nesting area she had inhabited for at least 57 days. She then traveled 689 km in 21 days to the southern offshore reefs of southern New Caledonia. She traveled southwest around the western tip of Moso Island and northwest of Lelepa island before moving south along the coast of Efate. On March 10, 2019 she departed the coast of Efate Island and moved in a south-southwest direction, eventually heading in a more southerly direction. On March 18, 2019 (11 days after her departure from Moso Island), Pua Lilia approached the southeastern shore of Lifou Island, New Caledonia and skirted around the east coast, departing the island on March 20, 2019. She proceeded south-southwest and came near the southern coast of New Caledonia on March 22, 2019 (Fig 9). She continued south and southwest in a somewhat meandering path until she reached what we consider to be her home foraging grounds on March 28,2019. This area is the southern reef area of New Caledonia approximately 56 km west of Isle of Pines, New Caledonia and 74 km southeast of Noumea, New Caledonia. (Fig 10-13).

In January of 2020, three more hawksbill nesters were tagged on the beaches on the north side of Moso Island. The first one was tagged with a Telonics TGW-4*7* Iridium GPS tag. This turtle migrated south west and arrived at her foraging grounds 21 days later traveling 662 km to reach southern New Caledonia near the Woodin Lighthouse. The next nester was also tagged with a Telonics TGW-4*7* Iridium GPS tag and migrated for only 12 days traveling 379 km to Aneityum Island, the southernmost inhabited island of Vanuatu. The third nester on Moso was tagged with a Telonics TAM 2640 ARGOS satellite tag and migrated 34 days and a total of 1709 km to arrive 360 km off northern Australia off Mackay when the tag stopped transmitting.

A summary of migratory tracks is given in Figure 15 of the seven hawksbill post-nesters satellite tagged on Moso Island, central Vanuatu between 2018 and 2020.

The most recent data available from the SPREP TREDS database covers 2017-2018. The 2016 data is currently missing. The 2017-2018 TREDS Report (19) indicates that out of the 15,217 tags issued to Vanuatu since 1991, 4,705 tags have been entered into the TREDS database and the hawksbill turtle (n=1,550) is the species with the highest record in TREDS for Vanuatu (19).

The breakdown on turtles tagged in 2017-18 are as follows:

- 2017: A total of 144 hawksbill turtles were reported to be tagged and released from Tranquility Island Resort (134 head starting hawksbill turtles), Malekula Island (5 hawksbill), Futuna Island (2 hawksbill), and Vanu Lava Island (3 hawksbills).

- 2018: A total of 144 hawksbill turtles were reported to be tagged and released from Tranquility Island Resort (134 head starting hawksbill turtles), Malekula Island (1 hawksbill) and Vanua Lava Island (9 hawksbills).

See Section 1.5 for specific future research goals and research priorities.

3 RMU: Leatherback turtle (*Dermochelys coriacea*) - West Pacific

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

TREDS tagging records show leatherback turtle nesting on the islands of Epi, Efate, Espiritu Santo and Malekula with Votlo beach on Epi showing the most numbers (Table 2; 14, 13). More detailed nesting beach survey data for Votlo is given in 21. Important sites that have emerged over the past few years as index sites include Votlo on Epi is the main leatherback nesting beach accounting for approximately 70% of the nesting in Vanuatu (Appendix Tables 2-3). In the 2018/19 nesting season there were 12 leatherbacks enumerated nesting at Votlo. However, by February most of these nests were observed to be all washed out by storm waves (D. Aromalo, pers comm, likely from TC Oma that passed to the west of Malekula in February 2019). The second most important nesting beach in Vanuatu is at Maranata on south Ambrym Island where approximately 30% of the leatherbacks in Vanuatu nests.

In the past, however, there are records of widely scattered reports of smaller leatherback nesting areas throughout Vanuatu Petro et. al. (21) reported "Residents of a number of different islands, from Gaua and Espiritu Santo in the north through Ambae, Efate to Tanna and Aneityum in the south indicated that there were formerly at least small nesting populations of leatherbacks on the black beaches of these islands. Nesting events on these islands were reported to have significantly declined since the 1980s, most probably in response to increasing human population growth, including migration to more remote coastal areas and subsistence pressure on nesting females and eggs." This report goes on to list leatherbacks formerly found nesting on Efate at Teouma Bay (circa 2005- consumed) and Mele Bay (2 in 1997–1998, 3 in 1999–2000, and 1 in 2003) south Pentecost Island in 2000 (consumed), Ambae (Devils Rock and Lolowai), Ranon area of north Ambrym, and at various locations around Malekula Island, including one that was consumed circa 1996 at Sarmette (9).

Malekula residents also indicated that a leatherback came ashore to nest on 11 December 2004 at the black beach of Aulua village some 20 km south of Crab Bay. This leatherback was observed by many people, not harmed and safely returned to sea. It is not clear, however, whether it successfully nested or not, or whether hatchlings emerged (9).

With the current turtle awareness level and trend in Vanuatu for greater concern for protecting turtles, some of these smaller leatherback nesting sites may become active again. It was encouraging that a Vanua-tai member on Erromango Island in southern Vanuatu recorded a leatherback nesting at Port Narvin on the east coast of Erromango on February 15, 2019. This was the first nesting of a leatherback in this area in living memory.

3.1.2 Marine areas

Other than travelling through the waters of Vanuatu to nest, the leatherback in a vagrant (incidental traveler) in the marine waters around Vanuatu. There are no known foraging sites known for leatherback around Vanuatu (21), however, leatherbacks are occasionally captured in the longline fishery (Appendix Table 12, 13, 14).

3.2 Other biological data

There are only 16 leatherback turtles with CCL measurements recorded in TREDS for Vanuatu. The CCL size class range for the nine leatherback turtles are from 70.0-199.9 cm.

Little other data are recorded (Table 1).

3.3 Threats

3.3.1 Nesting sites

See Section 1.3.1 for more information.

3.3.2 Marine areas

See Section 1.3.2 for more information. Fishery interactions with longline and purse seine vessels (Appendix Table 12, 13 and 14).

3.4 Conservation

Given the long time it takes for turtles to sexually mature, and that turtle conservation has only really been initiated over the last 20 years in Vanuatu (and for the far northern and southern islands conservation efforts are really just arriving there in the last few years) it is difficult to indicate any clear trends on increases in nesting at this point. Compounding this is that sampling effort of sites has also not been very uniform for many nesting sites as well. However, as of late 2017, leatherbacks reported for Votlo in 2015/16 were from 12-15 nests (D. Aromalo, pers. comm).

See Section 1.4 for more information.

3.5 Research

The most recent data available from the SPREP TREDS database covers 2017-2018. The 2016 data is currently missing. The 2017-2018 TREDS Report (19) indicates that out of the 15, 217 tags issued to Vanuatu since 1991, 4,705 tags have been entered into TREDS with only 17 leatherbacks being tagged (19).

See Section 1.5 for specific future research goals.

4 RMU: Loggerhead turtle (*Caretta caretta*) - South Pacific

4.1 Distribution, abundance, trends

4.1.1 Nesting sites

There is only one record in TREDS of a nesting loggerhead turtle in 2006/07 at Linua on the island of Loh in the Torres Group of northern Vanuatu (Table 2; 14). However, with the data provided from the Vanuatu Environment Unit (VEU) first turtle nesting survey 1992-94 in Table 1, at least three islands now have records of loggerhead nesting; Loh Island in the Torres Group, Wiawi, Malekula and Votlo, Epi (Appendix Table 4). Information on loggerhead nesting sites are data deficient nationally.

4.1.2 Marine areas

The loggerhead (*Caretta caretta*) is an intermittent visitor within the Republic of Vanuatu. There are no known or monitored foraging sites, however they do occur within the EEZ of Vanuatu.

4.2 Other biological data

Only five loggerhead turtles have CCL measurements in TREDS for Vanuatu. The CCL size class range for these loggerhead turtles are from 40.0-59.9cm for juveniles (n=4) and 100.0-104.9cm for one adult.

Little data are recorded for this species (Table 1).

4.3 Threats

4.3.1 Nesting sites

See Section 1.3.1 for more information.

4.3.2 Marine areas

See Section 1.3.2 for more information. Fishery interactions with longline and purse seine vessels (Appendix Table 12, 13 and 14).

4.4 Conservation

See Section 1.4 for more information.

4.5 Research

The most recent data available from the SPREP TREDS database covers 2017-2018. The 2016 data is currently missing. The 2017-2018 TREDS Report (19) indicates that out of the 15, 217 tags issued to Vanuatu since 1991, 4,705 tags have been entered into the TREDS with only seven loggerhead turtles being tagged (19).

See Section 1.5 for specific future research goals.

5 RMU: Olive ridley turtle (*Lepidochelys olivacea*) - West Pacific (LO-W PAC)

5.1 Distribution, abundance, trends

5.1.1 Nesting sites

NONE REPORTED. Information on olive ridley nesting sites are the most data deficient nationally.

5.1.2 Marine areas

The olive ridley is an intermittent visitor within the Republic of Vanuatu and is known to interact with the international fishing fleets registered with Vanuatu (2, 3).

5.2 Other biological data

Only three olive ridley turtles have CCL measurements recorded in TREDS for Vanuatu. The CCL size class range for these olive ridley turtles is from 45.0-59.9cm.

Little to no data is recorded for this species except from longline by-catch (Table 1).

5.3 Threats

5.3.1 Nesting sites

Not applicable

5.3.2 Marine areas

See Section 1.3.2 for more information. Fishery interactions with longline and purse seine vessels (Appendix Table 12, 13 and 14).

5.4 Conservation

See Section 1.4 for more specific information.

5.5 Research

The most recent data available from the SPREP TREDS database covers 2017-2018. The 2016 data is currently missing. The 2017-2018 TREDS Report (19) indicates that out of the 15, 217 tags issued to Vanuatu since 1991, 4,705 tags have been entered the with five olive ridley turtles being tagged (19).

See Section 1.5 for more specific future research goals.

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Table 1. Biological and conservation information about sea turtle Regional Management Units in the Republic of Vanuatu.

RMU	**CM-SW PAC**	Ref #	**EI-SW PAC**	Ref #	**LO-W PAC**	Ref #	**DC-W PAC**	Ref #	**CC-S PAC**	Ref #
Occurrence										
Nesting sites	Y	8,13	Y	8,13	N	n/a	Y	8,13	Y	8,13
Pelagic foraging grounds	N	n/a	N	n/a	Y	n/a	Y	n/a	Y	n/a
Benthic foraging grounds	Y	1,6,9	Y	1,6,9	Y	6,9	Y	6,9	Y	6,9
Key biological data										
Nests/yr: recent average (range of years)	30 (2006--2014)	13,14,15	51 (2006-2014)	13,14,15	n/a	n/a	5 (2002-2013)	13,14,15	1	13,14,15
Nests/yr: recent order of magnitude	10's	n/a	10's	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	2	n/a	2	n/a	n/a	n/a	1 (2002-03)	n/a	0	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	27	n/a	14	n/a	n/a	n/a	4	n/a	3	13,14,15
Nests/yr at "major" sites: recent average (range of years)	11 (2006-2014)	n/a	25 (2006-2014)	n/a	n/a	n/a	36 (2002-2003)	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	3 (2006-2014)	n/a	3 (2006-2014)	n/a	n/a	n/a	2 (2002-2013)	n/a	1	13,14,15
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Min adult size, CCL or SCL (cm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)	Decline	8	Decline	n/a	n/a	n/a	Decline	n/a	Decline	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Published studies										

Growth rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Genetics	Y	18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Stocks defined by genetic markers	Y	18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Remote tracking (satellite or other)	Y	18, this study	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	Y	11	Y	11	n/a		Y	11	Y	11
Threats										
Bycatch: presence of small scale / artisanal fisheries?	Y	12,15	Y	12,15	Y	12,15	Y	12,15	Y	12,15
Bycatch: presence of industrial fisheries?	Y	12,15	Y	12,15	Y	12,15	Y	12,15	Y	12,15
Bycatch: quantified?	Y	12,15	Y	12,15	Y	12,15	Y	12,15	Y	12,15

Take. Intentional killing or exploitation of turtles	Y	7,10	Y	7,10	Y	7,10	Y	7,10	Y	7,10
Take. Egg illegal harvest	Y	7,10	Y	7,10	Y	7,10	Y	7,10	Y	7,10
Coastal Development. Nesting habitat degradation	Y	4	Y	4	Y	4	Y	4	Y	4
Coastal Development. Photopollution	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Egg predation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	12	Y	12	Y	12	Y	12	Y	12
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	Y	n/a	Y	n/a	n/a	n/a	Y	n/a	Y	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Loss of traditional culture	Y	5,8	Y	5,8	Y	5,8	Y	5,8	Y	5,8
Long-term projects (>5yrs)										
Monitoring at nesting sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Number of index nesting sites	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Conservation										
Protection under national law	Y	2,3,15	Y	2,3,15	Y	2,3,15	Y	2,3,15	Y	2,3,15
Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hatcheries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

By-catch: onboard best practices	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: spatio-temporal closures/reduction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2. Nesting beaches in the Republic of Vanuatu.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Ref #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
				Long	Lat	Long	Lat	Long	Lat					
CC-S PAC														
Wiawi-Malekula	N	2 (1993)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	8	n/a	n/a
Votlo-Epi	N	1 (1994)	n/a	n/a	n/a	n/a	n/a	168.32	-17.73	n/a	n/a	8	n/a	n/a
Linua-Loh, Torres	N	1 (2006-2007)	n/a	n/a	n/a	n/a	n/a	166.6	-13.3	n/a	n/a	13, 14	n/a	n/a
Malekula	N	2 (2008-2009)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13, 14	n/a	n/a
CM-SW PAC														

Maskelynes -	N	3 (1992)	n/a	n/a	n/a	n/a	n/a	167.8	-16.5	n/a	n/a	8	n/a	n/a
Motalava	N	1 (1993)	n/a	n/a	n/a	n/a	n/a	167.7	-13.6	n/a	n/a	8	n/a	n/a
Wiawia-Malekula	N	9 (1993)	n/a	n/a	n/a	n/a	n/a			n/a	n/a	8	n/a	n/a
Asaola-Pentecost	N	1 (2000)	n/a	n/a	n/a	n/a	n/a	168.1	-15.5	n/a	n/a	13	n/a	n/a
Aniwa Lagoon-Aniwa	N	4 (2007)	n/a	n/a	n/a	n/a	n/a	169.6	-19.2	n/a	n/a	13	n/a	n/a
Bamboo bay-Malekula	N	93 (2004, 2006-2014)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Dickson reef village-Malekula	N	1 (2007)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Epau village-Efate	N	1 (2007)	n/a	n/a	n/a	n/a	n/a	168.4	-17.6	n/a	n/a	13	n/a	n/a
Epi-Epi	N	1 (2003)	n/a	n/a	n/a	n/a	n/a	168.3	-16.7	n/a	n/a	13	n/a	n/a

Lawa-Malekula	N	3 (2002)	n/a	n/a	n/a	n/a	n/a	167.4	-16.4	n/a	n/a	13	n/a	n/a
Letokas Village-	N	3 (2011)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Litatra-Tegua	N	2 (2001,2007)	n/a	n/a	n/a	n/a	n/a	166.63	-13.32	n/a	n/a	13	n/a	n/a
Mifilau-Epi	N	1 (2000)	n/a	n/a	n/a	n/a	n/a	168.32	-17.73	n/a	n/a	13	n/a	n/a
Malekula-Malekula	N	13 (2004,2006,2011,2013)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Molboe-Espiritu Santo	N	1 (2007)	n/a	n/a	n/a	n/a	n/a	167	-15	n/a	n/a	13	n/a	n/a
Motalava-Motalava	N	1 (1993)	n/a	n/a	n/a	n/a	n/a	167.7	-13.6	n/a	n/a	13	n/a	n/a
Okai-Malekula	N	3 (2004)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Rembe-Malekula	N	4 (2004)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Ringdove-Epi	N	1 (2003)	n/a	n/a	n/a	n/a	n/a	168.1	-16.6	n/a	n/a	13	n/a	n/a

Rovoliu-Epi	N	1 (1999)	n/a	n/a	n/a	n/a	n/a	168.32	-17.73	n/a	n/a	13	n/a	n/a
Tasiriki-Moso	N	46 (2006-2009)	n/a	n/a	n/a	n/a	n/a	168.25	-17.53	n/a	n/a	13	n/a	n/a
Tumaris-	N	3 (2011)	n/a	n/a	n/a	n/a	n/a			n/a	n/a	13	n/a	n/a
Unakap-Nguna	N	1 (2006)	n/a	n/a	n/a	n/a	n/a	168.35	-17.5	n/a	n/a	13	n/a	n/a
Unknown-Vanuatu	N	4 (2011-2013)	n/a	n/a	n/a	n/a	n/a			n/a	n/a	13	n/a	n/a
Vaipei-Espiritu Santo	N	2 (2006)	n/a	n/a	n/a	n/a	n/a	166.9	-15.3	n/a	n/a	13	n/a	n/a
Vakas-Malekula	N	1 (2004)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	13	n/a	n/a
Vasvasada-Pentecost	N	1 (2006)	n/a	n/a	n/a	n/a	n/a	168.17	-15.71	n/a	n/a	13	n/a	n/a
Votlo-Epi	N	10 (2002, 2011,2013)	n/a	n/a	n/a	n/a	n/a	168.32	-17.73	n/a	n/a	13	n/a	n/a
Votlo Research Site-Epi	N	6 (2003,2005,2011)	n/a	n/a	n/a	n/a	n/a	168.32	-17.73	n/a	n/a	13	n/a	n/a
Wanbe-Epi	N	1 (2006)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	13	n/a	n/a

Wiawia-Malekula	N	22 (2006-2008, 2011-2014)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	13	n/a	n/a
Worasivi-Pele	N	2 (2006)	n/a	n/a	n/a	n/a	n/a	168.4	-17.49	n/a	n/a	n/a	n/a	n/a
DC-W PAC														
Port Olry-Espiritu Santo	N	1 (2006)	n/a	n/a	n/a	n/a	n/a	167	-15	n/a	n/a	13, 14	n/a	n/a
Port Quimie-Epi	N	2 (2002-2004)	n/a	n/a	n/a	n/a	n/a	168	-16.32	n/a	n/a	13, 14	n/a	n/a
Port Vato-Epi	N	9 (2002-2003)	n/a	n/a	n/a	n/a	n/a	168	-16.32	n/a	n/a	13, 14	n/a	n/a
Votlo-Epi	N	11 (2002-2013)	n/a	n/a	n/a	n/a	n/a	168.32	-17.73	n/a	n/a	13, 14	n/a	n/a
EI-SW PAC														
Maskelynes -	N	3 (1992)	n/a	n/a	n/a	n/a	n/a	167.8	-16.5	n/a	n/a	8	n/a	n/a

Bamboo Bay-Malekula	N	129 (2004-2014)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Lalinda beach-Ambrym	N	1 (2007-2008)	n/a	n/a	n/a	n/a	n/a	168.1	-16.2	n/a	n/a	13	n/a	n/a
Letokas Village-	N	1 (2011-2012)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Malekula-Malekula	N	1 (2004-2005)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Tukutuku/Angoroa-Efate	N	1 (1995-1996)	n/a	n/a	n/a	n/a	n/a	168.4	-17.6	n/a	n/a	13	n/a	n/a
Tumaris-	N	2 (2011-2012)	n/a	n/a	n/a	n/a	n/a			n/a	n/a	13	n/a	n/a
Pinapow Beach-Malekula	N	1 (2005-2006)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Rembe-Malekula	N	2 (2003-2004)	n/a	n/a	n/a	n/a	n/a	167.5	-16.3	n/a	n/a	13	n/a	n/a
Ringdove-Epi	N	1 (2003-2004)	n/a	n/a	n/a	n/a	n/a	168.1	-16.6	n/a	n/a	13	n/a	n/a

Rovoliu-Epi	N	1 (2000-2001)	n/a	n/a	n/a	n/a	n/a	168.32	-17.73	n/a	n/a	13	n/a	n/a
Tasiriki-Moso	N	164 (2006-2010)	n/a	n/a	n/a	n/a	n/a	168.25	-17.53	n/a	n/a	13	n/a	n/a
Tavloel-Tegua	N	1 (2000-2001)	n/a	n/a	n/a	n/a	n/a	166.6	-13.2	n/a	n/a	13	n/a	n/a
Vaipei-Espiritu Santo	N	3 (1996, 2006)	n/a	n/a	n/a	n/a	n/a	166.9	-15.3	n/a	n/a	13	n/a	n/a
Wiawi-Malekula	N	8 (2007, 2014, 2019)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	13	n/a	n/a
Votlo-Epi	N	1 (2013, 2014)	n/a	n/a	n/a	n/a	n/a	168.32	-17.73	n/a	n/a	13	n/a	n/a

Table 3. International treaties with a nexus to sea turtle conservation to which the Republic of Vanuatu is a party.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPF Convention)	y	y	Annual Reports, legislation updates	The convention applies to all species of highly migratory fish stocks (defined as all fish stocks of the species listed in Annex I of the 1982 Law of the Sea Convention occurring in the convention area and such other species of fish as the WCPFC may determine) within the Convention Area, except sauries. The Commission has adopted a binding	A binding measure prescribes measures to reduce sea turtle bycatch in purse seine and shallow-set pelagic longline fisheries. The measure also prescribes the use of handling and release methods to maximize the probability of post-release survival in purse seine and shallow-set pelagic	This regional fisheries management organization has the authority to adopt binding measures for tuna fisheries, including to manage bycatch of sea turtles.

				measure applicable to sea turtle conservation resulting from fisheries bycatch (WCPFC, 2008)	longline fisheries (WCPFC, 2008)	
United Nations Framework Convention on Climate Change	y	n/a	Annual Reports, National legislation & policy updates	n/a	n/a	Relative sea level rise and changes in air and sea temperatures pose a threat to sea turtles.
Convention on Biological Diversity	y	n/a	National Biodiversity Strategy Action Plan (NBSAP)	n/a	n/a	As the convention title suggests.
United Nations Convention on the Law of the Sea	y	Y	n/a	n/a	n/a	Under the 1982 Law of the Sea Convention, States are obligated to protect and preserve the marine environment (Article 192) and consider the effects of fishing on species associated with or dependent upon commercially exploited species (United Nations, 1982 [Article 119]). This is elaborated further in the

						1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982, Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA), which requires States to minimize bycatch and impacts on associated and dependent species (United Nations, 1995 [Article 5(f)]).
CITES	Y	n/a	Annual reports	Controls trade of endangered species	Issues permits for international trade of Appendix II & III species.	Trade or export of any turtle products prohibited; especially relevant for hawksbills, the main species used for turtle shell jewelry.
Convention on Migratory Species (CMS)	Y	n/a	n/a	n/a	n/a	n/a
Convention on the Conservation and Management of High Seas	Y	n/a	n/a	n/a	n/a	n/a

Fishery Resources in the South Pacific Ocean						
MARPOL	Y	n/a	n/a	n/a	minimize pollution of the oceans and seas, including dumping, oil and air pollution. The objective of this convention is to preserve the marine environment in an attempt to completely eliminate pollution by oil and other harmful substances and to minimize accidental spillage of such substances.	Prohibits the pumping of bilge water in coastal waters

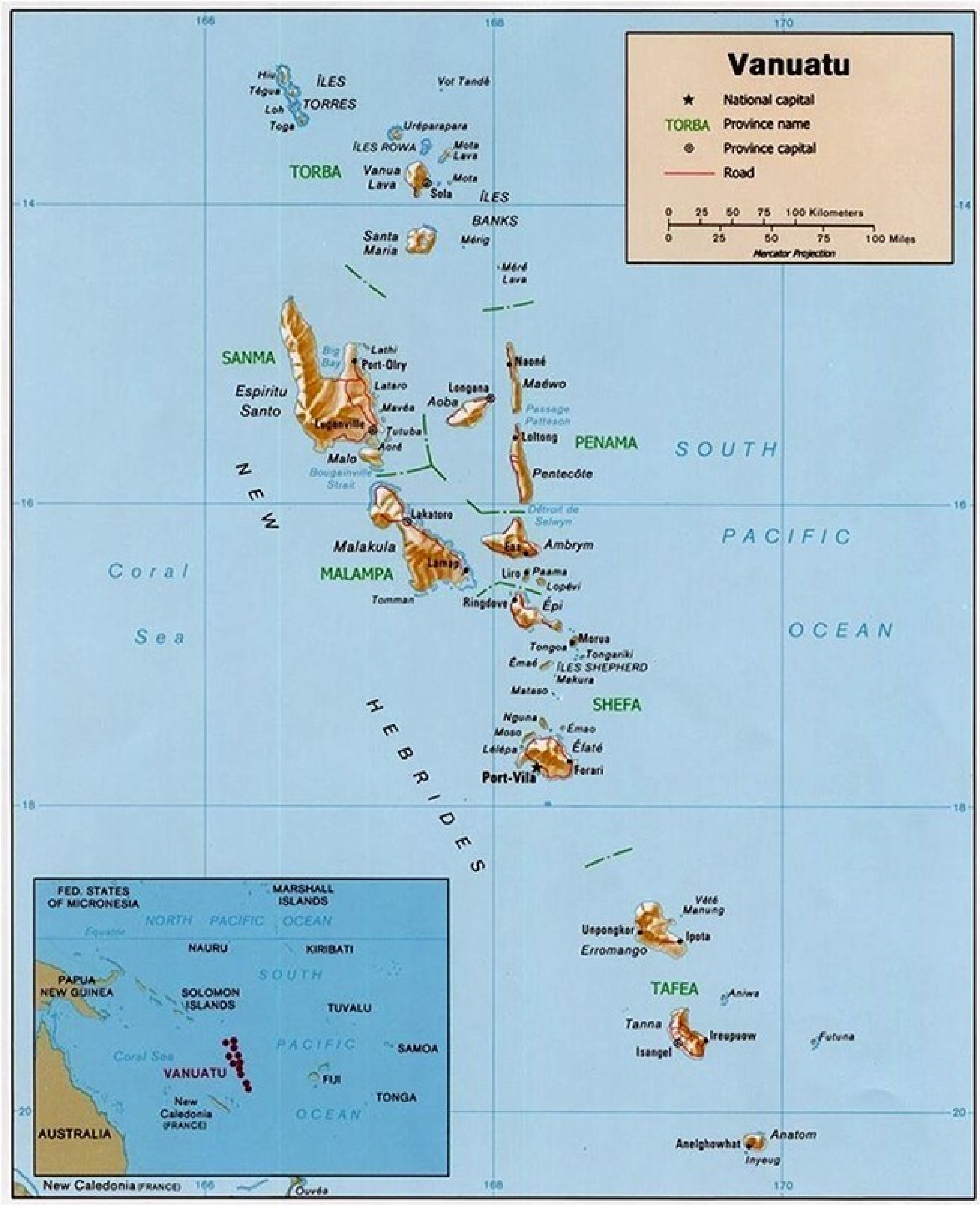

Figure 1. Map of Vanuatu showing the main islands

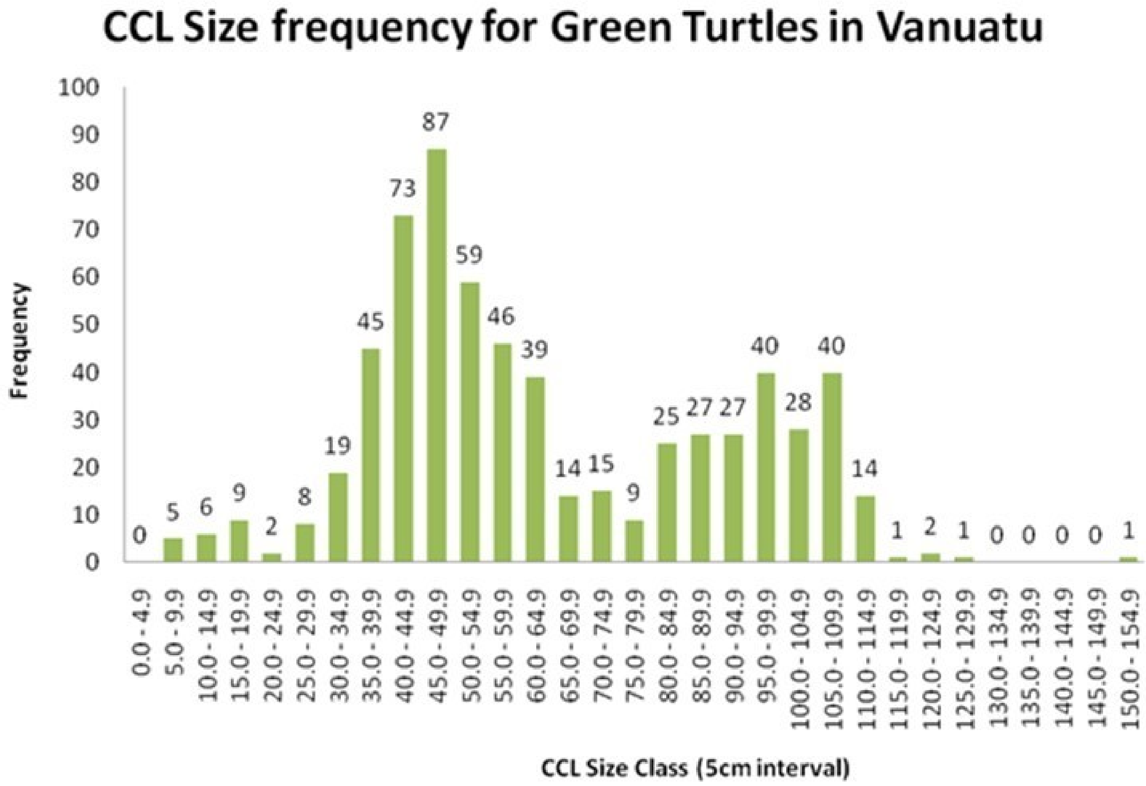

Figure 2: Size frequency for green turtles as recorded in TREDS for Vanuatu.

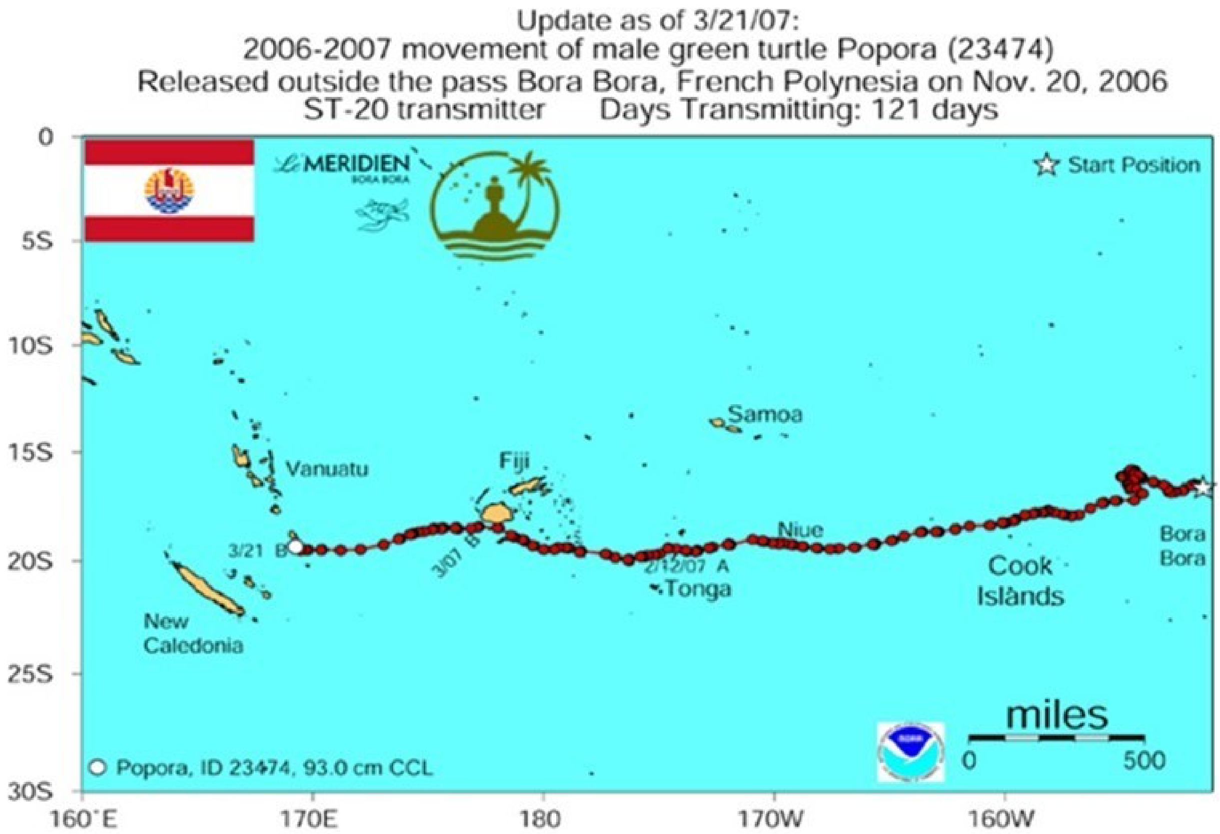

Figure 3. Satellite tracked movement of male green turtle from Bora Bora, French Polynesia to the waters of Vanuatu.

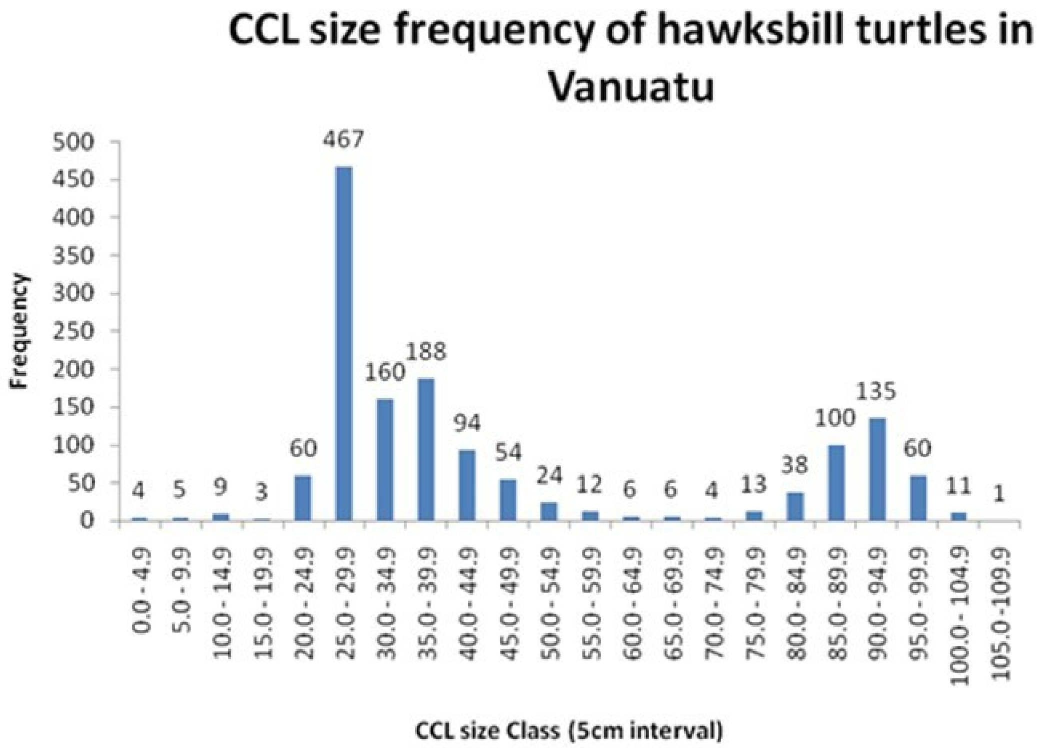

Figure 4: Size frequency for hawksbill turtles as recorded in TREDS for Vanuatu.

Figure 5. Three nesting hawksbill turtles tagged on Moso Island; north Efate in January 2017 shown as of March 30 2017.

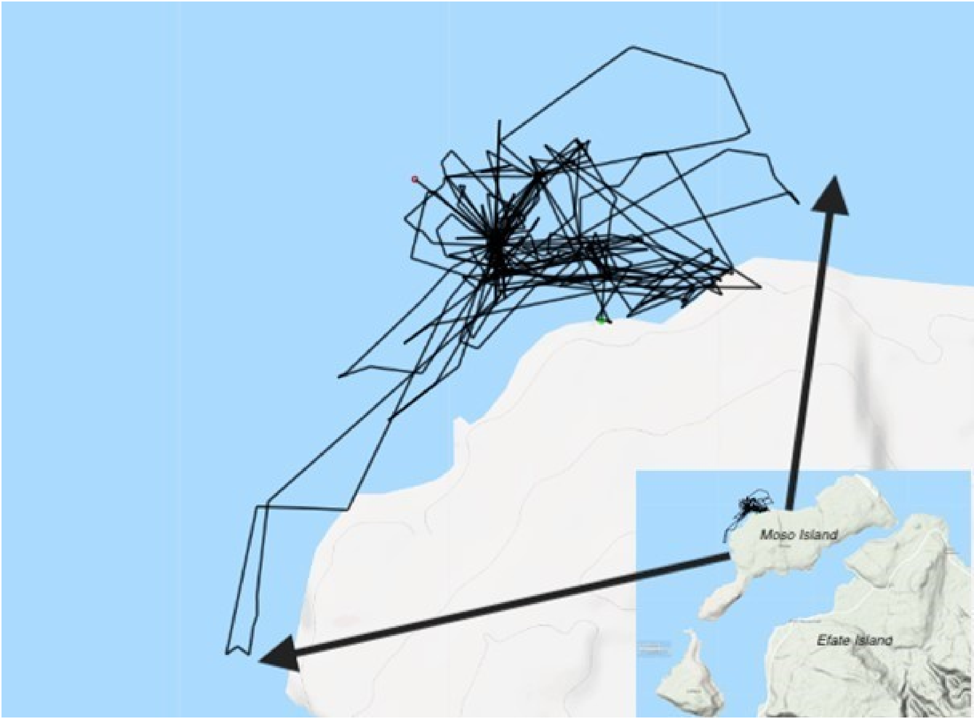

Figure 6. Pua Lilia inter-nesting period lasting from 01/09/2019 to 03/07/2019. It is estimated that she nested 5 times total during her time off northern Moso Island. The Distance covered during the interesting period totaled 72.8 km at an average speed of 0.05 km/hr.

Figure 7. The 95% kernel utilization distribution for Pua Lilia during the entire inter-nesting period from January 9 to March 6, 2019. The total area of the KUD is 1.31 km^2.

Figure 8. The tracks of each inter-nesting period are shown in blocks a-d. Block a represents interesting period from January 10 to January 23, 2019; block b is the interesting period from January 24 to February 6, 2019; block c is the interesting period from February 7 to February 20, 2019; block d is the period from February 21 to March 6, 2019.

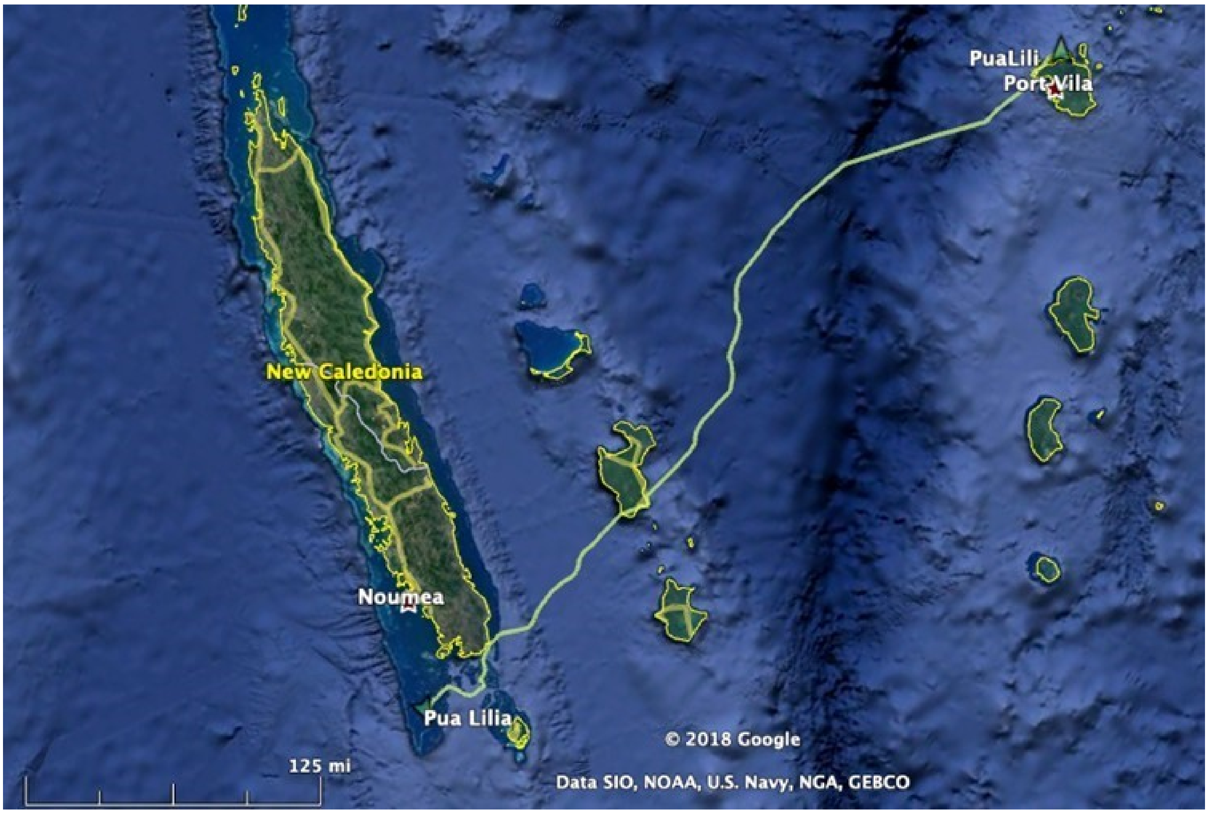

Figure 9. Pua Lilia's post nesting migration began on March 7, 2019 and ended at her home foraging areas on March 28, 2019. The total distance traveled was 689 km at an average speed of 1.4 km/h and she took 21 days to complete the trip.

Figure 10. The overview of Pua Lilia's foraging grounds is centered around latitude 22.78 N, 166.90 E and covers an area of approximately 14.5 km^{2}.

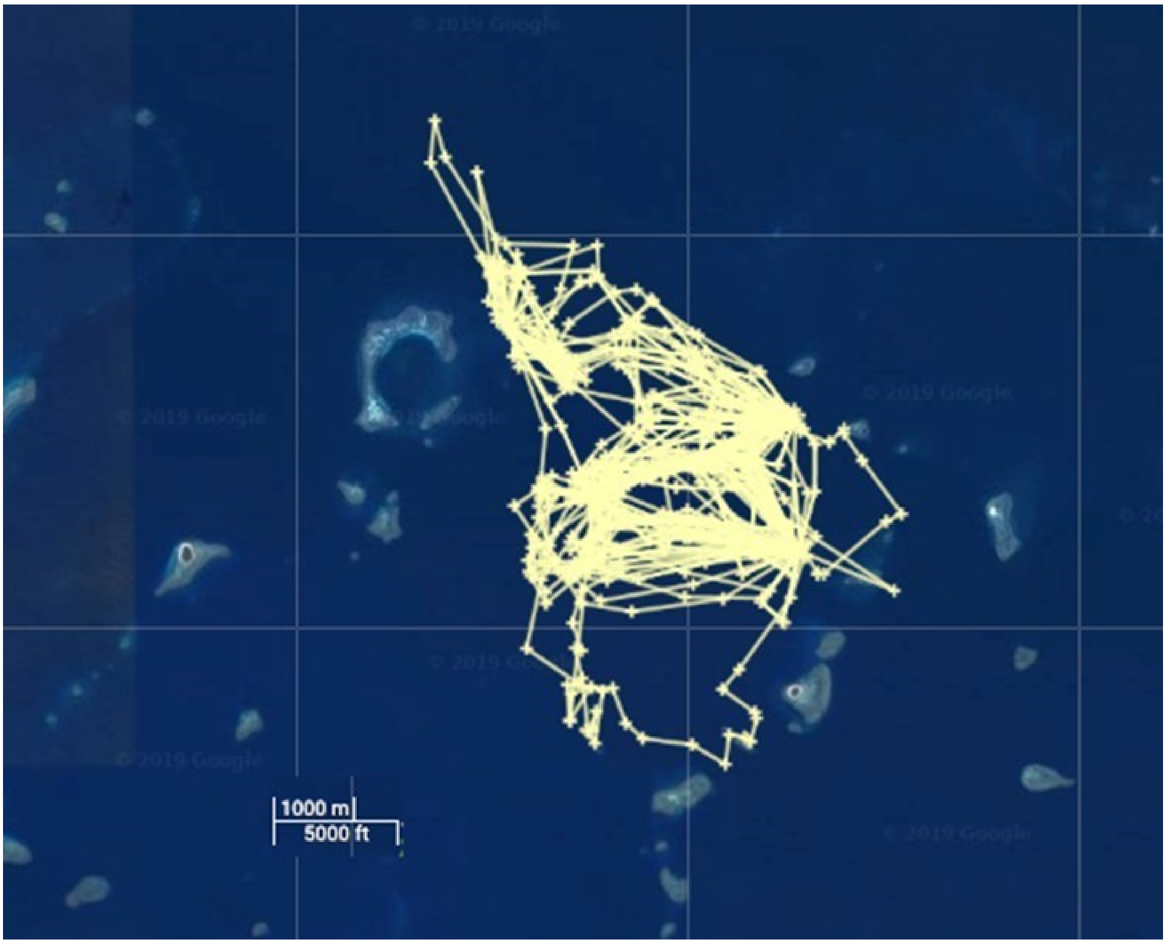

Figure 11. The track and locations for Pua Lilia in her home range from March 27, 2019 to July 19, 2019. There have been 2235 accurate detections with a mean of 20 detections per day. Over this period, she has traveled a total of 408 km at an average step speed of 0.15 km/h. The 97% kernel utilization distribution calculation shows a total area of 16.153 km.

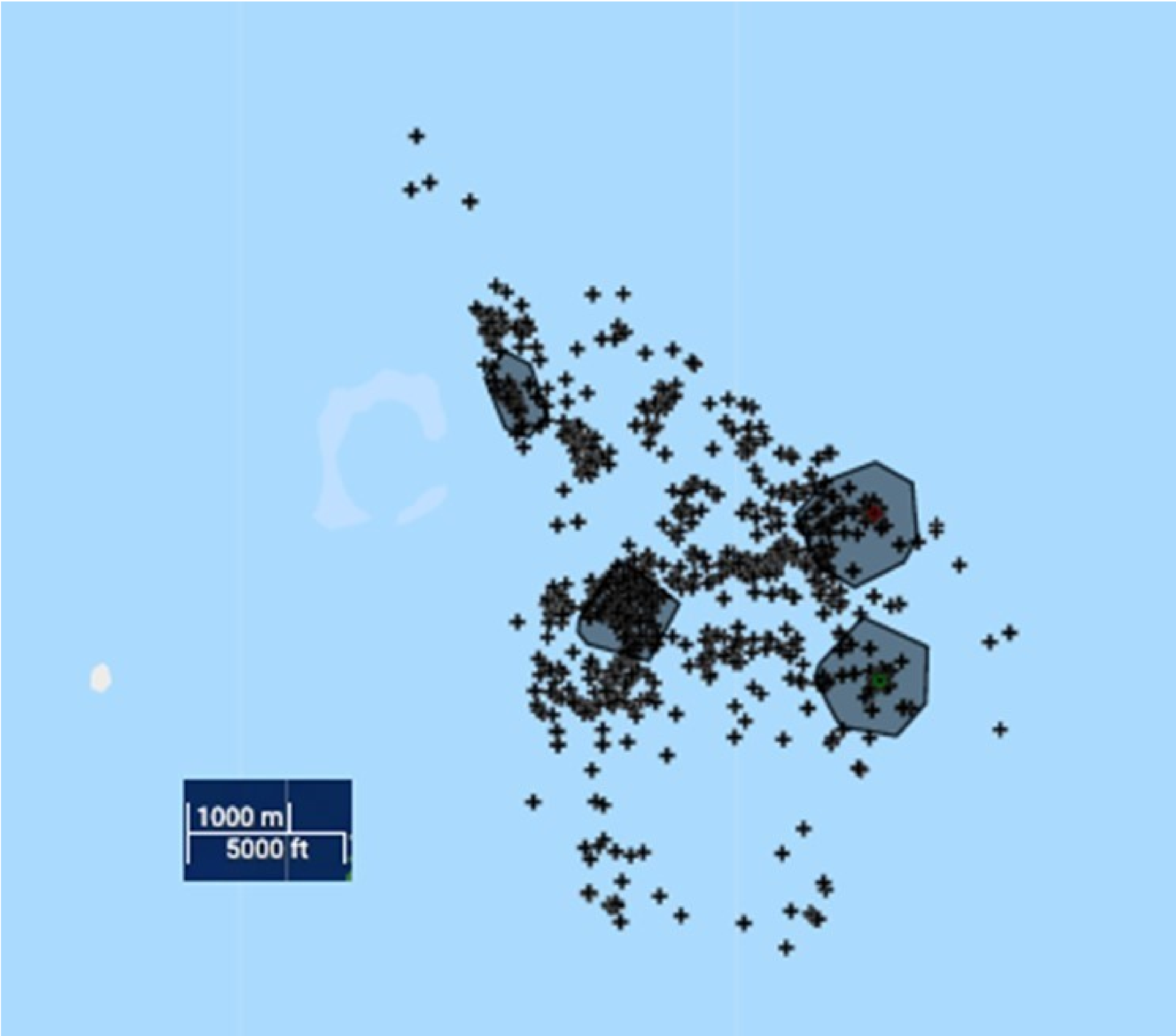

Figure 12. 50% Kernel Utilization Distribution for Pua Lilia's home range from March 28 until July 19, 2019. She continues to transmit location data and is remaining in the same area. The total area of the 50% KUD (black shaded area) is 3.0 km^2.

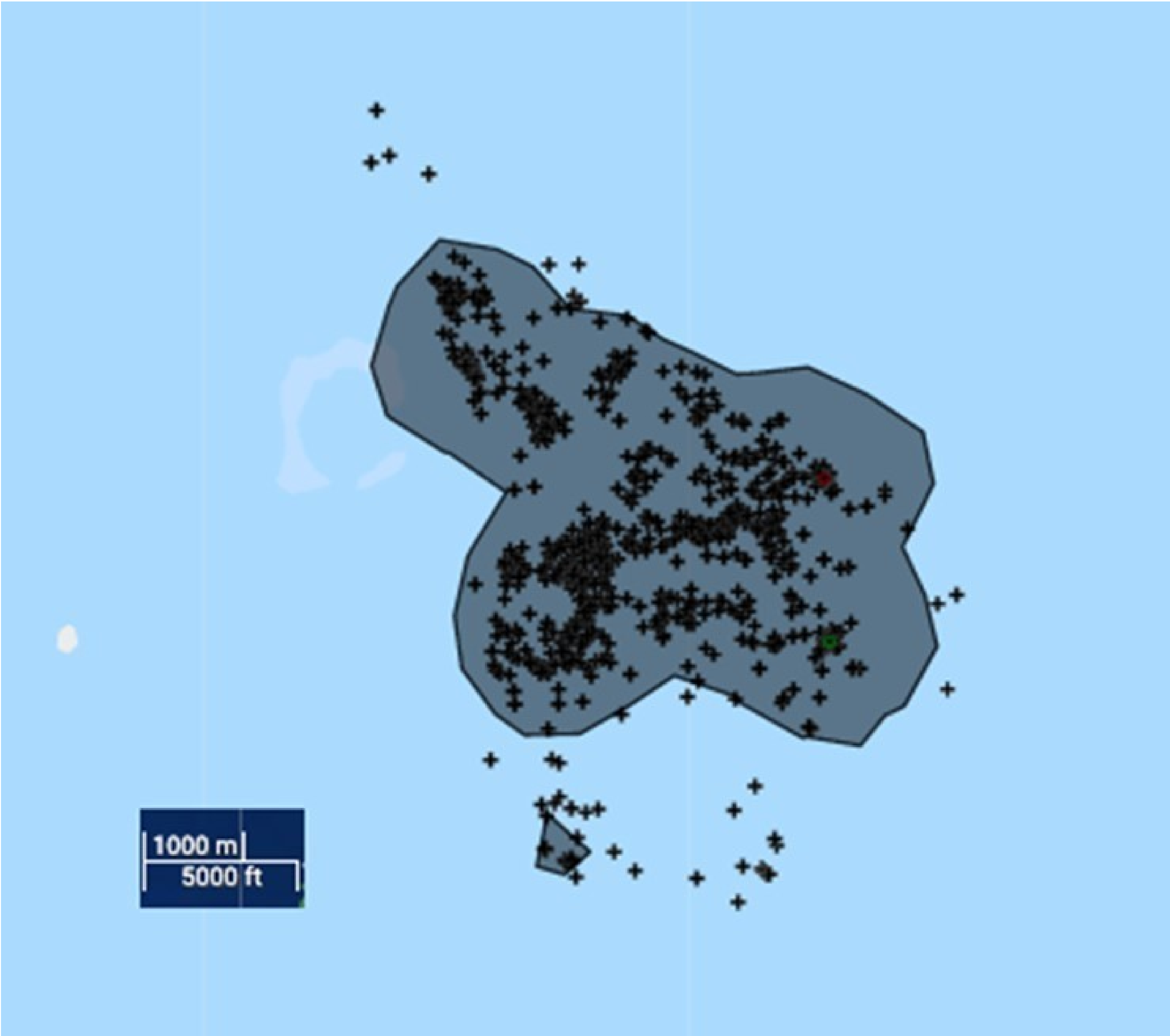

Figure 13. 95% Kernel Utilization Distribution for Pua Lilia's home range from March 28 until April 20, 2019. The total area occupied within the shaded yellow area (95% KUD) is 16.153 km^2. She continues to transmit location data and is remaining in the same area.

Figure 14. Summary of migratory tracks of the seven hawksbill post-nesters tagged on Moso Island, central Vanuatu between 2018-2020.

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Appendices

Appendix Table 1. Environment Unit's first turtle tagging study results 1992-94.

Location	Date (d/m/y)	Species tagged	Observations
Maskelynes	10/11/92 – 21/11/92	3 Green 3 Hawksbill	No nesting observed; Locals report a decline in turtle nesting & numbers
Mota Lava/Reef Islands	25/02/93 – 04/03/93	1 nesting Green	-on uninhabited Reef islands several nests had been disturbed
Wiawi – NE Malekula	11/93	9 Greens 2 Loggerhead	Identified as an important turtle nesting area
Votlo, SE Epi	01/94	1 Loggerhead	Numerous crawls observed; local informants identify Votlo as important Leatherback nesting area

Appendix Table 2. Nesting leatherback turtles recorded in TREDS for Vanuatu during 2002-2013 period (from 13).

Location	Island	2002/03	2003/04	2004/05	2006/07	2011	2012	2013
Port Olry	Espiritu Santo				1			
Port Quimie	Epi	1	1					
Port Vato	Epi	1						
Votlo	Epi	4					1	1
Votlo Research site	Epi			2		3		
	Total by year	**6**	**1**	**2**	**1**	**3**	**1**	**1**

Appendix Table 3. Summary of results of nesting beach survey at Votlo, Southern Epi, Vanuatu (from 21).

Activity	**Green**	**Hawksbill**	**Leatherback**	**Total**
False Crawls	10	3	5	18
Nesting	15	2	31	48
Grand Total	25	5	36	66
No. tagged	2	0	9	11

* Survey timing was November to December 2002, with follow-up in January and February 2003.

Appendix Table 4 - Loggerhead nesting data (summarized from C. 13 and VEU survey).

Location	**Island**	1994	2006/7	2008	2009
Votlo	Epi	1			
Linua	Loh, Torres		1		
Wiawi	Malekula (west)			1	1

Appendix Table 5 - Nesting hawksbill turtles for 1995-2015 period in TREDS for Vanuatu.

Location	**Island**	**1995/96**	**1996/97**	**2000/01**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2011/12**	**2013/14**
Bamboo Bay	Malekula					1	1	32	20	19	28	22	6
Lalinda beach	Ambrym								1				
Letokas Village												1	
Malekula	Malekula					1							
Tukutuku/Angoroa	Efate	1											
Tumaris												2	
Pinapow Beach	Malekula						1						
Rembe	Malekula				2								
Ringdove	Epi				1								
Rovoliu	Epi			1									

Tasiriki	Moso							19	30	57	58		
Tavloel	Tegua			1									
Vaipei	Espiritu Santo		1					2					
Wiawi	Malekula								7			1	
Votlo	Epi												1
Unknown													5
	Total by year	**1**	**1**	**2**	**3**	**2**	**2**	**53**	**58**	**76**	**86**	**26**	**12**

Appendix Table 6: Nesting green turtles recorded in TREDS for Vanuatu during 1992-2014 period**.**

Location	Island	1992/93	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2011/12	2013/14
Asaola	Pentecost			1											
Aniwa Lagoon	Aniwa										4				
Bamboo bay	Malekula							12		27	25	14	8	3	4
Dickson reef village	Malekula										1				
Epau village	Efate										1				
Epi	Epi						1								
Lawa	Malekula					3									
Letokas Village														3	
Litatra	Tegua				1						1				
Mifilau	Epi			1											
Malekula	Malekula							8		1				3	1
Molboe	Espiritu Santo										1				
Motalava	Motalava	1													
Okai	Malekula							3							
Rembe	Malekula							4							
Ringdove	Epi						1								
Rovoliu	Epi		1												
Tasiriki	Moso									30	3	10	3		
Tumaris														3	
Unakap	Nguna									1					

Unknown	Vanuatu													2	2
Vaipei	Espiritu Santo									2					
Vakas	Malekula							1							
Vasvasada	Pentecost									1					
Votlo	Epi					6								1	3
Votlo Research Site	Epi						2		3					1	
Wanbe	Epi									1					
Wiawia	Malekula									1	4	3		12	2
Worasivi	Pele									2					
	Total by year	**1**	**1**	**2**	**1**	**9**	**4**	**28**	**3**	**66**	**40**	**27**	**11**	**28**	**12**

Appendix Table 8. Tag recovery of turtles tagged outside and recaptured in Vanuatu

Tag No.	Species	Sex	Initial Encounter			Other Encounter		
			Date	Location	Activity	Date	Location	Fate
K21864	Green	Female	09/Dec/2000	Lady Elliot Island, SGBR, QLD, Australia	Nesting	02/Feb/2002	Lutes Village, Malekula Island	Killed
K625	Green	Female	05/Nov/1993	Rose Atoll, American Samoa	Nesting	01/Apr/1994	Ambrym Island, Vanuatu	Dead
K8415	Hawksbill	Female	21/Oct/1997	Unname reef, NGBR near Lizard Island, QLD, Australia	Foraging	?/10/2006	Vaipei village, NW Santo, Vanuatu	Killed
R16708/R	Hawksbill	Unknown	29/Apr/2006	Malua Theological	In captivity	18/Aug/2007	Wasaga Village,	RA?

1670 7				College, Upolu Island, Samoa			Vanua Lava,	
S111/ S112/ S113	Green	Female	22/Oct/19 91	Scilly Atoll, French Polynesia	Nesting	10/Feb/199 5	Aneityum Island, Vanuatu	?
K346 61	Green	Female	?/?/1992	Australia	unknow n	17/Dec/20 08	Wiawia village, Malekula Island	Nesting
39	Green	Female	30/Apr/19 72	Scilly Atoll, French Polynesia	In Captivity	14/Sep/19 73	Maskelyne Island, Vanuatu	Unknown

Appendix Table 9: Turtle tagged in Vanuatu and recovered outside *

Tag No.	Species	Sex	Initial Encounter			Other Encounter		
			Date	Location	Activity	Date	Location	Activity
R41825/ R41825	Hawksbil l	F	09/Dec/ 2009	Bamboo Bay village	Nestin g	20/Oct/ 2010	Lake Arrangan Beach, Brooms head NSW,Australia	Stranded, Moribund

* http://www.dailyexaminer.com.au/story/2010/11/09/turtle-grafton-vanuatu/

Appendix Table 10. Summary of tracking data for three post-nesting hawksbill turtles migrating from Moso Island, Republic of Vanuatu.

Turtle Name and ARGOS Number	Sat Tag Attach ed	Date of Departu re from Moso	Stopped Transmitti ng	Total Distan ce Travel ed (Km)	Numbe r of Days Migrati ng	Avera ge Speed of Travel (Km/h)	Number of Days Transmitti ng
Lucy (#16495 7)	1/09/18	1/26/18	3/22/18	2073	55	1.6	71
Ethana (#16494 8)	1/10/18	1/26/18	Still transmittin g as of 10/09/18	643	22	1.2	205(182 days at home range) (as of 8/18/18)
Teslaba (#16494 9)	1/12/18	2/09/18	3/29/18	2259	50	2.0	78

Appendix Table 11. Post-nesting hawksbill turtle captured on January 9, 2019 and outfitted with a Telonics GPS tag. Note: no flipper tags were attached because of a malfunction of tagging device.

Date of Capture	Time of Capture	Capture Location	Release Location	Curved Carapace Length	Curved Carapace Width	Time of Release
01/09/2019	2400 h	-17.522166 168.239963	-17.522166 168.239963	94.0 cm	87.2 cm	0130 h, 01/10/2019

Appendix Table 12. Turtle interactions recorded by species for the years 2010-2013 by Vanuatu flagged longline and purse seine vessels (15).

Category	Gear	Year	Species	Fate			Life status		
				Number	Retain	Discard	Alive	Dead	Unknown
Marine turtle	S	2005	Marine turtle (unidentified)	2	0	2	0	0	2
Marine turtle	S	2005	Olive ridley	1	0	1	0	0	1
Marine turtle	S	2006	Olive ridley	1	0	1	0	0	1
Marine turtle	S	2007	Olive ridley	1	0	1	0	0	1
Marine turtle	LL	2009	Loggerhead turtle	1	0	1	0	0	1
Marine turtle	S	2010	Loggerhead turtle	1	0	1	1	0	0
Marine turtle	S	2010	Loggerhead turtle	2	0	2	0	0	2
Marine turtle	LL	2011	Leatherback turtle	1	0	1	1	0	0
Marine turtle	S	2011	Green turtle	1	0	1	0	0	1
Marine turtle	S	2011	Hawksbill turtle	6	0	6	0	0	6
Marine turtle	S	2011	Loggerhead turtle	3	0	3	0	0	3
Marine turtle	S	2012	Olive ridley	2	0	2	0	0	2
Marine turtle	S	2013	Hawksbill turtle	3	0	3	0	0	3

Appendix Table 13. Observed annual estimated catches of turtles by gear for the National fleet in the WCPFC area. (from 15)

Year No.	Gear	Species	Number	Alive No.	Dead
2011	L	LEATHERBACK	1	1	0
2012	S	OLIVE RIDLEY	2	0	0
2013	S	HAWKSBILL	3	0	0
2014	S	LOGGERHEAD	1	0	0

NOTES:

1. Observed annual estimated catches of species of special interests have been determined by Observer data

2. As an interim measure, species composition data obtained from observers for this fleet in adjacent years have therefore been used to produce estimates of these species of special interests. For recent years, processed observer data may become available and will therefore contribute to a more reliable estimates in the future.

3. The observer data coverage rate is considered low (< 0.8%) to produce estimates of species of special interests for the previous years

Appendix Table 14. Observed annual estimated catches of Special interest (sea turtle) by gear for the National fleet in the WCPFC area (from 3)**.**

Year	Species	No.	Alive	Dead	Gear
2012	Hawksbill	7	0	0	Purse seine
	Green turtle	1	0	0	Purse seine
	Leatherback	1	1	0	Longline
	Loggerhead	3	0	0	Purse seine
2013	Hawksbill	3	0	0	Purse seine
2014	Loggerhead	1	0	0	Purse seine
	Olive Ridley	3	1	2	Longline
2015	Hawksbill	1	0	1	Longline
	Green turtle	2	1	1	Longline
	Leatherback	1	0	1	Longline
	Olive Ridley	28	10	18	Longline
2016	Hawksbill	1	0	1	Longline
	Green turtle	1	0	1	Longline
	Olive Ridley	1	0	1	Longline
Totals		**54**	**13**	**26**	

NOTES:

 Observed annual estimated catches of species of special interests have been determined by Observer data

 As an interim measure, species composition data obtained from observers for this fleet in adjacent years have therefore been used to produce estimates of these species of special interests.

 The observer data coverage rate is considered low ~ 5% to produce estimates of species of special interests for the reported years.

Appendix Annex I: Table of main Marine Protected Area initiatives in Vanuatu including overlap with seagrasses and turtles (source Department of Environmental Conservation and Protection):

Conservation/Tabu Area	Location	Type of Area Conserved / under Tabu	Management Plans (MP)	Dugong Habitat
Vatthe Conservation Area	Matantas, Santo	Terrestrial and Marine	Registered under EPA in year 2004; (MP)	Some turtles
Ringi Te Suh Marine Conservation Area	Peskarus, Uleveo Island, Maskelynes, South Malekula	Marine	Sea grass and Mangrove Area (MP)	Prime turtle foraging area for green and hawksbills
Mere-Sauwia Conservation Area	Nguna Island	Terrestrial and Marine	(MP)	Turtles
Epau Conservation Area	East Efate	Marine and Terrestrial	Draft management plan	Turtles
Amal-Crab Bay Tabu Eria	NE Malekula	Marine	Management Plan.	Rich seagrass & mangroves; green

				and hawksbill turtles.
Wiawi Conservation Area	NW Malekula	Marine and Terrestrial	Traditional Tabu	Sea grasses & Turtles; key hawksbill nesting area;
Mystery Island	Aneityum	Marine	Management Plan	seagrasses/turtles - green and hawksbill present
Anelcahaut Marine Conservation Area	Aneityum	Marine	Traditional Tabu	Seagrass/ green and hawksbill turtles
Uri Marine Reserve	Marine	Uri Island, Malekula	Traditional Tabu	Sea grass & mangroves; green and hawksbill turtles
Dixon Reef Tabu Area	Marine		Traditional Tabu/ Developing a management plan.	Turtles; also, important green turtle nesting area
Million Dollar Point*	Banban, South Santo	Marine	Under Fisheries Act	Coral reef;some seagrass/possibly turtles
President Coolidge*	South Santo	Marine	Under Fisheries Act	Coral reef;some seagrass
Loru Protected Area	Kohle, East Santo	Terrestrial and Marine	Traditional Tabu	Turtles
Mondoro Marine Conservation Area	South Gaua	Marine	Traditional Tabu; Draft Management Plan	Turtles

Lemoga Marine Conservation Area	North Gaua	Marine	Traditional Tabu	Turtles
7 Proposed Marine Conservation Areas	Around Epi Island	All Marine	Traditional tabus	Turtles
	South Pentecost	Terrestrial and Marine	Traditional tabu	Seagrasses & turtles
Lelepa Island Tours Marine Reserve	Lelepa Is., North Efate	Marine	Traditional Tabu; Developing a management plan.	Turtles
Tasi Vanua Conservation Areas	From Pangpang to Moso Island	Marine & Terrestrial	Tasi Vanua Resource monitors.	Turtles
Takara Tabu Area	Marine	North Efate	Traditional tabu; Draft Management Plan developed	Turtles
Marou Marine Conservation Area	Marine	Emau	Traditional Tabu.	Turtles
Unakap Marine Conservation Area	Marine	Nguna	MP	Turtles
Hideaway Island Sanctuary	Marine	Efate	MP	Coral reef; Hawksbill