NRDC REPORT

JANUARY 2014
R:13-11-B

NET LOSS:
THE KILLING OF MARINE MAMMALS IN FOREIGN FISHERIES

AUTHORS
Zak Smith
Margaretmary Gilroy
Matthew Eisenson
Erin Schnettler
Stephanie Stefanski

ACKNOWLEDGMENTS

This report was prepared by NRDC's Marine Mammal Protection project, under the direction of Michael Jasny. The authors wish to thank the Marisla Foundation, Furlotti Family Foundation, The Pew Charitable Trusts, for their generous support, as well as NRDC's members, without whom our work to save marine species and habitat would not be possible. We would also like to acknowledge the contributions made by our friends and colleagues Robin Baird, Sylvia Fallon, Lisa Suatoni, Christina Swanson, and Andrew Wetzler.

ABOUT NRDC

The Natural Resources Defense Council (NRDC) is an international nonprofit environmental organization with more than 1.4 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, San Francisco, Chicago, Bozeman, MT, and Beijing. Visit us at www.nrdc.org and follow us on Twitter @NRDC.

NRDC's policy publications aim to inform and influence solutions to the world's most pressing environmental and public health issues. For additional policy content, visit our online policy portal at www.nrdc.org/policy.

NRDC Director of Communications: Lisa Benenson
NRDC Deputy Director of Communications: Lisa Goffredi
NRDC Policy Publications Director: Alex Kennaugh
Design and Production: www.suerossi.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Few realize it, but nearly every foreign fish product sold in the United States enters the U.S. market in violation of federal law. From the cod and haddock that go into the fish sticks enjoyed by children to the sea bass served at fine restaurants, if it was imported, it probably entered this country illegally. The reason is simple: The Marine Mammal Protection Act (MMPA) requires that all imported fish or fish products be accompanied by proof that the technology used to land the catch does not kill or seriously injure whales, dolphins, and other marine mammals in excess of U.S. standards. Collecting dust for more than 40 years, this measure has never been enforced by the federal government, with predictable results: Foreign fisheries fail to invest in measures limiting harm to whales and dolphins; U.S. fisheries, which do make these investments, are placed at a disadvantage; and Americans unwittingly consume foreign fish or fish products caught using techniques that needlessly kill a multitude of marine mammals each year.

The numbers are staggering: Scientists estimate that more than 650,000 marine mammals are killed or seriously injured every year in foreign fisheries after being hooked or entangled or trapped in fishing gear. Some of the harm is intentional—as is the case when fishing fleets using massive gillnets set upon dolphins as indicators that fish are present—while other harm is incidental, as when North Atlantic right whales are entangled in crab and lobster pots. This unintentional capture of animals in fishing gear, or bycatch, is pushing some marine mammal populations to the brink of extinction. And it is unacceptable, given the global importance of marine mammals and the availability of various technologies and methods for reducing harm.

When it passed the Marine Mammal Protection Act, Congress intended to do more than protect whales and dolphins in U.S. waters; it wanted to encourage other nations to put in place measures to increase protections for marine mammals by harnessing the power of the U.S. economy. Section 101 of the MMPA sets forth a straightforward requirement that foreign fisheries meet U.S. standards for bycatch if they wish to export products to the United States. Thus, foreign fisheries that want access to the vast U.S. market must put in place measures that are at least as protective as those adopted within the United States for limiting or eliminating the bycatch of marine mammals.

In addition to reducing bycatch abroad, the provision was also intended to serve two critical domestic purposes. It addresses the concerns of U.S. consumers who do not want their dollars contributing to the decline of marine mammal populations through the purchase of imported seafood. And it addresses U.S. fishers' concerns that they are at a competitive disadvantage when operating under various domestic rules and regulations that foreign fishers are free to ignore.

It is time to enforce this important provision of the MMPA. American consumers and commercial fishers deserve to realize the benefits of this law, and the world's marine mammals are in critical need of relief from poorly regulated foreign fisheries. Fortunately, after years of neglect, the federal government is in the process of developing regulations to enforce the provision.

This report tells part of the story of why moving forward with enforcement is so critical. It identifies species at risk of extinction from bycatch resulting in part from foreign commercial fishing operations that export products to the United States, and it identifies problem areas of the world where bycatch is indiscriminate and substantial. Specifically, enforcing the MMPA's foreign bycatch provision could help save North Atlantic right whales, New Zealand sea lions, Mediterranean sperm whales, vaquitas, spinner dolphins in the Indian Ocean, Baltic and Black Sea harbor porpoises, and J-stock minke whales. It is also likely to significantly reduce the number of marine mammals killed or seriously injured from fishing operations in the Northwest Atlantic,

the Mediterranean, the Northwest Pacific, Southeast Asia and the Indian Ocean, West Africa, and the Southwest Atlantic, where populations of whales, dolphins, and other marine mammals are currently being threatened.

While ostensibly straightforward—meet U.S. bycatch standards if you want to bring your fish into the United States—the law presents a number of challenges to effective enforcement that must be addressed in order to realize its full benefits. First, regulators must enforce the law while keeping in mind U.S. international trade obligations. Second, regulators must promulgate a definition of "U.S. standards" that holds foreign exporters accountable for their bycatch, producing the equity Congress intended for U.S. fishers and the conservation benefits demanded by the American public. And finally, regulators must explicitly identify the data they need to support their determinations on whether imports meet U.S. standards and clearly communicate to foreign nations what information they must submit to secure access to the U.S. market.

KEY FINDINGS AND RECOMMENDATIONS

Enforcement of the foreign bycatch provision of the Marine Mammal Protection Act will benefit whale, dolphin, sea lion, and other marine mammal populations around the world—including some that have been hard hit by foreign fisheries and are near the breaking point. This belief is based in part on the following facts:

- **Bycatch kills hundreds of thousands of marine mammals every year.** Scientists estimate that commercial fisheries around the world kill or seriously injure more than 650,000 marine mammals every year.
- **Bycatch threatens the survival of numerous marine mammal populations.** Bycatch is the leading anthropogenic contributor to the decline of many marine mammal populations, including the New Zealand sea lion, Mediterranean sperm whale, vaquita, and J-stock minke whale. If not properly limited, bycatch will cause the extinction of these populations. While not necessarily the leading contributor to decline, bycatch could similarly spell the end for numerous other populations, such as the North Atlantic right whale, distinct spinner dolphin populations in the Indian Ocean, the Baltic Sea harbor porpoise, and the Black Sea harbor porpoise.
- **Fisheries contributing to the bycatch problem are found around the world and are not limited to poorer regions.** Marine mammal populations are threatened by bycatch around the globe, and few countries or regions are off the hook. With countries like Canada failing to require any specific measures to protect threatened populations, and nations like Italy failing to enforce protective mandates that do exist, bycatch rates are too often the product of policy choices rather than the result of meager resources.
- **The multibillion-dollar fish industry has the resources to reduce marine mammal bycatch.** In 2010, capture fisheries and aquaculture produced 148 million tons of fish valued at $217.5 billion, and in 2012 the United States imported more than $31 billion of fish products. An industry worth hundreds of billions of dollars should be able to find resources for bycatch reduction, especially in the case of large, industrial-scale fisheries.
- **U.S. bycatch reduction efforts have been successful in many ways.** The United States has established an aggressive, population-based regime for bycatch reduction, focusing on marine mammals and other species like turtles that are in the most need of protection. The United States has reduced marine mammal bycatch by nearly 30 percent over roughly two decades. U.S. efforts have demonstrated that real progress on this problem is practicable across numerous commercial fisheries.
- **By transferring U.S. bycatch practices to commercial fisheries exporting to the United States, bycatch reduction successes can be transferred globally.** While not a panacea, the foreign bycatch provision of the MMPA can help save threatened populations worldwide by requiring that fish and fish products exported to the United States meet U.S. bycatch standards. In doing so, it will also level the playing field for U.S. fishers as intended by Congress.

To achieve the full benefits offered by the MMPA's foreign bycatch provision, NRDC recommends the following:

- **Hold nations exporting fish to the United States to the rigorous bycatch standards applicable to U.S. domestic fishers.** The National Marine Fisheries Service, the federal agency with jurisdiction over the interpretation and enforcement of the MMPA, should define "U.S. standards" for bycatch as reducing the incidental kill or serious injury of marine mammals to insignificant levels approaching a zero mortality and serious injury rate through the application of the bycatch reduction regime set forth in Section 117 (Stock assessments) and Section 118 (Taking of marine mammals incidental to commercial fishing operations) of the MMPA.
- **Treat all nations exporting fish products to the United States equally.** To ensure that the United States does not run afoul of the World Trade Organization when regulating the importation of fish, the National Marine Fisheries Service must treat all exporters equally and must allow for flexibility in the means by which exporters meet U.S. bycatch standards.

© Alberto Romero, Marine Photobank

Sperm whale entangled in driftnet.

This 30 foot long grey whale was discovered entangled in a derelict drift net, 11 miles offshore of Dana Point, California.

© Marine Photobank/1986 Bob Talbot, The LegaSea Project

© Frank Baensch-bluereefphoto.org/Marine Photobank

About a 300 foot long gill net found abandoned on a shallow reef in the surf zone on Oahu, Hawaii.

Spotted dolphins in the Pacific Ocean captured in a tuna purse-seine net.

© NOAA/SWFSC

- **Identify the categories of data and information that must be collected to prove that exporters are meeting U.S. bycatch standards.** The National Marine Fisheries Service relies upon specific categories of data and information, such as observer-sourced bycatch estimates and population abundance data, to determine whether domestic fisheries are meeting U.S. bycatch standards. Reasonable proof from foreign nations exporting to the United States must be based on the same type of data and information.
- **Understand that nations seeking to comply with the foreign bycatch provision are not starting from scratch.** While this report identifies areas where data are lacking, it also shows that there is a wealth of data on species at risk and geographic regions of concern. The National Marine Fisheries Service should encourage a review of existing findings and recommendations on regional fisheries and marine mammal populations that identify specific actions that could be taken to address some of the most pressing bycatch concerns, such as those found in the paper *Global Priorities for Reduction of Cetacean Bycatch* by Randall Reeves and his colleagues.
- **Communicate at the highest levels that the enforcement of this provision is coming.** The State Department should instruct U.S. ambassadors in countries exporting fish to the United States to discuss the impending enforcement of the foreign bycatch provision, to make it clear that in many cases continued access to the U.S. market for foreign fish products will require significant data collection and changes to fishing practices.
- **Utilize the expertise developed over decades by U.S. fishers, regulators, and researchers.** The National Marine Fisheries Service should sponsor regional workshops open to all countries and regional fishery management bodies to fully explain the requirements and help interested countries build capacity. The workshops should include panels of researchers and U.S. fishers who can share their experiences and discuss best practices for data collection and bycatch reduction. Such workshops would benefit countries like China—where data on fisheries and bycatch are not publicly available—by providing details on how the U.S. manages a rigorous monitoring program and relies on stakeholders to help manage fisheries. If necessary, additional appropriations should be directed to the Fisheries Service to organize and conduct these workshops.
- **Take advantage of consultation opportunities to help address some of the most pressing bycatch problems, like those presented by artisanal fisheries.** While local artisanal fisheries are unlikely to export products to the United States, and thus will not be directly affected by enforcement of the MMPA foreign bycatch provision, they nonetheless represent a significant threat to numerous marine mammal populations. When the Fisheries Service engages with countries about the enforcement of the foreign bycatch provision, it should help them not only understand what they need to do to keep the U.S. market open to exports, but also take the opportunity to help them focus on how to limit bycatch in some of the most destructive artisanal fisheries.

CHAPTER 1: BYCATCH BASICS

Since the 19th century, with the industrialization of the world's fishing fleets, marine mammals have found themselves the victims of large-scale commercial fishing operations. The threat from bycatch has become more severe as fishing technology increases in capacity and decreases in target selectivity. For many small populations of marine mammals, bycatch in commercial gear such as gillnets, trawls, and longlines threatens their very survival.[1] Unfortunately, in too many parts of the world, bycatch is not the only threat that poorly regulated, modern fishing practices pose to marine mammals; together with habitat modification, pollution, and prey depletion, fisheries are substantially responsible for predictions that large numbers of marine mammal species will become extinct by the end of the 21st century.[2]

DEFINING "BYCATCH"

Commercial fisheries and marine mammals operate in the same environment, and as a consequence, many marine mammals end up caught in fishing gear: trapped in huge gillnets and purse seines, hooked on longlines, and entangled in lines from pot traps that wrap around their bodies, causing infections and destroying their mobility. Marine mammals that are caught inadvertently and subsequently discarded are considered "incidental take" or "bycatch."[3] Marine mammals that are caught accidentally yet retained for either commercial sale or personal consumption are often referred to as "nontarget catch" or "retained catch"—a practice that is illegal under U.S. law.[4]

The principal U.S. agency responsible for addressing bycatch issues under various environmental statutes, including the Marine Mammal Protection Act, the Endangered Species Act (ESA), and the Magnuson-Stevens Fishery Conservation and Management Act, is the National Marine Fisheries Service. The Fisheries Service defines bycatch as the "discarded catch of any living marine resource plus retained incidental catch and unobserved mortality due to a direct encounter with fishing gear."[5]

Researchers gather data on fishery interactions with marine mammals from various sources, such as independent observers, vessel operators and owners, vessel log books, examination of stranded animals or free-swimming animals entangled in fishing gear, and interviews with fishers. Depending on what fishing parameter the data correspond to (number of hauls, landings, fishing trips), researchers can extrapolate a total bycatch estimate for the fishery. Independent observer programs are generally considered the gold standard for estimating bycatch, although their value diminishes as the percentage of total fishing effort observed declines.[6]

Marine mammal bycatch data from non-observer sources are often systematically underreported. There are several reasons for this. First, fearing sanctions or fines, fishers have an incentive to underreport the marine mammal mortality that results from their operations. Second, marine mammals that fall victim to so-called cryptic bycatch, where they are wounded and later die as a result of interactions with fishing gear, are nearly impossible to include in official statistics. The first type of underreporting is pervasive industry-wide but can be mitigated by the presence of enforcement officials on board fishing vessels when bycatch events occur. The second type of reporting error, the nonrecognition of cryptic bycatch, requires a different solution.[7] Injuries, chronic exposure to fishing gear, and fatal encounters with nets and other gear that have been lost by fishers (also known as "ghost fishing")—all examples of bycatch that are not reflected in statistical data—should still be discussed to the extent practicable, to provide a clear understanding of how interactions with fishing gear are affecting marine species.

In the United States, the National Marine Fisheries Service collects data on marine mammal interactions with some fisheries through a monitoring program that includes the use of observers placed on fishing vessels. The Fisheries Service estimates annual bycatch for these fisheries by extrapolating the information received from observers. The agency also collects data received from fishers, who are required to report all marine mammal bycatch incidental to their operations, but does not rely on these data to estimate annual bycatch for fisheries as the data dramatically underestimate mortality.[8]

NETS CAST ROUND THE GLOBE

Comparing the U.S. bycatch rate with the estimated global marine mammal bycatch rate of more than 650,000 animals per year shows that bycatch in the United States represents, in absolute terms, only a small fraction—less than 1 percent—of the overall problem.[9] A recent literature review contextualizes the scale of global marine mammal bycatch on a taxonomic basis. The marine mammals known to suffer from bycatch include at least 82 percent of odontocete species (toothed whales such as dolphins and sperm whales), 93 percent of mysticetes (baleen whales such as humpback whales and right whales), 83 percent of phocid seal species (earless seals such as Mediterranean monk seals), 57 percent of otariid seals and sea lions (eared seals and sea lions such as Antarctic fur seals and California sea lions), and 100 percent of sirenians (dugongs and manatees).[10]

For too many marine mammal populations, bycatch represents an existential threat. Marine mammals are particularly susceptible to the damaging effects of bycatch due to their "slow" life history characteristics: Most mature relatively late in life, grow slowly, and have low reproductive rates.[11] They are, for this reason, unusually dependent on high adult survival rates to achieve population stability and growth. Anthropogenic factors such as bycatch can depress these survival rates and put populations at risk of decline and extinction.[12] In addition, because marine mammal habitats are often widely dispersed across the ocean and conservation units are smaller than implied by total abundances, with many species divided into populations or subpopulations, recovery can be hindered when populations are reduced in number.[13]

The reduced population sizes that may result from bycatch can also put marine mammal populations at risk for genetic inbreeding and introgression that can negatively affect their genetic resilience and inhibit their future capacity for evolutionary adaptation. For instance, it is possible that the vaquita, a unique species of porpoise found in the northern Gulf of California, has been reduced to far fewer than 250 individuals in the past century largely due to bycatch in gillnets.[14] A molecular analysis of tissue from 43 vaquitas demonstrated that the extremely small population size has produced regions of identical DNA sequences among individuals that reflect a complete lack of polymorphism unique for the DNA regions examined. The severe lack of genetic diversity in the vaquita population not only is a serious obstacle to population recovery but also increases susceptibility to disease outbreaks.[15]

COMMERCIAL FISHING AND AQUACULTURE ARE BIG BUSINESS

In 2010, capture fisheries and aquaculture around the globe produced 148 million tons of fish valued at $217.5 billion.[16] As U.S. domestic production has declined, both developed and developing countries have increased their exports to the United States.[17] For example, while China produced 7 percent of the world's fish in 1961, it was responsible for 35 percent in 2010.[18] Today, Canada and China are running neck and neck for the title of top exporter to the United States, together accounting for nearly one-third ($5.2 billion in 2012) of all imports of edible fish. And Chile, Indonesia, Thailand, and Vietnam joined China and Canada as countries that exported more than a billion dollars' worth of seafood to the United States in 2012, collectively sourcing more than 60 percent of all U.S. fish and fish product imports. By dollar value, the top six seafood types imported into the United States are shrimp ($4.46 billion), salmon ($2.03 billion), tuna ($1.71 billion), crab ($1.35 billion), tilapia ($977 million), and lobster ($887 million).

Most Valuable Fish Imports in the United States (2012)

IMPORT	$ VALUE IN BILLIONS	WEIGHT IN MILLIONS OF KILOGRAMS	PRINCIPAL SOURCE	PERCENT OF TOTAL BY VALUE
SHRIMP	4.46	534.9	THAILAND ($1.2 BILLION)	27%
SALMON	2.03	280.8	CHILE ($0.80 BILLION)	39%
TUNA	1.71	276.1	THAILAND ($0.57 BILLION)	33%
CRAB	1.35	96.3	CANADA ($0.43 BILLION)	32%
TILAPIA	.98	228.4	CHINA ($0.65 BILLION)	66%
LOBSTER	.89	47.4	CANADA ($0.87 BILLION	98%

California Sea Lion in LA Harbor with a gillnet cutting into its neck.

U.S. EFFORTS TO REDUCE MARINE MAMMAL BYCATCH

Spurred by concerns about the impact that human activities, such as whaling, seal harvesting, and fishing, were having on many marine mammal populations, public and congressional focus on marine mammals intensified in the early 1970s. Following extensive research and hearings, Congress passed the Marine Mammal Protection Act, reflecting its concern with the plight of marine mammals, as expressed in the House of Representatives report accompanying the bill:

> Recent history indicates that man's impact upon marine mammals has ranged from what might be termed malign neglect to virtual genocide. These animals, including whales, porpoises, seals, sea otters, polar bears, manatees, and others, have only rarely benefited from our interest; they have been shot, blown up, clubbed to death, run down by boats, poisoned, and exposed to a multitude of other indignities, all in the interests of profit or recreation, with little or no consideration of the potential impact of these activities on the animal populations involved.[19]

At the time, concerns about marine mammal bycatch focused largely on a method of fishing for tuna using "dolphin sets," which was prevalent in the Eastern Tropical Pacific (ETP). In this practice, dolphins serve as visual cues for locating schools of yellowfin, bigeye, and skipjack tuna, on which they feed. Once these mingled schools of dolphin and tuna are identified, fishers deploy long walls of net known as purse seines around both species. The nets are subsequently pulled closed underneath the fish. Such dolphin sets were responsible for between 200,000 and 400,000 annual dolphin mortalities in the global tuna fishery in the 1960s and 1970s.[20]

The Marine Mammal Protection Act was a response to this "malign neglect." Its intent was to protect animals from harm—for the pure benefit of the animals themselves—and to preserve their place within a healthy, functioning ocean ecosystem. This recognition of the intrinsic value of individual marine mammals was a groundbreaking moment in American environmental legislation.[21] Under the MMPA, it became illegal to take a marine mammal in the course of commercial fishing operations. While permits to take marine mammals were available, the law clearly placed the burden of marine mammal bycatch management on the resource users (i.e., fishers) instead of resource managers, requiring that they prove their practices did not adversely affect marine mammals beyond accepted levels.[22]

© Wolcott Henry 2005/Marine Photobank

Fishermen deploying illegal traps in Navassa Island, Haiti.

REDUCING MARINE MAMMAL BYCATCH IN THE UNITED STATES

Problems with enforcing the moratorium—and, separately, implementing a permit system for U.S. commercial fisheries—appeared soon after the law was enacted. The biggest challenge involved the National Marine Fisheries Service's inability to support its permitting determinations with sufficient information. Lacking enough data on the status of marine mammal populations and bycatch incidence, the Fisheries Service was unable to make the findings, required by the MMPA, that permitted takes would not harm marine mammal populations.[23] Congress responded by amending the act in 1988, establishing a five-year Interim Exemption Program for Commercial Fisheries and requiring the Fisheries Service to increase its data gathering (including the use of observers) and research. At the expiration of the five-year exemption, Congress in 1994 once again amended the act, setting forth an industry-specific regime for the management of marine mammal bycatch in U.S. commercial fisheries.

Relevant here are the two substantive sections Congress added to the MMPA—Section 117 (Stock assessments) and Section 118 (Taking of marine mammals incidental to commercial fishing operations)—which provide a framework for reducing marine mammal bycatch in the United States. Section 117 requires the preparation of formal stock assessment reports for all marine mammal populations living in U.S. waters, detailing annual human-caused mortality and serious injury for the populations and the commercial fisheries that interact with them. The reports are used to determine which fisheries require additional management efforts, such as developing and implementing "Take Reduction Plans" to prevent the depletion of vulnerable populations that interact with commercial fisheries.[24] These plans are discussed in Section 118. In addition, Section 118 sets extensive standards for a government-managed observer program and for self-reporting from fishing vessels, as well as a timeline to meet substantive requirements for bycatch reduction (with a target of eliminating bycatch altogether) and penalties for noncompliance.

Thus, the U.S. regime for reducing marine mammal bycatch consists of mitigation measures, focused data collection, quantitative targets, and stakeholder engagement.[25] The stock assessment reports of Section 117 play a key role in managing populations threatened by bycatch; the National Marine Fisheries Service uses data from the reports to determine whether a population is exceeding its "potential biological removal" level—that is, the maximum number of animals that can be lost to human causes without impeding the population's ability to reach or maintain its optimum sustainable population.[26] The National Marine Fisheries Service categorizes marine mammal populations where human-related mortality rates exceed the potential biological removal level, as well as species listed under the Endangered Species Act, as strategic stocks, a trigger for focused management.[27]

Pursuant to Section 118, once the Fisheries Service identifies a strategic stock that interacts with a commercial fishery having frequent or occasional marine mammal bycatch, it should then assemble a Take Reduction Team consisting of a variety of stakeholders, including fishers, environmental groups, and government officials. The team's task is to develop a policy framework, or Take Reduction Plan, outlining species and fisheries-specific bycatch mitigation strategies. Take Reduction Plans have two objectives: reducing bycatch to levels below the potential biological removal level within six months, and approaching a zero mortality and serious injury rate (which the act terms the "zero mortality rate goal") within five years.

One of the Marine Mammal Protection Act's implementation challenges is the lack of sweeping bycatch reduction measures that can be put in place for every fishery. The most effective measures are customized for the specific region, gear, ecosystem, species, and fishing culture. Despite this

The Harbor Porpoise Take Reduction Plan requires the use of acoustic net alarms, called "pingers," which are attached to gillnets in certain fisheries along the Atlantic Coast to reduce the incidence of harbor porpoise bycatch.

challenge, domestic regulation of marine mammal bycatch has proved relatively successful. According to data derived from the Fishery Service's stock assessment reports, the mean annual rate of marine mammal bycatch in the United States from 1990 to 1999 was 6,215 individuals.[28] And an analysis of stock assessments published between 1994 and 2006 revealed that the rate of annual marine mammal bycatch had fallen to 4,356, demonstrating a statistically significant decline in response to the long-term enforcement of the MMPA.[29] Furthermore, Take Reduction Plans have effectively brought take of nine marine mammal populations that were once designated "strategic" to below the designated potential biological removal value.[30] Compared with most other parts of the world, the United States has enjoyed relative success.

By value, over 91 percent of seafood consumed in the United States is imported and in 2012 the United States imported $16.7 billion of edible fish products, weighing 2.4 million metric tons, and $14.4 billion of nonedible fish products.[31]

REDUCING MARINE MAMMAL BYCATCH IN FOREIGN FISHERIES

The Marine Mammal Protection Act is not silent on the plight of whales, dolphins, and seals in foreign waters. It places an affirmative duty on the Secretary of Commerce, through the Secretary of State, to initiate negotiations with other nations for the purpose of protecting marine mammals, and it specifically calls for such negotiations to address foreign commercial fishing operations that are harmful to marine mammals.[32] It also prohibits the importation of fish caught using methods and gear prohibited by the United States.[33] And, perhaps most important, it bans the importation of fish and fish products that are caught in a manner that results in marine mammal bycatch in excess of U.S. standards. Section 101(a)(2) of the act states:

> The Secretary of the Treasury shall ban the importation of commercial fish or fish products from fish which have been caught with commercial fishing technology which results in the incidental kill or incidental serious injury of ocean mammals in excess of United States standards. For purposes of applying the preceding sentence, the Secretary—
>
> Shall insist on reasonable proof from the government of any nation from which fish or fish products will be exported to the United States of the effects on ocean mammals of the commercial fishing technology in use for such fish or fish products exported from such nation to the United States…[34]

The MMPA is clear: Foreign commercial fish or fish products may not enter the United States unless countries from which the products are exported have proved that the means used to catch the fish protect marine mammals in accord with U.S. standards.

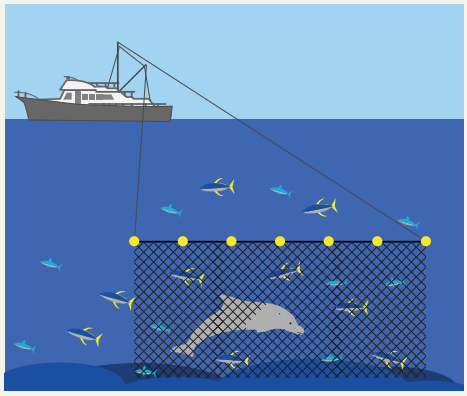
The provision serves three main purposes. First, it extends U.S. interests in protecting marine mammals abroad by linking access to U.S. markets to reducing bycatch in foreign fisheries. Second, it provides assurance to American consumers that the seafood they consume has been caught using methods and gear that protect whales, dolphins, and other marine mammals. And third, it levels the playing field for U.S. fisheries by requiring foreign fishers exporting to the United States to meet the same standards for marine mammal protection that U.S. fishers are required to meet at home.

The provision would do all of these things if it were enforced. But for the past 40 years, fish and fish products have entered the U.S. market on a daily basis without any accompanying proof, reasonable or otherwise, that the catch did not harm marine mammals in excess of U.S. standards. Seeking to finally enforce the provision, conservation organizations petitioned the federal government in 2008 to ban imports of swordfish from countries failing to comply with the act.[35] Two years later, the National Marine Fisheries Service announced that it was developing procedures to implement the provision and sought public comment on how it should be enforced.[36]

GEAR TYPES

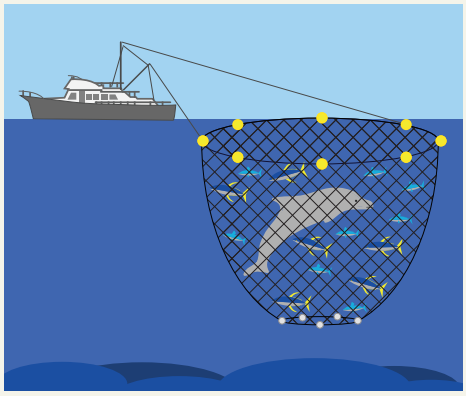
Certain types of fishing gear represent particularly significant bycatch threats for marine mammals and are referred to frequently in this report. These include gillnets and driftnets, purse seines, trawls, longlines, and traps.[37]

GILLNETS



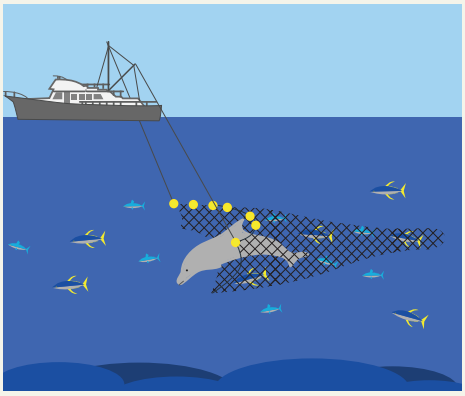
Gillnets are mesh nets that can be set on the seafloor ("bottom set") or floated vertically in the water column, depending on the targeted species. A **driftnet** is a type of gillnet that is maintained closer to the surface using buoys. Gillnets are appropriately named because when fish attempt to swim through, their gills become ensnared.[38] Marine mammals that dive for food around gillnets tend to become entangled and drown when they are unable to surface for air.[39] Gillnets come in various mesh sizes depending on the target, and those with larger mesh sizes are more likely to ensnare marine mammals. Andrew Read, a marine biologist at Duke University, estimated that hundreds of thousands of marine mammals are killed annually in gillnets worldwide.[40]

PURSE SEINES



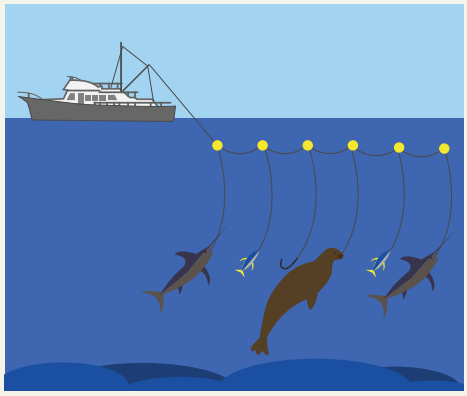
Purse seines are nets that hang vertically in the water column using weights at the bottom and buoys at the top. "Purse lines" threaded through the bottom of the nets are used to close the lower end of the net while the top remains open.[41] Purse seine fisheries killed hundreds of thousands of dolphins in the Eastern Tropical Pacific during the 1960s and 1970s using the presence of dolphins to locate schools of tuna and enclosing both in their nets.[42]

TRAWLS



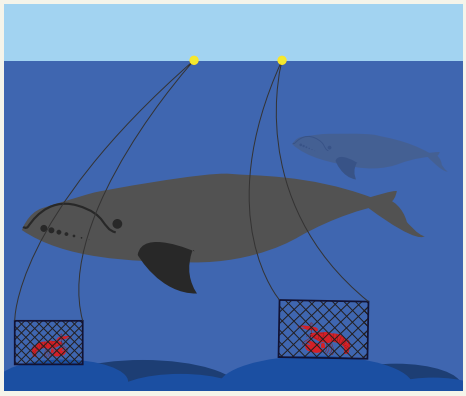
Trawls employ funnel-shaped nets that are dragged behind boats at different depths, depending on target species. Mid-water trawls targeting squid, mackerel, and other pelagic species are a serious threat to marine mammals.[43] Trawlers often target the species that mammals prey upon, and this inevitably increases the chance of bycatch as cetaceans or pinnipeds follow the trawlers and enter nets to feed.[44]

LONGLINES



Fishers use **longlines** to catch fish on baited hooks. Longlines can vary in length from 15 kilometers to more than 100 kilometers and may support as many as 2,000 hooks.[45] Longlines are set near or below the surface with floating buoys or are occasionally weighted and sunk to the seafloor for certain groundfish fisheries. Longline fisheries target tuna, swordfish, halibut, and other migratory fish and groundfish and in the process threaten sea lions, fur seals, toothed whales, and other marine mammals, which can get caught on hooks or tangled in the lines.[46]

TRAPS



Bottom-set **traps** (commonly called **pots**) targeting fish or crustaceans pose a threat because of the ropes that connect them to surface buoys ("buoy lines") and to one another ("ground lines").[47] Large whales are particularly prone to getting entangled in pot gear. Unlike most types of bycatch in nets, these interactions involve ropes and lines wrapping around the body of the whale. Large whale entanglements can last months and can result in lacerations, infection, hemorrhaging from open wounds, and starvation ending in death, not just representing a conservation risk for affected populations but creating a welfare concern for individual animals.[48]

CHAPTER 2: NET IMPORTS—A SURVEY OF MARINE MAMMAL POPULATIONS THREATENED BY INTERNATIONAL BYCATCH

While scientific studies confirm that bycatch is one of the most significant threats to many marine mammal species, the exact scope of the threat remains very difficult to accurately assess and quantify. Nonetheless, the next two chapters of the report attempt to to detail (1) the marine mammal species at greatest conservation risk as a result of bycatch in fisheries that export to the United States, and (2) the regions and countries whose fleets export seafood to the United States and are responsible for vast amounts of marine mammal bycatch. Documenting both the species at greatest risk and the countries and regions responsible for the most bycatch should help focus U.S. efforts to curb this harmful practice.

POPULATIONS UNDER THREAT

Bycatch is pushing many populations to the brink of extinction, and much of this bycatch is taking place in waters far from the United States. The fact that seafood is imported from these fisheries presents an opportunity for the United States to play an important conservation role. The following are some of the most vulnerable populations, as identified by our methodology, which focused on identifying marine mammal populations where bycatch from fisheries likely to export to the United States is a leading threat to survival.

OUR METHODOLOGY

To identify bycatch-threatened species and problem regions, we created an initial, broad list of potential regions and species of concern after reviewing academic and gray literature and the International Union for Conservation of Nature (IUCN) Red List of Threatened Species—an authoritative compendium of species extinction risk, providing thorough information on plant and animal distribution, status, ecological requirements, and relative risk of extinction. We also consulted with marine mammal experts in the field (including cetacean experts and pinniped experts) and authorities on global bycatch. We then narrowed our list by including only species and populations that met the following two criteria:

- **Species and stocks at greatest risk primarily as a result of bycatch, as opposed to other threats (such as habitat loss, ship strikes, or noise pollution).** Thus, high-risk species for which bycatch is not the highest risk factor were eliminated, such as the Mediterranean monk seal (*Monachus monachus*), listed as Critically Endangered by the IUCN, which suffers from bycatch but is primarily threatened by intentional killing and habitat loss.[49]

- **Species and stocks likely to be affected by commercial/industrial fisheries that could potentially export seafood products to the United States.** If certain marine mammals are severely harmed by bycatch but are not likely to be affected by commercial/industrial fisheries, we also eliminated them. These include species that are largely limited to freshwater or brackish waters (such as the Irrawaddy dolphin, *Orcaella brevirostris*, listed as Vulnerable by the IUCN with Critically Endangered subpopulations) or nearshore waters (such as the Franciscana, *Pontoporia blainvillei*, also listed as Vulnerable by the IUCN), which are more likely to be affected by small-scale, non-exporting artisanal fisheries.[50] While this excludes from focus many fisheries that are decimating marine mammal populations, enforcement of the foreign bycatch provision may indirectly benefit these populations when exporting countries examine and address their bycatch impacts to meet U.S. standards.

Seafood import data are available on the website of the National Marine Fisheries Service's Office of Science and Technology, using the cumulative trade data search engine. According to the Fisheries Service, the agency's import data are derived from "a combination of entries into the U.S. for immediate consumption and withdrawals from Customs bonded warehouses. These data reflect the actual entry into U.S. consumption channels of commodities that originated outside the United States."[51] We consulted 2012 import figures for specific fisheries (in kilograms and dollar values) that are known bycatch threats. For example, if crab traps were identified in the academic literature or by leading experts as a bycatch threat in Canadian fisheries, we checked Canadian snow crab import numbers to confirm whether the United States imported crab products from Canada. All values listed in this report are in U.S. dollars.

NORTH ATLANTIC RIGHT WHALE

The North Atlantic right whale (*Eubalaena glacialis*) is one of the most critically endangered populations of large whales in the world.[52] Listed as Endangered by the International Union for Conservation of Nature (IUCN) and under the U.S. Endangered Species Act, the total population was estimated at just 444 animals in 2009, based on a census of individual whales using photo-identification techniques.[53] The North Atlantic Right Whale Consortium's 2012 Annual Report Card provides a "best estimate" of 509 catalogued North Atlantic right whales for 2011, based on the number of photographed whales. The right whale is listed in the Convention on Migratory Species Appendix I, meaning it is "in danger of extinction throughout all or a significant proportion of [its] range." It also is listed in the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) Appendix I, meaning that it is threatened with extinction.[54]

The right whale's low reproductive rate, slow growth rate, and small percentage of reproductive females means that the premature loss of even one individual from the population has serious implications for the survival of the species. The National Marine Fisheries Service has established a potential biological removal level for the right whale of 0.9, meaning the premature mortality of even a single animal per year is considered unsustainable. While recent estimates suggest "a positive and slowly accelerating trend in population size," the status of the population is unclear as several indicators suggested that an increase in the mortality rate during the 1990s would result in future population growth rate reductions.[55]

Put simply, entanglement in fishing gear represents an extinction-level threat for the species. According to the Fisheries Service, "the small population size and low annual reproductive rate of right whales suggest that human sources of mortality may have a greater effect relative to population growth rates than for other whales."[56] Over the period 1970 through 1999, researchers reported that 6.7 percent of documented right whale mortalities and 55 percent of serious injuries were due to fishing gear entanglement, and the annual percentage of whales observed with rope on their bodies increased significantly from 1980 to 2009.[57]

Between 2006 and 2010, gear interactions accounted for at least 1.8 right whales killed or seriously injured each year, an impact that the population cannot sustain over time.[58] And this number is likely to substantially underestimate the actual impact, since most whale mortalities go unreported.

North Atlantic right whales seem especially prone to interactions with gear: 83 percent of all right whales have scars consistent with entanglement, with some animals showing evidence of up to six or seven separate incidents.[59] Bottom-set gillnets and offshore lobster and crab pots are the primary culprits.[60] When scientists analyzed North Atlantic right whale survey data and Canadian fishing gear deployment data in an area deemed critical habitat for the whale, they found that lobster and crab pot gear poses the greatest threat during the spring and autumn migration seasons, while groundfish hook-and-line gear poses the greatest risk to right whales during the summer resident period.[61]

Along the east coast of North America, the range of the North Atlantic right whale stretches from Florida to Nova Scotia and the Gulf of St. Lawrence, but a large percentage of the population resides in the Bay of Fundy and the western Scotian Shelf during the summer season and into autumn.[62] Canada's official right whale "recovery strategy," published in 2009, acknowledged that "the number and severity of entanglements or entrapments must be reduced" and proposed to "evaluate, promote, and/or implement where necessary, strategies (e.g., gear modifications, effort restrictions) that will reduce the potential for harmful interactions" between fishing gear and whales.[63]

Nonetheless, the Canadian federal government has failed to enact any regulations such as time or area closures or gear modifications to keep right whales from getting entangled in fishing gear.[64] Fisheries bycatch of the North Atlantic right whale continues unabated in Canadian waters. In the United States, by contrast, the Fisheries Service has taken steps to mitigate impacts of both bottom-set gillnet and pot fisheries, including a requirement that fixed-gear fisheries use sinking lines, which may pose less risk by limiting the amount of rope in the water column where whales are most vulnerable.

NEW ZEALAND SEA LION

Listed as Vulnerable by the IUCN, with some local populations listed as Endangered, the New Zealand sea lion (*Phocarctos hookeri*) is one of the rarest pinnipeds in the world.[65] According to the IUCN, the species likely has fewer than 10,000 mature individuals.[66] It is listed as Nationally Critical under the New Zealand Threat Classification System, as a threatened species under the New Zealand Marine Mammals Protection Act of 1978, and as requiring protection from international trade under CITES Appendix II. Unfortunately, bycatch is the leading anthropogenic cause of death for the species.[67]

Though the sea lion was once abundant, with a range extending throughout the waters of the North Island and South Island of New Zealand, breeding is now limited to just two small areas in the New Zealand sub-Antarctic: the Auckland Islands (accounting for 71 percent of pup production in 2010) and nearby Campbell Island.[68] Pup production declined in the critical Auckland Islands area by more than 50 percent between 1997/1998 and 2008/2009 as a result of decreasing numbers of adult females in the population.[69]

The Auckland Islands squid trawl fishery has been implicated as a particular bycatch problem for the species. The Islands' arrow squid and scampi fisheries were responsible for an estimated 89 sea lion mortalities annually from 1995/96 through 2009/10, with the squid fishery thought to have the greater bycatch impact.[70] Alarmingly, between 2004 and 2009, 82 percent of sea lions confirmed killed by the fishery were female, which is a particular problem as pup production decline has been directly linked to females' not returning to breeding areas.[71] The squid trawlers operate near the sea lions' critical Auckland Islands habitat from February through May each year, overlapping with the animals' breeding season.[72] Adding to the likelihood of fishery interactions is the important place that arrow squid hold in the sea lions' diet, meaning that both trawlers and sea lions are targeting the same prey species.[73]

A 2011 study by Louise Chilvers of the New Zealand Department of Conservation found that the current level of bycatch in the Auckland Islands squid trawl fishery is "the most significant known negative impact on the population" of New Zealand sea lions.[74] The study employed a population viability analysis model to estimate the impacts of both bycatch and epizootic diseases on the population. It concluded that if bycatch were to continue at the present rate, the population would go functionally extinct by 2035.[75] Sea lion bycatch is known to occur in other fisheries as well, with an average of 11 animals killed per year in sub-Antarctic fishing of southern blue whiting.[76]

Despite the impact of bycatch on the sea lion population, the New Zealand government has failed to adequately protect the species and insists that fisheries are not negatively affecting the population. Although the New Zealand Ministry of Fisheries has historically set a "fishing related mortality limit" (FRML, an equivalent of the potential biological removal level) for sea lions, in 2011 the ministry proposed eliminating the mortality limit altogether, arguing that the bycatch threat was minimal. After backlash from the scientific and environmental communities, the ministry backtracked in 2012, proposing instead that the limit be maintained at 68 estimated mortalities per year (the lowest quota over the previous 10 years), while reiterating its position that "fishing is unlikely to be having a direct effect on the sea lion population that could be considered adverse."[77] This position is inconsistent with the opinions of the IUCN as well as the New Zealand Department of Conservation's own scientist.

While the Ministry of Fisheries mandates the use of escape hatches for sea lions, called "sea lion exclusion devices," on all squid trawl nets, there are serious questions about the extent to which these devices actually improve sea lion survival rates.[78] Research has suggested that to avoid functional extinction of the sea lion population, the squid fishery must switch from trawling to another form of fishing called jigging, which proved successful in reducing pinniped bycatch in the Falkland Islands.[79]

In 2012, the United States imported nearly 850,000 kilograms of squid products from New Zealand, valued at more than $3.6 million. Whether or not the squid products imported into the United States from New Zealand originated from the Auckland Islands fisheries is difficult to determine for now, but the MMPA's foreign bycatch provision requires the New Zealand government to provide information on sourcing.

Species contrast: Australian sea lion. The Australian sea lion (*Neophoca cinerea*), like the New Zealand sea lion, is now one of the rarest sea lion species in the world, with bycatch representing the greatest threat to the survival of the species.[80] Unlike New Zealand, however, the government of Australia recognizes the impact of bycatch and is taking significant steps to reduce the impact of fisheries interactions.

The IUCN lists the species as Endangered, with "most major colonies…at risk of extinction from fishery bycatch."[81] In 2007 the total abundance was estimated at 13,790 individuals.[82] According to the IUCN, the population, which has been significantly reduced from historical levels, is declining and is projected to continue to decline by more than 50 percent in some major colonies unless and until fisheries-related mortalities are reduced.[83]

The Australian sea lion's greatest threats are the demersal gillnet and rock lobster fisheries.[84] The federal government has mandated the use of sea lion exclusion devices on all commercial and recreational rock lobster traps used in areas identified as sea lion habitat. These exclusion devices are different from those used in New Zealand because they are designed for use on different types of gear, but the goal is the same: to allow sea lions to escape entrapment.[85]

Recognizing that "a more precautionary approach is appropriate," the Australian government recently set very conservative bycatch limits that trigger the closure of gillnet fisheries affecting the Australian sea lion.[86] Under the new regulations, if and when the trigger limit is reached within a particular fishing zone, that zone will be closed to gillnet fishing for a full 18 months; and if the overall limit across all zones (a total of 15 bycaught sea lions) is met at any time, all zones will be closed for 18 months. The updated regulations came as a result of an internal review of the previous trigger limits, which, according to the government's findings, were not "guaranteed to demonstrably protect each of the sub-populations (breeding colonies), several of which have been recognized as being at risk [of] becoming locally extinct."[87] Australia's approach to sea lion conservation contrasts sharply with New Zealand's, where the government appears more interested in advancing fisheries than in ensuring species survival.

MEDITERRANEAN SPERM WHALE

The Mediterranean sperm whale (*Physeter macrocephalus*), a genetically distinct subpopulation, is listed as Endangered by the IUCN, with total population numbers thought to be in the low to mid hundreds.[88] Bycatch in driftnets continues to threaten the survival of the stock and is thought to have resulted in the steep decline in the population over the past half century.[89] The IUCN considers entanglement in high-seas swordfish and tuna driftnets, "which [have] caused considerable and likely unsustainable mortality since the mid-1980s," the greatest ongoing threat to the Mediterranean sperm whale population.[90]

As recently as the 1950s, sperm whales were considered common in parts of the Mediterranean, with frequent reports of "large aggregations" of up to 30 animals in the Strait of Messina and near the Sicilian coast.[91] While no current estimate of population size exists, a steep drop-off in sightings has led researchers to conclude that the abundance has declined significantly. Giuseppe Notarbartolo di Sciara, president of the Tethys Research Institute and European regional coordinator for the IUCN Cetacean Specialist Group, reports that the Mediterranean sperm whale is one of the marine mammal populations at greatest conservation risk globally as a result of bycatch.[92]

Historical stranding data tell the story of the sperm whale's particular vulnerability to getting caught in fishing gear, which some have attributed to the animal's unusual head shape.[93] Between 1986 and 1989, 24 sperm whales (and 126 other cetaceans) were found stranded on various Italian coasts, their deaths attributed to driftnet interactions.[94] Indeed, the majority of sperm whale strandings in Italy and Mediterranean Spain have been attributed to driftnet-related mortalities, evidenced either by scars consistent with driftnets or actual net fragments on the carcasses.[95]

Although the Pelagos Sanctuary for Mediterranean Marine Mammals in the Ligurian Sea and parts of the Corsican and Tyrrhenian Seas helps protect sperm whales, major areas that are likely to represent critical habitat for the sperm whale remain entirely unprotected.[96] And despite driftnet bans

by the United Nations and the European Union, as well as bans upheld by both the International Commission for the Conservation of Atlantic Tunas and the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, the use of illegal and quasi-legal driftnets persists in the region, with Italian and Turkish driftnet fleets representing the last likely holdouts.[97] In 2012 the United States imported 1.1 million kilograms of seafood valued at $11.6 million from Turkey, of which 30,831 kilograms were tuna, valued at $133,046. Also in 2012, the United States imported nearly 190,000 kilograms of tuna products valued at more than $1.3 million from Italy, while total seafood imports from Italy were valued at $12.7 million.

VAQUITA

The vaquita (*Phocoena sinus*) is widely considered to be one of the world's most endangered marine mammals. The IUCN Red List categorizes this small cetacean as Critically Endangered, and it is listed in Appendix I of CITES. According to a 2012 report from the International Committee for the Recovery of the Vaquita (CIRVA), "the vaquita population is still declining and now likely consists of fewer than 200 individuals."[98] The report goes on to state that if the ongoing decline is not stopped by 2017, "the species may be too depleted to ever recover."[99]

The vaquita has the smallest known range of any cetacean.[100] With no subpopulations, the entire species is limited to the extreme northern end of Mexico's Gulf of California, with its core area covering just 2,235 square kilometers of the upper gulf.[101] The vaquita may have once been abundant throughout the Gulf of California, though it is likely that its range has always been limited.[102]

Bycatch is, without a doubt, the single greatest threat to the species.[103] Living in relatively shallow waters, vaquitas are primarily affected by coastal gillnets that are deployed by regional fishers.[104] The vaquita probably began to decline in the 1940s when gillnet use became widespread in the area. For years the gillnet fishery for totoaba was mainly responsible for vaquita bycatch, and although the totoaba fishery is officially closed, it continues to operate illegally.[105]

More recently, vaquita bycatch has been occurring in artisanal gillnets that target finfish and shrimp and in industrial shrimp trawls.[106] According to Lorenzo Rojas-Bracho of the National Institute of Ecology in Mexico and his colleagues, the northern Gulf of California's high-value shrimp fishery supports a large commercial trawling fleet and local fishers using gillnets.[107] Shrimp trawlers have operated in the area for years, while small-scale gillnetting for shrimp began in the 1980s and has grown rapidly.[108]

In the only study estimating vaquita bycatch rates, total bycatch mortality from one of the two leading fishing ports was estimated at 39 animals per year for the 1993-94 season. Extrapolating this figure, scientists estimated total bycatch mortality of 78 vaquita annually for the two leading ports combined.[109] These figures are significantly higher than what would be considered sustainable for the survival of the dwindling species.[110] The vaquita's struggle for recovery is further complicated by a relatively low annual reproductive rate of 4 percent.[111] Females have only one calf during the spring and give birth only once every two years, unlike most other porpoises, which breed annually.[112]

According to Rojas-Bracho and other researchers, much of the fish and shrimp caught in the fisheries affecting the vaquita is sold to a domestic market, but the fisheries do export some products to the United States, including fish, sharks, skates, rays, and fresh-frozen shrimp.[113] Mexico's shrimp exports to the United States are significant: In 2012, they amounted to more than 26 million kilograms of product with a value exceeding $256 million, accounting for more than half the total value of seafood imports from Mexico. Import statistics from the specific fisheries affecting the vaquita are not available but are required of the Mexican government under the MMPA's foreign bycatch provision.

The vaquita represents a rare case in which population trends and bycatch rates are thought to be relatively reliable; thus conservation of the species depends not on better science but on sound management.[114] The Mexican government since 2008 has invested heavily in attempts to halt bycatch, creating a marine refuge within the core of the vaquita's range and using economic incentives such as "rent-outs," "switch-outs," and "buyouts" to end the fishing practices affecting the species. According to the International Committee for the Recovery of the Vaquita, "Never before has so much serious effort and funding been invested in vaquita conservation."[115]

In June 2013, the government took another important step toward saving the vaquita by adopting modifications to shrimp fishing standards, calling for a three-year phase-out of drift gillnet shrimp gear, to be replaced by more selective equipment that would reduce the likelihood of vaquita bycatch. While the gear has been approved by the government, the success of this new standard hinges upon the participation of local fishing communities as well as support, from the government and NGOs, in the form of training on the use of the new gear and temporary compensation for fishers.[116]

AN "HONORABLE" MENTION: FALSE KILLER WHALES IN THE WESTERN AND CENTRAL PACIFIC

While the IUCN Red List categorizes the false killer whale (*Pseudorca crassidens*) as Data Deficient, it highlights the species' potential vulnerability to low-level threats and is unable to rule out a 30 percent global reduction over three generations in part because of significant bycatch.[117] Unlike most of the other species discussed in this report, false killer whales have an extremely slow life history—they are slow to mature, have an estimated calving interval of seven years, and experience female reproductive senescence.[118] False killer whales are also a high trophic level predator, feeding on large game fish and sometimes attacking other cetaceans, so their abundance is naturally low in comparison with other delphinids.[119]

False killer whales are bycaught in gillnet, purse seine, trawl, and longline fisheries in tropical and temperate waters worldwide.[120] U.S. assessments of interactions between false killer whales and fisheries in Hawaiian waters show bycatch levels that consistently exceed the potential biological removal level for many of the region's populations.[121] Bycatch numbers are of increasing concern in the western and central Pacific as evidence of significant interactions with longline and purse seine fisheries mounts in conjunction with evidence of restricted gene flow between segmented populations.[122] While U.S. stock assessment reports detail threats from longline fisheries in and around Hawaii, the Western and Central Pacific Fisheries Commission has reviewed cetacean interactions in its purse seine fishery, estimating 281 false killer whale mortalities in 2009.[123]

Given their naturally low abundance, life history, high trophic level, and the threat from both longline and purse seine fisheries, it is probable that false killer whale populations throughout the western and central Pacific are declining as a result of bycatch. Nations operating in the region (e.g., China, Canada, Japan, and South Korea) export tuna and billfish targeted by longline and purse seine fisheries to the United States.

SPINNER DOLPHINS IN THE INDIAN OCEAN AND BEYOND

The IUCN Red List categorizes the spinner dolphin (*Stenella longirostris*) as Data Deficient, expressing concern that the species may warrant a Threatened listing even though data are lacking to make such an assessment. Combined population estimates from various parts of the world add up to more than 1 million spinner dolphins worldwide, but it is possible that the species as a whole has seen a 30 percent decline, with bycatch representing one of the primary drivers.[124] Spinner dolphins are bycaught in purse seine, gillnet, and longline fisheries in many of the world's tropical and subtropical seas.

Unlike most species profiled in this report, the overall global spinner dolphin population is not thought to be at immediate risk of extinction, but the sheer number of spinner dolphins killed by fisheries throughout the world makes it worthy of attention. Moreover, several subspecies and regional populations have yet to be thoroughly assessed individually, and on the basis of available estimates of abundance and bycatch, some of these subpopulations may well warrant a Threatened classification individually.[125] The spinner dolphin, like most other cetaceans, is listed in Appendix II of CITES.

Bycatch numbers are particularly high in the Indian Ocean, where spinner dolphin is the most abundant dolphin species. Reports from Indian Ocean countries indicate hundreds or even thousands of spinner dolphins killed per year.[126] Mortality on this scale could potentially represent a significant proportion of the total population.[127] Some estimates from the early 1990s put the number of spinner dolphin mortalities or serious injuries in Sri Lankan fisheries at up to 15,000 per year.[128] The problem of spinner dolphin interactions with Sri Lankan driftnets and set gillnets was identified as a priority in a 2005 paper authored by some of the world's foremost cetacean experts. The paper, *Global Priorities for Reduction of Cetacean Bycatch*, summarized the authors' findings on bycatch priorities—including species at risk and geographic regions of concern—and outlined specific economic and regulatory actions that could be taken to address some of the most pressing problems.[129]

The IUCN Red List states that fisheries operating out of India are reported to catch hundreds of spinner dolphins annually, but these represent just a small fraction of fisheries

that have been assessed. Spinner dolphins often get entangled in seer fish and tuna driftnets off the west coast of India.[130] Shark and catfish gillnets have also been implicated in spinner dolphin bycatch.[131]

The eastern subspecies of spinner dolphin was previously one of two dolphin species (the other being the pantropical spotted dolphin, *Stenella attenuata*) that suffered significant mortalities in the Eastern Tropical Pacific (ETP) tuna purse seine fishery. Because dolphins and yellowfin tuna tend to occur together in the ETP, purse seiners would set their gear on dolphin groups, knowing that tuna were likely to be schooling beneath them. As a result, the ETP tuna fishery killed hundreds of thousands of dolphins annually, reducing the population of spinners in the region by an estimated 65 percent by the late 1970s.[132] After the Inter-American Tropical Tuna Commission's bycatch regulations were implemented in the ETP, the spinner dolphin bycatch mortality rate in the tuna fishery there fell dramatically, from 30,500 mortalities in 1986 to 288 in 2007.[133] Yet studies have shown that the spinner dolphin population in the ETP is failing to recover, with an estimated growth rate that is not statistically different from zero.[134] Studies have not been able to pinpoint the reason for the lack of recovery in the region, but possible explanations include bycatch by vessels that do not have observers, or underreporting of interaction mortality.

In the Philippines, spinner dolphins (as well as Fraser's dolphins, *Lagenodelphis hosei*) are known to suffer significant levels of bycatch-related mortality, some of it due to tuna driftnet fisheries.[135] Not only do they wind up caught in nets, but spinner dolphins also fall victim to targeted hunts, with their meat used as bait in shark fisheries and for human consumption.[136] Spinner dolphins have been caught in shark nets and driftnets off Brazil, trapped in deepwater gillnets off Pakistan, and incidentally killed in a shrimp trawl fishery operating in the Gulf of Thailand, although numbers for the last are not available.[137] It is very likely that the species experiences fishery-related mortality in other regions as well, but this bycatch remains undocumented.

Because much of the spinner dolphin bycatch occurs in areas where fisheries regulation and monitoring are lacking (such as the Indian Ocean), researchers tend to rely on anecdotal and dated evidence to understand the interactions between fisheries and marine mammals. While it is sometimes difficult to pinpoint offending fisheries, it is nonetheless widely believed that spinners are bycaught frequently by fleets exporting to the United States (such as Indian and Sri Lankan fisheries) and that steps must be taken to reduce spinner bycatch in the region. In 2012, India exported to the United States more than 82.6 million kilograms of seafood products valued at more than $670 million, including more than $1.8 million in tuna products. Sri Lankan seafood exports to the United States totaled nearly 4.8 million kilograms valued at more than $41.5 million, including more than $20.7 million in tuna imports.

HARBOR PORPOISES IN THE BALTIC AND BLACK SEAS

Two stocks of harbor porpoise found in European waters are particularly vulnerable to bycatch: the Baltic Sea harbor porpoise (*Phocoena phocoena*), a distinct subpopulation, and the Black Sea subspecies of harbor porpoise (*P. p. relicta*). The IUCN Red List categorizes the Baltic Sea harbor porpoise as Critically Endangered and the Black Sea harbor porpoise as Endangered. Current fisheries regulatory measures in the Black and Baltic Seas are not adequate to protect cetaceans, and monitoring needs to be improved.[138]

BALTIC SEA HARBOR PORPOISE

The size of the Baltic Sea harbor porpoise population remains unknown, with estimates for the Western Baltic ranging from 27,767 animals in 1994 to a diminished 10,865 in 2005.[139] Harbor porpoises in the Baltic were directly hunted throughout much of the 20th century, significantly reducing their numbers.[140] The population is thought to be in decline, with bycatch in gillnets cited as a primary cause of mortality.[141]

Actual levels of bycatch are difficult to assess as fisheries observer data are lacking. A study in the German Baltic found stranded porpoises with bricks tied to their peduncles in obvious attempts to sink carcasses, and "a very high number of unreported [bycatch] cases," demonstrating that there is a disincentive to report bycatch.[142] In the absence of reliable data, strandings have been used to provide minimum bycatch estimates.[143] One study conducted from 1987 to 2008 examined stranded porpoises and found 167 out of 247 animals showed signs of entanglement. It estimated a total of 51 bycaught porpoises in 2005, 82 in 2006, and 150 in 2007.[144] A study published in 2008 estimated that the annual bycatch rate was 1.78 percent to 17.94 percent of the Western Baltic population, exceeding the maximum sustainable rate (1.7 percent) established by the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), a regional intergovernmental agreement for cetacean conservation.[145] While mild acoustic deterrents called

"pingers" have proved effective at reducing harbor porpoise bycatch, they are required in the Baltic Sea only on gillnet vessels more than 12 meters long.[146]

The main target species in gillnet fisheries in the Baltic Sea are cod, herring, gar, salmon, pike, perch, flounder, and turbot.[147] Fishing effort in the Baltic is undertaken by numerous surrounding countries, including Denmark, Germany, Poland, and Sweden. Exports from Poland to the United States in 2012 included salmon valued at more than $8.7 million, cod valued at more than $4.1 million, herring valued at nearly $1.5 million, and pike and perch valued at more than $1.3 million. German herring entering the United States was valued at more than $7.7 million, and salmon was valued at more than $955,000. Imports from Sweden in 2012 included salmon valued at nearly $1.3 million and herring valued at nearly $500,000. Imports from Denmark included more than $80,000 in herring and nearly $125,000 in cod. The exact origin of these fish products (the Baltic Sea versus other waters) is unknown, but the countries in question are required to provide this information under the MMPA's foreign bycatch provision.

BLACK SEA HARBOR PORPOISE

There are no estimates of current population size for the Black Sea subspecies, but it is possible that only several thousand individuals remain.[148] As with the Baltic Sea harbor porpoise, this population declined significantly as a result of a directed hunt, which continued until 1983. There are no accurate records of how many animals were taken, but it is generally assumed that the number was quite high.

Even after the hunt ended, the Black Sea population continued to decline due to interactions with bottom-set gillnets, with incidental mortality possibly in the thousands per year.[149] Gillnet fisheries targeting turbot, spiny dogfish, and sturgeon have been implicated, and reduction in bycatch levels for this population was identified as a priority in *Global Priorities for Reduction of Cetacean Bycatch*.[150]

The turbot fisheries normally operate during times when harbor porpoises are giving birth and nursing, putting them at greater risk.[151] Between 2006 and 2008, observers aboard turbot and spiny dogfish vessels in Ukraine waters reported 480 bycaught harbor porpoises.[152] Remarkably, this figure came from a single fishing boat operating legally; hundreds of other legal vessels operate in the same area for the same target species. "Illegal, unreported, and unregulated" fishing (a term of art in the fishing world, capturing activities that violate or are inconsistent with applicable national or international laws, rules, or regulations, commonly referred to as "IUU fishing") is also rampant in the Black Sea, and the level of bycatch occurring in those fisheries is difficult to quantify. Unlike in the Mediterranean, where IUU drift-netting is being slowly tackled to reduce marine mammal bycatch, illegal drift-netting continues unabated in the Black Sea.[153]

In 2012 the United States imported more than $400,000 worth of flatfish from Turkey and nearly $27,000 worth of turbot from Russia. Turkish bottom-set gillnet and trammel net fisheries for turbot and sole and Russian bottom-set gillnet fisheries for turbot have been identified as being responsible for harbor porpoise bycatch in the Black Sea.[154]

J-STOCK MINKE WHALE

The J-stock minke whale (*Balaenoptera acutorostrata*) is one of two or more distinct minke whale populations living in the western North Pacific. The population occurs in the Yellow Sea, East China Sea, and East Sea/Sea of Japan year-round, and some component of the population is thought to migrate to the Sea of Okhotsk in the summer.[155] The J-stock minke is genetically distinct from other minke whale populations and is unique in that it breeds in the summer rather than winter, an unusual trait among baleen whales.[156] The total population size is unknown due in part to questions about the status of the stock in North Korean, Russian, and Chinese waters, where bycatch is likely to occur, but experts agree the stock is in decline.[157] The legal but unregulated bycatch of J-stock minke whales in Japan and South Korea, in addition to suspected unreported catches, has researchers concerned about the possibility of extinction within the next few decades.[158]

Based on the best available information, the current bycatch rate is not sustainable for the stock.[159] Almost three decades ago, in 1985, the International Whaling Commission (IWC) officially classified the J-stock minke as a Protected Stock on the basis of evidence of the population's decline, and in 2009 the IWC Scientific Committee expressed concern about the continued decline of the population.[160] Official bycatch numbers from both Japan and South Korea put total mortalities at more than 200 per year since 2001, and genetic analysis of whale meat in markets in both countries demonstrates that the actual number (factoring in all illegal, unreported, and unregulated bycatch) could be as much as twice that figure.[161]

South Korean commercial whaling killed an estimated 16,000 J-stock minke whales from 1940 to 1986.[162] Although this hunt was banned in 1986 following the IWC whaling moratorium, the country still allows the sale of whale meat from animals killed as a result of bycatch in legal fishing

gear.[163] This loophole allows whale meat to enter the market legally, thereby fueling demand, which creates an incentive for fishers to "accidentally" catch and kill minke whales. A qualitative study of minke whale bycatch in South Korea confirmed that deliberate bycatch is occurring and reported that the income from one minke whale can equal more than 50 percent of a fisher's average annual income.[164] The price for a large minke in South Korea peaked at more than $100,000 in 2004 but has fallen to approximately one-third that value since then.[165] Interviews with local stakeholders in South Korea indicate that the illegal and unreported catch of minke whales may be even larger than the legal bycatch.[166]

While a great deal of attention has focused on Japan's controversial hunt of large whales, which includes the killing of J-stock minke (unintentionally or otherwise), records show that South Korea's officially reported bycatch figures—which are almost certainly lower than the actual number killed—has exceeded the number of J-stock minkes killed by the Japanese "scientific" hunt since 1996, when South Korea began keeping records.[167] A genetic analysis of whale products for sale in South Korean markets found the proportion of whale meat originating from J-stock minke whales, when factored into a population dynamics model, predicted a "decline toward extinction over the next few decades."[168] While the official bycatch figures in South Korea average 80 to 100 animals annually, genetic sampling of whale meat products in South Korean markets shows that total catches are likely twice the official number.[169]

In Japan, where the "scientific" hunt of whales has persisted despite the decades-old international moratorium on whaling, the sale of whales killed as bycatch was illegal until 2001, when fisheries regulations were changed to allow the sale of whales that are bycaught in fishing gear if the bycatch is recorded. A jump in reported whale bycatch followed the change (from 19 to 29 whales per year from 1997 to 2000, to 89 to 137 whales per year from 2001 to 2004), indicating that unreported bycatch was probably occurring in significant numbers before 2001.[170] A genetic analysis of whale meat for sale in Japanese markets found that 46 percent of butchered whales originated from the J stock and confirmed that significant underreporting of incidental J-stock minke takes was indeed occurring prior to 2001.[171]

An analysis of 214 lethal minke whale entanglements in the East Sea of Korea found that set nets (n = 75, 35.0 percent), pots (n = 67, 31.3 percent), and gillnets (n = 65, 30.4 percent) were the primary gear types involved, with most reported incidents occurring within 20 kilometers of shore (n = 179, 86.5 percent).[172] In Japan the majority of minke whales reported as bycatch are captured in "set nets," aptly described in a recent paper as "fixed fishing structures with a 'guide' up to 1 kilometer in length, extending from shore to offshore and leading to a large 'box' to retain the trapped fish (or whales)."[173] There are an estimated 20,000 set nets in Japanese coastal waters.[174] The Japanese claim that the sale of whales taken as bycatch in fisheries other than coastal set nets is prohibited, but experts in the field have expressed skepticism that this prohibition is in force.[175]

As the reported bycatch of J-stock minke whales occurs mostly in coastal waters, these fisheries are less likely to export to the United States. Nonetheless, seafood imports from South Korea and Japan are significant, and it is possible that some of these seafood exports are sourced in coastal fisheries and unreported fisheries. In 2012 the United States imported more than 20 million kilograms of seafood products from Japan, valued at nearly $290 million. Exports from South Korea also totaled more than 20 million kilograms and were valued at more than $129 million. Notably, the South Korean government has not made any attempt to limit bycatch, and this would seem to be confirmed by the fact that not a single successful disentanglement of a minke whale in the East Sea/Sea of Japan has been reported.[176]

CHALLENGES AND LIMITATIONS

Where bycatch is concerned, the lack of knowledge is pernicious. Areas that may represent the greatest urgency, precisely because management is lacking, may be overlooked because data are deficient in those areas. Randall Reeves and his colleagues highlight the problem in their 2013 paper *Marine Mammal Bycatch in Gillnet and Other Entangling Net Fisheries, 1990 to 2011*, which reviews the past 20 years' worth of literature on the subject, identifying data gaps and species at greatest risk from gillnet interactions.[177] For example, the paper shows that virtually no interaction data are available on Chinese fisheries or on the marine mammals affected by them, despite the fact that the Chinese fishing fleet is probably the largest in the world in terms of fleet size and quantity of fish caught each year.[178] Thus, although 7,000 gillnet vessels operated in Chinese coastal waters in 1990, the paper's authors were able to turn up only two records of gillnet bycatch in China since that time.[179]

Moreover, attention tends to focus on species and populations for which bycatch data are abundant enough to show that a conservation problem exists. This makes it even less likely that animals listed as Data Deficient—the majority of the world's marine mammal populations—receive attention. But data are often lacking because of a dearth of sightings or a lack of fisheries management, both of which could indicate a bycatch problem. For instance, recent research indicates that a significant amount of global marine mammal bycatch is occurring in small-scale artisanal fisheries, yet data on most of these undermanaged fisheries are virtually nonexistent.

People trying to assess and quantify bycatch face many challenges. Fisheries interactions are inherently difficult to monitor because they take place at sea, where most bycatch is thrown overboard and never recorded. Fishers have a disincentive to report these incidents, either because bycaught animals have value as food or bait, or because marine mammal bycatch is illegal and reporting could lead to increased regulation of the fishery. To make matters worse, a great deal of bycatch is simply never detected. For example, entanglements in nets that are not actively being used (known as "ghost nets") are nearly impossible to evaluate, as is "cryptic" bycatch, which occurs when animals manage to escape entanglement from active or ghost nets but then die as a result of their injuries.

The sad fact is that, in many parts of the world, fisheries and marine mammal bycatch are unregulated, unmonitored, and inaccurately assessed.

CHAPTER 3: REGIONS OF CONCERN FOR MARINE MAMMAL BYCATCH

NORTHWEST ATLANTIC

CANADA

Not surprisingly, Canada is one of the most significant exporters of seafood products to the United States. Canada ranked second after China in exports of fish products to the United States in 2012, with total imports from Canada valued at more than $2.5 billion. The United States imported more whole fish and shellfish from Canada than from any other country.[180] Shellfish imports alone were valued at nearly $1.5 billion.

The Canadian moratorium on Atlantic cod in 1992 and the closure of the Atlantic salmon pelagic gillnet fishery around the same time led to the development of new fisheries in the Canadian Atlantic, including an active offshore pot fishery for snow crab and lobster. These fisheries, in addition to those for lumpfish and monkfish, have expanded significantly since 1992.[181] While it is generally thought that the cod moratorium reduced the impact of gillnets on small cetaceans, data are largely lacking, and bycatch mitigation efforts have been inadequate. The Canadian crab and lobster pot fisheries have no bycatch standards and are implicated in lethal entanglements of large whales, including the endangered North Atlantic right whale, discussed above.[182]

Species affected

Large whales, predominantly humpbacks (*Megaptera novaeangliae*) and minkes, are caught in ropes from a variety of inshore and offshore fishing gear in Canadian waters, including traps and gillnets targeting groundfish such as Atlantic cod and lumpfish, as well as offshore pot gear targeting crab and lobster.[183] In 2005, researchers found that 89 percent of documented right and humpback whale entanglements in the Northwest Atlantic occurred in either gillnet or trap gear, at least when the gear was identifiable.[184] Following the cod moratorium, inshore bycatch rates dropped significantly, but more incidents have been reported farther offshore in recent years as a result of the expansion of the snow crab fishery.[185] Of the 1,209 large-whale entanglements recorded in Newfoundland and Labrador from 1979 to 1998—80 percent consisting of humpbacks and 15 percent of minke whales—approximately 60 percent involved pots targeting snow crab.[186]

While the majority of large whales entangled in Canadian fishing gear are either humpbacks or minkes, the impact of bycatch on the critically endangered North Atlantic right whale cannot be overstated. Canada's federal government published an official right whale "recovery strategy" in 2009 that recognized the need to reduce "the number and severity of entanglements or entrapments" and proposed to "evaluate, promote, and/or implement where necessary, strategies (e.g., gear modifications, effort restrictions) that will reduce the potential for harmful interactions" between fishing gear and whales.[187] Yet the strategy failed to put forth any actual requirements for bycatch reduction. To date, the Canadian government has failed to enact any regulations such as time or area closures or gear modifications to limit right whale interactions with fishing gear.[188]

In addition to large whales, harbor porpoises are also threatened by bycatch in the Northwest Atlantic. According to the National Marine Fisheries Service, four distinct populations of harbor porpoise can be found in the region: the Gulf of Maine/Bay of Fundy stock, the Gulf of St. Lawrence stock, the Newfoundland stock, and the Greenland stock.[189] Historically, very high numbers of harbor porpoises were bycaught in Canada's Atlantic cod fishery, which largely ceased after the 1992 moratorium. Yet experts believe that large numbers of small cetaceans including harbor porpoises continue to suffer bycatch in Canada's nearshore gillnet fisheries, which target cod and lumpfish, as well as in its offshore gillnet fisheries, which target groundfish such as monkfish, white hake, and Greenland halibut.[190] For the Gulf of Maine/Bay of Fundy stock (shared by the United States and Canada), U.S. fisheries are limited by enforced time and area closures and are required to put acoustic pingers on their gear, but they still exceeded the potential biological removal ceiling for harbor porpoises during the period 2006 to 2010, with a mean annual mortality of 796. Bycatch rates for Canadian fishers, for whom no such mitigation measures exist, are unknown but likely to be higher.

Bottom-set or "sink" gillnets deployed in groundfish fisheries are thought to produce the highest rates of harbor

porpoise bycatch in the North Atlantic.[191] In 1994 the Canadian Department of Fisheries and Oceans released a draft conservation plan containing research, conservation, and management measures for harbor porpoises in the Bay of Fundy. This plan led to trials of pingers (previously developed and tested in the United States) on gillnets in the bay, which were apparently successful: One estimate found that the fishery had reduced bycatch by 68 percent in 1996 as a result of pinger use that year.[192] And yet, despite the conservation plan and the apparent success of the pinger trials, the Canadian Department of Fisheries and Oceans has never required the fishery to install pingers or make other gear modifications, nor has it taken any other management action to reduce harbor porpoise bycatch in gillnets.[193]

The four harbor porpoise stocks face varied threats in terms of fisheries interactions. In the 1990s, the Canadian Department of Fisheries and Oceans temporarily implemented a fishery observer program in the Bay of Fundy sink gillnet fishery. The program provided useful estimates of porpoise bycatch but was discontinued in 2002. In 1994, with 49 percent observer coverage, bycatch was estimated at 101 animals; according to the IUCN, some estimates of bycatch in the bay have run as high as 400 animals per year.[194] Meanwhile, gillnet fishing in the Gulf of St. Lawrence resulted in an estimated bycatch of 2,215 harbor porpoises in 2000 and 2,394 in 2001.[195] Questionnaires returned by fishers indicated that the species most often sought by these fisheries were Atlantic cod, mackerel, and herring. The Newfoundland and Labrador gillnet fishery was estimated to be responsible for the bycatch of 2,228 harbor porpoises in 2003.[196] Other Canadian fisheries with harbor porpoise bycatch include cod, halibut, lumpfish, herring, white hake, and skate.[197]

Canadian exports to the United States

In 2012, U.S. imports of lobster and lobster products from Canada (including lobster from many U.S. fisheries, which is exported to Canada for processing and then imported back into the United States) totaled nearly 47 million kilograms and were valued at more than $873 million. Snow crab imports totaled nearly 37 million kilograms with a value of nearly $400 million, and the value of all crab products imported from Canada totaled more than $432 million. Herring imports were valued at nearly $36 million, Atlantic halibut at more than $31 million, and hake products at $12 million.

CONTRASTING CANADIAN AND U.S. BYCATCH MITIGATION MEASURES

In the Northwest Atlantic, U.S. fisheries, like Canadian fisheries, encounter the Gulf of Maine/Bay of Fundy stock of harbor porpoises and the North Atlantic stock of right whales. And yet the contrast between the two countries' mitigation measures for bycatch is striking.

The National Marine Fisheries Service has implemented several regulations to protect North Atlantic right whales. Groundlines are required to sink during certain times and in certain areas to reduce large whale entanglement. Canadian fishers have no such requirements. The Fisheries Service also requires lobstermen to use weak links designed to break free under the pressure exerted by a whale, a requirement not imposed on Canadian lobstermen.

The Fisheries Service has implemented several measures to protect the Gulf of Maine/Bay of Fundy stock of harbor porpoises. From 1990 to 1994, a NMFS observer program estimated that between 1,200 and 2,900 animals were bycaught each year—a number that exceeded what the population could sustain. This finding triggered the formation of a Take Reduction Team, which produced the Harbor Porpoise Take Reduction Plan. The plan applies to most sink gillnet fisheries from North Carolina to Maine and includes both time and area closures where bycatch rates are high, as well as a mandate for the use of pingers on gillnets in certain areas.

Following implementation of the plan, bycatch levels dropped in the Northeast sink gillnet fishery and the mid-Atlantic gillnet fishery. Average annual bycatch in the Northeast sink gillnet fishery from 1994 to 1998 topped 1,100 animals. Since full implementation of the Take Reduction Plan, harbor porpoise bycatch has been below PRB in several years, with numbers as low as 73 porpoises by-caught per year.[198] The Canadian government does not impose any requirements to protect harbor porpoises.

THE MEDITERRANEAN

It is widely reported that large-scale driftnets deployed far from shore are responsible for a significant number of marine mammal deaths and injuries in the Mediterranean.[199] A 2010 intergovernmental status report specifically blames these pelagic driftnets for the majority of cetacean bycatch in the region, despite bans from the General Fisheries Commission for the Mediterranean (a regional fishery body that coordinates fisheries management in the Mediterranean, Black Sea, and connecting waters), the International Commission for the Conservation of Atlantic Tunas (ICCAT, an intergovernmental organization responsible for the conservation of tuna in the Atlantic Ocean and its adjacent seas), and the European Commission.[200] Prior to the United Nations ban on driftnets, the Italian fleet alone was responsible for the bycatch of 8,000 cetaceans annually, out of a total of 10,000 cetaceans taken throughout the Mediterranean.[201]

The Mediterranean driftnet ban

In 1992, the U.N. called for a moratorium on the use of large-scale driftnets on the high seas, more than 200 nautical miles from any country's coast.[202] Before many countries and fishery authorities adopted the ban, legal driftnets on the high seas were known to reach lengths of an incredible 40 to 60 kilometers.[203]

Recognizing the destructive impact of large-scale deepwater drift-netting to marine ecosystems, the European Union took several steps toward regional compliance with the U.N.'s moratorium. In 1997, the E.U. adopted a regulation (No. 894/97) banning all driftnets larger than 2.5 kilometers, and in 1998 it adopted a ban (No. 1239/98) on the use of all driftnets for catching certain pelagic species, including swordfish and tuna. These measures originally excluded the Baltic Sea but were expanded in 2004 to include the Baltic (regulation No. 812/2004).[204]

In 2003 ICCAT banned driftnets in the Mediterranean that targeted large pelagic species.[205] This provision closed a loophole that had allowed continued driftnet fishing by the few ICCAT member states, such as Morocco, that were not E.U. members and therefore not regulated by the E.U. driftnet ban. In 2007, the General Fisheries Commission for the Mediterranean followed the E.U.'s lead by adopting a ban on driftnets greater than 2.5 kilometers in length, and then, in 2009, it adopted the ICCAT ban on the targeting of pelagic species with driftnets.[206]

Despite these bans, there is ample evidence that Italian, Turkish, and Moroccan fleets continue drift-netting for tuna and swordfish in deep water and with nets beyond the allowable size.[207]

MOROCCO

Historically, Morocco's driftnet fishery was responsible for some of the highest levels of bycatch in the Mediterranean, with reports of 3,000 to 4,000 striped dolphins (*Stenella coeruleoalba*) and endangered short-beaked common dolphins (*Delphinus delphis*) killed per year in the Alboran Sea alone, and a further 11,000 to 15,000 dolphins killed annually in the Strait of Gibraltar.[208] It continued to operate in the Mediterranean after the U.N. and E.U. moratoriums. However, according to the National Marine Fisheries Service, Morocco has recently been working to phase out its driftnet fleet, making it illegal to use, own, or sell driftnets, and working cooperatively with the Fisheries Service to transition its driftnet fleet to more sustainable practices.[209] In 2012 the United States imported more than 6 million kilograms of seafood products from Morocco, valued at nearly $46 million, although none of the imports included pelagic species generally caught in driftnets, such as tuna and swordfish.

TURKEY

Turkey's driftnet fishery also continued to operate well after the various bans went into effect, resulting in the bycatch of cetaceans including endangered short-beaked common dolphins—particularly in the Aegean Sea, where 110 driftnet vessels were reported to have been operating in 2005.[210] In 2006 the Turkish government banned driftnets for the first time, but driftnet fishers were allowed to continue the practice by making slight gear modifications to get around the government's definition of "driftnet." In 2011, on the heels of Morocco's driftnet ban, Turkey announced it would finally halt the driftnet fishery. There is very little information available regarding the effectiveness of Turkey's action, but some NGOs have expressed concern regarding a loophole in the Turkish law that allows the continued use of driftnet gear to target swordfish; therefore, compliance with the region-wide ban is not certain and should be continually monitored.[211] In 2012 the United States imported 1.1 million kilograms of seafood from Turkey, valued at $11.6 million. Of this total, nearly 31,000 kilograms were tuna, valued at more than $130,000.

ITALY

Italy has had one of the largest driftnet fleets in the Mediterranean since the 1980s. The traditional Italian large-scale driftnet vessels, called *spadare*, fished with nets that were more than 20 kilometers long.[212] By the 1980s, the *spadare* fishery was responsible for approximately 8,000 dolphin (mostly striped dolphin) mortalities annually.[213]

When the E.U. ban took effect, Italian driftnet fishers received approximately €97 million ($129.75 million) from the E.U. and the Italian government to convert to more sustainable fishing methods.[214] To this end, the Italian government in 1998 approved a new type of driftnet vessel meant to replace the *spadare*, called *ferrettare*, which had a maximum allowed net length of 2 kilometers and could not be deployed more than three miles from shore. This would effectively limit the targeting of large pelagics, such as tuna and swordfish, and thus the bycatch of most species of marine mammals in the region.

Despite the mandated transition to the smaller *ferrettare*, many fishers merely renamed their *spadare* nets without making any of the required modifications, and proposed penalties for infractions went largely unenforced.[215] In 2006, under pressure from fishers, the Italian government relaxed the rules on *ferrettare*, increasing allowable net length to 2.5 kilometers and mesh size from 100 millimeters to 180 millimeters, and expanding permitted use out to 10 nautical miles, in effect allowing them to once again target large pelagic species such as tuna and swordfish.[216] In 2007 the E.U. officially defined "driftnet," recognizing that the lack of a definition allowed fishers to redefine their gear and continue to fish.[217]

In January 2009, the United States identified Italy as engaged in illegal, unreported, and unregulated fishing. Yet despite language in the Magnuson-Stevens Fishery Conservation and Management Act allowing economic sanctions, the United States failed to impose any sanctions or other punitive measures on Italy.[218] In October 2009, the European Court of Justice ruled on an "infringement procedure" initiated five years earlier, finding that Italy had failed to comply with the E.U. driftnet ban and imposing a €19 million penalty.[219] The next month, the Conservation and Management Measures Compliance Committee of the International Commission for the Conservation of Atlantic Tunas found that Italy was in continued violation of the commission's driftnet regulations, though it does not appear that any punitive action was taken.[220]

Despite these rulings and persistent pressure from environmental NGOs, Italy failed to take action. While the maximum domestic penalty for violating the driftnet restrictions was set at €6,000 ($8,160, violators typically paid only one-third of the fine, and illegal nets seized as punishment were often returned.[221] Incredibly, many of the Italian fishers who received subsidies to transition away from drift-netting continued using illegal driftnets: One-third of the vessels penalized for illegal driftnet use from 2005 through 2010 had received a total of €10.5 million ($14.3 million) from the conversion plan.[222]

In 2011 E.U. inspectors in Italian ports in Sicily and Ponza found "no significant improvements" since the 2009 European Court of Justice ruling, concluding that driftnets were still being used illegally in significant numbers, with most appearing to be more than 2.5 kilometers in length.[223] The inspectors concluded that "actions taken by [Italian] authorities are neither sufficient nor adequately efficient" to deter the use of illegal driftnets.[224] In response, the European Commission announced it was initiating a second infringement procedure against Italy for failure to control this illegal activity, with potential fines of €120 million ($160.5 million). The threat of a new round of sanctions caused Italy to once again alter regulations on *ferrettare*, again reducing permitted net length and limiting the allowable distance from shore to five nautical miles. The E.U. conducted four verification missions the following year in an attempt to discourage violations.

According to the National Marine Fisheries Service, there remain "few, if any, loopholes left for Italian fishermen to circumvent."[225] NMFS's 2012 report on driftnets refers to a "significant decline in documented sightings of Italian fishing vessels employing large-scale driftnets on the high seas of the Mediterranean in recent years and none from 2009–2012." While the reduction in high-seas driftnet vessels is a positive sign, there is no assurance that Italian drift-netters will comply with international regulations within their own waters, and the situation warrants close attention.

Italian exports to the United States

In 1996, recognizing that the Italian fleet was fishing with illegal driftnets, the United States required that certain fish imports from Italy (including tuna) be accompanied by a formal document certifying that the tuna was "not harvested in any fishery that…caus[es] a regular and significant mortality or serious injury to dolphins," including high-seas driftnet fisheries. In theory, this requirement should ensure that no tuna imported from Italy was caught in large-scale driftnets on the high seas. But in July 2011, an investigation by the Italian Coast Guard uncovered a widespread, international bluefin tuna trafficking ring that falsified catch documents in an effort to circumvent restrictions.[226] Most of the bluefin tuna identified in the operation was likely to have been caught in pelagic driftnets.[227]

In 2012, the United States imported nearly 190,000 kilograms of tuna products from Italy, valued at more than $1.3 million. Total seafood imports from Italy were valued at $12.7 million.

Species affected

Though the Mediterranean Sea represents less than 1 percent of the world's oceans, it contains a diversity of marine mammals, many of which belong to distinct Mediterranean subpopulations. According to a report published through the regional Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), 11 species of cetacean regularly occur there: fin whale (*Balaenoptera physalus*), sperm whale, Cuvier's beaked whale (*Ziphius cavirostris*), killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), common bottlenose dolphin (*Tursiops truncatus*), striped dolphin, short-beaked common dolphin, and harbor porpoise. Several other cetacean species are occasional visitors to the area.

The Mediterranean subpopulation of short-beaked common dolphins is listed as Endangered by the IUCN, which reports a population decline of more than 50 percent over the past 30 to 45 years.[228] While bycatch is unlikely to have been the sole factor leading to the decline, it may have had a significant role "at certain times and in certain areas."[229] The Mediterranean subpopulation of striped dolphins is listed as Vulnerable by the IUCN and, as mentioned above, large numbers of striped dolphins were incidentally killed by the Italian driftnet fleet for years, with estimates of up to 8,000 animals annually.[230]

As discussed above, the Mediterranean subpopulation of sperm whales appears to have been severely affected by bycatch. Evidence suggests that sperm whales were common in some parts of the Mediterranean until about the 1950s, with large aggregations reported around the Strait of Messina, yet today the population is estimated at just 2,500 individuals and is in continued decline. According to the IUCN, "the most likely threat to sperm whales in the Mediterranean is entanglement in high-seas swordfish and tuna driftnets, which has caused considerable and likely unsustainable mortality since the mid-1980s."[231]

With an estimated population of fewer than 250 surviving individuals, the Mediterranean monk seal, the only pinniped native to the Mediterranean, is classified by the IUCN as Critically Endangered.[232] While it was once found throughout the Mediterranean, it is now the world's most endangered pinniped.[233] Though bycatch is not considered the primary cause of the species' decline, it is documented as one cause of mortality. Unfortunately, the seals seem particularly vulnerable to set nets placed on the seafloor, and they suffer from ghost fishing as well.[234] It is also possible that the monk seal population is affected more by small-scale local fishers than by commercial driftnet fisheries that export to the United States. But, according to the Food and Agriculture Organization (FAO) of the United Nations, "medium-scale fleets [i.e. drift-netters] worsen the situation because they are largely responsible for the overexploitation of fishing grounds."[235]

NORTHWEST PACIFIC

The Northwest Pacific includes the waters of eastern Russia, eastern China, Japan, Taiwan, and Korea. The FAO considers Northwest Pacific fisheries to be among the most productive in the world, but fisheries data for several of these nations are either unavailable or unreliable, making bycatch difficult to quantify.[236] Nevertheless, experts have found evidence suggesting continued and unsustainable levels of marine mammal bycatch in the region.[237] Salmon driftnet fisheries historically have been responsible for high levels of marine mammal bycatch, while gillnets, set traps, longlines, and purse seine fisheries are also thought to represent significant conservation problems.[238]

Drift-netting in the region

In the 1980s, the estimated total bycatch for the squid driftnet fisheries of Japan, Taiwan, and South Korea was estimated at 15,000 to 24,000 cetaceans per year.[239] Species affected by these fisheries included the Dall's porpoise (*Phocoenoides dalli*), the northern right whale dolphin (*Lissodelphis borealis*), and the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), among others.[240]

The U.N. moratorium on high-seas driftnets that took effect in 1992 significantly reduced mortalities.[241] The success of the moratorium can be attributed partly to the enforcement efforts of the North Pacific Anadromous Fish Commission, which focuses much of its enforcement efforts on driftnet fisheries in the region.[242] The commission was established pursuant to the Convention for the Conservation of Anadromous Stock in the North Pacific Ocean to further the goals of the U.N. moratorium, which included a complete ban on drift-netting beyond the exclusive economic zones of the signatories (Canada, Japan, South Korea, the Russian Federation, and the United States).[243] Many countries have adopted their own driftnet bans as well. For instance, Japan banned driftnets in international waters, although the country does allow the use of driftnets up to 13 kilometers in length.[244] And yet illegal drift-netting still occurs in the Northern Pacific. Sightings, boardings, and fishing vessel seizures indicate that driftnets are still a threat, although driftnet fishers have recently shifted from targeting salmon to mostly squid, tuna, and sharks.[245]

Other problem fisheries

Japan's inland gillnet fishery, along with the Taiwanese offshore and distant-water driftnet fisheries, have been implicated as problem fisheries for marine mammal bycatch.[246] As mentioned above, South Korea's nearshore gillnet fisheries are implicated in the bycatch of J-stock minke whales. Crab pots off the coast of Russia have also been identified as a priority for bycatch reduction, in part because of interactions with North Pacific right whales.[247]

Data on Chinese fisheries and bycatch are not publicly available, but China's offshore and distant-water fisheries use gear known to interact with cetaceans, mainly gillnets and trawls.[248] A 1994 report estimated that there were more than 3.5 million gillnets in use in China at the time.[249] While the available literature does not reflect a significant number of interactions between Chinese driftnets and set gillnets and baleen whales, the large number of vessels operating in Chinese coastal waters are likely causing more bycatch than suggested.[250]

CHINA: THE MAJOR PLAYER WE KNOW TOO LITTLE ABOUT

Reviewing fishing data from 2000 to 2011, Daniel Pauly (Professor, Fisheries Centre & Zoology; Principal Investigator, Sea Around Us Project at the University of British Columbia) and his colleagues concluded that Chinese distant-water fisheries have recently become "globally important economic actors."[251] The National Marine Fisheries Service reported that in 2010 (the most recent year for which data were available), China led the world in fishery landings and aquaculture production, accounting for 35 percent of the global harvest (the second-leading producer, India, accounted for just 6 percent.)[252] This is reflected in U.S. seafood imports from China. In 2012 the United States imported more from China than from any other nation—more than 560 million kilograms of seafood products, with a value in excess of $2.7 billion.

The 2005 report *Global Priorities for Reduction of Cetacean Bycatch* identified several targets for bycatch reduction in the region, including Japanese and Russian salmon driftnets.[253] From 1992 to 2008, more than 26,500 marine mammals were caught by Japanese driftnet fisheries operating in Russia's exclusive economic zone.[254] Although Russia does not make its commercial fisheries data available, its harvest of salmon for scientific research alone was estimated to have taken approximately 4,800 marine mammals between 1995 and 2008.[255]

TAIWAN

Taiwan maintains a massive distant-water fishing fleet, including tuna purse-seiners and longliners that are responsible for killing a large number of marine mammals in foreign fishing grounds.[256] At more than 1,900 vessels, the country's fleet is currently the largest in the Western and Central Pacific and contributes significantly to the region's outsize tuna catch, which represents some 60 percent of the entire world's tuna.[257]

Specific bycatch statistics for marine mammals killed in Taiwanese distant-water purse seines are not available. But the scale of the fishery, along with the lack of management, is cause for concern. NGOs have reported that observer numbers are insufficient and that observers are often unable to perform their jobs without interference from fishing operators; accordingly, any official bycatch figures for the fishery are likely to underestimate the impact.[258]

The Taiwanese offshore and distant-water driftnet fleet was also identified in *Global Priorities for Reduction of Cetacean Bycatch* as a problem fishery and conservation priority.[259] Taiwanese gillnetters targeting tuna previously operated in waters north of Australia, where they killed a variety of small cetaceans including spinner dolphins and Indo-Pacific humpback dolphins (*Sousa chinensis*).[260] This fishery caught approximately 14,000 cetaceans in a span of only four and a half years.[261] After the Taiwanese were expelled from Australian waters due to high levels of cetacean bycatch, the fishers are believed to have moved to Indonesian waters.[262] Illegal, unreported, and unregulated Taiwanese vessels have also been identified as a particular problem in offshore waters of the Philippines, where enforcement measures are lacking.[263]

Nearshore Taiwanese fisheries are also likely to represent a serious bycatch threat to cetaceans, as documented in the 2005 paper *Report of the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of South-East Asia* ("*Workshop Report on Southeast Asia Bycatch*").[264] The paper summarizes the findings of a 2002 Convention on Migratory Species workshop focusing intently on bycatch threats, conservation status, and relevant legislation applicable to marine mammals in Southeast Asia. According to the paper, between 27,000 and 41,000 cetaceans are incidentally killed each year by the fisheries in the eastern waters of Taiwan.[265] The report notes that while these estimates are "highly provisional because of the many assumptions involved and the relatively small sample sizes for the observations, they are indicative of large-scale mortality" taking place in the region.[266]

Species affected

Incidental catch is considered one of the primary causes of mortality for Dall's porpoise populations in the Northwest Pacific.[267] The Bering Sea Dall's porpoise may already have been diminished by as much as 94 percent as a result of bycatch in driftnets targeting squid.[268]

A large number of Dall's porpoises were killed in the 1990s and 2000s in the exclusive economic zones of Russia and Japan, despite the driftnet moratorium.[269] Japanese salmon driftnet fisheries that operated in Russia's exclusive economic zone had an estimated bycatch of more than 20,000 Dall's porpoises from 1992 to 2008.[270] Bycatch of the species continues in Russia, where several fisheries still use gillnets.[271] In 2008, the International Whaling Commission voiced concern for the Dall's porpoise populations in the Northwest Pacific due to the cumulative bycatch that the species has suffered over the years.[272]

According to the International Whaling Commission, South Korean waters account for 33 percent of global large cetacean mortality from bycatch, including an average of more than 80 minke whales per year reported in the past 10 years.[273] Many other cetacean species including the long-beaked common dolphin (*Delphinus capensis*), Pacific white-sided dolphin, finless porpoise (*Neophocaena asiaeorientalis*), and harbor porpoise are entangled in fishing gear in South Korean waters and sold in local markets.[274] The J stock of minke whales that is endemic to South Korean and Japanese waters is of particular concern due to its extremely low population estimates, declining numbers, and high bycatch rates. For details on the J stock, see Chapter 2.

Northwest Pacific exports to the United States

The United States imports seafood products from a number of countries in the Northwest Pacific region whose fleets have been implicated in high levels of marine mammal bycatch. Imports of Japanese salmon were valued at $710,000 in 2012, and squid imports were valued at close to $5.5 million. In 2012 the United States imported Taiwanese salmon and squid valued at $16 million, and imports of the same products from South Korea were valued at $13.8 million. Imported Russian salmon products were valued at nearly $5.7 million in 2012. Taiwan exported $4.78 million worth of tuna to the United States in the same year.

CONCLUSION

Despite limits in the available data, experts on cetacean bycatch maintain that this region presents a serious problem for marine mammals, and that it will remain a serious problem as the amount of fishing increases.[275]

SOUTHEAST ASIA AND THE INDIAN OCEAN

Despite experts' repeatedly identifying Southeast Asia as a major bycatch problem area, the region has failed to adequately limit the incidence of marine mammal interactions.[276] Indeed, very little regulation exists.[277] Thus, as noted in the *Workshop Report on Southeast Asia Bycatch*, unless marine mammal bycatch in the region is addressed "in an immediate, aggressive manner, major losses of biodiversity are inevitable."[278] Most countries in the region are contributing to the problem and generally do not provide sufficient marine mammal bycatch mitigation.[279] For example, although Sri Lanka gave cetaceans legal protection in 1993, enforcement was nearly impossible for most of the past 20 years during the country's civil war.[280] Similarly, although it is illegal to take cetaceans in India, bycatch continues.[281]

PHILIPPINES

The *Workshop Report on Southeast Asia Bycatch* identifies bycatch as the primary conservation threat to marine mammals in the Philippines but concludes that, despite its frequency, it is difficult to quantify the problem because of a lack of standardized documentation and poor data collection on the fishing fleet.[282] Both spinner dolphins and Fraser's dolphins experience high levels of bycatch in the fisheries, as do bottlenose, Risso's, pantropical spotted, and Irrawaddy dolphins.[283]

A 1994 report of the International Whaling Commission, one of the few studies of purse seine bycatch in the Philippines, reviewed data collected in 1990 and 1991 and estimated 2,000 to 3,000 dolphins were killed in one year by the commercial and smaller-scale purse seine fisheries operating out of just one Philippine town.[284] Data from the period also showed that a single tuna driftnet fishery operating in the province of Negros Oriental was responsible for more than 400 small cetacean deaths in one year.[285] Comparing available bycatch numbers like these with

abundance estimates shows that bycatch in the Philippines is not sustainable.[286] Further, illegal, unreported, and unregulated fishing fleets are a particular problem in the Philippines, as noted in the *Workshop Report on Southeast Asia Bycatch*, which singled out the activities of Taiwanese vessels in the area.[287]

Marine mammals are also severely affected by Philippine coastal fisheries. *Global Priorities for Reduction of Cetacean Bycatch* targeted the crab net fishery located in Malampaya Sound on Palawan Island for action because of its impact on the sound's subpopulation of Irrawaddy dolphins, considered Critically Endangered by the IUCN, with a remaining population of only around 80 individuals.[288] The Irrawaddy is highly vulnerable to bycatch, and a 2004 study showed an annual mortality rate of up to 4.4 percent from entanglements in crab nets.[289] With such a small population size, such take is considered unsustainable. While the Irrawaddy dolphin is a freshwater and nearshore species and thus may not be affected by fisheries exporting to the United States, a considerable amount of Philippine crabmeat enters the United States, some of which may come from so-called artisanal sources. The Philippines supplied the United States with crab products valued at $74.5 million in 2012; more than half of all blue swimming crab exported from the Philippines goes to the United States.[290] At least one major producer in the United States indicates that its blue swimming crabmeat comes from artisanal fishers using traditional methods.[291]

SRI LANKA AND INDIA

Bycatch from Sri Lankan and Indian tuna gillnet fisheries has been implicated as a critical threat to marine mammals.[292] During a two-year period in the mid-1980s, Sri Lankan gillnet fisheries caught at least 8,000 cetaceans. An IWC workshop held in 1990 estimated that more than 40,000 marine mammals were killed annually in Sri Lankan artisanal gillnet fisheries.[293]

In the 1980s and early 1990s, Sri Lanka was one of the few nations offering reliable marine mammal bycatch estimates. However, no new bycatch data for Sri Lanka have emerged since then.[294] According to a recent review by Randall Reeves and his colleagues of marine mammal bycatch from 1990 to 2011, the massive scale of unmonitored gillnet fishing there—estimated to account for 53,000 tons of fish annually from 2006 to 2010—"supports the inference of a continuing high level of cetacean bycatch."[295] And a Sri Lankan marine mammal researcher confirmed that levels of marine mammal bycatch are unlikely to have changed over the past two decades.[296]

The review by Reeves and his colleagues also points out that gillnet fleets originating from India, Indonesia, Iran, Oman, Pakistan, and Yemen each catch more than 20,000 tons of tuna annually.[297] The report concludes that "the bycatch of cetaceans in all of these Indian Ocean countries is unmonitored and likely high enough to merit conservation concern."[298]

In India, as in many other regions of the world, gillnets are believed to present the most significant bycatch threats for marine mammals. It is estimated that India's coastal gillnet fisheries catch approximately 9,000 to 10,000 marine mammals each year.[299] High incidences of bycatch are also known to occur during the peak tuna fishing season.[300]

INDONESIA

In the case of Indonesia, the *Workshop Report on Southeast Asia Bycatch* noted that the large expansion of national and foreign long-range longline and driftnet fleets in Indonesian waters has likely caused a significant increase in marine mammal bycatch.[301] As an example, the report noted that a Taiwanese shark gillnet fishery that had been expelled from Australian waters for high levels of marine mammal bycatch was found operating in Indonesian waters.[302] Unfortunately, Indonesia has not established any effective bycatch mitigation measures, and monitoring is largely nonexistent despite the sheer scale of offshore fishing operations in the country.

Southeast Asian exports to the United States

In 2012, the United States received close to 60 million pounds of tuna products from the Philippines, valued at more than $181 million, and $74.5 million of crab products. Imports of Sri Lankan tuna were significant, amounting to 1.9 million kilograms valued at more than $20.7 million, almost half the total value of all seafood products imported from Sri Lanka. Indian seafood exports to the United States were valued at more than $670 million in 2012, including tuna products valued at approximately $1.83 million. The heavy hitter for the region is Indonesia, which sent nearly $1.3 billion of seafood to the United States.

WEST AFRICA

The waters off West Africa are incredibly rich in biodiversity and experience some of the most intense fishing activity in the world.[303] Massive European and Asian trawlers, fishing through legal agreements with West African nations, operate with virtually no oversight. Meanwhile the area is notorious for the extent to which illegal, unreported, and unregulated fishing occurs, as "pirate" vessels from China and South Korea take advantage of the nations' general inability to patrol their waters.

While the United States imports virtually no seafood from West African nations themselves, China was the largest exporter of seafood to the United States in 2012. Just how much of that seafood originates in West African waters is nearly impossible to quantify because of the general dearth of information available on Chinese fisheries. But given the presence of Chinese fleets in West African waters, it seems likely that at least some of China's seafood exports to the United States are fished from West Africa.

Because of the region's illegal, unreported, and unregulated fishing and the lack of monitoring and enforcement, almost no reliable data exist on actual fisheries landings, let alone marine mammal bycatch. The Convention on Migratory Species (CMS) reports that despite the near-total lack of data on bycatch in the region, "it is assumed that the true extent of fisheries-related mortality in [West Africa] is substantial."[304] Another CMS report states that of the major fisheries operating off Cameroon—including purse seines and driftnets that are a bycatch risk for cetaceans— "none of these apply any protection measures for aquatic mammals."[305] Even if government-mandated bycatch standards existed in the region, the minimal fisheries monitoring and enforcement resources that presently exist would not be sufficient to enforce them.[306]

In one of the few regional assessments of marine mammal bycatch in West African waters, scientists monitored Dutch industrial freezer-trawler fisheries off Mauritania.[307] Onboard observers recorded bycatch from more than 1,400 trawl sets and used observed numbers to extrapolate total bycatch for the freezer-trawler fleet. They estimated annual bycatch of 70 to 720 dolphins from 2001 to 2004.[308] Despite an inability to definitively quantify the impacts of bycatch on cetacean populations, the authors concluded that, based on "stock trends, abundance estimates, and conservation policies established elsewhere…bycatch rates off Northwest Africa are at the limit of sustainability."[309] This study included only a small fraction of the trawlers in the waters off Mauritania, which represent just a small fraction of all West African seas, and was made prior to the incursion by the Chinese into the region's waters.

Problem fisheries

West Africa's most significant fisheries are for mid-water pelagics such as sardinella, sardine, herring, mackerel, and horse mackerel.[310] Purse seines and mid-water trawls dominate the fisheries and represent the greatest threats in the area to marine mammals, especially small cetaceans, which tend to prey on these same species of fish. The scale of the fisheries is remarkable: Purse seines can run as large as four kilometers in diameter, and pelagic freezer-trawlers are some of the largest fishing vessels in the world, with nets up to 600 meters long and openings measuring up to 200 by 100 meters.[311] According to a Greenpeace investigation, just one of these massive trawlers is able to catch and process 200 to 250 tons of fish daily, an amount approximately equal to the volume of fish that 56 traditional Mauritanian vessels are capable of catching in an entire year.[312]

West African nations lack their own large-scale fishing fleets, but their governments earn revenue by leasing fishing rights within their exclusive economic zones to other nations. These foreign fishing fleets come mostly from Europe and Asia, with China becoming an especially significant presence in recent years.[313] Most West African nations simply lack the financial and regulatory resources for robust fisheries monitoring and enforcement; thus even the legal industrial fleets that ply the region's waters operate with virtually no regulation or oversight.

In terms of fishing capacity, China now possesses the most significant fleet in the area.[314] An adviser at the Dakar-based Sub-Regional Fisheries Commission, referring to the plundering of West African waters by foreign industrial trawlers, states that "there is at least some possibility to use public opinion in Europe to force the E.U. fishing fleet to live up to European standards," implying that this is not the case for China.[315] According to a 2012 Convention on Migratory Species report, Asian countries, including China, "do not respect any existing fisheries regulations" in the area.[316] Local attempts to effectively regulate Chinese fisheries are virtually impossible due to the influence of Chinese trawling interests in the region, which are now so ubiquitous that the vessels' landings have become important to the local economies.[317]

Data on the Chinese fishing fleet are notoriously difficult to track down. Neither China's fishing statistics nor the terms of bilateral fishing agreements between China and African nations are publicly available, making it very difficult to

accurately quantify the Chinese fisheries operating in the area.[318] Chinese distant-water fleets extract more fish from African waters—an estimated 3.1 million tons per year—than from any other part of the world, including Asia. Of this total, approximately one-third is destined for the international market.[319]

Illegal, unreported, and unregulated fishing

If fully assessing bycatch in legal West African fisheries is difficult, assessing bycatch in fisheries engaged in illegal, unreported, and unregulated (IUU) fishing in the area is essentially impossible. As stated by Daniel Pauly and his colleagues in a 2013 paper examining the activities of China's distant-water fisheries from 2000 to 2011, the "complexity of reflagged vessels, charters, joint ventures and flags of convenience tend to obscure and mask fishing operations to the extent that tracking of real [fisheries] trends and policy interventions become impossible."[320] Evidence suggests that Chinese vessels represent a large proportion of IUU fishers in West Africa's seas.[321] According to the regional fisheries monitoring regime, called the Surveillance Operations Coordination Unit (SOCU), of the IUU vessels that can be identified, most are Chinese or South Korean.[322] In 2004, a joint aerial monitoring program between the Angolan and Namibian ministries of fisheries sighted 29 vessels—all of them Chinese—fishing in closed areas and during closed seasons.[323] Anecdotal reports describe how IUU fishers disguise their practices. For example, according to the U.K.-based Environmental Justice Foundation, a Chinese vessel named *Guo-Ji 806* was arrested by an arm of the Sub-Regional Fisheries Commission for West Africa for using illegal mesh in Guinea, but records indicate that the same vessel has been registered in a prominent shipping database under a different name, the *Taising 806*.[324]

Illegal fishing is inherently difficult to quantify, but there is no doubt that the scale of the problem is massive: Some estimates have put the value of fish illegally caught in West African waters at $1 billion annually.[325] Guinea alone has been estimated to lose more than 34,000 tons of fish annually to IUU fishing, at a value of $110 million. For perspective, the annual legal commercial catch for Guinea is estimated at 54,000 tons.[326] In the case of Chinese fisheries in the region, the line between legal and illegal is often blurred, further complicating our ability to quantify bycatch and to track the true origin of fish imported into the United States.

Species affected

According to a Convention on Migratory Species action plan on the conservation of cetaceans in West Africa, more than 30 species of cetaceans are found in West Africa's waters, representing more than one-third of the world's small cetaceans.[327] Despite the richness of marine mammal species, the natural history of West African small cetacean populations remains largely unknown.[328] Likewise, the distribution of small cetaceans in West African seas is also poorly understood, as is the regional conservation situation for most of these animals. The marine mammals most likely to be caught by pelagic trawlers off West Africa include short-beaked common dolphins, bottlenose dolphins, and Atlantic white-sided dolphins (*Lagenorhynchus acutus*).[329]

The Atlantic humpback dolphin (*Sousa teuszii*) is a species of particular concern. Endemic to the West African coast, the population is experiencing marked declines in abundance and is currently listed as Vulnerable by the IUCN.[330] Bycatch from local small-scale gillnets represents the primary threat, since the species lives in coastal waters, staying within several hundred meters of the shore.[331]

SOUTHWEST ATLANTIC

The Southwest Atlantic includes the waters of Brazil, Uruguay, and Argentina. A number of species are affected by fisheries interactions, including the Franciscana dolphin, dusky dolphin (*Lagenorhynchus obscurus*), common dolphin, Commerson's dolphin (*Cephalorhynchus commersonii*), and South American sea lion (*Otaria flavescens*).[332]

The region is largely lacking in fisheries monitoring or control and in bycatch mitigation measures. The monitoring programs that do exist are not designed to assess marine mammal bycatch.[333] We do know, however, that the Southwest Atlantic has suffered from documented bycatch in the past, such as in the hake and shrimp fisheries off Patagonia, where fishers lately have been trying to address "the problem" through changes in fishing gear, and from the current bycatch problem in the anchovy fishery, also off Patagonia.[334]

ARGENTINA

Marine mammals are threatened by the pelagic anchovy fisheries of Argentina. Overexploitation of the hake and shrimp fisheries in the 1990s led to reduction in fishing effort and loss of employment. Few attempts were carried out targeting anchovies.[335] However, because Atlantic anchovy does not have the same market potential as other anchovies of the world, this fishery has a limited horizon. When the fishery began, trial operations reported incidental catch of three of the most abundant pelagic small cetaceans in the Southwest Atlantic, the dusky dolphin, Commerson's dolphin, and common dolphin.[336] Though data correlating bycatch to fishing effort were not properly analyzed, the frequency with which dolphins were caught suggests the potential for high bycatch rates.[337]

The anchovy fishery uses mid-water trawls, which have demonstrated a high probability of dolphin entanglement.[338] A study of dusky and common dolphin diets in Patagonia found that anchovies make up a significant proportion of the dolphins' prey, and that both they and the fishery are targeting anchovy of the same size, explaining the high rate of interactions.[339] While current anchovy catch is relatively low, Enrique Crespo, a senior research scientist in the marine mammal lab at the National Research Council of Argentina, states that if catches increase, bycatch could represent "a huge problem" for dusky and common dolphins, as "there is no monitoring or control of this fishery."[340]

In 2012, the United States imported more than $2 million in Argentinian anchovy products. Anchovies in Argentina's waters are still considered relatively unexploited, but this could change. Bycatch in the fishery should be monitored closely and addressed before any expansions make the problem even worse.

A vulnerable coastal dolphin species

The Franciscana dolphin is considered particularly vulnerable to coastal, mainly artisanal, gillnet fisheries operating out of Argentina, Brazil, and Uruguay.[341] Though these fisheries are unlikely to export to the United States, the matter is worth further investigation given the extremely high conservation risk that bycatch poses to the species. The Franciscana is classified as Vulnerable on the IUCN Red List, and its populations appear to be in decline. Franciscana bycatch has been observed since the 1940s.[342] Reeves et al. estimated that around 2,900 individuals could be caught in coastal fisheries each year, while a 2009 study estimated bycatch mortality to range from 1,200 to 1,800 per year.[343] While the species' abundance is unknown, researchers believe gillnet mortality is not sustainable in most areas.

CONCLUSION

Though bycatch mitigation in pelagic fisheries of the Southwest Atlantic has improved with the closure of the red shrimp trawl fishery in Patagonian waters, there is still a lack of recent and reliable data.[344] In particular, the Argentinian anchovy fishery deserves immediate attention, which it may be getting soon.[345] The Secretaries of Environment and Fisheries of Argentina have been designing an action plan to reduce or mitigate the incidental catch of marine mammals in fisheries. Informed by subject experts, the action plan gives particular attention to the Franciscana dolphin, dusky dolphin, Commerson's dolphin, and the South American sea lion and is slated for implementation in 2014.[346]

CHAPTER 4: A CALL FOR ACTION—ENFORCING U.S. LAW ON INTERNATIONAL BYCATCH

Drafting and enforcing regulations for the MMPA's international bycatch provision is a serious undertaking. Done right, and the power of the U.S. market can be harnessed to secure protections for marine mammals from harmful fishing operations around the world. Done wrong, and such regulations will be mired in challenges in the World Trade Organization (WTO) or, worse, will be so weak that they offer no protection for marine mammals. While there are many pitfalls that could undercut implementation of the law, three issues stand out for special attention as the National Marine Fisheries Service finalizes regulations: navigating international trade obligations, defining applicable "U.S. standards" for marine mammal bycatch, and understanding how, under the provision, the burden of proof is transferred to foreign nations.

REMAINING CONSISTENT WITH WTO OBLIGATIONS

The National Marine Fisheries Service can promulgate regulations enforcing the MMPA's foreign bycatch provision that vigorously advance the objectives of the act while also meeting U.S. obligations as a member of the World Trade Organization. While important conservation-based U.S. trade regulations have attracted WTO scrutiny in the past, recent decisions out of the WTO's Dispute Settlement Body also demonstrate the legitimacy of such regulations and indicate that the MMPA's foreign bycatch provision can be enforced in a manner that is fully consistent with WTO rules.

The World Trade Organization recognizes that conservation and animal welfare are legitimate reasons for regulating international trade. This position traces back to its founding documents. In particular, the General Agreement on Tariffs and Trade specifies that "nothing in this Agreement shall be construed to prevent the adoption or enforcement [of trade restrictions] necessary to protect human, animal or plant life or health [or any measures] relating to the conservation of exhaustible natural resources."[347] The conservation exception applies only when "such measures are made effective in conjunction with restrictions on domestic production and consumption" and generally does not apply when regulations are based on favoritism or disguised protectionism.[348] Likewise, the Agreement on Technical Barriers to Trade provides that the "protection of . . . animal or plant life or health, or the environment" is a "legitimate objective" for the purpose of restricting trade.[349]

In practice, however, there was considerable uncertainty for a time about the strength of these provisions. In the mid-1990s, it appeared that the WTO would recognize only product-based restrictions on trade (such as trade in endangered species) but not process-based restrictions on trade (such as trade in products whose harvesting processes resulted in the deaths of endangered species). Fortunately, the organization has been moving away from this process/product distinction and has increasingly affirmed the validity of conservation and animal welfare goals as a basis for regulation of international trade.

This understanding is highlighted by decisions in two recent disputes concerning U.S. efforts to regulate seafood imports: the Shrimp/Turtle dispute of 1998–2001, in which the United States banned shrimp imports from countries that failed to use "turtle excluder devices"; and the Tuna/Dolphin dispute of 2012, in which the United States prohibited foreign suppliers from using the phrase "dolphin safe" on their tuna labels if they were engaged in the harmful practice of setting on dolphins.[350] The decisions in both disputes provide guidance as to how the MMPA's foreign bycatch provision can be enforced while still meeting the United States' international trade obligations.

SHRIMP/TURTLE DISPUTE

In the Shrimp/Turtle dispute, the WTO Appellate Body affirmed that U.S. efforts to protect endangered sea turtles through trade restrictions "serve[d] an environmental objective that is legitimate" under General Agreement on Tariffs and Trade Article XX(g).[351] Equally important, the opinion confirmed the legitimacy of process-based restrictions, such as import regulations based on fishing or shrimping methods.[352] While the Appellate Body initially ruled against the United States in 1998, it accepted the United States' regulation of shrimp imports with modifications in 2001.[353]

The initial failure of the United States was due primarily to the uneven distribution of U.S. aid among trading partners and to the inflexibility of the regulations with respect to the types of turtle excluder devices that were required. The Appellate Body found that the United States was discriminating among its trading partners by giving aid to some countries that were trying to adopt turtle exclusion devices, particularly Caribbean nations, but not to others, particularly the Asian nations that brought their challenge to the Dispute Settlement Body.[354] This was determined to be trade favoritism. The Appellate Body also initially found unjustifiable the U.S. regulations' insistence on using one method of reducing turtle mortality, even though other, equally effective methods may have existed.[355]

The results of the Shrimp/Turtle dispute are instructive when considering the enforcement of the MMPA's foreign bycatch provision. After the United States revised its guidelines for the importation of shrimp and shrimp products, providing exporters flexibility in meeting its conservation goals, the guidelines survived WTO scrutiny. The Appellate Body stated:

> Authorizing an importing Member to condition market access on exporting Members putting in place regulatory programmes *comparable in effectiveness* to that of the importing Member gives sufficient latitude to the exporting Member with respect to the programme it may adopt to achieve the level of effectiveness required. It allows the exporting Member to adopt a regulatory programme that is suitable to the specific conditions prevailing in its territory. As we see it, the Panel correctly reasoned and concluded that conditioning market access on the adoption of a programme *comparable in effectiveness*, allows for sufficient flexibility in the application of the measure so as to avoid "arbitrary or unjustifiable discrimination."[356]

Regulations enforcing the MMPA's foreign bycatch provision will similarly pass WTO muster if they give exporting nations sufficient latitude to adopt bycatch reduction programs that are comparable in effectiveness to those utilized in the United States.

TUNA/DOLPHIN DISPUTE

In the case of the Tuna/Dolphin dispute, the Appellate Body affirmed that "the United States objective of 'contributing to the protection of dolphins, by ensuring that the US market is not used to encourage fishing fleets to catch tuna in a manner that adversely affects dolphins' is a legitimate objective" under the Agreement on Technical Barriers to Trade Article 2.2.[357] By accepting this legitimate objective, the Appellate Body affirmed the Panel Report, which found that animal welfare and conservation are independent justifications for regulating trade.[358] In effect, then, the WTO recognizes the value of protecting animal health or life even when it is not "tied to a broader conservation objective."[359] This is particularly relevant to the enforcement of the MMPA's foreign bycatch provision, because it allows the United States to protect "individual animals or species whose sustainability as a group is not threatened," like spinner dolphins, as well as endangered species, like the North Atlantic right whale.[360] Experts in the law of international trade have argued that this distinction applies equally to the General Agreement on Tariffs and Trade, since the language in the Agreement on Technical Barriers to Trade Article 2.2 is closely modeled on Article XX(b) of the General Agreement on Tariffs and Trade.[361]

Although the WTO ultimately ruled that the U.S. labeling system violated the Agreement on Technical Barriers to Trade, the resolution of the dispute made the point that international trade restrictions must be sufficiently broad in scope. The WTO found that the U.S. tuna-labeling program discriminated against Mexican tuna because the regulations treated tuna sourced from the Eastern Tropical Pacific, where most Mexican tuna fleets operate, differently from tuna harvested in other areas. By regulating only those imports from the Eastern Tropical Pacific, the United States was effectively subjecting Mexican fleets to stricter requirements than other foreign tuna fleets.[362] Regulations enforcing the MMPA's foreign bycatch provision can avoid similar pitfalls if they are sufficiently comprehensive and hold all foreign fisheries to the same standard.

THE MMPA'S FOREIGN BYCATCH PROVISION MEETS THE UNITED STATES' WTO OBLIGATIONS

Fortunately, the MMPA's foreign bycatch provision is consistent with the WTO's rulings in the Shrimp/Turtle and Dolphin/Tuna cases. The provision was put in place to protect marine mammals for conservation purposes and to protect individual marine mammals, both of which are legitimate bases for restricting trade under Article XX of the General Agreement on Tariffs and Trade and Article 2.2 of the Agreement on Technical Barriers to Trade. The provision applies to all parties exporting to the United States and holds each exporter to the same standard: the U.S. standard for marine mammal bycatch incidental to commercial fishing. And, by not dictating the precise methods nations must use to meet the U.S. standard—that is, by not requiring particular technology, as in the Shrimp/Turtle case, but leaving other countries to find solutions of comparable effectiveness—it provides sufficient latitude to exporters as long as they show that the means chosen to meet U.S. bycatch standards are working. Thus, NMFS can ensure that enforcement of the MMPA's foreign bycatch provision survives scrutiny under the WTO by implementing regulations that closely adhere to the provision outlined by Congress and by enforcing the regulations evenhandedly.

A PROBLEM OF DEFINITION

The law states that the United States will ban the import of fish and fish products that are caught in a manner resulting in the incidental kill or incidental serious injury of marine mammals "in excess of United States standards."[363] So what are these U.S. standards? Although it is the most basic of questions, the answer may differ depending on whom one asks. A Maine lobster fisher might answer that to protect marine mammals she has to use vertical lines that break more easily and cannot fish in restricted areas. A consumer might reply that imported tuna has to be "dolphin safe." And a Pacific drift gillnet fisher might say he has to use pingers on his nets and cannot place those nets below a certain depth. None of these answers are inaccurate—they all capture fishery requirements—but they do not constitute a mitigation program that foreign fishers and nations can universally adopt in order to export to the United States. Just as U.S.

fisheries utilize different measures to reduce interactions, depending on the specific circumstances of their fishery, foreign fisheries must do the same.

Fortunately, the MMPA provides a path for navigating this challenge by distilling clear, measurable U.S. standards and does so in a way that provides needed flexibility for foreign fisheries.

WHAT ARE THE U.S. STANDARDS FOR BYCATCH?

Conceivably, all policies, rules, regulations, and requirements that U.S. fishers must follow to reduce interactions with marine mammals collectively constitute U.S. standards for bycatch. But realistically, publishing a compendium of such standards and demanding that foreign fishers meet them would miss the mark of what Congress intended with the MMPA. Congress did not demand that foreign fishers use a particular technology or method of fishing; it asked foreign fishers to obtain results for incidental kill or serious injury of marine mammals equivalent to U.S. standards. As stated in the MMPA, the standard for incidental kill or serious injury of marine mammals in the United States is meeting the zero mortality rate goal and, while implementing provisions to meet that goal, reducing bycatch to below the potential biological removal level, the number of mortalities that the population can sustain.

Applying the MMPA's moratorium on taking marine mammals to the activities of U.S. fishers, the act makes clear that while "[m]arine mammals may be taken incidentally in the course of commercial fishing operations," it is the "immediate goal that the incidental kill or incidental serious injury of marine mammals permitted in the course of commercial fishing operations be reduced to insignificant levels approaching a zero mortality and serious injury rate."[364] This goal is not merely aspirational; Congress set forth provisions governing how U.S. fishers will meet this requirement in Section 118 of the MMPA (taking of marine mammals incidental to commercial fishing operations), relying on data developed pursuant to Section 117 (Stock Assessments).

Section 118 establishes a comprehensive program for reducing bycatch to insignificant levels approaching zero mortality and serious injury within seven years of its enactment, setting requirements for registration and authorization, observation, reporting, Take Reduction Plans, and penalties. In essence the management of marine mammal bycatch in U.S. fisheries works as follows: First, the National Marine Fisheries Service assesses the significance of marine mammal bycatch for each marine mammal stock occurring in U.S. waters, relying on stock assessment reports and data collected by observers and reported by fishers. Second, the Fisheries Service issues commercial fishers authorizations to incidentally take marine mammals, outlining gear, reporting, observer, and other requirements for the reduction of marine mammal take. Third, for strategic stocks (i.e., those listed as Threatened or Endangered under the Endangered Species Act or depleted under the Marine Mammal Protection Act; those declining and likely to be listed as Threatened under the Endangered Species Act within the foreseeable future; or those where direct human-caused mortality, including bycatch, exceeds the potential biological removal level), the Fisheries Service prepares a Take Reduction Plan for reducing bycatch to below the potential biological removal level in the short term (six months) and reducing mortality and serious injury of marine mammals to insignificant levels approaching a zero mortality and serious injury rate in the long term (five years). Finally, assessments of all stocks are made on a regular basis to determine whether different requirements should be included in authorizations issued to fishers or if adjustments should be made to Take Reduction Plans.

The system is not perfect. But under this management scheme, and with considerable effort on the part of U.S. fishers (who have modified gear, respected seasonal and geographic restrictions, and raised awareness within the industry) and U.S. regulators (who have assessed populations, managed observer programs, and developed Take Reduction Plans), the number of marine mammals killed or seriously injured in commercial U.S. fisheries has been reduced. It is time for these gains to be exported to seafood exporters.

THE BYCATCH STANDARD APPLICABLE TO FISH AND FISH PRODUCT IMPORTS

The foreign bycatch provision appears in the section of the MMPA setting forth the commercial fishing exception to the act's moratorium on taking marine mammals. As noted above, domestic fishers may take marine mammals in the course of commercial fishing operations, but only if the take is insignificant (meeting the zero mortality rate goal) or in compliance with the bycatch reduction program designed by Congress. While Congress initially sought to manage marine mammal take from fishing operations through a vaguely defined permitting system whose details were left largely to the discretion of federal regulators, it set forth a general authorization in 1994, allowing commercial fishers to take marine mammals subject to the registration, observer, Take Reduction Plan, penalty, and timeline provisions detailed in Section 118 of the act (see "U.S. Efforts to Reduce Marine Mammal Bycatch" in Chapter 1, of this report). The components of this bycatch reduction program embody the U.S. standards for bycatch, which require a reduction in incidental mortality or serious injury to insignificant levels.

After identifying the requirements that domestic fishers must meet to be covered by the moratorium's commercial fishing exception, the act immediately turns to foreign fishers, banning the importation of fish that are caught in a manner that results in bycatch "in excess of United States standards." "In excess of United States standards" means in

excess of both the zero mortality rate goal and the specific standards identified in Section 118 of the act that Congress requires our own fishers to meet in return for the commercial fishing exception. These statutory provisions include both substantive standards for bycatch, such as the potential biological removal level that no fishery may exceed, and standards pertaining to monitoring and reporting that are essential for determining whether the substantive standards have been met. Among the latter are the requirements that monitoring provide statistically reliable estimates of bycatch and that owners or operators of commercial fishing vessels report the species, date, time, and approximate location of each incidence of bycatch.

The MMPA does not necessarily require foreign fisheries to use the same technology as U.S. fisheries, nor does it require foreign nations to adopt the exact same regulatory scheme for bycatch reduction—an important point in light of the United States' international trade obligations. But countries must show that their fish exports are meeting the standards set forth in the act.

With this understanding, the "reasonable proof" requirement applicable to nations wishing to show their fisheries are not operating in excess of U.S. standards must be read in light of Section 118's procedural standards for domestic fisheries related to the collection and submission of data—like the monitoring and reporting requirements, which were established precisely to ensure compliance with the zero mortality rate goal and the potential biological removal standards contained in Take Reduction Plans. The two items are intertwined; U.S. standards include rules for monitoring and reporting, which must be read to inform not only what kind of programs nations must adopt to meet U.S. standards but also what they must do to generate "reasonable proof."

A PROBLEM OF PROOF

To ensure that foreign fisheries are meeting U.S. standards, the MMPA requires "reasonable proof from the government of any nation from which fish or fish products will be exported to the United States of the effects on ocean mammals of the commercial fishing technology in use for such fish or fish products."[366] The data collection challenges presented by this requirement and the informational needs of the National Marine Fisheries Service to support its import determinations should not be underestimated. As Chapter 2 makes clear, we lack adequate bycatch data for many regions of the world, making it difficult to assess whether particular fish imports are meeting U.S. standards. In addition, foreign nations must have a clear understanding of what information they must submit to secure access to the U.S. market. Nonetheless, the data collection explicitly and implicitly required by the act is not insurmountable—it already takes place for activities in U.S. waters—and foreign nations can build on existing efforts around the world.

GLOBAL DATA COLLECTION ON MARINE MAMMAL BYCATCH

Combining the necessity of "reasonable proof" with the Fisheries Service's need to assess foreign bycatch results against U.S. standards, the MMPA necessitates data collection on (1) global marine mammal populations, (2) bycatch from fishery operations exporting to the United States, and (3) the effectiveness of bycatch reduction programs. Without this information, the Fisheries Service will be unable to determine whether foreign fish or fish products were caught in a manner that resulted in bycatch meeting U.S. standards.

SHOULD IMPORTS BE SUBJECT TO U.S. STANDARDS THAT U.S. FISHERS AREN'T MEETING?

While the United States has made significant progress in reducing the number of marine mammal interactions with fisheries, even after nearly 20 years, too many U.S. fisheries have failed to reduce bycatch below potential biological removal levels, let alone approach a zero mortality rate. For example, in 2012, the National Marine Fisheries Service identified more than 85 fisheries out of nearly 270 as causing frequent or occasional incidental mortalities or serious injuries of marine mammals, and many of these fisheries are responsible for bycatch exceeding the potential biological removal level for at least 14 populations.[365]

Does this mean that foreign fisheries and nations can similarly get away with failing to meet U.S. standards? No, because neither are U.S. fishers. U.S. fisheries may be taking longer to meet U.S. standards than contemplated by Congress, but they are not operating with impunity. They are subject to all the requirements of Section 118 of the act (registration, gear requirements, observers, Take Reduction Plans, penalties, etc.), and these requirements continually push domestic fishers toward realizing the U.S. standards for fishery interactions—the zero mortality rate goal in the long term and reduction of bycatch to below the potential biological removal level in the short term.

As discussed above, the Fisheries Service already collects this information for domestic fisheries to determine the impact their bycatch is having on marine mammals and whether these fisheries are meeting the zero mortality rate goal and the potential biological removal limit. To do so, the agency prepares stock assessment reports for all marine mammal populations occurring in U.S. waters. It collects bycatch data from the owners and operators of fishing vessels, who are required to report any and all bycatch. And, using observers, it has established a program for monitoring fisheries to "obtain statistically reliable estimates" of bycatch, "determine the reliability" of the bycatch data reported by owners and operators, and "identify changes in fishing methods or technology that may increase or decrease" bycatch.[367] With this information, the agency is able to assess whether the U.S. commercial fishing industry is meeting U.S. bycatch standards—and, if not, where it should focus resources to improve performance.

To adequately enforce the foreign bycatch provision of the MMPA, the Fisheries Service will need equivalent information on foreign fishery bycatch and affected marine mammal populations. The MMPA is clear that the onus is on exporting nations to collect and submit this information to the United States (requiring "reasonable proof from the government of any nation from which fish or fish products will be exported").[368] While the act does not define what constitutes "reasonable proof," it is clear about the scope of information required for domestic fisheries (stock assessment reports, observer data, mandatory reporting).[369] Given Congress's intent to level the playing field for U.S. fishers by holding all fish products in the United States to the same bycatch standards, it is reasonable to conclude that Congress similarly intended foreign nations and fishers to generate and submit data comparable to that collected by the Fisheries Service and U.S. fishers.

In practice, this means that nations, regional fishery organizations, and fishers engaged in exporting fish products to the United States will have to devise and fund plans to collect data on bycatch, marine mammal populations, and the effectiveness of mitigation technologies. Some countries will have to revive solid data collection programs in affected fisheries—such as Sri Lanka, which collected reliable marine mammal bycatch estimates from the 1980s to early 1990s. Many others will have to establish extensive data collection regimes for the first time, as in the case of Indonesia.[370] Fortunately, data on marine mammal stock structure, abundance, and trends as well as bycatch rates are continually improving through the use of advanced survey tools such as radio and satellite telemetry, photographic cataloging, molecular genetics, and advanced statistical extrapolations.[371]

While devising and funding extensive data collection regimes may seem like a daunting task, especially for countries with limited resources, three facts counterbalance such concerns. First and foremost, countries that export hundreds of millions of dollars' worth—and in some cases billions of dollars' worth—of fish products to the United States should be able to locate resources to maintain those exports. And even if securing resources is too difficult for some, countries and fishers are not barred from pooling resources and working collaboratively. For example, governments involved in exporting products from Southeast Asia could fund a regional fishery organization that manages a data collection scheme. India, Indonesia, and the Philippines alone exported more than $2.3 billion in fish products to the United States in 2012. If these countries had been able to secure just one-half of one percent of the value of those exports, they could have funded an $11.5 million data collection regime.

Second, while this report has highlighted certain data gaps, it has also identified a wealth of data on species at risk and geographic areas of concern. Researchers have been investigating marine mammal bycatch around the globe for decades and have identified some of the most pressing bycatch concerns. Nations commencing data collection will be able to build on existing data, findings, and recommendations.

Finally, the National Marine Fisheries Service has been managing bycatch reduction efforts for 40 years. It can provide expert advice not only about the categories of information that must be gathered to comply with the MMPA, but also about what has and has not worked as it has developed its own data collection regime. Thus, we recommend that the Fisheries Service invest in capacity-building efforts such as the organization of regional workshops—open to all interested countries—to share its expertise.

ENDNOTES

1 Andrew J. Read, "The looming crisis: interactions between marine mammals and fisheries," *Journal of Mammalogy* 89, no. 3 (2008): 541-548.

2 Douglas P. DeMaster et al., "Predation and competition: the impact of fisheries on marine-mammal populations over the next one hundred years," *Journal of Mammalogy* 82, no. 3 (2001): 641-651.

3 Eric L. Gilman, "Bycatch governance and best practice mitigation technology in global tuna fisheries," *Marine Policy* 35, no. 5 (2011): 590-609.

4 Randall R. Reeves, Kate McClellan, and Timothy B. Werner, "Marine mammal bycatch in gillnet and other entangling net fisheries, 1990 to 2011," *Endangered Species Research* 20 (2013): 71-97.

5 Lee R. Benaka and Tanya J. Dobrzynski, "The National Marine Fisheries Service's national bycatch strategy," *Marine Fisheries Review* 66, no. 2 (2004): 1-8. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, *Managing the Nation's Bycatch: Priorities, Programs and Actions for the National Marine Fisheries Service*, Washington, D.C. (June 1998).

6 Christina K.A. Geijer and Andrew J. Read, "Mitigation of marine mammal bycatch in U.S. fisheries since 1994," *Biological Conservation* 159 (2013): 54-60.

7 Reeves, McClellan, and Werner (2013).

8 16 U.S.C. § 1387. For a description of methodology, see James Carretta and Lyle Enriquez, *Marine Mammal and Seabird Bycatch in California Gillnet Fisheries in 2011*, NOAA Technical Memorandum NMFS (November 2012), swfsc.noaa.gov/publications/TM/SWFSC/NOAA-TM-NMFS-SWFSC-500.pdf (accessed October 8, 2013).

9 Andrew J. Read, Phebe Drinker, and Simon Northridge, "Bycatch of marine mammals in U.S. and global fisheries," *Conservation Biology* 20, no. 1 (2006): 163-169.

10 Reeves, McClellan, and Werner (2013), detailing the percentage and number (61 of 74 odontocete species, 13 of 14 mysticetes, 15 of 18 phocid seal species, 8 of 14 otariid seals and sea lions, and 4 of 4 sirenians) of marine mammals negatively affected by bycatch.

11 Read (2008).

12 Read (2008). For more on extinction risks generally, see Callum M. Roberts and Julie P. Hawkins, "Extinction risk in the sea," *Trends in Ecology & Evolution* 14, no. 6 (1999): 241-246.

13 Read (2008).

14 L. Rojas-Bracho et al., *Phocoena sinus*, IUCN Red List of Threatened Species, 2008. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

15 Patricia E. Rosel and Lorenzo Rojas-Bracho, "Mitochondrial DNA variation in the critically endangered vaquita *Phocoena sinus* Norris and MacFarland, 1958," *Marine Mammal Science* 15, no. 4 (1999): 990-1003.

16 Fisheries and Aquaculture Department, Food and Agriculture Organization of the United Nations, *The State of World Fisheries and Aquaculture 2012*, Rome (2012).

17 *The State of World Fisheries and Aquaculture 2012*.

18 *The State of World Fisheries and Aquaculture 2012*.

19 HR 707, 92nd Cong., 2d sess., reprinted in U.S.C.C.A.N. 4144 (1972). As seen in Jamie M. Woolsey, *Detailed Discussion of Dolphins Under the MMPA*, Animal Legal & Historical Center, Michigan State University College of Law (2002), www.animallaw.info/articles/ddusdolphins.htm (accessed October 8, 2013).

20 Woolsey (2002).

21 Joe Roman et al., "The Marine Mammal Protection Act at 40: Status, recovery, and future of U.S. marine mammals," *Annals of the New York Academy of Sciences* 1286 (2013): 1-21.

22 National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, *Office of Protected Resources and the Marine Mammal Protection Act*, fact sheet, www.nmfs.noaa.gov/pr/pdfs/mmpa_factsheet.pdf (accessed October 8, 2013).

23 Nina M. Young and Suzanne Iudicello, "Blueprint for whale conservation: Implementing the Marine Mammal Protection Act," *Ocean and Coastal Law Journal* 3, nos. 1 and 2 (1997): 149-216.

24 16 U.S.C. § 1387. Eugene H. Buck, *Marine Mammal Protection Act Amendments of 1994*, CRS Report for Congress 94-751 ENR (September 28, 1994), cnie.org/NLE/CRSreports/Biodiversity/biodv-11.cfm (accessed October 8, 2013).

25 Geijer and Read (2013).

26 16 U.S.C. § 1362(20).

27 16 U.S.C. § 1386.

28 Read, Drinker, and Northridge (2006). All 2012 stock assessment reports can be found on the National Marine Fisheries website, www.nmfs.noaa.gov/pr/sars/region.htm (accessed October 8, 2013).

29 Geijer and Read (2013).

30 Geijer and Read (2013).

31 NOAA Fisheries, National Oceanic and Atmospheric Administration, *Basic Questions about Aquaculture*, www.nmfs.noaa.gov/aquaculture/faqs/faq_aq_101.html (accessed January 3, 2014). National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, *Imports and Exports of Fishery Products Annual Summary, 2012*, Current Fishery Statistics No. 2012-2, www.st.nmfs.noaa.gov/st1/trade/documents/TRADE2012.pdf (accessed November 4, 2013).

32 16 U.S.C. § 1378(a).

33 16 U.S.C. § 1372.

34 16 U.S.C. § 1371(a)(2).

35 75 Fed. Reg. 22731, *Implementation of Fish and Fish Product Import Provisions of the Marine Mammal Protection Act* (April 30, 2010).

36 75 Fed. Reg. 22731.

37 Reeves, McClellan, and Werner (2013). Sean W. Brillant and Edward A. Trippel, "Elevations of lobster fishery groundlines in relation to their potential to entangle endangered North Atlantic right whales in the Bay of Fundy, Canada," *ICES Journal of Marine Science* 67, no. 2 (2010): 355-364. Rebecca L. Lewison et al., "Understanding impacts of fisheries bycatch on marine megafauna," *Trends in Ecology & Evolution* 19, no. 11 (2004): 598-604.

38 Project GloBAL (Global Bycatch Assessment of Long-lived Species), *Gillnets*, Nicholas School of the Environment and Earth Sciences at Duke University, bycatch.nicholas.duke.edu/gear/gillnets (accessed October 11, 2013).

39 Project GloBAL, *Gillnets*.

40 Read (2008).

41 Project GloBAL (Global Bycatch Assessment of Long-lived Species), *Purse Seines*, Nicholas School of the Environment and Earth Sciences at Duke University, bycatch.nicholas.duke.edu/gear/purseseine (accessed October 11, 2013).

42 Kobe II By-catch Workshop, *Marine Mammals*, background paper, Brisbane, Australia, June 23-25, 2010, www.tuna-org.org/Documents/Aus/Kobe_II_Bycatch_Workshop_Marine%20Mammal_FINAL_ENG.pdf (accessed October 11, 2013). Lewison et al. (2004).

43 Project GloBAL (Global Bycatch Assessment of Long-lived Species), *Trawls*, Nicholas School of the Environment and Earth Sciences at Duke University, bycatch.nicholas.duke.edu/gear/trawl (accessed October 11, 2013).

44 Dagmar Fertl and Stephen Leatherwood, "Cetacean interactions with trawls: a preliminary review," *Journal of Northwest Atlantic Fishery Science* 22 (1997): 219-248. Jacques Sacchi, "Review on marine mammals' by-catch issue in Mediterranean and Black Sea" (draft Scientific Advisory Committee review, General Fisheries Commission for the Mediterranean, Sofia, Bulgaria, February 20-24, 2012), 151.1.154.86/GfcmWebSite/SAC/14/GFCM_SAC14_2012_Dma.7.pdf (accessed October 11, 2013).

45 Project GloBAL (Global Bycatch Assessment of Long-lived Species), *Longlines*, Nicholas School of the Environment and Earth Sciences at Duke University, bycatch.nicholas.duke.edu/gear/copy_of_longline (accessed November 11, 2013).

46 Project GloBAL, *Longlines*.

47 Brillant and Trippel (2010).

48 Amanda Johnson et al., "Fishing gear involved in entanglements of right and humpback whales," *Marine Mammal Science* 21, no. 4 (2005): 635-645. Brillant and Trippel (2010). Rachel M. Cassoff et al., "Lethal entanglement in baleen whales," *Diseases of Aquatic Organisms* 96 (2011): 175-185.

49 A. Aguilar and L. Lowry (IUCN SSC Pinniped Specialist Group), *Monachus monachus*, 2013. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.1, www.iucnredlist.org.

50 R.R. Reeves et al., *Orcaella brevirostris*, 2008. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.1. R. Reeves et al., *Pontoporia blainvillei*, 2012. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.1, www.iucnredlist.org.

51 NMFS, *Imports & Exports of Fishery Products*, NOAA Office of Science and Technology, www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/raw-data/imports-exports-annual.

52 Phillip Clapham, Sharon Young, and Robert Brownell, "Baleen whales: conservation issues and the status of the most endangered populations," *Mammal Review* 29 (1999): 35-60.

53 S.B. Reilly et al., *Eubalaena glacialis*, 2012. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.1, www.iucnredlist.org. Gordon T. Waring et al. (eds.), *North Atlantic Right Whale*, NOAA Technical Memorandum NMFS-NE-223 (2012).

54 CMS, *Appendix I & II of CMS*, Convention on Migratory Species, www.cms.int/documents/appendix/cms_app1_2.htm.

55 Waring et al. (eds.), *North Atlantic Right Whale*.

56 Waring et al. (eds.), *North Atlantic Right Whale*.

57 Amy R. Knowlton et al., "Monitoring North Atlantic right whale *Eubalaena glacialis* entanglement rates: a 30 yr retrospective," *Marine Ecology Progress Series* 466 (2012): 293-302.

58 Waring et al. (eds.), *North Atlantic Right Whale*.

59 Knowlton et al. (2012).

60 Amanda Johnson et al., "Fishing gear involved in entanglements of right and humpback whales," *Marine Mammal Science* 21, no. 4 (2005): 635-645.

61 Angelia Vanderlaan, R. Kent Smedbol, and Christopher Taggart, "Fishing-gear threat to right whales (*Eubalaena glacialis*) in Canadian waters and the risk of lethal entanglement," *Canadian Journal of Fisheries and Aquatic Sciences* 68, no. 12 (2011): 2174-2193.

62 M.W. Brown et al., "Surveying for discovery, science and management." In: *The Urban Whale: North Atlantic Right Whales at the Crossroads*, S.D. Kraus and R.M. Rolland, eds. (Cambridge, MA: Harvard University Press, 2007), 105-137.

63 M.W. Brown et al., "Recovery strategy for the North Atlantic right whale (*Eubalaena glacialis*) in Atlantic Canadian waters," *Species at Risk Act Recovery Strategy Series*, Fisheries and Oceans Canada, 2009.

64 Vanderlaan, Smedbol, and Taggart (2011).

65 K.M. Kovacs et al., "Global threats to pinnipeds," *Marine Mammal Science* 28 (2012): 414-436. B.F.J. Manly, A. Seyb, and D.J. Fletcher, "Bycatch of sea lions (*Phocarctos hookeri*) in New Zealand fisheries, 1987/88 to 1995/96, and observer coverage," *DOC Science Internal Series* 42. Department of Conservation, Wellington, New Zealand (2002). I. Wilkinson, J. Burgess, and M. Cawthorn, "New Zealand sea lions and squid: managing fisheries impacts on a threatened marine mammal." In: *Marine Mammals: Fisheries, Tourism and Management Issues*, N. Gales, M. Hindell, and R. Kirkwood, (eds. Melbourne: CSIRO Publishing, 2003), 192-207.

66 N. Gales (IUCN SSC Pinniped Specialist Group), *Phocarctos hookeri*, 2008. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.1, www.iucnredlist.org.

67 B.C. Robertson and B.L. Chilvers, "The population decline of the New Zealand sea lion *Phocarctos hookeri*: a review of possible causes," *Mammal Review* 41, no. 4 (2011): 253–275.

68 Gales (2008). Robertson and Chilvers (2011).

69 B.Louise Chilvers, "Population viability analysis of New Zealand sea lions, Auckland Islands, New Zealand's sub-Antarctics: assessing relative impacts and uncertainty," *Polar Biology* 35.10 (2011): 1607-1615.

70 Chilvers, B.L., "Using life-history traits of New Zealand Sea Lions, Auckland Islands to clarify potential causes of decline." *Journal of Zoology* 287, no. 4 (2012): 240-249.

71 Robertson and Chilvers (2011).

72 Forest and Bird, *Sea Lions: Our Southern Pride*, www.forestandbird.org.nz/campaigns/sea-lions-our-southern-pride.

73 Wilkinson, Burgess, and Cawthorn (2003).

74 Chilvers (2011).

75 Chilvers (2011).

76 Chilvers (2011). F.N. Thompson, M.D. Oliver, and E.R. Abraham, *Estimation of the Capture of New Zealand Sea Lions (Phocarctos hookeri) in Trawl Fisheries, from 1995-1996 to 2007-2008*, New Zealand Aquatic Environment and Biodiversity Report No. 52, Ministry of Fisheries, Wellington (2010).

77 New Zealand Ministry of Primary Industries, *Squid Fishery Around the Auckland Islands (SQU6T): Final Advice Paper*, Wellington (2012).

78 Gales (2008).

79 Chilvers (2011).

80 Project GloBAL (Global Bycatch Assessment of Long-lived Species), *Australian Sea Lion*, Nicholas School of the Environment and Earth Sciences at Duke University, bycatch.nicholas.duke.edu/species/australian-sea-lion (accessed September 10, 2013). S. Goldsworthy and N. Gales (IUCN SSC Pinniped Specialist Group), *Neophoca cinerea*, 2008. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

81 Goldsworthy and Gales (2008).

82 S.D. Goldsworthy and B. Page, "A risk-assessment approach to evaluating the significance of seal bycatch in two Australian fisheries," *Biological Conservation* 139 (2007): 269-285.

83 Goldsworthy and Gales (2008).

84 Goldsworthy and Page (2007).

85 Differences in the sea lion exclusion devices used by fishers in New Zealand and Australia can be seen in the documents found at blog.forestandbird.org.nz/license-to-kill-spells-trouble-for-sea-lions/ and www.fish.wa.gov.au/Documents/recreational_fishing/additional_fishing_information/sea_lion_exclusion_devices.pdf.

86 Department of Fisheries, *Sea Lion Exclusion Devices (SLEDS): A Guide to Assist Rock Lobster Fishers Install SLEDS*, Canberra (2012), www.fish.wa.gov.au/Documents/recreational_fishing/additional_fishing_information/sea_lion_exclusion_devices.pdf.

87 Australian Fisheries Management Authority, *Australian Sea Lion Bycatch triggers Changes to Fisheries Management Arrangements to Further Protect Australian Sea Lion Sub-populations in the Gillnet, Hook, and Trap Fishery*, Canberra (2012).

88 V. Drouot et al., "A note on genetic isolation of Mediterranean sperm whales (*Physeter macrocephalus*) suggested by mitochondrial DNA," *Journal of Cetacean Research and Management* 6, no. 1 (2004): 29-32. D. Engelhaupt et al., "Female philopatry in coastal basins and male dispersion across the North Atlantic in a highly mobile marine species, the sperm whale (*Physeter macrocephalus*)," *Molecular Ecology* 18 (2009): 4193-4205. Giuseppe Notarbartolo di Sciara et al., *Physeter macrocephalus (Mediterranean subpopulation)*, 2012. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

89 Giuseppe Notarbartolo di Sciara and A. Birkun Jr., *Conserving Whales, Dolphins, and Porpoises in the Mediterranean and Black Seas: An ACCOBAMS Report*, ACCOBAMS, Monaco (2010). Notarbartolo di Sciara et al. (2012).

90 Giuseppe Notarbartolo di Sciara, "A note on the cetacean incidental catch in the Italian driftnet swordfish fishery, 1986-1988," *Report of the International Whaling Commission* 40 (1990): 459. International Whaling Commission, "Report of the workshop on mortality of cetaceans in passive fishing nets and traps," *Report of the International Whaling Commission*, special issue 15 (1994): 6-71.

91 Notarbartolo di Sciara et al. (2012).

92 Giuseppe Notarbartolo di Sciara, Universita degli Studi di Milano, personal communication with the author via email, April 15, 2013.

93 Sergi Tudela, *Ecosystem Effects of Fishing in the Mediterranean: An Analysis of the Major Threats of Fishing Gear and Practices to Biodiversity and Marine Habitats*, FAO Fisheries Department (EP/INT/759/GEF), Rome (2004).

94 R. Aguilar et al., *Technical Report on the Situation of Small Cetaceans in the Mediterranean and Black Seas and Contiguous Waters, and the Impact of Fishing Gear and Fishing Practices on These Animals*, technical report, Greenpeace International, Amsterdam (1991).

95 M. Podestà and L. Magnaghi, "Number of cetacean bycatches in the Ligurian Sea," *European Research on Cetaceans* 3 (1989): 67-70. Notarbartolo di Sciara et al. (2012).

96 Giuseppe Notarbartolo di Sciara et al., "The Pelagos Sanctuary for Mediterranean marine mammals," *Aquatic Conservation: Marine and Freshwater Ecosystems* 18, no. 4 (2008): 367-391. Notarbartolo di Sciara et al. (2012).

97 Notarbartolo di Sciara and Birkun (2010).

98 Report of the Fourth Meeting of the International Committee for the Recovery of the Vaquita (CIRVA), Ensenada, Baja California, México (February 20-23, 2012). See also A. Jaramillo-Legorreta et al., "Saving the vaquita: immediate action, not more data," *Conservation Biology* 21, no. 6 (2007): 1653-1655.

99 CIRVA (2012). See also L. Rojas-Bracho, R.R. Reeves, and A. Jaramillo-Legorreta, "Conservation of the vaquita *Phocoena sinus*," *Mammal Review* 36, no. 3 (2006): 179-216.

100 Project GloBAL (Global Bycatch Assessment of Long-lived Species), *Vaquita: Phocoena sinus*, Nicholas School of the Environment and Earth Sciences at Duke University, bycatch.nicholas.duke.edu/species/vaquita (accessed September 13, 2013).

101 Rojas-Bracho, Reeves, and Jaramillo-Legorreta (2006).

102 O. Vidal, "Population biology and incidental mortality of the vaquita, *Phocoena sinus*," *Report of the International Whaling Commission*, special issue 16 (1995): 247-272. Rojas-Bracho, Reeves, and Jaramillo-Legorreta (2006).

103 L. Rojas-Bracho et al., *Phocoena sinus*, 2008: In IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org. Project GloBAL, *Vaquita: Phocoena sinus*.

104 Vidal (1995).

105 Rojas-Bracho, Reeves, and Jaramillo-Legorreta (2006). L. Rojas-Bracho and B.L. Taylor, "Risk factors affecting the vaquita (*Phocoena sinus*)," *Marine Mammal Science* 15, no. 4 (1999): 974-989.

106 Hem Nalini Morzaria-Luna et al., "Exploring trade-offs between fisheries and conservation of the vaquita porpoise (*Phocoena sinus*) using an Atlantis Ecosystem Model," *PloS One* 7, no. 8 (August 2012): e42917.

107 Rojas-Bracho, Reeves, and Jaramillo-Legorreta (2006).

108 Rojas-Bracho, Reeves, and Jaramillo-Legorreta (2006).

109 C. D'Agrosa, C.E. Lennert-Cody, and Omar Vidal, "Vaquita bycatch in Mexico's artisanal gillnet fisheries: driving a small population to extinction," *Conservation Biology* 14, no. 4 (2000): 1110-1119.

110 Rojas-Bracho, Reeves, and Jaramillo-Legorreta (2006).

111 A. Jaramillo-Legorreta et al., "Saving the vaquita: immediate action, not more data," *Conservation Biology* 21, no. 6 (2007): 1653-1655.

112 A.A. Hohn et al., "Life history of the vaquita, *Phocoena sinus* (Phocoenidae, Cetacea)," *Journal of Zoology* 239, no. 2 (June 1996): 235-251.

113 Rojas-Bracho, Reeves, and Jaramillo-Legorreta (2006).

114 Rojas-Bracho, Reeves, and Jaramillo-Legorreta (2006).

115 CIRVA (2012).

116 Gill Braulik, *Mexican Government Approves Selective Fishing Gear to Reduce Vaquita Bycatch*, IUCN-SSC-Cetacean Specialist Group, www.iucn-csg.org/index.php/2013/06/12/mexican-government-approves-selective-fishing-gear-to-reduce-vaquita-bycatch/ (accessed September 17 2013).

117 B.L. Taylor et al., *Pseudorca crassidens*, 2008. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

118 I.M. Ferreira et al., "False killer whales (*Pseudorca crassidens*) from Japan and South Africa: differences in growth and reproduction," *Marine Mammal Science*, doi: 10.111/mms.12021 (2013). Robin W. Baird, *A Review of False Killer Whales in Hawaiian Waters: Biology, Status, and Risk Factors*, Report prepared for the U.S. Marine Mammal Commission (December 23, 2009).

119 Robin W. Baird et al., "False killer whales (*Pseudorca crassidens*) around the main Hawaiian Islands: long-term site fidelity, inter-island movements, and association patterns," *Marine Mammal Science* 24, no. 3 (July 2008): 591-612. Robin W. Baird, "False killer whale (*Pseudorca crassidens*)," *Encyclopedia of Marine Mammals* (2nd Ed.), Academic Press, San Diego, California (2009).

120 B.L. Taylor et al., *Pseudorca crassidens*.

121 NMFS, *False Killer Whale (Pseudorca crsssidens): Hawaiian Islands Stock Complex – Main Hawaiian Islands Insular, Northwestern Hawaiian Islands, and Hawaii Pelagic Stocks*, Stock Assessment Report, revised January 2013.

122 Secretariat of the Pacific Community Oceanic Fisheries Programme, *Summary Information on Whale Shark and Cetacean Interactions in the Tropical WCPFC Purse Seine Fishery*, Seventh Regular Session of the Western and Central Pacific Fisheries Commission, Honolulu, Hawaii, USA, December 6-10, 2010. NMFS, *False Killer Whale (Pseudorca crsssidens): Hawaiian Islands Stock Complex* (2013).

123 Secretariat of the Pacific Community Oceanic Fisheries Programme (2010).

124 G. Bearzi, et al., *Stenella longirostris*, 2012. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

125 Bearzi et al., *Stenella longirostris*.

126 Bearzi et al., *Stenella longirostris*.

127 Bearzi et al., *Stenella longirostris*.

128 B. Culik, "*Stenella longirostris* (Gray, 1828)," *Odontocetes The Toothed Whales*, CMS technical series no. 24, UNEP/CMS Secretariat, Bonn, Germany (2010).

129 Randall R. Reeves et al., *Global Priorities for Reduction of Cetacean Bycatch*, Report of the Priority Setting Working Group of the U.S. WWF Bycatch Task Force, World Wildlife Fund (2005).

130 Nina M. Young and Suzanne Iudicello, *Worldwide Bycatch of Cetaceans: An Evaluation of the Most Significant Threats to Cetaceans, The Affected Species and the Geographic Areas of High Risk, and the Recommended Actions from Various Independent Institutions*, report to the NOAA Fisheries Office of International Affairs, NOAA Technical Memorandum NMFS-OPR-36 (2007).

131 Young and Iudicello (2007).

132 S.B. Reilly et al., Report of the scientific research program under the International Dolphin Conservation Program Act, NOAA Technical Memorandum, 2005.

133 Culik (2010).

134 T. Gerrodette and J. Forcada, "Non-recovery of two spotted and spinner dolphin populations in the Eastern Tropical Pacific Ocean," *Marine Ecology Progress Series* 29 (2005): 1-21.

135 Reeves et al. (2005).

136 Reeves et al. (2005).

137 Young and Iudicello (2007). Culik (2010).

138 World Wildlife Fund, *On the Brink: Global Priorities for Saving Dolphins and Porpoises Threatened by Bycatch*, WWF fact sheet, www.assets.panda.org/downloads/wwfintdolphins.pdf (accessed November 21, 2013). NMFS, "U.S. actions taken on foreign large-scale high seas driftnet fishing," *2011 Report of the Secretary of Commerce to the Congress of the United States* (2011). EC Regulation 812/2004.

139 ASCOBANS, *Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea, and the Kattegat*, 19th ASCOBANS Advisory Committee Meeting, Galway, Ireland, March 20-22, 2012.

140 P.S. Hammond et al., *Phocoena phocoena (Baltic Sea Subpopulation)*, 2008. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

141 H. Herr, U. Siebert, and H. Benke, *Stranding Numbers and Bycatch Implications of Harbour Porpoises Along the German Baltic Sea Coast,* Document 62, 16th ASCOBANS Advisory Committee Meeting, Bruges, Belgium, April 20-24, 2009.

142 S. Koschinski and A. Pfander, *By-catch of Harbour Porpoises (*Phocoena phocoena*) in the Baltic Coastal Waters of Angeln and Schwansen (Schleswig-Holstein, Germany)*, 16th ASCOBANS Advisory Committee Meeting, Bruges, Belgium, April 20-24, 2009.

143 Herr, Siebert, and Benke (2009).

144 Koschinksi and Pfander (2009).

145 M. Scheidat et al., "Harbor porpoise *Phocoena phocoena* abundance in the southwestern Baltic Sea," *Endangered Species Research* 5 (2008): 215-223.

146 ASCOBANS (2012).

147 Christian Pusch, German Federal Agency for Nature Conservation, personal communication with the author via email, July 10, 2013.

148 Notarbartolo di Sciara and Birkun (2010). A. Birkun Jr. and A. Frantzis, *Phocoena phocoena ssp. Relicta*, 2008. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

149 Notarbartolo di Sciara and Birkun (2010). Reeves et al. (2005).

150 Reeves et al. (2005).

151 A.M. Tonay and B. Öztürk, *Cetacean Bycatches in Turbot Fishery on the Western Coast of the Turkish Black Sea*, International Symposium of Fisheries and Zoology, Istanbul, Turkey, October 23-26, 2003.

152 Alexei Birkun, interview by Nicola Hodgins, WDCS Fieldwork Blog, Whale and Dolphin Conservation Society, October 26, 2010.

153 Giuseppe Notarbartolo di Sciara, Universita degli Studi di Milano, personal communication with the author via email, April 30, 2013.

154 Alexei Birkun, BREMA Laboratory, personal communication with the author via email, May 16, 2013.

155 IUCN, *Scientific Whaling by the Republic of Korea* (position paper, response to Republic of Korea's Opening Statement at the 64th Meeting of the IWC, 2012).

156 C.S. Baker et al., "Incomplete reporting of whale, dolphin and porpoise 'bycatch' revealed by molecular monitoring of Korean markets," *Animal Conservation* 9 (2006): 474-482. S.B. Reilly et al., *Balaenoptera acutorostrata*, 2008. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

157 International Whaling Commission (IWC), *Report of the Scientific Committee, Annex J: Report of the Working Group on North Pacific Minke Whale Trials*, 49th Annual Meeting of the IWC, Bournemouth, United Kingdom, October 20-24, 1997, 203-226. IUCN Scientific Whaling Position Paper (2012).

158 International Whaling Commission (IWC), *Report of the Scientific Committee*, 61st Annual Meeting of the IWC, Madeira, Portugal, June 22-26, 2009. C. S. Baker et al., "Predicted decline of protected whales based on molecular genetic monitoring of Japanese and Korean markets," *Proceedings of the Royal Society of London, Series B: Biological Sciences* 267, no. 1449 (2000): 1191-1199.

159 IUCN *Scientific Whaling* position paper (2012).

160 IUCN *Scientific Whaling* position paper (2012). IWC (2009).

161 V. Lukoschek et al., "The rise of commercial 'by-catch whaling' in Japan and Korea," *Animal Conservation* 12, no. 5 (2009): 398-399.

162 IWC, *Annual Report of the International Whaling Commission 2005* (Cambridge, U.K.: 2006), 66-67.

163 D.R. MacMillan and H. Jeonghee, "Cetacean by-catch in the Korean Peninsula—by chance or by design?" *Human Ecology* 39 (2011): 757-768. K. Song et al., "Fishing gear involved in entanglements of minke whales (*Balaenoptera acutorostrata*) in the East Sea of Korea," *Marine Mammal Science* 26, no. 2 (2010): 282-295.

164 MacMillan and Jeonghee (2011).

165 MacMillan and Jeonghee (2011).

166 MacMillan and Jeonghee (2011).

167 Lukoschek et al. (2009).

168 Baker et al. (2000).

169 Y. An, *Republic of Korea: Progress Report on Cetacean Research, January 2010 to December 2010, with Statistical Data for the Calendar Year 2010*, paper submitted to IWC Scientific Committee, Tromsø, Norway, July 11-14, 2011. IWC (2012).

170 Lukoschek et al. (2009).

171 Lukoschek et al. (2009).

172 Song et al. (2010).

173 Lukoschek et al. (2009).

174 T. Kasuya, "Japanese whaling and other cetacean fisheries," *Environmental Science and Pollution Research Int.* 14 (2005): 39-48.

175 Scott Baker, Marine Mammal Institute, Oregon State University, personal communication with the author via email, July 2, 2013.

176 MacMillan and Jeonghee (2011). Song et al. (2010).

177 Reeves, McClellan, and Werner (2013).

178 Daniel Pauly et al., "China's distant-water fisheries in the 21st century," *Fish and Fisheries* DOI: 10.1111/faf.12032 (2013).

179 Pauly et al. (2013).

180 USDA, *U.S. Imports of Fish and Shellfish*, Foreign Agricultural Service, Washington D.C., www.fas.usda.gov/gats (accessed September 19, 2013).

181 W. E. Schrank, "The Newfoundland fishery: Ten years after the moratorium," *Marine Policy* 29 (2005): 407-420.

182 Read, personal communication (2013).

183 S. Benjamins et al., "Assessing changes in numbers and distribution of large whale entanglements in Newfoundland and Labrador, Canada," *Marine Mammal Science* 28, no. 3 (2012): 579-601.

184 A. Johnson et al., "Fishing gear involved in entanglements of right and humpback whales," *Marine Mammal Science* 21, no. 4 (2005): 635-645.

185 Benjamins et al. (2012).

186 Benjamins et al. (2012).

187 Brown et al. (2009).

188 Vanderlaan, Smedbol, and Taggart (2011).

189 G.T. Waring et al., eds., *Harbor Porpoise: Gulf of Maine/Bay of Fundy Stock: U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments*, NOAA Tech Memo NMFS NE 219 (2010): 595.

190 S. Benjamins, J. Lawson, and G. Stenson, "Recent harbour porpoise bycatch in gillnet fisheries in Newfoundland and Labrador, Canada," *Journal of Cetacean Research and Management* 9 (2007): 189-199.

191 T. A. Jefferson and B.E. Curry, "A global review of porpoise (Cetacea: *Phocoenidae*) mortality in gillnets," *Biological Conservation* 67 (1994):167-183.

192 E.A. Trippel et al., "Mitigation of harbour porpoise (*Phocoena phocoena*) bycatch in the gillnet fishery in the lower Bay of Fundy," *Canadian Journal of Fisheries and Aquatic Science* 56 (1999): 113-123.

193 Read, personal communication (2013).

194 E.A. Trippel, "Incidental mortality of harbour porpoise (*Phocoena phocoena*) by the gill-net fishery in the lower Bay of Fundy," *Canadian Journal of Fisheries and Aquatic Science* 53 (1996): 1294-1300. Hammond et al. (2008).

195 V. Lesage et al., "Bycatch of harbor porpoises (*Phocoena phocoena*) in gillnet fisheries of the Estuary and Gulf of St. Lawrence in 2000-2002," *Journal of Cetacean Research and Management* 8, no. 1 (2006): 67-78.

196 Benjamins, Lawson, and Stenson (2007).

197 Benjamins, Lawson, and Stenson (2007).

198 NMFS, *Harbor Porpoise (Phocoena phocoena): Gulf of Maine/Bay of Fundy Stock*, Stock Assessment Report, May 2013. Andrew Read, "By-catch of harbor porpoises," lecture, Nicholas School of the Environment, Duke University, Durham, North Carolina, fall 2012.

199 Notarbartolo di Sciara and Birkun (2010).

200 Notarbartolo di Sciara and Birkun (2010).

201 Environmental Justice Foundation (EJF), *Illegal Driftnetting in the Mediterranean*, London, U.K., 2007.

202 U.N. General Assembly, A/RES/44/225. *Large-scale Pelagic and Driftnet Fishing and Its Impact on Living Marine Resources of the World's Oceans and Seas,* 85th Plenary Meeting, December 22, 1989.

203 Food and Agriculture Organization of the United Nations: Fisheries and Aquaculture Department, "Fishing gear types: Driftnets," www.fao.org/fishery/geartype/220/en (accessed September 19, 2013).

204 National Marine Fisheries Service (NMFS), *U.S. Actions Taken on Foreign Large-Scale High Seas Driftnet Fishing*, report of the Secretary of Commerce to the Congress of the United States, 2011.

205 PEW Environment, *Mediterranean Driftnets: A History of (In) Action*, May 17, 2011, www.pewenvironment.org/uploadedFiles/PEG/Publications/Fact_Sheet/Italian%20Driftnets%20Final%20PDF%20Low%20Res.pdf (accessed September 19, 2013).

206 NMFS (2011).

207 NMFS (2011).

208 S. Tudela et al., "Driftnet fishing and biodiversity conservation: the case study of the large-scale Moroccan driftnet fleet operating in the Alboran Sea (SW Mediterranean)," *Biological Conservation* 121 (2005): 65-78.

209 NMFS, *U.S. Actions Taken on Foreign Large-Scale High Seas Driftnet Fishing*, report of the Secretary of Commerce to the Congress of the United States, 2012.

210 T. Akyol et al., "Investigations on driftnet fishery for swordfish (*Xiphias gladius L.*)," *Aegean Sea Turkish Journal of Veterinary and Animal Science* 29 (2004): 1225-1231. S. Tudela and P. Guglielmi, "A challenge to regional fisheries governance and a major threat to marine ecosystems and vulnerable species," *FINS* (Newsletter of ACCOBAMS) 2, no. 1 (June 2005).

211 Emily Fisher, "Turkey to Eliminate Driftnets in 2011," *The Beacon*, September 22, 2010, oceana.org/en/blog/2010/09/turkey-to-eliminate-driftnets-in-2011.

212 NMFS (2012).

213 Antonio Di Natale and Giuseppe Notarbartolo di Sciara, "A review of the passive fishing nets and trap fisheries in the Mediterranean Sea and of the cetacean bycatch," *Report of the International Whaling Commission*, special issue 15 (1994).

214 The Black Fish, *Illegal, Unreported and Unregulated Fishing in the European Union: The Case of Italian Illegal Driftnets*, November 2010, www.theblackfish.org/files/Italian_Driftnets.pdf.

215 NMFS (2012). PEW Environment (2011).

216 PEW Environment (2011).

217 NMFS (2011).

218 PEW Environment (2011)

219 NMFS (2011).

220 PEW Environment (2011).

221 The Black Fish (2010).

222 The Black Fish (2010).

223 PEW Environment (2011).

224 NMFS (2011).

225 NMFS, (2012).

226 "International €4 million bluefin tuna trafficking ring busted," (July 27, 2011), www.fishupdate.com/news/fullstory.php/aid/15839/International__804_million_bluefin_tuna_trafficking_ring_busted.html.

227 PEW Environment (2011).

228 Maria del Mar Otero and Michela Conigliaro, *Marine Mammals and Sea Turtles of the Mediterranean and Black Seas*, IUCN, Gland, Switzerland, and Malaga, Spain (2012).

229 G. Bearzi, *Delphinus delphis (Mediterranean subpopulation)*, 2003. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org.

230 A. Aguilar and S. Gaspari, *Stenella coeruleoalba (Mediterranean subpopulation)*, 2012. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.2, www.iucnredlist.org. Di Natale and Notarbartolo di Sciara (1994). Notarbartolo di Sciara et al. (2012).

231 Notarbartolo di Sciara et al. (2012).

232 A. Aguilar and L. Lowry *(2013)*.

233 A. Aguilar and L. Lowry *(2013)*.

234 Tudela (2004).

235 Tudela (2004).

236 Young and Iudicello (2007).

237 Reeves et al. (2005).

238 Young and Iudicello (2007).

239 Young and Iudicello (2007). M. Mangel, "Effects of high-seas driftnet fisheries on the northern right whale dolphin *Lissodelphis borealis*," *Ecological Applications* 3 (1993): 221-229.

240 Young and Iudicello (2007).

241 Young and Iudicello (2007). NMFS (2012).

242 NMFS (2012).

243 WWF Russia, *Driftnet Fishery for Salmon in the Pacific and Its Influence on Marine Ecosystem*, Moscow (2004): 64.

244 WWF Russia (2004).

245 NMFS (2012).

246 Reeves et al. (2005).

247 Reeves et al. (2005).

248 Young and Iudicello (2007).

249 K. Zhou and X. Wang, "Brief review of passive fishing gear and incidental catches of small cetaceans in Chinese waters," *Report of the International Whaling Commission*, special issue 15 (1994): 347-354.

250 Reeves, McClellan, and Werner (2013).

251 Pauly et al. (2013).

252 A. Lowther, ed., "Fisheries of the United States 2011." Current Fishery Statistics No. 2011, NMFS Office of Science and Technology, 2012.

253 Reeves et al. (2005).

254 Y.B. Artukhin, V. N. Burkanov, and V. S. Nikulin, *Accidental By-catch of Marine Birds and Mammals in the Salmon gillnet Fishery in the Northwestern Pacific Ocean*, Moscow: Skorost' Tsveta (2010).

255 Artukhin, Burkanov, and Nikulin (2010).

256 W.F. Perrin et al., "Report of the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of South-East Asia," *CMS Technical Series* publication no. 9, UNEP/CMS Secretariat, 2005.

257 Western and Central Pacific Fisheries Commission, *Tuna Fishery Yearbook 2012*, November 2013, www.wcpfc.int/system/files/WCPFC_YB_2012_0.pdf (accessed December 9, 2013). Western and Central Pacific Fisheries Commission, Current Record of Fishing Vessels in CSV format, December 2009, www.wcpfc.int/doc/current-record-fishing-vessels-csv-format (accessed December 9, 2013).

259 Reeves et al. (2005).

260 Young and Iudicello (2007).

261 M.B. Harwood and E.D. Hembree, "Incidental catch of small cetaceans in the offshore gillnet fishery in northern Australian waters: 1981-1985," *Report of the International Whaling Commission* 37 (1987): 363-367.

262 Young and Iudicello (2007).

263 Perrin et al. (2005)

264 Perrin et al. (2005).

265 Perrin et al. (2005).

266 Perrin et al. (2005).

267 P.S. Hammond et al., *Phocoenoides dalli*, 2012. In: IUCN 2013. IUCN Red List of Threatened Species, version 2013.1, www.iucnredlist.org.

268 Young and Iudicello (2007).

269 B. Culik, "*Phocoenoides dalli* (True, 1885)," (2010).

270 Artukhin, Burkanov, and Nikulin (2010).

271 Hammond et al. (2012).

272 Young and Iudicello (2007).

273 IWC (2009). MacMillan and Jeonghee (2011).

274 Song et al. (2010). C.S. Baker et al., "Incomplete reporting of whale, dolphin and porpoise 'bycatch' revealed by molecular monitoring of Korean markets," *Animal Conservation* 9 (2006): 474-482.

275 Young and Iudicello (2007).

276 Reeves et al. (2005). Perrin et al. (2005). Young and Iudicello (2007).

277 Gianna Minton and Brian D. Smith, *Determining and Quantifying Threats to Coastal Cetaceans: A Regional Collaborative Workshop* (workshop summary, Kuching, Sarawak, February 22-24, 2011), www.iucn-csg.org/wp-content/uploads/2010/03/Feb-2011-Threats-to-coastal-cetaceans-workshop-Complete-Report-Final.pdf.

278 Perrin et al. (2005).

279 P. McCarthy and R. Žydelis, *Regional Assessment—Southeast Asia*, Project GloBAL, bycatch.nicholas.duke.edu/regions/SoutheastAsia/SE%20Asia.pdf (accessed November 21, 2013).

280 R.R. Reeves et al., eds., *Dolphins, Whales and Porpoises: 2002–2010 Conservation Action Plan for the World's Cetaceans,* IUCN/SSC Cetacean Specialist Group, IUCN, 2003.

281 Marine Resources and Fisheries Consultants (MRAG), *A Review of Bycatch in the Indian Ocean Gillnet Tuna Fleet Focusing on India and Sri Lanka*, ISSF Technical Report 2012-06, International Seafood Sustainability Foundation, April 2012.

282 Perrin et al. (2005).

283 Perrin et al. (2005).

284 M.L.L. Dolar, "Incidental bycatch of small cetaceans in fisheries in Palawan, central Visayas and northern Mindanao in the Philippines," *Report of the International Whaling Commission*, special issue 15 (1994): 355–363.

285 Dolar (1994).

286 Young and Iudicello (2007).

287 Perrin et al. (2005).

288 Reeves et al. (2005). Reeves et al., *Orcaella brevirostris*.

289 B.D. Smith et al., "Status, ecology, and conservation of Irrawaddy dolphins (*Orcaella brevirostris*) in Malampaya Sound, Palawan, Philippines," *Journal of Cetacean Research and Management* 6, no. 1 (2004): 41-52.

290 Sustainable Fisheries Partnership, *Blue Swimming Crab*, www.sustainablefish.org/fisheries-improvement/fisheries-improvement/fip-stories/blue-swimming-crab (accessed December 9, 2013).

291 Chicken of the Sea, *From Sea to Shelf: Blue Swimming Crab Meat Processing*, chickenofthesea.com/frozen_crab_process.aspx (accessed December 9, 2013).

292 MRAG (2012).

293 MRAG (2012).

294 Reeves, McClellan, and Werner (2013).

295 Reeves, McClellan, and Werner (2013). MRAG (2012).

296 Reeves, McClellan, and Werner (2013).

297 Reeves, McClellan, and Werner (2013). MRAG (2012).

298 Reeves, McClellan, and Werner (2013).

299 K.S.S.M. Yousuf et al., "Observations on cetaceans in three landing centres along the Indian coast," *Marine Biodiversity Records* 2 (2009): 1-5.

300 MRAG (2012).

301 Perrin et al. (2005).

302 Perrin et al. (2005).

303 J. Zeeberg, A. Corten, and E. de Graaf, "Bycatch and release of pelagic megafauna in industrial trawler fisheries off northwest Africa," *Fisheries Research* 78, no. 2 (2006): 186-195.

304 CMS, *Action Plan for the Conservation of Small Cetaceans of Western Africa and Macronesia*, Convention on Migratory Species (2008), www.cms.int/species/waam/smcet_ap_E.pdf.

305 CMS, "Conserving cetaceans and manatees in the western African region," CMS Technical Series Publication No. 26, UNEP/CMS Secretariat (2012).

306 Jeffrey Moore, *Regional Assessment–West Africa*, Project GloBAL, bycatch.nicholas.duke.edu/regions/WestAfrica/W%20Africa.pdf (accessed September 20, 2013).

307 Zeeberg, Corten, and de Graaf (2006).

308 Zeeberg, Corten, and de Graaf (2006).

309 Zeeberg, Corten, and de Graaf (2006).

310 Jeffrey Moore, Regional Assessment–West Africa, Project GloBAL, bycatch.nicholas.duke.edu/regions/WestAfrica/W%20Africa.pdf (accessed September 20, 2013). Greenpeace, "The prices of plunder," *Ocean Inquirer: Exposing Sea Crimes*, no. 3 (February 2012). Pelagic Freezer-Trawler Association, *Species*, www.pelagicfish.eu/species (accessed September 20, 2013).

311 Greenpeace (2012). Fiona Schimmel et al., *Simply Seatrade*, November 2009 www.seatrade.com/fileadmin/user_upload/Documents/PDF/Simply_Seatrade_1109.pdf.

312 Greenpeace (2012).

313 Pauly et al. (2013).

314 Pauly et al. (2013).

315 Jared Ferrie, "Trawlers threaten West African fish stocks," *The National*, June 8, 2008, www.seaaroundus.org/newspapers/2008/TheNational_TrawlersThreatenWestAfricaFishStocks.pdf.

316 CMS (2012).

317 Pauly et al. (2013).

318 Pauly et al. (2013).

319 Pauly et al. (2013).

320 Pauly et al. (2013).

321 Environmental Justice Foundation (EJF), *Pirate Fish on Your Plate: Tracking Illegally-Caught Fish from West Africa into the European Market*, London, U.K., 2007.

322 Environmental Justice Foundation (EJF), *Party to the Plunder: Illegal Fishing in Guinea and Its Links to the E.U.*, London, U.K., 2005.

323 Environmental Justice Foundation (EJF), *Pirate Fishing Exposed: The Fight Against Illegal Fishing in West Africa and the E.U.*, London, U.K., 2012.

324 EJF (2005).

325 "West African fishermen claim foreign trawlers overfishing," *Voices of America*, June 14, 2010, www.voanews.com/content/foreign-trawlers-illegally-fishing-west-african-waters-96382089/154891.html.

326 Greenpeace (2012).

327 CMS (2008).

328 CMS (2008).

329 A.S. Couperus, "Interactions between Dutch midwater-trawl and Atlantic white-sided dolphins (*Lagenorhynchus acutus*) southwest of Ireland," *Journal of Northwest Atlantic Fishery Science* 22 (1997): 209-218.

330 Tim Collins et al., "The Atlantic humpback dolphin (*Sousa teuszii*) in Gabon and Congo: Cause for optimism or concern?" paper SC/62/SM9 presented to the International Whaling Commission Scientific Committee, Agadir, Morocco, 2010. Reeves et al. (2012).

331 C.R. Weir et al., "West Africa's Atlantic humpback dolphin (*Sousa teuszii*): Endemic, enigmatic and soon endangered?" *African Zoology* 46, no. 1 (2011): 1-17.

332 Young and Iudicello (2007). Project GloBAL (Global Bycatch Assessment of Long-lived Species), *Southwest Atlantic*, Nicholas School of the Environment and Earth Sciences at Duke University, bycatch.nicholas.duke.edu/regions/SWA (accessed October 14, 2013). E.A. Crespo et al., *Report of the Workshop: Estado de situacion del lobo marino comun en su area de distribucion*, Valparaiso, Chile (2010).

333 Reeves et al. (2005).

334 Reeves et al. (2005). E.A. Crespo et al., "Incidental catch of dolphins in mid-water trawls for southern anchovy off Patagonia," *Journal of Cetacean Research and Management* 2 (2000): 11-16. Enrique Crespo, Centro Nacional Patagonico, personal communication with the author via email, June 25, 2013.

335 Reeves et al. (2005). Crespo, personal communication (2013).

336 S.L. Dans, "Incidental catch of dolphins in trawling fisheries off Patagonia, Argentina: Can populations persist?" *Ecological Applications* 13, no. 3 (2003): 754-762. M.A. Romero et al., "Feeding habits of two sympatric dolphin species off North Patagonia, Argentina," *Marine Mammal Science* 28, no. 2 (2012): 364-377.

337 Dans (2003). Crespo et al. (2000).

338 Romero et al. (2012).

339 Romero et al. (2012).

340 Crespo, personal communication (2013).

341 M.A. Negri et al., "Bycatch of Franciscana dolphins *Pontoporia blainvillei* and the dynamic of artisanal fisheries in the species' southernmost area of distribution," *Brazilian Journal of Oceanography* 60, no. 2 (2012): 149-158. Reeves et al. (2005).

342 R. Reeves et al., *Pontoporia blainvillei*.

343 Reeves et al., 2008. E.A. Crespo, "Franciscana (*Pontoporia blainvillei*)," *Encyclopedia of Marine Mammals* (2nd Ed.), Academic Press, San Diego, California (2009).

344 Project GloBAL, *Southwest Atlantic*. Young and Iudicello (2007).

345 Crespo, personal communication (2013).

346 Crespo, personal communication (2013).

347 General Agreement on Tariffs and Trade, Article XX, October 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194 (hereinafter GATT).

348 GATT, Article XX.

349 Technical Barriers to Trade Agreement, Article 2.2, April 15, 1994, 1868 U.N.T.S. 121.

350 Appellate Body Report, *United States—Measures Concerning the Importation, Marketing and Sale of Tuna and Tuna Products*, ¶ 172, WT/DS381/AB/R (May 16, 2012) (hereinafter AB Report, *US—Tuna/Dolphin*).

351 Appellate Body Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products*, WT/DS58/AB/R ¶ 186 (October 12, 1998) (hereinafter AB Report, *US—Shrimp/Turtle*).

352 *See* Douglas A. Kysar, "Preferences for processes," *Harvard Law Review* 118 (2004): 525, 547 (explaining that GATT permits process-based trade measures "as long as the importing nation has a 'sufficient nexus' with the environmental ill targeted by the measure, the measure is 'not disproportionately wide in its scope and reach,' the 'means and ends relationship' between the measure and its espoused policy goal is 'close and real'") (citing AB Report, *US—Shrimp/Turtle*, ¶¶ 133, 141).

353 Appellate Body Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products, Recourse to Article 21.5 of the DSU by Malaysia,* WT/DS58/AB/RW (October 22, 2001) (hereinafter AB Report, *US—Shrimp/Turtle II).*

354 Appellate Report, *US—Shrimp/Turtle*, ¶ 173.

355 Appellate Report, *US—Shrimp/Turtle*, ¶¶ 162-165.

356 AB Report, *US—Shrimp/Turtle II*, ¶ 144 (emphasis in original).

357 AB Report, *US—Tuna/Dolphin*, ¶ 407(d).

358 Panel Report, *United States—Measures Concerning the Importation, Marketing and Sale of Tuna and Tuna Products*, ¶ 7.437, WT/DS381/R (September 15, 2011) (hereinafter Panel Report, *US—Tuna/Dolphin II*).

359 Panel Report, *US—Tuna/Dolphin II.*

360 Panel Report, *US—Tuna/Dolphin II.*

361 Robert Howse, "Permitting pluralism," *Yale Journal of International Law* 37 (2012): 367, 419.

362 Appellate Report, *US—Tuna/Dolphin*, ¶ 298 ("[T]he United States has not justified as non-discriminatory . . . the different requirements that it applies to tuna caught by setting on dolphins inside the ETP and tuna caught by other fishing methods outside the ETP for access to the US 'dolphin-safe' label.").

363 16 U.S.C. § 1371(a)(2).

364 16 U.S.C. § 1371(a)(2).

365 76 Fed. Reg. 73912 (November 29, 2011) (List of Fisheries for 2012). Roman et al. (2013).

366 16 U.S.C. § 1371(a)(2)(A).

367 16 U.S.C. §§ 1386 and 1387.

368 16 U.S.C. § 1371(a)(2)(A).

369 16 U.S.C. §§ 1386 and 1387.

370 Reeves, McClellan, and Werner (2013). Perrin et al. (2005).

371 R.L. Lewison et al. (2011). "Ingredients for addressing the challenges of fisheries bycatch," *Bulletin of Marine Science* 87, no. 2, 235-250.

Natural Resources Defense Council
40 West 20th Street
New York, NY 10011
212 727-2700
Fax 212 727-1773

Beijing

Chicago

Los Angeles

Livingston

San Francisco

Washington, D.C.

www.nrdc.org

www.nrdc.org/policy
www.facebook.com/nrdc.org
www.twitter.com/nrdc

Printed on recycled paper