SEABIRD BYCATCH SOLUTIONS
FOR FISHERY SUSTAINABILITY

AMERICAN BIRD CONSERVANCY

The WALTON FAMILY FOUNDATION

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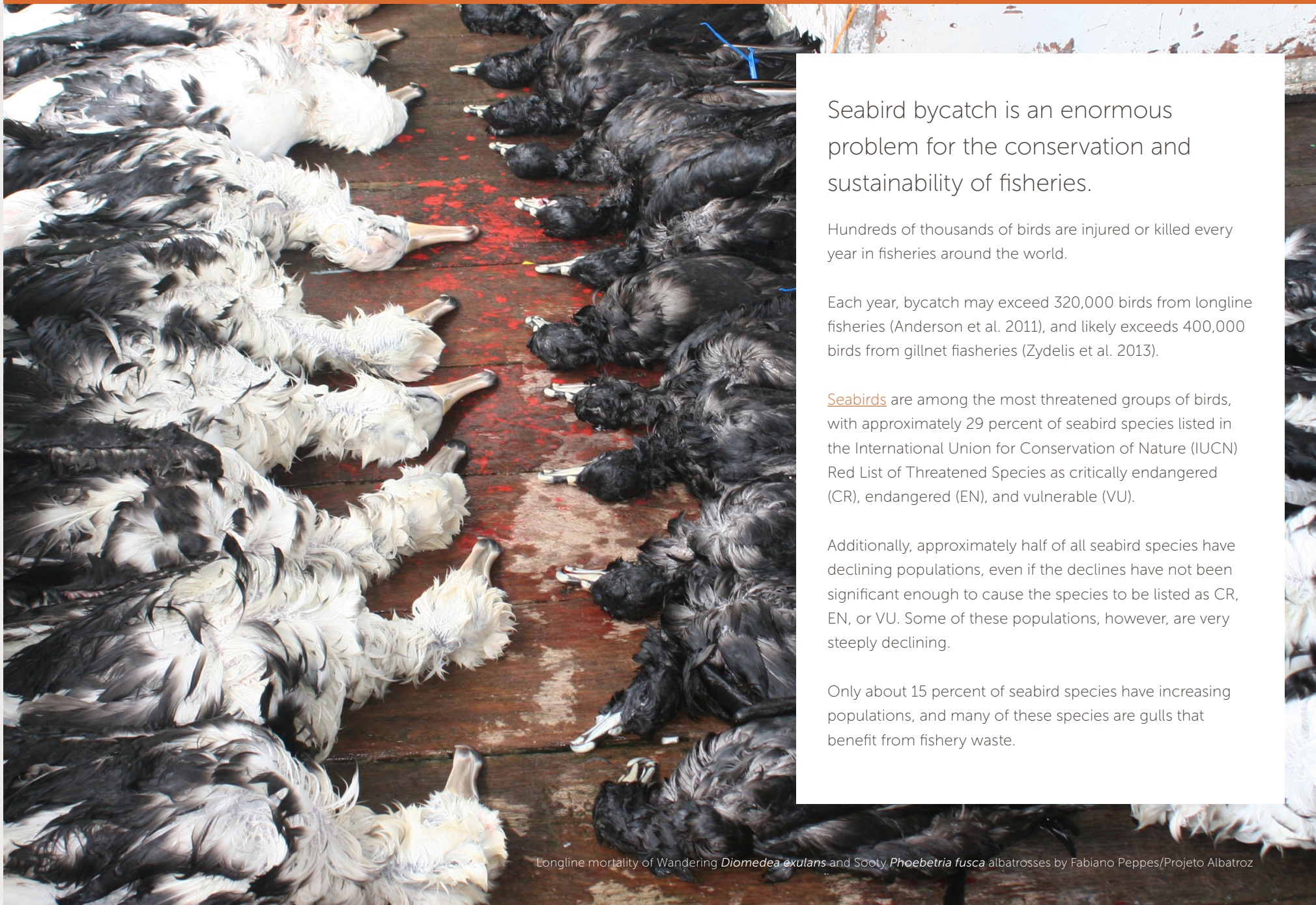
COVER: Atlantic Puffin *Fratercula arctica* with fish by Dan Behm

INTRODUCTION



Longline mortality of Wandering *Diomedea exulans* and Sooty *Phoebetria fusca* albatrosses by Fabiano Peppes/Projeto Albatroz

Seabird bycatch is an enormous problem for the conservation and sustainability of fisheries.

Hundreds of thousands of birds are injured or killed every year in fisheries around the world.

Each year, bycatch may exceed 320,000 birds from longline fisheries (Anderson et al. 2011), and likely exceeds 400,000 birds from gillnet fiasheries (Zydelis et al. 2013).

Seabirds are among the most threatened groups of birds, with approximately 29 percent of seabird species listed in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as critically endangered (CR), endangered (EN), and vulnerable (VU).

Additionally, approximately half of all seabird species have declining populations, even if the declines have not been significant enough to cause the species to be listed as CR, EN, or VU. Some of these populations, however, are very steeply declining.

Only about 15 percent of seabird species have increasing populations, and many of these species are gulls that benefit from fishery waste.

Fishing poses the highest at-sea risk to seabirds. Seabirds may become hooked on longlines, entangled in nets, or injured in collisions with cables or masts.

Seabirds are long-lived species, and most have very low reproductive rates. Many seabirds take years to reach adulthood – as many as six to ten years for some albatross, for example.

Once they begin reproducing, many species produce only one egg or chick at a time, and often do not breed annually.

Therefore, loss of seabirds to fishing activities can have very significant demographic effects. Removing only a few of the reproductive adults can diminish the population, and low population growth rates mean that it can take many years for a species to recover.

OBJECTIVES OF THIS PRESENTATION

The objectives of this presentation are to raise awareness of the problems of seabird bycatch; to provide basic information about seabirds; to show how seabirds interact with fisheries and how to prevent interactions and mortality; and to discuss how Marine Stewardship Council (MSC) certification requirements take seabirds into account.

This presentation contains extensive information about seabirds. Specific sections are directly and easily accessible by clicking on the hyperlinks in the table of contents. We have tried to make navigation easy, so that you can skip sections and easily return to them.

The presentation is divided into several sections:

- **About Seabirds:**
  What are They? Biology and Biogeography
- **Seabirds and Fisheries:**
  How Seabirds Interact with Fishing Practices and Mitigation Measures to Prevent or Reduce Seabird Bycatch and Mortality.
- **Seabirds and Fishery Sustainability:**
  How to Understand and Reduce Seabird Bycatch
- **Information** about evaluation of seabirds as bycatch in **certification programs**, such as that of the **MSC**.
- **Marine protected areas and legal protections** afforded to seabirds at national and international scales.
- There is also a section on **resources** that will facilitate a more complete evaluation of seabird issues with regard to fisheries.

ABOVE: Hawaiian Petrel *Pterodroma sandwichensis* by Jim Denny/kauaibirds.com

AMERICAN BIRD CONSERVANCY AND SEABIRDS

American Bird Conservancy (ABC) is the Western Hemisphere's bird conservation specialist, the only organization with a single and steadfast commitment to achieving conservation results for native birds and their habitats throughout the Americas. With a focus on efficiency and working in partnership, ABC takes on the toughest problems facing birds today, innovating and building on sound science to halt extinctions, protect habitats, eliminate threats, and build capacity for bird conservation.

ABC's Seabird Program works to protect seabirds through direct conservation, outreach, and policy work. ABC's focus is on the most threatened species of seabirds and the most severe and pervasive threats to seabirds at sea, including fishery bycatch.

ABC's Fisheries Program works to reduce the impact of fisheries on seabirds by working directly with fishery managers, helping them find ways to avoid inadvertently catching seabirds in the first place. ABC also encourages increased consumer demand for sustainably harvested seafood, which requires seabird-friendly practices such as minimizing bycatch.

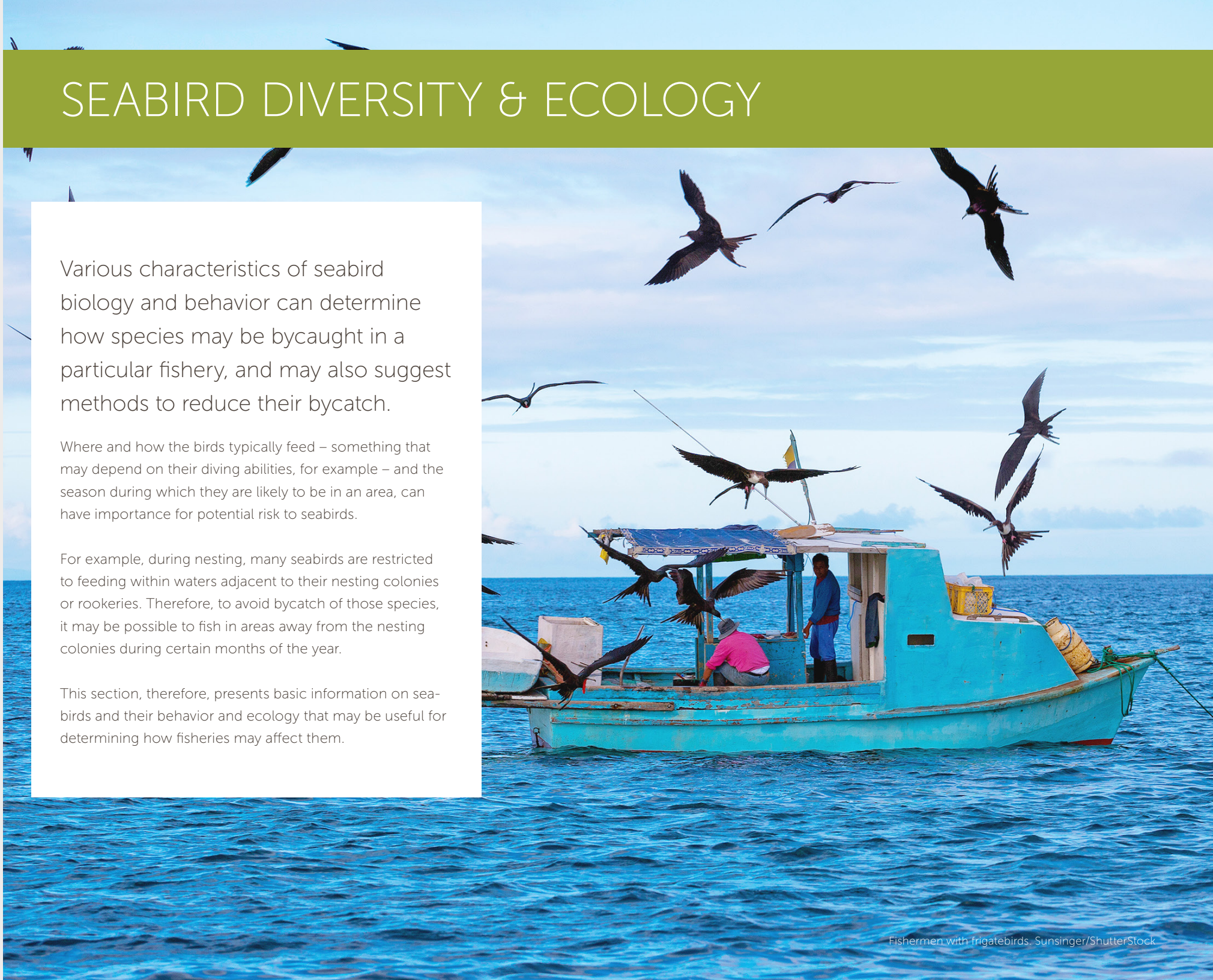
SEABIRD DIVERSITY & ECOLOGY

Various characteristics of seabird biology and behavior can determine how species may be bycaught in a particular fishery, and may also suggest methods to reduce their bycatch.

Where and how the birds typically feed – something that may depend on their diving abilities, for example – and the season during which they are likely to be in an area, can have importance for potential risk to seabirds.

For example, during nesting, many seabirds are restricted to feeding within waters adjacent to their nesting colonies or rookeries. Therefore, to avoid bycatch of those species, it may be possible to fish in areas away from the nesting colonies during certain months of the year.

This section, therefore, presents basic information on seabirds and their behavior and ecology that may be useful for determining how fisheries may affect them.



Fishermen with frigatebirds. Sunsinger/ShutterStock

Seabirds are those birds that obtain their food from the sea and alight on it.

There are some exceptions. Frigatebirds always forage at sea, but never alight on the water. Some gulls and terns forage from the sea, but are rarely away from the beach. Most seabirds are dependent on marine resources year-round, but some are not, living inland for part of the year.

Many ducks, loons or divers, and grebes breed inland on freshwater lakes and rivers, but winter at sea. Other species, such as American White Pelicans, do as well.

Some seabirds submerge themselves in the water, or will alight on it and swim, but others do not, picking food items from the surface of the water while skimming above it.

Some seabirds are found far out at sea, over the deepest oceans, while others are rarely out of sight of land, using only coastal and nearshore waters. Some can be found only on continental shelf waters, even though that may be hundreds of kilometers offshore.

But all seabirds depend on land for reproduction!

Great Northern Loon *Gavia immer* and chick by Brian Lasenby/Shutterstock

SEABIRD DIVERSITY (OR, KINDS OF SEABIRDS)

The exact number of seabird species varies based on the taxonomy used. These figures even change over time as a result of discoveries of new species, or splitting or lumping existing species (for example, see Brown et al. 2011 or Austin et al. 2004).

By our definition of "seabird," there are 378 species in nine orders and 18 families of birds. All of these have the potential to interact with marine harvest fisheries.

There are **nine major taxonomic groups** (orders). They are:

Anseriformes: ducks, eiders, mergansers, and allies
Although some of these breed in marine environments, most of the ducks do so on freshwater lakes, ponds, and streams, and only winter on salt water usually a few km from the shore. Some, however, go far to sea.

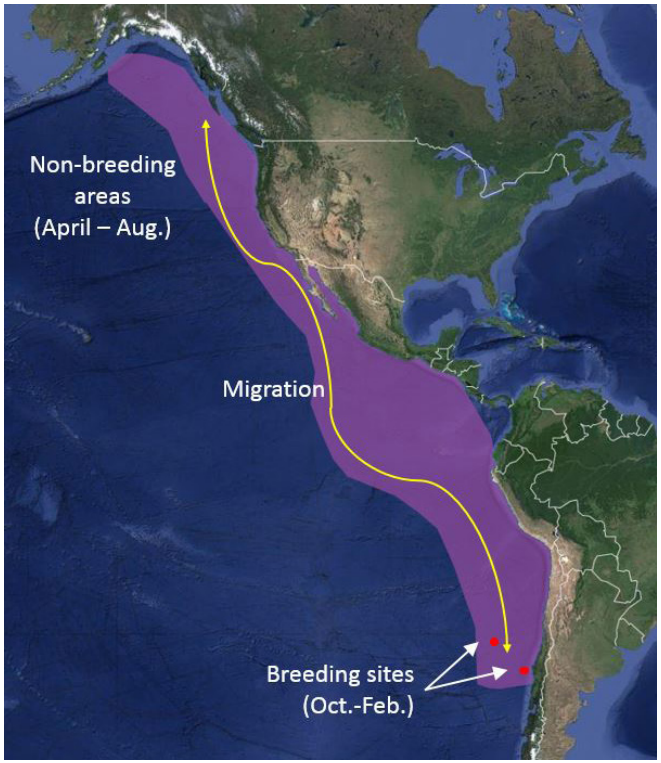
Gaviiformes: loons and divers
These are often called "divers" in Europe and "loons" in the Americas. There are only five species of loons. Like the ducks, loons mostly breed on freshwater, and winter on saltwater mostly close to shore, but are sometimes found far at sea.

Sphenisciformes: penguins
Although flightless, penguins can sometimes be found far at sea, although often associated with sea ice.

Procellariiformes: tubenoses (albatrosses, shearwaters, fulmars, and allies)
Often thought of as the "true" seabirds, many of these species spend their lives entirely at sea, often traversing oceans and coming to shore only to nest. Their young fledge directly from the nest into the sea.

Podicipediformes: grebes
This is a small group, with only seven species found at sea. Like the ducks and loons, most breed on freshwater and in winter are found at sea relatively close to shore.

Phaethontiformes: tropicbirds
This is the smallest group of seabirds with only three species. Like the tubenoses, though, they live entirely at sea, never on freshwater, and only come on land for nesting.



GENERAL DISTRIBUTION OF SEABIRDS

Seabirds can be highly migratory, moving from ocean to ocean or hemisphere to hemisphere, or they may be resident in a location, making very little seasonal movement. For migratory species, the timing of year may be important for fishery overlap – they may be highly abundant during summer and virtually absent in winter, or vice versa.

Seasonality of distribution may be an important factor in determining the risk of a fishery to a particular seabird species. For example, if the season of fishing and the season of occurrence of the seabird in an area do not overlap, there may be little risk of the seabird to the fishery.

Pelecaniformes: pelicans
Another small group, with only six marine species. Some are entirely marine, while others breed on freshwater and winter at sea near shore.

Suliformes: frigatebirds, boobies and gannets, shags, and cormorants
The frigatebirds, boobies, and gannets are all entirely marine. They are mainly found in continental shelf waters, and many return to roost each day on land, although they can overnight at sea.

Some of the shags and cormorants are likewise entirely marine, but some of these may breed or spend part of the year on freshwater. They also often return each day to roost on land.

Charadriiformes: shorebirds; gulls, terns, and skuas; guillemots, auks, auklets, murres, murrelets, and puffins and allies
This is a diverse group, morphologically and behaviorally.

Although many shorebirds can be found walking on the beach, only a few – the phalaropes – can be called seabirds. Phalaropes breed on freshwater lakes and ponds, but these peculiar shorebirds winter sometimes far at sea, floating in large rafts and returning to shore only in spring.

Some gulls, terns, and skuas breed in freshwater, but they may be entirely marine. They tend to be in continental shelf waters, but are sometimes found far to sea.

The guillemots, auks, auklets, murres, murrelets, puffins, and razorbill form a family, the Alcidae. They are all entirely marine, nesting on land, but like many of the Suliformes, they usually return at night to roost on land, on cliffs, and rocks. Although they are therefore usually found near shore, they can overnight at sea, and are sometimes encountered mid-ocean, especially in winter when they are not nesting.

LEFT:
Map of Pink-footed Shearwater *Ardenna creatopus* breeding and non-breeding distribution and migration
Map by Caroline Pott and David Wiedenfeld/ABC

Although many groups of seabirds are widely distributed, there are some general distribution patterns. Knowing where species occur can help in knowing what species may be at risk of bycatch in a specific fishery.

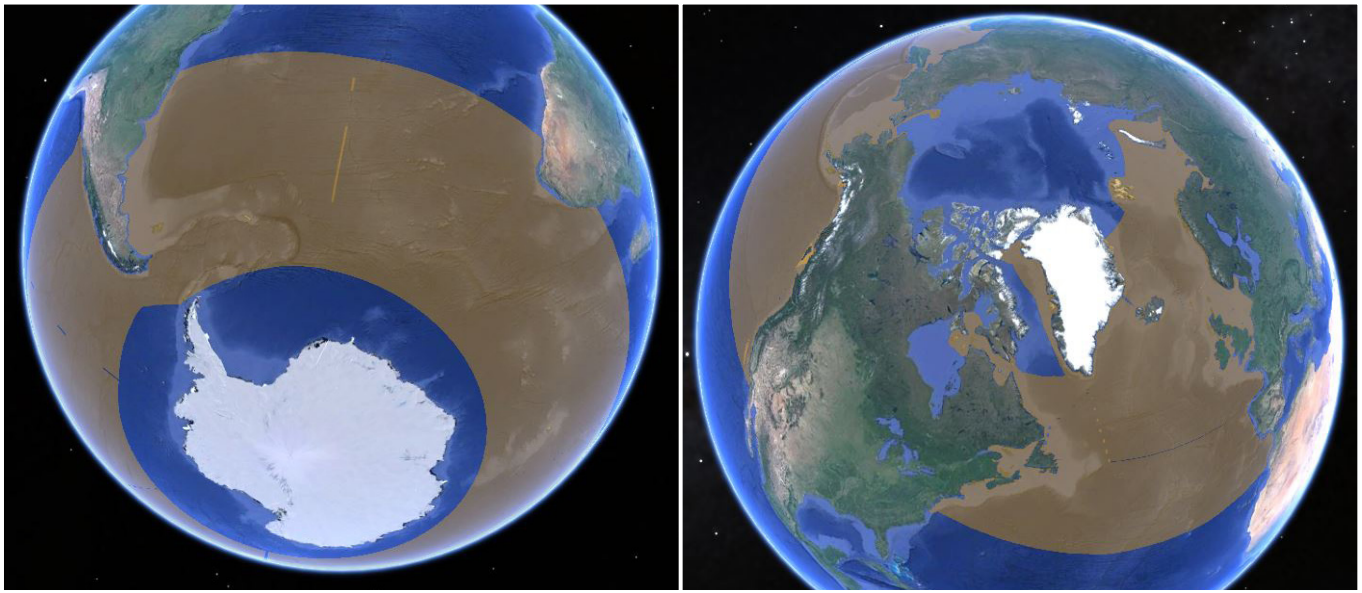
Although three of the 21 species of albatross nest and forage in the North Pacific Ocean (Laysan *Phoebastria immutabilis*, Short-tailed *Phoebastria albatrus*, and Black-footed *Phoebastria nigripes* albatrosses), the other 18 species of albatrosses occur only in the Southern Hemisphere. No albatrosses occur in the North Atlantic Ocean.

All penguins occur in the Southern Hemisphere. Some of the smaller species are found on the southern coasts of South America, Africa, Australia, New Zealand, and Tasmania, but most are sub-Antarctic and Antarctic.

The alcids (auks, auklets, murres, guillemots, and puffins) and the loons and divers are only found in the Northern Hemisphere, in both the North Atlantic and North Pacific oceans.

All of the ducks that can be classified as seabirds, except for the four species of steamer-ducks from the coasts of South America, are found in the oceans and seas of the Northern Hemisphere.

Some species of seabirds are very range-restricted, especially some of the Southern Hemisphere shags, which occur only on one or a few small islands and never go far to sea. A good example is the Macquarie Shag *Leucocarbo purpurascens*, only found on Australia's Macquarie Island.



LEFT: Map of the general distribution of albatrosses in the Southern Hemisphere.
RIGHT: Map of the general distribution of alcids in the Northern Hemisphere.
Maps by Caroline Pott/ABC

DIET

The type of prey consumed by seabird species can determine their susceptibility to different gear types and suggest bycatch reduction methods. It may also indicate whether a fishery is competing with a seabird's forage fish (the seabird's food).

Diets are highly variable among species. Few seabirds are dietary specialists; most species eat a wide variety of prey items.

The dietary information available for most seabirds is limited by methods that can be used to obtain it. Many diet items (particularly soft ones, such as squid or cnidarians) are quickly digested, and pelagic birds are difficult to catch and sample except during the nesting season when their diets may not be representative of what they eat during the rest of the year.

The most important diet items across some seabird groups are:

Fish ("forage fish")
These usually are smaller-sized fish (less than 15 cm in length and below 0.5 kg). The main fish eaten by seabirds are shoaling anchovies; herring and sardines (Engraulidae and Clupeidae) such as Engraulis spp., Sardinops spp., Clupea spp., Sardina spp., Sardinella spp.; Ammodytidae, Mallotus spp.; juvenile salmonids; and benthic fish (e.g., Gadidae).

Seabirds for which fish is an important part of the diet include:

- penguins
- shearwaters
- storm petrels
- grebes
- tropicbirds
- pelicans
- gannets and boobies
- cormorants and shags
- terns and gulls
- skuas and jaegers
- puffins and murrelets

Cephalopods/Squid
Squid is an important part of the diet for many pelagic seabirds, including:

- penguins
- albatrosses - squid may constitute up to 89 percent of the diet of some species (Ridoux 1994, Croxall and Prince 1994, or Vaske 2011).
- petrels and shearwaters
- storm petrels
- tropicbirds
- frigatebirds
- boobies and gannets

Methods for Determining the Diets of Seabirds

Determinting the diets of wide-ranging seabirds is challenging, especially because many soft-bodied invertebrates are rapidly digested and become unidentifiable. This therefore limits our understanding of seabird diets.

Methods used to determine the diets of seabirds include the following:

- Regurgitated pellet analysis (pellets are the indigestible portion of consumed food)
- Forced regurgitation/stomach flushing
- Observations of parental food delivery
- Prey remains at colonies
- Sea surface observations
- Necropsies
- Inferences from a combination of methods.

Krill (especially Euphausia spp. and Thysanoessa spp.), and other crustaceans

Krill can be an important part of the diet for species groups such as:

- penguins
- albatrosses
- petrels
- diving petrels
- prions

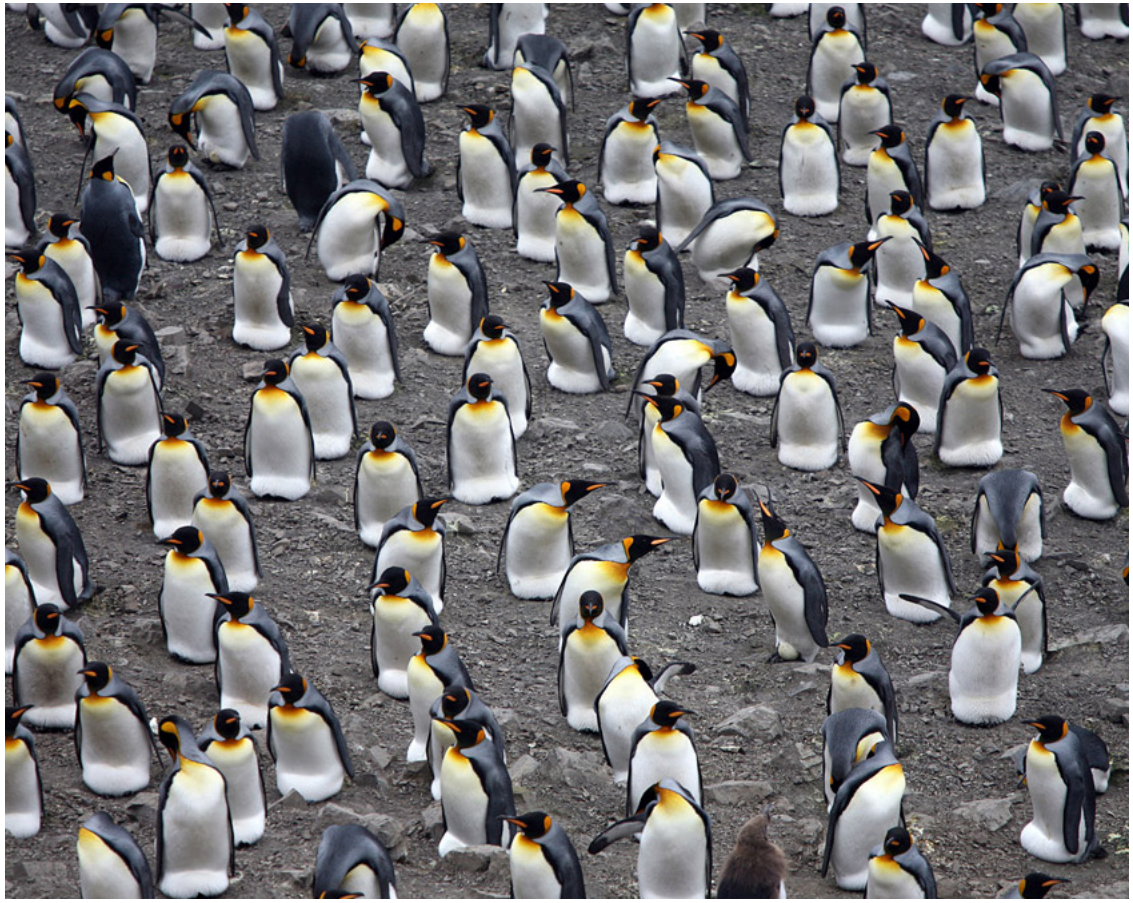
Miscellaneous invertebrates besides squid and krill.

These may include benthic invertebrates such as clams (Bivalvia), snails (Gastropoda), marine worms (Polychaeta) and barnacles, and sea urchins. It may also include invertebrates found in the water column or on the surface, such as insects (Halobates), jellyfish (Cnidaria), tunicates, zooplankton, and Amphipoda.

These invertebrates are important dietary items for some species groups, such as:

- ducks
- storm petrels
- diving petrels
- grebes
- pelicans
- frigatebirds
- cormorants and shags
- gulls and terns
- skuas and jaegers
- puffins and murrelets

ABOVE: Krill by Dmytro Pylypenk/ShutterStock



ABOVE: King Penguins *Aptenodytes patagonicus* by Ted Cheeseman

SEABIRD BREEDING STYLES AND BEHAVIOR

Seabirds all, of course, nest on land. Their nests may be built in crevices or on ledges on cliffs and rocks, on sandy beaches, or in vegetation.

Seabird nesting behavior – whether in large colonies or dispersed, on the coast or inland, or other factors – can be important for determining the risk posed by a fishery or for suggesting ways to reduce seabird bycatch.Some seabirds breed at or near the coast and are always associated with marine environments (known as "coastal breeders"). Those that breed inland (known as "inland breeders") do so typically on freshwater bodies, such as lakes or streams. These characteristics may be important in determining ways in which the birds interact with marine fisheries.

Coastal breeders come in two types: colonial breeders and dispersed breeders. These breeding types may determine bycatch reduction methods.

Colonial breeders nest in close groups, usually from 30 nests to well over 100,000 nests for some species. The colonies are usually located right at the coast, on sea cliffs or beaches.

Because colonial breeders are highly concentrated, one obvious bycatch reduction method is to avoid fishing near the colonies during the breeding season.

Dispersed breeders usually nest singly, although a few nests may be clustered in some species. Similar to nesting colonies, dispersed nests may be found along the seashore, on cliffs or

beaches. For some species, however, the nests may be a few km to more than 50 km from the coast (an example of the latter is the Marbled Murrelet *Brachyramphus marmoratus*).

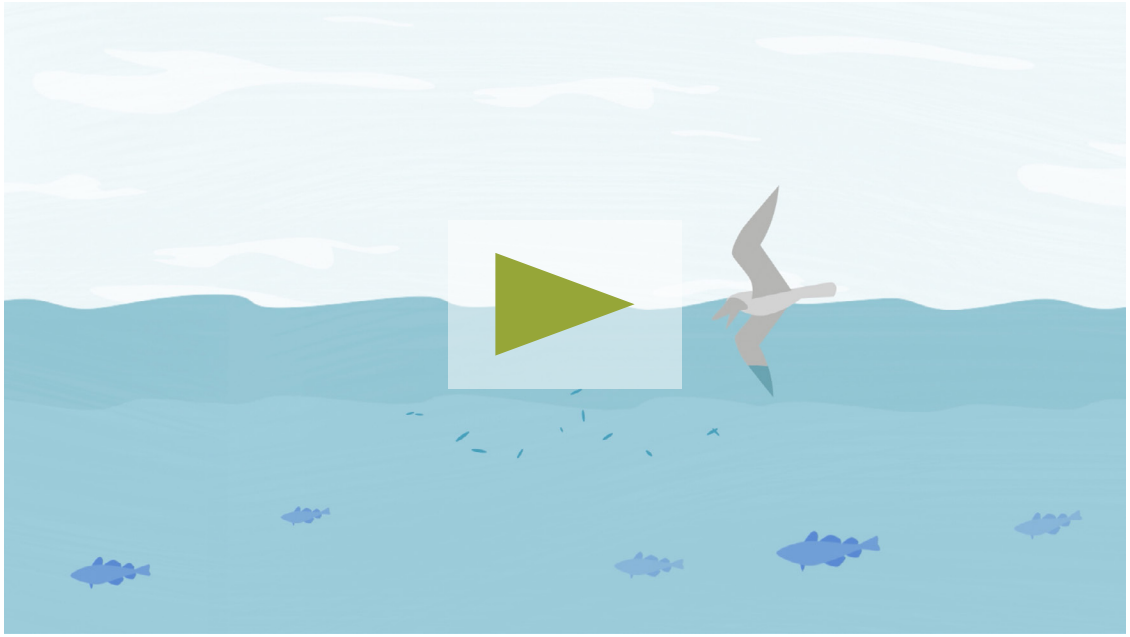
An important consideration for all coastal breeders is that juveniles fledge directly to the sea. Because juveniles are less strong and often naïve with respect to fisheries and other hazards, they may be more likely to be bycaught than adults.

Inland breeders move away from the sea during their breeding season, nesting on land around freshwater bodies.

Many of the species of ducks, grebes, and loons and some species of gulls and terns, pelicans, and cormorants or shags breed inland, and are only encountered at sea during the non-breeding, winter season. Some of these species disappear from saltwater completely during breeding season.

Because they are inland, juveniles of these species do not fledge into the marine environment and do not usually reach the sea for several months after fledging. This gives these juveniles an opportunity to reach greater maturity before encountering fishing operations.

An important implication for fisheries of species that breed inland is that when the birds are inland, they cannot be caught by marine fisheries.



VIDEO: SEABIRD FORAGING BEHAVIOR

ADDITIONAL SEABIRD BEHAVIORAL CHARACTERISTICS THAT CAN AFFECT INTERACTION WITH MARINE FISHERIES

Foraging Behavior

Surface foraging is obtaining food items that are either on the surface of the water or are very close beneath it. Surface foraging does not include diving. Birds foraging at the surface may alight on the water or fly above it, and may plunge the head and neck beneath the water (bird does not dive and is not submerged).

Surface foragers eat floating material, and may catch or filter zooplankton and nekton.

AT-SEA DISTRIBUTION OF SEABIRDS

Even when at sea, seabirds prefer different habitats. These preferences often depend on water depth, but may also depend on other characteristics such as salinity or visual proximity to land. These three terms are used here to describe locations, relative to the coast, where seabird species occur during different parts of the year:

- **Onshore**
  Birds are not in the marine environment, and are usually on land. This typically occurs during the breeding season, when even highly marine species, such as albatrosses and petrels must be on land with their nests. Also included in this term is the time of year when species that breed in non-marine environments, such as lakes, ponds, and rivers, are nesting or are otherwise away from the marine environment.
- **Inshore**
  Birds are in coastal and estuarine inshore environments within 5 km of the coast.
- **Offshore**
  Birds are beyond 5 km from the coast.

These three terms do not conform exactly to nautical terms, but are most useful for describing seabird behavior.

Map by David Wiedenfeld/ABC

Many species of seabirds use surface foraging at least some of the time.

However, some species are only surface foragers. These include all frigatebirds, most storm petrels, most gulls, and even some albatrosses, petrels, and pelicans.

The majority of seabirds, however, are divers (at least sometimes), completely submerging themselves.

Plunge divers enter the water from the wing, sometimes in spectacular dives. Well-known plunge divers include the boobies and gannets, but also some pelicans, tropicbirds, terns, and some shearwaters and petrels.

Pursuit divers spend extended periods of time underwater chasing mobile prey, usually fish. They often begin their dive while resting on the surface, but a few species, such as the Magellanic Diving Petrel *Pelecanoides magellani* will begin with a plunge dive. The pursuit divers include the loons, grebes, penguins, cormorants and shags, the alcids (auks, guillemots, murres, murrelets, and puffins) and some ducks.

Surface divers are usually surface foragers, but occasionally will submerge in pursuit of prey, in which cases they act similar to pursuit divers. These species include many of the albatrosses, petrels, storm petrels, gulls and terns, skuas and jaegers that are not strictly surface foragers.

Diving depths depend somewhat on the type of dive:

- Surface dives are usually shallow and relatively brief.
- Plunge divers tend not to go to great depths in their dives, usually less than 10 m, but a few are known to dive as deep as 40 m.
- Although pursuit dives mostly go less than 20 m deep, they do go deeper not infrequently. Some pursuit divers may go to extreme depths: King *Aptenodytes patagonicus* and Emperor *Aptenodytes forsteri* penguins are known to go deeper than 300 m!

Benthic feeders consume demersal species settled on the bottom.

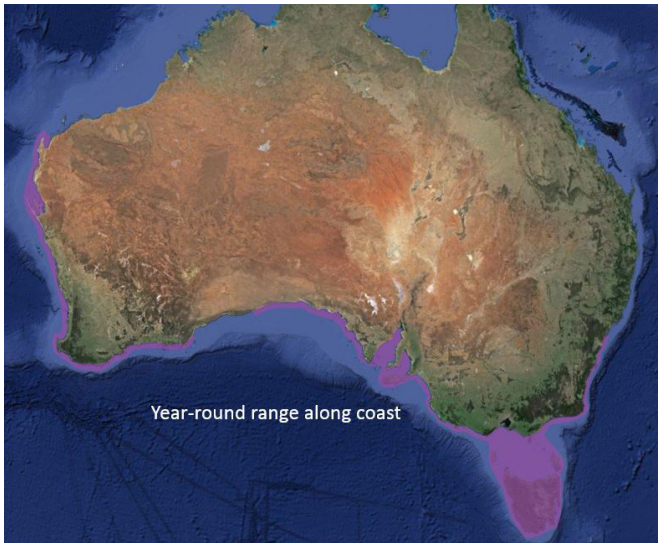
- The prey items are usually bivalves and other invertebrates.
- Many of the ducks are benthic feeders, but also some penguins, grebes, shags and cormorants, and alcids.
- Diving depths for benthic feeders are usually less than 20 m, but some species do go deeper than 100 m.

ABOVE: Northern Gannets *Morus bassanus* by Paul Cowell/Shutterstock

HERE ARE SOME EXAMPLES OF THE DIVERSITY OF SPATIAL AT-SEA DISTRIBUTION:

Franklin's Gull *Leucophaeus pipixcan*

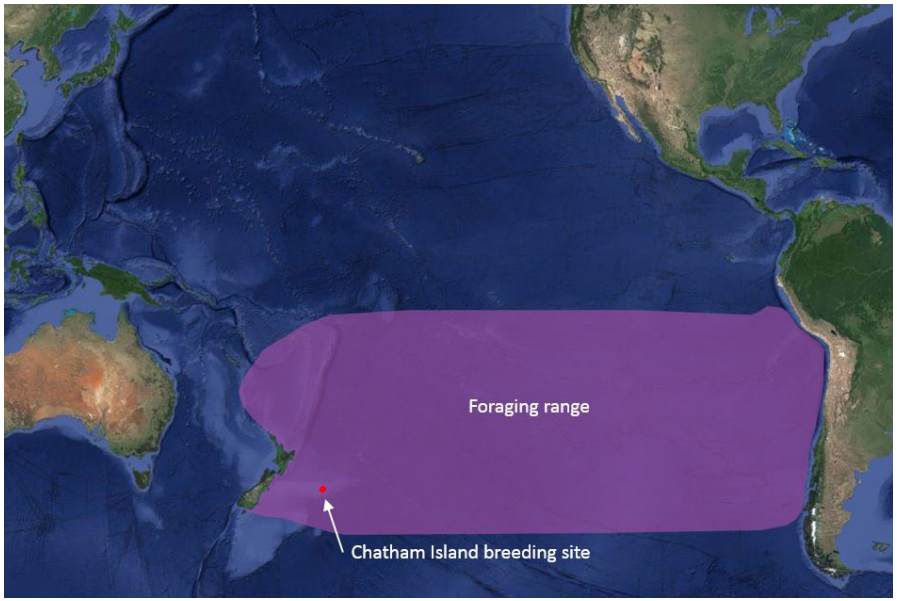
- Breeds inland in North America.
- Winters inshore along the Pacific coast of South America, but it can also be found far at sea during migration between wintering and breeding areas.



Pacific Gull *Larus pacificus*

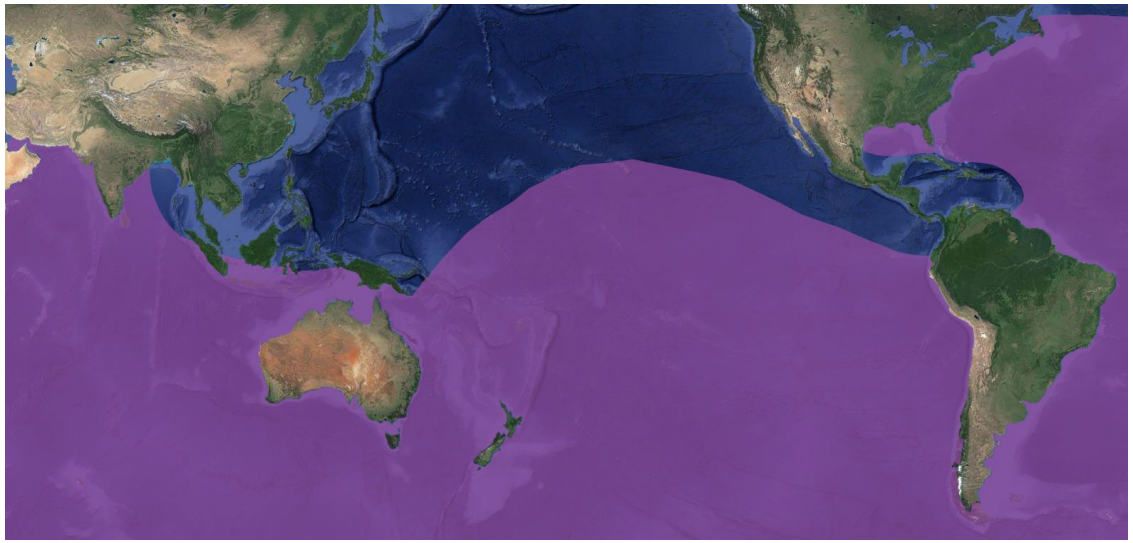
- Resident of the Australian coast.
- Spends the entire year onshore (when nesting) or inshore.

Maps by Caroline Pott and David Wiedenfeld/ABC



Chatham Albatross *Thalassarche eremita*

- Onshore when nesting, which it does on only one island in New Zealand.
- The rest of the year it is offshore, off the west coast of South America.



Wilson's Storm Petrel *Oceanites oceanicus*

- Widespread.
- Offshore year-round, except when nesting.

Maps by Caroline Pott and David Wiedenfeld/ABC

SEABIRDS SHOW VARYING LEVELS OF SOCIABILITY TO OTHER SEABIRDS.

Solitary

- The seabird is usually encountered alone.

Small groups

- These are aggregations usually of pairs or threes, up to ten individuals.
- They are usually all the same species.

Gregarious

- Birds in large groups, tens to hundreds to sometimes thousands.
- Especially in larger aggregations, the flocks can include more than one seabird species.

Seabirds may also associate with non-bird animals, such as cetaceans or tuna, where they seem to benefit from foraging opportunities.

Ship followers

Ship followers are seabirds that associate with marine vessels, even non-fishing vessels. Ship followers will follow vessels under way even if offal is not being discarded or fishing being carried out. For example, they will follow tourist boats or freighters.

It is thought that ship followers benefit from finding prey brought to the surface by the screw wash and wake.

This is not just opportunistic: some species actually change course and seek out boats to exploit foraging opportunities (Castilla & Pérez 1995, Waugh et al. 2005, Collett et al. 2015).

Seabirds may follow a variety of daily activity patterns. Knowledge of these patterns can be particularly useful when designing effective bycatch reduction methods.

Diurnal

- Active during the day.

Nocturnal (active at night)

- Many of the squid-feeding specialist seabirds tend to forage at night when squid are closer to the surface.

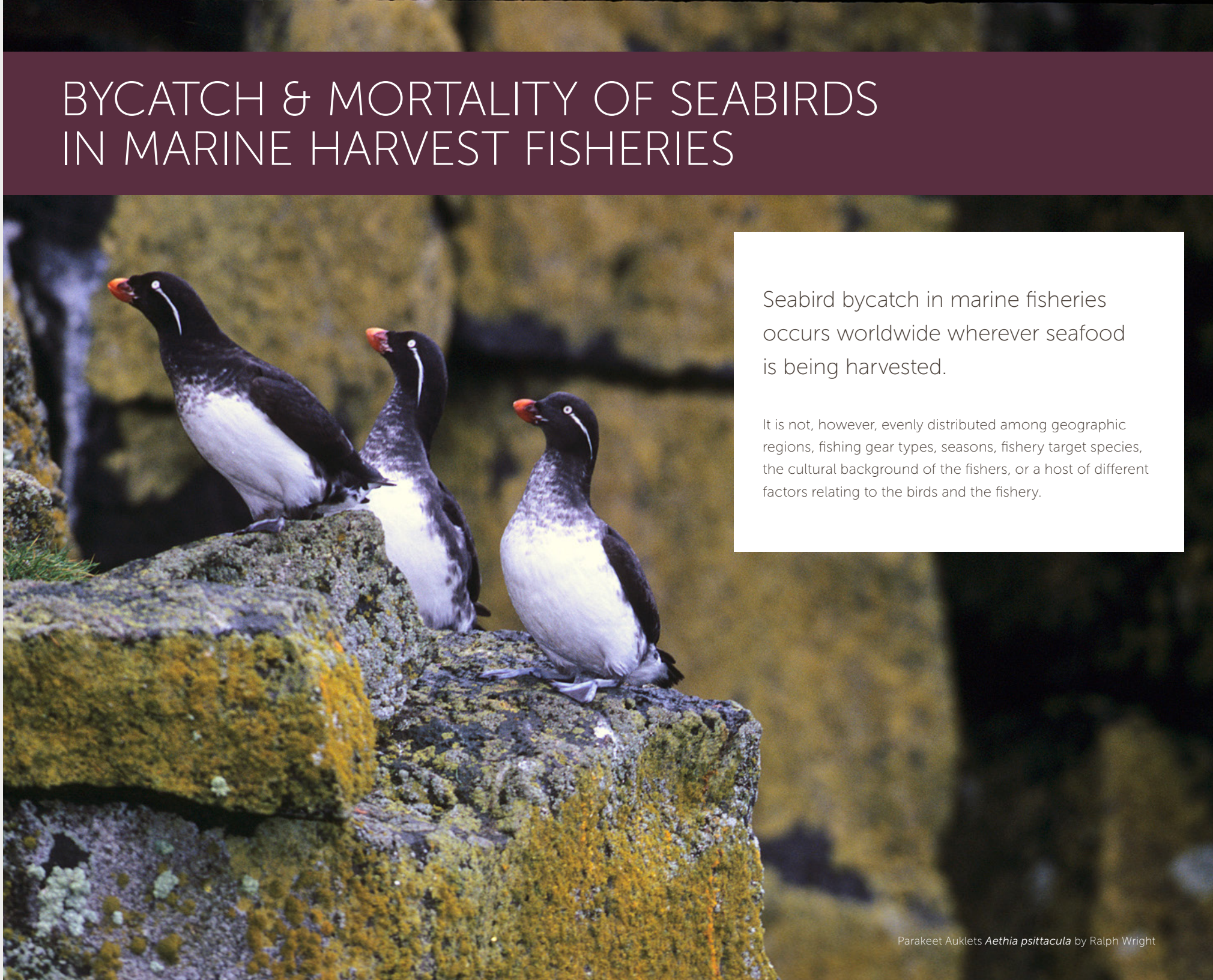
Both diurnal and nocturnal

- Species often favor one pattern or the other (they are primarily diurnal, but will forage at night on occasion, or vice versa).
- Some normally diurnal species will forage at night if there is bright moonlight, so the amount of nocturnal foraging by seabirds is often greater around the time of a full moon.

As with diet information, the limitations of seabird study methods means there is a bias in our knowledge about seabirds towards those with diurnal activity.

ABOVE: Mixed-species aggregation of Black-footed *Phoebastria nigripes* and *Laysan Phoebastria* immutabilis albatrosses by Sophie Webb

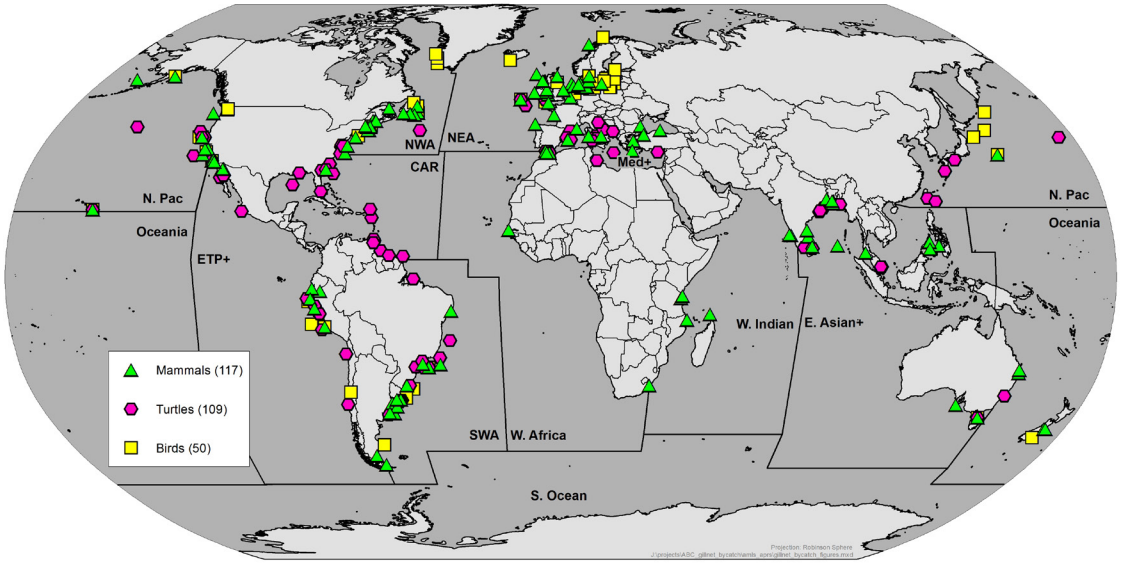
BYCATCH & MORTALITY OF SEABIRDS IN MARINE HARVEST FISHERIES



Seabird bycatch in marine fisheries occurs worldwide wherever seafood is being harvested.

It is not, however, evenly distributed among geographic regions, fishing gear types, seasons, fishery target species, the cultural background of the fishers, or a host of different factors relating to the birds and the fishery.

Parakeet Auklets *Aethia psittacula* by Ralph Wright



ABOVE: Map prepared by Brian P. Wallace from data in Lewison et al. (2014)

Lewison et al. (2014) mapped the global scope of seabird bycatch, showing areas where seabird bycatch is known to be high.

The map shows some striking patterns, but unfortunately it shows more about the extent of knowledge and the availability of data than it does about where seabird bycatch is high.

The data are highly correlated with developed nations.

For example, there are many seabirds in the Indian Ocean, but little bycatch data from there.

Nonetheless, the maps do confirm some things that we know from other sources. For example, gillnet and longline bycatch is higher in mid-latitude waters, where more longline and gillnet fishing occurs.

Seabirds may be killed and brought on board as bycatch, or brought on board alive.

They may also be killed outright, or fatally injured but never hauled on board of the fishing vessel. These may be, for example, bird strikes or birds that "drop off" a hook. These fatally injured birds not brought on board – and maybe never even seen or noticed by the fishers – should still be recognized as "bycatch." The MSC, for example, does consider such birds not hauled on board as bycatch.

The ways this may occur will be discussed below.

Throughout this document we use nomenclature for fishing gear developed by the Food and Agriculture Organization of the United Nations (FAO). This system is called the International Standard Statistical Classification of Fishing Gear (ISSCFG).

Seabirds may interact with fishing gear in different ways. These different types of interactions may be significant when choosing or developing bycatch reduction techniques for a fishery. Many times the fishery can work to develop simple and practical solutions to bycatch. Here are some types of interactions. Mitigation methods for many of these are discussed in a following section.

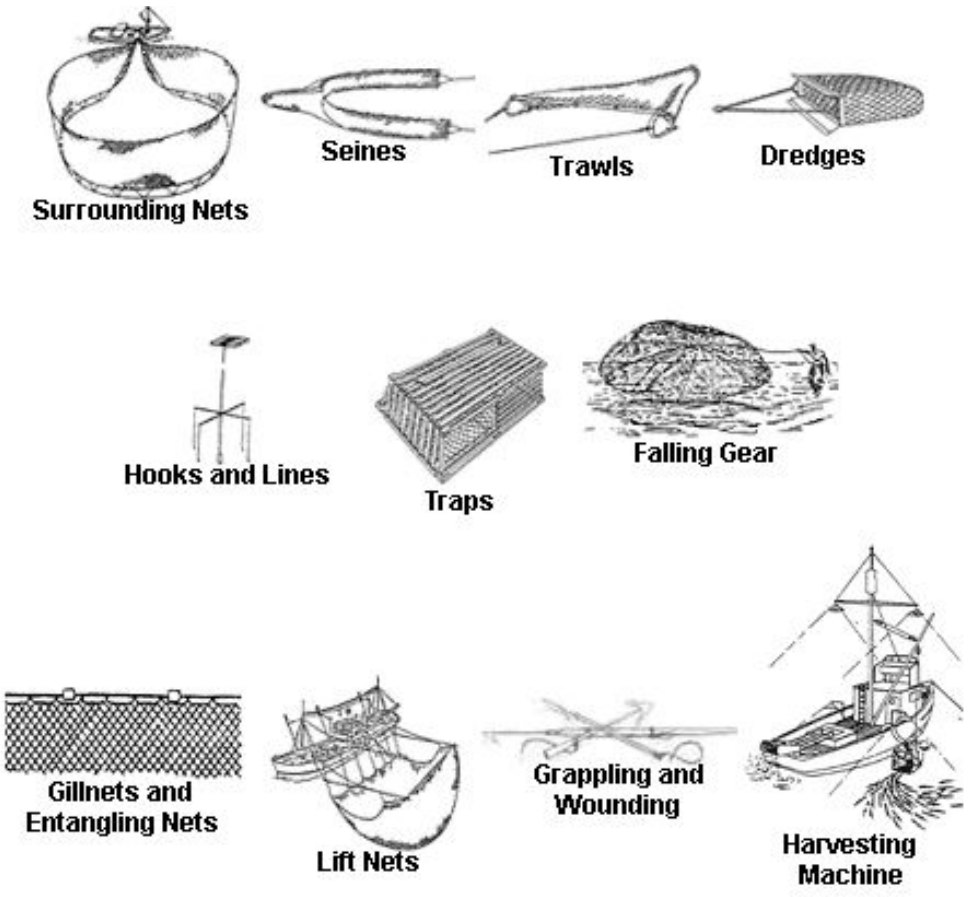
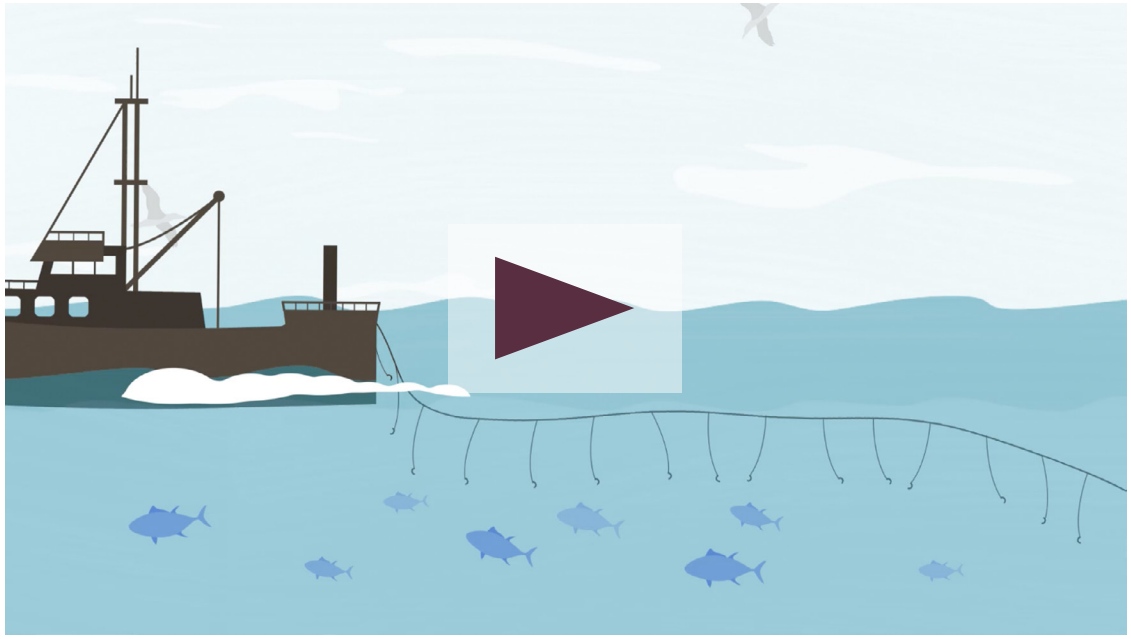


Illustration from FAO International Standard Statistical Classification of Fishing Gear



VIDEO: BIRDS GETTING CAUGHT IN HOOKS

TOP: Wandering Albatross *Diomedea exulans* caught on hook by Fabiano Peppes/Projeto Albatroz

HOOKED

In hook fisheries (longlines, troll, jig, handlines – ISSCFG Code 9), seabirds are commonly hooked when the gear is baited and being set. They may also be hooked when gear is soaking or being hauled as the birds attempt to eat the harvested items being brought on board.

The danger zone for seabirds is usually immediately behind the vessel, when the hooks are near the surface within reach of the birds. This is usually just before the line has sunk to the appropriate depth. As the line is being set it is also very attractive to seabirds because it has just been baited.

Birds hooked when the gear is being hauled are sometimes brought on board alive. It may be possible to free and release them alive.

Handling & releasing seabirds

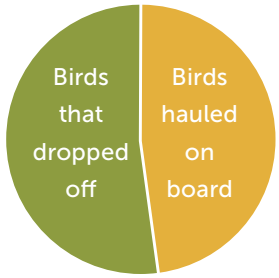
Some simple guidelines for handling and releasing seabirds that have been hooked and brought on board alive are:

- Hold the bird carefully but firmly, not allowing it to flop about or escape. Do not hold it only by the neck or bill or wingtip. The bird's body should be held as well.
- Remove any external hooks by cutting the line as close as possible to the hook, pushing the hook barb out point first, cutting off the hook barb using bolt cutters, and then removing the hook shank. Cut the fishing line as close as possible to ingested or inaccessible hooks.
- If the bird has become wet, leave it in a safe enclosed space to recover until its feathers are dry.
- Release the bird only if it is able to:
  - Hold its head erect and respond to noise and motion stimuli.
  - Breathe without noise.
  - Flap and retract both wings to normal folded position on its back.
  - Stand on both feet with toes pointed forward.
- After the birds are recovered, release seabirds by placing them on the sea surface. *Do not throw the bird into the air!* Make sure there is no fishing gear in the water and that the vessel is in neutral when you release the bird, and that the bird is clear of the vessel before motoring away.

TOP: Chart based on data from Brothers et al. (2010)

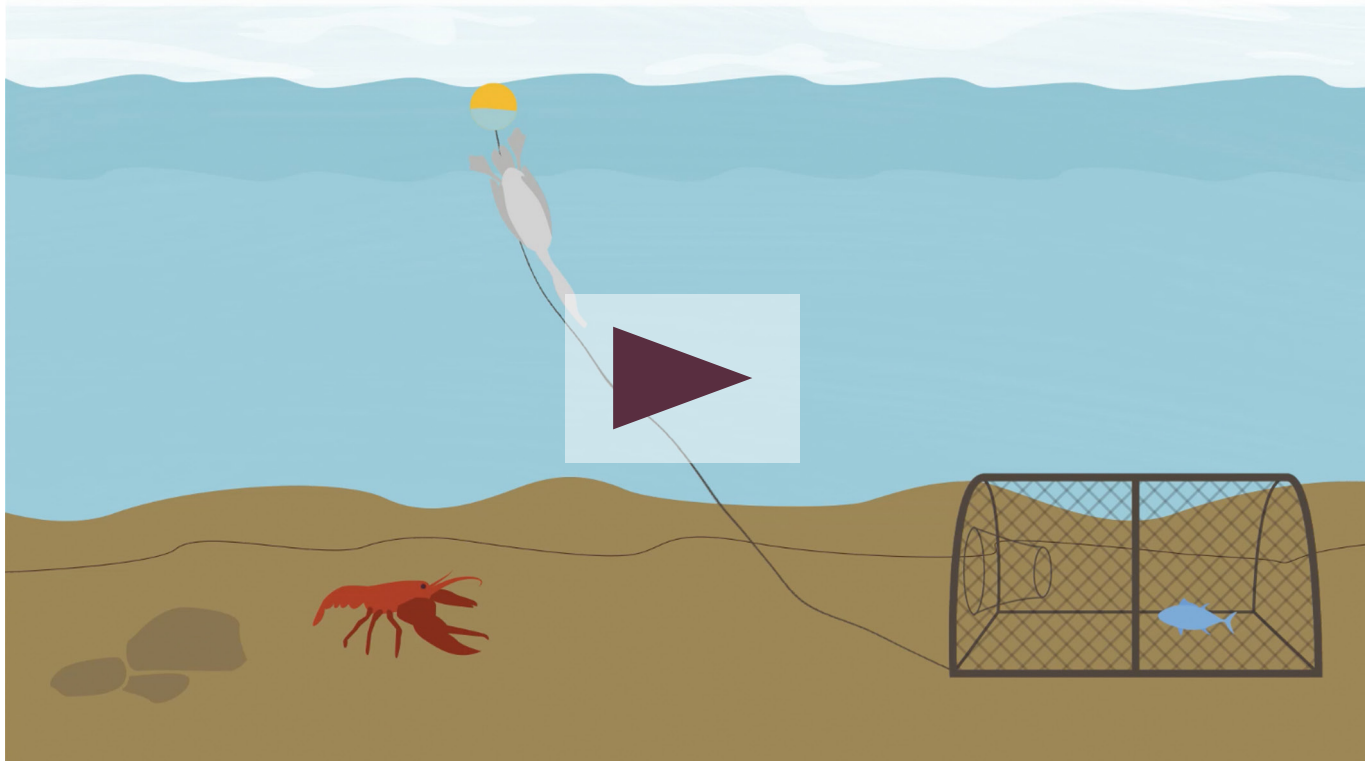
ABOVE: Brown Pelican *Pelecanus occidentalis* by Melissa Wiedenfeld

Bycaught Seabirds



Seabirds that are hooked are not always brought on board as bycatch. For example, birds hooked during setting of a longline may disappear during the soak as a result of scavenging. Dead birds may also drop off the hook during hauling of a longline.

Brothers, Duckworth, Safina, and Gilman (2010) estimated that 52 percent of hooked individuals of longline fisheries in four regions were lost between setting and hauling. Observations are typically made only during hauling. Mortality is therefore often highly underestimated.



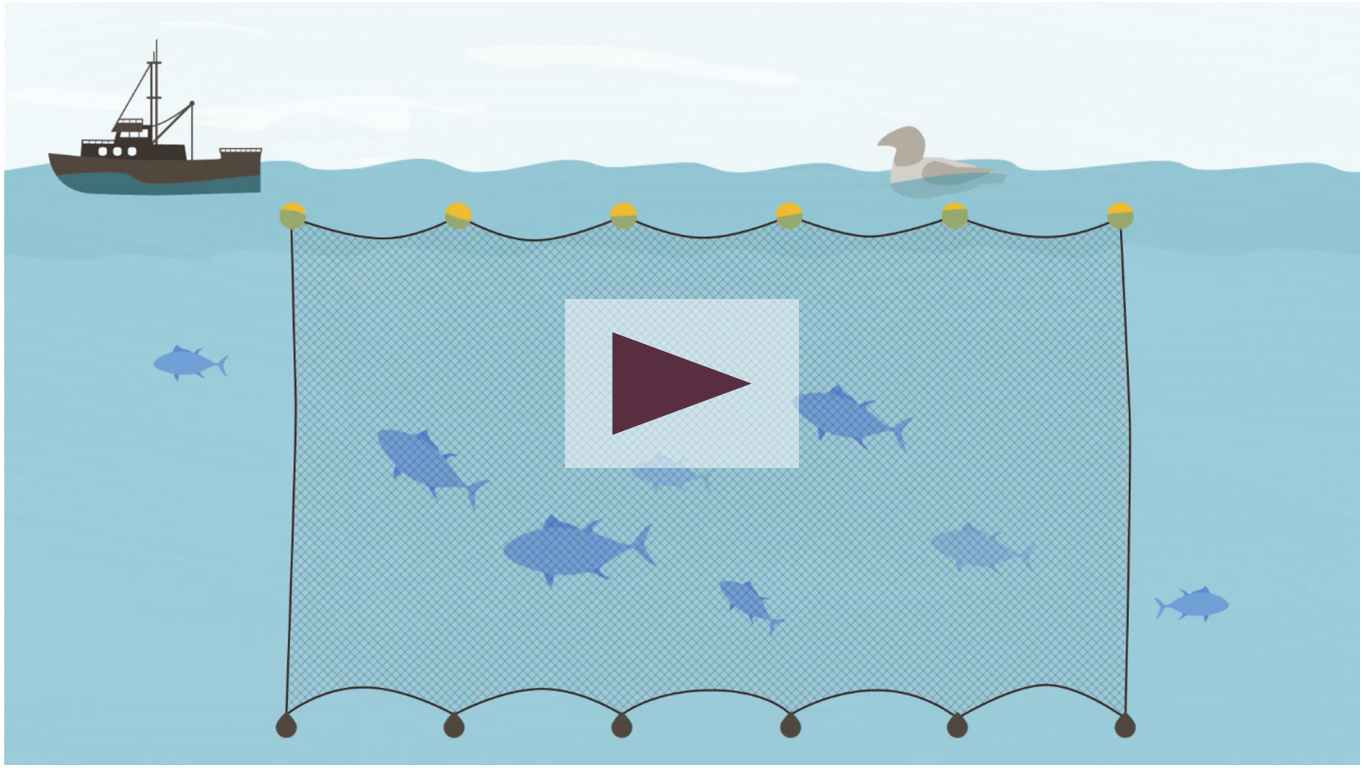
VIDEO: SEABIRDS CAUGHT IN TRAPS & POTS

TRAPPED

Birds may be trapped in many kinds of traps and pots (ISSCFG Code 8).

Often, these are pursuit diving birds such as cormorants and shags or alcids, or some benthic feeders, that enter into pots or traps to eat the bait, or fish or crustaceans that might already be caught. As with the traps' target species, once in, the birds are unable to escape and so they drown.

Birds, including landbirds but more often gulls, can be trapped in pots or traps that have been stored open on shore! The birds enter the trap to obtain remaining small food items.



VIDEO: SEABIRDS ENTANGLED IN NETS

ENTANGLED

All nets may entangle seabirds, although different categories of nets may have different modes of entanglement.

Gillnets and other entangling nets (ISSCFG Code 7) tend to be more effective at entangling seabirds than other nets, such as seine nets, surrounding nets, and other nets types (ISSCFG Codes 1, 2, 5, 6, 10.5, 10.6, and 10.7).

In most cases of seabird bycatch and mortality from net entanglement, the cause of death is drowning of the entangled bird during the soak period.

However, birds may also become entangled in nets that are being set, and then dragged into the water and drowned.

Seabirds may be attracted to detritus or small bycatch organisms that are left in the nets. Clean nets are not very attractive to birds.

Some birds may also be entangled during net hauling, as they try to take fish or bycatch items from the full net.

In some cases when the net is being hauled, the birds may become entangled but brought on board alive. In these instances, it may be possible to disentangle the bird and release it alive. However, if care is not taken, seabirds can be killed by becoming caught in machinery used to haul the net, such as winches.

ABOVE: Gull eating remnants left in a net by William Folsom/Marine Photobank

NETTED

Diving seabirds may be netted in trawls (ISSCFG Code 3) and drown.

Few seabirds, however, are ever found in the cod-end of a trawl. Mortality of seabirds from trawls tends to be from striking the gear, especially warps or cables, and the bird is never hauled on board. This will be further discussed below.

VIDEO: SEABIRDS CAUGHT IN A SEINE

MORTALITY OF SEABIRDS NEVER HAULED ON BOARD THE FISHING VESSEL

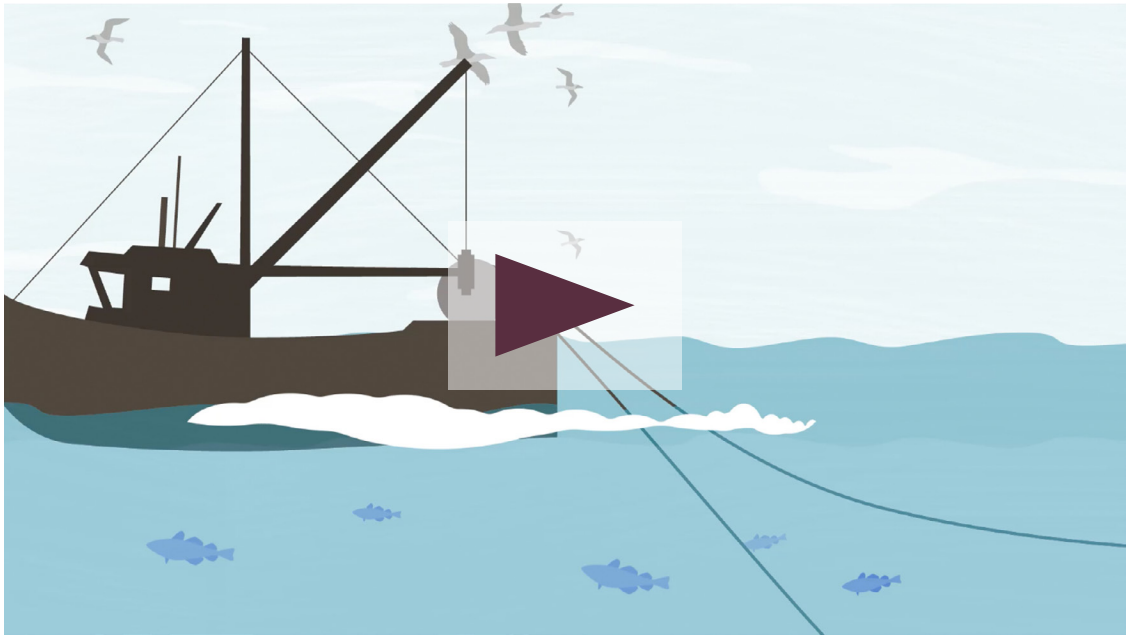
As mentioned above, birds fatally injured but not hauled on board the fishing vessel should still be considered in analysis of bycatch.

The most common causes of these injuries are:

Seabirds striking trawl warps, lines, and third (sonde) wires
During a trawl, seabirds may approach the stern of a trawler to obtain and compete with other birds for food items in the screw wash. They may then be injured by collision with the trawl warps or the third (sonde) wire, if used.

Birds have fragile bones. Collisions may cause broken bones or other internal injuries that are not immediately evident.

A bird with a fractured wing may settle onto the water and not appear to be injured. However, if it is unable to fly, it will eventually starve, perhaps many days later.



VIDEO: BIRD STRIKES TRAWL WARP

VIDEO: BIRD STRIKE ON BOAT

Boat strikes

Seabirds may also strike other parts of vessels not directly part of the fishing gear, such as masts, spars, antennas, other lines, or even the structure of the vessel itself.

As with striking the fishing gear, the significance of the injury may not be immediately evident.

Vessel strikes may be more common in fog and at night, and may be exacerbated by bright lights on the boat.

Injuries

Other injuries can impede proper food consumption, and hooks can be regurgitated for chicks to consume. See examples in Huin and Croxall (1996).

NON-FATAL INJURIES AND INTERACTIONS

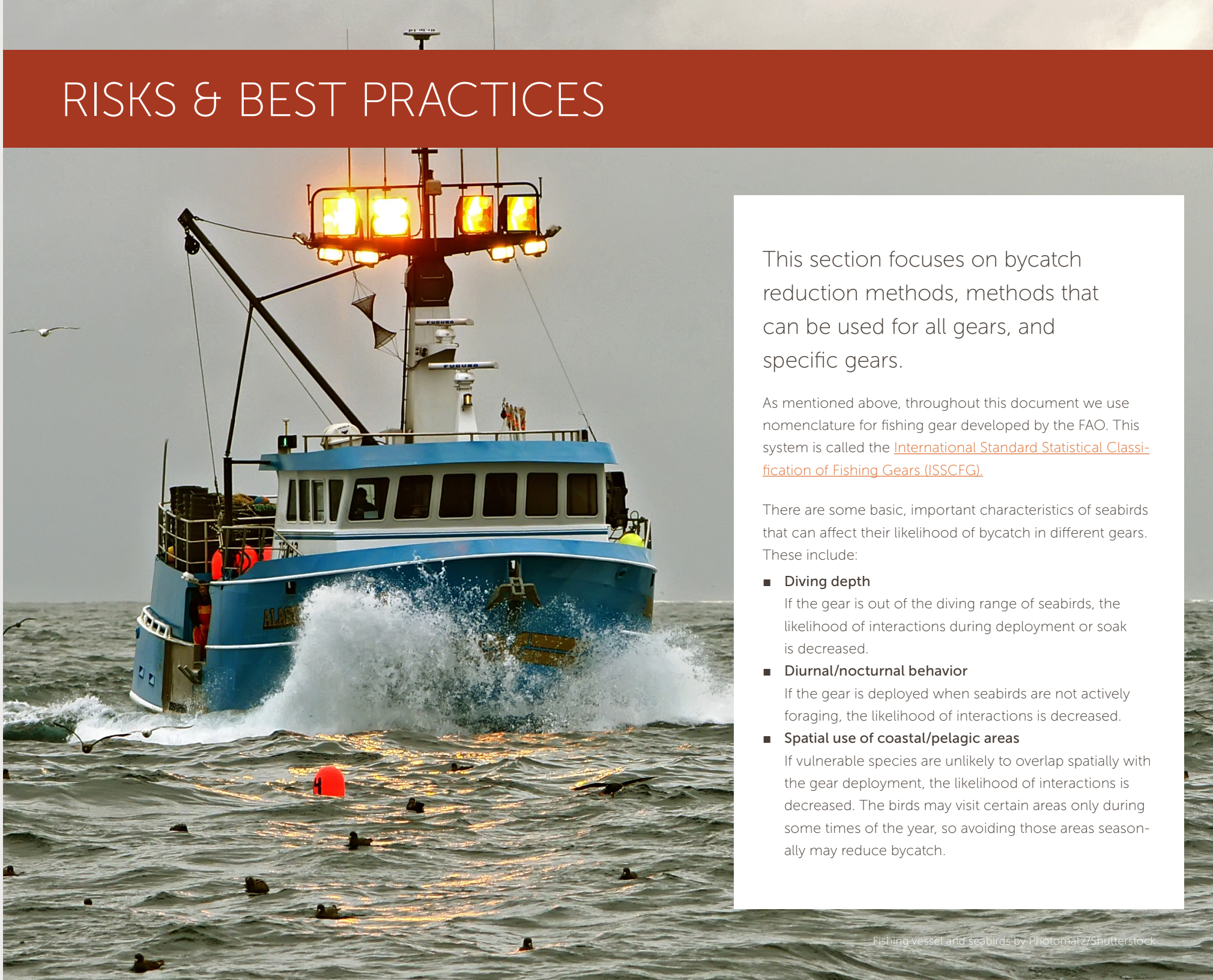
Of course, all of the above interactions with gears and vessels can have effects that are non-fatal to the seabird either immediately or subsequently.

"GHOST FISHING" BY DERELICT GEAR ALSO ACCOUNTS FOR UNOBSERVED MORTALITY

The way in which seabirds are caught by derelict gear of course depends upon the gear type, and can be a result of hooking, entangling, or any other kind of interaction, depending on gear type.

Bird caught in derelict gear by Cor Kuyvenhoven/Ghost Fishing

RISKS & BEST PRACTICES



This section focuses on bycatch reduction methods, methods that can be used for all gears, and specific gears.

As mentioned above, throughout this document we use nomenclature for fishing gear developed by the FAO. This system is called the International Standard Statistical Classification of Fishing Gears (ISSCFG).

There are some basic, important characteristics of seabirds that can affect their likelihood of bycatch in different gears. These include:

- **Diving depth**
  If the gear is out of the diving range of seabirds, the likelihood of interactions during deployment or soak is decreased.
- **Diurnal/nocturnal behavior**
  If the gear is deployed when seabirds are not actively foraging, the likelihood of interactions is decreased.
- **Spatial use of coastal/pelagic areas**
  If vulnerable species are unlikely to overlap spatially with the gear deployment, the likelihood of interactions is decreased. The birds may visit certain areas only during some times of the year, so avoiding those areas seasonally may reduce bycatch.

Fishing vessel and seabirds by Photomatz/Shutterstock

- **Gregariousness**
  As the number of birds attending fishing boat and gear increases, so does the likelihood of interactions.

By considering these types of characteristics for the seabirds at risk in the area of your fishery and comparing them with characteristics of your gear type can suggest which bycatch reduction methods will be most effective.

When evaluating risks and comparing potential bycatch reduction methods, it is important to consider the entire water column through which the gear will be passing, and the entire time period in which the gear will be deployed.

Interactions with seabirds may vary at different levels in the water.

For example, a demersal longline may affect different species when being deployed, when fishing, and when being hauled.

- During deployment, the longline poses a risk to surface feeders and shallow divers, but possibly also to deep divers.
- During fishing, the longline poses a risk to deep divers, but not to surface feeders or shallow divers.
- During hauling, the longline again poses risk to shallow divers and surface feeders, but is possibly more attractive to larger seabird species capable of eating larger fish (the target species, not bait).

Because seabirds – as well as other potential bycatch species and the target species – may be active, and potentially bycaught, at different times of day, it is also important to consider the times of day and duration of different fishing activities, such as setting, soak, and haul.

Most bycatch reduction measures are used in combination for best effect.

Using more than one method can ensure that risk to all seabirds is minimized because although some bycatch reduction methods can be very effective to one species or group of species, not all species of seabirds react the same to any particular method.

ABOVE: African Penguins *Spheniscus demersus* by Caroline Pott

GENERAL BEST PRACTICES FOR BYCATCH REDUCTION

There are some bycatch reduction methods that can be used regardless of gear type and require no technical adjustments to the gear itself. We will discuss several of these methods.

Offal and discards management

Seabirds are attracted to the discard of unwanted fish or invertebrates that are offloaded by fishing vessels as well as the offal produced from processing. If the waste or offal is discarded during fishing, seabirds may be attracted to it and can attempt to take bait and be hooked. This may result in their becoming entangled in nets being set or hauled, or colliding with trawl warps or other gear.

There are simple ways to reduce the attractiveness of discarding to birds, or to carry it out in a way that reduces risks to birds.

Discards

- Do not discard fish during trawls or setting hooks.
- When hauling, wait until the haul is complete before returning discards to the sea.
  This separates the activities of discarding and fishing, and thereby decreases opportunities for birds to come into contact with gear.
- Discard bycatch on the side of the ship as far as possible from the hauling hatch.

Offal management

As with discards, techniques that separate the activities of fishing and dumping offal can be very effective.

- Do not discharge offal during trawls or sets.
- Discard offal on the side of the ship away from the hauling hatch.
- Discharge minced offal.
  Offal must be reduced to a sufficiently small size that is unattractive as food to birds.
- Retain offal.
  On processor ships with freezing facilities, offal may be frozen until it can be discarded properly, whether at sea or at port.

Night-setting

Night-setting may be an effective bycatch reduction method if the key seabird species forage mainly by day, as most seabirds do. However, approximately one-third of all seabirds will sometimes forage at night.

Night-setting is also more effective on nights with low light levels (dark moon or heavy cloud cover).

On bright moonlit nights, bycatch can be quite high.

Night-setting has been shown to be effective in some cases in longline fisheries (both pelagic and demersal) and gillnet fisheries.

Deck lights should be kept to the minimum required for crew safety, and directed inboard so they do not illuminate the area where nets or hooks are being set and inadvertently attract seabirds. The goal is for the area to be too dark for the birds to find baits, so they are discouraged from being there.

Fleet communication to identify seabird concentration areas

Fleet communication programs can facilitate avoidance of areas with high numbers of seabirds (such as highly active foraging areas) or areas where bycatch is particularly high at a given time. In these types of programs, participating vessels report in real time, usually via modern electronic communications such as satellite communications, their levels and kinds of bycatch. Such information can then be analyzed and the results broadcast to other vessels fishing the same area. Those other vessels may avoid the area or may implement effective avoidance methods, thereby reducing bycatch.

Such programs can also be built into fisheries management regulation, and can be used to call spatio-temporal pauses in fishing to avoid areas experiencing high levels of bycatch.

These programs rely on modern, rapid communication.

These programs also rely on participation and cooperation by vessels, some of which may be competitors. The programs can provide gains at any level of participation among fleet participants (that as, any proportion of vessels in the fleet participating), but effectiveness is increased with increased participation.

There is a good review of fleet communications programs in O'Keefe, Cadrin, and Stokesbury (2014).

Gear switching

A different type of gear may still achieve good catches of target species and reduce its accessibility to seabirds.

The objective is to trade high-risk gear for low-risk gear that achieves similar catch of target species.

Chuenpagdee, Morgan, Maxwell, Norse, and Pauly (2003) illustrate assessments that could guide such a decision.

Reducing "ghost fishing"

Care to retain control of, or to recover, lost gear is an important part of reducing overall bycatch and mortality levels – not just to seabirds, but other marine life too.

Seasonal Adjustment

For colonial-breeding species:

Colonies of seabirds tend to be highly seasonal and have highly concentrated numbers of individuals.

Seabird bycatch can be reduced by avoiding areas around breeding colonies either:

- Altogether; or
- By shifting the timing of fishing to avoid the breeding season.

The distance from the colony that seabird adults may travel to find food to carry back to the nestlings varies by species and the environment around the colony. Therefore, a fixed distance by which to avoid a colony cannot be recommended; rather, it depends on the species and conditions.

The North Pacific Seabird Colony Database, although not comprehensive, can provide information about locations of colonies in the northeastern Pacific.

For all species:

- Seasonal closure (during breeding) of favored foraging grounds (often associated with undersea features) could reduce bycatch for some species.
- This may be one way to reduce bycatch for some non-colonial breeders.
- Favored foraging grounds are still poorly known for many species, but some of the well-studied albatrosses and penguins generally have more information of this kind.

RISKS AND BYCATCH REDUCTION FOR SPECIFIC GEARS

LONGLINES OF ALL TYPES (PELAGIC, DEMERSAL)

Of any gear type, unmitigated pelagic longlines are likely to pose the highest risk to surface-feeding albatross, fulmars, gulls, and shearwaters.

However, effective bycatch reduction methods do exist for all types and uses of longlines, and can reduce seabird bycatch to near zero when used appropriately and effectively.

General Principle:
Reduce accessibility of hooks to birds

Seabird bycatch will be reduced when any method is used that reduces birds' access to hooks, either during setting or hauling.

Pelagic operations can have secondary effects. For example, a diving bird may bring a hook and bait to the surface, placing other birds at risk.

This can occur even when the longline was deployed properly from the boat.

Best Practices

A description of most of the bycatch reduction methods described here, and how to deploy and use them, is detailed in the Agreement on the Conservation of Albatrosses and Petrels (ACAP) Bycatch Mitigation Fact Sheets.

White Tern *Gygis alba* by ClipArt.com

BIRD-SCARING LINES

For all types of longlines, bird-scaring lines (these may also be called "streamer lines" or "tori lines" in different countries or fisheries) are very effective when used properly.

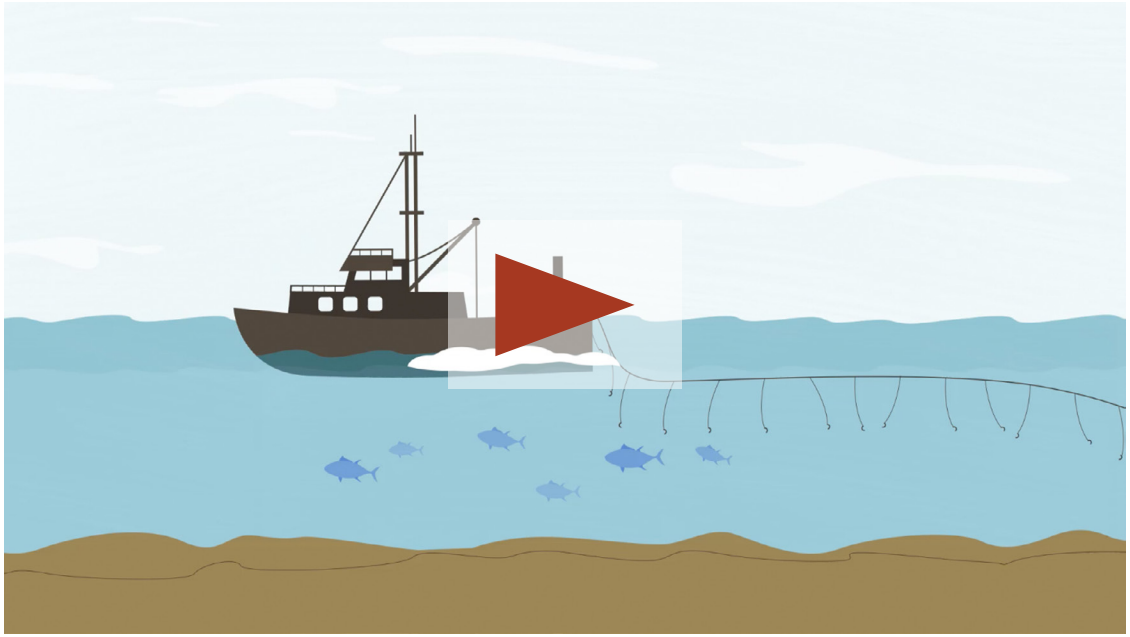
These lines act to keep birds away from the setting area of the longline, where the longline is entering the water.

On larger vessels, paired bird-scaring lines are more effective in keeping birds away from the longline setting area.

Bird-scaring lines are especially effective in combination with line-weighting

Weighting is necessary because adept divers (e.g., shearwaters) may still succeed in diving for hooks once out of the bird-scaring line protected setting area.

When streamer lines are used in combination with proper line-weighting, bird bycatch in longlines can be nearly eliminated.



VIDEO: BIRD SCARING LINES

LINE-WEIGHTING

Rapidly sinking lines minimize the surface time of hooks and their availability to surface feeding birds. The rate of sinking is an important factor for consideration: faster sinking lines reduce bycatch by greater amounts. Line-weighting can significantly reduce seabird bycatch when used in conjunction with bird-scaring lines.

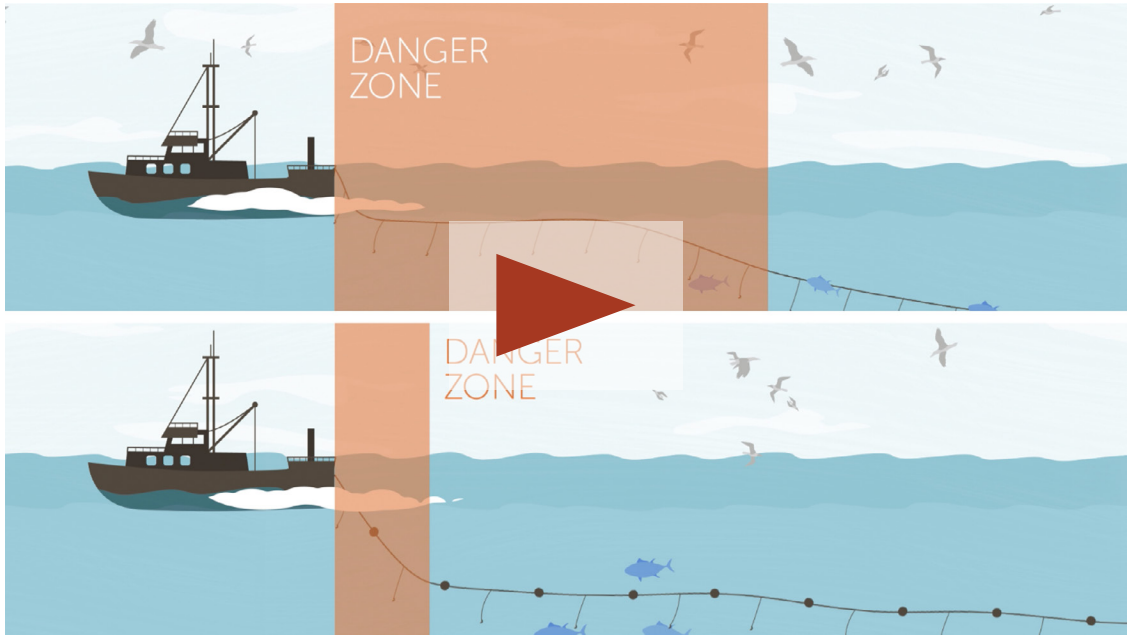
There are two basic categories of line-weighting systems.

External weight systems

- Includes the "Chilean System" of line weighting.
- Weights are attached to the line at intervals. The weights may be attached as part of the setting process and removed as the net is hauled.

Internally-weighted or integrated-weight lines

- Weight is incorporated into the main line itself.
- Internal line-weighting is safer for fishermen and is more effective in achieving rapid sinking rates, but it is also more expensive than external weights.



VIDEO: WEIGHTED VS UNWEIGHTED LINES

HAUL PRACTICES

Brickle curtain: This streamer curtain can effectively reduce access by seabirds to the area around the hauling hatch, reducing hooking during the haul.

Use more than one bycatch reduction method:
All of the methods described above are more effective when used in conjunction with other bycatch reduction methods. Bycatch can be reduced to effectively zero by combining them with night-setting and proper offal/discard management.

Other practices and technologies

SIDE-SETTING

- Setting the hooks to the side of the vessel instead of directly astern can potentially reduce seabird bycatch: birds may be unwilling to approach the side of the vessel and the line is not set into the screw wash where it may be maintained afloat for a longer period.
- However, this method has not been well-tested. Side-setting also likely to be effective only with surface-feeding seabird assemblages, and is likely to be less effective with diving seabirds.

UNDERWATER-SETTING

- Use of an underwater-setting system, or setting chute, can reduce bycatch of surface-feeding seabirds.
- It is not, however, usually highly effective when deployed alone, but may be effective when used in conjunction with other bycatch mitigation methods, such as line-weighting, especially internally weighted lines.

BAIT CASTERS

- These may be effective when properly used in conjunction with bird-scaring lines. However, bait casters are complex, require training, and pose some safety concerns for the fishermen using them. They should only be used as a secondary method in conjunction with bird-scaring lines as the primary method.

LASER DETERRENTS

- This is a new technology.
- Laser deterrents use a bright visible laser that moves rapidly and erratically within the setting zone, and can frighten seabirds from the area.
- Although they may be effective, laser deterrents are not well-tested in many types of fisheries.
- Disadvantages include high cost and the advanced technology and equipment that must be durable and maintained.

DYED BAITS

- The objective of dying baits is to make them less detectable or attractive to birds.
- Dying is usually recommended only when using squid as bait. Fish baits do not absorb dye well and do not become dyed blue.
- Blue-dyed baits have not been shown to be very effective in reducing seabird bycatch. They may be more effective as a bycatch reduction method for sea turtles.

SONIC DETERRENTS

- These systems play recorded threat or fear vocalizations from seabirds to frighten birds from an area or vessel.
- The systems have not been well-tested in a variety of fisheries.

WATER SPRAYS

- Sprays using water from a high-pressure pump may keep seabirds away from a very local area.
- However, the cost is relatively high, and usually requires active management of the spray by the fishermen to aim or direct the spray at the birds.

HORNS OR SIRENS

- Although horns or sirens may be temporarily effective in frightening seabirds away from a vessel or area, the birds tend to become rapidly habituated, returning to the area and ignoring further use of the horn or siren.

LINE SHOOTERS

- Loose lines do not sink as rapidly as lines set the regular way, and therefore may increase seabird bycatch. In addition, there have been concerns about safety of the fishermen using line shooters.

ABOVE: Blue-dyed squid by Fabiano Peppes/Projeto Albatroz

GILLNETS

Gillnets pose the highest risk to diving alcids, penguins, cormorants, and boobies. Bycatch reduction in gillnets is now the hot issue for seabird bycatch research. Gillnet bycatch of seabirds has proven to be a much more challenging problem to solve than longline bycatch, and has no immediate and obvious solutions. At present, there are no highly effective, universal seabird bycatch reduction methods for gillnet fisheries.

Several characteristics may affect what birds are bycaught in a gillnet and how they are caught. These include:

- Net dimensions, length, and height of the net.
- A larger surface area of a net panel will increase interactions with birds in the water.
- Mesh size and twine type.
- Smaller diving birds are more likely to be caught with smaller mesh size.

GENERAL PRINCIPLE:
Increase visibility to seabirds, and reduce encounter/entanglement rate.

High-visibility panels:

- These panels are now being tested in nets in several fisheries. They may consist of a checkerboard-patterned panel placed in the net.
- There are problems with these causing the net to loft.
- Brightly colored or white meshes may be woven into the net using white or colored twine.
- The cost and effectiveness of this has not been fully assessed.

Surface-set:

- Dropped corklines suspend the net below the surface 1 to 2 m, as opposed to having the net directly at the surface. The dropped corkline may allow shallow-diving species to avoid the net by swimming over it.
- One of the most effective methods of reducing seabird bycatch is simply attending the nets. Having someone there keeps seabirds away. This approach is most feasible in artisanal fisheries in which nets are only a few hundred meters long and have shorter soak times.

TRAWLS

Trawls generally pose less risk to seabirds than gillnets and longlines. However, trawls may produce significant seabird mortality in some situations. This can apply to all types of trawls (e.g., mid-water, bottom, pair).

In trawl fisheries, it is actually uncommon for seabirds to be hauled on board in the net, and therefore evaluators may consider that they have little or no problem with seabird bycatch and mortality. This is true even for fisheries with 100 percent observer coverage: Because few birds come in at the cod end of the net, it is assumed there is no problem.

Many trawl fisheries have issues involving collisions with high-tension cables (warp strikes, or third wire (sonde) strikes).

Birds may also be entangled in a net, often when the net is being hauled.

GENERAL PRINCIPLES:
Deter birds from high-tension cables, and prevent them from becoming entangled in deploying nets.

The ACAP's Bycatch Mitigation Fact-Sheets provide a good summary of warp strike mortality reduction methods.

Keeping Birds away from Operations

Streamer lines, like those used for longlines, appear to be most effective, but for some types of trawls they may not be easily and effectively deployed.

"Bafflers" such as the Brady baffler can be effective in some, but not all, configurations of gear.

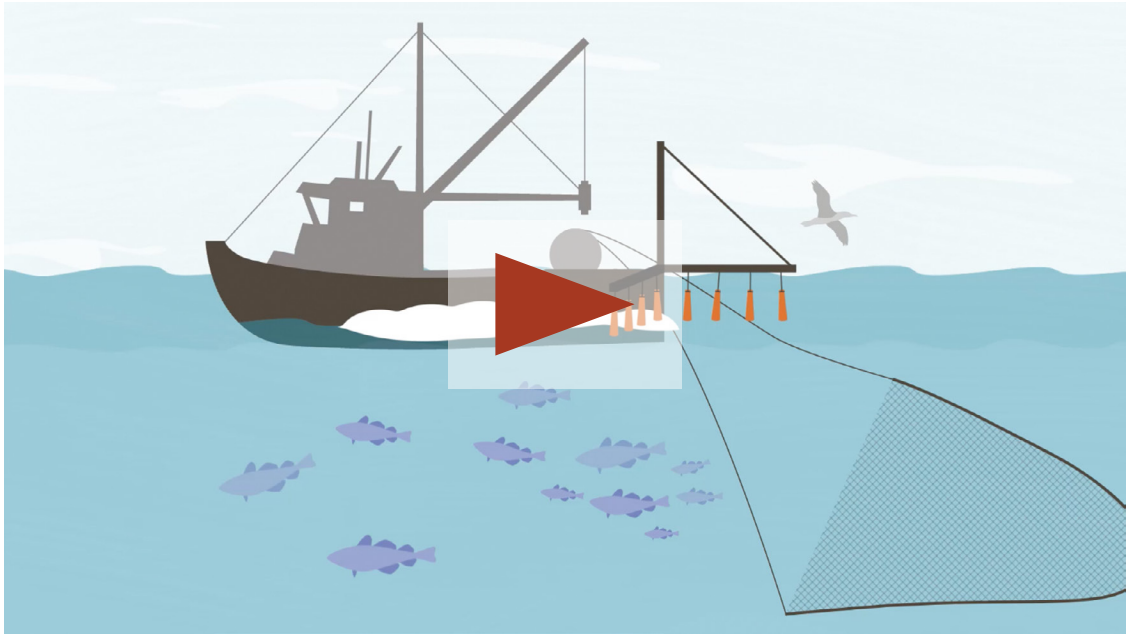
Offal management can be an important component of efforts to keep birds away from operations. Some jurisdictions require offal management (e.g., New Zealand).

Reducing Surface Time during Deployment

Net binding and net weighting may be used to attract surface-feeding birds by keeping the trawl net closed when at the surface and making it sink more rapidly to deployment depth, reducing its attractiveness to surface-feeding birds.

Reducing Attraction of Birds

As with seines (described above), maintaining clean nets can also reduce the gear's attractiveness to birds during deployment.



VIDEO: BRADY BAFFLER

SEINES AND OTHER SURROUNDING NETS

These types of nets can pose risks to all kinds of seabirds, including diving and surface foragers. However, the risk is not as high as it is for other gear types, such as longlines and gillnets.

Seabirds usually face greatest risk when shooting or hauling the seine nets.

Shooting

During shooting, seabirds may be attracted to discards or remnants from previous fishing, and can become entangled, dragged under, and drowned when attempting to take the food items from the net.

Keep clean nets to reduce the nets' attractiveness to birds.

Hauling

During hauling, seabirds are attracted to the catch and may be caught in the net as it is being brought to the surface and on board. The birds face risk of drowning and, importantly, being pulled through machinery, such as winches.

Alertness of those managing the haul equipment can enable them to stop it before a bird is crushed; it may be possible to release the seabird alive.

LOW-RISK GEARS

Low-risk gears pose little risk to seabirds, so few bycatch reduction methods have been developed or tested for them. These low-risk gears include: pots; traps; fish wheels; weirs; fyke nets; pound nets; dredges; lift nets; falling gear; trolls and jigs; handlines; and hand-deployed implements such as harpoons, tongs, and rakes.

The easiest method to reduce any seabird bycatch caused by the gear types is to attend the gear. The likelihood of any seabirds approaching or interacting with the gear is reduced when it is not left to fish alone (e.g., handlines).

Store gear when not actively fishing.

Most of this section has focused on the risks and bycatch reduction methods when fishing. However, gear poses some risks to seabirds when not fishing. These risks are of course different from those posed to aquatic life, which usually is zero when the gear is stored out of the water. Gear stored onboard a fishing vessel or even stored on land may still have the potential to catch and injure, or kill seabirds.

Nets or Hooks

Nets or hooks stored out of water but in the open may pose a hazard to seabirds, although usually only if they have attractive remnants on them. If hooks retain old baits or bits of the catch, and if nets retain small fish or invertebrates, they may be attractive to some seabirds. Birds trying to eat the remnants may be hooked or become entangled in lines or nets.

This most commonly occurs with scavenging species, such as gulls.

The solution is to make sure hooks or nets that are dried or stored in the open are clean, without any remaining baits, discards, or bycatch bits that can be attractive.

Traps and Pots

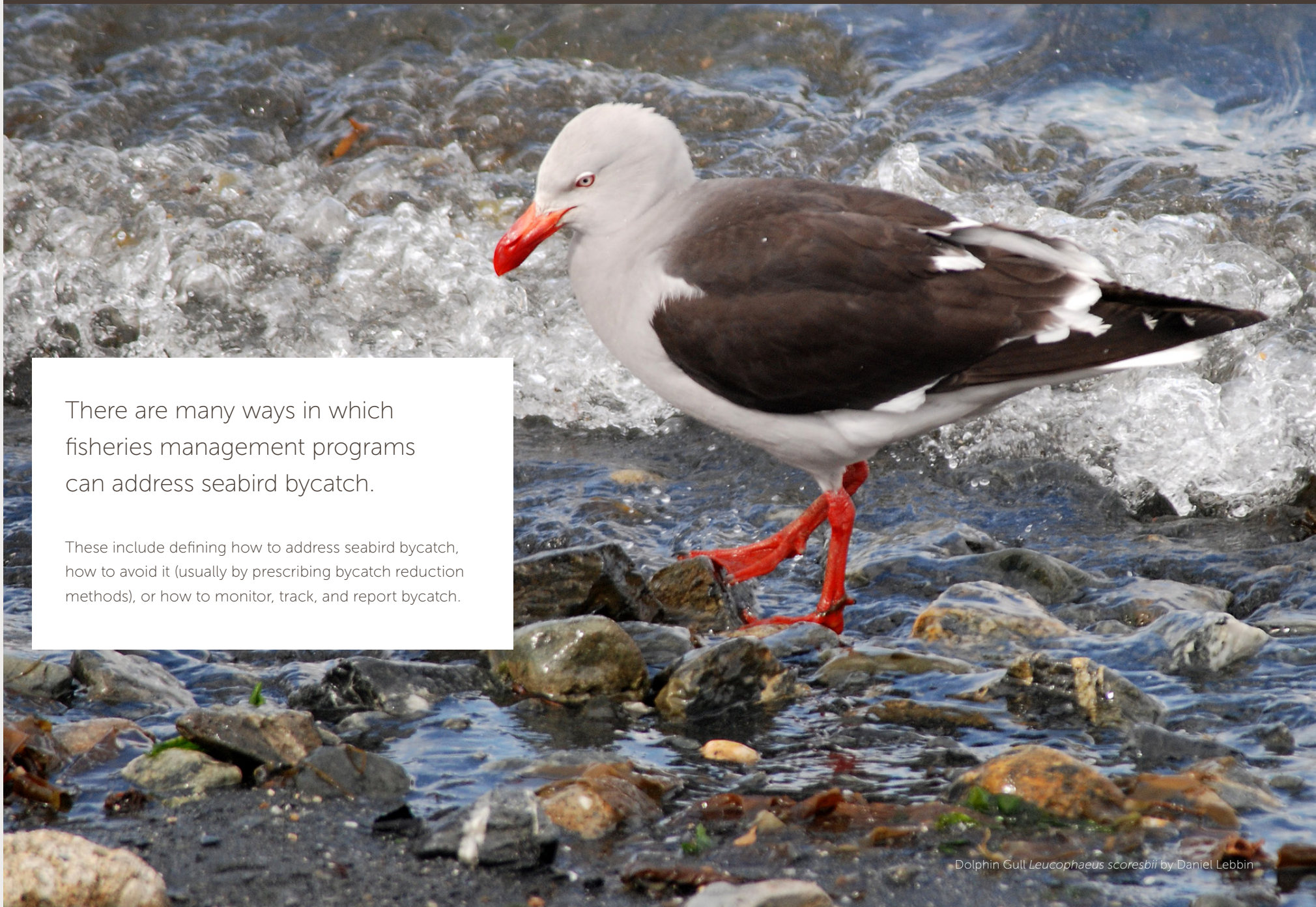
Old bait or bycatch left inside traps or pots may attract some birds. The birds may become trapped when entering the gear, just as the target species would be when fishing.

As with hooks and nets, entrapment most commonly happens with scavenging species such as gulls, but may also occur with other birds present in the area, including passerines (songbirds).

To reduce the risk to birds, clean out remnant bait, discards, or bycatch bits, and leave the pot or trap open, allowing a way for birds that do enter to escape.

ABOVE: Landing the harvest by Valerie Craig/Marine Photobank

FISHERY MANAGEMENT & MONITORING



There are many ways in which fisheries management programs can address seabird bycatch.

These include defining how to address seabird bycatch, how to avoid it (usually by prescribing bycatch reduction methods), or how to monitor, track, and report bycatch.

Dolphin Gull *Leucophaeus scoresbii* by Daniel Lebbin

WHEELHOUSE

Manuals describing regulations, best practices, and recommended procedures may be made available or even required to be kept by captains in their wheelhouse along with other logbooks. Some information that may be available in such wheelhouse manuals may relate to seabird bycatch. It may include legally binding regulations on fishing methods and gears, bycatch reduction methods, restrictions on times of day or year for fishing, and fishery closure areas. The manual may also contain some non-binding but useful information about seabirds, such as:

ABOVE: Seabirds and fishing by NEFSC/NOAA Fisheries

A seabird identification guide
The guide can help fishers to identify seabirds when they are bycaught. This can aid them in reporting bycatch and in knowing if a particular bird is significant (e.g., Endangered, Threatened, or Protected species).

How to report bycatch
The manual may contain instructions on how to report seabird bycatch, such as how and with whom to file the report. Reporting of seabird bycatch is mandatory in some fisheries, and optional in others.

What to do if you have a live bird
The manual may also contain information on how to deal with a live bird that is hauled on board. Instructions may tell how to determine if birds are severely injured and what to do if they are, and how to release birds that are uninjured or have minor injuries.

General instructions can also be found on the Seabird Maps and Information for Fisheries website.

OBSERVER AND MONITORING PROGRAMS

Many fisheries management programs include efforts to obtain catch and bycatch data. Some fisheries require observer programs for target species and fish bycatch, but not seabird bycatch. Likewise, with regard to the seabird bycatch component, observer and monitoring programs may be mandatory or optional.

Seabird monitoring and observer programs are highly variable in application globally and across fisheries (Lewison et al., 2004). The programs may depend on the vessel size and character, or crew size.

Factors affecting observer and monitoring programs with regard to seabirds:

Self-reporting

Even fisheries where target species and fish bycatch reporting is mandatory and carried out by observers may only require self-reporting of seabird bycatch. Self-reporting is much weaker and usually produces less reliable information. In fisheries using self-reporting, a wheelhouse manual can often aid the fishers in identifying and reporting the seabird.

Training of observers to include seabird bycatch

Many observers are placed on board vessels to monitor target catch and fish bycatch. They are often not trained to monitor seabird bycatch.

Onboard observers should be trained to look for different types of bycatch and mortality, not just dead birds hauled on board in net or on hook. Few birds are found in the cod-end of a trawl. The observers should therefore be trained to:

- Look for birds that drop off hooks. This often occurs during the haul, as a longline is being brought out of the water into the area of the hauling hatch.
- Watch for birds killed or injured by warp strikes or collisions with the vessel itself, and which are not hauled on board.
- Identify seabird species. Many seabirds are difficult to identify even under good conditions due to species similarities and plumage variability, especially in slow-maturing seabirds. Waterlogged and partial specimens are of course more difficult to identify. Training in seabird identification is a must for observers.
- How to record and report seabird bycatch data.

FORAGE FISH

Anchovy baskets by Xuan Huong Ho/Shutterstock

In shorthand, we will refer to this as the "forage fish" issue, although the food items involved do not actually have to be fish, but could include items such as squid, shelled mollusks, or crustaceans such as krill.

The issue of forage fish can be difficult to address because the effects of depletion of forage fish are often complex and indirect. For instance, if a seabird species loses its main forage fish source, it may be able to shift to alternate forage fish species and show no immediate detrimental effects. However, the effects are often diffuse and difficult to quantify.

The forage fish issue in seabirds arises when humans are competing with seabirds directly for food. That is, humans are harvesting a species (e.g., anchovies) that birds also eat.

Forage fish are sometimes sought by fisheries for aquaculture, usually as a food source for the farmed fish, for fish meal, or for direct human consumption. These are often reduction fisheries, producing oils or fish meal.

Harvest of forage fish may affect seabirds by direct competition (e.g., sardines, krill; Cape Gannet *Morus capensis* (Okes, Hockey, Pichegru, Lingen, Crawford, & Grèmillet, 2009); Gulf of California anchovy; U.S. central Atlantic coast menhaden).

Because of the reduction in their food sources, seabirds have to forage further from their colonies or from shore, increasing energetic requirements (e.g., African Penguin *Spheniscus demersus* (Pichegru, Ryan, van Eeden, Reid, Grèmillet, & Wanless, 2012). Overharvest of forage fish can result in starvation, reduced body condition, and breeding failures.

Forage fish will generally be smaller items that birds can capture and consume. Forage fish therefore would generally not need to be addressed directly in a tuna fishery or halibut fishery, for example, as the harvest target species are larger than birds typically consume.

Ecosystem structure and function in these large-fish fisheries may need to be addressed if the harvesting of top predator species, such as tuna, causes effects lower on the food chain that in turn impact forage fish.

Forage fish issues generally arise in fisheries targeting:

- sardines and anchovies;
- menhaden;
- juvenile salmonids;
- squid (either as bait or food);
- krill and other small crustaceans; and
- small-shelled mollusks (e.g. some types of clams).

BEST PRACTICES

Best practice is to leave approximately one third of the maximum biomass of the forage fish observed in long-term studies (Cury et al. 2011). This provides prey for the seabirds, but also a sufficiently large population of the forage fish species that it can maintain itself.

Sustainability of the fishery itself of course requires harvesting below the Maximum Sustainable Yield (MSY). The proportion of the total fish stock that is consumed by seabirds (and other harvesters within the ecosystem) is of course always one component of the MSY.

Stop-loss orders as described by Pikitch (2015) define a harvest rule whereby "fishing is suspended when forage fish biomass falls below a minimum biomass threshold, and is allowed to proceed for biomass levels above the threshold." These stop-loss orders should be defined in advance of fishing, to avoid last-minute decision making.

Risk-based approaches should also be considered. Even fairly conservative approaches (with respect to the risk of a forage-fish fishery collapse) can reduce fishery harvest levels only slightly while providing adequate forage of the natural predators in the ecosystem such as seabirds and other predators, by allowing more rapid recovery of the target forage-fish stock and therefore greater harvests (Essington et al. 2015).

MARINE STEWARDSHIP COUNCIL (MSC) CERTIFICATION

In this section, how seabirds and seabird bycatch issues are addressed in the MSC certification process will be discussed.

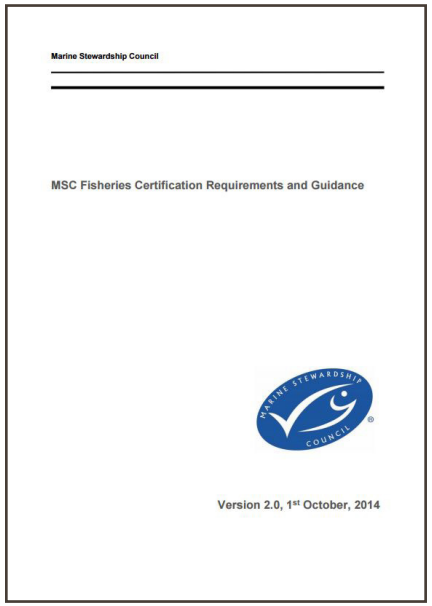
The focus includes the sections where and how seabirds are addressed in the certification requirements. Note that FAO guidelines state that bycatch should be minimized, not just reduced to minimally sustainable levels.

This implies that bycatch should be reduced even if it is already below biologically significant levels.

See the FAO's Code of Conduct for Responsible Fisheries (2011), Articles 7.6.9 and in 8.4.

This goes beyond just receiving a passing score in an MSC certification, and then considering that the fishery is "done." Not so: the fishery should keep improving. A fishery that is not sustainable should not be fishing. This then implies that reduction of bycatch begins at the point of sustainability — it does not end there. Once a fishery is sustainable, it should continue to improve.

Red-legged Kittiwake *Rissa brevirostris* by Greg R. Hormel/Natural Elements Productions



THE NEW MSC FISHERY CERTIFICATION REQUIREMENTS 2.0 (FCR 2.0) TOOK EFFECT ON 1 APRIL 2015

FCR 2.0 covers all fisheries entering assessment or reassessment after that date. Although the FCR 2.0 has many similarities with earlier versions, there are differences in the way this version treats seabirds.

New Terminology: Out of Scope

Seabirds are considered in FCR 2.0 to be out of scope.

This means that birds, like marine mammals or sea turtles, can never be a target or retained species.

This was always true of MSC-certified fisheries, but what is new is the terminology: now they are called "out-of-scope."

Although the terminology was not really used in the previous FCRs, the concept was always there. In FCR 2.0, the concept is now explicit, and sea-birds are referred to this way through-out the documents and guidance.

ABOVE: Red-tailed Tropicbird *Phaethon rubricauda* by Owen Deutsch; BELOW: Cover of "MSC Fisheries Certification Requirements and Guidance

All seabird issues are of course considered under Principle 2.

- Principle 2.2 Main bycatch.
- Principle 2.3 Endangered, Threatened, or Protected (ETP) species.
- Principle 2.5 Ecosystem effects

In the case of seabirds, P 2.5 will primarily address the fishery's effects on forage fish or other food sources for seabirds.

PRINCIPLE 2.2: MAIN BYCATCH

All seabirds are Secondary Main species.

Seabirds have always been Secondary species because they are not (and cannot be) target species. They are bycatch and never retained. This has not changed in the new FCR 2.0.

All seabirds are Main species.

The new FCR 2.0 considers all seabirds to be Main species regardless of their total volume or weight in the catch.

- See FCR 2.0 Annex GSA3.7.1.
- This is also true for all other out of scope species, such as marine mammals and sea turtles.
- The status of all Main species has to be assessed on a species-by-species basis. Even if bycatch of these species is very low (but existent), they cannot be combined into a single group and assessed as a unit (as Minor species can be).

This point will help reduce confusion caused by the previous FCR, which stated that a species had to be 5 percent of the haul. This guideline never made sense for seabirds, or other out of scope species.

ETP species have always been considered to be Main species. Now, all non-ETP species are as well.

Note that under FCR 2.0 Annex SA3.1.1.1, reports should contain a list of all Main species in a Principle 2 assessment.

This means that it is necessary for a reviewer to know all of the seabirds in his fishery area that might be bycaught!

Common Goldeneye *Bucephala clangula* by Tom Grey

A web-based mapping tool, Seabird Maps and Information for Fisheries, can quickly produce a list of all seabirds for any area designated. The tool also quickly provides a great deal of information about the birds in the area that can be useful in a certification assessment.

Therefore, all effects on seabirds have to be evaluated under the Performance Indicators (PIs) for Secondary Main species.

The following section will consider each of the Scoring Issues (SI) in PI 2.2, including seabird issues. However, the SIs will only be mentioned if there is a specific component related to seabirds.

PI 2.2.1 Secondary species outcome

SI 2.2.1 (a) Secondary species stock status

Because all seabirds are now considered Main bycatch, they must all be considered under this SI and cannot be considered under SI 2.2.1 (b).

PI 2.2.2 Secondary species management strategy

PI 2.2.2 SI (e): Review of alternative measures to minimize mortality of unwanted catch.

The inclusion of this new SI relates to the FAO Code of Conduct for Responsible Fisheries previously discussed: Not just achieve a minimum level of sustainability for a fishery, but also to minimize unwanted catch. Once a fishery achieves certification, it should not simply be frozen in place forever, or even until the next reassessment. A good, sustainable fishery should continually review its methods with an eye on improving them.

The SI does not require implementation of alternative methods unless those methods are effective, practical, and not cost-prohibitive relative to the current fishing method.

The SI does require considering and implementing improved methods as they arise.

For seabirds, this means consideration of bycatch reduction techniques. In gillnet fisheries, in particular, research on bycatch reduction methods is very active. Fisheries reviewers should keep abreast of this important area.

Bird ranges intersected by fishery: 'East of N Zealand' (57 species)

Include Species | Include Maps | Taxonomic Order

Display Range	English Common Name	Scientific Name	IUCN Status	Min. Population	Documented Bycatch	Range Area (sq. km)	Intersection Area (sq. km)
	King Penguin	*Aptenodytes patagonicus*	Least Concern(LC)	2,000,000	Yes	25,237,054	100,358
	Fiordland Penguin	*Eudyptes pachyrhynchus*	Vulnerable (VU)	5,000	Yes	1,702,620	13,231
	Erect-crested Penguin	*Eudyptes sclateri*	Endangered (EN)	165,000	Yes	968,576	121,771
	Southern Rockhopper Penguin	*Eudyptes chrysocome*	Vulnerable (VU)	2,400,000	Yes	1,361,393	131,939
	Wandering Albatross	*Diomedea exulans*	Vulnerable (VU)	unknown	Yes	95,324,740	251,106
	Antipodean Albatross	*Diomedea antipodensis*	Vulnerable (VU)	44,508	Yes	16,411,415	251,106
	Southern Royal Albatross	*Diomedea epomophora*	Vulnerable (VU)	27,200	Yes	67,671,024	251,106
	Northern Royal Albatross	*Diomedea sanfordi*	Endangered (EN)	25,000	Yes	71,627,520	251,106
	Light-mantled Albatross	*Phoebetria palpebrata*	Near Threatened (NT)	87,000	Yes	56,427,278	251,106
	Black-browed Albatross	*Thalassarche melanophris*	Near Threatened (NT)	2,100,000	Yes	105,920,996	251,106
	Campbell Albatross	*Thalassarche impavida*	Vulnerable (VU)	49,200	Yes	24,325,276	251,106
	Shy Albatross	*Thalassarche cauta*	Near Threatened (NT)	60,000	Yes	78,087,409	251,106
	Chatham Albatross	*Thalassarche eremita*	Vulnerable (VU)	unknown	Yes	2,814,563	120,894
	Salvin's Albatross	*Thalassarche salvini*	Vulnerable (VU)	90,000	Yes	31,789,423	251,106

An example of a complete list of seabirds for a fishery area produced by the Seabird Maps and Information for Fisheries web tool.

PI 2.2.3 Secondary species information
PI 2.2.3 SI (a) Information adequacy for assessment of impact on Secondary species

Because seabirds are always Main species, they must be evaluated under this SI and cannot be evaluated under PI 2.2.3 SI (b).

In too many cases, this SI is scored as passing (Scoring Guidepost [SG] 60 or higher) when in actuality little or no information is available to substantiate the adequacy of the data. If there are no data on seabird bycatch – neither positive data (stating that there is seabird bycatch and its level can be evaluated) nor negative data (indicating that seabird bycatch is known to be nil) – this SI should not be scored above SG 80. If there is some qualitative information that seabird bycatch information is adequate, then the fishery could be scored at SG 60, but less than 80, thereby triggering the need for a Condition to obtain the needed information. Even if some qualitative data are available and evaluators score the SI at SG 80 or above, a careful determination should be made as to whether the information available is fully adequate, or if a Recommendation is needed to obtain additional and improved data on seabird bycatch.

PI 2.2.3 SI (c) Information adequacy for management strategy
As with PI 2.2.3 SI (a), evaluators should ensure that this SI meets the adequacy requirements to pass SG 60. All of the comments for SI (a) apply here.

PRINCIPLE 2.3: ENDANGERED, THREATENED, OR PROTECTED (ETP) SPECIES

Given that all seabird bycatch must be evaluated as Main bycatch under FCR 2.0, there is now considerable overlap under P 2.2 and P 2.3 on how seabirds are evaluated.

In FCR 2.0, MSC has extended and broadened the definition of what constitutes an ETP species.

Details are listed in FCR 2.0 Annex SA3.1.5.

Species are considered ETP if the fishery occurs in a nation's waters and that nation has legal protection for the species.
This did not change from the previous FCR.

Some examples of national ETP protections or regulations include the U.S. Endangered Species Act of 1973 or the U.K. Wildlife and Countryside Act 1981.

See the section below on "Legal status and conservation of seabirds" for a partial list of regulations from some nations.

Species listed on the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I.
Species listed on Appendix I are required to be considered as ETP wherever they occur in the world, whether under any national jurisdiction or on the high seas.

Only six species of seabirds are listed on Appendix I.

Species listed on agreements under the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

As with CITES-listed species, listing on any of the CMS instruments requires that the species listed be considered as ETP wherever they occur in the world, whether under any national jurisdiction or on the high seas. These agreements include:

- Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)

The CMS also includes other agreements such as Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS), Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS), and the Agreement on the Conservation of Seals in the Wadden Sea. No seabirds are listed under these agreements. These agreements include some marine species that will have to be considered in an MSC certification evaluation.

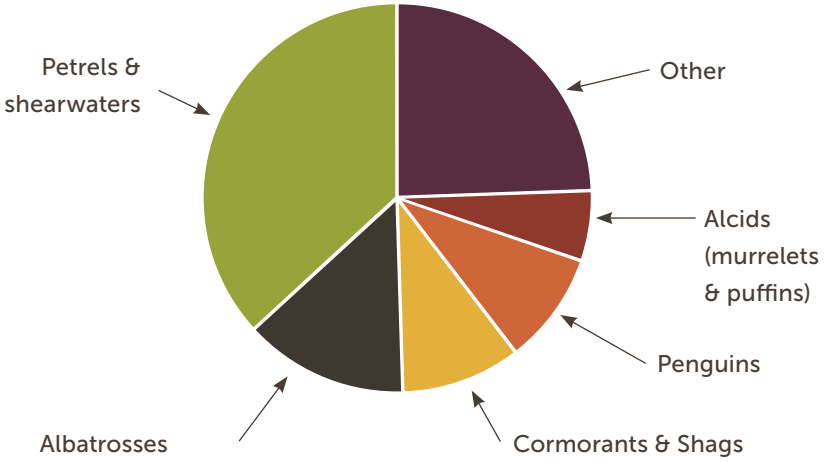
ABOVE: Common Eider*Somateria mollissima* by Erni/Shutterstock

Species listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as Critically Endangered (CR), Endangered (EN), and Vulnerable (VU).
This is a new and significant change in FCR 2.0 from the previous FCR. See FCR 2.0 Annex SA3.1.5.3.

As with CITES- and CMS-listed species, this change requires that species listed in any of these three IUCN Red List categories be considered as ETP wherever they occur in the world, regardless of jurisdiction, for the purposes of a MSC certification evaluation.

In 2015, this accounts for species of seabirds, approximately 28 percent of the 378 seabird species. These include:

- 39 species of petrels and shearwaters;
- 15 species of albatrosses;
- 11 species of cormorants and shags;
- 10 species of penguins;
- 6 species of alcids (murrelets and puffins); and
- 26 other species from various other families and groups.



Proportion of the 107 species of seabirds listed as Critically Endangered, Endangered, or Vulnerable by IUCN in each family of seabirds.

There is significant overlap among the species under the IUCN Red List criterion and other criteria. For example, the 15 species of albatrosses that would have to be considered ETP because they are listed on the Red List are all also required to be considered as ETP because of their being listed by ACAP.

In general, if a species is listed under national legislation, CITES Appendix I, ACAP, or AEWA, it will also be listed by the IUCN Red List as VU, EN, or CR.

Besides the albatrosses, many of these species, especially the cormorants and shags, have small ranges and are likely to be encountered only in very specific places.

For example, the Chatham Shag *Leucocarbo onslowi*, an IUCN CR species, is found only in the Chatham Islands.

As mentioned above under P 2.2, because all seabird species are now considered Main species, and with the broadening of the list of seabird species being considered ETP species, it is necessary to know all of the seabirds in a specific fishery area that might be bycaught!

Bird ranges intersected by fishery: 'North Sea Fishery' (26 species)

Include Species Include Maps Taxonomic Order

Display Range	English Common Name	Scientific Name	IUCN Status	Min. Population	Documented Bycatch	Range Area (sq. km)	Intersection Area (sq. km)
	Common Eider	*Somateria mollissima*	Least Concern(LC)	3,100,000	Yes	793,786	34,367
	Red-throated Loon	*Gavia stellata*	Least Concern(LC)	200,000	Yes	923,762	30,473
	Northern Fulmar	*Fulmarus glacialis*	Least Concern(LC)	15,000,000	Yes	15,264,569	129,957
	Sooty Shearwater	*Ardenna grisea*	Near Threatened (NT)	20,000,000	Yes	253,391,361	82,066
	Great Shearwater	*Ardenna gravis*	Least Concern(LC)	15,000,000	Yes	61,426,003	35,128
	Manx Shearwater	*Puffinus puffinus*	Least Concern(LC)	1,050,000	Yes	59,136,959	129,957
	Balearic Shearwater	*Puffinus mauretanicus*	Critically Endangered (CR)	13,000	Yes	4,540,212	129,957
	European Storm Petrel	*Hydrobates pelagicus*	Least Concern(LC)	1,290,000	Undocumented	59,381,188	82,096
	Leach's Storm Petrel	*Oceanodroma leucorhoa*	Least Concern(LC)	20,000,000	Yes	51,174,862	82,096
	Northern Gannet	*Morus bassanus*	Least Concern(LC)	526,000	Yes	18,541,670	129,957
	Black-legged Kittiwake	*Rissa tridactyla*	Least Concern(LC)	17,000,000	Yes	19,150,613	129,957
	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concern(LC)	4,800,000	Yes	5,329,553	129,957
	Little Gull	*Hydrocoloeus minutus*	Least Concern(LC)	97,000	Undocumented	1,968,571	41,312
	Mew Gull	*Larus canus*	Least Concern(LC)	2,500,000	Undocumented	3,166,451	129,957
	Great Black-backed Gull	*Larus marinus*	Least Concern(LC)	400,000	Yes	2,793,131	129,957
	Glaucous Gull	*Larus hyperboreus*	Least Concern(LC)	340,000	Yes	1,763,083	14,780

Another example of a complete list of seabirds for a fishery area produced by the Seabird Maps and Information for Fisheries web tool.

There are some tools that can aid in this, such as Seabird Maps and Information for Fisheries.

This is a web-based mapping tool that can quickly produce a list of all seabirds for any designated area. The tool also quickly provides a great deal of information about the birds in the area that can be useful in a certification assessment.

This will probably also require better data: More and better observer programs or bycatch studies.

If the fishery under analysis is located in an area that has had few seabird bycatch analyses, such as the Indian Ocean and other analysis-poor areas, there may be little in the way of previous studies or basic information to build upon.

The following section will consider each of the SI in PI 2.3 that includes seabird issues. However, the SIs will only be mentioned if there is a specific component related to seabirds.

PI 2.3.2

Note that the PI requires not only that the fishery passes the various Scoring Issues, but that it "minimize[s] the mortality of ETP species." This is in keeping with the FAO guidelines discussed above: the bycatch of these species should not just be sustainable, it should also be minimal.

PI 2.3.2 SI (e): Review of alternative measures to minimize mortality of ETP species

This is very similar to PI 2.2.2 SI (e) (see above).

For seabirds, reviewing alternative measures means consideration of bycatch reduction techniques. In gillnet fisheries, in particular, research on bycatch reduction methods is very active. This is an important area for fisheries reviewers to keep up on.

PI 2.3.3 Secondary species information

PI 2.3.3 SI (a) Information adequacy for assessment of impact on main secondary species

In too many cases, this SI is scored as passing (SG 60 or higher) when

in actuality little or no information is available to substantiate the adequacy of the data. If there are no data on seabird bycatch – neither positive data (stating that there is seabird bycatch and its level can be evaluated) nor negative data (indicating that seabird bycatch is known to be nil) – this SI should not be scored above SG 80. If there is some qualitative information that seabird bycatch information is adequate, then the fishery could be scored at SG 60, but less than 80, thereby triggering the need for a Condition to obtain the needed information. Even if some qualitative data are available and evaluators score the SI at SG 80 or above, a careful determination should be made as to whether the information available is fully adequate, or if a Recommendation is needed to obtain additional and improved data on seabird bycatch.

PI 2.3.3 SI (b) Information adequacy for management strategy

As with PI 2.3.3 SI (a), evaluators should ensure that this SI meets the adequacy requirements to pass SG 60. All of the comments for SI (a) apply here.

PRINCIPLE 2.5: ECOSYSTEM EFFECTS

Issues relating birds to their food supplies ("forage fish") are addressed under Performance Indicators (PIs) of Principle 2.5.

PI 2.1.1 requires that the fishery not cause "serious or irreversible harm to the ecosystem's structure and function."

This includes loss of biodiversity, but can also include loss of ecosystem services.

Ecosystem services may include the ability of the system to support its natural seabird populations.

There can also be cascading interactions, in which the loss of forage fish may reduce seabird populations, allowing non-preferred or invasive species to increase and harm the overall system.

CUMULATIVE FISHING PROBLEM

The question is how to assess the cumulative effect of separate fisheries, which a widespread or migratory species might encounter, to ensure sustainability.

Many seabirds fall into the category of widespread or migratory or both.

The FCR 2.0 makes an attempt to address this issue—how do separate fisheries that harvest widespread or migratory species take into account the overall picture to ensure that the cumulative effect is also sustainable.

This does not yet appear to be an adequate, workable solution.

REPORT WRITING

All fishery certification evaluators need to more completely consider seabird bycatch, in all of its forms, including the unobserved mortality from gear strikes or drop-offs. Although certification reports in general have become much more complete than in some of the early years of MSC certification, evaluators should still make efforts to ensure that seabird bycatch meets all of the criteria. In some cases, it is true, there is little information, but the information that exists should be reported, and efforts made to fill existing gaps.

Absence of evidence is not evidence of absence!

In too many cases, evaluators have conducted an Internet search and spoken with a few fishermen, and finding no immediate and compelling reports of seabird bycatch that apply to the fishery, have leapt to the conclusion that none exists there. The lack of information does not, of course, indicate a lack of seabird bycatch. For this reason, evaluators should report the quality of their data.

If no data are available, that should be reported. The lack of data does not absolve the evaluator and fishery of responsibility, however.

If data or studies of seabird bycatch are lacking, the certification report should require either a Condition or a Recommendation that the data gap be filled, rather than just assuming that there is no seabird bycatch.

Mention it if no seabirds are caught or killed!

Some evaluators in fisheries that do not have seabird bycatch problems simply have failed to report that fact, failing to mention seabird bycatch at all.

If you have information showing seabird bycatch is not an issue in your fishery, report it. This helps other reviewers and analysts confirm there is no problem.

This also applies to marine mammals and sea turtles.

ABOVE: Long-tailed Duck *Clangula hyemalis* by Dan Behm

LEGAL STATUS & CONSERVATION OF SEABIRDS

Seabirds may occur outside the jurisdiction of any particular nation. Their conservation therefore depends on different strategies.

International agreements among many nations or among groups of nations may afford some conservation protection to seabirds in some areas. The extent of protection varies, not only geographically, but also in level of protection given to the birds.

Some international agreements that are important for seabirds are:

Agreement on the Conservation of Albatrosses and Petrels (ACAP)
The ACAP falls under the umbrella of the CMS (see below). In effect since 2004, the agreement has 13 member countries and covers all actions of the member countries wherever the actions may occur throughout the world.

The agreement covers all species of albatross, seven species of petrels and giant petrels, and two species of shearwaters.

Audubon's Shearwater *Puffinus lherminieri* by Glen Tepke

The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)

CCAMLR is not specifically aimed at seabirds, but rather covers all living resources in Antarctica and the Southern Ocean south of approximately 50 degrees latitude in the Atlantic and Indian Ocean sectors, and approximately 60 degrees latitude in the Pacific Ocean sector.

The Convention has 35 members and the European Union, and has been in effect since 1982.

It has numerous conservation measures that affect seabirds, ranging from gear regulations to seasonal closures and observation requirements.

ABOVE: Gentoo Penguin *Pygoscelis papua* by ChameleonsEye/Shutterstock

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

The CMS is its own agreement and also serves as an umbrella for the ACAP and AEWA. It includes 36 species of seabirds that are not also listed by these two agreements.

It has 121 Parties, but significant countries that are not Party include the U.S., Canada, China, and Russia.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES went into effect in 1975 and now has 181 Parties. There are seven species of seabirds listed by CITES, of which six are on Appendix I and one is on Appendix II.

MSC only recognizes species listed on Appendix I as being protected.

International trade of the species listed in the appendices is regulated. In the case of Appendix I species, international trade is only permitted in exceptional circumstances. Appendix II species requires control of the trade.

Nairobi Convention of 1985

The Nairobi Convention region includes the marine environments of the countries of the western Indian Ocean, from Somalia to South Africa. It has 10 Parties.

Forty-five seabirds are on the Convention's priority list. For these species, Parties are required to take conservation actions.

Convention for the Protection of the Marine Environment of the North-East Atlantic (the Oslo and Paris Convention; (OSPAR)

OSPAR has 16 member countries bordering on the north Atlantic Ocean as well as Luxembourg and Switzerland, but has as its goal the conservation of the northeast Atlantic Ocean.

Although OSPAR does list threatened or declining seabird species, most of its protections for seabirds seem to be directed at establishing marine protected areas. These may include areas in the national or exclusive economic zone (EEZ) waters of its Parties, but also on the high seas.

Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)

The AEWA falls under the umbrella of the CMS. It has 75 Parties from Europe and Africa, and includes Canada.

Some of the seabirds listed are specific to AEWA, but many are also listed by the CMS.

REGIONAL FISHERIES MANAGEMENT ORGANIZATIONS (RFMO)

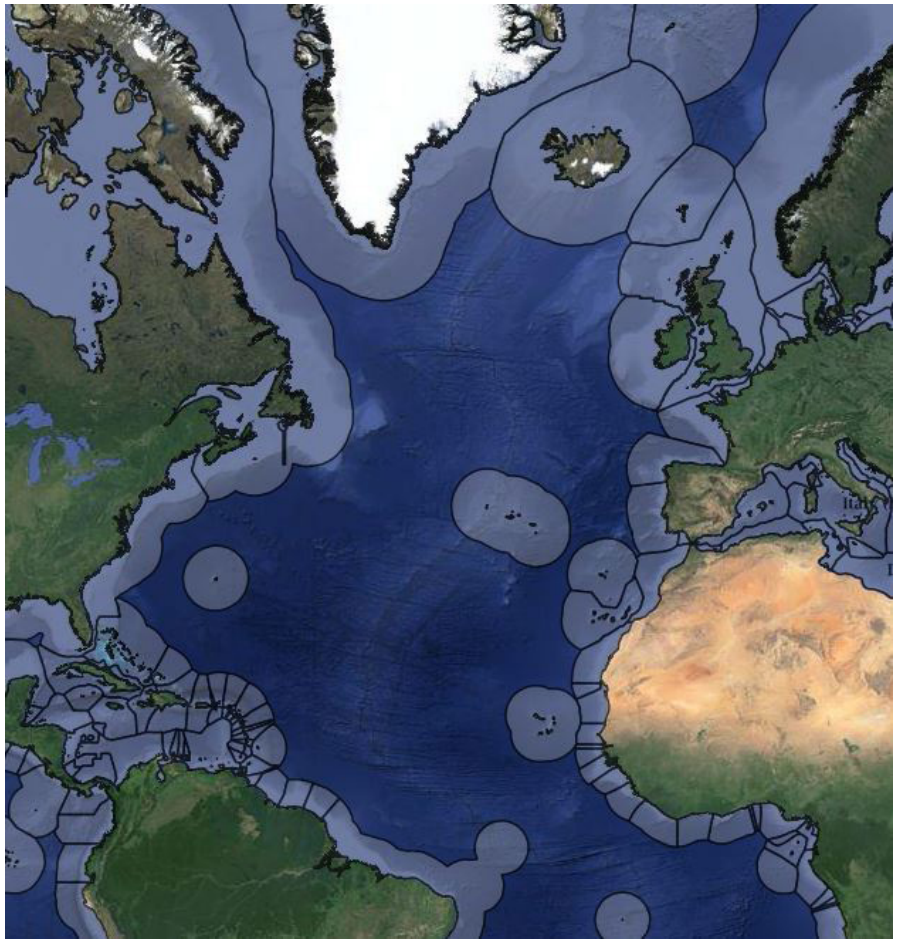
RFMOs are usually also international agreements among groups of countries. There are many such organizations, and this guide will not attempt to list nor describe them.

Some RFMOs have seabird-specific conservation measures and recommendations that apply to their members.

For example, the Inter-American Tropical Tuna Commission (IATTC) has conservation requirements for the use of seabird bycatch reduction methods in certain areas, and the collection of bycatch data.

The Western and Central Pacific Fisheries Commission (WCPFC) maintains a database listing some of these measures and the International Seafood Sustainability Foundation (ISSF) has a similar database for only the tuna RFMOs.

Conservation measures affecting seabirds vary significantly among the RFMOs. Any consideration of seabird conservation measures must be made on a RFMO-by-RFMO basis.



MANY INDIVIDUAL NATIONS ALSO HAVE CONSERVATION PROTECTIONS FOR SEABIRDS.

Of course, these protections can be enforced only within the nation's jurisdiction, national waters, and EEZ.

The specific protections vary significantly among countries, with some countries placing strong restrictions and high penalties on infractions, and other countries having very weak restrictions. Enforcement likewise varies widely.

Note that some countries have blanket protections for all birds, but do not specifically list any one kind of seabird. These protections may affect fishery bycatch of seabirds, but it may not be immediately obvious because no individual species is listed.

Some of the protections given to seabirds for a few countries are listed here. These are not meant to be comprehensive lists, and countries often have more than one legal protection instrument that can cover seabirds.

ABOVE: Exclusive Economic Zones (EEZs) of some Atlantic nations. Source: FAO

U.S.

The Endangered Species Act of 1973 (ESA) provides protection to a few listed species of seabirds.

Migratory Bird Treaty Act (MBTA)
This is the U.S. implementing legislation for the Migratory Bird Treaty, signed by the U.S. and Canada.

Depending on interpretation, this Act may cover almost all seabirds in U.S. waters.

Fishery management plans established under U.S. law
There are many of these plans. For example, the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area.

U.S. marine protected areas
There are many of these areas. An example is the Papahānaumokuākea Marine National Monument in the western Hawaiian Islands.

CANADA

Species At Risk Act (SARA) provides protection for a few listed seabirds.

Migratory Birds Convention Act (MBCA)
This is the Canadian legislation implementing the Migratory Bird Treaty.

ABOVE: Harlequin Duck *Histrionicus histrionicus* by Alan Wilson

European countries

Most coastal European countries have individual legislation for seabird conservation.

The EU has the EU Birds Directive, which requires the various member countries to implement conservation measures for all seabirds (and other birds).

UK

The Wildlife and Countryside Act 1981

This Act makes it an offense (with exception to species listed in Schedule 2) to intentionally kill, injure, or take any wild bird, with special penalties for some species.

FRANCE

Arrêté du 14 août 1998 fixant sur tout le territoire national des mesures de protection des oiseaux représentés dans les Terres australes et antarctiques françaises

This legislation applies to the protection of birds in the French Southern and Antarctic Lands (e.g., Kerguelen Islands, Crozet Islands, St. Paul and Amsterdam Islands, etc.).

Non-European countries

These listings are the names of the specific legal instruments.

ARGENTINA

Conservación de la fauna. Ordenamiento legal en todo el territorio de la Republica. Derogase la ley 13.908

AUSTRALIA

Environment Protection and Biodiversity Conservation Act 1999

BERMUDA

Protected Species Order 2012

BRAZIL

Ministério do Meio Ambiente, Instrução Normativa Nº 003, de 26 de Maio de 2003

CHILE

Aprueba Reglamento para la Clasificación de Especies Silvestres Según Estado de Conservación

CAPE VERDE

Decreto-Regulamentar No. 7/2002

JAPAN

Law for the Conservation of Endangered Species of Wild Fauna and Flora (Law No. 75).

KIRIBATI

Laws of the Gilbert Islands: Revised Edition 1977, Chapter 100, Wildlife Conservation

MAURITIUS

Wildlife and National Parks Act 1993

MEXICO

Norma Oficial Mexicana NOM-059-SEMARNAT-2010, Protección ambiental-Especies nativas de México

MALAYSIA

Wild Life Protection Ordinance, 1998

NEW ZEALAND

Wildlife Act 1953 and its subsequent amendments

This provides blanket protection for all seabirds, except Kelp Gull (also called Southern Black-backed Gull) *Larus dominicanus*.

PERU

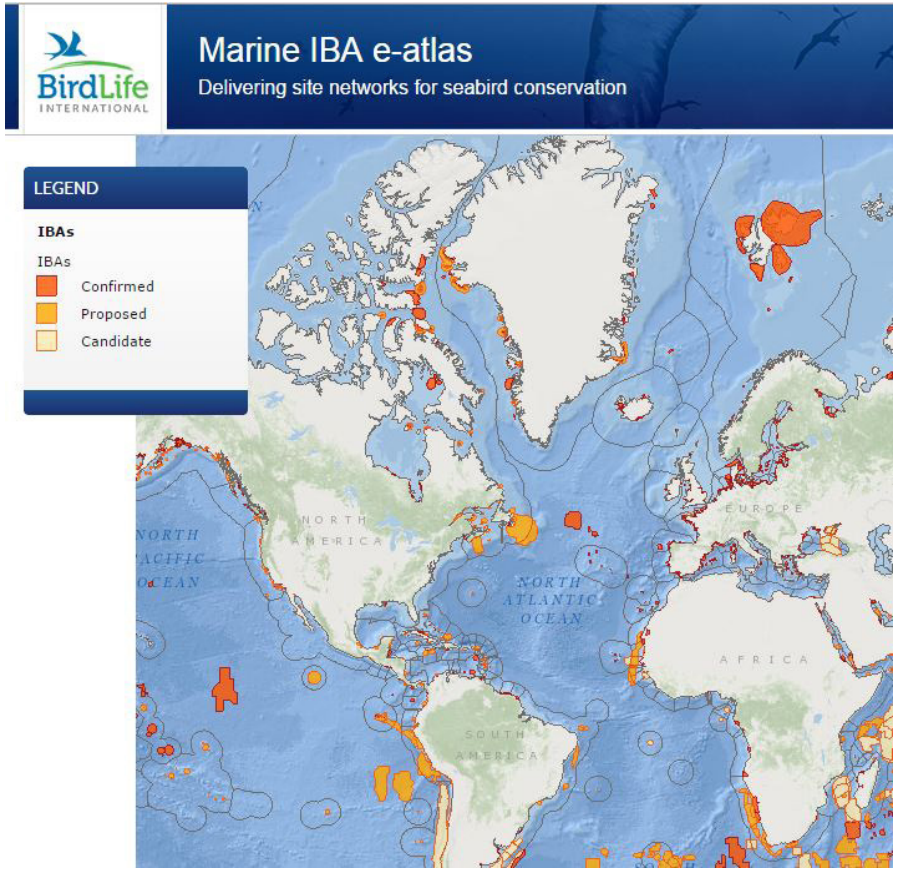
Decreto Supremo Nº 004-2014-MINAGRI

PAPUA NEW GUINEA

Decreto-Lei 75/91

Additional Information

This is a short, and incomplete, list of countries and their legal protections. A very useful source for finding additional information for most countries is FAOLEX, an extensive legislative and policy database of national laws.



Marine Important Bird Area website home page

THE INTERNATIONAL UNION FOR CONSERVATION OF NATURE (IUCN) RED LIST OF THREATENED SPECIES

The IUCN Red List does not itself have legally binding protections. It is the result of an IUCN evaluation program.

The IUCN Red List indicates the threat status of a species, based on a set of objective criteria. Although the IUCN Red List itself does not carry any legal weight, some countries, organizations, and agreements may use the assessment as a basis for protection of species.

That is, a country may specify that species listed as VU (Vulnerable), EN (Endangered), or CR (Critically Endangered) by the IUCN Red List will receive legal protections.

The MSC Fishery Certification Requirements 2.0, which came into effect for all new assessments after 1 April 2015, use IUCN Red List status of VU, EN, or CR to categorize a seabird as an ETP (Endangered, Threatened, or Protected) species, and the certification assessment must therefore treat the species as such.

MARINE IMPORTANT BIRD AREAS (IBAS)

IBAs are defined on land and sea, using a set of criteria. IBAs themselves do not provide any legally binding status to the areas they define.

However, as with IUCN Red List status, some countries or organizations may use IBAs to define marine protected areas, thereby conferring protected status on the IBA.

The online database, Protected Planet, is a useful resource for finding marine protected areas in general.

RESOURCES

The following resources may be useful for fishery evaluations (certification or other purposes), Fishery Improvement Plan (FIP) development, or many other purposes involving seabirds and fisheries.

Juan Fernandez Petrel *Pterodroma externa* by Sophie Webb

Seabird Maps and Information for Fisheries (SMIF)
This is a web-based mapping tool that can quickly produce a list of all seabirds occurring in any area designated. The tool also quickly provides a great deal of information about the birds in a user defined area (for example, a fishery), which can be useful in a certification assessment.

Seabird Information Network
A portal to many databases and tools that relate to seabirds, including tracking (distribution), observer programs, and seabird colonies.

Consortium for Wildlife Bycatch Reduction
A useful website with information about bycatch and methods of bycatch reduction for seabirds, but also for sea turtles and marine mammals. A major feature of the site is an extensive database of bycatch reduction methods and literature on the results of trials of those methods.

BirdLife Datazone
An information source about seabirds, organized by species. Includes information on distribution, populations, and ecology of each species.

Seabird Tracking Database
Also known as "Tracking Ocean Wanderers." The database and mapping tool allows the user to see the movements and tracks of individual tagged seabirds. This can aid in identifying key foraging areas.

The North Pacific Seabird Colony Database
This is a portal to the seabird nesting and colony database and mapping tools in the northeastern Pacific.

Global Biodiversity Information Facility (GBIF)
The GBIF has species occurrence records for most seabirds (and for a great many other species as well, including sea turtles, marine mammals) that can be mapped to see distributions. See Data > Explore species

OBIS-SEAMAP (Ocean Biogeographic Information System Spatial Ecological Analysis of MegAvertebrate Populations)
A source of distribution information for seabirds as well as sea turtles and marine mammals.

The Biogeographic Atlas of the Southern Ocean
The atlas maps the census of Antarctic marine life (downloadable).

Western and Central Pacific Fisheries Commission Bycatch Mitigation Information System
The BMIS database contains information on mitigation methods and the Western Central Pacific Ocean Observer database. It also includes conservation measures from other tuna RFMOs, CCAMLR, and some other non-tuna RFMOs.

ISSF RFMO Management Database
The database contains information strictly on the tuna RFMOs.

Southern Seabird Solutions
The website has information and fact sheets on various topics relating to seabirds and fisheries, how-to videos on how to use various bycatch reduction methods, and other useful resources. It focuses on seabirds and fisheries of New Zealand area.

FAOLEX
FAOLEX is a worldwide database maintained by the Food and Agriculture Organization of the United Nations. It is a "comprehensive and up-to-date legislative and policy database, one of the world's largest electronic collection of national laws, regulations and policies on food, agriculture and renewable natural resources."

Protected Planet
A useful resource for finding marine protected areas. The website is based on the World Database on Protected Areas (WDPA), and users can download the WDPA database.

IN-DEVELOPMENT THREATS AND ANALYSIS TOOLS

Three new website-based tools are under development and/or partially deployed by U.S., UK, and New Zealand government agencies. All three appear to have similar objectives, but apply only to their respective areas of national jurisdiction.

U.S. Fish and Wildlife Service Information for Planning and Conservation (IPaC)
This website provides information on land and sea within the U.S. jurisdiction.

It includes seabirds, but is not focused on them. The information provided includes lists of managed species, potential threats to those species, locations of protected areas, and impact analysis.

New Zealand Department of Conservation Seabird Prioritization Framework
The web tool is only partially developed, but should be more fully deployed in 2016.

It applies to the species and waters within New Zealand jurisdiction.

UK Department for Environment, Food and Rural Affairs (DEFRA) Sea Bird Bycatch
The tool is not apparently available as a website. It is expected to be published in early 2016.

It will apparently apply to UK jurisdiction waters.

ONLINE SPECIES INFORMATION

Neotropical Birds Online
Like the BirdLife Datazone, this site may provide information on ecology and distribution of seabirds. However, it is restricted to birds of neotropical waters and many species accounts are incomplete.

New Zealand Birds Online
Also a source of information on ecology and distribution of seabirds, but restricted to species that occur in New Zealand waters.

The Birds of North America
A source of information on ecology and distribution of seabirds, but restricted to species that occur in North American waters. There is a fee for use of the species accounts.

Handbook of Birds of the World (HBW)
This contains the contents of the printed Handbook of Birds of the World, although the information may be updated periodically. There is a fee for use of the species accounts.

ABOVE: Red-legged Cormorants *Phalacrocorax gaimardi* by Fabrice Schmitt

REFERENCES

Red-tailed Tropicbird *Phaethon rubricauda* by Michael Walther

Anderson, O. R. J., Small, C. J., Croxall, J. P., Dunn, E. K., Sullivan, B. J., Yates, O., & Black, A. (2011). Global seabird bycatch in longline fisheries. *Endangered Species Research* 14 (2), 91–106. doi:10.3354/esr00347

Brothers, N., Duckworth, A.R., Safina, C., & Gilman, E.L. (2010). Seabird bycatch in pelagic longline fisheries is grossly underestimated when using only haul data. *PLoS ONE* 5 (8): e12491. doi:10.1371/journal.pone.0012491

Castilla, A. M., & Pérez, J. J. (1995). Relationships between fishery activities and presence of the Audouin's Gull (*Larus audouinii*) in the Columbretes Islands. *Colonial Waterbirds* 18 (1), 108–112.

Chuenpagdee, R., Morgan, L. E., Maxwell, S. M., Norse, E. A., & Pauly, D. (2003). Shifting gears: Assessing collateral impacts of fishing methods in U.S. waters. *Frontiers in Ecology and the Environment* 1 (10), 517-524.

Collet, J., Patrick, S. C., & Weimerskirch, H. (2015). Albatrosses redirect flight towards vessels at the limit of their visual range. *Marine Ecology Progress Series* 526, 199-205.

Croxall, J. P., & Prince, P. A. (1994). Dead or alive, night or day: how do albatrosses catch squid? Antarctic Science 6, 155–162.

Cury, P. M., Boyd, I. L., Bonhommeau, S., Anker-Nilssen, T., Crawford, R. J. M., Furness, R. W., Mills, J. A., Murphy, E. J., Osterblom, H., Paleczny, M., Piatt, J. F., Roux, J.-P., Shannon, L., & Sydeman, W. J. (2011). Global seabird response to forage fish depletion - One-third for the birds. *Science* 334 (6063), 1703-1706.

Essington, T. E., Moriarty, P. E., Froehlich, H. E., Hodgson, E. E., Koehn, L. E., Oken, K. L., Siple, M. C., & Stawitz, C. C. (2015). Fishing amplifies forage fish population collapses. *Proceedings of the National Academy of Sciences of the United States of America* 112 (21), 6648–6652.

Huin, N., & Croxall, J. P. (1996). Fishing gear, oil and marine debris associated with seabirds at Bird Island, South Georgia, during 1993/1994. *Marine Ornithology* 24, 19-22.

Lewison, R. L., Crowder, L. B., Read, A. J., & Freeman, S. A. (2004). Understanding impacts of fisheries bycatch on marine megafauna. *Trends in Ecology & Evolution* 19 (11), 598-604.

Lewison, R. L., Crowder, L. B., Wallace, B. P., Moore, J. E., Cox, T., Žydelis, R. McDonald, S., DiMatteo, A., Dunn, D. C., Kot, C. Y., Bjorkland, R., Kelez, S., Soykan, C., Stewart, K. R., Sims, M., Boustany, A., Read, A. J., Halpin, P. Nichols, W. J., & Safina, C. (2014). Global patterns of marine mammal, seabird, and sea turtle bycatch reveal taxa-specific and cumulative megafauna hotspots. *Proceedings of the National Academy of Sciences of the United States of America* 111 (14), 5271–5276.

O'Keefe, C. E., Cadrin, S. X., & Stokesbury, K. D. (2014). Evaluating effectiveness of time/area closures, quotas/caps, and fleet communications to reduce fisheries bycatch. *ICES Journal of Marine Science: Journal du Conseil*, 71(5), 1286-1297. doi:10.1093/icesjms/fst063 (http://icesjms.oxfordjournals.org/content/early/2013/05/12/icesjms.fst063.full.pdf+html)

Okes, N. C., Hockey, P. A. R., Pichegru, L., Lingen, C. D. van der, Crawford, R. J. M., & Grémillet, D. (2009). Competition for shifting resources in the southern Benguela upwelling: Seabirds versus purse-seine fisheries. *Biological Conservation, 142*(10), 2361–2368. doi:10.1016/j.biocon.2009.05.031

Pichegru, L., Ryan, P. G., van Eeden, R., Reid, T., Grémillet, D., & Wanless, R. M. (2012). Industrial fishing, no-take zones and endangered penguins. *Biological Conservation* 156, 117–125.

Pikitch, E. K. (2015). Stop-loss order for forage fish fisheries. *Proceedings of the National Academy of Sciences of the United States of America* 112 (21), 6529-6530.

Ridoux, V. (1994). The diets and dietary segregation of seabirds at the subantarctic Crozet Islands. *Marine Ornithology* 22, 1-192.

Vaske, T. J. (2011). Are deep-sea cephalopods really common preys for oceanic seabirds? *Biota Neotropica* 11 (1), 177–180.

Waugh, S., Filippi, D., Fukuda, A., Suzuki, M., Higuchi, H., Setiawan, A., & Davis, L. (2005). Foraging of royal albatrosses, Diomedea epomophora , from the Otago Peninsula and its relationships to fisheries. *Canadian Journal of Fisheries and Aquatic Sciences* 62 (6), 1410–1421. doi:10.1139/f05-001

Žydelis, R., Small, C., & French, G. (2013). The incidental catch of seabirds in gillnet fisheries: A global review. *Biological Conservation* 162, 76–88. doi:10.1016/j.biocon.2013.04.002

ABOVE: Black-footed Albatross *Phoebastria nigripes* and chick by Cameron Rutt

WALTON FAMILY
FOUNDATION

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Wandering Albatrosses *Diomedea exulans* by Durk Talsma/Shutterstock