

7 November 2014



**Single Species Action Plan  
for the Loggerhead Turtle (*Caretta caretta*) in the  
South Pacific Ocean**



*This Single Species Action Plan has been prepared to assist the fulfillment of obligations under:*

Convention on the Conservation of Migratory Species  
of Wild Animals (CMS)

Single Species Action Plan for the Loggerhead Turtle (*Caretta  
caretta*) in the South Pacific Ocean

November 2014

## 1. BIOLOGICAL ASSESSMENT

### 1.1 Taxonomy

Loggerhead turtle, *Caretta caretta*.

#### Common names:

English – Loggerhead

French – Tortue Caouanne, Caouanne

Spanish – Cayuma, Tortuga Boba, Cabezona, Amarilla

CLASS: REPTILIA

ORDER: TESTUDINES

FAMILY: CHELONIIDAE

SPECIES: *Caretta caretta* (Linnaeus, 1758)

There is one extant species for the genus and there are no valid subspecies currently recognized.

### 1.2 Global Distribution

The monospecific genus *Caretta* has a worldwide circumtropical and subtropical distribution (Dodd, 1988; Bolten and Witherington, 2003). *C. caretta* breeds primarily in subtropical to tropical regions of each ocean. In the Indian Ocean there are breeding aggregations in South Africa-Mozambique, Yemen-Oman-Pakistan, Sri Lanka and Western Australia (Baldwin *et al.* 2003) (Figure 1). In the Pacific Ocean there are breeding aggregations centred on Japan, south Queensland, Australia and New Caledonia (Limpus and Limpus, 2003) (Figure 1). There is no known *C. caretta* breeding in Papua New Guinea, Indonesia or Malaysia.

In response to local reports of an abundance of small immature *C. caretta* within its oceanic pelagic dispersal life history phase off the coast of Peru in the south eastern Pacific Ocean, a study funded by the CMS Small Grants Program provided the first evidence that *C. caretta* originating from nesting beaches in the Australian region migrate through Peruvian waters in the south east Pacific Ocean (Kalez *et al.* 2005).

### 1.3 South Pacific Ocean Distribution

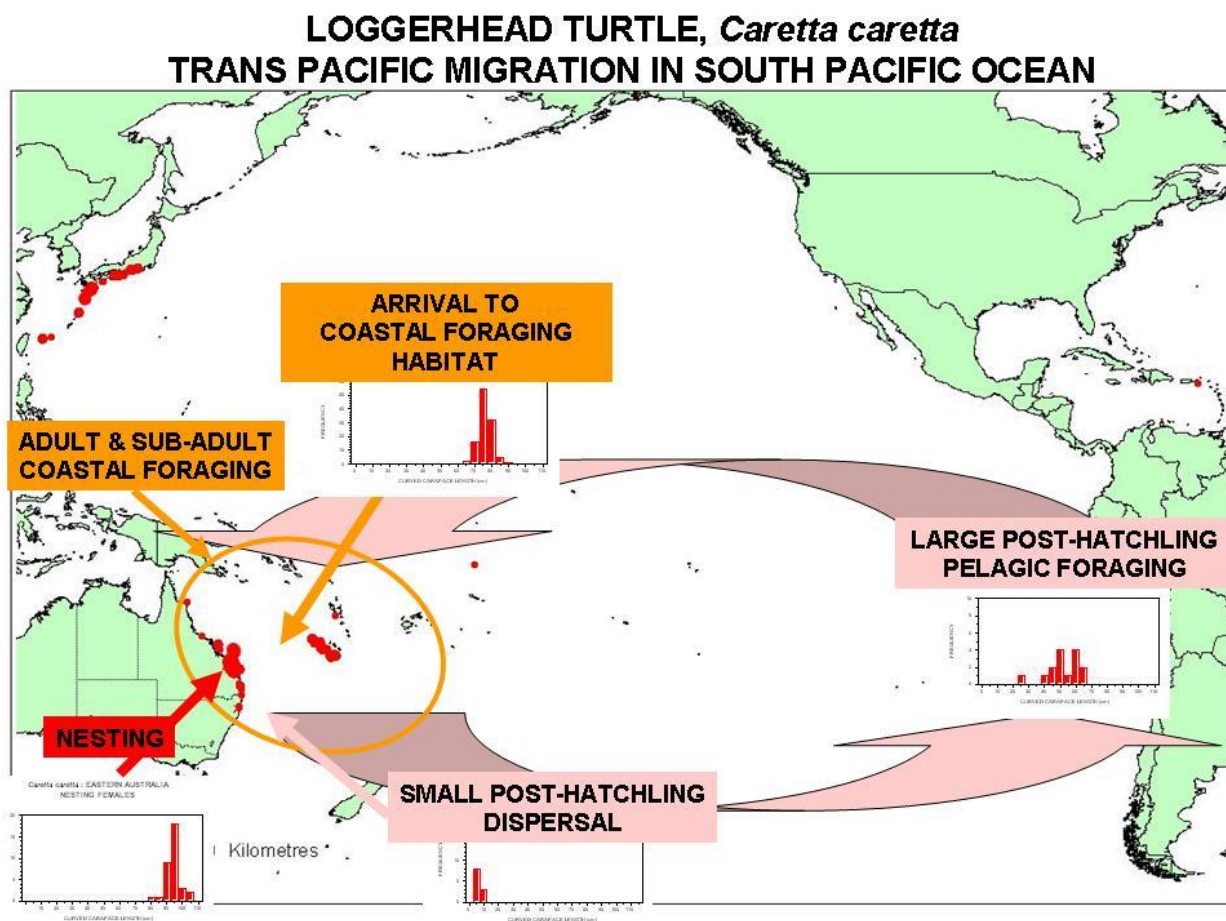
There is one genetic stock (management unit) for *C. caretta* in the South Pacific Ocean (Hatase *et al.* 2002; Dutton, 2007). Almost the entire breeding for *C. caretta* in the South Pacific Ocean occurs on beaches of the southern Great Barrier Reef islands and adjacent mainland of south Queensland and northern New South Wales of Australia and in New Caledonia (Limpus and Limpus, 2003; Limpus, 2008).

During summer months, breeding adult turtles migrate to their nesting beaches from their distant foraging areas up to 2,500km away. At the end of the breeding season, the adult turtles migrate back to their respective foraging areas (Limpus 2008).

Hatchlings from the eastern Australian nesting beaches disperse into the East Australian Current and are transported south and out past New Zealand. Young turtles (post-hatchlings) feed on zooplankton (including jellyfish, Portuguese man-o-war, ctenophores, salps, Spirula, Lepas barnacles growing off floating objects, janthid snails and planktonic crabs) (Limpus 2008).

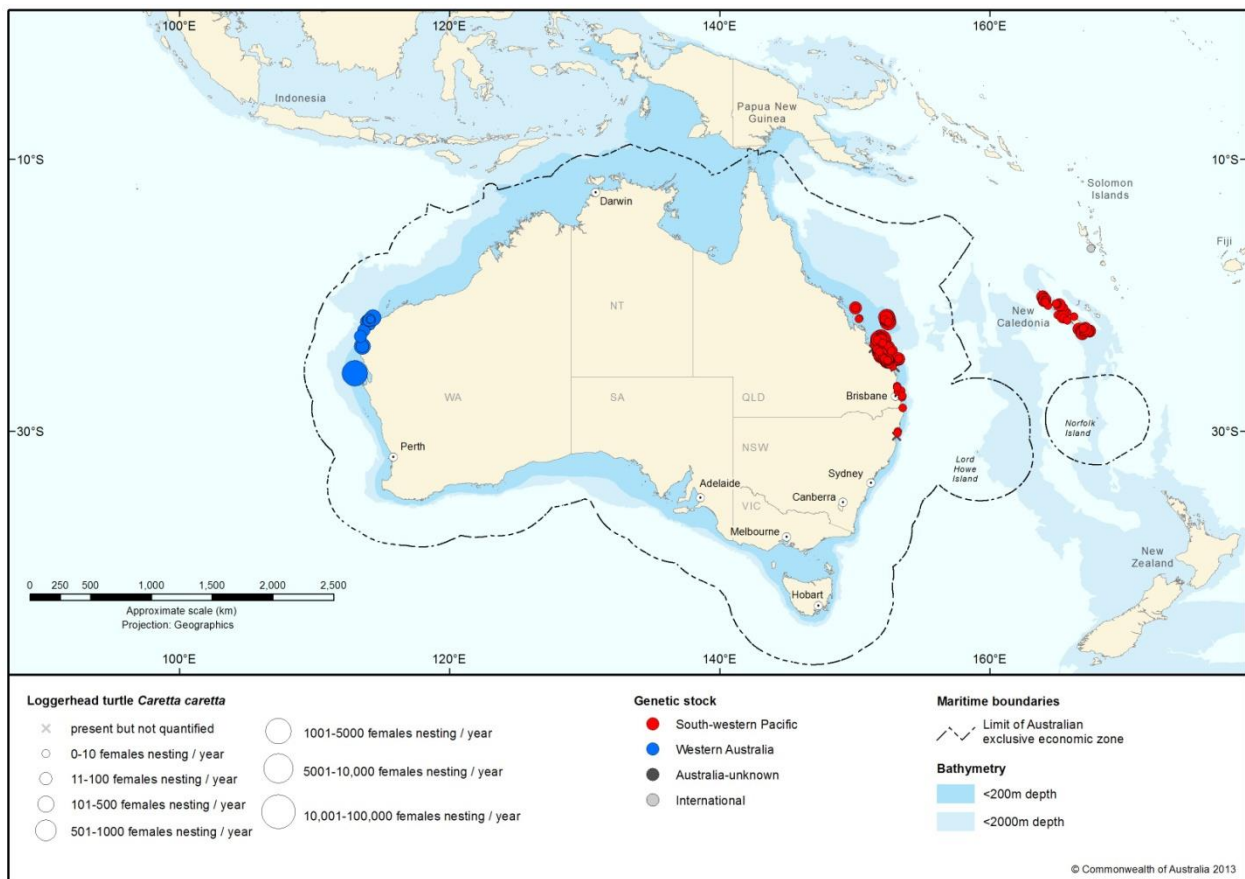
There are sparse data on their distribution once they disperse past New Zealand into the broader Pacific Ocean until they reach the east coast of South America where small *C. caretta* occur in the oceanic waters of Peru and Chile and to a lesser extent off Ecuador (Alfaro et. Al., 2008; Donoso and Dutton, 2010; Kalez et al. 2005).

Large immature *C. caretta* return to the Coral Sea - Tasman Sea region of the southwest Pacific at an estimated 15 - 16 years of age (Snover 2002; C. Limpus, Environmental Sciences Division, Queensland, personal communication, 2014). At this time they change from feeding on plankton in surface waters to begin feeding in benthic waters for the rest of their lives.



**Figure 1.** Trans Pacific migration of *Caretta caretta* in the South Pacific Ocean.

Here they feed primarily on crabs and shellfish in shallow coastal water over the continental shelves and on remote reefs. Recently, a loggerhead turtle was documented foraging in Fiji and tracks have shown them to enter Fijian waters. On reaching maturity at approximately 29 years of age, the young adults make their first breeding migrations back to nest on beaches within the region of their birth.



**Figure 2:** Loggerhead turtle (*Caretta caretta*) nesting sites in Australia and New Caledonia. Colours represent different genetic stocks and the size of the circle represents the relative number of nesting turtles. Known and likely species range is provided in dark and light blue respectively.

#### 1.4 Population Productivity and Trend

The best estimate of age from birth to first breeding for the eastern Australian *C. caretta* is 29 years on average. The estimated age at recruitment from the pelagic post-hatchling phase to coastal benthic feeding phase is 16 years.

There has been a general decline in the size of the annual *C. caretta* nesting population at all monitored rookeries in eastern Australia since the mid 1970s. Long-term census data are available for the eastern Australian index beaches but not from New Caledonia.

The eastern Australian nesting population declined from approximately 3,500 females per year in the mid-1970s to approximately 500 by the year 2000 (Limpus and Limpus 2003). The decline in breeding numbers was attributed primarily to by-catch mortality in otter trawl fisheries of northern and eastern Australia (Robins et al. 2002). Following the regulation of compulsory use of turtle excluder devices (TEDs) in the otter trawl fisheries of eastern and northern Australia in 2001, the decline in annual nesting numbers ceased and some recovery in the numbers of nesting females is in evidence (Limpus 2008).

Commencing in the late 1980s, Queensland Parks and Wildlife Service started a dual programme to reduce loss of eggs and increase hatchling production through:

- Fox baiting programmes along significant mainland nesting beaches to reduce predation of eggs by this feral predator.
- Rescuing of doomed eggs, those likely to be lost through natural erosion and flooding, and relocating them to safer incubation sites higher up the beach.

These management interventions typically result in an extra 50,000 or more hatchlings leaving the south Queensland beaches each summer (Limpus and Limpus, 2003; C. Limpus, personal communication, 2014).

Commencing in 2006, the major nesting beach in New Caledonia (~140 nests/year on average) has been protected. Hatching has changed from 90% failure to 90% success (R. Farman, personal communication, 2014).

Monitoring the *C. caretta* foraging at index foraging areas in southern Queensland over recent decades has shown a marked decline in recruitment of young *C. caretta* to benthic foraging from the pelagic planktonic feeding phase over the last 20 years. Instead of increasing numbers of young *C. caretta* recruiting from the open ocean as was expected from the actions to increase hatchling production some 20 years ago, the recruitment of young loggerheads to Australian coastal waters is approaching zero percent of the resident population.

If this continues, it is expected that by the year 2020, there will be no new adults to replace the loss of older ones in the breeding population. This will have a significant impact on the population, contributing to substantial further declines in the already depleted *C. caretta* breeding population of the South Pacific.

## **2. THREATS TO SOUTH PACIFIC LOGGERHEAD TURTLES FROM ANTHROPOGENIC SOURCES**

Turtles in the marine environment face a number of threats. The following threats were identified as major threats to Loggerhead turtles in the South Pacific Ocean by a technical gathering convened in March 2014.

It should be noted that cumulative impacts from various sources of threats can significantly impact individuals or populations but each threat on its own does not necessarily lead to a significant decline or large impact on a population.

Many threats listed below are common to all marine turtles; however the significance of each threat will often vary based on the geographical range and specific life history traits of each population. Individual range states will need to assess these threats in the context of their local situation and variety of threats operating in the area.

### ***THREATS***

#### ***2.1 Terrestrial predators***

Reduced hatchling production from predation by feral and native fauna predation is a major threat to many marine turtle populations. Excessive loss of both eggs and hatchlings on nesting beaches has been identified as an issue in both Australia and New Caledonia (in Limpus and Limpus, 2003; Limpus 2008).

- Feral (foxes, dogs, pigs) and native (varanid) predators on mainland beaches:
  - In Australia, predation is variable between beaches – overall, there is a high probability of exceeding annual sustainable loss of ~30% of clutches (Limpus 2008; Limpus, C., personal communication 2014).
  - Feral dogs are the main issue in New Caledonia (Limpus et al. 2006).

## **2.2 Lower water table**

This problem is specific to Mon Repos beach in Queensland, Australia. Historically, there was a swamp located behind the nesting beach on Mon Repos which assisted in retaining moisture in both the soil and sand. This swamp was drained during the 1970s to allow for the expansion of cane fields. Since draining, there has been increased evidence of decreased hatching success in drought years due to the reduced retention of moisture in the soil and sand.

- Decreased hatching success of eggs resulting from lowering of water table in swamp lands adjacent to Mon Repos beach
- Up to 20% reduction in hatchling emergence success from nests in drought years.

## **2.3 Changed light horizons**

Changed light horizons in marine turtle habitats can occur during the construction and operation phases of offshore and coastal developments. It can disrupt marine turtle nesting and hatchling dispersal as well as foraging behaviour. It has been well documented that land-based light pollution, in particular, deters nesting female marine turtles (Salmon 2003) and disrupts the offshore dispersal of hatchlings (Philibosian 1976, Witherington et al. 1991). There is also evidence that the response to different wavelengths of light may be species-specific (Pendoley 2005).

- **HATCHLINGS:** Changed light horizons from coastal development are unquantified but an increasingly observed issue. The following includes known impacts to hatchlings from changed light horizons, as reviewed in other loggerhead recovery plans (e.g., NMFS and USFWS, 2008 and Limpus (2008)):
  - Disruption of ocean finding behaviour by hatchlings, causing them to crawl inland which exposes them to increased terrestrial predator pressure, death following entrapment in terrestrial vegetation, road kill, etc.
  - Slowing the speed of hatchlings swimming out to sea with associated presumed increased predator pressure on slow swimming turtles.
  - Hatchlings already in the sea can be attracted back out of the water by bright coastal lighting.
  - Hatchlings already in the sea can be entrapped in bright light “pools” around anchored vessels and platforms, creating feeding stations for fish and sharks.
- **ADULTS:** Changed light horizons from coastal development:
  - Causing a reduction in adult nesting population at beaches with illuminated landward horizons
    - Largely unquantified but an observed response at Kellys Beach on Woongarra Coast, Queensland, Australia.

## **2.4 Armouring of beaches to prevent erosion of sand dunes**

A major impact of land-based construction on marine turtles is direct destruction and alteration of dunes and coastal vegetation on nesting beaches. This can reduce the suitability of beaches for nesting and incubation of eggs or cause the loss of nesting beaches through beach armouring.

- Beach armouring can reduce adult turtle access to prime nesting habitat above tidal/storm inundation with resulting reduced hatching success.
  - Largely unquantified, but occurring on nesting beaches in New Caledonia and South-east Queensland, Australia.



## 2.5 Fisheries bycatch

Interactions between fisheries and loggerhead turtles generally occur at juvenile, sub-adult and adult life cycle stages in coastal and pelagic foraging areas and along migration routes. Fisheries bycatch mostly involves incidental (non-targeted) capture through entanglement in fishing nets (e.g. mesh nets, crab pots) hooking or entangling in longlines or becoming trapped in trawl nets. Interactions can be with both large and small scale commercial and non-commercial fisheries, and includes shark control programs.

- **ADULT and LARGE IMMATURE:** Fisheries bycatch mortality in coastal foraging areas (*in* Limpus 2008):
  - Entanglement/entrapment in crab-pots and crab traps and associated float lines:
    - 10s of dead adult and near adult turtles annually in Queensland, Australia.
  - Ingestion of hooks and lines / entanglement in fishing line, mostly recreational fishing:
    - 10s of adult and near adult turtles annually in Queensland, Australia.
  - Capture in Otter-trawl fisheries:
    - very minor mortality since the compulsory introduction of turtle excluder devices (TEDs) into eastern and Northern Australian prawn fisheries in 2001-2002.
  - Hooking on drum lines and entanglement in shark nets with the Queensland and New South Wales Shark Safety Programmes:
    - 10s of adult and near adult loggerheads impacted annually in Queensland and New South Wales.
  
- **POST-HATCHLING:** Fisheries bycatch mortality of post-hatchling turtles across the South Pacific Ocean e.g., Robins et al. 2002; Limpus 2008; Dutton and Donoso 2010; Alfaro-Shigueto et al., 2011):
  - Longline bycatch, Gill net bycatch, Purse seine bycatch:
    - These pelagic fisheries occur in all national waters in the South Pacific and in international waters.
    - Mortalities by individual fisheries have variable depth and quality of data.
    - Studies suggest that bycatch affects loggerheads throughout their distribution in foraging areas. Possibly many thousands of young pelagic loggerheads could be incidentally caught annually by multiple fishing fleets in international waters (e.g. distant water longline fleets), and those in Ecuador, Peru and Chile. There are a large number of fisheries that overlap with the range of loggerheads, with associated mortality which varies by fishery.
    - Captures in the Peruvian and Chilean longline fishery are usually non-lethal and turtles are regularly released alive with varying degrees of injury, including severe injuries (Donoso and Dutton 2010; Alfaro-Shigueto et al. 2011; Kalez et al. 2005).
    - In the South-west Pacific, the indications are that the longline by-catch is low and recorded mortality low.
    - In the eastern tropical Pacific Ocean (east of 150 degrees W longitude), the international fisheries managed by the Inter-American Tropical Tuna Commission places observers on 100% of large vessels (>364 metric tons capacity) targeting tuna with purse seine nets. Loggerheads are rarely encountered in either the net or the fishing aggregating devices (FADs), with less than one loggerhead entangled dead per year with 3,000-5,000 sets observed annually. Loggerheads have been observed entangled and



alive in FADs at a higher level than previously mentioned. Due to the IATTC resolution passed in 2007, all vessels that encounter sea turtles entangled alive in FADs, whether or not it belongs to that vessel, are required to disentangle the animals. Skippers are also required to employ proper handling procedures for all sea turtles found entangled in purse seine gear, which is expected to increase the survival rates. Not all turtles with internal hooking have the hooks removed before release.

- Loggerhead turtles are sometimes taken incidentally (as a byproduct of fishing) and used as food (equivalent to marine bush-meat) (e.g., Alfaro-Shigueto et al. 2011).
  - Largely unquantified.

## **2.6 *Ship Strike***

Impact from marine vessels, including commercial ships, fishing boats and recreational craft, can cause serious injury and/or death to marine turtles (Dobbs 2001). This is particularly an issue in shallow coastal foraging habitats and inter-nesting areas where there are high levels of recreational and commercial vessel traffic, (Hazel et al. 2006, Hazel et al. 2007), and in areas of marine development (BHPBilliton 2011, Chevron 2012).

- ADULT and LARGE IMMATURE: Mortality and injury from vessel strike and propeller cuts in coastal foraging areas:
  - 10s of dead adult and near adult turtles annually in Queensland (Limpus 2008).
  - Unquantified mortality from boat strike in New Caledonia.

## **2.7 *Dredging***

Blasting and dredging during marine construction and development (e.g. oil, gas and petroleum installations, marina construction), structure removal, and underwater demolitions in marine turtle habitats (particularly nesting and foraging areas) can cause significant disturbance and impacts to marine turtles.

- ADULT and LARGE IMMATURE: Mortality and injury from dredging in coastal foraging areas:
  - Less than 10 dead adult and near adult turtles annually in Queensland (Limpus 2008).

## **2.8 *Marine Debris***

Floating non-degradable debris, such as land-sourced garbage (e.g. plastic bags and bottles), abandoned fishing gear (e.g. discarded nets, crab pots, strapping bands, synthetic ropes, floats, hooks, fishing line and wire trace), and ship-sourced materials disposed of at sea (e.g. fibreglass, insulation) can pose a threat to marine turtles at all life stages through entanglement and ingestion (Balazs 1985, Carr 1987, Limpus 2008).

Entanglement in marine debris can lead to restricted mobility, starvation, infection, amputation, and drowning. Ingestion can 1) cause internal wounds, ulceration or suffocation; 2) prevent further feeding, leading to starvation and 3) create blockages that increase buoyancy and inhibit diving behaviour (Beck et al. 1991, Bjorndal et al. 1994, Sloan et al. 1998). In addition, toxins from ingested plastics may accumulate in marine turtle tissues, with possible health implications (Teuten et al. 2009).

- POST-HATCHLINGS: Ingestion of synthetic debris and associated mortality with post-hatchlings after they have left their nesting beaches as hatchlings and their return to coastal waters as large immature turtles.:
  - Largely unquantified. However, Boyle et al. 2008 identified that >70% of small post-hatchlings less than 3 months old (in the East Australian Current before they had left the east Australian coast) had ingested plastic debris that contributed to their strandings.
- LARGE IMMATURE and ADULT: Entanglement in lost and discarded fishing gear (ghost nets or longline, lost FADs, etc):
  - Evidence of threat in South America, but largely unquantified (Jorge Azocar and Joanna Alfaro pers com.).

## 2.9 *Climate Change / Climate Variability*

Climate change and variability may have a range of quantified and unquantified impacts on marine turtles, particularly during this century, as climate prediction models show that sand temperatures may rise in many important nesting beaches throughout the world. Increases in global temperatures, including both air temperatures and sea surface temperatures, may lead to higher sand temperatures, which may increase female-biased sex ratios in marine turtle populations, or in worst-case scenarios, sand temperatures may increase beyond the tolerable limits for marine turtle egg development (Fuentes *et al.*, 2009). Predicted ocean acidification may also have an impact on the extent of suitable nesting beaches and/or the physical characteristics of the nest environment. Predicted sea level rise and increased frequency of severe weather events (e.g. cyclones, typhoons) can also have an impact on marine turtle populations by reducing or altering nesting habitat and/or increasing egg mortality through inundation (Reece *et al.*, 2013). Climate change and variability may also impact coastal foraging habitat, alter ocean circulation patterns and disrupt marine food webs; all of which would have significant impacts on turtles during all phases of their lifecycle (*in* Kinan 2006; Fuentes *et al.*, 2009).

Depending on the capacity of turtle stocks to respond to climate change by shifting the timing of nesting or location of nests, rapid climate change has the potential to be devastating to turtles.

- Impacts on loggerhead turtle population dynamics
  - Increasing sea surface temperature in foraging areas has caused a decline in loggerhead turtle breeding rates over recent decades in the northern and southern Pacific loggerhead turtles stocks.
  - Rising temperature affects hatching success and sex ratio of hatchlings.
    - Seasons with high rainfall and/or cloud cover result in cool sands which result in reduction in female hatchling production.
      - The last four breeding seasons have experienced some of the coolest sand temperatures recorded at Mon Repos within the last 45 years of monitoring.
    - Elevated beach temperatures during drought years in response to El Niño Southern Oscillation (ENSO) weather events bias loggerhead hatchlings to a higher female sex ratio and cause reductions in incubation and hatchling emergence success and hatchling vigour.
  - Ocean acidification predicted with increasing atmospheric CO<sub>2</sub> may also have an impact on carbonate sediment production. This may affect the amount and characteristics of sediment on marine turtle nesting beaches particularly in and around coral reefs. This may have implications for the extent of suitable nesting

beaches and/or the physical characteristics of the nest environment. It may also affect food availability for pelagic foraging loggerhead turtles due to the reduction of calciferous food items.

- Possible effects of ENSO on the dynamics of stocks of loggerheads in the south-eastern Pacific (i.e, changes in distribution, diet, recruitment).
- Extreme cyclones may increase erosion of nesting beaches and excessive loss of incubating EGGS.
  - 60% of 2012-2013 season egg production lost through beach erosion by Cyclone Oswald.

### **2.10 Legal Direct Take**

In Australia, under the *Native Title Act 1993*, Traditional Owners have a right to harvest marine turtles and their eggs for the purpose of personal, domestic, or non-commercial communal needs (Limpus 2008). Direct harvest of turtles and eggs occurs across northern Australia and community management plans are in place in many regions with the aim of sustainably managing this natural resource.

Estimated harvest of adults from the Pacific Ocean population is approximately 40 turtles per year, including harvests in Papua New Guinea, Solomon Islands and New Caledonia, as well as within eastern Australia 2008 (Limpus 2008).

- Indigenous communities take:
  - Large immature and adult loggerhead turtles are taken for food in Papua New Guinea (possibly numbering 10s of adult and near adult loggerhead turtles), historically in Fiji and possibly other countries. Loggerhead turtles are taken less frequently within Australia. The take across the population is largely unquantified.
  - Eggs are harvested for food.

### **2.11 Illegal Take**

Illegal take refers to those instances where loggerhead turtles and/or eggs are taken for food, without appropriate permits or legislative frameworks in place.

### **2.12 Acute Pollution**

Oil spills are a specific threat to water quality in the marine environment and directly to marine turtles. The effect of the discharge of oil and other chemicals by vessels and/or mining operations is largely unquantified. In addition, oil spill cleanup efforts and potential impacts to sea turtles are largely unknown but scientists are learning more from large spills and associated clean-ups, such as from the Deepwater Horizon spill in 2010 in the Gulf of Mexico.

- Small post-hatchlings have stranded in eastern Australian debilitated by tar balls.

### **2.13 Chronic Pollution**

Anthropogenic contaminants can make their way into the marine environment from a wide range of agricultural, industrial and domestic sources, and can have direct impacts on marine turtles and their habitats. Chemical contaminants such as heavy metals and persistent organic pollutants (POPs) have been identified in marine turtles in Australian waters (Hermanussen et al. 2006, Hermanussen et al. 2008, van de Merwe et al. 2010, Ikonopoulou et al. 2011, Gaus et al. 2012).

- Non-point source pollution:
  - Metal and organo-halide pollution within coastal waters impacts on the health of loggerhead turtles in their coastal foraging areas.
    - Impact on turtle health is largely unquantified even though high levels of pollution have been recorded in the turtles foraging in coastal embayments in eastern Australia.

### **2.14 Disease**

A number of diseases and infections have been identified in marine turtles, many of which are caused or exacerbated by water quality problems. Loggerhead turtles are susceptible to a range of diseases including parasitic worms, bacteria, fungi and viruses (Limpus 2008). Fibropapillomatosis is a disease that produces tumours (fibropapillomas) on marine turtles worldwide. Severe tumours around the eyes and mouth can limit vision and ability to forage, and tumours on flippers can inhibit swimming. Fibropapilloma tumours can also develop internally around the heart and lungs leading to respiratory and circulation disorders. The cause of fibropapillomatosis in marine turtles remains unclear, but the disease has been linked to herpes virus infections (Quackenbush et al. 1998, Quackenbush et al. 2001), and pollution in foraging areas (Aguirre et al. 1994, Aguirre et al. 2000).

- The potential exists for disease to elevate mortality of loggerhead turtles and their eggs.

### **2.15 Tourism**

There are a number of nature-based tourism operations that specifically promote human interactions with marine turtles at nesting beaches. In addition, other tourism activities, particularly SCUBA diving can include interactions with marine turtles as part of the experience. If managed correctly, these activities can have great conservation value by raising public awareness of the issues relating to marine turtles. However, if mismanaged, these operations have the potential for disturbing marine turtle nesting and foraging behaviour, ultimately impacting the viability of these populations.

- Tourism has the potential to disrupt successful turtle breeding and foraging.
  - The impact is largely unquantified for loggerhead turtles in the South Pacific Ocean.
  - Closely managed ecotourism at Mon Repos Conservation Park enhances hatchling production via rescuing of doomed eggs. From mid-October to the end of April, public access to the beach is restricted from 6pm to 6am to protect nesting turtles and hatchlings. From November to late March, turtle watching tours are operated by Queensland government officers to manage interactions with turtles and hatchlings.

### **2.16 Scientific Research and Rehabilitation**

Whilst the majority of scientific research and rehabilitation of sick and/or injured turtles is done to assist in the conservation of the species, there can be some instances where the impacts are negative.

- Scientific research (e.g. fishing trials, incubation studies, in-water captures) may unintentionally injure or kill loggerheads or impede important biological functions and/or survival rates.
- Inappropriate husbandry of turtles undergoing rehabilitation can have negative impacts on their health.

## Threat Prioritisation

Each threat outlined above has been assessed using a risk matrix (see below) to determine their relative impact on loggerhead turtles (in one or several life stages) in the South Pacific Ocean. The risk matrix considers the likelihood of occurrence of a threat relevant to loggerhead turtles, and the consequences of that threat or impact considering existing mitigation measures. Where mitigation/management measures do exist and have been implemented (e.g. TEDs), the threat has been assessed assuming that these measures continue to be applied appropriately. Based on these factors the priority for action was determined. Taking a conservative approach, the threat category was discussed and determined by the participating range states at varying risk levels, as defined at the 2014 meeting. Population-wide threats are generally considered to present a higher risk than those threats acting at the individual level.

The risk matrix uses a qualitative assessment drawing on peer reviewed literature and expert opinion. Levels of risk and the associated priority for action are defined as follows:

|           |   |
|-----------|---|
| Very High | immediate additional mitigation action required   |
| High      | additional mitigation action and an adaptive management plan required, the precautionary approach should be applied |
| Moderate  | obtain additional information and develop additional mitigation action if required                                  |
| Low       | monitor the occurrence of threats and reassess level of threat if likelihood or consequences change                 |

## RISK MATRIX

| Likelihood      | Consequences  |  |   |   |              |
|-----------------|---|--|---|---|--------------|
|                 | Not significant   | Minor  | Moderate  | Major   | Catastrophic |
| Almost certain  | Low <ul style="list-style-type: none"> <li>• Pollution: chronic disease</li> </ul>      | Moderate <ul style="list-style-type: none"> <li>• armouring of beaches</li> <li>• legal direct take</li> <li>• tourism</li> <li>• illegal take</li> <li>• ship strike</li> </ul> | Very high <ul style="list-style-type: none"> <li>• lower water table</li> <li>• changed light horizons</li> </ul> | Very high <ul style="list-style-type: none"> <li>• terrestrial predators</li> <li>• fisheries bycatch</li> <li>• marine debris</li> </ul> | Very high    |
| Likely          | Low   | Moderate   | High  | Very high <ul style="list-style-type: none"> <li>• climate change/variability</li> </ul>  | Very high    |
| Possible        | Low <ul style="list-style-type: none"> <li>• adverse research/rehabilitation</li> </ul> | Moderate <ul style="list-style-type: none"> <li>• dredging</li> </ul>  | High  | Very high   | Very high    |
| Unlikely        | Low   | Low  | Moderate  | High  | Very high    |
| Rare or unknown | Low   | Low  | Moderate <ul style="list-style-type: none"> <li>• pollution: acute</li> </ul>                                     | High  | Very high    |

Within the threat matrix, there are a number of threats that impact primarily adult and near-adult loggerhead turtles that are designated as “moderate”. To address concerns regarding cumulative impact, consideration should be given to elevating these particular threats to a higher level of significance when planning conservation management responses.

### 3. POLICIES AND LEGISLATION RELEVANT FOR MANAGEMENT

#### 3.1 *International conservation and legal status of the species*

| IUCN Status   | CMS        | CITES      |
|---|------------|------------|
| Endangered A1abd:<br><br>A) Population reduction in the following:<br><br>1) An observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is the longer, based on (and specifying) the following:<br><br>a) direct observation<br><br>b) an index of abundance appropriate for the taxon<br><br>d) actual or potential levels of exploitation | Appendix I | Appendix I |

#### 3.2 *International Conventions and Agreements ratified by the Range States*

| Country or territory                      | CMS | CITES | CBD    | IOSEA | IAC |
|---|-----|-------|--------|-------|-----|
| Australia                                 | ✓   | ✓     | ✓      | ✓     |     |
| Chile                                     | ✓   | ✓     | ✓      | n/a   | ✓   |
| Ecuador                                   | ✓   | ✓     | ✓      | n/a   | ✓   |
| Fiji                                      | ✓   | ✓     | ✓      | n/a   | n/a |
| New Zealand                               | ✓   | ✓     | ✓      | n/a   | n/a |
| Peru                                      | ✓   | ✓     | ✓      | n/a   | ✓   |
| American Samoa (USA)                      |     | ✓     | signed | ✓     | ✓   |
| New Caledonia & French Polynesia (France) | ✓   | ✓     | ✓      | ✓     |     |

#### 3.3 *Relevant organisations operating in the South Pacific Ocean*

| Country or territory                      | SPREP | SPC | CPPS | CCSBT | IATTC | SPRFMO | WCPFC |
|---|-------|-----|------|-------|-------|--------|-------|
| Australia                                 | ✓     | ✓   |      | ✓     |       | ✓      | ✓     |
| Chile                                     |       |     | ✓    |       |       | ✓      |       |
| Ecuador                                   |       |     | ✓    |       | ✓     |        |       |
| Fiji                                      | ✓     | ✓   |      |       |       |        | ✓     |
| New Zealand                               | ✓     | ✓   |      | ✓     |       | ✓      | ✓     |
| Peru                                      |       |     | ✓    |       | ✓     | ✓      |       |
| American Samoa (USA)                      | ✓     | ✓   |      |       | ✓     | ✓      | ✓     |
| New Caledonia & French Polynesia (France) | ✓     | ✓   |      |       |       |        | ✓     |

## **Abbreviations**

|         |  |
|---------|--|
| CMS:    | Convention on the Conservation of Migratory Species of Wild Animals                    |
| CITES:  | Convention on the International Trade in Endangered Species of Wild Fauna and Flora    |
| CBD:    | Convention on Biological Diversity   |
| IOSEA:  | Indian Ocean – South-East Asian Marine Turtle MOU                                      |
| IAC:    | The Inter-American Convention (IAC) for the Protection and Conservation of Sea Turtles |
| SPREP:  | Secretariat of the Pacific Regional Environment Programme                              |
| SPC:    | Secretariat of the Pacific Community   |
| CPPS:   | Permanent Commission for the South Pacific   |
| CCSBT:  | Commission for the Conservation of Southern Bluefin Tuna                               |
| IATTC:  | Inter-American Tropical Tuna Commission  |
| SPRFMO: | South Pacific Regional Fishery Management Organisation                                 |
| WCPFC:  | Western and Central Pacific Fisheries Commission                                       |



### 3.4 National legislation relevant to the Loggerhead Turtle

| Country   | National Protection Status   | Law protecting species  | Legal protection from killing, egg harvesting and nest destruction  | Penalties  | Responsible Authority   |
|-----------|--|---|---|--|---|
| Australia | <p>Commonwealth: <b>Endangered State:</b><br/>                     QLD: <b>Endangered</b><br/>                     NSW: <b>Endangered</b><br/>                     NT: <b>Endangered</b><br/>                     SA: <b>Vulnerable</b><br/>                     TAS: <b>Endangered</b><br/>                     WA: <b>Fauna that is rare or likely to become extinct</b><br/>                     VIC: <b>Threatened</b></p> | <p>Australia has a Federal Government with 8 separate State or Territory Governments. The Australian Government has responsibility for matters in the national interest, and for non-state/territory areas, which includes the marine environment from 3 nautical miles out to the edge of the Exclusive Economic Zone (EEZ). The State and Territory governments have responsibility for issues within their jurisdictional borders, including State/Territory waters.</p> <p>Loggerheads are listed as threatened migratory and marine under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). It is an offence to kill, injure, take, trade, keep or move the species in a Commonwealth area (i.e. Commonwealth waters), unless the person taking the action holds a permit under the EPBC Act, the act is consistent with native title rights under the <i>Native Title Act (1993)</i>, or the activity is carried out in accordance with a State/Territory or Australian Government fishery plan of management accredited by the Minister for the Environment.</p> <p><b>Implementing legislation:</b><br/> <b>Commonwealth:</b><br/>                     EPBC Act 1999<br/>                     Great Barrier Reef Marine Park Act 1975<br/>                     Torres Strait Fisheries Act 1984<br/> <b>QLD:</b> Nature Conservation Act 1992<br/>                     Marine Parks Act 2004<br/> <b>NSW:</b> Threatened Species Conservation Act 1995<br/>                     National Parks and Wildlife Act 1974<br/> <b>NT:</b> Territory Parks and Wildlife Conservation Act 2000</p> | <p>Yes, through Commonwealth and State/Territory implementing legislation. The Recovery Plan for Marine Turtles in Australia was made in 2003 and is currently being revised. The Recovery Plan identifies threats to marine turtles and actions to promote the recovery of marine turtle species. Under the EPBC Act the Minister for the Environment must not make a decision that is inconsistent with a recovery plan and a Commonwealth agency must not take any action that contravenes a recovery plan.</p> <p>In Qld, protection of islands used as rookeries have been gazetted as National Parks under the Nature Conservation Act 1992.</p> <p>Mandatory inclusion of turtle excluder devices (TEDs) was introduced in the East Coast Otter Trawl Fishery in 2001. TEDs are also in place in all vessels in the Northern Prawn Fishery, Western Australian trawl fisheries and the Torres Strait Prawn Fishery.</p> <p>Section 211 of the Native Title Act 1993 provides a native title right to direct harvest of marine turtles by Traditional Owners, where that harvest is for the purpose of satisfying personal, domestic, or non-commercial communal needs; and in the exercise of native title rights and interests.</p> | <p>The EPBC Act provides penalties (financial and incarceration time) for various offences relating to listed marine turtles. Amendments aimed at deterring persons from committing offences are being considered by the Australian Parliament to increase financial penalties in respect of the illegal killing, injuring, taking, trading, keeping or moving of turtles. Tripling the financial penalties will increase maximum fines to 3,000 penalty units. Note: 1 penalty unit currently = \$AUD170.</p> | <p>Department of the Environment (C'wealth)<br/>                     GBRMPA (C'wealth)<br/>                     AFMA (C'wealth)</p> |

| Country | National Protection Status  | Law protecting species   | Legal protection from killing, egg harvesting and nest destruction | Penalties   | Responsible Authority  |
|---------|---|--|--|---|--|
|         |   | <p><b>SA:</b> National Parks and Wildlife Act 1972<br/> <b>TAS:</b> Threatened Species Protection Act 1995<br/>           Living Marine Resources Management Act 1995<br/> <b>WA:</b> Wildlife Conservation Act 1950<br/>           Conservation and Land Management Act 1984<br/> <b>VIC:</b> Wildlife Act 1975<br/>           Flora and Fauna Guarantee Act 1988</p>         |  | Penalties for offenses relating to turtles exist under other Commonwealth, State and Territory legislation. |  |
| Chile   | Decree No. 75, 2005 of the General Secretariat of the Presidency approves Regulations for the Classification of Wildlife. | <p><b>Supreme Decree No. 225 of November 9, 1995</b> established extractive closure for thirty years until November 9 2025.<br/>           Supreme Decree No. 135 of 2005, amending 225, catch and possession is authorized for research.<br/>           Supreme Decree No. 434 of 2007. Amendment 225. Is hereby empowered to research centers to transporting specimens.</p> |  | According to Decree No. 430 of 1991 of the Ministry of Economy, development and reconstruction              | Chile's environment ministry ( <b>MMA</b> ) is the state body with the primary responsibilities of designing, regulating, planning and applying the country's environmental policies and programs, as well as the protection and conservation of biological diversity. Under-Secretary of fisheries is a focal point of CIT and technical point of CPPS. |
| Ecuador |   | Article 73 of the Republic of Ecuador  | Some agreements and resolutions more                               |   | The Ministry of  |

| Country | National Protection Status | Law protecting species  | Legal protection from killing, egg harvesting and nest destruction  | Penalties   | Responsible Authority  |
|---------|----------------------------|---|---|---|--|
|         |                            | <p>Constitution (2008). Government will apply measures for precaution and restriction on the activities that may cause species to go extinct, destroy ecosystems or alter permanently the natural cycles.</p> | <p>important for the protection of the 5 species of marine turtles in the country include the following:</p> <p>1.- Ministerial Agreement No.212 1990 – SRP Fishing ban indefinitely of marine turtles, to consider existing species in Ecuadorian waters, protected by Ecuador. In addition, the capture, processing and domestic sale and export is forbidden.</p> <p>2.- Ministerial Agreement Nro.121, April 1996-SRP requires the use of turtle excluder devices (TEDs) in trawlers for shrimp.</p> <p>3.- In the Galápagos there is an Organic Law for the Special Regimen for the Conservation and Sustainable Development in the Province of Galapagos and the Special Regulation for the Fishing Activity in the Marine Reserve of the Galápagos, forbids the capture of the species of marine turtles and other emblematic species in the ecosystem.</p> <p>4.- Agreement No. 121, 22 April 1996, requires the obligatory use of TEDs in the shrimp trawlers, the same that is completed with the Regulation for the use of TEDs according to the Ministry Acuerdo Nro. 047 -SRP Agosto 2002.</p> <p>5.- Legislation for Biodiversity published on the 10th September 2004, that considers the national properties of public use, the species that form the biological biodiversity of the country, this is, the living organisms from any source, the terrestrial and marine</p> | <p>Sanctions such as suspension of fishing permits, fines and imprisonment (According to the Legislation of Fisheries).</p> | <p>Environment (MAE) is the organization responsible to elaborate environment politics, strategies, projects and programs to promote conservation of ecosystems and the sustainable use of natural resources. Within the MAE is Galapagos National Park, responsible of the conservation of the ecological integrity, biodiversity of insular and marine ecosystems of protected areas.</p> <p>Sub-secretarias of Fishing Resources (SRP): Responsible for Laws and Regulations of the Fishing</p> |

| Country | National Protection Status | Law protecting species                        | Legal protection from killing, egg harvesting and nest destruction   | Penalties | Responsible Authority   |
|---------|----------------------------|---|--|-----------|---|
|         |                            |   | <p>organisms, aquatic and complex ecosystems of which they form part.</p> <p>6.-Forestal Law and Conservation of the Natural Areas and Wildlife (Published in September 2004), this allows the conservation of the wildlife fauna and flora as in Article 73.</p> <p>7.- National Strategy for the Biodiversity of Ecuador as Government Politics (Executive Decree, January 2007), establishes action items for the protection of threatened species including the reptiles.</p> <p>8.- Ministerial Agreement No. xx National Plan of Dorado (the use of the circle hook will be promoted in replacement of the traditional J hook), as it reduces the incidental capture of marine turtles.</p> <p>9.- Ecuador is signatory of three international agreements for the protection of marine turtles, which are CITES, CIT and CMS, that focusses on: international commerce, habitat protection, development of Plans of Action and reduction of incidental catch, among other themes. Other instruments for the protection of the 5 species of marine turtles are the Regional Plan of Action for the Protection of marine turtles of the Permanent Commission for the South Pacific (CPPS) asll as international agreements of the Inter-American Tropical Tuna Commission, ( IATTC) which has formulated few recommendations and resolutions that apply to marine turtles.</p> |           | <p>National Sector.</p> <p>National Institute for Fisheries (INP): Its objective is of research and technology of bioaquatic resources.</p> |
| Fiji    |                            | A moratorium on the harvesting of turtles was | Permits to take turtles are issued by the  |           | Ministry of   |

| Country     | National Protection Status   | Law protecting species  | Legal protection from killing, egg harvesting and nest destruction  | Penalties   | Responsible Authority  |
|-------------|--|---|---|---|--|
|             |  | extended for 10 years from 2009 to 2018. The moratorium criminalises the harvesting of turtles and their derivatives.   | Department of Fisheries. Turtle harvests are only allowed for traditional obligations. There is no issuance of harvest exemption permits during the nesting months of November to March.  |   | Fisheries and Forests.   |
| New Zealand | Listed as vagrant, with the qualifier Threatened Overseas.   | Wildlife Act 1953. The Wildlife Act deals with the protection and control of wild animals and birds and the management of game. Most species of wildlife (including mammals, birds, reptiles and amphibians), native or introduced, are absolutely protected under the Act. No-one may kill or have in their possession any such bird or animal, unless they have a permit.   | Yes, through Wildlife Act.  |   | Department of Conservation.  |
| Peru        | Listed as Endangered<br><br>Endangered (D.S.N° 004-2014) (08.04.2014) approving the updated list of classification and categorization of endangered wildlife species that are legally protected. | Ministerial Resolution N° 103-95-PE. prohibits the directed catch of all species of sea turtles in Peruvian waters.<br><br>Supreme Decree N° 026-2001-PE. Maintains the prohibition of directed catch of all species of sea turtles in Peruvian waters.<br><br>Supreme Decree N° 034-2004-AG. Approves the categorization of threatened wildlife species and prohibits hunting, capture, possession, transport or export for commercial purposes.<br><br>Law for the conservation and sustainable use of biological diversity. Regulates the conservation of biodiversity and sustainable use of its jurisdiction in accordance with the Peruvian Constitution. The principles and definitions in the Convention on Biological Diversity govern the purposes of this law. | Penal Code, Title XIII: Chapter II Article 308. Illegal trafficking of protected species of flora and fauna is considered a crime.<br><br>Supreme Decree N° 016-2007-PRODUCE. Regulations of Inspections and Sanctions in Fisheries and Aquaculture | Trafficking of protected wild flora and fauna is punished with imprisonment no less than three years nor more than five years and 180-400 days penalty<br><br>Extract, process, transport, market or store legally protected species, is considered a serious offense and the penalty is confiscation and a fine. | Ministry of Agriculture and Irrigation (MINAGRI) is responsible for the management and administration of wildlife, setting the technical and administrative conditions for the conservation, management, sustainable use, hunting, fishing, transportation, processing and marketing of wildlife products and by-products. |

| Country               | National Protection Status   | Law protecting species   | Legal protection from killing, egg harvesting and nest destruction  | Penalties | Responsible Authority  |
|-----------------------|--|--|---|-----------|--|
|                       |  |  |   |           | <p>Ministry of Production (PRODUCE) takes action for the conservation of hydrobiological species (including sea turtles).</p> <p>Ministry of Environment (MINAM) is the regulatory body for national environmental policies.</p>               |
| U.S. (American Samoa) | <p>Endangered (the Distinct Population Segment of the South Pacific loggerhead was designated as Endangered in 2009; loggerheads were previously listed globally as a Threatened Species under the Endangered Species Act).</p> <p>The the latest status document from the United States can be found at:<br/> <a href="http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/loggerheadturtle2009.pdf">http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/loggerheadturtle2009.pdf</a></p> | <p>The Endangered Species Act 1973 (ESA) prohibits the take (capture, hunt, harassment, etc.) of all sea turtles, as they are all listed as endangered or threatened under the Act. Federally funded or permitted activities must avoid jeopardy to listed threatened and endangered species and avoid destruction of critical habitat. The ESA also authorizes the designation of critical habitat within the U.S. territory and waters for the loggerhead and permits scientific research and non-federal activities. Regulations specify mitigation resuscitation, and prohibitions for all commercial fishermen for incidentally caught sea turtles and specific regulations are put in place to reduce sea turtle interactions and increase survivorship in gillnets, longline, and purse seine fisheries throughout the country.</p> <p>In American Samoa, likely within the only U.S. territory where the South Pacific loggerhead is</p> | <p>The inclusion on the Endangered Species Act, and associated regulations prevent killing, egg harvest etc. Implementing regulations at<br/> <a href="http://www.nmfs.noaa.gov/pr/pdfs/fr/fr76-58868.pdf">http://www.nmfs.noaa.gov/pr/pdfs/fr/fr76-58868.pdf</a></p> |           | <p>National Oceanic and Atmospheric Administration (marine environment) and U.S. Fish and Wildlife Service (terrestrial environment).</p> <p>American Samoa, one of the U.S. territories that may be within the range of the South Pacific</p> |

| Country              | National Protection Status  | Law protecting species   | Legal protection from killing, egg harvesting and nest destruction  | Penalties  | Responsible Authority   |
|----------------------|---|--|---|--|---|
|                      |   | <p>found, the Dept. of Marine and Wildlife Resources regulates fishing and hunting activities within U.S. territorial waters. These regulations, located in Chapter 09, Title 24 of the American Samoa Administrative Code, were last amended in 1995. Areas restricted to fishing and/or other activities include the Fagatele Bay National Marine Sanctuary (Section 24.0907-09) and the Rose Atoll National Wildlife Refuge. Section 24.0935 applies to sea turtles and includes prohibitions on importation, exportation, sale of sea turtles, take of sea turtles, and possess, delivery, carrying, transporting or shipping of sea turtles or their body parts. While this section specifically mentions green, hawksbills, and leatherbacks, they should likely apply to any loggerheads encountered.</p> |   |  | <p>loggerhead also has a Department of Marine and Wildlife Resources.</p>   |
| <p>New Caledonia</p> | <p>There are four separate jurisdictions:</p> <ul style="list-style-type: none"> <li>• New Caledonia Govt (NC)</li> <li>• Northern Province.</li> <li>• Southern Province</li> <li>• Island Province</li> </ul> <p>No specific reference to status in legislation, except in Southern Province, where status is “threatened”.</p> | <p>NC Govt has jurisdiction over EEZ (12 – 200 miles). The three provinces have jurisdiction over territorial waters (within 12 miles of baselines, taken from the outer reef).</p>  | <p>NC: It is forbidden to fish for, capture, remove, intentional perturbation, mutilation, destruction, butchering, transport, put for sale, sale, purchase, eat all marine turtle species, dead or alive, including their eggs, and any part of the animals.</p> <p>It is also forbidden to export marine turtles. In case of bycatch all efforts will be taken to free the animals alive and minimise injury. All bycatch has to be declared. Special permits can be issued for scientific studies and stock enhancement.</p> <p>Northern Province: same provisions as in NC. Special permits for customary use, only for Green Turtle. No permits for Loggerheads. Fines same as for NC.</p> <p>Southern Province: Same as above, but also a measure to protect the habitat. It is forbidden to approach within 10m.</p> | <p>NC: 1 million francs (approx. AUD 10,000)</p> | <p>Ecology and Sustainable Development</p> <p>NC: Fisheries Department</p> <p>All provinces: Environmental Services</p> |



| Country          | National Protection Status | Law protecting species  | Legal protection from killing, egg harvesting and nest destruction   | Penalties | Responsible Authority                                 |
|------------------|----------------------------|---|--|-----------|---|
|                  |                            |   | <p>Lights and dogs forbidden on nesting beaches during nesting and hatching seasons. Fine is similar, plus 6 months in jail.</p> <p>Island Province: Capture by any means is prohibited between 1 Nov – 31 March. But destruction of nests, collecting eggs is prohibited at all times.</p> <p>Permits for customary feasts and scientific research.</p> <p>Fines EUR 1,000.</p> |           |   |
| French Polynesia |                            | <p>Sea turtles are a protected species whose trade is prohibited internationally. Environment regulations require their protection and conservation. It is prohibited to destroy, deface, intentionally disturb, capture or intentionally remove marine turtles and their eggs. Destruction and degradation of sensitive habitats is also prohibited.</p> | <p>2013-2017 Marine Emblematic Species Action Plan, which includes objectives from the SPREP Marine Turtle Action Plan.</p>  |           | <p>Ministry of the Environment, Energy and Mines.</p> |

## **4. FRAMEWORK FOR ACTION**

### **4.1 Goal**

To ensure a favourable conservation status of the loggerhead turtle in the South Pacific Ocean.

### **4.2 Objectives, Actions and Results**

The objectives and corresponding actions and results are set out in the tables below for all threats identified for loggerhead turtles in the South Pacific Ocean. Tables have been listed according to ratings assigned in the risk matrix.

**Actions** should be prioritized as:

- Essential
- High
- Medium
- Low

**Timescales** should be attached to each Action using the following scale:

- Immediate: completed within the next year
- Short: completed within the next 3 years
- Medium: completed within the next 5 years
- Long: completed within the next 10 years
- Ongoing: currently being implemented and should continue
- Completed: completed during preparation of Action Plan

**TERRESTRIAL PREDATORS** (Risk Matrix Ranking: Very High)

| <b>Objective 1: Research and test existing and emerging solutions to reducing the threat of terrestrial predators on primary nesting beaches.</b>  |  |                 |                            |
|--|--|-----------------|----------------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b>          |
| 1.1 A summary of potential solutions is evaluated, prioritized, and tested for each site.  | 1.1.1. Conduct a search of the available literature and non-published material and prepare a toolbox of practical and cost-effective options.<br><br>Applicable: eastern Australia, New Caledonia  | Medium          | Short / partially complete |
|  | 1.1.2. Research emerging technology.<br><br>Applicable: eastern Australia, New Caledonia   | High            | Immediate                  |
|  | 1.1.3. Test efficacy of solutions.<br><br>Applicable: eastern Australia, New Caledonia   | High            | Short                      |
|  | 1.1.4 Implement permanent solutions, as applicable.<br><br>Applicable: eastern Australia, New Caledonia  | High            | Medium                     |
| <b>Objective 2: To reduce the excessive loss of EGG and HATCHLINGS on nesting beach from terrestrial predators.</b>  |  |                 |                            |
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b>          |
| 2.1 There is a significant increase in eggs and hatchlings at the nesting beaches as a result of reduced influences of terrestrial predators with at least 70% of clutches producing hatchlings. | 2.1.1 Work with conservation management agencies, local municipal councils, surrounding land owners and communities to limit access of foxes, dogs and varanid lizards to nesting beaches and reduce loss of egg to predators.<br><br>Applicable: eastern Australia, New Caledonia | High            | Short                      |
|  | 2.1.2 Implement community awareness and education programs promoting responsible pet ownership by local community residents close to nesting beaches.<br><br>Applicable: eastern Australia, New Caledonia  | High            | Short                      |
|  | 2.1.3 Promote the development of formal Management Plans for identified nesting beaches encompassing at least 70% of the loggerhead nesting population for the region.<br><br>Applicable: eastern Australia, New Caledonia   | Medium          | Medium                     |
|  | 2.1.4 Promote long term protection of significant nesting area through their declaration as protected areas.<br><br>Applicable: eastern Australia, New Caledonia   | Medium          | Long                       |

**FISHERIES BYCATCH** (Risk Matrix Ranking: Very High)

| <b>Objective 3: Identify those fisheries that overlap spatially with the range of south Pacific loggerhead turtles</b>   |  |                 |                   |
|--|--|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time scale</b> |
| 3.1 Fisheries with potential interactions are identified   | 3.1.1 Obtain and analyse information on fisheries operating in the south Pacific.<br><br>Applicable: All range states  | High            | Immediate         |
| 3.2 Data collection is standardized and regional information sharing is facilitated.   | 3.2.1 Establish protocols for data-sharing on fishing effort and for emergence of new fishing techniques (such as artisanal offshore fisheries for flying fish eggs). Build upon resources and data standardisation developed by other organisations, including those developed by IAC for net fisheries, CPPS data standardization protocols, and bycatch data standardisation occurring through Regional Fisheries Management Organizations.<br><br>Applicable: Australia, Chile, Ecuador, Peru and other range states to be identified. | High            | Medium            |
| <b>Objective 4: Assess and determine the levels of mortality, if any, in all commercial, recreational and small-scale longline, trawl, purse-seine and gillnet, trap fisheries (among others) that overlap spatially with the range of south Pacific loggerhead turtles.</b> |  |                 |                   |
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 4.1 The level of loggerhead turtle bycatch is quantified by age class within all fisheries.  | 4.1.1. Logbook, observer and dockside survey data are collected and analysed<br><br>Applicable: Australia, Chile, Ecuador, Peru and other range states to be identified.   | High            | Short             |
| <b>Objective 5: Undertake research of loggerhead turtle distribution, abundance and injuries and mortality associated with fishery bycatch.</b>  |  |                 |                   |
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 5.1 The overlap of loggerhead turtle distribution and fishing effort by fishing fleets is clarified.   | 5.1.1 Data on loggerhead distribution and relative abundance are collected and analysed (with respect to the fishing grounds of fleets operating in the south pacific ocean).<br><br>Applicable: Australia, Chile, Ecuador, Peru and other range states to be identified.  | High            | Medium            |
| 5.2 Loggerhead injury rates, severity of injuries and rates of post-release mortality are characterized and quantified.  | 5.2.1 Undertake studies to assess injury severity and quantify post-release mortality.<br><br>Applicable: Australia, Chile, Ecuador, Peru and other range states to be identified.   | Essential       | Medium            |
|  | 5.2.2 Data from stranding programmes are collected and analysed.<br><br>Applicable: Australia, New Caledonia, Chile, other range states to be identified.  | Medium          | Medium            |

| <b>Objective 6: Reduce incidental mortality or risk of mortality of South Pacific loggerhead turtles in those fisheries where bycatch has been identified as a problem.</b> |  |                 |                   |
|---|--|-----------------|-------------------|
| <b>Result</b>   | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 6.1 The level of loggerhead turtle bycatch is reduced within all fisheries to negligible levels.  | 6.1.1. Encourage the research and development of mitigation measures for gear types where technical solutions are currently unavailable or insufficiently developed e.g. gillnets, longlines, trap fisheries.<br><br>Applicable: Australia, Chile, Ecuador, Peru and other range states to be identified.  | High            | Medium            |
|   | 6.1.2. Mitigation devices and management strategies are implemented in fisheries as appropriate to reduce interactions with fishing gear.<br><br>Appropriate mitigation measures may include:<br>TEDs for trawl fisheries;<br>Use of large circle hooks (18/0 or larger with whole finfish bait) in longline gear;<br>Use of sensory cues;<br>Spatial and temporal closures in all fisheries where technical solutions are not available.<br><br>Applicable: Those fisheries identified to have bycatch. | High            | Ongoing           |
|   | 6.1.3. Use of appropriate handling, resuscitation and release techniques is promoted in all fisheries to maximize the survival of turtles that are incidentally caught.<br><br>Applicable: Australia, Chile, Ecuador, Peru and other range states to be identified.  | High            | Short             |
|   | 6.1.4. Monitor the use and effectiveness of mitigation measures through observer programs, log books, electronic monitoring systems or other means, as appropriate.<br><br>Applicable: Australia, Chile, Ecuador, Peru and other range states to be identified.  | High            | Medium            |
|   | 6.1.5 Capacity building of human resources (i.e. fishers, management authorities and other stakeholders) to promote effective bycatch monitoring and mitigation.<br><br>Applicable: Australia, Chile, Ecuador, Peru and other range states to be identified.   | Medium          | Medium            |
| <b>Objective 7: Reduce retention of incidentally caught turtles captured alive and retained for use as food, where applicable.</b>  |  |                 |                   |
| <b>Result</b>   | <b>Action</b>  | <b>Priority</b> | <b>Time scale</b> |
| 7.1 Live-caught animals released back to sea.   | 7.1.1 Outreach/awareness-raising with fishers to reduce consumption and promote safe release.<br><br>Applicable: Australia, Papua New Guinea, Chile, Ecuador and Peru  | High            | Short             |
|   | 7.1.2 Enforcement of existing rules and regulations prohibiting turtle consumption and commerce.<br><br>Applicable: Australia, Papua New Guinea, Chile, Ecuador and Peru.  | Medium          | Long              |

**MARINE DEBRIS** (Risk Matrix Ranking: Very High)

| <b>Objective 8: Determine the frequency of ingestion of marine debris and/or entanglement in lost or discarded fishing gear and the associated debilitation and/or mortality of loggerhead turtles by origin of the debris and by age classes.</b> |   |                 |                   |
|--|---|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>   | <b>Priority</b> | <b>Time Scale</b> |
| 8.1 The level of loggerhead turtle ingestion of synthetic debris and entanglement in lost or discarded fishing gear is quantified by age class and area.   | 8.1.1. Quantify and report the temporal and spatial distribution of sick, injured and dead loggerhead turtles impacted by ingested marine debris and entanglement in lost or discarded fishing gear by age class.<br><br>Applicable: Australia, Fiji, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified. | High            | Short             |
|  | 8.1.2. Identify the origin of the synthetic debris and/or fishing gear recorded with the turtles examined in the above action.<br><br>Applicable: Australia, Fiji, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.  | High            | Medium            |
| <b>Objective 9: Prevent where possible or reduce the escape of synthetic debris to the marine environment.</b>   |   |                 |                   |
| <b>Result</b>  | <b>Action</b>   | <b>Priority</b> | <b>Time Scale</b> |
| 9.1 Reduction in the proportion of loggerhead turtles recorded with ingested marine debris.  | 9.1.1. Evaluate and improve where possible land-based and ship-based waste disposal systems to reduce loss of synthetic waste to the marine environment.<br><br>Applicable: Australia, Fiji, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.  | High            | Medium            |
|  | 9.1.2. Develop and implement an education program that fosters public engagement in reducing the loss of synthetic waste to the marine environment.<br><br>Applicable: Australia, Fiji, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.   | High            | Medium            |
|  | 9.1.3. Give priority to actions that reduce the proliferation of marine debris identified in Action 8.1.2.<br><br>Applicable: Australia, Fiji, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.  | High            | Medium            |

| <b>Objective 10: Prevent where possible or reduce the loss and/or discarding of fishing gear to the marine environment.</b> |  |                 |                   |
|---|--|-----------------|-------------------|
| <b>Result</b>   | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 10.1 Reduction in the proportion of loggerhead turtles entangled in lost or discarded fishing gear.                         | 10.1.1. Evaluate, and improve where possible, land based and ship based waste disposal systems, including consideration of development of waste management plans and procedures, to reduce the occurrence of lost or discarded fishing gear in the marine environment.<br><br>Applicable: Australia, Fiji, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified. | High            | Short             |
|   | 10.1.2. Develop and implement an education program, promoting best practice strategies, that fosters engagement of fishers in reducing the loss or discarding of fishing gear to the marine environment.<br><br>Applicable: Australia, Fiji, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.   | High            | Medium            |
|   | 10.1.3. Give priority to actions that reduce the proliferation of marine debris identified in Action 8.1.2.<br><br>Applicable: Australia, Fiji, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.  | High            | Medium            |



**CLIMATE CHANGE/CLIMATE VARIABILITY** (Risk Matrix Ranking: Very High)

| <b>Objective 11: Establish a climate change response plan for loggerhead turtles.</b> |  |                 |                   |
|---|--|-----------------|-------------------|
| <b>Result</b>   | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 11.1 The impacts of climate change on Loggerhead turtles are buffered.                | 11.1.1. Quantify and predict changes in beach temperatures, nesting seasonality or locations, loss of nesting habitat and alterations to foraging areas.<br><br>Applicable: all range states.  | High            | Medium            |
|   | 11.1.2. Quantify and predict changes in Ocean acidification and atmospheric CO <sub>2</sub> , on foraging and nesting habitats, and impacts/availability of food for pelagic foraging loggerheads.<br><br>Applicable: all range states                                 | High            | Long              |
|   | 11.1.3. Monitor possible effects of ENSO or longer ocean shifting regimes (e.g. Pacific Decadal Oscillation) on the dynamics of stocks of loggerheads in south-eastern Pacific (i.e., changes in distribution, diet, recruitment).<br><br>Applicable: all range states | High            | Medium            |
|   | 11.1.4. Validate predictions of population response to climate change against measured data.<br><br>Applicable: all range states   | Medium          | Long              |
|   | 11.1.5. Develop climate change response plan for Loggerhead turtles in the South Pacific.<br><br>Applicable: all range states  | High            | Long              |
|   | 11.1.6. Identify potential foraging and nesting habitat for future range expansion and ensure adequate coverage of these areas in marine protected areas.<br><br>Applicable: all range states  | Medium          | Medium            |
|   | 11.1.7. Identify and implement appropriate adaptation measures and monitor the progress. Lessons learnt to be shared among wider community.<br><br>Applicable: all range states  | High            | Long              |
|   | 11.1.8. Provide capacity building for sea turtle managers and turtle groups on implementing adaptation measures.<br><br>Applicable: all range states   | Medium          | Ongoing           |
|   | 11.1.9. Encourage and promote information exchange on loggerhead turtles in the South Pacific Ocean and climate change between all relevant fora.<br><br>Applicable: all range states  | Medium          | Medium            |

**LOWERED WATER TABLE AT NESTING BEACHES** (Risk Matrix Ranking: Very High)

| <b>Objective 12: Maintain or re-establish the water table height under the nesting habitat at significant turtle nesting beaches to support high incubation success of eggs and high emergence success of hatchlings from the nests.</b> |  |                 |                   |
|--|--|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 12.1 High incubation success of eggs and high hatchling emergence success at all significant turtle rookeries.   | 12.1.1. Establish a long-term monitoring programme to quantify and report the temporal and spatial distribution of incubation success and hatchling emergence success at significant loggerhead turtle nesting beaches.<br><br>Applicable: Australia, New Caledonia.   | High            | Short             |
|  | 12.1.2. Identify beaches where annual hatchling emergence success regularly falls below 80% and assess the role of altered water table height in this low emergence success.<br><br>Applicable: Australia, New Caledonia.  | High            | Short             |
|  | 12.1.3. At Mon Repos beach, explore options for re-establishing the natural water table levels associated with the swamp land behind the dune and hence under the dunal nesting habitat and implement an appropriate action to achieve this.<br><br>Similar action to be applied to other beaches subsequently identified with similar problems.<br><br>Applicable: Australia. | High            | Short             |

**CHANGED LIGHT HORIZONS** (Risk Matrix Ranking: Very High)

| <b>Objective 13: Manage coastal lighting at significant loggerhead turtle nesting beaches to create a dark coast line.</b>                                   |  |                 |                   |
|--|--|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 13.1 No direct light source visible to the nesting beaches and reduced reflected light illuminating the sky/salt spray above and behind the nesting beaches. | 13.1.1 Turn off all lighting at recreational areas within 100 m of the nesting beaches after 8:00 pm until daylight during nesting and hatching season (October to May).<br><br>Applicable: Australia, New Caledonia.  | Essential       | Immediate         |
|  | 13.1.2 Prohibit the use of vertical illumination of building, other structures and vegetation using lighting that shines into the sky within 1.5 km of the nesting beaches during the nesting and hatching season.<br><br>Applicable: Australia, New Caledonia.    | Essential       | Immediate         |
|  | 13.1.3 Fit 25 cm deep vertical shades to all street lights within 1.5 km of the nesting beaches, and possibly others that remain visible from the beach.<br><br>Applicable: Australia, New Caledonia.  | High            | Short             |
|  | 13.1.4 Activate lighting required on stairs and access areas for safety purpose with proximity sensors or motion detectors with an associated deactivation of lighting after 10 minutes.<br><br>Applicable: Australia, New Caledonia.                              | Medium          | Short             |
|  | 13.1.5 Explore the feasibility of using lines of road-surface mounted LED lights in place of street lights.<br><br>Applicable: Australia, New Caledonia.   | High            | Medium            |
|  | 13.1.6. For buildings visible from nesting beaches, interior lighting should be blocked from shining from the interior of the building towards the respective nesting beaches during the nesting and hatching season.<br><br>Applicable: Australia, New Caledonia. | High            | Short             |
|  | 13.1.7 Continue to investigate new options for lighting that does not have a negative impact on turtle population function.<br><br>Applicable: Australia, New Caledonia.   | High            | Ongoing           |

**ARMOURING OF BEACHES** (Risk Matrix Ranking: Moderate)

| <b>Objective 14: Maintain adult turtle access to prime nesting habitat above tidal/storm inundation by reducing the need for rock or concrete armouring of sand dunes.</b> |  |                 |                   |
|--|--|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 14.1 Main nesting beaches preserved.   | 14.1.1. Promote ecosystem based management of coastal dunes / sand and coastal dune restoration such as mangrove plantations, vegetating coastal environment etc instead of structural designs.<br><br>Applicable: Australia, New Caledonia. | Medium          | Ongoing           |
|  | 14.1.2. Consider nesting beaches in land use planning.<br><br>Applicable: Australia, New Caledonia.  | High            | Ongoing           |
|  | 14.1.3. Explore and promote ecologically sound practices to mitigate problems associated with sand dune erosion and coastal development at nesting beaches.<br><br>Applicable: Australia, New Caledonia.                                     | High            | Medium            |
| 14.2 Restoration of prime nesting habitat.   | 14.2.1 Remove unsuitable substrate and rehabilitate nesting habitat with appropriate sand and vegetation.<br><br>Applicable: Australia, New Caledonia.   | High            | Short             |
|  | 14.2.2 Create access paths for loggerhead turtles to suitable zones within the beach area.<br><br>Applicable: Australia, New Caledonia.  | High            | Short             |

**SHIP STRIKE** (Risk Matrix Ranking: Moderate)

| <b>Objective 15: Conduct research to investigate loggerhead turtle/vessel interactions and develop a boat strike strategy to reduce threats.</b> |   |                 |                   |
|--|---|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>   | <b>Priority</b> | <b>Time Scale</b> |
| 15.1 The level of interaction between loggerhead turtles and vessels is quantified.  | 15.1.1. Conduct fine-scale tracking of turtles in areas of high boat activity.<br><br>Applicable: all range states  | Medium          | Short             |
|  | 15.1.2. Identify areas of high risk and establish or review go slow zones as needed.<br><br>Applicable: all range states  | Medium          | Medium            |
|  | 5.1.3. Monitor and quantify mortality of marine turtles from interactions with vessels.<br><br>Applicable: all range states   | Medium          | Short             |
|  | 15.1.4 Implement boat strike strategies to reduce mortality.<br><br>Applicable: all range states  | Medium          | Medium            |
|  | 15.1.5. Where appropriate, place conditions on approved developments that will require speed limitations on boats within marine turtle habitat.<br><br>Applicable: all range states | High            | Immediate         |

**TOURISM** (Risk Matrix Ranking: Moderate)

| <b>Objective 16: Promote the development of sound ecotourism practises in turtle breeding and foraging grounds</b> |   |                 |                   |
|--|---|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>   | <b>Priority</b> | <b>Time Scale</b> |
| 16.1 Vulnerable life stages and habitat is protected with greater public awareness.                                | 16.1.1 Develop guidelines for tourism encounters with turtles in the wild including site carrying capacity.<br><br>Applicable: Australia, New Caledonia.        | Medium          | Medium            |
|  | 16.1.2. Investigate the suitability of developing and applying “green certification” for tourism operators.<br><br>Applicable: Australia, New Caledonia.        | Medium          | Long              |
|  | 16.1.3. Encourage the development and distribution of appropriate education material for use by tourism operators.<br><br>Applicable: Australia, New Caledonia. | Medium          | Medium            |

| <b>Objective 17: Generate revenue for conservation from tourism activities</b>         |  |                 |                   |
|--|--|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 17.1. More resources are available for conservation activities for loggerhead turtles. | 17.1.1. Investigate and develop appropriate funding mechanisms and allocation procedures to be applied to tourism ventures interacting with loggerhead turtles.<br><br>Applicable: Australia, New Caledonia. | Medium          | Long              |

**LEGAL DIRECT TAKE** (Risk Matrix Ranking: Moderate)

| <b>Objective 18: Ensure the legal direct take of loggerhead turtles is sustainable.</b>           |  |                 |                   |
|---|--|-----------------|-------------------|
| <b>Result</b>   | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 18.1 Loggerhead turtle populations exposed to legal direct take remain within sustainable levels. | 18.1.1. Indigenous communities develop and implement marine turtle management plans that consider cumulative impacts and aim to achieve sustainable use.<br><br>Applicable: Australia, Papua New Guinea.                 | Medium          | Ongoing           |
|   | 18.1.2. Expand and increase capacity of Indigenous ranger programs that conduct research and monitoring of marine turtles, including Loggerhead turtles, at rookeries and feeding grounds.<br><br>Applicable: Australia. | Medium          | Ongoing           |

**ILLEGAL TAKE** (Risk Matrix Ranking: Moderate)

| <b>Objective 19: Reduce illegal take of loggerhead turtles</b>                       |   |                 |                   |
|--|---|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>   | <b>Priority</b> | <b>Time Scale</b> |
| 19.1 The areas where the illegal capture of loggerhead turtles occurs are identified | 19.1.1. Identify key areas where loggerhead turtle poaching occurs.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states to be identified.  | Medium          | Ongoing           |
|  | 19.1.2. Strengthen control systems and vigilance of areas affected by harvesting, landing at ports, trading and illegal use.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states to be identified. | Medium          | Medium            |

|   |  |        |           |
|---|--|--------|-----------|
| 19.2 Levels of illegal take by age class are estimated.         | 19.2.1. Estimate illegal take of loggerhead turtles by age classes.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states to be identified.   | Medium | Medium    |
|   | 19.2.2. Monitor and quantify illegal take, using techniques such as inspections of ports, nesting beaches, rubbish dumps and interviews/surveys with park guards and local communities.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states to be identified. | Medium | Medium    |
| 19.3 Reduced illegal take of loggerhead turtles and their eggs. | 19.3.1 Promote the enforcement of legal mechanisms to reduce take.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states to be identified.  | High   | Immediate |
|   | 19.3.2 Implement an educational/awareness programme, which may include incentives for best practice, aimed at reducing the take of loggerheads in the south Pacific.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states to be identified.                    | High   | Immediate |

**DREDGING** (Risk Matrix Ranking: Moderate)

| <b>Objective 20: Manage dredging operations within coastal waters to minimize the injury and mortality of loggerhead turtles.</b> |  |                 |                   |
|---|--|-----------------|-------------------|
| <b>Result</b>   | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 20.1 The injury and mortality of loggerhead turtles is minimised during dredging operations.                                      | 20.1.1. Quantify and report the temporal and spatial distribution of injured and dead loggerhead turtles impacted by dredging operations by age class.<br><br>Applicable: Australia, Fiji, New Caledonia and other range states to be identified.        | Medium          | Ongoing           |
|   | 20.1.2. Establish and implement guidelines/codes of practice for dredging with consideration of exclusion devices, timing of operation, monitoring of impact.<br><br>Applicable: Australia, Fiji, New Caledonia and other range states to be identified. | High            | Short             |
|   | 20.1.3. Major dredging projects should be accompanied by technically sound environmental assessments.<br><br>Applicable: Australia, Fiji, New Caledonia and other range states to be identified.   | High            | Ongoing           |

**POLLUTION: ACUTE** (Risk Matrix Ranking: Moderate)

| <b>Objective 21: Assess the risk of oil spills off eastern Australian and New Caledonian breeding and coastal foraging areas</b> |  |                 |                   |
|--|--|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 21.1 A review of major ports and associated shipping routes and their proximity to nesting beaches has been conducted.           | 21.1.1. Conduct a risk assessment that reviews available information on existing regulations for vessels entering East Australian and New Caledonian ports.<br><br>Applicable: Australia, New Caledonia. | Medium          | Medium            |
| 21.2 A review of historic spills has been conducted.   | 21.2.1. Conduct a risk assessment that reviews historic spills off Eastern Australia and New Caledonia.<br><br>Applicable: Australia, New Caledonia  | Medium          | Long              |
| <b>Objective 22: Assess the regional capacity to respond to oil spills</b>   |  |                 |                   |
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 22.1. A review of potential responses to oil spills is conducted.  | 22.1.1. Review “Area Contingency Plans” if available.<br><br>Applicable: Australia, New Caledonia  | Medium          | Medium            |
|  | 22.1.2. Review “best management practices” for oil spill management.<br><br>Applicable: Australia, New Caledonia   | Medium          | Medium            |
| 22.2 Sensitive areas and times have been identified and communicated for coordination with the appropriate agencies.             | 22.2.1. Integrate pertinent information on sensitive sites/seasons for nesting beaches into Area Contingency Plans.<br><br>Applicable: Australia, New Caledonia  | High            | Medium            |
|  | 22.2.2. Plan and conduct oil spill response drills.<br><br>Applicable: Australia, New Caledonia  | Medium          | Long              |

**POLLUTION: CHRONIC** (Risk Matrix Ranking: Low)

| <b>Objective 23: Understand and ensure the incidence and impact of chronic pollution on loggerhead turtle health is not population limiting.</b> |  |                 |                   |
|--|--|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 23.1 Monitoring programs are in place to measure the impact of chronic pollution within coastal waters on the health of loggerhead turtles.      | 23.1.1. Monitor water quality and loggerhead turtle health in key coastal foraging areas.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states to be identified. | Low             | Ongoing           |



**DISEASE** (Risk Matrix Ranking: Low)

| <b>Objective 24: Understand and ensure the incidence and impact of disease on loggerhead turtle health is not population limiting.</b>  |   |                 |                   |
|---|---|-----------------|-------------------|
| <b>Result</b>   | <b>Action</b>   | <b>Priority</b> | <b>Time Scale</b> |
| 24.1 Loggerhead turtle and egg mortality is not elevated by a range of diseases including parasitic worms, bacteria, fungi and viruses. | 24.1.1 In key coastal foraging areas and nesting beaches, monitor disease impacts on loggerhead turtles and their eggs.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states. | Low             | Ongoing           |

**SCIENTIFIC RESEARCH AND REHABILITATION** (Risk Matrix Ranking: Low)

| <b>Objective 25: Ensure scientific research on South Pacific loggerhead turtles has the least impact on individuals and populations.</b>       |  |                 |                   |
|--|--|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 25.1 Summary of existing protocols is completed and annual takes/mortalities are recorded to assess cumulative impacts of scientific research. | 25.1.1. Summarize/characterize existing scientific research permits on South Pacific loggerhead turtles, including existing protocols in place to reduce impacts.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru and other range states to be identified. | Low             | Medium            |
|  | 25.1.2. Research protocols within other countries and compare with current protocols to ensure existing protocols are appropriate.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.                               | Low             | Medium            |
|  | 25.1.3. Revise existing protocols, if applicable, including development of outside reviewing committee (e.g. IACUC).<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.   | Low             | Long              |
|  | 25.1.4. Track annual take/mortalities to assess cumulative impacts on loggerhead turtles of scientific research.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.   | Medium          | Medium            |

| <b>Objective 26: Ensure the use of best practices in the rehabilitation, captive holding, transportation, and release of South Pacific loggerhead turtles</b> |  |                 |                   |
|---|--|-----------------|-------------------|
| <b>Result</b>   | <b>Action</b>  | <b>Priority</b> | <b>Time Scale</b> |
| 26.1 Successful rehabilitation of healthy loggerhead turtles back to the wild is occurring.   | 26.1.1. Review and summarize existing protocols for rehabilitation and release of sea turtles.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.   | Low             | Short             |
|   | 26.1.2. Management of turtles in rehabilitation follows best practice veterinary standards.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.  | Low             | Short             |
|   | 26.1.3. Annual reporting on the results of rehabilitation programs.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified.  | Low             | Long              |
|   | 26.1.4. Provide plain language advice online with regard to best practice care for debilitated loggerhead turtles, taking into account already existing resources.<br><br>Applicable: Australia, New Caledonia, Chile, Ecuador, Peru, and other range states to be identified. | Low             | Long              |

## RESEARCH ACTION

| <b>Objective 27: To monitor the population dynamics of loggerhead turtles in the South Pacific to detect population responses to management implemented under this Single Species Action Plan.</b> |   |                 |                   |
|--|---|-----------------|-------------------|
| <b>Result</b>  | <b>Action</b>   | <b>Priority</b> | <b>Time Scale</b> |
| 27.1 Demographic data are available for representative age classes to allow assessment of the response of loggerhead turtles to anthropogenic impacts throughout the Pacific Ocean.                | 27.1.1. Establish long term monitoring of key demographic parameters following best practice at index study sites at:<br>A. Nesting beaches;<br>B. Coastal foraging areas for adult and large immature turtles;<br>C. Pelagic foraging areas for post-hatchling turtles.<br><br>Applicable: all range states. | Essential       | Medium            |

|  |   |               |                |
|--|---|---------------|----------------|
|  | <p>27.1.2. Implement tagging of loggerhead turtles of all suitable age classes for mark recapture studies that will be informative with respect to demographic studies and migration using flipper tags, PIT tags and satellite tagging technology, where appropriate.</p> <p>Applicable: all range states.</p> | <p>Medium</p> | <p>Ongoing</p> |
|  | <p>27.1.3. Continue to collect, preserve and bank tissue samples suitable for population genetic analysis and make these samples available to accredited researchers for continued investigation of stock composition and population distribution.</p> <p>Applicable: all range states.</p>                     | <p>Low</p>    | <p>Ongoing</p> |
|  | <p>27.1.4. Define the temporal and spatial distribution of diet of loggerhead turtles as it changes during their life history using available technology including: necropsy of dead turtles, gastric lavage, underwater imagery, and stable isotope analysis.</p> <p>Applicable: all range states.</p>         | <p>Low</p>    | <p>Long</p>    |
|  | <p>27.1.5. Explore the repeat of the hatchling tagging study in Queensland in the 1970s, to re-introduce cohorts of known age turtles into the South Pacific Gyre.</p> <p>Applicable: all range states.</p>   | <p>Medium</p> | <p>Long</p>    |
|  | <p>27.1.6. Establish regional stranding networks and data bases to collate the temporal and spatial distribution of sick, injured and dead loggerhead turtles impacted from anthropogenic activities.</p> <p>Applicable: all range states.</p>  | <p>Medium</p> | <p>Short</p>   |
|  | <p>27.1.7. Share data, including accessing data from other regional organisations, and analyse and report on available data for population trends, distribution and migration.</p> <p>Applicable: all range states.</p>   | <p>High</p>   | <p>Medium</p>  |

## References

- Aguirre, A., G. H. Balazs, B. Zimmerman and F. D. Gale (1994). "Organic contaminants and trace metals in the tissues of green turtles (*Chelonia mydas*) afflicted with fibropapillomas in the Hawaiian islands." Marine Pollution Bulletin **28**(2): 109-114.
- Aguirre, A. A., C. J. Limpus, T. R. Spraker and G. H. Balazs (2000). Survey of fibropapillomatosis and other potential diseases in marine turtles from Moreton Bay, Queensland, Australia. Proceedings of the Nineteenth Annual Symposium on Sea Turtle Conservation and Biology. H. Kalb and T. Wibbels. South Padre Island, Texas, 1999, U.S. Department of Commerce. **NOAA Technical Memorandum NMFS-SEFSC-443**: 36.
- Alava, J.J. 2008. Loggerhead Sea Turtles (*Caretta caretta*) in Marine Waters off Ecuador: occurrence, Distribution and Bycatch from the Eastern Pacific Ocean. Marine Turtle Newsletter 119:8-11.
- Alfaro Shigueto, J., Dutton, P., Mangel, J. and Diana Vega. 2004. First confirmed occurrence of loggerhead turtles *Caretta caretta* in Peru. Marine Turtle Newsletter 103: 7-11.
- Alfaro Shigueto, J., Mangel, J.C., Seminoff, J.A., Dutton, P.H. 2008. Demography of loggerhead turtles *Caretta caretta* in the southeastern Pacific Ocean: fisheries-based observations and implications for management. Endangered Species Research 5: 14-21.
- Alfaro-Shigueto, J., Mangel, J.C., Pajuelo, P., Dutton, P.H., Seminoff, J.A., Godley, B.J. 2010. Where small scale can have a large impact: Structure and characterization of small-scale fisheries in Peru. Fisheries Research 106: 8-17.
- Alfaro-Shigueto, J., Mangel, J., Bernedo, F., Dutton, P. H., Seminoff, J. A., and Godley, B. J. (2011). Small-scale fisheries of Peru: a major sink for marine turtles in the Pacific. Journal of Applied Ecology doi: **10.1111/j.1365-2664.2011.02040.x**, 1-9.
- Alfaro-Shigueto, J., Mangel, J.C., Dutton, P.H., Seminoff, J.A. & Godley, B. J. 2012. Trading information for conservation: a novel use of radio broadcasting to reduce sea turtle bycatch. Oryx 46(3): 332-339.
- Balazs, G. H. (1985). Impact of ocean debris on marine turtles: entanglement and ingestion. Proceedings of the Workshop on the Fate and impact of Marine Debris, 26-29 November 1984, Honolulu, Hawaii, U.S. Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum (July 1985).
- Baldwin, R., Hughes, G. R., and Prince, R. I. T. (2003). Loggerhead turtles in the Indian Ocean. In "Loggerhead Sea Turtles". A. B. Bolten, and B. E. Witherington, ed. Pp. 218 – 232. (Smithsonian Institution: Washington, D.C.)
- Beck, C. A. and N. B. Barros (1991). "The impact of debris on the Florida manatee." Marine Pollution Bulletin **22**(10): 508-510.
- BHP Billiton (2011). "Marine Turtle Management Plan: Port Hedland Outer Harbour Development."
- Bjorndal, K. A., A. B. Bolten and C. Lageaux (1994). "Ingestion of Marine Debris by Juvenile Sea Turtles in Coastal Florida Habitats." Marine Pollution Bulletin **28**: 154 - 158.
- Bolten, A. B. and Witherington, B. E. (2003). "Loggerhead Sea Turtles." (Smithsonian Institution: Washington, D.C.)
- Boyle, M.C., Fitz-Simmons, N.N., Limpus, C.J., Kelez, S., Velez-Zuazo, X. & Waycott, M. 2009. Evidence for transoceanic migrations by loggerhead sea turtles in the southern Pacific Ocean. Proceedings of the Royal Society B 276: 1993–1999.
- Carr, A. (1987). "Impact of nondegradable marine debris on the ecology and survival outlook of sea turtles." Marine Pollution Bulletin **18**(6, Supplement B): 352-356.
- Chevron (2012). "Gorgon Gas Development and Jansz Feed Gas Pipeline: Long Term Marine Turtle Management Plan (Revision 1)."
- Dobbs, K. (2001). Marine turtles in the Great Barrier Reef World Heritage Area: a compendium of information and basis for the development of policies and strategies for the conservation of marine turtles. Townsville, Great Barrier Reef Marine Park Authority.
- Dodd, C. K. (1988). Synopsis of the biological data on the loggerhead turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report 88(14), 1–110.
- Donoso, M. & Dutton, P.H. 2010. Sea turtle bycatch in the Chilean pelagic longline fishery in the southeastern Pacific: opportunities for conservation. Biological Conservation 143: 2672–2684.
- Dutton, P. 2007. Genetic stock composition of loggerheads (*Caretta caretta*) encountered in the Hawaii-based longline fishery using mtDNA analysis. Pages 17-19 in North Pacific Loggerhead Expert Workshop, December 19-20, 2007. A report of the the Western Pacific Regional Fishery Management Council pursuant to NOAA Grant FNA05NMF4411092, Honolulu, Hawaii.
- Fuentes, M.M.P.B., J.A. Maynard, M. Guinea, I.P. Bell, P.J. Werdell, and M. Hamann. 2009. Proxy indicators of sand temperature help project impacts of global warming on sea turtles in northern Australia. Endangered Species Research, Vol. 9:33-40.
- Gaus, C., S. Grant, N. L. Jin, K. Goot, L. Chen, A. Villa, F. Neugebauer, L. Qi and C. J. Limpus (2012). Investigations of contaminant levels in green turtles from Gladstone, National Research Centre for Environmental Toxicology.
- Hatase, H., M. Kinoshita, T. Bando, N. Kamezaki, K. Sato, Y. Matsuzawa, K. Goto, K. Omita, Y. Nakashima, H. Takeshita, and W. Sakamoto. 2002. Population structure of loggerhead turtles, *Caretta caretta* nesting in Japan: bottlenecks on the Pacific population. Marine Biology 141:299-305.
- Hazel, J. and E. Gyuris (2006). "Vessel-related mortality of sea turtles in Queensland, Australia." Wildlife Research 33(2): 149-154.
- Hazel, J., I. R. Lawler, H. Marsh and S. Robson (2007). "Vessel speed increases collision risk for the green turtle

- Chelonia mydas." *Endangered Species Research* 3: 105-113.
- Hermanussen, S., C. J. Limpus, O. Paepke, D. W. Connell and C. Gaus (2006). "Foraging habitat contamination determines green sea turtle PCDD/F exposure." *Organohalogen Compounds* **68**: 592-595.
- Hermanussen, S., V. Mathews, O. Paepke, C. J. Limpus and C. Gaus (2008). "Flame retardants (PBDEs) in marine turtles, dugongs and seafood from Queensland, Australia." *Marine Pollution Bulletin* **57**: 409-418.
- Ikonomopoulou, M. P., H. Olszowy, C. J. Limpus, R. Francis and J. M. Whittier (2011). "Trace element concentrations in nesting flatback turtles (*Natator depressus*) from Curtis Island, Queensland, Australia." *Marine Environmental Research* **71**: 10-16.
- Kelez, S., Mamrique, C. and Velez-Zuazo, X (2005). Conservation of sea turtles along the coast of Peru. Unpublished report to UNEP/CMS from Asociación Peruana para la Conservación de la Naturaleza y Grupo de Tortugas Marinas – Perú.
- Largacha, E., Parrales, M., Rendon, L., Velasquez, V., Orozco, M. & Hall, M. 2005. Working with the Ecuadorian fishing community to reduce the mortality of sea turtles in longlines: the first year March 2004 – March 2005. Report to the World Wild Fund, pp 66.
- Limpus, C. J. and Limpus, D. J. (2003). Loggerhead turtles in the Equatorial and Southern Pacific Ocean: a species in decline. In "Loggerhead Sea Turtles." A.B. Bolten and B.E. Witherington ed. Pp. 199–209. (Smithsonian Institution: Washington, D.C.)
- Limpus, C.J., M. Boyle, and T. Sunderland. 2006. New Caledonian loggerhead turtle population assessment: 2005 Pilot Study. In Kinan. I. (editor) 2006. Proceedings of the Second Western Pacific Sea Turtle Cooperative Research and Management Workshop. Volume II: North Pacific Loggerhead Sea Turtles. March 2-3, 2005, Honolulu, HI. Western Pacific Regional Fishery Management Council: Honolulu, HI, USA.
- Limpus, C. J. (2008). A biological review of Australian marine turtles. 1. Loggerhead turtle *Caretta caretta* (Linnaeus). (Queensland Environmental Protection Agency: Brisbane.)
- Mangel, J.C., Alfaro-Shigueto, J., Witt, M.J., Dutton, P.H., Seminoff, J.A. & Godley, B.J. 2011 press. Post-capture movements of loggerhead turtles in the southeastern Pacific assessed by satellite tracking. *Marine Ecology Progress Series* 433: 261-272.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2008. Recovery plan for the Northwest Atlantic population of the loggerhead sea turtle (*Caretta caretta*), Second Revision. National Marine Fisheries Service, Silver Spring, Maryland
- Pajuelo, M., Bjorndal, K., Alfaro-Shigueto, J., Seminoff, J.A., Mangel, J.C., and Bolten, A.B. 2010. Stable isotope variation in loggerhead turtles reveals Pacific-Atlantic oceanographic differences. *Marine Ecology Progress Series* 417: 277–285.
- Pendoley, K. (2005). *Sea turtles and the environment management of industrial activities in north western Australia*. Doctor of Philosophy, Murdoch University.
- Philibosian, R. (1976). "Disorientation of hawksbill turtle hatchlings, *Eretmochelys imbricata*, by stadium lights." *Copeia* **1976**(4): 824.
- Quackenbush, S. L., R. N. Casey, R. J. Murcek, T. A. Paul, T. M. Work, C. J. Limpus, A. Chaves, L. duToit, J. V. Perez, A. A. Aguirre, T. R. Spraker, J. A. Horrocks, L. A. Vermeer, G. H. Balazs and J. W. Casey (2001). "Quantitative analysis of herpesvirus sequences from normal tissue and fibropapillomas of marine turtles with real-time PCR." *Virology* **287**(1): 105-111.
- Quackenbush, S. L., T. M. Work, G. H. Balazs, R. N. Casey, J. Rovnak, A. Chaves, L. duToit, J. D. Baines, C. R. Parrish, P. R. Bowser and J. W. Casey (1998). "Three closely related herpesviruses are associated with fibropapillomatosis in marine turtles." *Virology* **246**(2): 392-399.
- Reece, J.S., D. Passeri, L. Ehrhart, S.C. Hagen, A. Hays, C. Long, R.F. Noss, M. Bilskie, C. Sanchez, M.V. Schwoerer, B. Von Holle, J. Weishampel, and S. Wolf. 2013. Sea level rise, land use, and climate change influence the distribution of loggerhead turtle nests at the largest USA rookery (Melbourne Beach, Florida). *Marine Ecology Progress Series*. Vol. 493: 259-274.
- Robins, C.M., A.M. Goodspeed, I.R. Poiner, and B.D. Harch. 2002. Monitoring the catch of turtles in the northern prawn fishery. Fisheries Research and Development Corporation Final Report, Canberra, Australia.
- Salmon, M. (2003). "Artificial night lighting and sea turtles." *Biologist* **50**: 163-168.
- Sloan, S., B. Wallner and R. Mounsey (1998). Fishing debris around Groote Eylandt in the Western Gulf of Carpentaria. A report on the Groote Eylandt Fishing Gear Debris Project 1998, Australian Fisheries Management Authority.
- Snover, M.L. 2002. Growth and ontogeny of sea turtles using skeletochronology: methods, validation, and application to conservation. Unpublished Ph.D dissertation. Duke University, Durham, North Carolina. 144 pages
- Teuten, E. L., J. M. Saquing, D. R. U. Knappe, M. A. Barlaz, S. Jonsson, A. Björn, S. J. Rowland, R. C. Thompson, T. S. Galloway, R. Yamashita, D. Ochi, Y. Watanuki, C. Moore, P. H. Viet, T. S. Tana, M. Prudente, R. Boonyatumanond, M. P. Zakaria, K. Akkhavong, Y. Ogata, H. Hirai, S. Iwasa, K. Mizukawa, Y. Hagino, A. Imamura, M. Saha and H. Takada (2009). "Transport and release of chemicals from plastics to the environment and to wildlife." *Philosophical Transactions of the Royal Society B: Biological Sciences* **364**(1526): 2027-2045.
- van de Merwe, J. P., M. Hodge, H. A. Olszowy, J. M. Whittier and S. Y. Lee (2010). "Using blood samples to estimate persistent organic pollutants and metals in green sea turtles (*Chelonia mydas*)." *Marine Pollution Bulletin* **60**: 579-588.

- van de Merwe, J. P., M. Hodge, J. M. Whittier, K. Ibrahim and S. Y. Lee (2010). "Persistent organic pollutants in the green sea turtle *Chelonia mydas*: Nesting population variation, maternal transfer, and effects on development." Marine Ecology Progress Series **403**: 269-278.
- Witherington, B. E. and K. A. Bjorndal (1991). "Influences of artificial lighting on the seaward orientation of hatchling loggerhead turtles *Caretta caretta*." Biological Conservation **55**(2): 139-149.