WHALESAFE

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INDENTIFICATION GUIDE

COMMON WHALES & DOLPHINS

IN NEW ZEALAND COASTAL WATERS

NZ ROCK LOBSTER
INDUSTRY COUNCIL
Ka whakapai te kai o te moana

WHALESAFE

2022 (3rd Edition)

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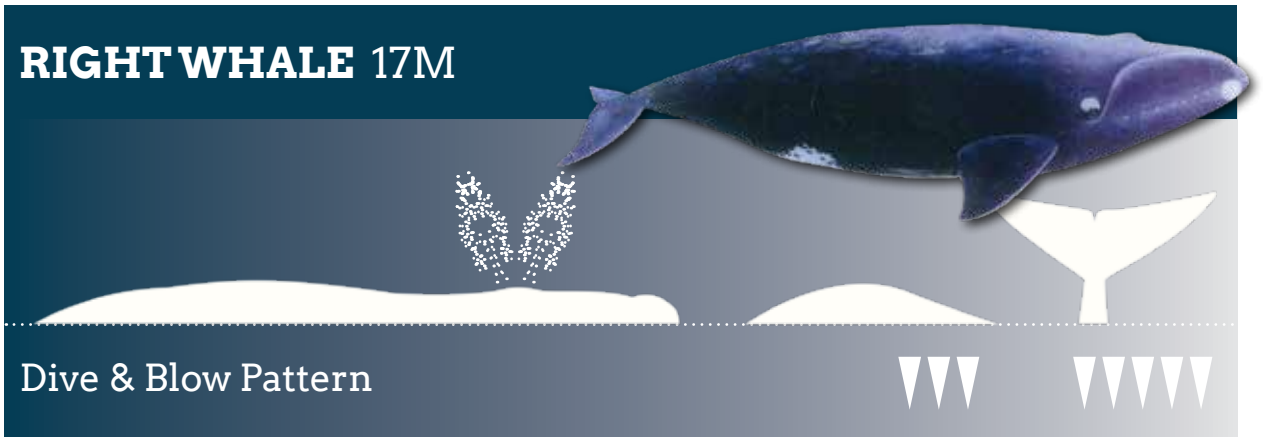

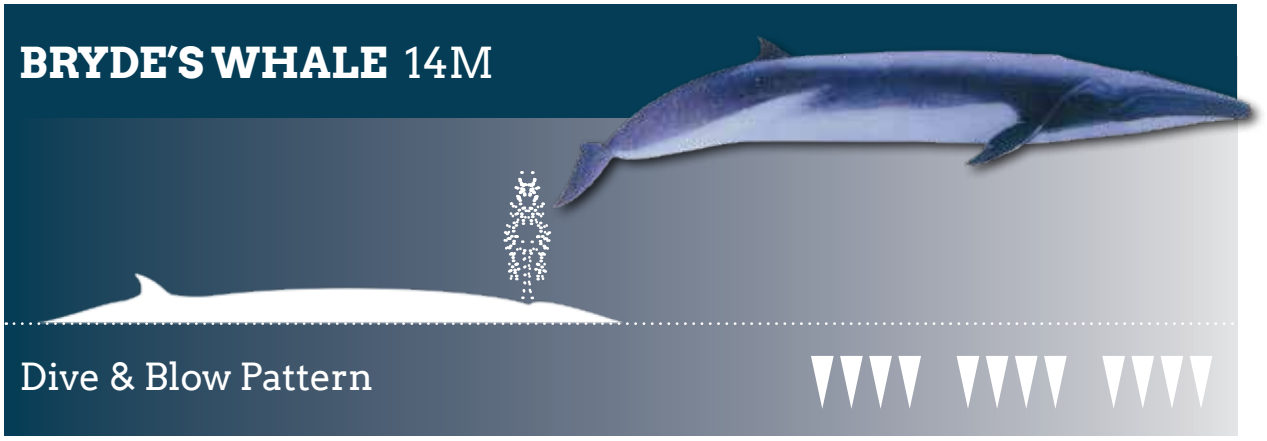

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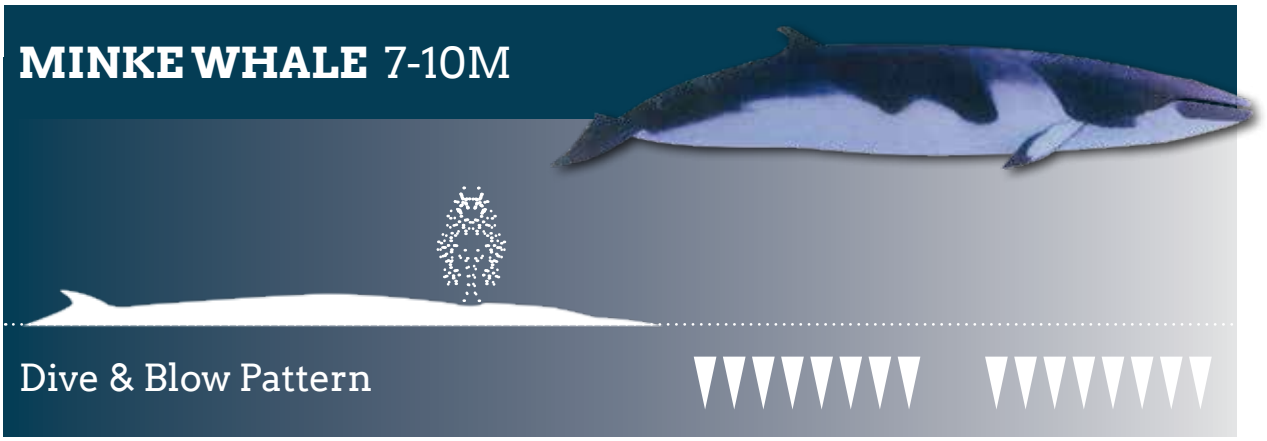

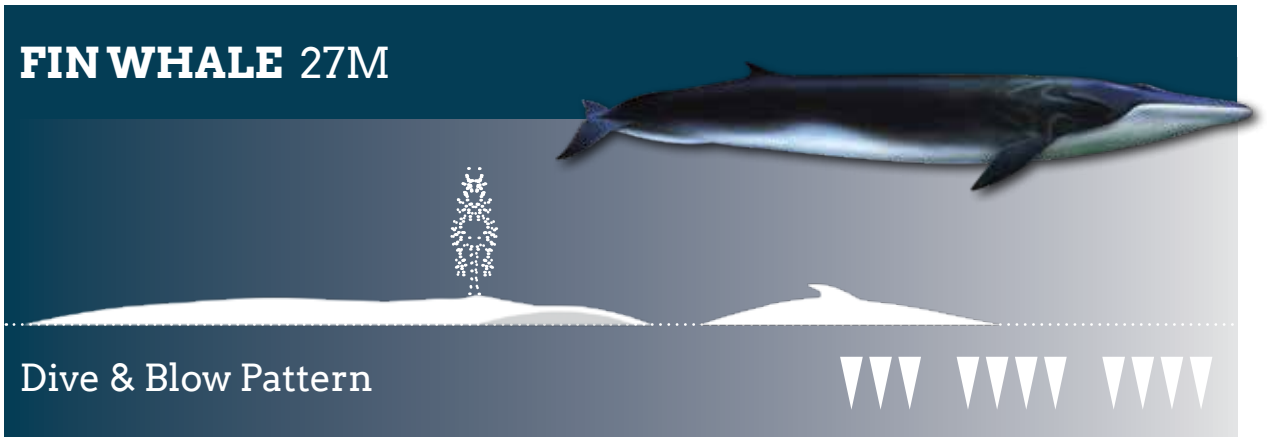

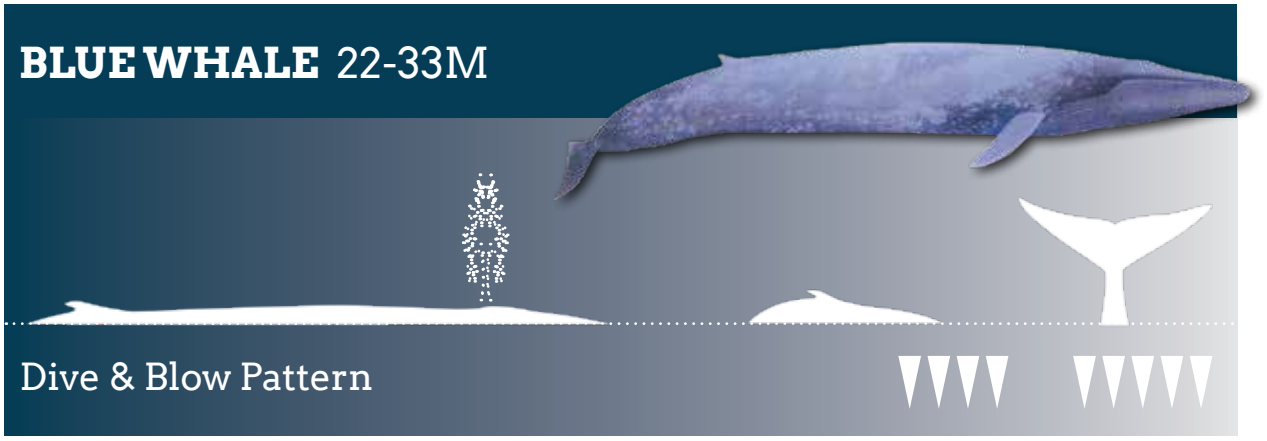

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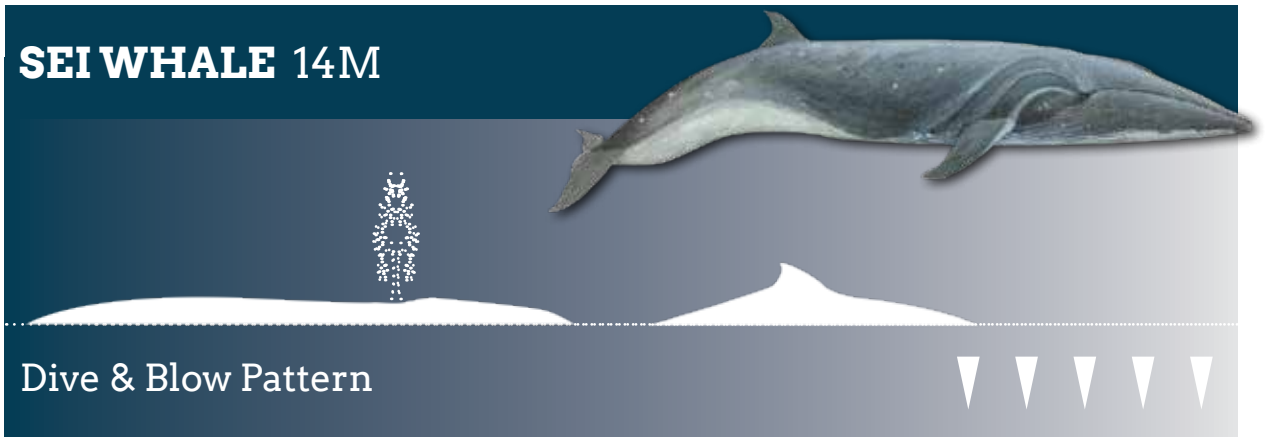

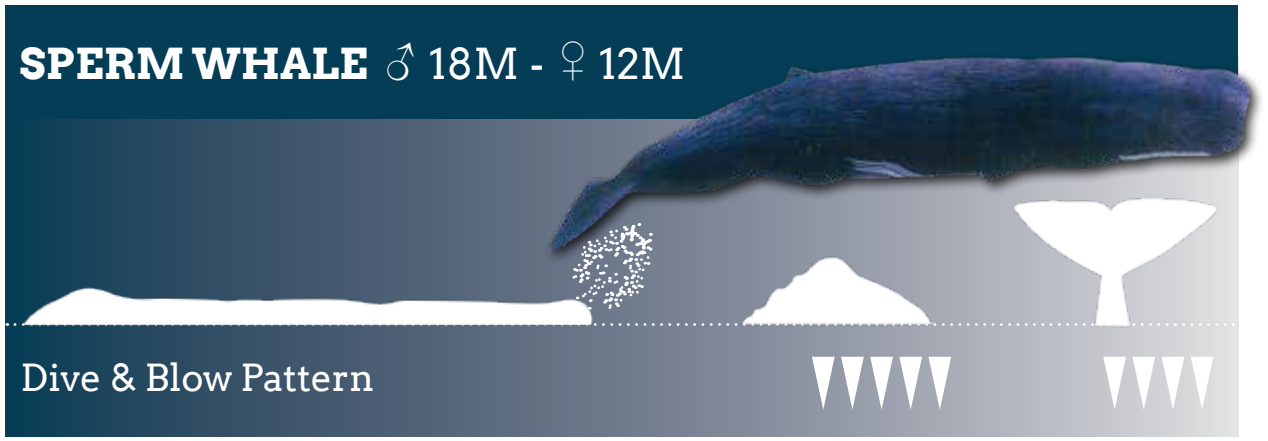

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HUMPBACK WHALE
SIGHTINGS AND STRANDINGS

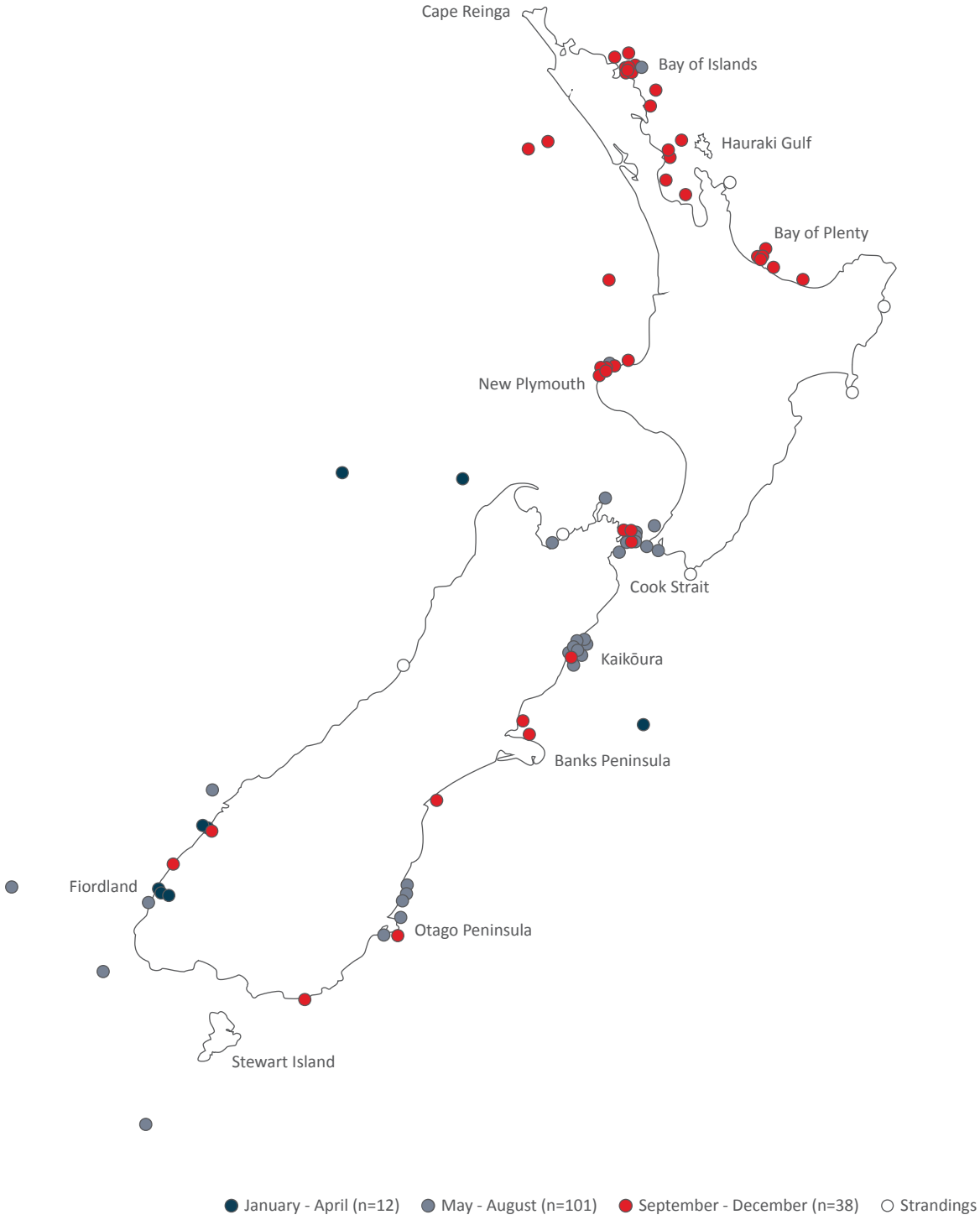
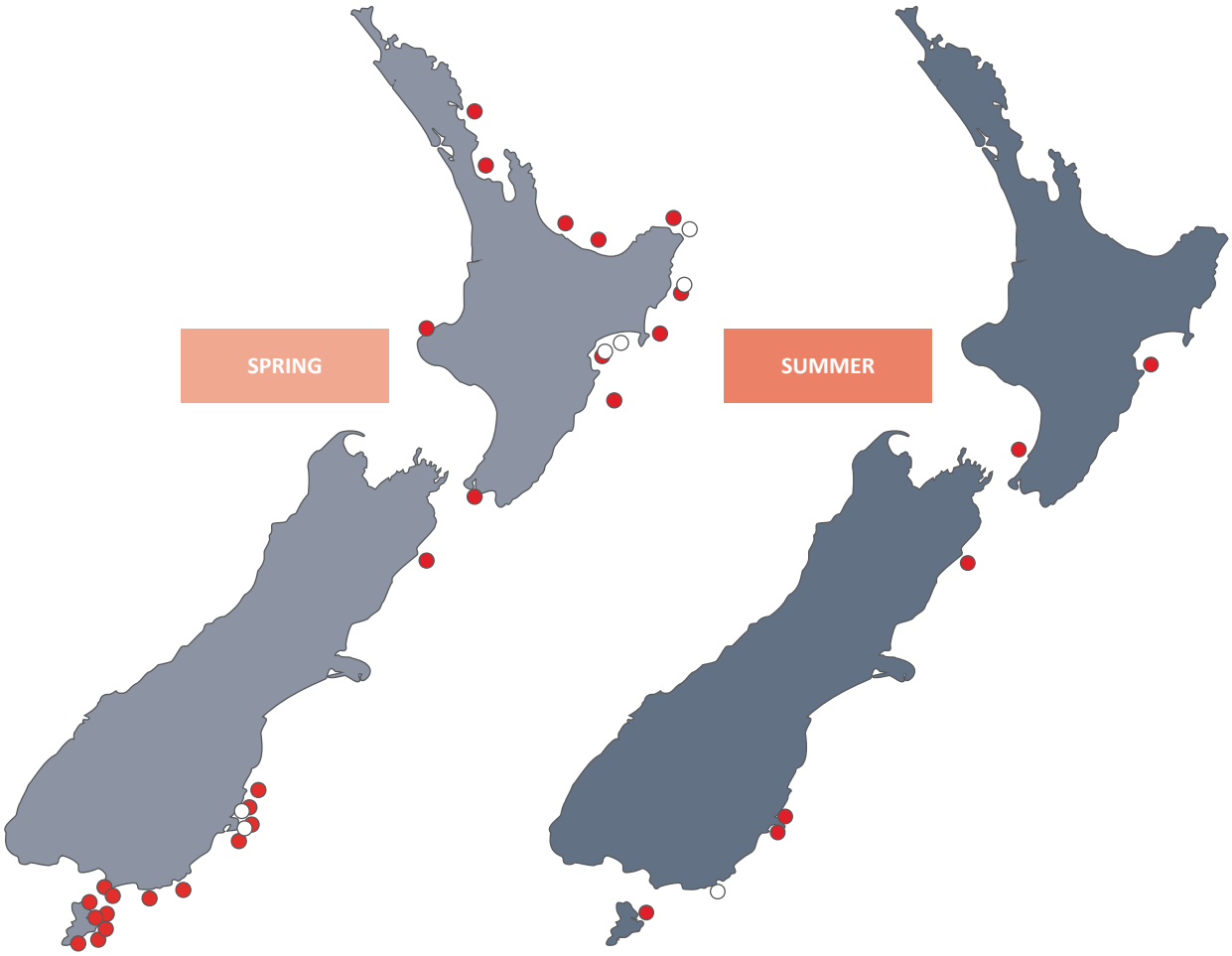


FIGURE 1. The locations of humpback whales sighted or stranded per month along New Zealand coastlines. *(Gibbs, N. & Childerhouse, S. (2000)).*

HUMPBACK WHALE
MIGRATORY ROUTES

FIGURE 2. The northern and southern migratory routes of humpback whales in New Zealand waters. Fan indicates main areas where humpbacks are inferred to approach or leave coastal waters (modified from Dawbin 1956). *(Gibbs, N. & Childerhouse, S. (2000))*

RIGHT WHALE
SEASONAL SIGHTINGS



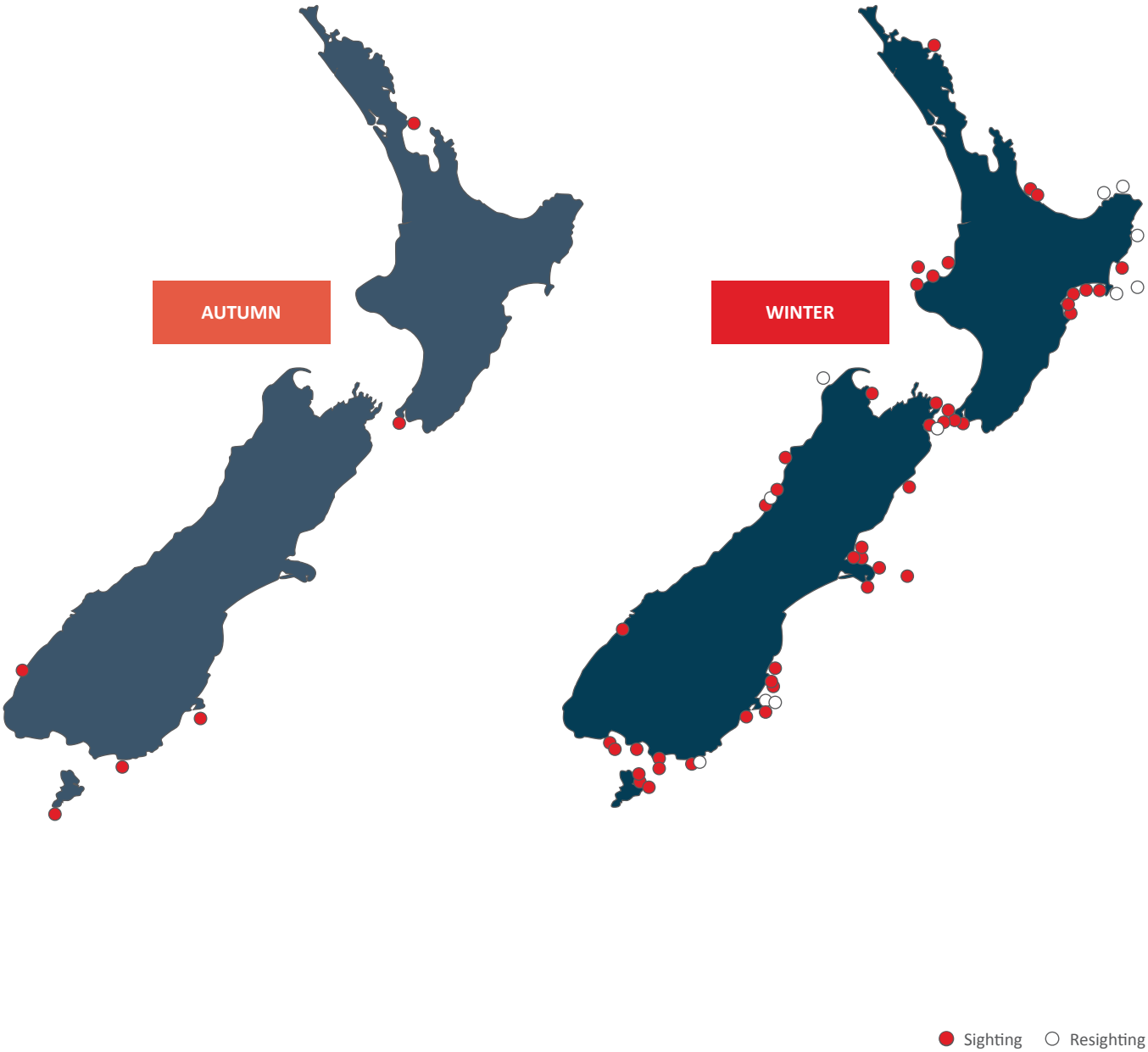


FIGURE 3. Location of sightings of right whales around mainland New Zealand from 1976-2002 during spring (21 September - 20 December), summer (21 December - 20 March), autumn (21 March - 20 June) and winter (21 June - 20 September -)*(Patenaude, N.J. (2003).*

AVOIDING AND MITIGATING ENTANGLEMENT OF MARINE MAMMALS IN ROCK LOBSTER POT BUOYLINES

Interactions between marine mammals and commercial fisheries have occurred worldwide for centuries but now are apparently increasing in frequency, a trend likely to continue as the international demand for high quality, high value seafood continues whilst cetacean populations increase annually.

New Zealand waters are occupied permanently or seasonally, by about 9 species of baleen whales, 3 species of sperm whales, 13 species of beaked whales, 1 species of porpoise, and at least 18 species of dolphins. New Zealand straddles the migration routes of many of the large and medium sized whales travelling through the southwest Pacific between the tropics and Antarctic, a fact exploited by early whalers.

Whaling in New Zealand began in 1792. Right whales and humpbacks, the two baleen whale species most involved with entanglements in New Zealand waters, were reduced to 'commercial non-viability', i.e., near extinction, by commercial whaling by the 1840s and 1960 respectively. Humpback whales were taken commercially in New Zealand from the late 1850s to 1962 when, because of overfishing throughout its range, from the tropics to the Antarctic, the stock crashed.

Perano's whaling operation in Tory Channel, which had operated almost continuously for 72 years, switched to sperm whaling and, as a result of an almost 50% reduction in the world sperm whale oil price, ceased operations in December 1964. In the absence of commercial whaling, stocks of all the large whales in the southern hemisphere are increasing at rates ranging from about 7% to 13% annually.

In 1978 the government promulgated the New Zealand Marine Mammal Protection Act (1978), providing full protection for all marine mammals within the 200 nautical mile zone of New Zealand.

The two baleen whale species which travel inshore along the New Zealand coast annually are humpbacks and southern right whales. Humpbacks migrate south from mid-September to early December, and north from May to early August. Southern right whales occur in New Zealand coastal waters in all four seasons, with the majority in winter months.

Three whale species predominate in entanglements in rock lobster gear in New Zealand waters, they are humpback whales, southern right whales, and orca.

Recovery of both humpbacks and southern right whales has been slow with females of both species producing one calf every three years or so. Southern right whales were reduced to less than 10% of their original population size by 19th century whaling and were internationally protected in 1936. In New Zealand waters right whale recovery suffered a major setback in the early 1960s when the unregulated Soviet "Slava" whaling fleet, moving north through the New Zealand subantarctic in March-April, took about 128 right whales in Auckland Island waters, and other baleen whale species through the south-eastern waters of the South Island.

The New Zealand population of right whales numbers over 2,000 animals, while the once large humpback population migrating nearshore past New Zealand annually, probably numbers no more than 250-500 individuals.

The third species of cetacean involved with entanglements in New Zealand waters is the orca, the largest of the dolphins. Although they are not greatly abundant worldwide, there are thought to be about 80,000 orca south of the Antarctic Convergence, and a local New Zealand population of about 200 orca in 3 groups.

Scope of the Entanglement Problem

In the 33 years between 1984 and 2017, 44 large whale entanglements in New Zealand waters were reported, of which 39 were attributable to pot/trap and set net fisheries. Twenty-five (64%) involved humpback whales, eight (21%) orca, three (8%) southern right whales, one minke whale, one blue whale and one unknown baleen whale were documented as entangled.

From 1991-2017, 1.4 whales per year were reported as entangled in pot/trap and set net fisheries in New Zealand waters. 62% of large whale entanglements involved rock lobster and 'likely' rock lobster gear, 21% of entanglements involved set net gear, and 18% of entanglements involved either rope from an unknown gear type, or the gear involved in the entanglement was unknown[1].

Most entanglements recorded were observed on the east coast of the South Island and the Bay of Plenty/ Coromandel region of the North Island, although it is important to note that this is where the entanglement was observed and reported, and not necessarily the location of the actual entanglement. Almost one third (11 of 39) of all entanglements were recorded in the month of June, and these were exclusively humpback whales. Of these 11 entanglements, eight (73%) occurred in the region of Kaikōura, two in Marlborough and one around Banks Peninsula.

For the years 2018 and 2019, the total number of observations of all cetacean species recorded by month in the New Zealand Whale Stranding Database was 1619 whales (837 and 782 respectively). Of these, humpbacks totalled 52, i.e., 32 in 2018 and 20 in 2019. 72 orca were recorded, i.e., 29 in 2018 and 43 in 2019. Southern right whales totalled 27, i.e., 21 in 2018 and 6 in 2019.

The total numbers by species entangled in rock lobster buoy lines were: humpbacks 2018-2019 (6) i.e., 2018 (2) and 2019 (4). Orca entangled in 2018 (0), 2019 (2). No southern right whales were specifically recorded entangled in either 2018 or 2019. However, in 2018 one animal identified as *Balaenoptera species* species (sic) was recorded[2]. The problem with this record is *Balaenoptera spp.* includes 2 blue whales, fin and sei whales, Bryde, minke, and humpback whales.

Given the figure of about 1.4 whale entanglements per year, and the levels of population recovery for New Zealand humpbacks and southern right whales, the risk from entanglement is likely to be low. However, the risk to the small local population of orca from a single entanglement is likely to be of greater concern.

It is without doubt that the animals at greatest risk of entanglements are northward migrating humpbacks travelling along the east coast of the South Island in the winter months when the Kaikōura rock lobster fishery effort is high.

Two government agencies maintain databases on events involving marine mammals in recreational and commercial fisheries. The MPI Fisheries database is derived from records kept by fisheries observers at sea through the national Fisheries Management system, and from carefully designed surveys of recreational fishers. The Department of Conservation (DOC) maintains an ever-increasing database of sightings and incidents involving marine mammals, including; whale strandings, collisions with vessels at sea, natural deaths and those attributed to fishing gear. However, the DOC database records do not always differentiate between recreational and commercial fisheries and verification of records is a continuing problem. Thus, the numbers of entanglements should be regarded as minimum estimates only.

Entanglement is a problem which must be addressed as rapidly as possible. With very small, slowly recovering populations of both humpbacks, right whales and orca in the New Zealand region, any fatal entanglements have the potential to slow recovery. Rock lobster fishermen can only benefit from being proactive and exploring and developing means to mitigate entanglements, i.e., to become "the fence at the top of the cliff rather than the ambulance at the bottom".

The more that rock lobster fishermen learn about the seasonal movements and behaviour of the animals likely to interact with their gear, the better at their job they become.

This understanding fosters rapid modification of fishing techniques, innovative gear design and "whale-safe" fishing.

1 Laverick, S. et al. (2017)
2 Hendriks, H. pers. comm. (2021)

DESCRIPTION AND STATUS OF WHALES

Humpback whales

Humpbacks grow to about 15m and weigh around 45 tonnes. Their name comes from the way they arch their back on diving raising the dorsal fin as they submerge. Their most distinctive features are their long oar-like flippers, almost one third of their body length, with knobs on the leading edges. Similar bumps also occur on the head from snout to blowhole and along the lower jaws, with each of these bearing a single stiff hair. The broad tail flukes have a scalloped trailing edge. Their basic colour pattern is black above and white beneath.

They are one of the most curious whale species often approaching stationary vessels and investigating floating objects. They are probably best known for their spectacular behaviours; leaping almost clear of the water (breaching), waving their flippers clear of the water, lifting their snouts clear of the water (spyhopping), and raising their tail flukes clear of the water when diving. Patterns of black marks on the white underside of the tail are used as photographic identification for each animal.

Male humpbacks are renowned “singers”, producing complex phrases of notes which they repeat for 30 minutes or more, presumably to attract females in the breeding season. Their songs are distinctive for the population they belong to. They also make social sounds and calls when feeding.

Mating and calving occur in the winter months after a gestation of 10-11 months. Only one calf is born. Calves are weaned after about 6 months and may begin feeding on krill during their first Antarctic season. Another calf will not be born for 2-3 years.

Most migrating baleen whales rarely feed during migration, but humpbacks appear to forage opportunistically on a wide range of food species during their travels south and north. In the Antarctic feeding grounds during the southern summer they feed largely on krill *(Euphausia superba)*. But further north, they consume a wide variety of small school fish such as mackerel, anchovies and sardines.

While on migration past New Zealand, humpbacks swim slowly close to shore and have been recorded feeding on lobster krill *(Munida gregaria)* in the Canterbury Bight. They are one of the few baleen whale species which cooperate during feeding bouts forming ‘bubble nets’ to concentrate their prey into ‘baitballs’ through which they lunge toward the surface taking vast amounts of food in a single mouthful.

Migration of Humpbacks

Humpbacks make very long seasonal migrations, usually in small groups of 2-10 animals, between summer feeding grounds in Antarctic waters where they feed almost exclusively on krill, and winter breeding grounds between latitudes 10°S - 22°S around New Caledonia, Tonga and Fiji during the southward migration. At a round trip of over 6000 nautical miles, these migrations are amongst the longest-known of any mammal.

Although capable of a maximum swimming speed of about 15 knots, migrating humpbacks travel about 200 nautical miles per week at a leisurely 1.5 - 3.0 knots.

Northbound humpbacks probably begin their migration from the Antarctic feeding grounds in April, taking about one month to reach New Zealand waters. They are first seen in the vicinity of Port Pegasus, Stewart Island and in small numbers off the Otago coast in May-June. Most of the migrating humpbacks travel in a straight line north between Otago and Banks Peninsulas although a few move inshore through the Canterbury Bight. The migrating whales swing slightly inshore toward Kaikōura then parallel the coast to Cook Strait, where the majority pass northwest through the Strait in June-July.

When they exit Cook Strait the whales turn northwest toward Cape Egmont and stay offshore as they move north past North Cape. Those humpbacks which do not turn west into Cook Strait move inshore up the east coast appearing first in Palliser Bay in June. From there, they follow the coast to East Cape by-passing Hawke’s Bay enroute. They cross the Bay of Plenty, often just a few miles offshore, and travel northwest passing the Coromandel Peninsula from June to August before leaving North Island waters. A smaller splinter group of northbound humpbacks travel along the west coast of Stewart Island and, on reaching the latitude of Puysegur Point, move offshore and appear

to travel due north through the Tasman Sea enroute to the breeding grounds in the sub-tropics[3].

The critical period for the NZ rock lobster industry is during the winter months of May-August when most of the northward migrating humpback stock is travelling closer inshore than during the spring southbound migration from October-December.

Currently, seven southern hemisphere breeding populations of humpbacks are recognised, one each on either side of South America, Africa and Australia, and the 'Oceania' stock in the central South Pacific. The 'New Zealand' humpbacks are thought to be just part of the 'Oceania breeding stock' with genetic links to the New Caledonian and east Australian stocks. In 2005, the abundance of the 'Oceania stock' was estimated to be only 4,329 whales.

Humpbacks were afforded full international protection by the International Whaling Commission in 1965. Consequently, this stock is classified as *Migrant* under the New Zealand Threat Classification (2019) and *Endangered* under the IUCN listing (2008).

Southern right whales

The southern right whale is a large robust whale up to 17m long. It has a large head with strongly arched jaws, large paddle-like flippers, and no dorsal fin – its defining identification feature. Its blow, seen from ahead or astern, is characteristically V-shaped. Right whales are the only species to produce a double blow.

Body colouring is generally black but there may be splashes of white on the belly. About 3% of newborn calves may be white patterned with black spots, patches and dashes. Calving occurs in winter through spring. Patches of raised, rough, warty skin (callosities) are usually present on the chin, snout, along the lower jaw and lips, and above the eyes. These often appear creamy yellow in colour caused by the presence of accumulations of whale lice. Callosity patterns remain throughout life and are used to identify individuals.

The pre-whaling total population size of southern hemisphere southern right whales may have been as high as 65,000[4].

3 Dawbin, W.H. (1956)
4 Bannister, J. (2008)

Southern right whales were almost exterminated from the New Zealand region by excessive pelagic and commercial bay whaling by about 1845. Coastal bay whaling in New Zealand continued until the 1920s. The recovery of southern right whales has been painfully slow, due in part to the fact that these whales have only one calf every 3 years.

No southern right whales were sighted by the Cook Strait whalers between 1927 and 1963. In that year the first in 36 years was recorded and photographed in Tory Channel[5]. Two other right whales were seen in that year, one in Hauraki Gulf and the other in eastern Foveaux Strait.

It is now believed that there is currently one population of southern right whales in New Zealand waters with a range including two wintering grounds; the primary wintering ground around the NZ subantarctic and the secondary wintering ground of mainland NZ. Between 1995-2009 this population was estimated at 2,169 whales, with a 5% rate of increase for females and 7% for males in the subantarctic population[6].

Females become sexually mature at 8-9 years of age. Gestation lasts about about 12 months, and a single calf is born in coastal waters around July-August. Studies in Australia have shown that cows may return briefly with the calf to its birth locality in the year after birth. Southern right whales appear to be re-occupying favoured calving grounds around the mainland coast, possibly by expanding the range of the subantarctic population.

It is only recently that the movements of southern right whales from the Auckland Islands breeding area have been revealed. In August 2020, six whales were satellite tagged in Auckland Islands waters. All six animals headed south then northwest toward the Great Australian Bight. Five of the tags transmitted positions of the whales for 40-237 days before failing. As of April 2021, one tag was still transmitting. That animal had continued travelling west into the south-central Indian Ocean where it turned south and travelled as far as the Antarctic. From there it turned east and moved parallel to the Antarctic coast back toward the New Zealand subantarctic. If the tag is still transmitting, the data will be remarkable.

5 Cawthron, M.W. pers. obs. (1963)
6 Carroll, E.L. et al. (2013)

Southern right whales are 'skim feeders' with a diet predominantly of copepods taken in the upper part of the water column near the surface.

Southern right whales are classified as *Nationally Vulnerable* under the New Zealand Threat Classification (2019) and *Least Concern* under the IUCN listing (2017).

Orca

Orca, the largest of the dolphins, are the most cosmopolitan cetacean species ranging from the equator to the polar ice edges in both hemispheres, and one of the most easily recognised of all cetacean species being found particularly in coastal and high productivity oceanic waters. In the Southern Hemisphere, orca have been divided into 4 morphological types; A,B,C and D, based primarily on physical features and colouration[7].

In the New Zealand region only type 'A' orca have been considered resident in New Zealand waters and are regularly sighted around the North and South Islands, east to the Chatham Islands and south to the subantarctic islands. It has been suggested that there are three populations of orca: one around the North Island, one around the South Island and one transient population moving between the two[8]. However, recent research provides evidence for long distance migrations of type 'C' orca between the Ross Sea and New Zealand waters and seasonal site fidelity at these widespread destinations. The best example of this is of one female recorded on 6 occasions between 2001 and 2015 off Whangarei, the Bay of Islands, and McMurdo Sound in the Ross Sea[9].

A large proportion of the type 'C' cetaceans in the above study bore the circular scars from attacks by cookie-cutter shark *(Isistius sp)* currently assumed to be restricted to waters north of 55°S, further possible evidence of polar migration by orca from the New Zealand region. Until the taxonomy and genetics of orca is properly determined it may be preferable to refer to these cetaceans as one type[10].

7 Jefferson, T.A. et al. (2008)
8 Visser, I.N. (2007)
9 Eisert, R. (2015)
10 Cawthron, M.W. (2016)

Female orca reach sexual maturity around 10-15 years of age and males at about 15 years. After mating, the gestation lasts about 15-18 months, an exceptionally long period for a marine mammal.

Orca have a robust, spindle shaped body. Adult males may reach 9m-10m and weigh up to 10 tonnes. The smaller females may reach 8.5m and 7.5 tonnes. At birth calves may reach 2m-2.5m and weigh 160kg-180kg. Calves are weaned after being suckled for 1-2 years or more.

The male's tall, triangular dorsal fin may reach 1.8m high and at times appear to lean slightly forward. The dorsal fins of females and young animals are crescentic, almost 1.0m high with slightly rounded tips. The flippers are large, oval and have blunt tips; the tail flukes are broad with an almost straight or slightly convex trailing edge. The snout is blunt with a very short beak.

The black and white colour pattern on this species is unmistakeable. The back is uniformly black except for a grayish 'saddle patch' behind the dorsal fin and an oval, white patch behind each eye. White colouring extends from the underside of the lower jaw rearwards to the genital area. Two crescentic white lobes curve rearward up across the flanks behind the dorsal fin.

Orca are top predators feeding on marine mammals, seabirds, fish, sharks, and rays in New Zealand coastal waters. They are regular visitors to feeding areas. In Cook Strait they arrive at the fur seal rookeries in August when weaned pups are leaving the colonies.

When hunting marine mammals such as seals, orca will act as a well-coordinated team to outwit their prey. Through Cook Strait in October, pods patrol close inshore when searching for rays. They enter harbours and move close inshore along the rocky coast, often within 2-3m of water. On locating large rays, they will bite out the fat-rich livers and discard the rest of the fish.

Studies of orca show that groups are organised into stable family units comprising a matriarchal female, her immediate offspring and their offspring, thus family pods can contain up to four generations. These inter-generational bonds are very stable and permanent.

Orca are very long-lived with males reaching 50-60 years and females 80-90 years.

In the Southern Hemisphere there are thought to be about 80,000 orca south of the Anatrctic Convergence.

Orca are classified as *Nationally Critical* under the New Zealand Threat Classification (2019) and *Data Deficient* under the IUCN listing (2017). They are fully protected under the New Zealand Marine Mammals Protection Act (1978) throughout New Zealand waters.

Pot, Trap and Setnet fisheries in NZ

Around New Zealand, pots are used in the rock lobster, scampi, cod and crab fisheries; but only rock lobster potting is known to have entangled whales. However, any of the other methods of potting have the potential to entangle whales IF the pots are connected by a line to buoys at the surface. Rock lobster pots have been set in water as deep as 275m[11] but most rock lobster fishing generally occurs within the 100m depth range.

Rock lobster pots used in New Zealand waters are usually rectangular constructions of welded steel reinforcing mesh, or heavy synthetic trawl net mesh over a welded metal frame, with an entrance on the upper surface and escape gaps for small rock lobsters on the sides[12]. To enable location of each pot, a line is attached from the pot frame to one or more marked buoys at the surface. There is usually sufficient buoy line to account for current and tide, which can drag buoys beneath the surface.

The pots used in the rock lobster fisheries in Fiordland waters and around Stewart Island, where tidal currents are often very strong, weigh about 80-140kg, and pot lines are of 12mm-14mm Duradan (a polypropylene-polyethylene combination, or similar) with a breaking load of 2,654-3,636kg. Soak times are usually overnight to 3 days. Pots are normally lifted onto vessels using hydraulic haulers.

Further north and in North Island fisheries pot weights are somewhat lighter, around 50kg, and sizes and shapes vary according to the fishers' preferences. The principal areas where the greatest concentration of rock lobster potting occurs are; Jacksons Bay south to Te Waewae Bay, north between Banks Peninsula and Cape Campbell. In the North Island from; Palliser Bay north to Cape Turnagain and between Hicks Bay and Bream Bay.

11 Annala, J.H. & Bycroft, B.L. (1984)
12 Cave, S. & Wichman, L. pers. comm. (2021)

Set Netting

Set netting occurs generally around the entire New Zealand mainland coast but particularly from Oamaru north to Banks Peninsula, Cheviot to Cape Campbell in the South Island, and in the North Island across the Bay of Plenty, inner Hauraki Gulf, Bream Bay to Cape Reinga. Set netting density is greatest in the coastal areas of Hauraki, Marlborough, Kaikōura, Timaru, Southland and Fiordland.

The areas from Fiordland up the east coast of the South Island and west coast of the North Island are all regions where humpback whales migrate north close to shore.

Nets are set depending on the target species, on the bottom for flatfish and other demersal species and near the surface for schooling species such as kahawai. The nets are held approximately vertically in the water by a combination of sinker weights on the ground ropes, and floats along the headlines. The ends of the net are fixed to the seafloor by anchors or weights from which vertical lines rise to buoys at the surface.

Nets can soak for 18-24 hours at sea, although in harbours, setting time can be short with nets set and lifted through tide changes. Mesh sizes vary depending on the target species, as does the netting which may be dark coloured laid synthetic, or transparent monofilament. Baleen whales feeding at the surface occasionally run into monofilament and other types of set nets which wrap around the whales' snouts, jaws, and flippers.

WHY, HOW AND WHERE DO WHALES BECOME ENTANGLED

Manoeuvrability

With regard to entanglements, the baleen whales fall into two physical groups. First, the oceanic, fast swimmers with long, streamlined bodies and relatively short, tapering, paddle-shaped flippers, such as blue whales and fin whales, are rarely entangled. Second, the slower swimming right whales and humpbacks which travel and feed closer to shore and dominate the large whale entanglements in NZ waters. These whales are somewhat bulkier for their length. Both have broad tail flukes, with very long (4.0m-5.0m) oar-shaped flippers with knobbed leading edges – in the case of humpbacks, or right whales with broad, roughly sub-rectangular flippers about 1.7m long.

Unlike fish, all cetaceans have horizontal tail flukes. Their drive comes from vertical beats of the flukes. They have only one gear and that is forwards. If they wish to turn suddenly, they will change the angle of their flippers, flex their bodies, roll, and bend the tail stock to one side or the other as much as is required to complete a turn. This flexibility and slow, precise manoeuvring are found in cetaceans utilizing more complex habitats[13] ranging from open ocean to close inshore. Humpbacks can make tight turns for their body length, particularly when concentrating prey at the surface within 'bubble nets'. Right whales can manoeuvre happily in water depths 1.5 times their body length.

Echolocation

Toothed whales such as sperm whales and orca use sound for both communication and echolocation. Although they probably do have the ability to detect net headlines, pots and other objects in the water it does not prevent orca from becoming entangled.

It does appear that although humpbacks and right whales use sound to communicate, they, like other

13 Fish, F.E. (2002)

baleen whales, do not have the ability to echolocate objects. This raises the possibility that they could blunder into thin synthetic lines which are unlikely to be easily seen. They will entangle in pot lines at any depth in the water column, from surface to close to the pot on the seafloor.

Sight

Humpback and right whales' eyes are set laterally at the widest part of the head and can be moved both horizontally, vertically, and also in and out. If humpbacks and right whales want to see objects directly ahead, they will raise their chin and look downward reducing the size of the 'blind spot' directly in front of them. To study objects at, or near the surface they will roll to one side 'eyeballing' the objects as they pass.

Whales' underwater vision is good with peak sensitivity in the blue range, thus high contrast colours such as red, will appear very dark, or black[14].

The majority of entangled whales are probably naive and unused to coming into contact with vertical lines in the water which are not perceived to be a hazard.

Orca will rub their skin on selected patches of gravel and have been observed rubbing on buoy lines. Southern right whales at the Auckland Islands have been observed rubbing on vessels' anchor chains in Port Ross. In the same location, one right whale was observed, apparently enjoying repeatedly rolling about among long stalks of bull kelp at the surface so it wound around its' body then slid off as the whale slowly swam through the kelp. Humpbacks and dolphins will pick up pieces of floating seaweed on their flippers and carry them about until they lose interest.

It is not surprising therefore, that during migrations when whales are passing close to shore, a humpback, right whale, or orca will come into contact with a long vertical line in the water, catch it over a flipper or fluke and, in its efforts to rid itself from the rope it cannot see, becomes increasingly entangled. If a pot line is caught across the mouth, around the body, flipper, or wrapped around the tail stock, inescapable entanglement is most likely.

As the cetacean tries to rid itself of the line, the combined resistance of the weight of the pot beneath and the buoys above causes the hard, synthetic line to cut through the skin and blubber into the muscle beneath disabling the rapidly tiring animal and, in the worst case, causing a slow death from drowning or stranding.

Curiosity

Many whale species are compulsively curious. They will investigate floating objects, from stationary boats to buoys, coils of rope, bits of wood, even discarded human clothing. Many years ago off Kaikōura the author watched a pod of 6 male sperm whales playing with a 6m-8m wooden spar, flailing it about like some gargantuan toothpick. At the Tory Channel whaling station in 1963, 3 wooden planks from an olive oil box, one coconut and an old leather boot were found in the stomach of a large male sperm whale[15].

This begs the question, is entanglement the result of juvenile naivety, curiosity and unfamiliarity with fishing gear, or a genuine accident caused by the whale being unable to clearly see thin lines in the water and blundering into them?

Observations of entanglements immediately after the event are very rare but on 28 October 2020 at 5:45pm, three recreational fishers spotted a small group of orca apparently in distress. A orca calf had become entangled with a rock lobster buoy line and float about 30km north of Napier. One of the fishers said, ***"There were three or four holding the baby up and as we got closer, they all moved away, except for one, which we assumed was the mother."***

The other members of the pod remained close to the exhausted calf, circling near the mother who would not leave its side. The fishers could see the buoy line around the calf's tail stock just forward of the flukes. The mother remained with the calf as the fishers pulled up the pot line and cut the calf free. The disentanglement took less than five minutes, and the pod of orca swam away[16].

14 Mass, A.M. & Supin, A.Y. (2002)

15 Cawthron, M.W. pers. obs.
16 Gilbertson, G. (2020)

AT WHAT DEPTH DO WHALES ENTANGLE?

Right whales are 'skim' feeders taking in swarms of copepods close to the surface. They are most likely to become entangled close to the buoy line. Humpbacks have a varied diet and generally feed in the upper water column. However, recent research[17] reveals they are capable of dives to 616m. When near land, orca usually stay in surface waters, but data logging tags have shown they are capable of dives to 700m[18]. Therefore there are no hard and fast rules as to where in a buoy rope an entanglement may occur.

Mitigation Measures

The dynamics of whale entanglement are not well understood, because few people have been able to observe an entanglement occurring. Gear mitigation methods therefore become a necessary exercise in trial and error.

1. **GEAR MODIFICATIONS:**

   The greatest problem for migrating whales travelling along the coast is encountering collections of vertical pot lines in their path, all of which have to be negotiated without contact. Gear modifications therefore have two basic aims; to reduce the number of vertical lines from gear on the seafloor to buoys at the surface (through minimisation or removal of slack lines), to avoid or reduce entanglement of passing whales, while allowing fishing to successfully continue. The simplest methods to achieve this are to reduce slack lines (by coiling up or tying surplus line) and removing unfished gear from the water. The following section considers other mitigation methods that have been or are continuing to be developed and trialled.

   (a) Ropeless fishing / on demand releases

   Remote or acoustic release systems are designed to remove all rope from the water column. These systems rely on two features to bring traps to the surface; (1) GPS to locate the sunken gear and (2) an acoustic signal to activate the flotation system incorporated in the pot and bring the buoy line to the surface. This system has been tested on the Australian Continental Shelf where traps are often set in deep water with strong currents, and in USA coastal waters with heavy coastal shipping traffic. However this equipment is expensive.

   (b) Galvanic timed releases

   Ropes and floats attached to pots are "stored" near the seafloor and released by means of a soluble anode which corrodes through electrolysis in salt water to breaking point at a pre-set time. Anode links are made to release at times ranging from 60 minutes to 100 days. Reliable release times depend on salinity and temperature at the operating depth.

   Galvanic timed releases appear to be one of the most cost-effective options available for temporarily reducing the amount of slack potline in the water.

   (c) Weak links in buoylines, set net headlines

   In the USA the National Marine Fisheries Service (NMFS) and other agencies have been studying 'weak links' designed to break apart when pressure on gear is greater than that exerted under normal fishing conditions, such as when a whale swims into the net or becomes entangled in a buoy line.

   After many years of trials, weak links have not reduced the incidence or severity of entanglements in pot or set net fisheries.

   (d) Rope colour

   Whales' eyesight is monochromatic ranging from white to black at either end of the colour spectrum with peak sensitivity in the blue range. Recent research in the Gulf of Maine lobster fishery has focused on assessing the visibility to northern right whales of different coloured potlines[19]. Tests found bright and contrasting colours such as red appear black to whales and are therefore more visible.

   Rope colour trials in the Western Australian rock lobster fishery were conducted assessing the colour of pot ropes involved in humpback

17 Derville, S. et al. (2020)
18 Reisinger, R.R. et al. (2015) in reference footer

19 Kraus, S.D. et al. (2014)

entanglements. Colours included yellow, red, orange, green, pink and blue, all of which featured in entanglements. The tests found yellow and orange coloured ropes occurred most frequently, while red was absent from entanglements despite being used in 19% of header (buoy) ropes in the fishery[20]. Whales may more readily perceive high contrast colours and thus avoid them.

(e) Rope size

In Western Australian trials, thin ropes (8-10mm) were statistically over-represented in entanglement reports compared to their surveyed use in the fishery. It was thought thin ropes are more pliable and less rigid than 12-14mm rope and could tangle more easily as the rope lays over the whale's body. Additionally, thin, lightweight rope may provide fewer visual and tactile cues to the whale that it has picked up a buoy line.

It appears that 12mm to 14mm Duradan, or similar rope is most widely used in the New Zealand rock lobster fishery. Given the nature of the fishery and the areas worked there would be little advantage in changing rope types at this time.

(f) Sinking/weighted line

Given that, in New Zealand waters, pots are set singly, the advantage in the use of weighted lines would be to reduce the length of slack buoy line that could be floating on the surface.

(g) Biodegradable ropes

Biodegradable ropes have been suggested as a possible means of causing an entanglement around a whale's body or tail stock to break free as the rope fibres degrade and weaken. To be effective these ropes, or sections of rope, should degrade and part as soon after entanglement as possible allowing the entanglement to slip off.

Of all the ropes traditionally made of vegetable fibre the most common are manilla, sisal and coir (coconut fibre). Of these, manilla and sisal are the preferred fibres respectively. Both are negatively buoyant. Manilla has a softer fibre than sisal which is stiffer, absorbs water more readily than manilla and deteriorates faster. Both sisal and manilla have similar weights and safe working loads. However both fibres are rapidly weakened by abrasion, knots, cuts, and fungal decay if stowed away wet. As yet, biodegradable synthetic ropes do not appear to be available.

There has been little work done on assessing the practicality of biodegradable ropes as pot or float lines. However, as vegetable fibre rope is negatively buoyant and sinks, retrieval of a float line using a hand-thrown grapnel could be difficult.

(h) Acoustic devices

Also known as Pingers and Clangers, acoustic devices are intended to dissuade harbour porpoises in the USA, and Hector's dolphin in New Zealand, from approaching nets, and humpback whales from entering areas of high rock lobster pot density in Western Australia have been trialled for many years. These devices were designed as a warning to cetaceans rather than a deterrent. The results with dolphins have been equivocal and not entirely successful.

Perversely, ADDs (acoustic deterrent devices) emitting a variable signal designed to dissuade dolphins from approaching aquaculture gear in New Zealand have occasionally had the opposite effect, with dolphins being attracted from over 1 nautical mile away to remain for 5-10 minutes within 2m of the ADD operating at full power.

Studies on humpback whales during both northward and southward migrations in Australia showed limited response to ADD tones well within the hearing range of the whales.

(i) Effort management

Temporal and spatial closures are an option to reduce entanglements in the rock lobster fishery. A closure of the fishery during the northern humpback migration would largely solve the problem of entanglement. However, to be effective, migrating humpbacks would have to be continuously, accurately tracked throughout the months of northward migration. Effective spatial closures of fishing areas during the migration would require a continuous and very detailed analysis of locations of entanglements to allow specific areas to be managed. However, entangled whales can move considerable distances from the point of entanglement, compounding the difficulty in assessing the areas for management. With the rate of entanglement being so low (approximately 1.4 whales per annum) any future effect on the

20 How, J. et al. (2015)

populations of right whales and humpbacks are likely to be minimal.

Neither temporal nor spatial closures, both of which rely on multi-year time-series of data, are the most practical solution at this time. Financial costs to the industry of temporal and spatial closures throughout the northward migration would be extreme.

When fishers become aware of whales in the area or approaching, it would be prudent to lift their gear, advise other fishers in the area, and delay resetting until whales have passed.

2. TRACKING TECHNIQUES TRIALLED

(a) Kegging

Kegging is a technique adopted from the days of open-boat whaling whereby a number of floats or kegs were fastened to a harpooned whale. The drag from the floats exhausts the animal allowing it to be approached. It has now been adopted as a standard practice by entanglement-release teams to slow down an entangled whale sufficiently for them to attempt to clear the entangling gear from a whale's body.

It can also have the opposite effect - a DOC entanglement team attached buoys to an entangled humpback which somehow found the strength to swim away from the team as dusk approached and the team had to abandon the chase. The whale swam into Tory Channel and subsequently became entangled in a mussel farm, where the line around its tail stock was quickly removed by the mussel farm staff.

(b) GPS tracking buoys

GPS tracking buoys are a promising development which could be pursued. These devices have an iridium modem built into the unit. Once activated they are attached to an entangled whale allowing rescuers to rapidly follow the course of the whale and intercept it to free it from entangling pot lines, netting or other debris.

The NZ Rock Lobster Industry Council has recently acquired 3 GPS tracking buoys which have been provided to DOC personnel in Kaikōura and the Bay of Islands to be used by disentanglement teams as necessary.

(c) Colour marking of pot lines for area

This is a simple, inexpensive means to identify the area in which a pot is set. Thirty centimetres or so of the pot line, where it joins the buoy rope, is marked with a bright colour or combination of colours designated to the home port or area of the fishers. If the attached pot is picked up by a whale, other fishers or disentanglement teams can immediately assess how far it has travelled while burdened by rope and a pot, and gauge how exhausted the animal may be before attempting a rescue.

(d) Training of fishers in disentanglement techniques and incorporation into DOC disentanglement teams

Rock lobster fishers are the people on the spot if an entanglement occurs. They are skilled seamen with first-hand knowledge of the areas they work. It would be a considerable advantage to all organisations involved in disentanglement if they could be trained as first responders at whale entanglements. The readiness, local knowledge and vessel handling skills of professional fishermen are beneficial to any disentanglement operations.

SAFETY: GENERAL RULES WHEN ENCOUNTERING WHALES

Migrating whales, either singly or in small pods, are normally relaxed and maintain a steady course and speed. Humpbacks and southern right whales are the species most commonly found in inshore waters. Orca will travel at a speed the slowest members of the pod (calves) can maintain. Pods may range in size from 10-30 animals or more.

When animals are within about 200m, travel at a slow, 'no wake' speed. Do not accelerate rapidly - rapid changes in motor noise will alarm the animals which may dive. No vessel shall approach within 50m of a whale, unless authorised by the Director-General. Be careful not to separate groups or calves from adults. If you are stopped quietly in the water, it is possible (depending on the species) that individual whales may swim close and investigate your boat.

If a whale has picked up a buoy line there are two main possibilities:

a) **The line may have broken free of the pot and the whale will be lightly entangled with just a couple of turns around the tail-stock, flipper, or even through the mouth, with a couple of buoys attached. Under these circumstances the whale may still be able to maintain a good swimming speed, breathe relatively easily and be quite active.**

b) **The whale may be heavily entangled with a lot of line wrapped around the tail stock, body and / or flipper. The buoys and pot may still be attached. In this condition the whale could be tired or exhausted, have difficulty breathing and be swimming in short bursts, and the pot line may have cut deeply into the blubber, flipper or tail flukes. The animals will be in pain and alarmed by a rapidly approaching boat or outboard powered inflatable.**

The whale will be stressed and potentially dangerous as it tries to rid itself of the mass of line, floats and possibly a heavy pot.

Fishermen can send marine incident reports including whale or dolphin encounters, seabird sightings and any other incident, using the OceanSnap app, or by calling their regional liaison officer, or by using email – if they are working within cell phone range.

FISHING INDUSTRY PRACTICES THAT REDUCE THE RISK OF WHALE ENTANGLEMENT

The readiness, local knowledge and vessel handling skills of fishermen are beneficial to distanglement operations.

Remain vigilant particularly during the months of May, June and July.
Avoid excessive slack in pot ropes. Ropes should be adjusted to a length appropriate to the depth and strength of tide being worked, especially inshore. Excess slack in pot ropes can be coiled and tied close to floats.
Slack line should be limited to enough rope to allow for recovery and to commence hauling safely (dog bone/shanking).
Where possible avoid setting pots in clusters.
Do not leave pots in water for prolonged periods if not fishing. Pots should be retained onboard or returned to shore if not fishing for long periods.
Regularly check pots as per standard fishing practice. The DOC Entanglement Response Teams have a greater chance of success if an entangled whale is quickly discovered.
Report any entanglements as soon as possible. Rapid reporting ensures Entanglement Response Teams have the best possible chance of successfully disentangling a whale. Fishermen should monitor entanglement situations, with due regard for the safety of the vessel and the whale, until assistance teams arrive.
Keep up to date 'Whale Safe' contact details on board and report entanglements directly or by using the OceanSnap smartphone app.
Collect any abandoned/lost or floating pot lines, rope or fishing gear and bring it ashore.
Investigate any new technologies that may reduce the likelihood of entanglements.
Adopt a cooperative approach to avoiding entanglements and responding to entanglements when they occur. Fishermen can voluntarily participate in any training programmes for disentanglement operations. This training will ensure fishermen are aware of procedures and are familiar with Entanglement Response Team personnel and techniques.

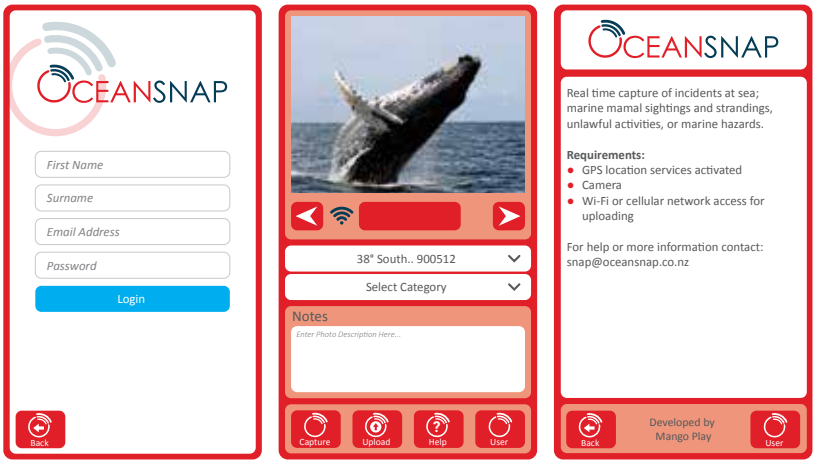
OCEANSNAP
THE SIGHTINGS APP & WEBSITE

The *OceanSnap* system is primarily intended to compile a detailed inventory of marine mammal and seabird observations and provide support for the New Zealand rock lobster industry *Whale_Safe* programme.

OceanSnap is a resource for rock lobster (and other) participants to record and report whale sightings from around New Zealand. The smartphone application can be downloaded from the Google Play Store. Access to the application requires users to register with their name and email address.

The application requires your smartphone to have a camera and to have GPS or location services turned on for the camera at all times. This allows the image to be embedded with electronic data confirming the location and time of the sighting. Your ***OceanSnap*** record (a photo of your observation) will be uploaded to a database managed by NZ RLIC when the phone is within cellular or wi-fi range.

Reports can also be made by emailing a photo directly to snap@oceansnap.co.nz. Please ensure that location services is turned on when recording a whale sighting, or be sure to describe the location.



OceanSnap is also available online at https://oceansnap.co.nz/. Reports can be made by visitors or registered users, however only registered users are able to access their previously submitted records. Please ensure that location services is turned on when recording a whale sighting, or describe the location in the manual upload notes section.

As a general caution to all ***OceanSnap*** users remember to be smart and safe online. Unless you have good reason to do so, don't give anyone your photo, or tell anyone your name, email, home address, telephone, or any other information about you that they could use to contact you either online or in the real world. Your ***OceanSnap*** report does not allow you or your vessel to be identified by other users from the database (see the Privacy Policy on the website).

NOTIFICATION PROTOCOL

Whale Entanglements

1. **Immediately** report the entanglement via OceanSnap.
2. **Complete** the supplementary Entanglement Response Data form. This can be uploaded as an image via OceanSnap to update your initial report.
3. **NZ RLIC** will contact the regional liaison personnel, who will alert the DOC Disentanglement Team and other vessels in the area. If you are unable to report via OceanSnap, contact your regional liaison personnel. The contact for your area can be found at www.nzrocklobster.co.nz - be sure to note these in your fishing diaries.

Whale Sightings

Report the sighting via OceanSnap when regular fishing operations allow. It is useful to note the whale's heading. The regional liaison officer will send a communication out to other vessels in the area and DOC (if applicable).

ATTENTION

NOTE: DOC is currently responsible for the following steps – fisherman should stand down from these.

1. Attachment of floats (Kegging)
2. Attachment of location devices
3. DNA sampling
4. Removal of entanglement lines, etc.

NEW ZEALAND LEGISLATION
MARINE MAMMALS PROTECTION REGULATIONS 1992

REGULATION 19: Special conditions applying to whales

In addition to complying with the provisions set out in regulation 18, every commercial operation and every person coming into contact with whales shall also comply with the following conditions:

(a) no person in the water shall be less than 100 metres from a whale, unless authorised by the Director-General:

(b) no vessel shall approach within 50 metres of a whale, unless authorised by the Director-General:

(c) if a whale approaches a vessel, the master of the vessel shall, wherever practicable,—

  (i) manoeuvre the vessel so as to keep out of the path of the whale; and

  (ii) maintain a minimum distance of 50 metres from the whale:

(d) no vessel or aircraft shall approach within 300 metres (1 000 feet) of any whale for the purpose of enabling passengers to watch the whale, if the number of vessels or aircraft, or both, already positioned to enable passengers to watch that whale is 3 or more:

(e) where 2 or more vessels or aircraft approach an unaccompanied whale, the masters concerned shall co-ordinate their approach and manoeuvres, and the pilots concerned shall co-ordinate their approach and manoeuvres:

(f) no person or vessel shall approach within 200 metres of any female baleen or sperm whale that is accompanied by a calf or calves:

(g) a vessel shall approach a whale from a direction that is parallel to the whale and slightly to the rear of the whale:

(h) no person shall make any loud or disturbing noise near whales:

(i) where a sperm whale abruptly changes its orientation or starts to make short dives of between 1 and 5 minutes duration without showing its tail flukes, all persons, vessels, and aircraft shall forthwith abandon contact with the whale.

PROTECTED FISH SPECIES AND REPORTING

REQUIREMENTS UNDER ELECTRONIC CATCH REPORTING

Under the Fisheries (Reporting) Regulations 2017, permit holders are required to complete a non-fish species or protected fish species (NFPS) catch report if any of the following are caught:

- Seabirds
- Marine mammals
- Marine reptiles (e.g. turtles)
- Protected fish species
- Selected benthic organisms (corals, sponges and bryozoans)

All seabird captures must be reported regardless of whether the bird was taken as a direct result of an interaction with fishing gear (e.g. in a trawl net) or whether the interaction was independent of fishing gear. Please note that in the case of the latter, the interaction only needs to be reported if the bird requires assistance to leave the vessel. Do not report incidents where a bird simply lands on deck before flying away unassisted.

It is important to note that only three types of benthic (bottom-dwelling) organisms are required to be reported on NFPS reports: corals, sponges and bryozoans. Any other types that are captured should be reported on disposal reports. Fisheries New Zealand does not require recording of non-biogenic material such as rocks, wood or rubbish.

A permit holder must

- Complete an NFPS report for each incident where a type of non-fish species or protected fish species (page 38-39) is taken. A NIL report is NOT required.
- Where captures are the result of an interaction with fishing gear, please report all captures taken during a fishing event on a single NFPS report. For example, if a trawl tow results in a seabird, a fur seal and some sponge being captured, report the three captures on a single NFPS report that is linked to the fish catch report (where the details of the specific trawl tow are recorded). The report must be completed within 8 hours of the fishing event ending.
- Where captures occur independently of fishing gear, report each incident on a separate NFPS report. For example, if you have a bird strike during the morning and same thing happens in the afternoon, details should be recorded on two separate NFPS reports. The reports must be completed by the end of the day on which the incidents occur.
- Provide the completed report to FishServe before the close of the day on which it is completed.

Retaining protected species

Protected fish and non-fish species (i.e. seabirds, marine mammals, reptiles, and most corals) may only be retained if authorised by a DOC permit or a Fisheries New Zealand observer. It is illegal to interfere with any protected species, regardless of whether it is dead or alive, prior to returning it to the sea.

NON-FISH/PROTECTED SPECIES
CATCH RETURN CODES

BIRDS	
Common Name	**Code**
Antarctic fulmar (Southern fulmar)	XAF
Antarctic petrel	XAP
Antarctic prion	XPR
Antipodean (wandering) albatross and Gibson's albatross	XAG
Australasian gannet	XGT
Black petrel	XBP
Black-backed gull	XBG
Black-bellied storm petrel	XFT
Broad-billed prion	XPV
Buller's and Pacific albatross	XPB
Buller's shearwater	XBS
Campbell albatross (Campbell Island black-browed mollymawk)	XCM
Cape petrel (Cape pigeon)	XCC
Chatham Island albatross (Chatham Island mollymawk)	XCI
Common diving petrel	XDP
Fairy prion	XFP
Flesh-footed shearwater	XFS
Fluttering shearwater	XFL
Great-winged petrel (includes Grey-faced petrel)	XGF
Grey petrel	XGP
Grey-backed storm petrel	XGB
Grey-headed albatross (Grey-headed mollymawk)	XGM
Light-mantled sooty albatross	XLM
Little blue penguin	XLB
Masked booby	XMB
Northern giant petrel	XNR
Pied shag	XPS
Red-billed gull	XRB
Salvin's albatross	XSA
Short-tailed shearwater	XTS
Shy albatross (Shy mollymawk)	XSY
Sooty shearwater	XSH
Southern black-browed albatross (Southern black-browed mollymawk)	XSM
Southern giant petrel	XSP
Southern royal albatross	XRA
Spotted shag	XPP
Wandering (or snowy) albatross	XAS
Westland petrel	XWP
White-bellied storm petrel	XWB
White-capped albatross (New Zealand white capped mollymawk)	XWM
White chinned petrel	XWC
White-faced storm petrel	XWF
White-headed petrel	XWH
Yellow-eyed penguin	XYP

MAMMALS	
Common Name	**Code**
Bottle nose dolphin	BDO
Common dolphin	CDD
Dusky dolphin	DDO
Elephant seal	EPH
Fin whale	FIW
Hector's dolphin	HDO
Humpback whale	HBW

Leopard seal	LEO
Māui dolphin	HDM
Minke whale	MIW
New Zealand fur seal	FUR
New Zealand sea lion (Hooker's sealion)	HSL
Orca (killer whale)	ORC
Pilot whale	PIW
Sei whale	SEW
Southern right whale	SRW
Spectacled porpoise	PHD

REPTILES

Common Name	Code
Banded sea snake	BSS
Green turtle	GNT
Hawksbill turtle	HBT
Leatherback turtle	LBT
Loggerhead turtle	LHT
Yellow-bellied sea snake	YSS

OTHER PROTECTED SPECIES CODES

For these protected species, you must use one of these codes:

Common Name	Code
White pointer shark (Great white shark)	WPS
Spotted black grouper	SBG
Black corals	COB

SPECIES GROUP CODES

Otherwise, use one of these Group Codes:

Common Name	Code
Albatrosses (Unidentified)	XAL
Petrels, Prions and Shearwaters	XXP
Gulls and Terns	XLA
Shags	XHG
Boobies and Gannets	XSU
Penguins	XPG
Dolphins and Toothed whales	WHT
Baleen whales	WHB
Seals and Sealions	SEA
Marine turtles	TLE
Sea snakes	SSN
Corals, Sponges and Bryozoans	CSB
Coral (Unidentified)	COU
Sponges	ONG
Bryozoan	COZ

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Useful Links

NZ Rock Lobster Industry Council

Phone: +64 4 802 1509 **Email:** admin@nzrocklobster.co.nz **Web:** www.nzrocklobster.co.nz

OceanSnap

Email: snap@oceansnap.co.nz **Web:** www.oceansnap.co.nz

Ministry for Primary Industries - Fisheries

Web: www.mpi.govt.nz/fisheries

FishServe

Phone: +64 4 460 9555 **Web:** www.fishserve.co.nz

NZ ROCK LOBSTER
INDUSTRY COUNCIL
Ka whakapai te kai o te moana