
An overview and gaps analysis of protected marine species management and research in the Hauraki Gulf Marine Park

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Purpose

To provide the Ministerial Advisory Committee overseeing the Sea Change Tai Timu Tai Pari process with an overview of the protected species values of the Hauraki Gulf Marine Park (HGMP), protected species policy and management within the HGMP, research priorities and a gaps analysis.

Introduction

The long, complex coastline, numerous offshore islands and reef systems, extensive areas of sheltered inner continental shelf habitats, strong currents and high biological productivity mean that the HGMP provides critical habitat for many protected species.

Inputs of nutrients from oceanic and terrestrial sources make the HGMP one of New Zealand's most productive continental shelf regions, and phytoplankton blooms in spring and early summer support a relatively high biomass of large zooplankton that in turn supports a variety of squids and small fishes that are important in the diets of large predatory fishes, seabirds and cetaceans (Sharples & Greig 1998; O'Callaghan & Baker 2002; Chang et al. 2003; Stanton & Sutton 2003; Stephens 2003; Zeldis et al. 2001, 2004, 2005; Zeldis 2004; Bradford-Grieve et al. 2006; Wiseman et al. 2011; Hadfield et al. 2014).

The migratory fish community of the HGMP includes a variety of large pelagic sharks, manta and devil rays (*Mobula* spp.), billfishes (Istiophoridae), mahimahi (*Coryphaena hippurus*) and tunas (Scombridae). Protected migratory sharks and rays recorded from the HGMP are whale shark (*Rhincodon typus*), giant manta ray (*Mobula birostris*) and spine-tailed devil ray (*M. mobular*). Whale sharks and devil rays are occasionally observed within the HGMP east of Great Barrier Island (Aotea), Cuvier Island (Repanga Island) and the Mercury and the Aldermen Islands, but both species tend to be most abundant over and just beyond the upper continental shelf slope (Paulin et al. 1982; Bailey 1983; Duffy 2002; Duffy & Abbott 2003; Francis & Lyon 2012; Jones & Francis 2012). In contrast, giant manta rays are regularly reported from the inner and outer Hauraki Gulf near Anchorite Rock, Horn Rock, Te Hauturu-ō-Toi / Little Barrier Island, northern Great Barrier Island (Aotea Island) and the Mokohinau Islands (Duffy & Abbott 2003; Duffy unpubl. data). The giant manta ray is known to Ngāti Rehua and Ngāti Manuhiri as Te Whai Rahi. Te Whai Rahi is the paramount kaitiaki / guardian taniwha of Ngāti Manuhiri and is also the name given by Ngāti Manuhiri to Te Hauturu-ō-Toi / Little Barrier Island.

Protected resident or semi-resident fishes occurring in the HGMP are great white sharks (*Carchardodon carcharias*), spotted black groupers (*Epinephelus daemeli*) and giant groupers (*E. lanceolatus*). The latter species are infrequently sighted on shallow, exposed rocky reefs in the outer Hauraki Gulf. Great white sharks are found throughout the HGMP. Residency of individuals is unknown, but sightings and capture data indicate the species is present most months of the year. Juveniles are regularly encountered along the HGMP's western shoreline and in Waitemata Harbour. A near-term pregnant female was caught off Gannet Rock, north of Waiheke Island (C. Duffy unpubl. data).

The cetacean fauna of the HGMP is relatively diverse and includes southern right whales (*Eubalaena australis*), humpback whales (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*

intermedia), Bryde's whale (*Balaenoptera edeni brydei*), sei whales (*Balaenoptera borealis*), minke whales (*Balaenoptera acutorostrata*, *B. bonaerensis*), common dolphins (*Delphinus delphis*), bottlenose dolphins (*Tursiops truncatus*), killer whales (*Orcinus orca*), false killer whales (*Pseudorca crassidens*), long-finned pilot whales (*Globicephala melas*) and a variety of beaked whales (Baker 1983; Visser 2000; Baker & Madon 2002; Constantine 2002; O'Callaghan & Baker 2002; Stockin et al. 2008; Visser et al. 2010; Wiseman et al. 2011; Zaeschmar et al. 2013). Semi-resident species are Bryde's whales, common dolphins, bottlenose dolphins and killer whales. Bryde's whales are most abundant in the inner Hauraki Gulf where, along with common dolphins, they are the mainstays of the commercial whale and dolphin watching industry (Baker & Madon 2002; O'Callaghan & Baker 2002; Wiseman et al. 2011; Stockin et al. 2013). Genetic evidence shows there is little or no connectivity between the northeast North Island and other coastal New Zealand bottlenose dolphin populations, but population structure within the northeast North Island is unclear (Tezanos-Pinto 2009; Tezanos-Pinto et al. 2009). There is evidence of movement of bottlenose dolphins between the Hauraki Gulf, Bay of Islands and elsewhere in Northland, as well as changing habitat use in the Bay of Islands (Constantine 2002; Berghan et al. 2008; Tezanos-Pinto 2009; Tezanos-Pinto et al. 2013). The significance of the region to endangered southern right whales is unknown. Recent sightings of right whales in Hauraki Gulf have involved mother-calf pairs suggesting the species may have once used the Gulf as a nursery habitat. Humpback whales migrate through the region without feeding; however, dwarf minke (*Balaenoptera acutorostrata*) and blue whales have been observed feeding on euphausiid swarms in Hauraki Gulf (Gaskin 1968; Garrigue et al. 2010; Torres et al. 2013; C.D. pers. obs.). Long-finned pilot whales, false killer whales and beaked whales are most frequently encountered over the outer shelf and upper slope, probably reflecting the importance of squids in their diet. Long-finned pilot whales can be particularly abundant in this habitat and sometimes form mixed pods with large bottlenose dolphins. As the New Zealand fur seal (*Arctocephalus forsteri*) population recovers, numbers of seals hauling out and seen foraging in the HGMP are increasing, particularly along the east coast of Coromandel Peninsula and offshore islands. Groups of foraging fur seals are sometimes encountered along the shelf break on the eastern boundary of the HGMP.

All seabirds, except the southern black-backed gull (karoro, *Larus dominicanus dominicanus*), are protected species. The North Eastern Marine Bioregion, including the HGMP, is a nationally and internationally significant hotspot for seabird biodiversity. About 72 species have been recorded from the wider Hauraki Gulf, representing about 20% of seabirds globally (Gaskin & Rayner 2013). Twenty-seven species, about 31% of the New Zealand fauna, breed in the HGMP, of which 16 (59%) are endemic to New Zealand. Seabird breeding occurs on most offshore islands within the HGMP, with a few resilient species also breeding at scattered mainland locations. Burgess Island (Pokohinau Island) in the Mokohinau Islands supports one of most diverse seabird breeding assemblages in New Zealand (Gaskin & Rayner 2013).

Four species (14.8%) – New Zealand fairy tern (tara iti, *Sternula nereis davisae*), Pycroft's petrel (*Pterodroma pycrofti*), black petrel (tāiko, *Procellaria parkinsoni*) and New Zealand storm petrel (*Fregatta maoriana*) – are regional endemics, meaning the entire global population breeds within the Hauraki Gulf region (Gaskin & Rayner 2013). Black petrels breed on Great Barrier Island (Aotea Island) and Te Hauturu-ō-Toi / Little Barrier Island; Pycroft's petrels breed on the Mercury Islands, Cuvier Island (Repanga Island), Hen and Chickens Islands and Poor Knights Islands; New Zealand

storm petrels, thought to be extinct until 2003, breed on Te Hauturu-ō-Toi / Little Barrier Island; and New Zealand fairy terns breed on Mangawhai, Pakiri and Waipu beaches. Other species for which the HGMP provides critical habitat include Hutton's shearwaters (kaikōura tītī, *Puffinus huttoni*) and Cook's petrels (*Pterodroma cookii*). The global population of Hutton's shearwaters breeds on the Poor Knights Islands, with the Hauraki Gulf providing an important foraging area during the breeding season. In the case of Cook's petrels, 96% of the global population breeds on Te Hauturu-ō-Toi / Little Barrier Island (Gaskin & Rayner 2013). Petrels and shearwaters are not known to breed on the Coromandel Peninsula (Kessels Associates 2010).

At least 77 shorebird species, including some of the most endangered bird species in New Zealand, are recorded from the HGMP. The Firth of Thames is an internationally important feeding area for shorebirds, with up to 25,000 mostly migratory species using it at any time. It is listed as a wetland of international importance under the Ramsar Convention and is ranked among New Zealand's three most important shorebird habitats. The Firth of Thames is also recognised as part of the Flyway Sites Network of the East Asian-Australasian Flyway Partnership (EAAFP). Birds using the Ramsar site also forage elsewhere within the HGMP and move between the Firth of Thames and Manukau and Kaipara Harbours. There is also connectivity with harbours elsewhere in New Zealand. Throughout the HGMP many smaller estuaries, harbours and beaches also provide critical habitat for species such as northern New Zealand dotterel (*Charadrius obscurus aquilonius*) and New Zealand shore plover (*Thinornis novaeseelandiae*). Significant examples of indigenous coastal wetland and saltmarsh vegetation providing habitat for protected coastal birds occur in Manaia Harbour, Coromandel Harbour (south side of Preece Point), Colville Bay, Whangapoua Harbour, Tairua, Wharekawa and Whangamata Harbours, as well as a number of sites around the coastline of Great Barrier Island (Aotea Island). Nationally important shorebird habitats occur in Tairua, Wharekawa and Whangamatā Harbours. Waitematā Harbour, Coromandel Harbour, Colville Bay, Whangapoua Harbour and Whitianga Harbour contain regionally important shorebird habitats. Omaha spit is a post breeding flocking site for New Zealand dotterel.

Other protected species occurring within the Marine Park are marine turtles, sea snakes, black corals (order Antipatharia), gorgonians (order Gorgonacea) and stony corals (order Scleractinia). Some hydrocorals (family Stylasteridae) may also occur on rocky reefs below 50 m depth in the outer Gulf; however, these species are most common below 200 m depth and are thought to be very sensitive to sedimentation and high nutrient levels (Cairns 2011).

Although uncommon, juvenile green turtles (*Chelonia mydas*) occur in a variety of coastal habitats, mainly shallow rocky reefs, all along the northeast North Island and it is now recognised that this area represents a post-pelagic nursery for the species (Godoy et al. 2016). Observations of live green turtles within the HGMP are most frequent at the Mokohinau Islands and Great Barrier Island (Aotea Island), and along the east coast of Coromandel Peninsula. Leatherback turtles (*Dermochelys coriacea*) are oceanic and mainly feed on gelatinous organisms such as salps and jellyfishes in the upper 200 m of the water column, although they can dive to over 1000 m depth (Wallace et al. 2015). They are occasionally seen over the outer shelf and upper slope in the outer parts of the HGMP but mostly occur outside it. Yellow-bellied sea snakes and blue-lipped kraits are subtropical vagrants in New Zealand waters.

Some stony corals, notably *Monomyces* spp. (formerly placed in *Flabellum*) and the small colonial cup coral *Culicia rubeola*, are common on shallow coastal reefs throughout the Marine Park, whereas the occurrence and distribution of the larger, habitat-forming deep water species such as black corals and gorgonians is poorly known. Black coral colonies (?*Antipathella* sp.) usually occur below about 40 m depth within the marine park and have been observed on deep reefs north of Te Hauturu-ō-Toi / Little Barrier Island, at the Mokohinau Islands, east of Great Barrier Island (Aotea Island) and the Mercury Islands, and off The Aldermen Islands.

Threats to most marine protected species are well documented and include fishing, terrestrial run-off containing fine sediments, nutrients and other pollutants, habitat loss, chronic disturbance, disease and the effects of climate change (which include temperature increases, acidification, coastal inundation, increased coastal erosion and shifts in prey distribution). Seabirds and shorebirds are also threatened by introduced mammalian predators and light pollution.

Protected species population status

No information is available on population size and trend of corals or protected marine fishes within the HGMP. The most common shallow water (generally less than 200 m depth) genera of black corals reported around New Zealand are *Antipathella*, *Antipathes* and *Stichopathes* spp. (Opresko et al. 2014). The large bushy black coral colonies observed within the HGMP are probably *Antipathella* sp. The only *Antipathella* species assessed by the New Zealand Threat Classification System (NZTCS) is *A. fiordensis*, a species endemic to Fiordland (Freeman et al. 2014; Opresko et al. 2014). Black coral colonies have been observed on deep reefs between Te Hauturu-ō-Toi / Little Barrier Island and the Mokohinau Islands, off northeast Great Barrier Island (Aotea Island), east of the Mercury Islands and near Hahei, suggesting they are widespread in suitable habitat within the HGMP (Foster 1978; Sivaguru & Grace 2002; Drury 2008; Lee et al. 2015; Middleton 2018; Howarth & Smith 2020). No colony density estimates are available for any locations within the HGMP and, as implied above, the species of black corals occurring within it have not been identified. Colonies entangled with fishing gear have been reported off northeast Great Barrier Island (Aotea Island) (Sivaguru & Grace 2002).

Of the protected fishes, the great white shark is the only species for which the HGMP may contain critical habitat (i.e. primary and secondary nursery habitat). The great white shark is assessed as Nationally Endangered under the NZTCS (Duffy et al. 2018). Adult abundance is estimated to be between 590 and 750 individuals, with a total estimated population size of 5460 (2909–12 802) (Bruce et al. 2018; Hillary et al. 2018). Adult population trend is estimated to have slightly declined or remained stable since the early–mid 2000s (Bruce et al. 2018). This species had previously been assessed as Gradual Decline based upon its low biological productivity and reported levels of bycatch in commercial and recreational fisheries (Hitchmough et al. 2007).

Of the seabirds breeding in the HGMP, 22% have been assessed under the NZTCS as Threatened, 56% At Risk and 22% as Not Threatened nationally (Robertson et al. 2016; Whitehead et al. 2019). Very little population and trend information is available for most seabird species nesting in the HGMP, particularly burrow-nesting species. Mainland seabird populations have, however, been devastated by the arrival of humans and the introduction of mammalian predators. Many species only survive on predator-free offshore islands and rock stacks, while those remaining on the mainland are exposed to ongoing threats from introduced pests and domestic animals, coastal

development and chronic disturbance (Gaskin & Rayner 2013; Whitehead et al. 2019). Many species' populations have been reduced to levels where they are now vulnerable to pressures occurring primarily at sea such as fisheries interactions, plastic ingestion, oil spills and the effects of global climate change (Whitehead et al. 2019).

Among the procellariiformes (petrels and shearwaters), both tāiko and flesh-footed shearwaters (toanui, *Puffinus carneipes*) are threatened by bycatch in longline, trawl and recreational fisheries (Abraham et al. 2015; Whitehead et al. 2019; Richard et al. 2020). Although implementation of a variety of mitigation methods has substantially decreased bycatch of these species, current levels of fishery mortality of tāiko are still considered unsustainable (Whitehead et al. 2019; Hauraki Gulf Forum 2020; Richard et al. 2020). In addition to mortality in fisheries, tāiko are subject to ongoing mortality in their breeding colonies due to introduced predators (feral cats, rats and pigs) (Whitehead et al. 2019). On the positive side, 40 islands within the HGMP are now free of mammalian pests, and 'mainland islands' have been established at Shakespear and Tāwharanui Regional Parks. Eradication of all introduced predators from Te Hauturu-ō-Toi / Little Barrier Island undoubtedly contributed to the survival and eventual rediscovery of the New Zealand storm petrel. This species was first seen at sea in 2003 after being considered extinct for decades, and subsequently found to be breeding on Hauturu. Today, the species is thought to number in the hundreds, possibly several thousand (Gaskin 2013).

New Zealand fairy terns are ranked as Critically Endangered under the NZTCS, with at most only 43 adults remaining. Numbers have not increased over the past decade despite intensive management of breeding sites. Habitat loss, chronic disturbance and predation are considered the main threats to the species (Hauraki Gulf Forum 2020). Populations of other more familiar coastal bird species such as little penguins (kororā, *Eudyptula minor*), red-billed gulls (tarāpunga, *Larus novaehollandiae*), white fronted terns (tara, *Sterna striata*) and all cormorant (shag) species are either known (or suspected) to be declining in abundance (Frost 2017; Rawlence et al. 2019; M. Rayner, Auckland Museum, pers. comm.; T. Landers, Auckland Council, pers. comm.). Red-billed gull numbers are estimated to have dropped by about 67% nationally since the mid-1960s, with the colony on the Mokohinau Islands, one of the largest nationally, dropping to only 58 pairs in 2015/16 from between 2000 and more than 6500 pairs in the late 1940s (Frost & Taylor 2016, 2018). Similarly, the northern spotted shag (parekaraka, *Phalacrocorax punctatus*), now recognised as the most genetically distinct population within *P. punctatus*, has fallen to such low levels that it is in danger of being extirpated (Rawlence et al. 2019).

Five shorebird species have been assessed as Threatened and five as At Risk of extinction under the NZTCS. Two species – New Zealand dotterels and shore plovers – are actively managed. Predator control, fencing of nest sites, and watching of New Zealand dotterel nests by volunteer 'dotterel minders' and DOC staff started in the 1980s and has greatly increased breeding success. Consequently, the northern New Zealand dotterel population has doubled to 2500, and the subspecies' conservation status has improved from Threatened to At Risk. Lesser knots (huahou, *Calidris canutus*) are assessed as Nationally Vulnerable and are considered threatened overseas. Bar-tailed godwits (kuaka, *Limosa lapponica*) are assessed as At Risk–Declining and are noted as threatened overseas. Variable oystercatchers (tōrea pango, *Haematopus unicolor*), another at risk species, have also benefited from the dotterel management programme as they share the same breeding habitat. One hundred and twenty-eight juvenile tuturuatū/shore plovers were released on

Motutapu Island between 2012 and 2019. A small population has established but rates of juvenile dispersal and adult mortality are high, and productivity is low. The population is not self-sustaining, and modelling suggests it will continue to decline without further supplementation and the control of avian predators. Fifteen birds are currently present. Population trends for other shorebirds occurring within the Marine Park are increasing for wrybills (ngutuparore, *Anarhynchus frontalis*), banded dotterels (tūturiwhatu, *Charadrius bicinctus*), variable oystercatchers and New Zealand dotterels; stable for bar-tailed godwits and pied stilts (*Himantopus himantopus*); and declining for South Island pied oystercatchers (*Haematopus finschi*) and lesser knots (Hauraki Gulf Forum 2020).

Population estimates are available for most of the cetaceans inhabiting the Marine Park but there is no robust long-term trend information for any species. About 135 Bryde's whales are estimated to be semi-resident within the HGMP. Prior to 2015 up to six Bryde's whales were killed by ship strike annually. This level of incidental mortality was considered unsustainable and resulted in the introduction of the Hauraki Gulf Transit Protocol which restricts the speed of commercial vessels to 10 knots while transiting the Hauraki Gulf. Since the protocol was introduced in 2015 there have been no confirmed Bryde's whale deaths due to ship strike and only one possible ship strike mortality (Hauraki Gulf Forum 2020; Rochelle Constantine, University of Auckland pers. comm.). Research on the foraging ecology of Bryde's whales in the Gulf has, however, highlighted a change to lower calorific value food over time. Twenty years ago, small pelagic fishes were the predominant prey items in the diet whereas now the whales appear to be mainly feeding on zooplankton. This suggests a decline in the abundance of small pelagic fishes such as pilchards and anchovies (Hauraki Gulf Forum 2020). The long-term consequences of this for Bryde's whales and the resident dolphin species are unknown. The only marine mammal species that appears to be increasing in abundance in the HGMP is the New Zealand fur seal. Anecdotal evidence suggests the size of winter haul-outs on islands east of Coromandel Peninsula is increasing.

Sea Change Plan recommendations

The rehabilitation and restoration of of Tīkapa Moana / Te Moananui-ā-Toi (the Hauraki Gulf Marine Park) is an overarching aspiration of the Tai Timu Tai Pari Sea Change process. This aspiration includes more abundant fisheries, strengthening the mauri of the Hauraki Gulf and its inhabitants, and improved health and functioning of the Gulf.

While the Sea Change Plan acknowledges the work undertaken to eradicate introduced predators and pests from islands within the HGMP and restore terrestrial island ecosystems and freshwater habitats, it concludes there is a need for more information and an integrated inter-agency approach to monitoring and reporting. It also identifies the need for communities, mana whenua and relevant sector groups to work alongside the agencies to implement the Sea Change Plan's recommendations.

Objectives and actions for species management are contained in section 6 (Biodiversity) of the Sea Change Plan. Themes A and B while relevant to protected species management are related mainly to ecosystem and habitat function and health. Theme C addresses restored species diversity and abundance. The objectives of this theme (as presented in the Plan) are to:

1. Halt any further decline in biodiversity within the Hauraki Gulf Marine Park by 2025.

2. Restore species diversity and abundance so that there are healthy functioning populations within the Hauraki Gulf Marine Park by 2040.
3. Ensure threatened species are not put at risk from fisheries bycatch within the Hauraki Gulf Marine Park by 2025, with a view to eliminating all threatened species bycatch.
4. Understand seabird foraging habits (especially during their breeding seasons) and ensure that there is adequate food supply for Seabirds in the Hauraki Gulf Marine Park by 2025.
5. As far as practicable, eliminate Bryde's whale ship strike from the Hauraki Gulf Marine Park by 2025.
6. Avoid any increase in human disruption of the Bottlenose dolphin population in the Hauraki Gulf.
7. Significantly increase the amount of freshwater habitat that can support healthy populations of eel and whitebait species (Link to catchment management plans) by 2020. Actively manage all populations of threatened species in the Hauraki Gulf Marine Park so that they all exhibit a stable or increasing population trend within three generations (of each species).

The management actions for restored species diversity and abundance are:

Shorebirds and Seabirds

10. Maintain the mammalian predator-free status of all predator-free islands in the Hauraki Gulf.
11. Establish a collaborative working group to report and advise on the status of Seabird and Shorebird populations and important breeding sites within the Hauraki Gulf Marine Park, including any adverse impacts, management actions and research affecting these. The work of this group will include:
 - Reviewing National and Regional Marine Oil Spill Contingency Plans with respect to the protection of Seabird and Shorebird populations in the Hauraki Gulf Marine Park from the adverse effects of oil spill by 2019; and identification of industries that need to specifically consider potential effects on Shorebirds and Seabirds in their Site Marine Oil Spill Contingency Plans by 2020.
 - Assessment of the risk to Seabird and Shorebird populations posed by the wreck of the Niagara by 2020.
 - Review of the risk to Seabirds posed by ongoing public access to Pokohinu/Burgess Island, Mokohinau Islands by 2019, including agency contingency planning for predator incursion and fire.
 - Prioritisation of the research recommendations in Gaskin & Rayner 2013 (Seabirds of the Hauraki Gulf: Natural History, Research and Conservation).
 - Development of priority management actions and research for Shorebirds by 2019.
12. Work towards the elimination of all Seabird and Shorebird by-catch in fisheries by:
 - Increasing camera or in-person observer coverage to all commercial fishing vessels operating in the Hauraki Gulf Marine Park to improve bycatch information.
 - Implementing a programme to better estimate recreational fishing Seabird bycatch.
 - Supporting ongoing refinement, improvement and uptake of Seabird mitigation measures.

- Significantly up-scaling existing programmes focused on education and outreach targeted towards recreational fishers to reduce Seabird bycatch.
 - Investigating the effectiveness and feasibility of spatial and/or temporal closures when most at risk Seabirds are foraging and breeding within the Hauraki Gulf.
13. Improve the quality of Seabird and Shorebird terrestrial habitat by:
- Identifying terrestrial areas of importance to threatened Shorebirds and Seabirds by 2020.
 - Increasing legal protection for roosting and nesting sites for Seabirds on beaches and coastlines.
 - Maintaining existing predator control programmes at high priority mainland sites and extending these by encouraging and supporting local communities to undertake effective predator control for lower priority (less threatened) species.
 - Coordinating and supporting community-led projects aimed at protecting and restoring important habitats that benefit Shorebirds and Seabirds by 2025.
 - Regularly monitoring reproductive success of Seabirds and Shorebirds.

Bryde's whales

14. As far as practical work towards eliminating Bryde's whale deaths by ship strike through the following actions:
- Support the voluntary protocol to reduce the speed of ships travelling through the Hauraki Gulf, with a target to keep speeds to no greater than 10 knots on average, acknowledging that there needs to be some flexibility to allow for oceanographic variation such as tides and other exigencies.
 - Continue regular monitoring of the speed of ships transiting the Hauraki Gulf Marine Park (currently undertaken voluntarily by the International Fund for Animal Welfare - IFAW).
 - Undertake necropsies of all dead Bryde's whales, subject to mana whenua consent, to identify the cause of death.
 - In the event of further Bryde's whale deaths due to ship strike, or the above target not being met by 2018, convene a meeting of the Bryde's Whale Collaborative Group to examine what further action, if any, is necessary.
 - Support ongoing Bryde's whale research to provide a better understanding of the distribution and movements of the Whales and threats to them.

Bottlenose dolphins

15. No new permits should be issued to approach and interact with Bottlenose Dolphins within the Hauraki Gulf Marine Park, including swimming with the Dolphins.
- All existing permits that authorise interaction with Bottlenose Dolphins within the Hauraki Gulf Marine Park should exclude interactions with Bottlenose Dolphins when next reviewed.
 - Establish and fund a monitoring programme to identify any adverse effects of the exercise of the current marine mammal tourism permits in the Hauraki Gulf Marine Park.

Diadromous fishes (including Whitebait and Eels)

16. Initiate a programme by 2018 to identify and progressively remove barriers to the movement of diadromous species by:
 - Constructing fish passages where needed; or
 - Where required, modifying infrastructure to remove the obstacle (recognising that this may not be practical in tidal areas or for flood control structures) to fish movement.
17. Ensure all new structures affecting freshwater systems provide for fish passage where possible (recognising that this may not be practical in tidal areas or for flood control structures).
18. Increase spawning areas for diadromous species by:
 - Identifying (and where required assisting with) restoring inanga spawning habitat in key areas (link to restoration in catchment plans).
 - Working with landowners to increase understanding of the issue and to develop migration route and riparian habitat restoration plans for private properties.

As diadromous fishes are not protected species their management is being addressed by the habitat restoration workstream.

Overview of protected species management within the Hauraki Gulf Marine Park

Central and local government agencies with responsibilities to protect indigenous biodiversity within the HGMP include the Department of Conservation (DOC), Fisheries New Zealand (FNZ), Auckland Council and Waikato Regional Council. Maritime New Zealand has responsibilities to prevent or mitigate adverse effects of maritime transport on indigenous wildlife and sensitive marine habitats under the Maritime Transport Act 1994 (Maritime Rules, Marine Protection Rules) and the Resource Management Act 1991 (Marine Pollution Regulations). The Marine Protection Rules cover general marine protection, prevention of pollution by oil and other contaminants including sewage, oil spill contingency planning and response, and can be used to impose controls on vessel movements such as the declaration of Areas to be Avoided. Compliance with the Marine Protection Rules is undertaken by regional councils within the Territorial Sea and by Maritime New Zealand outside it.

Department of Conservation

The Department's functions with respect to protected species include the management of land and all other natural and historic resources subject to the Conservation Act 1987 for conservation purposes, promotion of the benefits of conservation of natural and historic resources, the provision of educational material relating to conservation, and the management of natural and historic resources for recreation and tourism where this is not inconsistent with their conservation. In addition to the Conservation Act 1987, the department has powers and functions under the:

- Wildlife Act 1953
- Marine Reserves Act 1971
- Reserves Act 1977
- Wild Animal Control Act 1977
- Marine Mammals Protection Act 1978

- Resource Management Act 1991.

The Conservation General Policy 2005 provides the highest level of statutory policy addressing the Department's work. It guides conservation management and the development and content of Conservation Management Strategies (CMSs) and plans, and national park management plans. Subsection 4.4 of the General Policy addresses the management of marine species, habitats and ecosystems and states that:

- marine protected species should be managed for their long-term viability and recovery throughout their natural range
- where unprotected marine species are identified as threatened, consideration will be given to amending the Wildlife Act 1953 schedules to declare such species absolutely protected
- Tangata whenua, as kaitiaki, will be:
 - invited to participate in the protection of marine species of cultural importance
 - provided with access to the remains of dead marine protected species for customary use, including those incidentally caught in commercial fishing
 - provided with immediate notification of strandings where possible
 - involved in the management of stranded marine mammals in accordance with agreed protocols.
- carcasses of stranded marine mammals should be left unburied if they are lying in remote places where this does not give rise to a public nuisance
- human interactions with marine mammals and other marine protected species should be managed to avoid or minimise adverse effects on populations and individuals
- whales and dolphins should not be brought into or bred in captivity in New Zealand or exported to be held in captivity, except where this is essential for the conservation management of the species
- the Department should work with other agencies and interests to protect marine species.

Also relevant to DOC's management of protected seabirds are subsections 4.1 and 4.2. Subsection 4.1 addresses terrestrial and freshwater species, habitats and ecosystems and states that each CMS or plan should establish management objectives for indigenous species and their habitats and ecosystems and recreational freshwater fisheries and their habitats for the purposes of:

- prevention of the loss of indigenous species and the full range of their habitats and ecosystems
- maintenance of representative examples of the full range of indigenous ecosystems
- maintenance of populations of indigenous species, habitats and ecosystems with unique or distinctive values
- recovery of threatened indigenous species (including their genetic integrity and diversity), and restoration of their habitats where necessary
- restoration of threatened indigenous ecosystems where necessary
- maintenance of the ecological integrity of indigenous ecosystems consistent with the purposes for which the land is held.

Subsection 4.1 (e) states that customary use of traditional materials and indigenous species may be authorised on a case-by-case basis where it is consistent with the purposes for which the land is

held, there is an established tradition of such customary use at the place and the preservation of the indigenous species at the place is not affected.

Subsection 4.2 addresses biosecurity and management of threats to indigenous species, habitats and ecosystems, and states that:

- CMSs and plans should identify and, where possible, prioritise the threats posed by pests to indigenous species, habitats and ecosystems
- biosecurity and pest management programmes should give priority to:
 - preventing pests becoming established, including illegal and inadvertent transfers
 - eradicating newly naturalised pests at places, where practicable
 - eradicating, containing or reducing the range of pests that are established but not widespread, where practicable
 - controlling widespread pests where this is required to protect indigenous species, habitats and ecosystems, where eradication or containment of them is not practicable.
- biosecurity and pest management programmes should:
 - seek to maximise outcomes for the benefit of indigenous species, habitats and ecosystems
 - provide for either single or multiple species measures where required to protect specified places
 - take account of statutory pest management strategies
 - be developed in collaboration with other relevant management agencies.

Conservation Management Strategies (CMSs) are 10-year regional strategies prepared by DOC in collaboration with its Treaty partners and relevant Conservation Boards. They are statutory documents prepared under the Conservation Act 1987 and serve to implement general policies (including the Conservation General Policy 2005) and provide objectives for the integrated management of natural and historic resources across the department's multiple statutory functions. The Auckland and Waikato CMSs (DOC 2014a, b) share general policies emphasising the management of public conservation lands and waters will be consistent with the statutory purposes for which they are held. They also share policies relating to the use of reserves (including protection of natural heritage values, control of biosecurity risks, species protection), human interactions with marine mammals and the management of the Firth of Thames Ramsar site. The Auckland CMS includes a policy to seek inclusion of foreshore areas as public conservation land where natural, historic, cultural or recreational values are adversely affected by activities occurring in them. Areas identified where this may be appropriate include parts of the Mokohinau Islands. Neither CMS contains any specific policies addressing the management of seabirds, marine reptiles, protected fishes or corals. Policies relevant to shorebird conservation within the HGMP are focussed on the Firth of Thames Ramsar site, particularly maintaining and improving shorebird roosting habitats, predator control and reducing sedimentation and nutrient inputs to it.

CMS policies relating to human interactions with marine mammals and commercial marine mammal tour operations are to:

- support research into and require monitoring of the adverse effects of human interactions with marine mammals

- take a precautionary approach to the number of commercial operators involved in marine mammal operations, including seeking a moratorium on the issuing of new permits if research and monitoring indicate that such a step is required
- require commercial operators viewing marine mammals to provide a high standard of education and interpretation.

Whereas the Auckland CMS undertakes to implement a marine mammal tourism site plan for the region and review it at regular intervals, the Waikato CMS only undertakes to consider this. The Auckland CMS also undertakes to work with tangata whenua, shipping companies and other relevant agencies to manage threats to marine mammals, including Bryde's whale, to ensure their recovery and protection.

While neither CMS contains specific policies on seabirds and shorebirds, these species directly benefit from pest control and the island restoration and biosecurity work undertaken by DOC. Both CMSs recognise the significance of the islands of Hauraki Gulf as sites for maintaining New Zealand's biological heritage and diversity, particularly their role as refuges for threatened and at-risk species. All the Hauraki Gulf islands administered by DOC are now predator free. For management purposes they are generally divided into three groups:

- Island nature reserves and wildlife sanctuaries where public access is restricted and highly controlled to protect high-priority natural values and to enable ecological restoration
- Islands where ecological restoration is the priority, but opportunities are available for limited and controlled public access
- Islands where public access is unrestricted and there is potential for increased recreation opportunities.

For all these islands, policies focus on measures to maintain their predator-free status, prevent the introduction of diseases and plant and animal pests, and control existing plant and animal pests that threaten native species.

In addition to the Auckland and Waikato CMSs, DOC has a national island strategy (Department of Conservation 2010; Towns et al. 2012). The Island Strategy sits within the Department's statutory planning and outcomes framework and guides overall management of islands as well as providing a nationally consistent classification for islands. At an operational level, priorities for island management are determined by ecosystem and species optimisation processes, and by priorities identified locally by managers and communities of interest through the CMS. It aims to:

- provide a nationally consistent planning tool for long-term strategies
- reduce confusion caused by different legal land designations based on different statutes
- clarify the goals of management within these land designations so that the effectiveness of actions undertaken can be assessed.

The strategy's approach is to establish national functional management categories for islands based upon their legal status, and natural, historic/cultural values and recreational potential. Within each island category an overall outcome and suite of objectives for management are identified covering the range of conservation management issues common to island management. These objectives provide the link between the island categories and department's terrestrial monitoring framework. They focus on:

- maintaining ecosystem processes
- reducing the spread and dominance of invasive exotics
- preventing declines and extinctions
- improving ecosystem composition
- forming partnerships with tangata whenua
- preserving historic and cultural values
- fostering community engagement, enjoyment and use.

The strategy requires all islands be classified, and detailed operational (restoration) plans prepared for each island or group of islands.

Although the island classification and much of the information contained in the management objectives remain relevant, the Island Strategy's age and changes to DOC's structure and planning processes that have occurred over time mean the strategy and many of the island plans developed under it should be reviewed to ensure they remain relevant. The Department's Auckland region is currently reviewing biosecurity planning for all the islands it manages.

The Firth of Thames Ramsar Site represents one of the most significant shore bird habitats nationally and forms part of the East Asian – Australasian Flyway for international migratory waders (<https://www.eaaflyway.net/>). It encompasses the coastal and intertidal wetland of the southern Firth of Thames/Tikapa Moana and adjoining public conservation land administered by DOC. Key management actions identified in the Auckland and Waikato CMSs include integrated catchment management to reduce sedimentation and nutrient inputs; increased legal protection for wetland habitats; and on-site management to restore and protect important habitats and birdlife, and to remove in situ or adjacent sources of ecosystem degradation and pollution. Ongoing research to improve understanding of the implications of catchment-wide impacts is identified as a management need. Shared policies for the site are to:

- advocate for a reduction in catchment-wide adverse effects, particularly with respect to:
 - a. minimising sedimentation and nutrient inputs; and
 - b. protecting wildlife habitat, botanical values, hydrological processes, and ecological integrity
- advocate for the prevention of aircraft activity within, adjacent to and above the site, particularly during important migratory periods
- work collaboratively with tangata whenua, local authorities, the Hauraki Gulf Forum, the Ministry for Primary Industries, and other interested parties to achieve protection of the area and its associated bird and marine life from adverse impacts associated with marine-based activities (such as fishing and aquaculture) in the Firth of Thames/Tikapa Moana
- work with local authorities to facilitate cooperative management of activities on reserves within and adjacent to the site to protect habitat and ecosystem values in respect of:
 - a. freedom camping
 - b. dog and cat control
 - c. litter and pollution management
 - d. shell harvesting on the foreshore and chenier plain
 - e. vehicle use
- secure legal protection of land to protect habitat and ecosystem values, including:

- a. closure of unformed legal roads within the Miranda Taramaire Government Purpose Wildlife Reserve
- b. extension of protected land along the wetland coastal margin
- consider reclassifying the Miranda Taramaire Government Purpose Wildlife Reserve as a scientific reserve to reflect the significant ecological and geological values present
- limit grazing within the Miranda Taramaire Government Purpose Wildlife Reserve.

In practice, DOC undertakes little direct management of marine protected species within the HGMP, focussing instead on pest control and island biosecurity, and advocacy for the protection of conservation values through its functions under the Conservation Act 1987 and Resource Management Act 1991. No marine protected areas have been established to assist management of any marine protected species, although Long Bay-Okura, Motu Manawa-Pollen Island and Te Matuku marine reserves protect relatively large areas of shorebird habitat. Research priorities and mitigation actions related to the effects of fishing on seabirds are generally determined according to national and international priorities. Marine mammal management is largely limited to managing stranding events, responding to ship strike and entanglements, managing interactions between seals and the public and permitting commercial marine mammal tour operators. Active management programmes include nest guarding and predator control around nesting New Zealand fairy terns, reintroduction of shore plovers to islands within Hauraki Gulf and support for the New Zealand dotterel programme. Most direct management of marine protected species is undertaken by researchers, conservation and community groups, landowners and mana whenua.

Cultural harvest of ōi/titi/grey-faced petrel

The Grey-Faced Petrel (Northern Muttonbird) Notice 1979 (the Notice), issued pursuant to section 6 of the Wildlife Act 1953, provides for the customary harvest of ōi from Mokohinau Islands, Aldermen Islands (Ruamaahua) and Rabbit and Penguin Islands in the Slipper Island group. While the Notice is administered by DOC, permits to take ōi are issued by committees for the respective islands. Permit holders are required to keep an accurate record of how many birds are taken and report these to the committee that issued the permit. Ōi may only be taken during the season (second Saturday in November to 7 December) and using methods specified in the Notice.

Although ōi is not a threatened species, declining customary harvest, the observations of birders and independent research all indicate there has been a significant decline in the harvested populations (Lyver et al. 2008). The decline has been such that Hauraki iwi have largely ceased customary harvest of this species until it can be determined that a sustainable harvest can be re-established (Alice Anderson, Ruamaahua (Aldermen) Island Trust, pers. comm.). In addition, these kaitiaki would like greater engagement with DOC on the management of ōi and the islands they nest on. Like most other seabirds that breed in the HGMP, robust long-term monitoring is needed to establish population trends, and sustainable levels of harvest need to be determined and agreed upon (Whitehead et al. 2014). Further research may also be required to determine if changes in vegetation at breeding sites are adversely affecting the species (Lyver et al. 2008; Buxton et al. 2016).

Mana whenua are linked by whakapapa to the Hauraki Gulf and the indigenous wildlife of the HGMP. Connection to place and the taonga associated with it are essential for the maintenance of mana, culture and matauranga (Lyver et al. 2008). Access to these taonga are guaranteed by the

Treaty of Waitangi and are provided for in protected species legislation, the Conservation Act 1987 and Conservation General Policy. It was also part of the agreement gifting the Aldermen Islands (Ruamaahua) to the Crown. There is therefore a need for government agencies, particularly DOC, to deepen their engagement with mana whenua on the management of protected wildlife, particularly harvested species such as ōi within the HGMP.

Fisheries New Zealand (FNZ), Ministry for Primary Industries (MPI)

Fisheries New Zealand is responsible for managing the utilisation of New Zealand's fisheries resources while ensuring sustainability. The Fisheries Act 1996 defines ensuring sustainability as:

- (a) maintaining the potential of fisheries resources to meet the reasonably foreseeable needs of future generations; and
- (b) avoiding, remedying, or mitigating any adverse effects of fishing on the aquatic environment.

The environmental principles contained in the act require decision-makers take into account that:

- (a) associated or dependent species should be maintained above a level that ensures their long-term viability;
- (b) biological diversity of the aquatic environment should be maintained; and
- (c) habitat of particular significance for fisheries management should be protected.

The obligation to maintain biological diversity and populations of non-target species at levels that ensure their long-term viability reflect New Zealand's commitments under a variety of international agreements, notably the United Nations Convention on the Law of the Sea 1982 (UNCLOS Article 61(3), Article 119(1)(b)), the 1995 United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNSCA) and the United Nations Food and Agriculture Organisation's (FAO's) Code of Conduct for Responsible Fisheries. The latter sets principles and international standards of behaviour for responsible fishing. Within the framework of the Code of Conduct the FAO has developed international plans of actions for seabirds and sharks which New Zealand has implemented through the development of national plans of action (NPOA) for both groups of species. The first NPOA Seabirds was developed in 2004, updated in 2013 and was reviewed again in 2019. Following that review a new NPOA Seabirds was released in 2020. The first NPOA Sharks was released in 2008 and was also updated in 2013. These plans set goals and objectives for reducing incidental catch; ensuring the long-term viability of populations; risk assessment; domestic and international engagement and partnerships; identification of non-fishing-related threats; research and information and, in the case of sharks, utilisation, waste reduction and the elimination of shark finning.

The NPOA Seabirds 2020 has an overarching vision that New Zealanders work towards zero fishing-related seabird mortalities and has the following goals, each with measurable objectives:

1. Avoiding bycatch: Effective bycatch mitigation practices are implemented in New Zealand fisheries
2. Healthy Seabird Populations: Direct effects of New Zealand fishing do not threaten seabird populations or their recovery

3. Research and Information: Information to effectively manage direct fisheries effects on seabirds is continuously improved
4. International Engagement: New Zealand actively engages internationally to promote measures and practices that reduce impacts on New Zealand seabirds.

The major change in the NPOA Seabirds 2020 is a move away from risk assessment as the primary measure and driver to an approach focussed on bycatch minimisation with risk assessment used as prioritisation tool. The NPOA Seabirds 2020 is supported by an implementation plan, specific management actions for seabird species of particular concern, and international engagement to protect migratory species such as Antipodean albatross. The plan supports commercial fishers in adopting the best available mitigation options suited to their operation and encourages further innovation in the commercial sector. Regulatory tools are also available to ensure the objectives of the plan are met. The Department of Conservation will be responsible for implementing mitigation plans on vessels through the Conservation Services Programme's (CSP's) protected species liaison programme, development of improved mitigation options, research on affected populations, implementing species-specific actions and engaging with others on this work. The NPOA Sharks is scheduled for review in late 2020.

Implementation of the goals and objectives of the NPOA Seabirds and NPOA Sharks is also achieved through annual internal and collaborative research planning processes and by targeting observer coverage to specific fisheries.

Data on protected species bycatch is managed by the Data Management team within MPI and includes that obtained from research trawls, fishery observers and catch-effort and non-fish or protected fish bycatch returns completed by fishers.

Auckland Council and Waikato Regional Council

The role of regional councils under the Resource Management Act 1991 is to provide for the integrated management of natural and physical resources within a region. This includes statutory responsibility for safeguarding the life-supporting capacity of air, water, soil and ecosystems; and avoiding, remedying, or mitigating any adverse effects of activities on the environment. Matters of national importance include the preservation of the natural character of the coastal environment (protection from inappropriate subdivision, use, and development), the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna, the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga and the protection of customary rights. The coastal environment includes catchments adjacent to the coast, estuaries and the estuarine reaches of rivers, coastal wetlands and the coastal marine area (the outer boundary of which is the seaward limit of the Territorial Sea).

Regional councils are obliged to prepare a regional policy statement. These provide an overview of the resource management issues of the region, and policies and methods to achieve integrated management of the natural and physical resources within it. Regional policy statements are required to state:

- the significant resource management issues for the region
- resource management issues of significance to iwi authorities

- the resource management objectives to be achieved
- policies regarding significant issues and objectives
- methods (excluding rules) to be used to implement the policies
- principle reasons for adopting the objectives, policies and methods
- the environmental results anticipated
- processes to deal with cross-boundary issues
- the local authority responsible for specifying objectives, policies and methods for land use control in respect of natural hazards, hazardous substances and indigenous biological diversity
- monitoring procedures.

The Resource Management Act also requires all regional councils prepare a regional coastal plan. These plans include objectives, policies and rules that govern what activities the councils will allow, control or prohibit in the coastal environment. To ensure consistency and integration of the management of the coastal environment throughout New Zealand regional coastal plans must give effect to the New Zealand Coastal Policy Statement (NZCPS). Regional coastal plans are generally standalone documents, but the Auckland RCP has been incorporated into the Auckland Unitary Plan as required by legislation (the Unitary Plan does not replace the Auckland Council District Plan Hauraki Gulf Islands Section – Operative 2013). For the coastal environment of the Hauraki Gulf, the Hauraki Gulf Marine Park Act 2000 requires that sections 7 and 8 of that Act must be treated as a New Zealand coastal policy statement issued under the Act. Section 10(2) of the Hauraki Gulf Marine Park Act 2000 states that if there is a conflict between sections 7 and 8 and the provisions of the NZCPS, the NZCPS prevails.

Regional policies and rules developed by councils applying to the coastal environment of the HGMP generally provide for the protection of the natural character of the coastal environment and, where practicable, restoration. The special significance of the islands, including their conservation and biodiversity values, is recognised and the Auckland Unitary Plan includes a schedule of areas of significance in relation to natural heritage, mana whenua, natural resources, coastal, historic heritage and special character. The Unitary Plan identifies two categories of areas significant to the ecological and biodiversity values of the Hauraki Gulf. These are: Significant Ecological Areas – Terrestrial (SEA-T) which are areas of significant indigenous vegetation or significant habitats of indigenous fauna located either on land or in freshwater environments that are protected from the adverse effects of subdivision, use and development; Significant Ecological Areas – Marine (SEA-M) which are areas of significant indigenous vegetation or significant habitats of indigenous fauna located in the coastal marine area. SEA-M areas are divided into:

- SEAM1 – areas which, due to their physical form, scale or inherent values are the most vulnerable to any adverse effects of inappropriate subdivision, use and development
- SEAM2 – areas are of regional, national or international significance which do not warrant an SEAM1 identification as they are generally more robust
- SEAM1w, SEAM2w – areas that are identified as significant shorebird areas.

The Waikato Regional Coastal Plan identifies and protects 16 Areas of Significant Conservation Value (ASCV) of importance to rare and threatened shorebirds and coastal birds or that contain important

seabird colonies. These sites include the Firth of Thames Ramsar site, many of the harbours and inlets on Coromandel Peninsula and on Ohinau Island and the Mercury and Aldermen Islands.

In addition to its Resource Management Act functions, Auckland Council recently announced the establishment of the Auckland Seabird and Shorebird Plan. This is a proactive seabird research and restoration programme led by the Research and Evaluation Unit (RIMU) funded from the Natural Environment Targeted Rate. Collaborators include iwi, land owners, Auckland Museum, University of Auckland and Australian National University. The programme aims to:

- improve the quality of seabird and shore habitat
- maintain the predator free status of islands
- regularly monitor reproductive success
- develop priority management actions and research for seabird and shorebird populations.

Components of the programme include:

- i) development of a Seabird/Shorebird Plan that will include priorities for monitoring species and sites developed from a review of current knowledge of population states, trends and knowledge gaps
- ii) population assessments (acoustic and video monitoring, ground surveys to establish the location and extent of seabird colonies)
- iii) investigation of restoration techniques
- iv) population health assessments (nest productivity, identification of population stressors and key threats)
- v) identification of key seabird restoration sites (including habitat suitability modelling).

Implementation of seabird restoration projects involves:

- attracting birds to pest-free islands through the use of nest boxes, acoustics, decoys, etc.
- establishment of pest-free mainland sites (Pest Free Auckland) and reintroductions of seabirds to these
- iwi and community engagement
- identification of threats including pollution and fisheries issues.

Active restoration of seabirds in the Hauraki Gulf include the attempts to restore pārekareka/northern spotted shags to Otata Island in the Noises group.

Overview of protected species research in the Hauraki Gulf Marine Park

The Hauraki Gulf is one of the most intensively studied marine ecosystems in New Zealand (Bradford-Grieve et al. 2006). This work includes a considerable amount of research on marine mammals, seabirds and shorebirds. Much of the information available for shorebirds and seabirds is summarised in Straw 2005, Minton et al. (2006), Battley & Brownell (2007) and Gaskin & Rayner

(2013). Gaskin & Rayner (2013) provided an exhaustive list of strategic objectives for seabird research and conservation in the HGMP. Those are reproduced in Appendix 1 of this report for convenience.

Monitoring of commercial marine mammal tourism operators by the department and research related to the effects of tourism on marine mammals in the inner Hauraki Gulf is partially funded by a customer levy on commercial marine mammal tour companies operating within the Auckland region. This levy is paid into the Hauraki Gulf Cetacean Fund managed by DOC's Auckland operations team. Currently funded projects include a literature review of cetacean research undertaken in the Gulf and investigation of the effects of vessel disturbance on multi-species feeding aggregations.

Conservation Services Programme (CSP)

This programme is administered by DOC. It monitors and undertakes research to improve understanding of the adverse effects of commercial fishing on protected species and inform management of those species and the fisheries they interact with. The costs of these services are recovered from the commercial fishing sector. The programmes funded through CSP are generally directed at those threatened species most at risk from commercial fishing.

Current CSP projects in the Hauraki Gulf include:

- flesh-footed shearwater population surveys and tracking of birds nesting on Lady Alice Island, Hen and Chickens Islands, and Ohinau Island (research on this species has been ongoing since 2016, so that updated population counts are available for these islands, as well as Atiu or Middle Island, Mercury Islands)
- indirect effects of fisheries on seabirds that forage in association with shoaling fishes (includes fish shoal dynamics, species occurrence, seabird diets, trends in fish shoal distribution, size and composition over time determined from spotter plane data)
- population monitoring of black petrels at Great Barrier Island (Aotea Island) and Te Hauturu-ō-Toi / Little Barrier Island, and surveys of historical nesting areas on Moehau Range, Coromandel Peninsula.

Project plans are available at <https://www.doc.govt.nz/our-work/conservation-services-programme/csp-plans/current-csp-annual-plan/>.

Other seabird research in the Hauraki Gulf

The Northern Seabird Trust has funding to survey Buller's shearwaters (*Puffinus bulleri*) and fairy prions (tītī wainui, *Pachyptila turtar*) nesting on the Poor Knights Islands and to track their movements at sea. It also monitors New Zealand storm petrels on Hauturu and conducted a census of white-fronted tern (tara, *Sterna striata*) colonies in the Hauraki Gulf in the summer of 2019/20.

The University of Auckland is undertaking research on the diet, physiology and foraging movements of little shearwaters (*Puffinus assimilis*) and fluttering shearwaters (pakahā, *Puffinus gavia*) on the Mokohinau Islands and Hen and Chickens Islands.

Auckland Council has recently surveyed nesting seabirds on the Mokohinau Islands and several of the inner Gulf islands and will be using this information to complete a prioritisation of sites to monitor as part of the Council's seabird and shorebird plan. The results of that prioritisation process

should be available at the end of March 2021. The council in collaboration with Matt Rayner, Auckland Museum, has also started studies on spotted shags including colony re-establishment, nest monitoring and GPS tracking of adults.

Birds New Zealand monitors seabird colonies on Motuora and Tiritiri Matangi Island, including the success of seabird transfers to Motuora. Birds New Zealand also undertakes the national wader census in summer and winter each year, counting roosting wading birds at major estuaries and harbours over one to two weekends on each occasion. This uses Birds New Zealand volunteers.

Pūkoro Mirānda Naturalists' Trust undertake monitoring of shorebirds in the Firth of Thames Ramsar site. They are also involved in a large-scale tracking study on the movements of bar-tailed godwits, and collaborative research on the migration of Pacific golden plover (*kuriri*, *Pluvialis fulva*).

Research on marine mammals by the University of Auckland and Massey University

Dr Rochelle Constantine, Marine Mammal Ecology Group, University of Auckland is leading the Pulse of the Gulf project. This project involves:

- large-scale aerial surveys of the outer Hauraki Gulf documenting the distribution and abundance of macrofauna and prey aggregations
- investigation of the use of hydrophone arrays to detect and estimate the abundance of soniferous marine organisms (cetaceans and their prey)
- detailed description and analysis of multi-species feeding events using drones and machine learning to describe the behavioural repertoires and the sizes of all species involved in these
- examining how boats affect these feeding events (funded by DOC through the Hauraki Gulf Cetacean Fund)
- prey sampling
- examining the genome of Bryde's whales for the presence of markers associated with the ability to detect dimethyl sulphide (a chemical cue used by seabirds to detect prey schools)
- use of D-tags to study the feeding behaviour of Bryde's whales.

Other projects nearing completion include modelling temporal variation in the distribution and abundance of Bryde's whales, common dolphins, bottlenose dolphins and killer whales in the Hauraki Gulf using 19 years of sightings data collected by Auckland Whale and Dolphin Safari, and photo-ID analyses of pilot whale social associations and associations between false killer whales and bottlenose dolphins using Jochen Zaeschmar's photo-ID dataset. Future work includes a large-scale multi-species survey involving regular aerial surveys, simultaneous telemetry of multiple species and integration with remote sensed data. This project has MPI funding for a large fixed-wing drone pending CCA approval.

Marine mammal research led by Dr Karen Stockin, Massey University, has focussed on the ecology and behaviour common dolphins, bottlenose dolphins and Bryde's whales, including population estimation, individual turnover of Bryde's whales in the Gulf, habitat use and tourism impacts. Research on bottlenose dolphins at Great Barrier Island (Aotea) has highlighted connectivity with the Bay of Islands population, changing social behaviour (i.e. a shift from very large groups and lots of social behaviour to smaller groups and significantly less social behaviour). Similar changes have also

been noted in the behaviour of dolphins in the inner Hauraki Gulf. These changes appear to be associated with changes in diet and contaminant levels. Current research projects include:

- investigation of habitat use by Australasian gannets (*tākapu*, *Morus serrator*) and Bryde's whales in relation to large-scale climate drivers
- stable isotope analysis of common and bottlenose dolphins using a 20-year tissue archive to investigate trophic changes, trends in contaminant loads and detect emerging contaminants
- the public health implications of human consumption of whale meat (various locations around New Zealand)
- common dolphin genetic population structure
- investigation of the occurrence of microplastics in a variety of marine megafauna (collaboration with Cawthron Institute, ESR and Aotearoa Plastic Pollution Alliance)
- use of drones to measure stress hormone levels in cetacean blows to determine if this can be used to monitor trends in individual health of cetaceans in the Hauraki Gulf.

Ecosystem modelling

Pinkerton et al. (2015) describe a mass-balance ecosystem model for the Hauraki Gulf. This model covers the Gulf out to 250 m depth and extends south to Waihi. It was developed to model ecosystem function within the Gulf for five time periods between 2000 ybp and the present day. The present-day model incorporates about 20 years of data from multiple studies of the Hauraki Gulf, and includes coastal primary producers and benthic invertebrates. It is not spatially resolved. That is, it represents a single food web for the entire Gulf averaged over a year. Some are species grouped into functional groups, and it is balanced so that there is sufficient energy flow between groups. The other time period scenarios were based on rebalancing of the present-day model. The purpose of the model was to look for emergent properties of the system as a whole. The modelling concluded that, while important in the past, marine megafauna (including whales, seals and large sharks) are no longer important components of the ecosystem in terms of energy flow and that following their removal the system has re-balanced at the middle and lower levels of the food web. It also highlights the risk of ecosystem collapse arising from disturbance to the lower levels of the food web, particularly primary production.

Limitations of the model for understanding interactions between and effects on individual species are the lack of spatial resolution and a lack of a mechanistic understanding of how the species represented in the model interact with each other in the real world. Despite the large amount of research data used in the model the precise nature of many of the interactions between species (e.g. predator-prey relationships) are unknown. This means that the model contains a number of judgements about how one species interacts with another; any one of which can have a major effect on the modelled outcome of the interaction. As a result, the model outcomes can become unreliable when looking at specific groups (Matt Pinkerton, NIWA, pers. comm.).

Assessment of management actions recommended in the Sea Change Plan

Shorebirds and seabirds

Maintain the mammalian predator-free status of all predator-free islands in the Hauraki Gulf

Assessment

The importance of predator control for the maintenance of indigenous biodiversity is well understood in New Zealand and has been core work of DOC since its inception in 1987 and its parent agencies before that. The significance of this work to DOC, other government agencies, manawhenua and local communities is demonstrated in DOC's recently released Predator Free Strategy 2050 (DOC 2020).

Pest control and island biosecurity within the HGMP has been and continues to be a major focus of work for DOC, Auckland Council and Waikato Regional Council. This is reflected in the CMSs for the Auckland and Waikato regions, and regional pest management strategies prepared by both councils. As well as its usual day-to-day operations, DOC is currently reviewing all island biosecurity plans in the Auckland region. The Pest Free Hauraki Gulf campaign is a joint initiative between DOC and Auckland Council to further protect predator-free islands in the Hauraki Gulf through increasing awareness of the need for individuals and commercial operators to be vigilant regarding biosecurity around vessels and personal equipment when visiting islands. It includes a Pest Free Warranting system for commercial vessel operators.

Establish a collaborative working group to report and advise on the status of sSeabird and sShorebird populations and important breeding sites within the Hauraki Gulf Marine Park, including any adverse impacts, management actions and research affecting these. The work of this group will include:

- *reviewing National and Regional Marine Oil Spill Contingency Plans with respect to the protection of Seabird and Shorebird populations in the Hauraki Gulf Marine Park from the adverse effects of oil spill by 2019; and identification of industries that need to specifically consider potential effects on Shorebirds and Seabirds in their Site Marine Oil Spill Contingency Plans by 2020.*
- *assessment of the risk to Seabird and Shorebird populations posed by the wreck of the Niagara by 2020.*
- *review of the risk to Seabirds posed by ongoing public access to Pokohinu/Burgess Island, Mokohinau Islands by 2019, including agency contingency planning for predator incursion and fire.*
- *prioritisation of the research recommendations in Gaskin & Rayner 2013: Seabirds of the Hauraki Gulf: Natural History, Research and Conservation.*
- *development of priority management actions and research for Shorebirds by 2019.*

Assessment

There are currently no plans to establish a seabird and shorebird working group to advise on the research and management of these species within the HGMP. This is, however, an area in which the Hauraki Gulf Forum has historically taken a leadership role in. The 2011 State of the Gulf reports commissioned by the Forum highlighted the significance of seabirds to the Hauraki Gulf and the Forum responded by commissioning a plan that established a comprehensive set of strategic goals for the protection, sustainability and enhancement of seabird populations (Gaskin & Rayner 2013). Among its other recommendations, that plan emphasises that prevention of pest species colonising seabird islands is an essential conservation action for many seabird taxa. Since its release, individual researchers, community groups and management agencies have used the advice contained in the

seabird plan to inform their work programmes. Although now seven years old and therefore in need of review, the Hauraki Gulf Forum's seabird plan remains relevant and its recommendations have been implemented (often not explicitly) through initiatives such as Auckland Council's seabird and shorebird plan, rules in regional and coastal plans, pest management strategies, and consent, ecosystem management and research prioritisation processes (e.g. NPOA Seabirds, Conservation Services Programme).

Oil spill response in New Zealand is managed by Maritime New Zealand through a tiered system of contingency planning that includes identification of risk to natural resources. Tier 1 oil spill contingency plans address the first level of spill response and operate at an industry-level. Each site or vessel operator is responsible for providing response equipment and training its response personnel. Maritime New Zealand and regional councils assist industry through risk assessment and contingency planning to ensure that appropriate capability exists at each site to conduct a response appropriate to the level of risk posed by the operation. Regional councils have delegated authority to approve these plans. Tier 2 responses are led by regional councils and involve spills within the Territorial Sea for which no responsible party can be identified or that are beyond the capacity of the operator to deal with. Tier 3 responses are those where the size, complexity or environmental impact of the spill exceed the resources available to the operator or regional responders. In these situations the response is managed by Maritime New Zealand, which has the ability to draw on response equipment and resources from other regions and agencies and internationally. Maritime New Zealand works with industry and regional authorities to ensure regional response equipment is located appropriately (according to the level of risk) and coordinates the and training of local responders for Tier 2 responses with regional councils and works with councils in Tier 3 response operations (Maritime New Zealand 2018).

With respect to the oil spill risk posed by the wreck of the RMS *Niagara*, Maritime New Zealand has completed, in collaboration with the Ministry of Transport, DOC and Treasury, a business case for a two-stage risk assessment of the wreck. The first stage would be a detailed desk-top study, followed by examination of the wreck using sonar, submersibles, remotely operated vehicles and, possibly, divers to determine how much oil remains in it and if its condition would allow safe recovery of the oil. This business case was provided to cabinet in 2018 but was declined due to the cost. The wreck lies in 120 m depth just inside the Hauraki Gulf cable protection zone.

DOC has not undertaken a formal review or risk assessment of public access to Burgess Island (Pokohinau) in the Mokohinau Islands.

Although there is no formal management and research plan for shorebirds within the Hauraki Gulf, the significance of these species is recognised in the protection from development afforded to important shorebird foraging habitats within the relevant regional and regional coastal plans, and the Ramsar status of the tidal flats and coastal wetlands at the head of the Firth of Thames. Direct management programmes (predator control, nest protection) have been in place for the most threatened shorebirds occurring within the HGMP (New Zealand fairy tern, Northern New Zealand dotterel, shore plover) for several decades. Northern New Zealand dotterel numbers have increased substantially with direct management but there has been little or no improvement in New Zealand fairy tern and shore plover populations. Conservation needs of international migratory shorebirds occurring within the Hauraki Gulf are addressed through international partnerships and agreements

such as the East Asian-Australasian Flyway. Auckland Council's Seabird and Shorebird Plan is expected to identify priority sites for shorebird conservation within the Auckland Region.

Work towards the elimination of all Seabird and Shorebird by-catch in fisheries by:

- *Increasing camera or in-person observer coverage to all commercial fishing vessels operating in the Hauraki Gulf Marine Park to improve bycatch information.*
- *Implementing a programme to better estimate recreational fishing Seabird bycatch.*
- *Supporting ongoing refinement, improvement and uptake of Seabird mitigation measures.*
- *Significantly up-scaling existing programmes focused on education and outreach targeted towards recreational fishers to reduce Seabird bycatch.*
- *Investigating the effectiveness and feasibility of spatial and/or temporal closures when most at risk Seabirds are foraging and breeding within the Hauraki Gulf.*

Assessment

As noted above, national priorities for the reduction of seabird bycatch in commercial fisheries are identified in the NPOA Seabirds. These are addressed by DOC and FNZ through the observer, fisher education and training and research services contracted through the CSP, and research on recreational fishing and the ecosystem effects of fishing funded by FNZ. In response to black petrels being identified as 'very high risk' from commercial fishing in the New Zealand seabird risk assessment, a collaborative black petrel working group (BPWG) was set up in 2014. Membership of the BPWG includes the World Wildlife Fund New Zealand (WWF), Forest and Bird, the commercial fishing industry (Moana, Sanford and Leigh Fisheries, Whitianga Commercial Fishermen's Association and Fisheries Inshore New Zealand), the Hauraki Gulf Forum, Southern Seabird Solutions Trust (SSST), FNZ and DOC. This group has two key goals: 1) to ensure seabirds that use the FMA 1 fishing area thrive without pressure from fishing-related activities, and 2) to assist FMA 1 fishers to become recognised locally and nationally as seabird advocates.

A key project supported by the BPWG is the assessment of the efficacy and viability of cameras on inshore bottom long line vessels targeting snapper and bluenose off the northeast North Island (the main foraging areas of black petrels and flesh-footed shearwaters during their breeding seasons) as a monitoring tool to detect the incidental capture of seabirds during fishing activity. The installation of camera equipment and the initial years of footage review were funded by the fishing industry. Continuation of the programme (including installation and ownership of replacement cameras and footage review) has since been funded by FNZ and is supported by ongoing voluntary participation from the fishing industry.

Fisheries New Zealand gathers information on recreational bycatch of seabirds through the Recreational Panel Survey and uses the findings to prioritise outreach activities for recreational fisheries. A responsible fishing brochure published in 2016 by FNZ describes responsible seabird handling practices and tips to avoid interacting with seabirds for recreational fishers and has been widely distributed in fishing magazines and to sports fishing clubs.

Planned work in this area by FNZ includes work to characterise recreational interactions with seabirds and determine the extent and nature of these interactions using a spatially explicit risk assessment framework. The Department of Conservation has also initiated work to investigate the extent of recreational fishing impacts on protected species.

Very few shorebirds are taken as bycatch in commercial or recreational fisheries. The main immediate threats to these species are introduced predators, habitat loss (particularly loss of high tide roosts), pollution (which affects foraging areas), excess sedimentation, chronic disturbance and entanglement in debris/litter.

Improve the quality of seabird and Shorebird terrestrial habitat by:

- *Identifying terrestrial areas of importance to threatened shorebirds and seabirds by 2020.*
- *Increasing legal protection for roosting and nesting sites for seabirds on beaches and coastlines.*
- *Maintaining existing predator control programmes at high-priority mainland sites and extending these by encouraging and supporting local communities to undertake effective predator control for lower priority (less threatened) species.*
- *Coordinating and supporting community-led projects aimed at protecting and restoring important habitats that benefit shorebirds and seabirds by 2025.*
- *Regularly monitoring reproductive success of seabirds and shorebirds.*

Assessment

Terrestrial areas of importance to shorebirds within the HGMP have been well documented by ornithologists, a fact reflected in the level of protection of these areas in the Auckland Plan and the Waikato Regional Coastal Plan. Less well known are mainland habitats of burrow-nesting seabirds, particularly petrels and shearwaters but also little penguins. Known mainland nesting areas have been identified by Taylor (2000 a, b), Gaskin & Rayner (2013) and Forest & Bird (2016). Although several large grey-faced petrel colonies have been documented on Auckland's west coast, no petrels and shearwaters are known to breed on Coromandel Peninsula. Although black petrels were historically present on the Moehau Range, Coromandel Peninsula, an automated acoustic survey conducted there between 30 November 2015 and 31 January 2016 (funded through the CSP) failed to record any black petrel calls. The detection of Cook's petrel flight calls during the survey indicates that if black petrels had been present and nesting on the range, the equipment should have recorded them.

Pest control, including supporting predator control around nesting areas of the most threatened species of shorebird (New Zealand fairy tern, New Zealand dotterel), is core DOC business. The Department's work on public conservation land, including mainland sites within the HGMP, is prioritised using an ecosystem approach that is primarily based upon terrestrial habitat and species values. Work on incorporating seabirds into the ecosystem prioritisation process began recently and is ongoing. The Department also supports the Predator Free NZ vision and recently released its Predator Free 2050 strategy (DOC 2020), both of which aim to eradicate rats, stoats, and possums from New Zealand. The Department works with a variety of partners (mana whenua, councils, individuals and community groups, landowners) to eradicate or control pests, particularly introduced predators, off public conservation lands.

Currently, very few seabird and shorebird populations are monitored within the HGMP. Existing programmes are limited to the most threatened species or those most at risk from commercial fishing. Auckland Council's Seabird and Shorebird plan seeks to address this within the Auckland region but at this stage it is focussed on locating and mapping seabird colonies (Todd Landers, Auckland Council, pers. comm.).

Bryde's whale

As far as practical work towards eliminating Bryde's whale deaths by ship strike through the following actions:

- *Support the voluntary protocol to reduce the speed of ships travelling through the Hauraki Gulf, with a target to keep speeds to no greater than 10 knots on average, acknowledging that there needs to be some flexibility to allow for oceanographic variation such as tides and other exigencies.*
- *Continue regular monitoring of the speed of ships transiting the Hauraki Gulf Marine Park (currently undertaken voluntarily by the International Fund for Animal Welfare – IFAW).*
- *Undertake necropsies of all dead Bryde's whales, subject to mana whenua consent, to identify the cause of death.*
- *In the event of further Bryde's whale deaths due to ship strike, or, if the above target is not being met by 2018, convene a meeting of the Bryde's Whale Collaborative Group to examine what further action, if any, is necessary.*
- *Support ongoing Bryde's whale research to provide a better understanding of the distribution and movements of the whales and threats to them..*

Assessment

The Department worked with Auckland University, Ports of Auckland and the shipping industry to implement the Hauraki Gulf Transit Protocol in 2015. This voluntary protocol requests that companies and operators plan their voyages to Auckland so that they transit the Hauraki Gulf at no more than 10 knots; and when transiting through the Gulf, vessels are required to post whale lookouts during daylight hours. If a whale is sighted forward of the beam, vessels are instructed to slow down and/or change course to pass no closer than 1000 m from a whale. Vessels are encouraged to report all whale sightings to Auckland Harbour Control which then relays details of whale sightings to all vessels in the Hauraki Gulf. Compliance with the protocol is high and since its introduction there have been no confirmed Bryde's whale deaths due to ship strike (prior to 2015, deaths averaged 2.3 per year). However, the reduction in Bryde's whale deaths and changes in the DOC's structure mean that whale necropsy protocols need to be reviewed and potentially re-established.

Bottlenose dolphins

No new permits should be issued to approach and interact with Bottlenose Dolphins within the Hauraki Gulf Marine Park, including swimming with the Dolphins.

- *All existing permits that authorise interaction with Bottlenose Dolphins within the Hauraki Gulf Marine Park should exclude interactions with Bottlenose Dolphins when next reviewed.*
- *Establish and fund a monitoring programme to identify any adverse effects of the exercise of the current marine mammal tourism permits in the Hauraki Gulf Marine Park.*

Assessment

Marine mammal tourism is currently focussed on the inner Hauraki Gulf close to Auckland. Only two commercial operators are permitted to run cetacean viewing tours in the Auckland region and neither are permitted to interact with bottlenose dolphins. The bottlenose dolphin hotspot on the west coast of Great Barrier Island (Aotea) is also outside the normal operating area of these vessels.

Auckland region is currently reviewing its marine mammal permitting regime, including the number of operators allowed to operate in the inner Hauraki Gulf. Very little directed marine mammal tourism occurs around Coromandel Peninsula, with most interactions with operators being incidental to their main activities.

Research on the effects of commercial marine mammal watching on cetaceans inhabiting the inner Hauraki Gulf is funded from the Hauraki Gulf Cetacean Fund.

Gaps in management and research of protected marine species in the HGMP

With few exceptions, the management actions recommended in Sea Change reflect work that is either core, ongoing work of the various management agencies with responsibilities for managing indigenous biodiversity or anthropogenic impacts on it, or work that has already been undertaken by the Hauraki Gulf Forum, independent researchers or conservation groups.

The most obvious gap in protected species research and management within the HGMP is the complete absence of robust information on the distribution and abundance of corals and protected fishes. With respect to corals, there is no authoritative list of the species of corals known to occur within the HGMP, their preferred habitats or an assessment of the threats to them. Drop camera and baited underwater video surveys of deep reefs within the HGMP have demonstrated the occurrence of large black coral colonies and a diverse assemblage of fragile deep-water sponges and bryozoans in these habitats. In some places, black corals have exhibited signs of damage from fishing gear (e.g. rock lobster pots, droplines), whereas many of the organisms encrusting reefs located below 80 m depth off Mercury Bay were found to be covered by a fine drape of what appeared to be terrestrial silt. In contrast, sections of reef above 80 m depth at the same location appeared to be little affected by sedimentation. Apart from gaps in taxonomy, distribution and abundance, little is known of the growth, reproduction, genetic connectivity and meta-population structure of temperate corals. This information is necessary to understand the effects of fishing and other forms of disturbance on corals, and to design effective networks of marine protected areas to conserve them. Better understanding of offshore reef systems, hydrology of the outer HGMP and deposition sites of terrestrial sediments is also required.

Great white sharks and giant and spotted black groupers are probably the only protected fishes that are resident or semi-resident in the HGMP. Spotted black groupers may be more abundant than records indicate due to the cryptic behaviour of juveniles, but the few records of mature individuals around mainland New Zealand suggests it is unlikely that there is a self-sustaining population in the HGMP or elsewhere off the northeast of the North Island. Giant groupers are similarly unlikely to breed successfully in New Zealand waters. Great white sharks do, however, appear to breed in the inner Hauraki Gulf, and juveniles and subadults have been recorded throughout the HGMP. Information on movements and habitat use by this species within the HGMP is limited and would be difficult and potentially expensive to obtain given the species' low estimated population size (Duffy et al. 2018). Documented sightings and captures do not indicate the presence of any aggregation sites for great white sharks in the region.

Diver surveys of shallow rocky reefs targeting cryptic fishes in caves and overhangs would provide a better understanding of the distribution of protected groupers in the HGMP and could be potentially undertaken as a citizen science initiative. Satellite tracking of great white sharks as part of a larger study of habitat use around the upper North Island is likely to be the only way to obtain a better understanding of how important the HGMP is for this that species.

Seabird research and management priorities have been comprehensively identified at a national and regional level, with most research and monitoring targeted towards understanding and mitigating the effects of fisheries interactions, particularly bycatch. Monitoring programmes are in place for the species most at risk from commercial fishing (black petrels and flesh-footed shearwaters) and research on foraging ecology of species associated with surface-feeding fishes (trevally and kahawai) has been funded for several years by the CSP. Delivery of the outputs from that research is expected this year. Notwithstanding this, there is a general lack of baseline abundance data for most seabirds, particularly burrow-nesting species in the HGMP (Taylor 2000a, b; Gaskin & Rayner 2013; Todd Landers, Auckland Council, pers. comm.; Matt Rayner, Auckland Museum pers. comm.).

The focus on the most threatened species and those most at risk does potentially mean significant declines in common coastal species such as cormorants, terns and little penguins have gone unnoticed (Matt Rayner, Auckland Museum; Todd Landers, Auckland Council; Graeme Taylor, DOC pers. comm.). Aside from known or inferred declines in abundance, tracking studies have shown that several of these common coastal species are foraging in deeper water, further offshore than they historically used to (Matt Rayner, Auckland Museum pers. comm.). In some cases, this shift has been associated with a decline in the quality of prey they are consuming. The reason for the shift offshore and change in prey type and quality are unknown, as are the population level consequences of this. Possible explanations include increased turbidity in coastal waters reducing foraging efficiency (seabirds are predominantly visual predators), and declining benthic habitat quality in coastal waters and estuaries resulting in declines in abundance and/or condition of preferred prey fishes. Assessing either of these scenarios is currently confounded by a lack of knowledge of the ecology and population dynamics of prey fishes in the HGMP and their response to declining environmental quality.

For shorebirds, landscape-scale management of habitats, introduced predators and terrestrial sedimentation and pollution is required to secure populations of these species. The management response should be compartmentalised into those species which breed and migrate within New Zealand (e.g. New Zealand dotterels and shore plovers) and those which migrate internationally (knots, godwits, etc.). Each group has different management needs at the scale of the Hauraki Gulf. Standardisation of shorebird data and research on movements would assist identification of critical habitats for shorebird species that do not form large flocks on tidal flats or high tide roosts. Auckland Council's climate change risk assessment identifies 'coastal squeeze' caused by sea level rise as an important medium- to long-term threat to intertidal habitats. Identification of intertidal shorebird habitats at most risk from coastal squeeze and areas where managed retreat could be employed to allow landward migration of these is needed to inform mitigation strategies.

While the review of marine mammal research in the Hauraki Gulf commissioned by DOC has yet to be delivered, Auckland and Massey University researchers interviewed for this report agreed that no further research on marine mammal reactions to commercial marine mammal tourism vessels was

required (this is not so say that some form of compliance monitoring of tourism vessels would not be required). Instead they identified knowledge gaps regarding the effects of chronic disturbance by small recreational vessels on critical life history processes such as resting and feeding, the effects of noise pollution on communication and foraging, a lack of baseline information on animal health (potentially a more sensitive indicator than changes in demographics or trends in abundance) and the ecosystem level effects of fishing, ongoing loss of biogenic habitats, sedimentation and climate change. Very little information is available on cetacean populations in the outer Hauraki Gulf, including the waters east of Great Barrier Island (Aotea) and Coromandel Peninsula.

To date, much of the discussion around ecosystem-level effects on protected species has focussed on the potential indirect effects of fishing-related reductions in numbers of surface-schooling fishes on seabirds such as red-billed gulls and fairy prions, with little consideration given to large-scale climate-driven changes to pelagic productivity in the region. Research on long-term trends in chlorophyll-*a* concentration – a proxy for phytoplankton abundance – in New Zealand waters shows a declining trend in productivity off the northeast North Island and an increasing trend over the Chatham Rise from 1997–2018 (MfE & Stats NZ 2019; Matt Pinkerton, NIWA, pers. comm.). The possibility that this decline in phytoplankton abundance and, possibly, species composition is what has driven the observed changes in abundance, distribution, diet and nutritional status of small pelagic fishes (anchovy, pilchards), seabirds and whales in the HGMP warrants investigation.

Ecosystem-based management of the HGMP is an objective of Sea Change. Ecosystem-based management is often defined as an integrated management approach that recognizes the full array of interactions within an ecosystem, including human activities, rather than considering single issues, species, or ecosystem services in isolation. The potential benefits of such an approach include consideration of cumulative impacts on marine environments and the ability to work across sectors to sustainably manage species and habitats, economic activities and resource use conflicts. In theory, it allows for identification of resource trade-offs that help protect biodiversity and ecosystem services. Achievement of these benefits requires a detailed, mechanistic understanding of how species interact with their environment, each other and humans.

While the ecosystem model currently available for the Hauraki Gulf highlights the likely effect that the removal of megafauna has had on the function of the marine ecosystem of the Gulf as a whole (Pinkerton et al. 2015), the lack of spatial resolution and lack of a detailed understanding of predator-prey dynamics (necessitating a number of important assumptions about these in the model) means that it should not be used to infer what the indirect effects of fishing or other environmental drivers on protected species are likely to be. The advice of Dr Matt Pinkerton, NIWA, is that smaller models that specifically address the question and part of the system of interest should be used. These models still require a good understanding of the mechanistic drivers underlying the question. In the case of surface feeding seabirds and Brydes's whales, this would require the development of models to determine what drives changes in the distribution of zooplankton and small pelagic fishes in the Gulf. From that, predictions about how these components of the food web have changed over time and their effects on higher trophic levels could be inferred (Matt Pinkerton, NIWA, pers. comm.). Even so, a much better understanding of the foraging behaviour of these species, their diet and how schooling fishes influence the foraging success of species like red-billed gulls and fairy prions is required. As previously noted, the biology and ecology of small pelagic fishes (e.g. piper, saury, mullet, anchovy, pilchard, sprat) in the Hauraki Gulf is also a major knowledge gap.

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Appendix 1

Chapter 11. Strategic Objectives for Seabird Research and Conservation. Reproduced (with permission) from Gaskin & Rayner 2013: Seabirds of the Hauraki Gulf: natural history, research and conservation. Hauraki Gulf Forum, Auckland. 143 p.)

11.1 Research priorities

Research priorities for New Zealand seabirds were identified by Rowe and Taylor (2006): determining the distribution and abundance of breeding colonies, additional work on basic breeding ecology, understanding taxonomic relationships of species and populations, studies of movements and dispersal of seabirds at sea and between breeding colonies, and more work on foraging ecology and diet. Also, monitoring of population demography (survival rates, breeding success etc.) of representative species of migratory and non-migratory seabirds is needed to assess the impacts of global climate change on seabird populations. Taylor (2000a, b) provides species-specific research priorities, a number of which have been achieved since that landmark publication. Further guidance is presented in Towns et al (2012), a research strategy for biodiversity conservation in New Zealand's offshore islands. In particular, they argue for 1) greater understanding of ecosystem processes and their resilience to long-term environmental change; and 2) defining and better understanding the consequences of direct involvement by the public in management of islands, including partnerships between government agencies, Tangata Whenua (original people of the land - Māori) and non-government organisations such as community groups. The following section lists those priorities arising from a recent surge in seabird research, also closer collaboration between researchers active in the region than probably has been evident earlier.

11.1.1 Research on the distribution, size and status of seabird populations

Data detailing the distribution of seabird breeding colonies and their size and population trends are essential for sound conservation management of seabirds in the WHGR. Moreover in the wake of many successful eradication programmes on islands and mainland sites within the WHGR it is important to be able to follow the restoration of these sites and the dynamics of colonisation (or otherwise) of seabirds that is likely to vary from site to site. Unfortunately, such datasets are currently lacking for nearly all seabird species – see species profiles.

The recommendations for research are:

- 1. Development of a regional seabird breeding site database for the WHGR, either as (1) a subset of the New Zealand Seabird Colony Database (see Notes below), or (2) as part of an integrated region-al biodiversity database, or (3) both.**
- 2. Provide accurate population estimates for high priority species in Table 4 (above) including Buller's shearwater, red-billed gull, white-fronted tern and black petrel.**
- 3. Systematic ground surveying of all islands /breeding sites within the WHGR (see Section 5 above) to determine accurate population estimates for all species. Where possible an integrated ecological approach plotting seabird presence against vegetation and other biodiversity factors could be adopted. Acoustic surveying is providing a new and useful tool for identifying seabird diversity on remote offshore islands (G. Taylor, C. Gaskin pers. com.) and could be used for this purpose in the WHGR. Also, many islands of the Aotea/Great Barrier Island group present the last significant opportunity for WHGR conservation initiatives. Surveys are required to determine seabird breeding presence/absence, in preparation to developing island and seabird restoration plans.**
- 4. Assess population size and security of the New Zealand storm petrel to enable accurate conservation designation (currently listed at 'data deficient' in DOC Threat Classification 2012) and appropriate management action.**

5. Liaise with community groups to ensure regular monitoring of selected sites to detect recolonising seabirds, especially those islands where invasive species have been eradicated (e.g. Burgess Island, Tiritiri Matangi Island, Taranga/Hen Island, Tawharanui Open Sanctuary).

	Species	Research req'd	Future research areas			Current	Recent
			Popula-tion/ trends	Breeding biology/ cycles	Foraging ecology		
SENI- ISCI- FORMES PROCELLARIIFORMES	Northern Little Penguin						
	Cook's Petrel						
	Pycroft's Petrel						
	Black-winged Petrel						
	Grey-faced Petrel						
	Buller's Shearwater						
	Flesh-footed Shearwater						
	Fluttering Shearwater						
	Little Shearwater						
	Sooty Shearwater						
	Black Petrel		LBI				
	Fairy Prion						
	Common Diving Petrel						
	White-faced Storm Petrel						
	New Zealand Storm Petrel						
PELICANIFORMES	Australasian Gannet						
	Pied Shag						
	Little Shag						
	Black Shag						
	Little Black Shag						
	Spotted Shag						
CHARADRIIFORMES	Southern Black-backed Gull						
	Red-billed Gull						
	Black-billed Gull						
	White-fronted Tern						
	Caspian Tern						
	NZ Fairy Tern						



6. Reassess the legal description of key biodiversity sites. For example Burgess Island in the Mokohinau Islands Group is currently designated as an open access public reserve, despite the presence of 12 seabird species, significant bellbird (*Anthornis melanornis*) and kakariki (*Cyanoramphus novaezelandiae*) populations in addition to large populations of geckos, skinks and endemic invertebrates. Moreover, the fact this open access island lies within a 30 metres water gap to other islands within the group designated as Nature Reserves further threatens islands of the highest conservation status.

Notes:

- (1) Developing a comprehensive, accurate, up-to-date, dedicated seabird colony database (or register) for New Zealand is fundamental to the conservation management of New Zealand seabirds. It was also seen as fundamental to the New Zealand IBA for seabirds project (see Section 9 above) and work began in 2009. Initially data was entered into Birdlife International's World Bird/Biodiversity Database (WBDB), subsequently into regional spreadsheets extracted from the WBDB. This is very much a work in progress and a collaborative, consultative approach is required to ensure the best possible eventual outcome.
- (2) Buller's shearwater is a WHGR endemic, restricted to predator-free islands in the Poor Knights group with a total population estimate in 1981 of 2.5 million birds with c. 200 000 pairs breeding on Aorangi Island (see species notes) following a rapid population increase following the removal of pigs in 1936. There have been no recent estimates of population size. Overnight visits to Aorangi Island by G. Taylor and others in 2011 and 2012 noted absence of Buller's shearwaters from a number of areas on the island and poor breeding success for those two years. A detailed population assessment is required, particularly if translocations or use of acoustic attraction to establish additional secure colonies of the species at other islands in the WHGR (e.g. Fanal Island, Cuvier Island, Rakitu (Arid) Island) are to be considered.
- (3) While iconic and threatened species like Buller's shearwater take high priority, there is the danger of seeing other endemic or native species, particularly birds perceived to be 'common', slipping quietly away where their decline just doesn't register in the official conservation circles. White-fronted tern and red-billed gull could prove to be such species, at least in northern New Zealand, where declines have been detected but not quantified due to lack of a thorough census.
- (4) Flesh-footed shearwater is another such species, however two projects (one completed (Baker et al. 2010a) and one current (2012) through Te Papa/ Museum of New Zealand), contracted by DOC's Conservation Services Programme (CSP) are addressing this issue for this particular species. Apparent conflicting population estimates may have distorted a decline in populations, although the species is acknowledged to be at risk from both local and offshore fisheries.
- (5) Acoustic monitoring using remote recorders is a cost-effective low-impact method for surveying for the presence of seabirds at sites of interest. These recorders can be programmed to run through the night when nocturnal burrowing seabirds, by nature species whose presence is very hard to census, are accessing colonies. Nearly all seabird species have distinctive calls which are used for pair formation and territorial defence. The advantage of acoustic census is that recorders can be left in place and run for up to 5 weeks, logging any species that calls within the range of the microphones, so providing evidence for the presence of species. This information can be followed up with ground searches. For example: a recent pilot survey of Hauturu/Little Barrier Island using acoustic recorders confirmed the presence of two species (fluttering shearwater and diving petrel) thought to be absent from the main island (C. Gaskin and M. Rayner unpublished data).
- (6) Marine-to-land transfer of nutrients by seabirds is a crucial ecosystem process on many islands (Hawke and Holdaway 2005; Fukami et al. 2006). Changes to the marine environment, such as shift-ing sea-surface temperatures, loss of seabirds as by-catch from fishing, and historic harvesting of both seabirds and marine mammals, could alter these nutrient subsidies (Towns et al. 2012a).
- (7) Burgess Island (Pokohinu) is one of the outermost islands of the WHGR. The island was first inhabited by Maori for seasonal mutton-birding of Oi (grey-faced petrel) and then taken over by the New Zealand Government as a lighthouse station (1882-1990) and for military purposes in World War 2. During this time the Island was heavily grazed and invaded by Pacific rats. In 1990, Burgess Is (c. 56 ha) and its adjacent smaller islands were amongst the first of New Zealand's offshore islands to successfully undergo aerial poisoning targeting Pacific rat. The significance of Burgess Island as a Procellariiform stronghold in the Gulf became clearly evident from 2004 making the island (and its Maritime New Zealand house) an ideal field laboratory to study the dynamics of a naturally regenerating seabird dominated terrestrial ecosystem.

11.1.2 Research on seabird breeding biology

Data on the breeding biology and behaviour of species is fundamental to guiding conservation management actions such as predicting population responses at times of conservation threat, for example predator invasion of an island. Despite the importance of these data, published or unpublished data detailing the breeding and

life history traits (i.e. colony attendance, timing of laying, hatching and fledging dates, adult and juvenile survival) of a large number of Gulf seabirds are lacking.

The recommendation for research is

- 1. Studies of breeding behaviour and life history for key species such as the New Zealand storm petrel, Buller's shearwater, fluttering shearwater, little shearwater, fairy prion, common diving petrel, spotted shag (high priority), and black-winged petrel (moderate priority) (see Table 4 above).**

Notes:

- (1) Incidental observations made during deployment/retrieval of tracking devices on Burgess Island for little shearwater and fluttering shearwater has shown considerable overlap of their breeding cycle beyond that suggested from available published sources (Marchant and Higgins 1990; Heather and Robertson 1996)(M. Rayner, G. Taylor, C. Gaskin pers. obs.). Determining accurate dates for various stages of breeding for these species is important when considering timing of weed management programmes on Burgess Island (and others) to minimise disturbance or destruction of nesting sites.
- (2) Prior to 2000 a number of researchers made visits to islands to study seabirds, and while papers have been published on specific species (e.g. Buller's shearwater, fairy prion, Pycroft's petrel) incidental observations made during those visits remain in notebooks. A suggestion was made to the authors of this report to invite researchers to a workshop to assess how these types of data (including anecdotal reports) could be collated and disseminated as potential seed sources for student projects within the WHGR.

11.1.3 Research on seabird diet, foraging and community ecology

The biology of seabirds is heavily influenced by bottom-up (food related) ecological processes. Accordingly research of the diet, foraging and community ecology of seabirds, in conjunction with assessment of population dynamics, presents a viable and cost effective "canary in the cage" for long term assessment of changes to the WHGR marine ecosystem across broad spatial scales (see Piatt et al. (2007) and other papers within this special theme). Such research is yet to be undertaken.

The recommendations for research are:

- 1. Studies of the diet, foraging behaviour, trophic dynamics and habitat use of seabirds and seabird communities within the WHGR. Data collection methodologies would include observation data collected at seabird colonies (chick development and adult attendance and provisioning), tracking data obtained from geolocation (Rayner et al. 2008), GPS (Freeman et al. 2010) and PTT (Peron et al. 2010) sources, dive depth data from capillary tubes and/or time depth recorders (Rayner et al. 2008; Taylor 2008, Shaffer et al. 2009; Rayner et al. 2011b) and dietary and/or physiological analyses utilising stable isotopes (Hobson et al. 1994), fatty acid analyses (Williams and Buck 2010), doubly-labelled water (Shaffer 2011) and direct analyses of sampled regurgitates (Imber 1973, 1996).**
- 2. Subsequent identification of suitable indicator species for long-term assessment of ecosystem change. Such taxa would feed into wider ecosystem research and would preferentially include species for which some historic data are already available. These species would most likely include shelf-specialist species including red-billed gull, white-fronted tern, fluttering shearwater, fairy prion, common diving petrel, white-faced storm petrel and Australasian gannet.**

Notes:

- (1) In 2010 a consortium of researchers who received funding from the Auckland Regional Council now known as the Auckland Council (Coastal Enhancement Fund) in 2010-2011 to investigate the foraging ecology and community of seabirds (grey-faced petrel, little and fluttering shearwaters, common diving petrel, black-winged petrel, and little blue penguin) breeding on Burgess Island, Mokohinau Group. This project set out to complement other projects in the region, notably G. Taylor, M. Rayner (grey-faced petrel, flesh-footed and sooty shearwaters, common diving petrel at Bethell's Beach and Buller's shearwater at Poor Knights Islands), E. Bell (black petrel on Aotea/Great Barrier Island), M. Rayner (Cook's petrel on Hauturu/Little Barrier Island and Pycroft's petrel at Red Mercury Island), and T. Dennis, M. Rayner, T. Landers (Australasian gannet on Mahuki Island, Broken Pig Islands). By 2012 geolocator (GLS) devices have been used to determine dispersal and migration patterns for ten species, and GPS-loggers on three of the larger

species (grey-faced petrel, black petrel and little blue penguin). Blood and feather sampling has also been conducted for stable isotope analysis of community composition and for the sexing of tracked individuals.

11.1.4 Assessing island biosecurity and at-sea threats

Identifying the most important land- and sea-based issues affecting the long-term viability of seabirds that breed in WHGR are vital to preventing extinctions of indigenous species, ensuring population recovery of threatened taxa, and protecting and restoring seabird breeding sites.

The recommendations for research are:

1. **Provide seabird information on utilisation of WHGR waters and breeding site data to inform a multi-disciplinary and comprehensive approach to threat/risk mapping for the region.**
2. **Investigate behavioural interactions and associated mortality with inshore long-line, trawl and set-net fisheries within the WHGR. This work builds on current research with black petrels and flesh-footed shearwaters through the DOC's Conservation Services Programme (CSP).**
3. **Investigate seabird interactions with the recreational fishery within the WHGR, in particular with black petrels and flesh-footed shearwaters, and also the extent of set-netting and the threat it poses to fluttering shearwaters and pied and spotted shags.**
4. **Investigate fishing practises to see whether the overall fish harvest may be competing directly with seabirds for food (i.e. pilchard harvests) or making it harder for seabirds to capture food. In particular purse seine fishing is a threat to seabirds by reducing numbers and size of shoaling fish schools making it harder for seabirds to capture krill and small forage fish brought to the surface by these fish species. Major seabird species of concern are those with limited diving skills (Buller's shearwaters, red-billed gulls, white-fronted terns and fairy prions).**
5. **Use a better understanding of species utilisation of the marine environment and knowledge of where seabirds breed and feed to best inform oil spill response within the WHGR.**
6. **Determine the risks and effects of petrochemical spills on seabird-driven island ecosystems in the WHGR (proposed in Towns et al. (2012a)).**

Notes:

- (1) Abraham et al. (2010) published a survey of the seabirds and marine mammals caught by non-commercial fisheries in New Zealand and highlighted the extent of captures of seabirds in the north eastern region. In this work the authors estimated 11,500 (between 6,600 and 17,200) bird captures occurred a year. Birds were reported as unharmed in 77% of the capture incidents that were recalled during boat ramp surveying. The authors noted that the fate of birds that have been hooked or tangled remained unclear despite the fact fishers may have reported the birds as apparently unharmed. A. Tennyson presented at the OSNZ AGM and conference (2012) a study of the birds recovered dead from beaches during the *Rena* oilspill aftermath, where a significant number of shearwaters found were to be, in fact, unoiled. In these cases mortality appeared to be fisheries-related with actual death in most cases caused by trauma such as broken wings, crushed skulls and stab wounds.
- (2) Offshore Islands need protection as they are crucial storehouses for biodiversity and thus represent opportunities for DOC and the community to restore and sustain biological and cultural heritage (NZ Island Strategy, DOC). Mammalian predators pose the greatest threat to the survival of seabirds, and together with human disturbance, dogs and fire, it is vital that the hard-won predator-free status of many of the WHGR's treasured islands is maintained. Despite numerous successful eradications of invasive animals, including at least 60 involving the aerial spread of baits (Bellingham et al. 2010), some direct and indirect effects of the eradication campaigns are poorly understood. A question often asked by the public and agencies that regulate the use of chemicals is how toxins affect island food webs after eradications, but it is a question that remains largely unanswered (Towns et al 2012).
- (3) Risks to seabirds from petrochemical spills are particularly high in NZ, with its extraordinary sea-bird diversity (Taylor 2000a) and enormous densities of birds nesting in burrows. For example, it is unclear whether the current methods for dispersing spilled oil are appropriate given their potential effects on

pelagic seabirds (Butler et al. 1988). The grounding of the *Rena* on Astrolabe Reef off Tauranga in 2011 and subsequent oil spill brought home the impact such a situation can have on local and regional wildlife, especially seabirds. A total of 2000 seabirds was found dead or rescued during the disaster though the full impact on seabirds is likely much greater, but difficult to determine as the number of seabirds killed at sea (i.e. those not washed ashore and collected on beaches) was not possible to quantify. Moreover the disaster revealed how events such as oil spills have the potential to impact seabirds, with their great mobility, on a much broader geographic scale. For example though species such as common diving petrels and little penguins are most likely to have been local breeding birds (given sizeable colonies nearby), species such as fluttering shearwater (bird banded on East Island (East Cape) was amongst those collected) and Buller's shearwater (breeding only on Poor Knights Islands) were also significantly affected.

11.1.5 Population genetics and taxonomy

Understanding of the gene flow and/or the taxonomy of populations can assist conservation of threatened species (Haig et al. 2011). In particular such information is essential to establish accurate threat classifications which in turn guide the level of conservation effort and critically funding of conservation action (i.e. IUCN Red List, DOC Threat Classification System).

The recommendations for research are:

- 1. Comparative studies of the breeding behaviour and life history traits of WHGR populations in comparison with southern populations breeding in markedly different environments and selection pressures. Such data would provide an indication of the behavioural flexibility of populations to withstand long terms environmental changes. Example study taxa would include common diving petrel, sooty shearwater and fairy prion. For example, see Rayner et al. (2008).**
- 2. Expanded study of the taxonomy of the New Zealand fairy terns to indicate taxonomic divisions between NZ and overseas populations. This research should include expanded analyses of mitochondrial and nuclear genetic markers and comparisons of morphology and behaviour.**
- 3. Identify the taxonomic status and or gene flow between recognised populations of little shearwater including the northern little shearwater of the WHGR?**
- 4. Assess the genetic diversity present in New Zealand storm petrel to understand potential of bottleneck impacts and/or assess the effective population size for the species.**

Notes:

- (1) Baling and Brunton (2005) contended that the single fairy tern DNA haplotype found in New Zealand did not occur elsewhere (i.e. Australia and New Caledonia), indicating that the continuation of the DOC Recovery Plan for the New Zealand fairy tern to conserve and expand this distinct population was warranted. The New Zealand fairy tern is currently listed as a subspecies (OSNZ Checklist of 2010).
- (2) The Subantarctic little shearwater (*Puffinus elegans*) is now considered a separate species (OSNZ Checklist 2010). The Kermadec little shearwater (*P. assimilis kermadensis*) remains a subspecies, likewise the northern little shearwater (*P. a. haurakiensis*) and Norfolk Island little shearwater (*P. a. assimilis*) (OSNZ Checklist 2010).

11.1.6 Standardising seabird census, monitoring and research techniques

Recommendation:

- 1. Support the development of an online manual detailing up-to-date surveying, monitoring and re-search techniques and protocols (including permitting) for all New Zealand's seabirds and relevant habitats.**

Notes:

- (1) An outline of seabird census, monitoring and research techniques is presented in the Action Plan for Seabird Conservation in New Zealand (Taylor 2000b), also in other publications (Walsh et al. 1995). However, our recommendation here is for an online manual detailing up-to-date surveying, monitoring and research techniques and protocols (including permitting) for all of New Zealand's seabirds and the range of habitats to be created. This manual would greatly assist in standardising procedures.

11.1.7 Broad-scale WHGR ecosystem research

The WHGR is a dynamic marine environment in which tidal movements, cross-shelf intrusions of sub-tropical water from the East Auckland current, spatial and temporal changes in sea temperature, salinity, likely influence the distributions of prey and thus top predators such as seabirds. In addition anthropogenic-related impacts such as increased sediment and nutrient loads and benthic habitat damage from fisheries likely impact the productivity of this dynamic ecological community with the potential for inter-action effects on top predators. Consequently, there is a strong need to understand the dynamics of Gulf as an ecosystem in both space and time and across multiple trophic levels in order to better inform management decisions that could affect seabirds.

Recommendations for research are:

- 1. Integrated studies of the marine environment through inter-disciplinary collaboration between researchers with expertise from oceanography, benthic and pelagic ecology and top predator biology and spatial ecology. Such research would ideally provide base-line data across all trophic levels and understanding of physical processes driving trophic level interactions in space and time.**
- 2. Research could focus on using the presence of top predators (seabirds, marine mammals, sharks) to understand the spatial and temporal dynamics of marine hotspots in the Gulf, see Piatt et al. (2007) and Block et al. (2011). Such research would integrate remote tracking and/or aerial survey of top predators and prey aggregations with remote and location based data on oceanic characteristic such as sea surface temperature, current flow and productivity.**

Notes:

- (1) Future incorporation of physical dynamics of the WHGR, characterizing primary and secondary production hotspots and modelling primary production (PP) would establish links between feeding locations of the birds and productivity (or more accurately to investigate the disjuncts between aggregations of seabirds observed through tracking data and PP/chlorophyll-a (Chl-a) values. J. Zeldis and M. Gall (NIWA) have been running time series nutrient and production data in the WHGR, with resultant PP modelling papers published (or forthcoming) and M. Pinkerton (NIWA) has produced a trophic model for the region. Nitrogen and Carbon isoscapes currently being developed by NIWA will make a valuable contribution to the interpretations about the movements and diets of some of the WHGR seabirds (S. Bury, NIWA, pers. com.).
- (2) The types of tracking devices (tags) that can be deployed on seabirds can be summarised, as follows: 1) GPS tags provide fine-scale data (location accuracy +/- c. 10m) with a sampling resolution from one fix every few seconds to every day or more. The current lightest weight commercially available GPS tag is just over 5 g, however such devices are extremely expensive and very limited in battery life. GPS tags weighing between 10-20 g are currently best suited for seabird research in the Gulf. 2) Satellite tags, otherwise known as Platform Terminal Transmitters (PTT's), provide meso-scale data (location accuracy +/- 250 metres, 1500 metres to 25 km depending on the quality of satellite-based position fixes at the time of position acquisition). An advantage of PTT's is battery lifetime, which can be up to 5 years. Solar powered PTT's weighing > 5 g are now commercially available for research purposes. 3) Geolocator tags provide broad-scale data (location accuracy +/- 200km (Phillips et al. 2004) of the locations of tracked animals which are calculated through measurement of day length (latitude) and the time of sunset and sunrise compared to Greenwich meantime (GMT) (longitude). Despite the low accuracy of position fixes from geolocators the devices remain the best and only tool for examining long-term broad-scale movements of small seabirds (< 600g) as a result of their extremely small weight (< 2 g for the latest models). GPS, PTT and geolocation tracking devices all provide the opportunity to answer different questions about behaviour and distribution patterns of Gulf top predators. Technological advances are rapidly reducing the size of these tracking technologies thus expanding the potential of these devices to studies of smaller seabird species
- (3) Aerial at-sea surveys have been undertaken elsewhere in New Zealand, principally for Maui dolphin (*Cephalorhynchus hectori maui*) (North Island west coast) and basking shark (*Cetorhinus maximus*) (Canterbury). In Tasman Bay aerial surveys were conducted (2011) to assess marine life prior to oil exploration (R. Schuckard pers. com.) In the WHGR aerial surveys have been conducted solely for marine mammals (i.e. Bryde's whales) (R. Constantine, pers. com.).

11.1.8 Field research facilities, field stations

The WHGR represents an unrivalled natural laboratory for the study of seabird biology and seabirds island ecosystems. Despite these research opportunities (largely missed by academic institutions to date), field research on seabirds and seabird islands remains primarily dependant on researchers living in remote field conditions with poor facilities and challenging health and safety issues. In general supply of field equipment is the responsibility of institutions and/or individual project teams. Accommodation on islands or close to breeding sites is currently by arrangement with DOC (huts or bunkhouses), Maritime NZ (with respect to Burgess Island, Mokohinau Islands), Auckland Council (Tawharanui Open Sanctuary), community groups (e.g. Motuora, Motuihe and Kaikoura Island), iwi (e.g. Mahuki Island) and tent camps. The latter are temporary arrangements for the duration of the research trip only, although on Taranga and Aorangi (Poor Knights Islands) some basic facilities are provided (DOC).

The recommendations are:

1. **Upgrade the Maritime NZ house on Burgess Island, Mokohinau (Pokohinu) Islands to provide a base for research activities on the island, suitable for prolonged stays (up to six weeks at a time).**
2. **Establish a database/inventory of equipment that can be pooled for field research purposes within the region.**

Notes:

- (1) Seabird researchers have used the house on Burgess Island periodically from 2005 to 2010. More recently research groups have visited the island two or three times each year, and up to six weeks at a time. On-going use of the hut is critical to future research projects. Maritime NZ do some basic work on the house in conjunction with their bi-annual service trips to the island to maintain the lighthouse. Work required to bring the house up to standard as a field station would include: refurbish the hut's interior (cleaning, fixing ceiling panels, painting); purchase and install a VHF radio, small freezer unit; upgrade the water supply (including installation of new tanks); and install some additional fixed furniture and lockable storage.
- (2) The success of the NZ storm petrel project in recent years has demonstrated how projects can benefit from better coordination amongst institutions, organisations (including DOC and regional authorities) and individual researchers for skill and equipment sharing. With the latter, particularly items with limited specialised use (e.g. automated telemetry receivers and sound recorders, burrowscopes).

11.2 Priorities for seabird conservation

In their research strategy for biodiversity conservation in New Zealand's offshore islands Towns et al.(2012) draw attention to a number of conservation management priorities that affect seabirds, in particular, a systematic approach that provides for a range of alternative management strategies on islands urgently needs national application, especially if this also facilitates the protection or restoration of islands outside administration by government agencies.

Rowe and Taylor (2006) outlined a priority outcome statement for New Zealand seabird conservation, that is, to halt the decline of biological and genetic diversity of seabirds that breed in New Zealand or New Zealand's outlying islands through:

- Preventing the extinction of indigenous seabirds in the New Zealand region;
- Ensuring population recovery of all acutely threatened seabird taxa;
- Restoring the role of seabirds in New Zealand's terrestrial ecosystems;
- Ensuring fishing activities within the New Zealand EEZ are not adversely affecting any seabird populations;
- Advocating for the protection of all seabirds throughout their at-sea range;
- Protecting and restoring key seabird breeding sites.

Within the WHGR there are many challenges for seabird conservation management; biosecurity of islands, reducing fisheries-related mortalities, and, that elephant in the room, birds caught and killed by recreational fishers. Threat or risk mapping will be an important exercise for determining seabird and marine conservation

priorities. Certainly, the onus is on researchers, conservation and biodiversity staff, and advocates within conservation groups for raising public awareness of seabirds and the threats they face. There is a pressing need to engage the community more and involvement in restoration projects which focus on seabirds can be very useful in this respect.

On-going, long-term studies are vitally important and, together with the research projects outlined above, require a major commitment in terms of funding, either directly through government/local government grants, or through active, official support in applications to donors. Overall a collective approach needs to be adopted if we are to live up to our responsibilities in caring for these remarkable creatures, seabirds. After all, the WHGR, like New Zealand, is a global hotspot, and the world is watching us.

11.2.1 Coordinated regional approach to seabird conservation management

Recommendation for conservation management is:

- 1. Map seabird assets showing islands with species ranked according to species conservation status (DOC Threat Classification System 2012/IUCN Red List).**
- 2. Overlay with assessment of risk for island biosecurity based upon public access, and recreational and commercial small vessel traffic.**
- 3. Map all shipping lanes with speed restrictions, then assess likely threat arising from shipping traffic not adhering to lanes, i.e. short-cut passages between islands, and likely distribution of pollutants if there was a major oil spill.**
- 4. Map overland seabird passage routes (i.e. North Auckland Seabird Flyway, Tamaki Isthmus).**
- 5. Identify and overlay key hotspots in the WHGR for seabird foraging activity.**
- 6. Achieve coordination through spatial planning.**

Notes:

- (1) The *Rena* disaster, high rate of fisheries-related mortality of black petrels and flesh-footed shearwaters in WHGR waters, pressure from coastal development on New Zealand fairy tern, incursions by rats on a number of islands in recent years (e.g. Lady Alice Island, Motuora, Rakino), growing aquaculture development, and interest in wind farm development has thrown the spot- light on the vulnerability of the WHGR and its ecosystems.

Furthermore, the *Rena* led to calls to investigate the wreck of the RMS *Niagara* sunk by a mine laid by the German raider HSK *Orion* in 1940. Located approximately midway between the Mokohinau Islands and Poor Knights Islands Marine Reserve, it is regarded by some as a ticking time-bomb that will release heavy oil into the marine environment (ref Keith Gordon book). Quoting author and diver Wade Doak "*In the rest of the Pacific where you have war wrecks, they are not mucking around, they are checking them. But if you asked Maritime New Zealand about the Niagara they will not have a reply. It is one of those can-of-worms they do not want to get into.*" Also, see the Listener article by Wade Doak published on 26 November 2011 (<http://www.listener.co.nz/commentary/the-danger-of-the-rms-niagara/>).

11.2.2 Island biosecurity

Seabirds have few predators on the open seas and it is on land at their breeding sites where they are arguably their most vulnerable. Island biosecurity is thus one of the most important factors in the conservation of seabirds within the WHGR. During breeding and roosting, mammalian predators pose the greatest threat to adult seabirds and chicks and eggs (section 5.1) and many species now only survive on island refuges free from mammalian predators. To ensure the long-term viability of seabird species, it is essential to eradicate mammalian predators from offshore islands and mainland reserves and implement sound plans to maintain their predator-free status.

Recommendations for conservation management are:

- 1. Development of a coordinated inter-organisational approach for the eradication of mammalian predators, prevention against reinvasion, and regular monitoring of seabird islands and mainland**

breeding sites throughout the region. This approach could be guided by threat/risk mapping as outlined in 11.2.1 above.

2. **Maintaining regular monitoring, pest management, closed areas and warden presence during breeding is critical at New Zealand fairy tern breeding sites.**
3. **Ensure public awareness of island conservation status through publicity campaigns and also review adequacy of signage at key protected biodiversity sites with restricted public access.**
4. **Encourage all commercial vessels (e.g. fishing vessels, charter vessels) that regularly anchor close to nature reserves and/or predator-free island sanctuaries to be checked by DOC staff and have invasive species mitigation measures in place.**

Notes:

- (1) Currently commercial charter boats moving people and cargo to islands in the HGMP are required by DOC and the Auckland Council to be checked and have invasive species mitigation measures in place – the Pest Free Warrant Programme. This good conservation measure is made futile by the fact that commercial fishing vessels and recreational vessels can anchor overnight within metres of pest free island sanctuaries with no such requirement. Pest-free certification should be made mandatory for commercial vessel operating in such conditions and public awareness campaigns should be conducted to advise the public and recreational boat owners of the necessity of good biosecurity protocols for their vessels.

11.2.3 Fisheries interactions

The mortality of seabirds in association with New Zealand fishing fleets is a major factor contributing to the decline of a number of endemic and native species. The estimated by-catch levels in New Zealand waters are of around 10,000 albatrosses and thousands of other seabirds killed annually (Richard et al. 2011). Within the WHGR breeding seabirds most at risk by commercial fisheries are black petrels and flesh-footed shearwaters (long-line and trawl fisheries), although fluttering shearwaters, pied shags and spotted shags are killed by set nets and recreational line fishers.

Recommendations for conservation management are:

1. **Lobby the Ministry of Primary Industries - Fisheries to increase inshore fisheries observer and/or remote camera coverage to 100% within the WHGR to collate accurate data on the by-catch of WHGR species and to better understand the dynamics of seabird-boat interactions.**
2. **Deployment of mitigation measures to minimise seabird mortality by making them mandatory in these fisheries. Such measures to be improved when new data become available as above.**
3. **Organisation of meeting(s) between selected seabird researchers, seabird advocacy groups, DOC, Ministry of Primary Industries and the fishing industry. This meeting would discuss co-ordinated action to assess and reduce seabird losses associated with fishing practises within the WHGR and ensure long-term sustainability of fisheries within the region in relation to seabirds. Tabled discussion items for an agenda could include: establishing targets for reducing by-catch rates, vessel best-practice to achieve this goal, agreed criteria and results from research that could trigger temporary closures of fisheries.**

Notes:

- (1) The Fisheries (Commercial Fishing) Regulations (2001) and subsequent notices detail mitigation measures required for all New Zealand fisheries. However, levels of observer coverage and consequently compliance are very low for inshore fisheries.
- (2) One of the Gulf's endemics, the black petrel (see species profile), is currently classified by IUCN as Vulnerable (Nationally Vulnerable by NZ classification) with a threat ranking likely to rise on review of current available data. Long-term research of the black petrel at its strong hold on Great Barrier Island by E. Bell suggests this population (approximately 2000 breeding pairs) is declining by 1.4% per annum with possible extinction within 30 years. The recent expansion of the marine observer programme to shelf fisheries within the WHGR (particularly bottom long-line snapper and bluenose fisheries) has revealed unsustainable by-catch rates of black petrel. Fisheries related threat assessment places black petrel at the top of the list of endemic species at risk of extinction as a result of NZ fisheries by-catch (Richard et al. 2011)

- (3) DOC's CSP aims to understand the adverse effects from commercial fishing activities in NZ waters and to develop effective solutions for threat mitigation. Southern Seabird Solutions Trust (SSST) is an alliance including representatives from the New Zealand seafood industry and government, WWF and Te Ohu Kaimoana. SSST takes a cooperative approach to seabird conservation and supports and encourages fishers in southern ocean fleets to adopt responsible fishing practices (http://www.southernseabirds.org/ss-about_us). The Global Seabird Programme (GSP) of BirdLife International, works through its partner organisation the Royal Forest and Bird Protection Society of New Zealand. The GSP was established in 1997 in recognition of the fact that seabirds travel widely across oceans facing threats both at their breeding sites and at sea. A major objective of the pro-gramme is to reduce seabird by-catch both within New Zealand waters and internationally.
- (4) Fishermen are the key to solving the issue of seabird injuries and deaths during fishing. This is the approach taken by SSST. Promoting good fishing practices by providing publicity and recognition to individuals and companies taking positive action is desirable. However, a wider collaboration between all parties (i.e. seabird researchers, advocacy groups as well as industry and government agencies) could achieve greater reduction in seabird mortality by adopting a more rigorous and effective process.
- (5) In New Zealand, participation in recreational fishing is extensive and has impacts on seabirds. It has been estimated that 16.5% of the New Zealand adult population fish annually, with 2.5% of the adult population (81 000 people) fishing at least once a week. In a study of recreational fisheries Abraham et al. (2010) found a seabird capture rate by recreational fishers of 0.22 (95% c.i.: 0.13 to 0.33) birds per 100 hours. A similar rate of 0.36 (95% c.i.: 0.09 to 0.66) birds per 100 fisher hours was obtained from records kept by observers on 57 charter fishing trips. When combined with estimates of fishing effort from trailer boats for the north-eastern coast, the capture rate from the interviews undertaken in the study resulted in an estimated total annual catch of 11 500 (95% c.i.: 6600 to 17 200) seabirds by recreational fishers in this region. The study concluded that there is currently little attention given by New Zealand governmental or non-governmental agencies to reducing the impacts of recreational fishing on seabirds and that, given the apparent scale of the problem, the by-catch of seabirds by recreational seabirds requires increased focus (Abraham et al. 2010).
- (6) Under Section 15(5) of the Fisheries Act 1996 the Minister may, by notice in the *Gazette*, prohibit all or any fishing or fishing methods in an area either: (a) under subsection (1)(a), for the purpose of ensuring the maximum allowable fishing-related mortality level set by the relevant population management plan is not exceeded; or (b) under subsection (2), for the purpose of ensuring that any limit on fishing-related mortality is not exceeded. If results of proposed research demonstrate the scale of impacts on seabirds within the WHGR is sufficient to trigger such action, consideration should be given to temporary closure of marine areas to commercial fishers. In the case of black petrel an area would likely include areas adjacent to Aotea/Great Barrier Island and Hauturu/ Little Barrier Island and out to the shelf edge.

11.2.4 Minimising disturbance

Human disturbance of seabirds in New Zealand is generally unintentional due to the general lack of knowledge about seabird behaviour and breeding sites. People disturb nests through recreational use of beaches and riparian zones, during activities such as fishing, walking, horse riding, motorcycling/off-roading, swimming, pet-walking, hunting and picnicking. Human disturbance may cause the deaths of eggs and or chicks through them being dislodged from the nest or may cause birds to abandon nests, placing eggs and chicks at greater risk from predators or human trampling (Rowe and Taylor 2006). Tourism ventures also have the potential to disturb birds during the breeding season and at roost sites. Scientific research, where it requires manipulation of birds, and close investigation of breeding/roosting sites, also has the potential of adversely affecting birds.

Recommendations for conservation management are:

1. **Review and where necessary improve all publicity campaigns, advocacy material, signage and methods used to convey threats to seabirds, seabird islands and mainland breeding sites.**
2. **Islands open to public access to have well-maintained, clearly defined paths and walking tracks to channel visitor activity, i.e. to direct visitors away from any seabird breeding areas, particularly burrowing seabirds which can be hidden amongst low-growing vegetation close to access ways.**
3. **Visitors to islands where access is by permit only, including DOC staff, maintenance and research parties, to be informed where seabirds are breeding, preferably using maps highlighting sensitive areas.**

4. All roosting and nesting sites for seabirds on beaches and coastlines should be legally protected as wildlife refuges, or wildlife management areas, to allow for management capacity to reduce impacts on protected species.
5. Dog owners need to be informed and educated about the risk dogs impose on ground-nesting seabird colonies.
6. Where not already in place, controlled dog areas should be established under the Conservation Act Amendment 1996 in areas where breeding sites of species such as penguins, terns and gulls are vulnerable.
7. Notification of restrictions and controls on fires should be reviewed and strictly imposed, particularly on islands with open public access (e.g. Burgess Island, Mokohinau Islands).
8. Standards for all wildlife tourism activity on islands and within regional parks should be set through concession conditions by DOC and Auckland Council.
9. Risk to seabirds and seabird islands to be given appropriate consideration when investigating an alleged offence such as unauthorised entry to a nature reserve (i.e. disturbing, injuring or killing birds, damaging nesting sites/burrows). Moreover, there should be increased focus on using resolution of such incidents as public advocacy opportunities by which to promote conservation messages to the public through media channels.

Notes:

- (1) On Burgess Island, Mokohinau Islands a large proportion of the old lighthouse settlement tracks have been allowed to become overgrown with rank grass, bracken, sweet pea, and in some places pohutukawa (*Metrosideros excelsa*) and *Coprosma macrocarpa* (the latter two as sizeable trees). Visitors will make their own pathways around obstacles, or take short cuts. With the rapid spread of common diving petrels, little shearwaters, white-faced storm petrels, and to a lesser extent grey-faced petrels and little blue penguins, there is a high risk of damage to burrows and birds being trampled (C. Gaskin, M. Rayner pers. obs.).
- (2) Domestic dogs kill seabird adults and chicks, destroy eggs on the nest, dig up burrows and chase seabirds from nesting and roosting sites. Dogs roam into seabird breeding sites from adjacent residential areas and attack birds when taken to beaches or rivers by recreational users. Controlled dog areas can be established under the Conservation Act Amendment 1996 in areas where breeding sites are particularly vulnerable (Rowe and Taylor 2006).
- (3) Evidence of fires having been lit is frequently found on Burgess Island in the Mokohinau group. Most of this island is covered in rank grass and bracken which in summer is tinder-dry. A fire could easily get out of control and would have devastating effect on large breeding seabird populations as well as adversely impact the natural regeneration of the islands forest cover with flow on impacts on terrestrial birds and reptiles (C. Gaskin and M. Rayner pers. obs.).

11.2.5 Enhancing seabird influenced ecosystems

National and international research indicates that when introduced mammals are removed from seabird dominated habitats, ecological communities can recover through four pathways: recolonisation of flora and fauna from outside the island/area; reappearance of species reduced to such low densities they were previously undetected; recovery of species known to be present, but reduced in abundance; and reintroduction of extirpated species which are unlikely to recolonise unaided (Towns et al 2012). Within the past 30 years eradication of introduced species from islands and pest control campaigns within mainland habitats have meant significant conservation gains, particularly for seabirds and seabird-dominated islands. However, many exciting opportunities remain to further enhance the special biological communities with the region.

Recommendations for conservation management are:

1. **A multi-institutional and community focus on the ecological restoration of the islands and islets surrounding Aotea/Great Barrier Island (including DOC, Auckland Council, Ngati Rehua and wider Great Barrier Island community). Management actions would include eradication of mammalian predators from Rakitu (Arid) Island and other smaller islands and ecological restoration of these islands through**

planting, species translocations and or augmentation techniques such as seabird acoustic playback systems.

- 2. Work with Aotea/Great Barrier Island community to establish conservation goals for the main island. In particular, funding should be sought for a community led feasibility study of the potential for removal of introduced mammalian pests from Aotea/ Great Barrier Island.**
- 3. Encourage private island owners such as Great Mercury Island, Rotoroa and The Noises to engage in or increase the level of ecological restoration for the benefit of seabirds and island ecosystems.**
- 4. Inform weed control programme coordinators of seabird presence and timing of breeding to ensure no breeding sites are destroyed or birds disturbed by control measures.**

Notes:

- (1) Conservation managers have become increasingly adept at eradicating weeds and pests from islands, including the unprecedented eradication of rats from Campbell Island, cats and rats from Raoul Island, and multi-species eradications from Rangitoto and Motutapu in the inner Hauraki Gulf. These eradications have produced spectacular benefits for native ecological communities with New Zealand seen as international showcase of successful island based conservation (Towns et al. 2009).
- (2) Weed control on most sites in the WHGR is undertaken by DOC, local and regional authorities, and community groups. However accurate knowledge of seabird breeding site locations is needed to prevent inadvertent destruction of nesting sites during weed control. For example, where penguins have burrows and are nesting under gorse (e.g. Motuihe), or diving petrels amongst bracken (e.g. Tiritiri Matangi Island) these sites should be made known to DOC staff, volunteer weed teams and/or contractors.
- (3) In general seabirds are not discriminatory between native and exotic vegetation; however boxthorn does pose real problems for petrels preventing them reaching their burrows as birds become snared on thorns and die. Seabirds can potentially be vectors for transportation of weeds by carrying seeds, although burrowing seabirds are strongly philopatric and while movement between sites can occur (e.g. grey-faced petrels), weed management around colony sites could minimise any potential spread.
- (4) The establishment of new seabird populations through chick translocations is increasingly being used as part of the restoration of islands within the WHGR. Chick-translocation techniques have been used since 1991 allowing the successful introduction of burrow-nesting seabirds to a number predator-free restoration sites around New Zealand and are well documented by Miskelly et al. (2009). An additional seabird restoration technique is the use of acoustic playback systems which broadcast seabird calls and aim to anchor returning translocated individuals or attract immigrants from other colonies. Given the high cost of seabird translocation playbacks are providing a cost- effective, though potentially slower, alternative to translocations for restoring seabirds at mainland and offshore island sites. For example, Sawyer and Fogle (2010) successfully introduced grey-faced petrels and fluttering shearwaters to Young Nicks Head using acoustic attraction combined with artificial burrows from 2005 with first breeding of grey-faced petrel confirmed in 2007. More recently, at Tawharanui Open Sanctuary, diving petrels, fluttering shearwaters and Cook's petrels have been attracted using acoustic playback systems with diving petrels confirmed breeding in November 2012.

11.2.8 Engaging communities, working with iwi on seabird conservation

Within the WHGR there are a number of seabird conservation and restoration projects underway. At these locations iwi, supporter groups, researchers and or conservation managers have recognised the ecological, and cultural benefits of bringing back seabirds and are working together to achieve great conservation success at sites such as Cuvier island Motuora, Tawharanui Open Sanctuary, Motuihe, Limestone Island (Whangarei Harbour) and at Bethell's Beach. Community-based projects such as these offer excellent opportunities for public advocacy about seabirds and their ecology, as well as hands-on experience with the birds themselves through a variety of workshops, fieldwork and with translocations.

The recommendations are:

- 1. Community projects and supporters groups are encouraged to introduce seabird restoration into their project planning.**

2. **Build community support for seabird conservation through involvement of volunteers from iwi, OSNZ, Forest and Bird and other groups, including students from both within New Zealand and overseas.**
3. **Use the BirdLife International IBA for seabirds programme to generate more community support for seabirds and locations within the Gulf.**
4. **Arrange hui within the WHGR between individual iwi, seabird researchers and conservation/biodiversity staff from within DOC and local authorities, such collaboration refers to the Conservation Act 1987 which states the Crown is required “to give effect to the principles of the Treaty of Wai-tangi”**
5. **Progress one of the suggestions made at first seabird hui (see Notes below) for recording of traditional knowledge relating to the WHGR islands, seabirds, and the harvesting of Oi on northern is-lands.**
6. **Run regular seminars on Auckland seabirds, similar to the first Auckland Seabird Seminar held in April 2010, hosted by the Centre of Biodiversity and Biosecurity, University of Auckland.**

Notes:

- (1) Research within the WHGR is generally conducted by a core group of conservation staff, environmental advocates, researchers (including student projects) and enthusiastic volunteers working individually or in small groups. The NZ storm petrel project is one example of a collaboration that has fostered a widening net of people who are spending time in the field, working with seabirds and seeking to answer seabird related research question.
- (2) Confirmation of the Global IBA status for the Hauraki Gulf’s marine environment and many of its off-shore islands and seabird breeding sites (see Section 10 above) can be used to stimulate greater awareness of the importance of seabirds in the regional environment, also to the threats that they face.
- (3) All seabird research activities are subject to permit requirements which include consultation with Tangata Whenua. Regular contact between researchers and iwi results knowledge sharing and forming trust, and facilitating the consultative process by developing a collaborative relationship. The first seabird hui with Ngati Rehua on Aotea/Great Barrier Island (August 2011) was organised through DOC Warkworth/Great Barrier Island Area Office to discuss seabird research objectives in an open forum. It was seen by participants as highly successful, an important first step towards “sharing knowledge”, both scientific and traditional.
- (4) Landcare Research has worked under a Cultural Safety Agreement with Hauraki’s Ruamaahua Islands Trust (RIT) for the past 7 years. The agreement guides the relationship between the two groups and stipulates the responsibilities each group has to the other. Each person involved in the research signs the agreement and becomes personally accountable for their behaviour and actions. Adherence to the agreement means there are no surprises for each party. In summary, the agreement defines the ownership of data and information and guides its collection and release. For example, scientific data is jointly owned by the two parties, however mātauranga (traditional knowledge) remains the ownership of RIT. Members from the RIT have 2 weeks to review and respond (if re-quired) to material planned for release. No party has the right to veto scientific data and results, however temporary embargos may be placed over the release of information if either party deems that necessary (this has not been used to date) (P. Lyver pers. com.).
- (5) The suggestion of recording of traditional knowledge was made by Ngati Rehua kaumatua with Aotea and Mokohinau Islands in mind, but the suggestion can be extended to all other islands.
- (6) Build on the success of the ‘**Auckland Seabirds: Conservation, Restoration and Research**’ Seminar Day held at University of Auckland, Tamaki Campus, 16 April 2010.

11.2.9 Closer collaboration with Iwi

The DOC general policy, as outlined in the New Zealand Island Strategy (2010), indicates that the customary use of traditional materials and indigenous species may be allowed on a case-by-case basis where there is an established tradition of such use; it is consistent with all relevant Acts, regulations, and management plans; the preservation of the species involved is not adversely affected; the effects of use on conservation values are not significant; and Tangata Whenua support the application.

Recommendations for conservation management are:

- 1. Determine the abundance of grey-faced petrel (Oi) populations within the WHGR.**
- 2. Determine the sustainability of seabird harvests in the WHGR.**
- 3. Maintain consistent biosecurity protocols with respect to all entry to nature reserves and other predator-free islands throughout the WHGR.**
- 4. Determine the level of illegal harvesting in the WHGR.**

Notes:

- (1) Identifying and developing an understanding of the human, biological and physical factors that influence seabird populations and ecosystem processes will assist iwi and relevant Crown agencies to implement effective management of these resources and environments (www.landcareresearch.co.nz/science/plants-animals-fungi/animals/birds/seabird-ecology).