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# WASTED CATCH

## WASTED CATCH: UNSOLVED PROBLEMS IN U.S. FISHERIES

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An underwater photograph showing a large, rusted metal structure, possibly a piece of fishing gear or a shipwreck, resting on a coral reef. The water is clear and blue, and the reef is covered in various types of coral and marine life. The structure is made of dark, weathered metal with several horizontal bars and a chain attached to it. The background shows a vast expanse of the reef extending into the distance.

ACCORDING TO SOME  
ESTIMATES, GLOBAL  
BYCATCH MAY AMOUNT  
TO **40 PERCENT OF THE  
WORLD'S CATCH,**  
TOTALING 63 BILLION  
POUNDS PER YEAR

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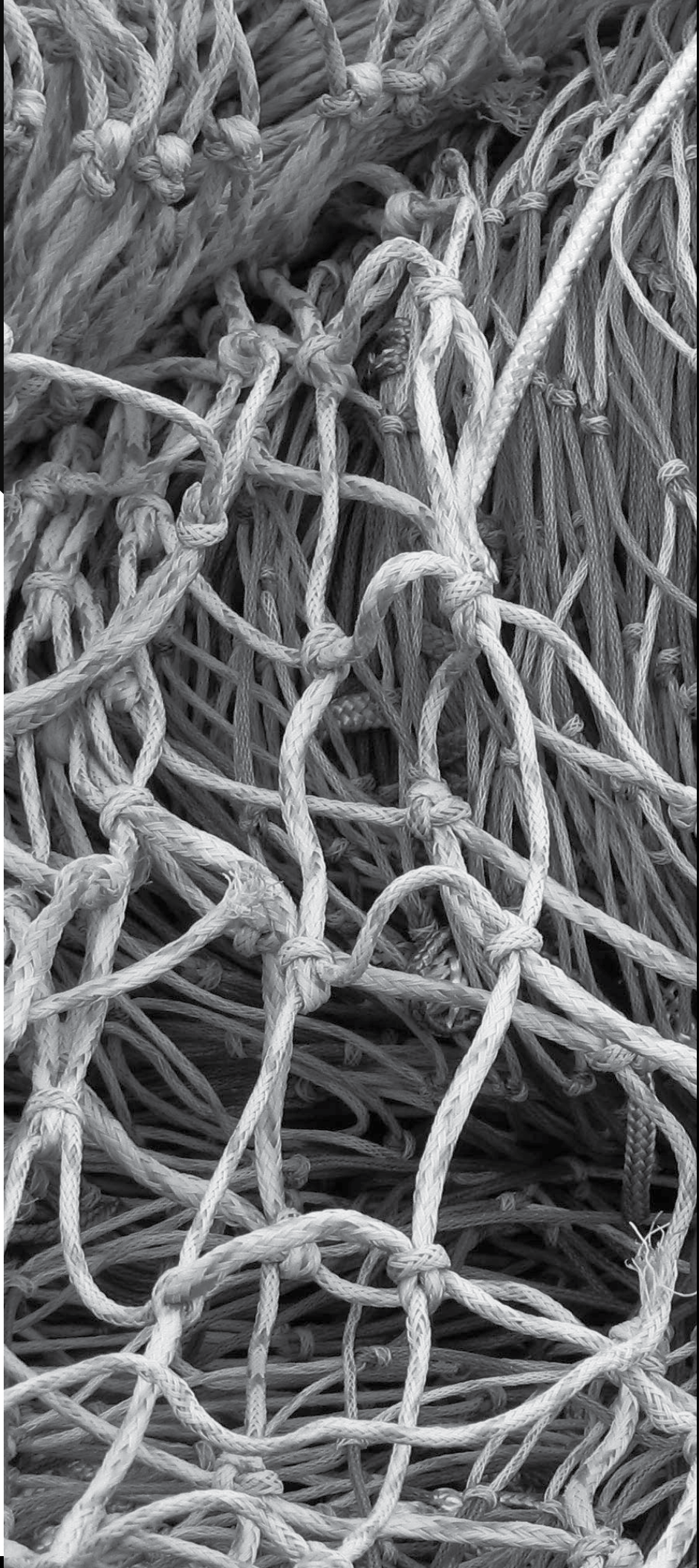
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## **BYCATCH**, OR THE CATCH OF NON-TARGET FISH AND OCEAN WILDLIFE, IS ONE OF THE LARGEST THREATS TO MAINTAINING HEALTHY FISH POPULATIONS AND MARINE ECOSYSTEMS AROUND THE WORLD.

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According to some estimates, global bycatch may amount to 40 percent of the world's catch, totaling 63 billion pounds per year. In the United States, despite strong management measures and conservation initiatives in some regions, bycatch remains a persistent problem for far too many fisheries. Some fisheries discard more fish at sea than what they bring to port, in addition to injuring and killing thousands of whales, dolphins, seals, sea turtles and sharks each year.

While bycatch data is often outdated and inaccurate, researchers estimate that 17-22 percent of U.S. catch is discarded every year, according to the best available data. Bycatch in the U.S. could amount to 2 billion pounds every year, equivalent to the entire annual catch of many other fishing nations around the world. One of the biggest concerns about bycatch is that the severity of the problem in many regions and fisheries still remains unknown. The National Marine Fisheries Service rarely reports comprehensive bycatch data and in fact has not published a nationwide estimate using data more recent than 2005—and has no intention of updating its estimates until 2017. In short, bycatch harms ocean wildlife, wastes important food resources and undercuts the economic success of our nation's fisheries.

In this report, we have identified nine of the worst bycatch fisheries in the U.S.—fisheries that discard large amounts of fish or harm marine wildlife at a high rate. Several of these fisheries discard more fish than they keep, or discard large amounts of the very species they are aiming to catch. Solutions to the bycatch problem already exist and must be applied nationwide. In order to stop harmful bycatch and wasteful discarding, fisheries managers and fishermen must employ adequate monitoring, count everything that is caught, establish science-based bycatch limits, and use innovative measures to control the problem.

## QUICK FACTS

### WHAT IS BYCATCH?

- Bycatch is the catch of non-target fish and ocean wildlife, including what is brought to port and what is discarded at sea. It is one of the most significant threats to maintaining healthy marine ecosystems.

### U.S. BYCATCH

- Approximately 17-22 percent of what fishermen catch every year is discarded at sea, likely already dead or dying. Some fisheries discard more than what they bring to port.
- Nine fisheries in the U.S. are responsible for more than half of all reported domestic bycatch, but only bring in 7 percent of landings.

### INJURY TO MARINE WILDLIFE

- Federal fisheries managers authorize the killing of tens of thousands of sea turtles each year by commercial fisheries, primarily by Gulf of Mexico shrimp trawls.
- In 2010, more than 3,400 dusky sharks were captured as bycatch in just two bottom longline fisheries in the southeast region of the U.S.—even though it is illegal to deliberately catch them.
- More than 300 pilot whales and almost 700 sea turtles were entangled or killed in a single year in Atlantic and Gulf of Mexico longlines.

### LOOMING UNCERTAINTY

- Bycatch is not accurately estimated in three out of four fisheries in the U.S. due to monitoring levels being below what is recommended by federal fisheries managers.

### SOLUTIONS AND PROGRESS

- Bycatch is not inevitable. There are ways to minimize unintended injury and waste by using cleaner gear, avoiding areas where vulnerable species are known to be present and enforcing bycatch limits each season.

- Oceana has successfully advocated for bycatch limits in some of the largest U.S. fisheries, such as Chinook salmon bycatch limits in the Alaska pollock fishing fleet, exemplifying a management strategy that should be implemented nationwide.

### CURRENT POLICY IMPLEMENTATION IS INADEQUATE

- Loopholes exist in the implementation of existing laws, and less than one out of five Fishery Management Plans include incentives for fishermen to minimize bycatch.

### RECOMMENDATIONS

- Fisheries managers must employ adequate monitoring to accurately count everything that is caught, set science-based limits on bycatch and ensure bycatch limits are not exceeded. The fishing industry can accomplish this through cooperative bycatch avoidance programs, time-area management and using cleaner fishing gear.

## WHAT IS BYCATCH?

Bycatch is the capture of non-target fish and ocean wildlife, including what is brought to port and what is discarded at sea, dead or dying. Bycatch is one of the biggest threats to the oceans and has contributed to overfishing and the dramatic decline of fish populations around the world. Commercial fisheries bring in approximately 160 billion pounds of marine catch around the world each year,<sup>1</sup> which means almost 400 million pounds are caught every day. Recent estimates indicate as much as 40 percent of global catch is discarded overboard.<sup>2,3</sup> Anything can be bycatch: the dolphins that are encircled to bring you canned tuna, the sea turtles caught to bring you shrimp, the flounder thrown overboard to put seared scallops on the menu, the endangered whales migrating thousands of miles only to become entangled for the sake of lobster bisque, and the millions of pounds of halibut or cod that are wasted when fishermen have already reached their quota. Much of this captured wildlife is treated as waste, thrown overboard dead or dying. This conservation problem must be solved to ensure healthy oceans into the future.



# BYCATCH IS AN UNDOCUMENTED PROBLEM

Bycatch has been a persistent problem for decades, because it remains largely undocumented. As defined above, “bycatch” includes not only entangled wildlife, but also discarded fish that could not be brought to port because they were the wrong size, poor quality, low market value, or prohibited for conservation reasons. In the 2000s, fisheries managers in the U.S. established strict catch limits to end overfishing and rebuild depleted fish stocks. The success of these limits can be compromised when target fish for one fishery are discarded as bycatch in a different fishery, like snapper being discarded by grouper fishermen in the South Atlantic and Gulf of Mexico

bottom longline fishery. Similarly, if New England trawl fishermen capture summer flounder but lack the permit to keep them, the fish are thrown overboard and wasted, and sometimes even go undocumented—which means a recreational angler is deprived of a fishing opportunity. Discarding large quantities of fish can lead to overfishing, prevent populations from recovering after decades of overexploitation, and disrupt the natural balance of marine ecosystems. Indeed, some valuable overfished populations are unable to recover because of persistent high levels of bycatch.

Reducing bycatch is a solvable problem. Essential steps include: documenting all catch (whether brought to port or discarded at sea), setting scientifically based catch limits for target and non-target species, and making every effort to actually avoid bycatch. Reducing bycatch will not only save thousands of dolphins, whales, seals, sea turtles, sharks and seabirds, but will also help to rebuild overfished populations and maintain healthy ones.

## DEFINITIONS

**BYCATCH** All incidental catch of non-target fish and ocean wildlife, often discarded at sea.

**CATCH** All fish that are caught, including targeted fish that are kept, non-targeted fish that are discarded, and non-target catch that fishermen bring to port.

**LANDINGS** All fish that are brought to port.

**DISCARD RATE** A common metric to evaluate bycatch, calculated as the fishery’s total discards divided by its total catch (e.g., 1 pound discarded for every 5 pounds caught =  $1/5 = 20$  percent discard rate).

**PROTECTED SPECIES** Species that need special conservation and management considerations such as whales, dolphins, seals, sea turtles, seabirds and anything listed under the Endangered Species Act.

**FISHERY** A group of fishermen or vessels targeting a given species (or group of fish) using certain types of fishing gear(s) in a given area.

**FISHERY MANAGEMENT COUNCIL** An advisory body comprised of stakeholders from industry, government, academia and conservation groups established by the Magnuson-Stevens Act to establish management measures in eight regions of the U.S.

**FISHERY MANAGEMENT PLAN** A document prepared by the National Marine Fisheries Service with advice from regional Councils containing

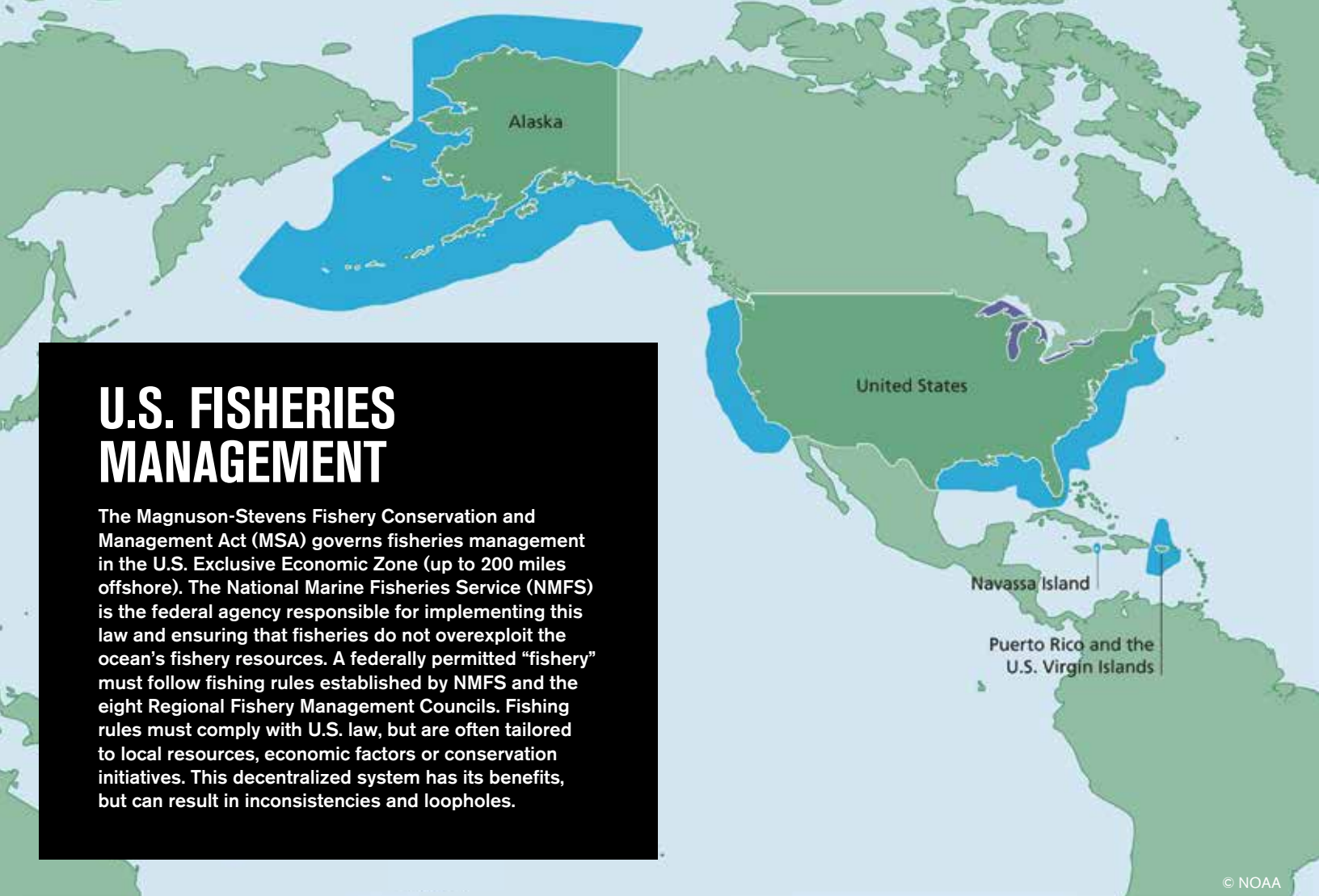
conservation and management measures for fisheries such as annual catch limits, accountability measures, bycatch limits and gear requirements.

**ANNUAL CATCH LIMIT** The amount a fishery is allowed to catch of a certain species every year to ensure that overall fishing limits are not exceeded.

**CATCH SHARE PROGRAM** A fishery management framework where individuals or groups of fishermen are allocated the rights to a percentage of the fishery’s total annual catch.

**OBSERVER** An individual trained to go onboard fishing trips and objectively document fisheries catch, location, discarding, bycatch composition and protected species entanglements.





# U.S. FISHERIES MANAGEMENT

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) governs fisheries management in the U.S. Exclusive Economic Zone (up to 200 miles offshore). The National Marine Fisheries Service (NMFS) is the federal agency responsible for implementing this law and ensuring that fisheries do not overexploit the ocean's fishery resources. A federally permitted "fishery" must follow fishing rules established by NMFS and the eight Regional Fishery Management Councils. Fishing rules must comply with U.S. law, but are often tailored to local resources, economic factors or conservation initiatives. This decentralized system has its benefits, but can result in inconsistencies and loopholes.

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## BYCATCH: A GLOBAL PROBLEM

Worldwide, as many as four million fishing vessels bring in more than 160 billion pounds of fish every year, with estimates of as much as 40 percent (or 63 billion pounds) of global catch discarded.<sup>3</sup> Not only are millions of pounds of fish thrown away every day, but scientists estimate that as many as 650,000 whales, dolphins and seals were killed around the world each year throughout the 1990s as a result of bycatch.<sup>4</sup>

Bycatch is such a persistent global problem in part because many countries lack the capacity to accurately monitor and report catch. In 2005, less than half of the world's fishing records quantitatively documented landings and bycatch.<sup>2</sup> This problem is further compounded by illegal fishing and inadequate law enforcement. However, only 25 countries, including the U.S., are responsible for 75 percent of all global marine landings. Reducing bycatch and discards in these countries alone would yield vast improvements for fish populations, ocean health and long-term fisheries management.

# 650,000

**WHALES, DOLPHINS AND SEALS WERE KILLED AROUND THE WORLD**

**EACH YEAR THROUGHOUT THE 1990s AS A RESULT OF BYCATCH**

# BYCATCH OCCURS EVERY DAY IN THE U.S.

## THE BEST AVAILABLE INFORMATION IS UNRELIABLE AND INCONSISTENT

Estimating bycatch is extremely difficult for a variety of reasons, including low levels of observer coverage, incomplete catch documentation, and the challenges of getting fishery managers to release bycatch data in a timely fashion. Therefore, few independent researchers have attempted to comprehensively estimate bycatch, and the problem gets little attention.

Because no comprehensive bycatch estimates existed in the early 2000s, Oceana commissioned researchers to compile one of the first nationwide bycatch estimates, resulting in a publication covering 27 fisheries and estimating that 22 percent of U.S. catch was discarded each year.<sup>5</sup> Because the data was from 2002 or earlier, the report quickly drew criticism from the federal government, which then committed to develop its own comprehensive estimates as a result.

Unfortunately, it was six years later, in 2011, before NMFS released the first ever *National Bycatch Report*. Based on landings and discard information dating back to 2005 or earlier, this report estimated that 17 percent of the nation's catch is discarded each year.<sup>6</sup> In 2014, NMFS published

an update to this report using 2010 data,<sup>7</sup> but failed to produce an aggregate nationwide bycatch estimate or discard rate. In fact, the report only included data from one-third of U.S. fisheries that produce just more than half of the nation's wild-caught seafood.

Based on these reports, we conclude that 17–22 percent of the fish caught in U.S. fisheries are discarded before reaching port, likely amounting to 2 billion pounds every year.

## NMFS MUST IMPROVE THE COLLECTION, ANALYSIS AND DISSEMINATION OF BYCATCH INFORMATION

Although NMFS is the clearinghouse for fisheries data, and therefore has an obligation to analyze and disseminate the information in a standardized and timely manner, it usually fails to do so. Relying on outdated information leads to inaccurate catch estimates, poor catch projections for the future and flawed decision-making. Fishing regulations change almost as often as the fish populations themselves, and failing to use the best available information is a disservice to the public. The resilience of fishing communities could also be weakened if quotas are unnecessarily restrictive based on outdated information.

*NMFS must release consistent, comprehensive nationwide bycatch estimates so that management and conservation decisions can be based on the most recent and accurate information about environmental conditions, the number of fish in a population and the overall impacts of fishing mortality.*

# 17–22 PERCENT

**OF THE FISH CAUGHT IN U.S. FISHERIES ARE DISCARDED BEFORE**

**REACHING PORT, LIKELY AMOUNTING TO 2 BILLION POUNDS EVERY YEAR**



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### INADEQUATE MONITORING LEADS TO INACCURATE ESTIMATES

Estimating bycatch is challenging because federal, state and regional fishery managers do not often require enough monitoring to know how many fish are caught and subsequently discarded. Information gaps arise when catch is not precisely reported or collected in a consistent, standard way. For example, some fisheries report the number of pounds that are caught, while others instead report the number of individual fish, making it difficult to compare fisheries or calculate the regional bycatch of a certain species. For example, were 20 1-pound juvenile snappers discarded, or one adult 20-pound snapper? These questions matter for modeling populations and making management decisions, and they require precise and consistent reporting.

Collecting bycatch data is critical to effective fisheries management. Trained individuals, known as observers, are often assigned by NMFS to ride along on fishing trips and document information about catch, fishing location and entanglements. Even though increasing observer coverage throughout U.S. fisheries has been a priority for decades, only half of the major U.S. fisheries carry any observers at all, with coverage often being less than 1 percent of fishing trips. To accurately estimate bycatch on both observed and unobserved trips, fisheries must have a minimum of 20 percent coverage, with higher coverage (up to 100 percent) for fisheries more likely to encounter rare or endangered species or where observer data is used to enforce quotas. In 2007, observer coverage in Atlantic bottom trawl and gillnet fisheries was only a fraction of what NMFS recommended to precisely calculate bycatch.<sup>8</sup> Only 4 percent of bycatch

estimates in the 2011 *National Bycatch Report* were derived from what the federal government considers the “highest quality” data, according to several criteria.<sup>6</sup>

One of the biggest problems with low and inconsistent observer coverage is what is known as the “observer effect,”<sup>9</sup> where fishermen actually fish in different locations or underreport bycatch when observers are not onboard to monitor their activities.<sup>10</sup> The existence of this phenomenon means that actual bycatch could easily be much higher than existing estimates suggest.<sup>11</sup> Employing more extensive monitoring is one of the only ways to produce accurate bycatch estimates. The need for accurate and precise bycatch data, and the significant cost of at-sea observers, highlights the importance of developing new technology and incentives to accurately report bycatch.

### STANDARDIZED REPORTING IS ESSENTIAL

Under the Magnuson-Stevens Act (MSA), Fishery Management Plans must detail how each fishery collects and reports bycatch information, following what is known as a Standardized Bycatch Reporting Methodology (SBRM). However, very few fisheries follow such a protocol. In 2001, a federal court first ordered the New England groundfish fishery to develop a standard approach to reporting bycatch. In 2004, and again in 2007, the New England and Mid-Atlantic Fishery Management Councils established bycatch reporting protocols, but they did not include enough observers to accurately estimate bycatch in a range of fisheries.

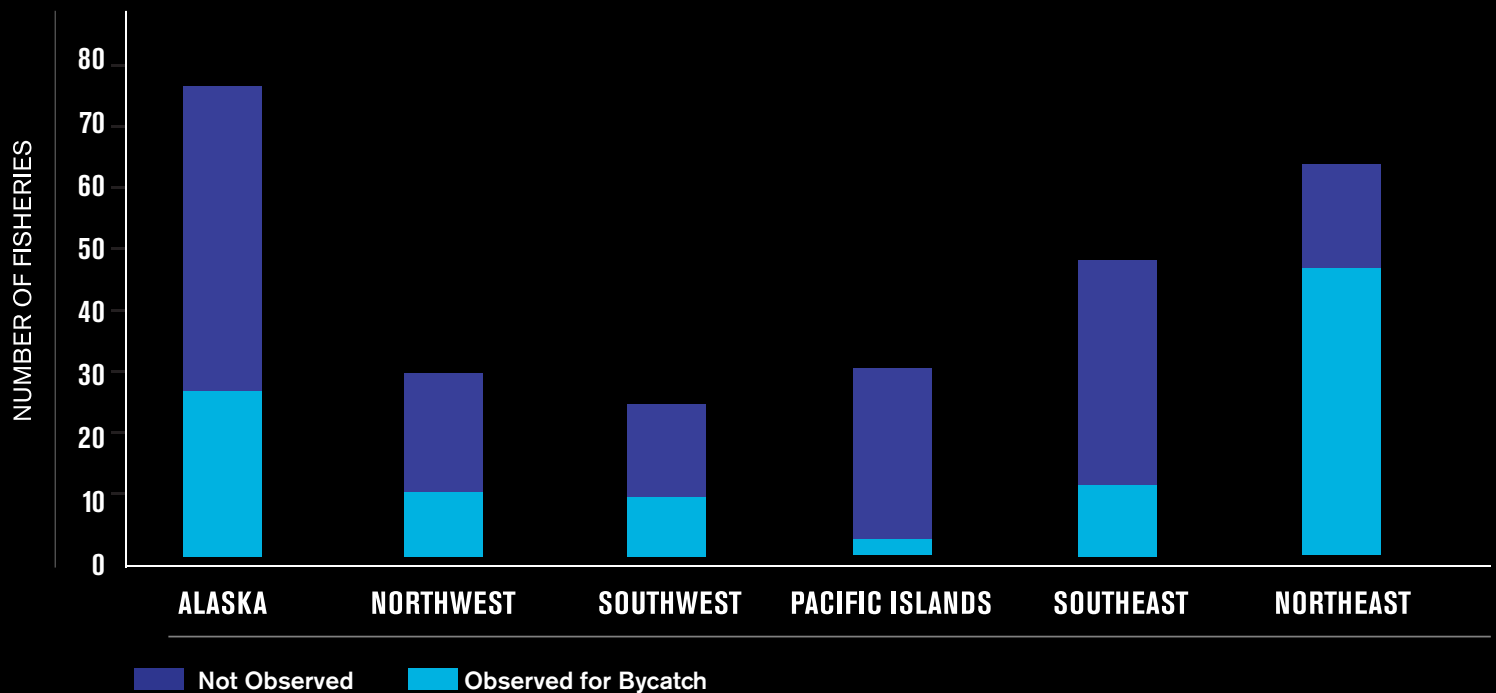
Review of the updated *National Bycatch Report* reveals that only four out of hundreds of U.S. fisheries are meeting

**BYCATCH EXCEEDS MORTALITY LIMITS ESTABLISHED BY LAW FOR**

# 20 PERCENT

**OF MARINE MAMMAL POPULATIONS IN THE U.S.**

# MANY FISHERIES ARE NOT OBSERVED FOR BYCATCH



the recommended standards for the statistical accuracy and validity of their catch data, if they report data at all. For this reason, it is crucial that NMFS and the Fishery Management Councils implement standardized bycatch reporting methodologies across all U.S. fisheries. Any credible, effective data collection program must be feasible on the water and generate accurate catch estimates. Unfortunately, the federal government has not met these requirements, and the fishing mortality of many species remains unknown.

*Without standardized protocols, bycatch will continue to be underreported.*

## PROTECTED SPECIES ARE EVEN MORE POORLY MONITORED

For protected species such as whales, dolphins, seals, sea turtles and seabirds, the picture is even worse. Marine wildlife of all kinds becomes hooked, entangled, injured or drowns during the course of fishing activities. Some animals are particularly vulnerable to certain types of fishing gear depending on what they eat, where they live and how far they migrate. For example, sea lions and large whales often become entangled in gillnets, while sea turtles are most often captured by trawls and longlines.

Unfortunately, accurately estimating the magnitude of these entanglements and deaths is even more difficult than estimating the rate of fish discarding, because the likelihood of an observer being onboard to report the incident is lower. A scientific report recommended that observer coverage must be at least 50 percent to accurately estimate marine mammal and sea turtle bycatch,<sup>12</sup> and for some rare and endangered species, 100 percent coverage is necessary.<sup>13</sup> These recommended levels are far higher than the 1-5 percent that is common among many fisheries, if they are even observed at all.

Under the Marine Mammal Protection Act, NMFS is required to publish assessments for all marine mammals, including information about fishing mortality. In 2013, at least one-third of these assessments relied on outdated data and did not provide estimates of fishing mortality, as required. Bycatch exceeds mortality limits established by law for 20 percent of the marine mammal populations in the U.S. Even worse, human-related mortality is not even estimated for one-third of marine mammal populations, as is also required by law.

*Without enhanced monitoring for entanglement events, bycatch estimates for protected species will remain highly uncertain and therefore ineffectively managed.*



# NOTABLE PROGRESS, BUT NO SOLUTION

## WHERE HAVE WE BEEN AND WHERE ARE WE GOING?

Minimizing bycatch is required by law under the Magnuson-Stevens Act (MSA). Resource managers and the federal government have taken steps to minimize harmful fishing practices in some fisheries, but the current implementation of existing policies and regulations is inadequate to reduce bycatch. In some cases, regional Fishery Management Councils have taken initiative and established voluntary measures to minimize bycatch, such as awarding higher quota to fishermen who participate in experimental gear projects or have observers onboard more often. However, fewer than 20 percent of existing Fishery Management Plans include incentives for fishermen to minimize bycatch. Even where they do exist, voluntary measures alone are not enough to eliminate harmful practices and cannot ensure a future of responsible fishing.

## COUNT: ALL CATCH MUST BE ACCOUNTED FOR

Bycatch and targeted fish should all be counted as one unit: catch. When marine animals are taken from the ocean, everything should be counted, because every fish counts in maintaining the balance of ecosystems. Almost two decades ago, scientists were calling for this very change - that bycatch and catch comprise one combined quota, where everything removed from the ocean is counted equally.<sup>14</sup>

In 2006, Congress amended the MSA to require fisheries to establish annual catch limits as well as accountability measures to end overfishing. NMFS required these limits and accountability measures for all fish stocks in a fishery, but did not define what it meant for a species to be considered “in a fishery” and instead gave regional Councils the discretion to decide for themselves. Unfortunately, the Councils and NMFS declared many un-managed fish as not “in the fishery” even when they are commonly captured. This means there is no limit on the bycatch of many fish and invertebrates. If species do not have a bycatch limit, fish and other species such as corals can be discarded at rates high enough to harm populations or alter entire ecosystems. This vagueness in the law allows fishermen and managers to look the other way when species such as ocean sunfish, perch, skates, crabs and other marine life are thrown back into the ocean dead and wasted.

This off-the-books catch then goes largely undocumented and unmanaged. Effective fisheries management means that fishermen must be held accountable for all catch, both targeted species and bycatch. In 2010, Oceana sued the federal government to compel NMFS to set annual catch limits for all species caught across the seven Fishery Management Plans managed by the Mid-Atlantic Fishery Management Council, not just the targeted catch in these fisheries. The government has resisted, and the courts continue to delay the decision. Fisheries managers must require enough monitoring to accurately calculate total catch within a fishery, including bycatch.

LESS THAN

# 20 PERCENT

OF EXISTING FISHERY MANAGEMENT PLANS INCLUDE

INCENTIVES FOR FISHERMEN TO MINIMIZE BYCATCH

## **CAP: ESTABLISH BYCATCH LIMITS FOR ALL PROTECTED AND DEPLETED SPECIES**

Placing a strict limit on the amount of fish that can be caught, whether landed or discarded, is essential to improving the sustainability of U.S. fisheries. The most straightforward way to limit the bycatch of a species is to set a total catch limit, or cap, that cannot be exceeded. For example, the New England Fishery Management Council has established bycatch limits for groundfish caught in the directed groundfish fishery as well as the Atlantic herring and scallop fisheries. The North Pacific Fishery Management Council has also established salmon bycatch caps in several groundfish trawl fisheries. Unfortunately, these case-by-case bycatch limits can take many years to establish, only exist in a small number of fisheries around the country and still do not always have sufficient monitoring to determine when the limits are reached. Each regional Council should take an analytical approach to identify which fisheries catch a particular stock of fish and set limits on this bycatch. Oceana has proposed this approach to the fisheries managers in New England<sup>15</sup> and the Mid-Atlantic regions<sup>16</sup> and continues to work toward this goal around the country.

In the Alaska groundfish fisheries, halibut and salmon are prohibited species that cannot be targeted or brought to port, and they are managed with a bycatch limit in trawl fisheries targeting pollock, sole, flounder and cod. If fishermen exceed the bycatch limits, they risk prematurely ending their season. In 2012, the North Pacific Fishery Management Council voted to reduce the halibut bycatch quota by 15 percent in the Gulf of Alaska trawl fishery, bringing the limit to approximately 4 million pounds. However, implementing this change took two years, showing that progress is often slow.

While bycatch limits have been shown to effectively reduce the catch of specific species in particular fisheries, they must be implemented more extensively throughout the U.S. Bycatch limits must be in place for fish species listed under the Endangered Species Act (ESA), such as Pacific eulachon and Atlantic sturgeon. Additionally, since many species are caught in more than one fishery, comprehensive bycatch limits should span all fisheries in a region, regardless of the species they target. These holistic bycatch limits are the best way to manage depleted species such as Atlantic cod, Atlantic wolffish, butterfish

and flounder. Bycatch limits are also essential for fish that are critical links within the food web, such as herrings, sand lance and smelts. Once science-based limits are established, adequate monitoring must be employed to ensure that limits are not exceeded.

## **Few Limits Exist For Sea Turtles And Marine Mammal Bycatch**

Strict limits are needed to control and minimize the catch of vulnerable marine mammals, sea turtles and seabirds, similar to those for fish. Many of these animals are listed as threatened or endangered under the ESA and therefore need strong protections against the harmful impacts of commercial and recreational fishing to ensure their continued survival and ultimate recovery.

For example, sea turtle mortality in the Hawaii-based pelagic longline fishery is governed by such a bycatch limit. North Pacific loggerheads are captured and killed in the fishery, putting a species whose population has declined by 50–90 percent during the last 50 years at risk.<sup>17</sup> Unfortunately, despite compelling evidence of continued decline, NMFS raised the bycatch limit in 2012, effectively doubling the number of sea turtles allowed to be killed. As a result, conservation groups have sued to defend the limits in court. NMFS must act according to the best and most recent scientific evidence to protect sea turtles and ensure their recovery.

More recently in 2013, NMFS set a bycatch limit of one sperm whale in the drift gillnet fishery that targets swordfish off California, and the rules require 100 percent observer coverage for boats fishing with drift gillnet gear in areas frequented by sperm whales. Establishing scientific and enforceable bycatch limits like these, which require fishing to stop for the remainder of the season if and when these limits are reached, is essential for all marine wildlife.

## **Some Sharks Are Overfished Because Of Bycatch**

Sharks are top predators that play a crucial role in maintaining healthy and balanced marine ecosystems. Yet they are also extremely vulnerable to overexploitation and continue to be caught in large numbers in U.S. and international fisheries. Fishermen captured 12 million sharks and rays as bycatch each year throughout the 1990s





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in international waters alone.<sup>18</sup> Researchers recently estimated that as many as 100 million sharks are still caught and killed each year around the world due to bycatch, illegal fishing and the persistent demand for shark fins.<sup>19</sup> Prohibiting certain highly depleted shark species from being landed in the U.S. is one way to minimize bycatch mortality, because such prohibited species must be released back into the water if they are still alive when caught.

### Dusky Sharks

Dusky shark populations off the Atlantic coast are estimated to have plummeted by 98 percent during the last 40 years.<sup>20</sup> Although NMFS designated dusky sharks as “prohibited” in 2000 (meaning the species cannot be targeted or brought to port), fishermen are still overfishing this depleted population and the number of deaths are still too high for the population to begin to recover – solely due to bycatch. In order to end overfishing as required by law, NMFS proposed to close designated areas to pelagic longlining in the Atlantic. Despite strong support from conservation groups and scientists alike, NMFS withdrew their proposal after complaints from fishermen.

Even when a species cannot be intentionally caught, separate measures must be in place to minimize bycatch across different fisheries and regions. In 2010, more than 3,400 dusky sharks were captured as bycatch in just two bottom longline fisheries in the south Atlantic and Gulf of Mexico.<sup>7</sup> To ensure sustainable fisheries management and the recovery of overfished sharks, NMFS must establish and adequately monitor bycatch limits that result in the end of the fishing season if exceeded.

### Scalloped Hammerhead Sharks

Scalloped hammerheads are highly vulnerable to fishing mortality based on their uniquely shaped and sensitive bodies. Approximately 90 percent of scalloped hammerheads die after being released from fishing gear even when fishermen follow safe handling protocols.<sup>21</sup> This high rate of “post-release” mortality shows that significant numbers of these sharks die even after annual catch quotas have been reached and that the species needs greater protection. In 2011, NMFS officially announced that the scalloped hammerhead was overfished, almost 10 years after researchers established that populations in the northwest Atlantic had been decimated by 90 percent.<sup>22</sup> In 2013, scalloped hammerheads were recognized as needing special protections under the Convention on International Trade in Endangered Species. However, NMFS not only failed to list the U.S. populations under the ESA but also continues to allow fishermen to directly target them, with a quota exceeding 100,000 pounds in 2013.<sup>23</sup> This quota accounts for bycatch within the target fishery, but does not include the thousands killed each year in trawls and bottom longlines in the Atlantic and Gulf of Mexico.

Unfortunately, too many species of sharks are still caught at an unsustainable rate, further depleting vulnerable populations and hindering recovery. Longline fisheries catch sharks instead of the intended target at least 20 percent of the time, with some estimates as high as 50 percent for Atlantic and Hawaiian fisheries.<sup>24,25</sup> The continued depletion of shark species in the U.S. and around the world highlights the importance of stronger regulations to minimize bycatch.

RESEARCHERS ESTIMATE AS MANY AS

# 100 MILLION SHARKS

ARE KILLED AROUND THE WORLD EVERY YEAR

## CONTROL: AVOID BYCATCH AND MINIMIZE MORTALITY

### Use Turtle Excluder Devices

All sea turtle species that swim in U.S. waters are listed as threatened or endangered under the ESA, and they are all often harmed during fishing activities. Wherever sea turtles feed, rest and mate, they must also navigate the dangers of gillnets, longline hooks and especially trawl nets that scoop up everything in their path.

Although trawling is one of the most destructive, non-selective ways to fish, providing an escape for turtles once they are caught dramatically reduces the numbers that drown in the end of the net. Turtle Excluder Devices (TEDs) provide this escape through an opening in the back of the net, and when installed correctly, may reduce sea turtle deaths by 97 percent.<sup>26</sup> However, requiring even such a promising fix has been laden with controversy. When TEDs were first in use, researchers realized they were too small for many adult turtles to fit through. In 2003, Oceana and others persuaded NMFS to require larger TEDs so adult turtles could successfully escape shrimp nets.

Even though sea turtles are listed under the ESA, federal fisheries managers continue to authorize shrimp trawlers in the Gulf of Mexico to kill more than 50,000 sea turtles each year<sup>27</sup> under the presumption that all fishermen comply with legal requirements. In 2011, Oceana released a report revealing that only 21 percent of fishermen were using TEDs correctly.<sup>28</sup> Shrimp fishermen using skimmer trawls in shallower waters are exempt from using TEDs under the presumption that they will protect sea turtles from drowning by limiting the time their nets are towed through the water.

However, observer data revealed that only 35 percent of fishermen complied with required tow time limits in 2012, with one in five tows exceeding 70 minutes,<sup>29</sup> far longer than the 55-minute limit and the amount of time sea turtles can hold their breath.

This evidence indicates that significantly more sea turtles than previously thought have been dying each year because NMFS does not have the capacity to monitor and enforce its own regulations. Despite this noncompliance, in 2013, NMFS withdrew a proposal to require TEDs in skimmer trawls in the Gulf of Mexico and southeast Atlantic, a decision that will likely lead to thousands of sea turtle deaths for each year of inaction.<sup>27</sup> Because there is only minimal observer coverage onboard these shrimp trawls, if any, it is impossible to know the real number of sea turtles that are killed each year when TEDs are not used properly or trawls tow for longer than allowed.

### Modify Destructive Gear Or Transition To Selective Gears

The fishing industry has had some success in improving the selectivity and efficiency of its catch by making changes to the gear they use. Fishermen have modified the shape and size of hooks, switched bait, changed the depth of a net or attached deterrents onto gillnets, all with varied success. Changes such as these can go a long way toward minimizing bycatch. For example, transitioning to using circle hooks and fish bait may have reduced bycatch of sea turtles, sharks and bluefin tuna by approximately 30 percent.<sup>30</sup> Additionally, in 2011, after years of Oceana advocacy, New England sea scallop fishermen developed a new type of dredge that included deflector panels and

.....  
**HOW MANY IS 50,000? THAT IS ALMOST**

# 150 TURTLES CAPTURED PER DAY

.....



other components to minimize the number of sea turtles caught and crushed by the heavy steel gear.

Even after modifications to address specific bycatch concerns, some fishing gears still result in excessive levels of bycatch. Instead of waiting for researchers to develop and test small changes that might reduce bycatch, fishermen can and should transition to alternative gears that have already been proven to have fewer detrimental impacts. For example, in 2003, the California Fish and Game Commission banned the use of bottom trawls to catch spot prawns in southern California. This fishery had previously discarded 17 pounds of fish (many of them severely depleted rockfish) for every 1 pound they kept.<sup>31</sup> After the ruling, fishermen transitioned to using traps instead, a move that dramatically reduced bycatch and improved the market value of the spot prawns they sell.

Every year that NMFS does not encourage and facilitate these gear transitions is a waste of precious time and ocean resources. For example, traps and pots could be used to catch cod rather than bottom trawls, and harpoons could be used to catch swordfish instead of drift gillnets. Green stick

gear, a newer method of fishing for tuna, involves towing fishing lines through the water rather than setting miles of longlines out to soak. This method allows fishermen to retrieve the catch much more quickly and has significantly less bycatch.

### Use Innovative And Adaptive Management To Avoid And Reduce Bycatch

Bycatch limits show great potential for eliminating harmful fishing when combined with other management and technological solutions. Where bycatch limits have been established, fishermen are motivated to reduce their bycatch in order to keep fishing. In what is called a catch share program, individual fishermen can be allocated a portion of the fishery's annual quota and can also receive a portion of the bycatch quota. Under this framework, fishermen are held accountable for their own bycatch and can use their knowledge and experience to avoid hotspots and minimize their impact. However, such a system requires extensive monitoring to ensure these limits are not exceeded. Another tactic employed largely in Alaska, termed "Bycatch Avoidance," involves fishing during specific times of day, in certain water depths, or in geographic



## GULF SHRIMP TRAWL FISHERMEN HAVE SOME OF THE HIGHEST DISCARD RATES OF ALL U.S. FISHERIES

© S.McGowan | AMC 2008/Marine Photobank

areas where bycatch is less likely to occur. This tactic can minimize bycatch and maximize fishing opportunities. For example, pollock trawl companies have implemented an electronic monitoring system using real-time reporting from other fishermen in a cooperative effort to avoid bycatch hotspots. In order to comply with bycatch limits, Alaska trawl fishermen report where and when they encounter the most salmon each day so that the information can be circulated to the entire fleet and others can avoid these hotspots.<sup>32</sup> This approach keeps the fleet fishing longer and saves salmon, representing hundreds of thousands of dollars in economic value. These fisheries have also experimented with the use of oceanographic indicators to avoid hotspots entirely and have found that ocean temperature may be useful in predicting when and where salmon will likely gather.<sup>33</sup>

This type of real-time monitoring has yet to be implemented in most fisheries across the U.S., though others are beginning to catch on. In 2013, New England scallop fishermen, in conjunction with the University of Massachusetts, developed a similar technique to avoid catching yellowtail flounder, which dramatically reduced bycatch and allowed the fleet to maintain access

to lucrative fishing grounds. Fishermen report bycatch through the program, which in turn disseminates near real-time information so the entire fleet can avoid bycatch hotspots.

In addition to using real-time reporting, bycatch can also be minimized by implementing fishing restrictions that apply only to specific areas or seasons during the year. This concept, known as “Time and Area Management,” is often based on the seasonal behaviors of protected species and other marine wildlife. Time and area closures can be designed to ensure that the fishery stays below an established bycatch limit, thereby giving depleted species a chance to rebuild, minimizing the capture of young animals or adults preparing to spawn, and protecting valuable seafloor habitat.

Seasonal and spatial management measures have proven successful in many situations and this tool should be more widely adopted. For example, in the Gulf of Mexico and Atlantic regions, sea turtle, bluefin tuna and marine mammal bycatch could be reduced if fisheries were seasonally restricted based on known mating, foraging and migratory patterns of common bycatch species.

# REDUCING HARMFUL AND WASTEFUL FISHING IN THE US

## NINE OF THE WORST BYCATCH FISHERIES

In order to eliminate harmful and wasteful fishing practices, fisheries managers must develop regulations and national policies to count, cap and control bycatch. However, sometimes it can be difficult to determine which fisheries and bycatch problems are the most pressing and therefore warrant immediate attention. Oceana has identified nine fisheries that have some of the worst bycatch in the U.S., based on the amount and rate of discarded fish, the number of protected species that are harmed, and other criteria as described further below. Not only do these nine fisheries injure and kill thousands of protected and endangered species every year, but they are responsible for more than 50 percent of reported bycatch in the U.S., and yet bring in just 7 percent of U.S. landings.

Because bycatch takes on many different forms and occurs across diverse fisheries, it is important to evaluate its severity using several criteria, as a single criterion alone does not tell the whole story. For example, a fishery may have a low discard rate, but it might still be harming protected species, depleting long-lived populations, irreversibly altering the food web, or throwing away staggering amounts of fish. Criteria used to evaluate fisheries in this report included:

- How many pounds are discarded?
- What is the relative rate at which fish are discarded compared to how many are kept?
- How many protected species are entangled or killed?
- What types of fish are discarded (high market value, prohibited, overfished, etc.)?
- What are the ecosystem-level impacts of bycatch?

As mentioned above, many bycatch statistics are highly uncertain and often outdated, but we have used the best publicly available data. In this report, we compiled and assessed data from the 2014 *National Bycatch Report*<sup>7</sup> because it facilitates comparative analysis between fisheries and notes the composition of bycatch species, unlike many other stand-alone government or Council reports. Where more recent information was available, comparisons showed that entanglement and discarding have not significantly changed over time in the worst bycatch fisheries.

## GLOBAL DISCARDS BY GEAR TYPE

TRAWLS: 78%

LOONGLINES: 13%

GILLNETS: 1%

OTHER: 8%

Bottom trawls account for 50 percent of global marine fishery production but almost 80 percent of global discards, the majority coming from just 19 trawl fleets.

Shrimp trawlers in Indonesia, Australia, and Trinidad were discarding 10-15 pounds of fish for every 1 pound of shrimp they kept in the early 1990s.

More recently in the early 2000s, shrimp trawls in the Mediterranean Sea were still discarding approximately 6 pounds of fish for every pound of shrimp they kept.

Identifying the worst bycatch fisheries is essential for guiding conservation and management priorities. In addition to quantitative data, our analysis also relied on personal communications with fishermen and best professional judgment because (1) not all criteria could be evaluated across all fisheries due to information gaps, (2) not all criteria could be evaluated equally across all fisheries because each fishery has a unique target catch, gear type and region, and (3) each of the criteria could be weighted differently depending on priority issues.

## NINE DIRTY FISHERIES: HARMFUL GEARS

Though some fishing methods are more harmful than others, researchers, fisheries managers and conservationists all agree that bycatch is highest in trawl, longline and gillnet fisheries.<sup>34</sup> The nine fisheries that account for more than half of the nation's reported bycatch all use these harmful gear types, as described below.

### TRAWL FISHERIES: BULLDOZING THE OCEANS

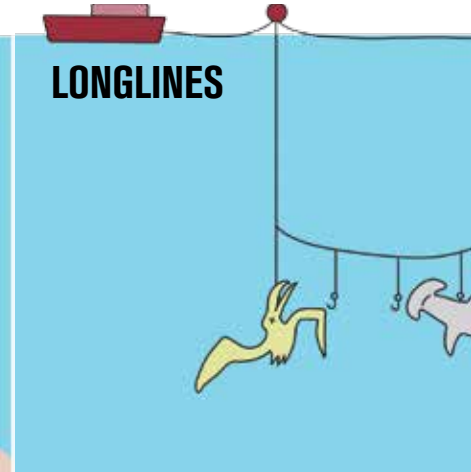
Trawling is one of the most harmful methods of fishing because enormous nets are dragged across the seafloor or through the water and capture almost everything in their path, while damaging vulnerable habitat. Shrimp trawls,

not even among the largest, can be 160 feet wide, which is approximately the same width as a football field.<sup>35</sup> And it is not just the industrial-sized trawls that are a problem. Every year, trawls drag nets over an average of six million square miles, impacting an area equivalent to twice the size of the entire U.S.<sup>36</sup> In the U.S., trawlers targeting sole in the Gulf of Alaska discarded more than half of their catch,<sup>6</sup> and trawlers in the Gulf of Mexico have discarded as much as 4-10 pounds of bycatch per 1 pound of marketable shrimp they bring to port.<sup>5,6</sup>

*Most fish that are targeted by trawls can be fished using other, more selective methods.*

### LONGLINE FISHERIES: THOUSANDS OF HOOKS

Longline fishermen use lines that can extend for up to 50 miles, with thousands of baited hooks branching off from the main line.<sup>37</sup> Longlines can be used either along the seafloor to catch cod, rockfish, groupers and other flatfish, or in open water to catch larger fish such as tuna, swordfish and sharks. Unfortunately, the baited hooks that can be left to "soak" attract a vast array of species that are not intentionally targeted by fishermen, including diving birds. If an animal becomes hooked, it is often seriously injured or dead by the time the gear is retrieved. In the U.S., there are 20 different longline fisheries, with many discarding more fish than they keep.<sup>6</sup> If the 94 vessels targeting migratory fish in the Atlantic



Illustrations © Sylvia Liu



# WORST IN FISH DISCARDS

FISHERY	TARGET FISH	DISCARD RATE
Snapper-grouper longline	Snapper, grouper	66%*
California set gillnet <sup>+</sup>	Halibut	65%*
Southeast shrimp trawl	Brown, pink, white shrimp	64%
California drift gillnet <sup>+</sup>	Swordfish, thresher sharks	63%*
Gulf of Alaska flatfish trawl	Flounder, sole	35%
Northeast bottom trawl	Groundfish, whiting	35%
Mid-Atlantic bottom trawl	Scup, flounder, sea bass	33%
Atlantic HMS longline	Swordfish, tuna	23%
New England/Mid-Atlantic gillnet	Monkfish, groundfish, skates	16%

Table 1. Nine of the worst bycatch fisheries in the U.S., with discard rates based on the 2014 NMFS *National Bycatch Report* unless otherwise noted. The discard rate for fisheries with multiple sectors or gear types represent averages. \*Discard rate was calculated from number of individual fish as opposed to weight. <sup>+</sup>Bycatch estimates for the two Pacific fisheries were derived from recent observer data.

and Gulf of Mexico stretched out their 45-mile longlines, the combined length would stretch from Miami to London, which does not even include the branching lines that actually attach to the hooks.

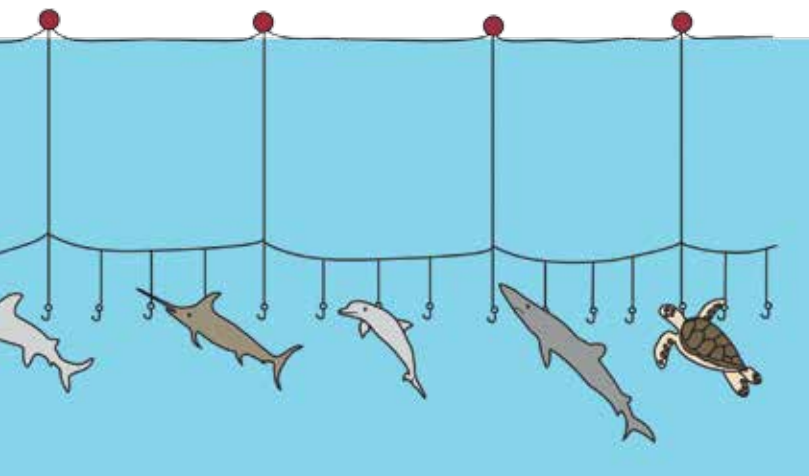
*Using harpoons, handlines, greenstick or buoy gear instead of longlines is proven to reduce bycatch and improve fishing efficiency.*

### GILLNET FISHERIES: WALLS OF DEATH

Gillnets are walls of netting drifting (“drift” gillnets) or anchored (“set” gillnets) in the water, designed so that fish get stuck around their gills when they try to swim through.

The netting can be up to two miles long and anchored hundreds of feet deep or left floating at the surface.<sup>38,39</sup> Drift gillnets more than one mile long are so harmful to the marine environment that they have been banned on the high seas by the United Nations and by many other countries. In the U.S., only six states have fully banned drift and set gillnets within state waters. Despite these bans and closures, 38 U.S. fisheries still use drift or set gillnets.<sup>40</sup>

*Though researchers work to develop ways of helping marine wildlife to avoid becoming entangled in gillnets, this gear should be banned.*

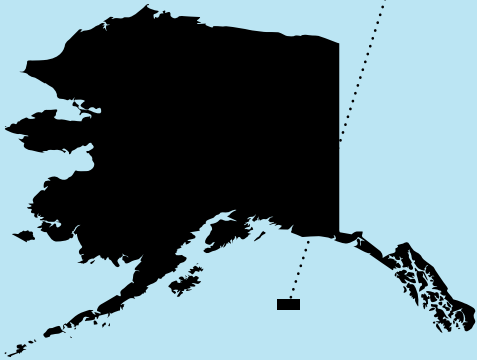


# NINE OF THE DIRTIEST US FISHERIES

## GULF OF ALASKA FLATFISH TRAWL FISHERY

**35%**  
DISCARDED

- More than 34 million pounds of fish are thrown overboard in one year, including 2 million pounds of halibut and 5 million pounds of cod



## CALIFORNIA SET GILLNET FISHERY

**65%**  
DISCARDED

- More than 30,000 sharks and rays as well as valuable fish were discarded as waste over three years

## CALIFORNIA DRIFT GILLNET FISHERY

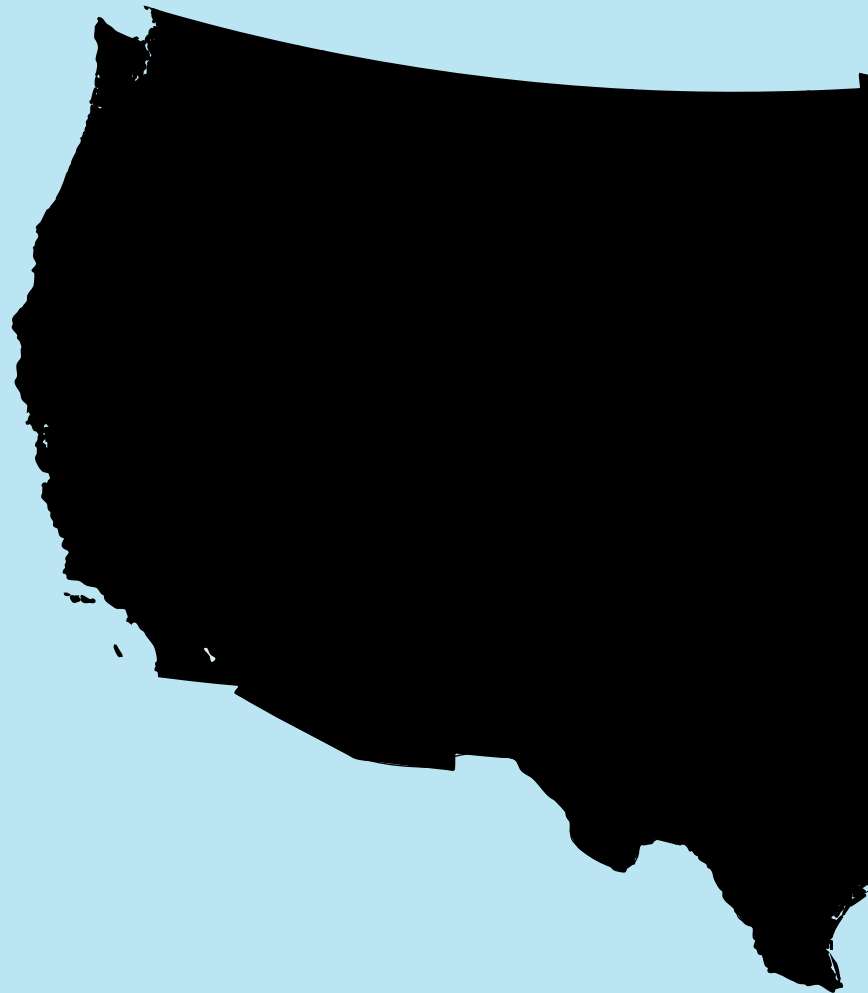
**63%**  
DISCARDED

- Almost 550 marine mammals were entangled or killed over five years

## SOUTHEAST SHRIMP TRAWL FISHERY

**64%**  
DISCARDED

- Thousands of turtles are killed annually
- For every pound of shrimp landed, 1 pound of finfish is discarded





## NORTHEAST BOTTOM TRAWL FISHERY

**35%**  
DISCARDED

- More than 50 million pounds of fish are thrown overboard every year

## NEW ENGLAND & MID-ATLANTIC GILLNET FISHERY

**16%**  
DISCARDED

- More than 1,200 endangered sturgeon were captured in one year
- More than 2,000 dolphins, porpoises and seals were captured in one year

## MID-ATLANTIC BOTTOM TRAWL FISHERY

**33%**  
DISCARDED

- Almost 200 marine mammals and 350 sea turtles were captured or killed in one year

## ATLANTIC HIGHLY MIGRATORY SPECIES LONGLINE FISHERY

**23%**  
DISCARDED

- More than 75 percent of the wasted fish are highly valuable tuna, swordfish and other billfish

## SOUTHEAST SNAPPER- GROUPEL LONGLINE FISHERY

**66%**  
DISCARDED

- More than 400,000 sharks were captured and discarded in one year

Numbers in yellow represent the percent of total catch discarded.

Data compiled from the 2014 NMFS National Bycatch Report unless otherwise noted. Bycatch estimates for the two Pacific fisheries were derived from recent observer data. See full report for complete citations.



# SOUTHEAST SNAPPER-GROUPER LONGLINE FISHERY

# 66%

## DISCARDED

## PROBLEMS

Scattered fishermen on smaller vessels are difficult to monitor.

Bottom longlines catch significant numbers of small snappers and groupers that are too young to sell but are killed when brought to the surface.

Although the abundance and fishing mortality of most targeted fish remain unknown, overfishing likely continues.

Recreational fishermen have significant impacts on populations, yet data collection requirements are inadequate.

Approximately 1,000 fishermen in the Gulf of Mexico and South Atlantic catch snappers and groupers using bottom longline gear. Very little is known about catch and bycatch in this fishery, and observer coverage remains at less than 1 percent of fishing effort. What is known is that the fishery discarded more than 400,000 sharks in 2010, many of which may not have survived after being released from hooks. Seven out of the eight targeted species in this fishery are still being overfished in the South Atlantic, and bycatch estimates remain unknown.

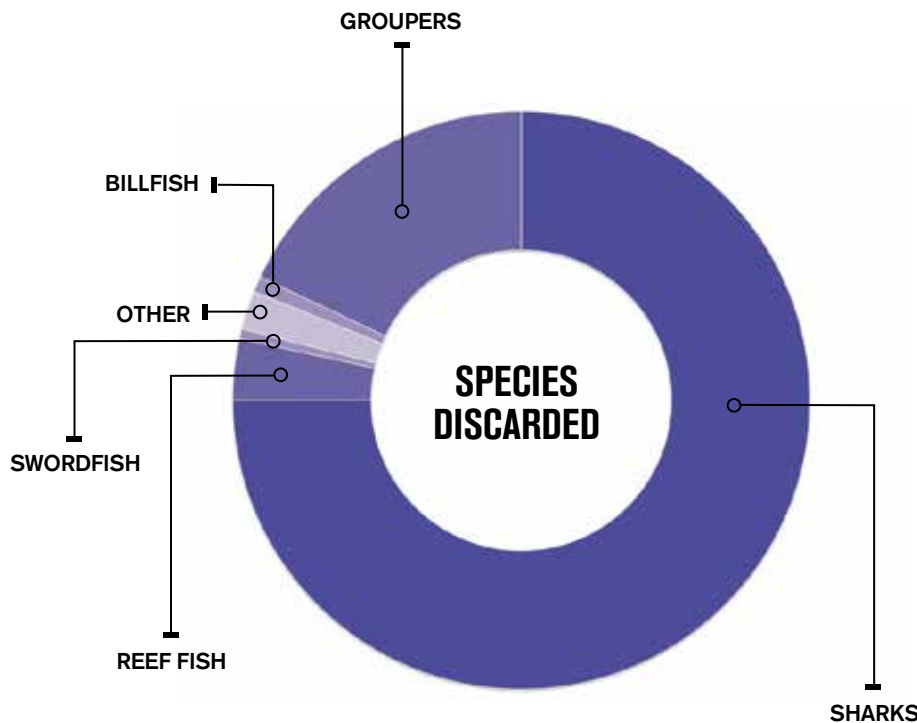
## SOLUTIONS

Implement a ban on discarding fish that encourages quota-sharing, and fishing in times and places where fewer juvenile snappers, groupers and other finfish would likely be caught.

Avoid catching sea turtles, sharks and juvenile fish by reporting bycatch hotspots in real-time and disseminating this information across the fleet for effective time-area management.

Improve stock assessments so that all fishing mortality can be compared to known abundance and ecological characteristics of snapper and grouper populations to ensure that overfishing due to bycatch does not occur.

6,400,000 LBS DISCARDED



YEARLY NUMBERS

**VESSELS:** Approx. 1,000<sup>41</sup>

**OBSERVER COVERAGE:** 1%<sup>41</sup>

**DISCARDS:** 850,000 fish<sup>7</sup> (66% of total catch)

**SEA TURTLES:** No comprehensive estimate, but likely significant mortalities

**OVERFISHING** is still occurring with many stocks still unassessed

**VALUE OF FISHERY:** \$13.8 million<sup>41</sup>



# CALIFORNIA SET GILLNET FISHERY

# 65%

## DISCARDED

Off the coast of southern California, fishermen use anchored or “set” gillnets to target California halibut, angel shark and white sea bass. These bottom-set gillnets entangle and kill thousands of marine mammals, sharks and turtles every year. In 1994, gillnets were banned in nearshore waters off Southern California, yet they are still allowed in federal waters. In 2002, this fishery captured and killed so many harbor porpoises around Monterey Bay that using set gillnets was prohibited in nearshore waters less than 360 feet deep, effectively eliminating the fishery in central California. This fishery is the primary known threat to the dangerously low population of great white sharks off the U.S. Pacific coast. Recently, fishermen voluntarily reported 94 captured white shark pups during a five-year period, almost half of which were already dead.<sup>42</sup> Fishing occurs year-round, though the primary season is during the summer months, when many newborn marine mammals and sharks are just learning to navigate the threats of their marine environment.

## PROBLEMS

The fishery catches significant numbers of depleted, long-lived fish like giant sea bass as well as a wide array of vulnerable sharks and rays.

There are too few fisheries observers to accurately estimate this unabated bycatch.

Gillnets are so harmful that they have been banned in certain areas of California state waters, though they continue to be used offshore in Southern California.

The fishery occurs in the heart of a primary nursery ground for great white sharks and many other shark species.<sup>46</sup>

There are no bycatch caps in place for any species caught in this fishery.

## SOLUTIONS

Establish and enforce catch and bycatch limits for all species that are captured in these gillnets, starting with great white sharks.

Allocate sufficient observers to accurately and precisely estimate bycatch.

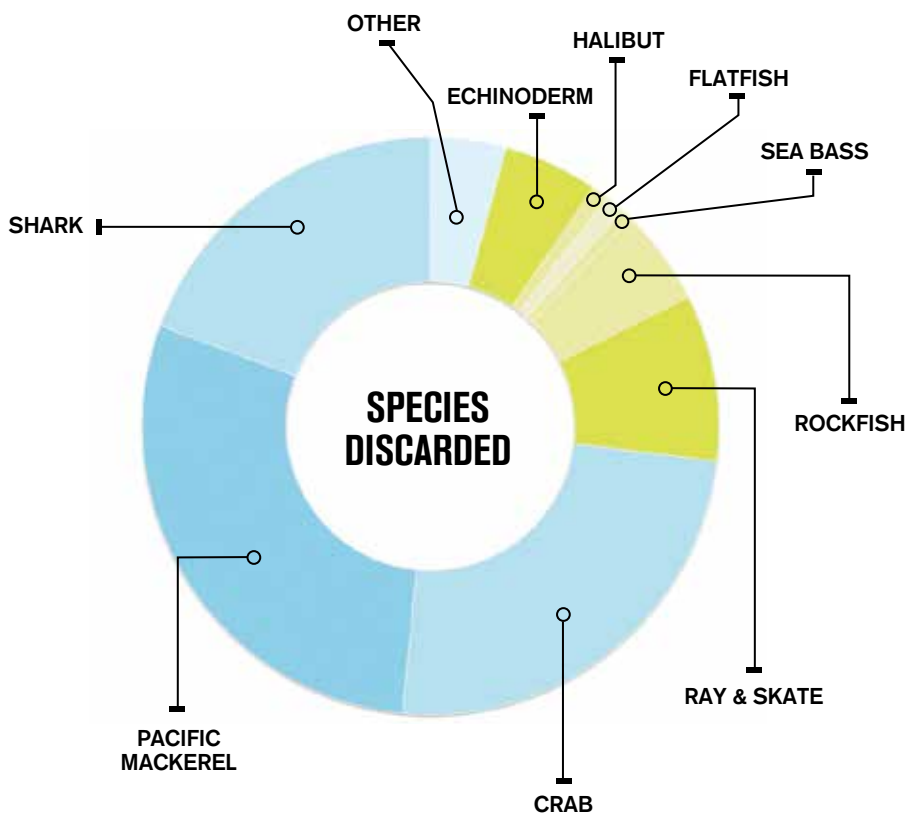
Convert additional effort to hook and line gears that are shown to catch target species with substantially lower bycatch.

Prohibit set gillnets from operating in times and areas where marine mammals, great white sharks, seabirds and other sensitive marine life are present.

Establish maximum soak times to reduce the mortality of animals caught in gillnets.

Designate great white sharks as endangered or threatened under the Endangered Species Act.

49,300 FISH DISCARDED



YEARLY NUMBERS

**VESSELS:** 42<sup>43</sup>

During 3 years (2007, 2010 and 2011), the fishery discarded an estimated 65% of all animals caught, including:<sup>44</sup>

- 470 seals and sea lions and 241 seabirds
- More than 12,000 sharks and rays and 18,000 other vulnerable fish

**OBSERVER COVERAGE:** 12–18%<sup>43</sup>

**VALUE OF FISHERY:** \$450 thousand<sup>45</sup>



# SOUTHEAST SHRIMP TRAWL FISHERY

# 64%

## DISCARDED

## PROBLEMS

Nets as wide as a football field used to target shrimp also catch millions of pounds of sharks and other reef fish such as snappers and groupers.

Commercially and recreationally valuable juvenile reef fish and sharks are discarded and then are not available to fishermen who actually target them in the area.

Observer coverage has historically been low or nonexistent, making it impossible to accurately document what is caught and discarded.

Fishing vessels using skimmer trawls are required to limit their tow time to minimize injury and mortality of sea turtles because they have resisted using Turtle Excluder Devices. Unfortunately, they often do not comply with those time limits.

Fishermen who are required to use Turtle Excluder Devices frequently install them incorrectly or intentionally tie them shut, leading the government to underestimate the number of sea turtles killed each year.

In 2012, the National Marine Fisheries Service estimated that up to 50,000 sea turtles could be killed annually in southeast shrimp trawls.

## SOLUTIONS

Require and enforce the use of Turtle Excluder Devices and other Bycatch Reduction Devices in all types of trawls.

Use electronic monitoring to supplement onboard observers to derive accurate and precise bycatch estimates that include sea turtles, sharks and valuable fish that are discarded or injured.

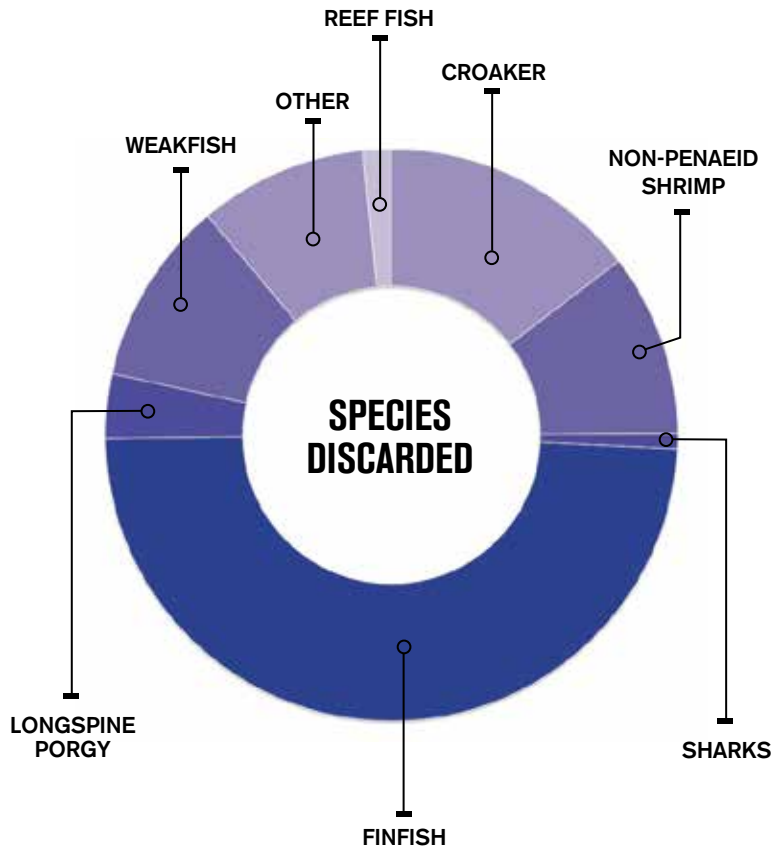
Examine the feasibility of banning discards to encourage fishermen to use more selective gear and fish in specific times and areas where bycatch is less likely to occur.

Avoid catching threatened and endangered sea turtles, marine mammals and valuable fish by reporting bycatch hotspots in real-time and disseminating this information across the fleet.

Implement strict limits on the number of threatened and endangered sea turtles, fish and marine mammals that can be harmed and killed by the fishery.

Trawlers fishing in the Gulf of Mexico and South Atlantic for brown and pink shrimp have some of the highest discard rates of all U.S. fisheries. Vessels skim nets along the water's surface or tow heavy trawl nets along the seafloor. Despite the known impacts of this fishery, the National Marine Fisheries Service continues to allow fishermen to injure tens of thousands of sea turtles and discard more pounds of fish than the pounds of shrimp they keep. Turtle Excluder Devices have been used in this fishery for many years to reduce the number of captured and killed sea turtles, but their effectiveness is limited because they are frequently used improperly. Although this fishery is one of the most lucrative in the U.S., catch and income have declined in recent years.

229,200,000 LBS DISCARDED



YEARLY NUMBERS

**VESSELS:** 2,800 large and 8,000 small<sup>27</sup>

**DISCARDS:** 229 million lbs. (64% of total catch)<sup>7</sup>

**SEA TURTLES:** 50,000 mortalities<sup>27</sup>

**OBSERVER COVERAGE:** Less than 1%

**VALUE OF FISHERY:** \$314 million<sup>47</sup>



# CALIFORNIA DRIFT GILLNET FISHERY

# 63%

## DISCARDED

Off the coast of California, fishermen use drift gillnets to catch swordfish and thresher sharks. Nets extending a mile in length are left out overnight to drift and catch large oceanic fish. When the large nets are hauled back the next morning, a wide array of amazing sea creatures are tangled in the nets. Air-breathers such as sea turtles and marine mammals usually drown or are so entangled that they become fatally injured. In 2010, an estimated 49 dolphins and 16 endangered sperm whales were seriously injured and killed in this fishery. Worst of all, these numbers could be underestimates because observers cover less than 20 percent of the total fishing effort and almost half the boats are never observed at all. During the past five years, Oceana helped stop multiple proposals to allow driftnets into closed areas established to protect leatherback sea turtles and compelled the National Marine Fisheries Service to implement emergency regulations, including a strict bycatch limit of one sperm whale.

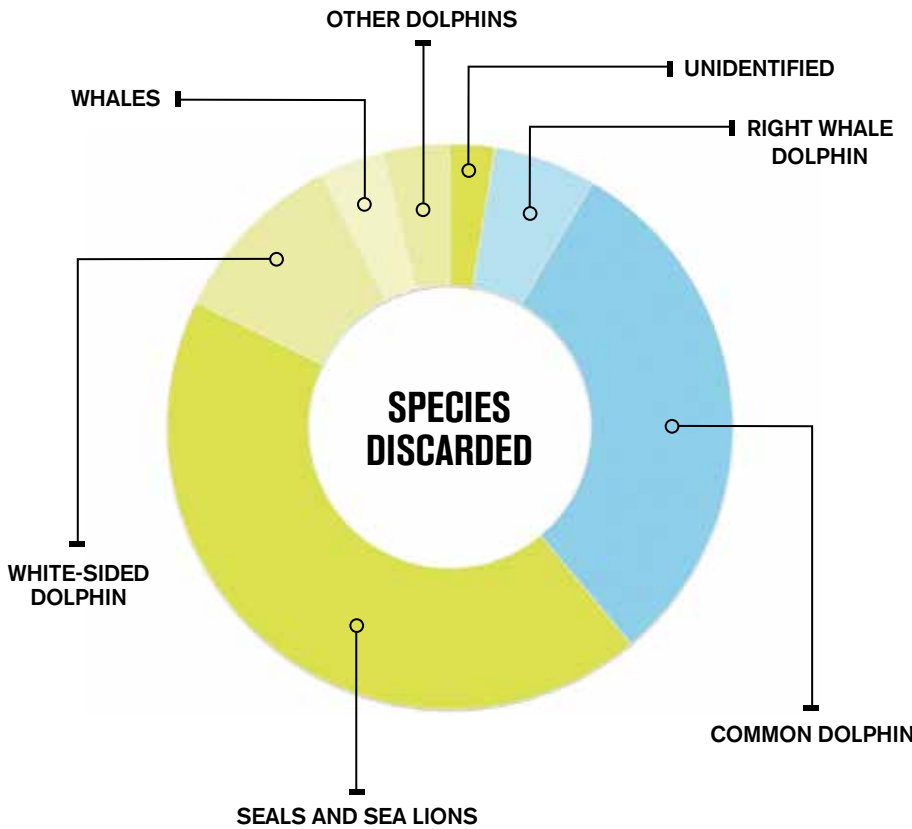
## PROBLEMS

Drift gillnets entangle and kill dozens of marine species that journey to the California Current from across the Pacific, including dolphins, whales, sea lions, sharks and sea turtles.

There are too few fisheries observers to accurately estimate this unabated bycatch.

In the last five years, drift gillnets have entangled humpback whales, gray whales, minke whales, sperm whales and hundreds of dolphins, seals and sea lions. On average, this fishery kills more than 100 marine mammals per year.

550 MARINE MAMMALS CAPTURED



## SOLUTIONS

Immediately start phasing out the use of drift gillnets.

Replace gillnets with cleaner gears such as harpoons, which have zero bycatch, and also consider other, more selective alternatives.

Until drift gillnets are phased out, institute hard bycatch caps on all captured marine life and enforce it through 100 percent observer coverage.

YEARLY NUMBERS

**VESSELS:** 16<sup>48</sup>

Over five years (2008-2012) the fishery discarded **63%** of all animals caught, including:<sup>44</sup>

- More than 39,000 common molas and hundreds of billfish
- More than 6,000 sharks (45% of all caught)
- 290 dolphins, 237 seals and sea lions and 21 whales
- 8 leatherback sea turtles

**OBSERVER COVERAGE:** Approx. 15%<sup>48</sup>

**VALUE OF FISHERY:** \$1.1 million<sup>48</sup>



# NORTHEAST BOTTOM TRAWL FISHERY

# 35%

## DISCARDED

Some of the most iconic Atlantic fish are caught using bottom trawls in New England waters. Each year, fishermen sail to the Gulf of Maine and Georges Bank to catch Atlantic halibut, haddock, cod, yellowtail flounder, whiting and other fish. However, many of these important fish have declined significantly in recent decades due to years of unabated overfishing and ineffective management, requiring the National Marine Fisheries Service to reduce fishing quotas in hopes that the stocks will begin to rebound. Some overfished and depleted species are completely prohibited from being brought to port and sold, such as Atlantic wolffish. This prohibition means that fishermen must throw them back overboard if they are caught as bycatch—often dead and sometimes uncounted. Common dolphins, bottlenose dolphins, harbor porpoises, harbor seals, pilot whales and gray seals have all been captured in large numbers by New England bottom trawls.

## PROBLEMS

Trawls are so large and indiscriminate that fishermen cannot selectively target healthier species while avoiding the depleted ones.

Oceana has worked to increase observer coverage in New England to 22 percent in 2013, still far below levels recommended by the best available science.

Too many sea turtles are injured and killed because bycatch is assessed in each fishery separately without acknowledging the total number that are caught across all combined fisheries in a given region.

Shrinking quotas encourage and even require many marketable fish to be discarded instead of being brought to port, an approach that does not conserve fish or benefit fishermen.

Millions of skates are treated as trash and discarded at such high catch levels that it will likely change the population and the ecosystem.

## SOLUTIONS

Allocate sufficient observers to accurately and precisely estimate bycatch for each species.

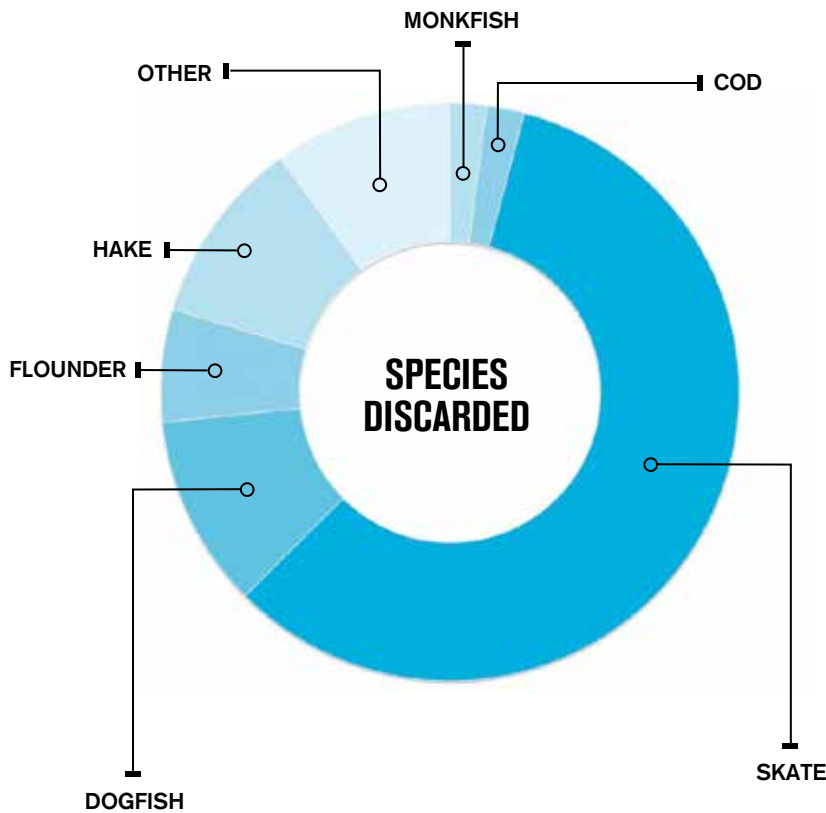
Develop initiatives and incentives to reduce bycatch, including spatial management and gear modifications.

Conserve habitat for juvenile fish to bolster the recovery of depleted stocks and minimize bycatch.

Ensure adequate observer coverage to enforce in-season management measures.

Implement a pilot program that uses video monitoring to enforce requirements to retain all marketable fish.

50,000,000 LBS DISCARDED



YEARLY NUMBERS

**VESSELS:** 800<sup>49</sup>

**DISCARDS:** 50 million lbs. (35% of total catch)<sup>7</sup>

**MARINE MAMMALS:** 180 mortalities<sup>7</sup>

**OBSERVER COVERAGE:** 22%<sup>50</sup>

**33%** of targeted species are overfished<sup>51</sup>

**VALUE OF FISHERY:** \$90 million<sup>52</sup>





# GULF OF ALASKA FLATFISH TRAWL FISHERY

# 35%

DISCARDED

## PROBLEMS

Observer coverage is inadequate for generating accurate bycatch estimates.

Nonselective trawls catch everything in their paths and destroy sensitive habitat.

Catch limits do not account for the fish needed to support other animals in the food web.

Trawls kill commercially valuable, depleted species that are prohibited from being landed.

## SOLUTIONS

Establish precautionary bycatch caps for all species captured in the fishery, not just the ones that are being targeted.

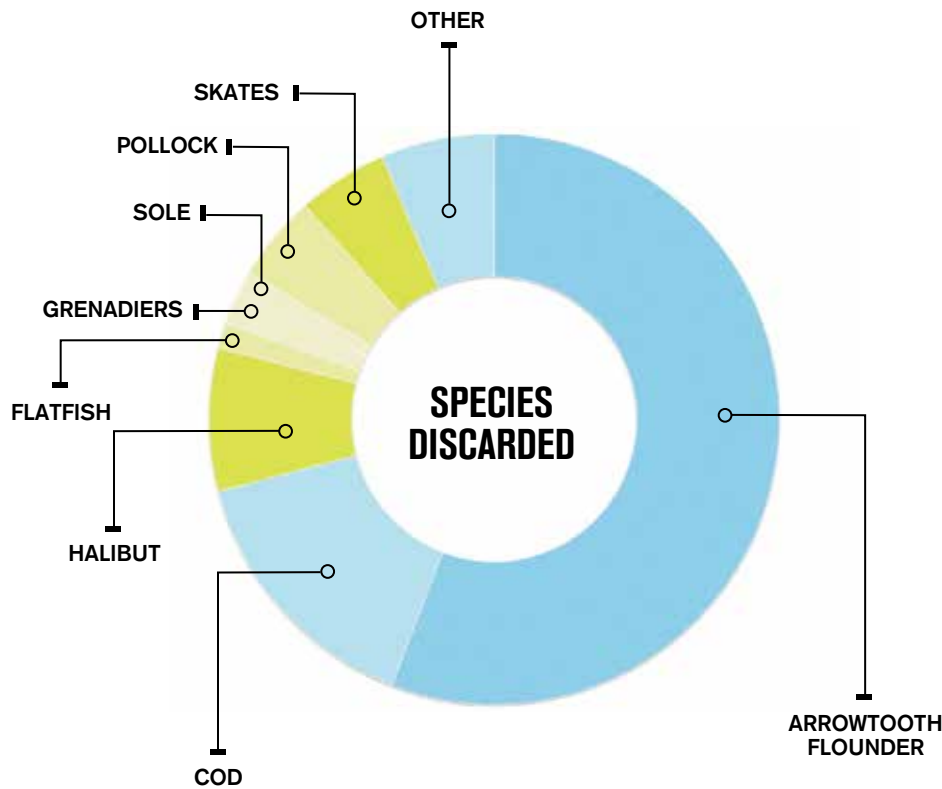
Continue improving utilization of captured arrowtooth flounder and other historically less marketable species.

Implement a system to report bycatch hotspots in real-time and disseminate this information across the fleet for effective time-area management.

Increase observer coverage in order to accurately estimate bycatch.

In the Gulf of Alaska, a few dozen bottom trawl vessels discard more than the rest of the fisheries in the region combined. Flatfish bottom trawling in the Gulf of Alaska results in high bycatch as trawlers attempt to catch high volumes of relatively low-value flatfish amongst a diverse fish and invertebrate community on the seafloor. Many of the discarded bycatch species are perfectly edible, and some are even quite valuable. Species such as sharks, skates, cod, rockfish, other flatfish, crabs, salmon and halibut are all wasted as bycatch in this fishery. This fishery is a proposed candidate for a future catch share program, and it is important that the high bycatch does not become enshrined in fishery management.

34,572,000 LBS DISCARDED



YEARLY NUMBERS

**VESSELS:** 41<sup>53</sup>

**DISCARDS:** 34 million lbs. (35% of catch)<sup>7</sup>

**HALIBUT:** 2 million lbs. wasted<sup>7</sup>

**COD:** 5 million lbs. wasted<sup>7</sup>

**OBSERVER COVERAGE:** 14%<sup>54</sup>

**VALUE OF FISHERY:** \$6–11 million<sup>55</sup>

**VALUE OF DISCARDS:** \$17.7 million<sup>56</sup>



# MID-ATLANTIC BOTTOM TRAWL FISHERY

# 33%

DISCARDED

## PROBLEMS

Trawls are so large and indiscriminate that fishermen cannot selectively target healthier species while avoiding the depleted ones.

Observer coverage has never been higher than 3 percent, leading to inaccurate bycatch estimates.

Too many sea turtles are injured and killed because fisheries assess bycatch in each single fishery without counting how many are caught by all fisheries in the region.

Millions of skates are discarded at such high levels that it will likely change the population and ecosystem.

## SOLUTIONS

Allocate sufficient observers to accurately and precisely estimate bycatch for each species and require video monitoring to supplement onboard observers where appropriate.

Establish a bycatch limit for sea turtles and all other species based on the best-available scientific information.

Promote the conservation of deep sea coral habitat to minimize bycatch and protect fish nurseries.

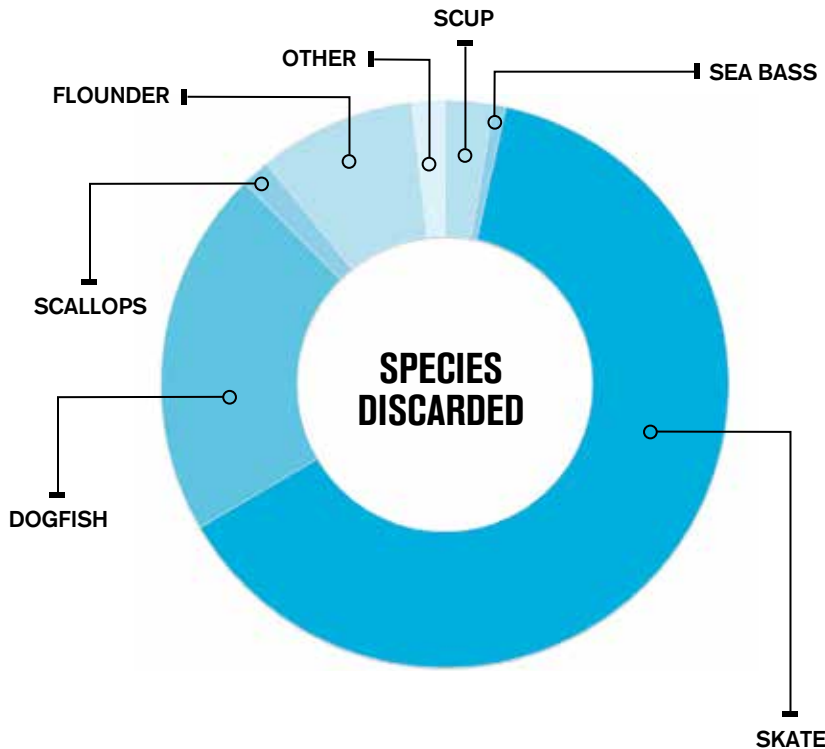
Monitor and report sea turtle mortality across all regional fisheries to ensure that the bycatch limit is not exceeded.

Require the use of Turtle Excluder Devices in these trawls in times and areas where sea turtles are known to be present to prevent unnecessary mortality.

Establish regional sea turtle bycatch limits that, if exceeded, result in fishery closures.

In the Mid-Atlantic, fishermen use bottom trawls to catch summer flounder, scup and black sea bass as well as dogfish and skates. These fish live along the seafloor, and trawls damage the bottom habitat in order to catch them. Although it is often assumed that the seafloor of the Mid-Atlantic region is barren, there is growing recognition that the region has diverse seafloor communities including hard bottom, coral gardens, canyons and rare clay outcroppings that provide burrows for tilefish. This important seafloor provides an essential nursery for the very same economically important fish that are caught along the Atlantic coastline. Common dolphins, bottlenose dolphins, harbor porpoises, pilot whales, harbor seals, gray seals and sea turtles have all been captured in large numbers by Mid-Atlantic bottom trawls.

9,400,000 LBS DISCARDED



YEARLY NUMBERS

**VESSELS:** 95<sup>57</sup>

**DISCARDS:** 9.4 million lbs. (33% of total catch)<sup>7</sup>

**MARINE MAMMALS:** 145 mortalities<sup>7</sup>

**SEA TURTLES:** 350 mortalities<sup>7</sup>

**OBSERVER COVERAGE:** 1–3%<sup>58</sup>

**DISCARD OF TARGET SPECIES:** 1.2 million lbs.

**VALUE OF FISHERY:** \$30.6 million<sup>57</sup>



# ATLANTIC HIGHLY MIGRATORY SPECIES LONGLINE FISHERY

# 23%

## DISCARDED

## PROBLEMS

Longline fishermen discard hundreds of thousands of the same fish and sharks that they target because the animals are too small or the fishermen exceed annual quotas.

The number of sea turtles that are injured and killed every year has likely exceeded the legally authorized number since 2004.

Hundreds of marine mammals are caught and killed every year because no precautionary measures are in place.

Tens of thousands of pounds of blue and white marlin are discarded every year, two valuable species important for recreational fishermen that have been prohibited and remain overfished due to bycatch.

In the Gulf of Mexico and along the Atlantic coast, fishermen use longlines to catch sharks, tuna and swordfish that are known as “highly migratory species.” In 2011, 30 percent of the fish that were captured on the hooks were discarded,<sup>59</sup> which included hundreds of thousands of pounds of valuable bluefin tuna, swordfish and sharks. When discarded dead, these important fish can no longer add to recovering populations or fulfill their important ecological roles as top predators. Even though the number of participants in this fishery has shrunk by 50 percent from more than 200 throughout the 2000s, and measures have been implemented to reduce sea turtle and marine mammal injuries, bycatch levels nearly reached record high levels in 2011, with more than 300 pilot whales entangled or killed. More than two-thirds of captured bluefin tuna were discarded in 2011, amounting to more than 750 fish.<sup>58</sup> Despite legal action and repeated petitions, fishermen have likely exceeded the number of allowed sea turtle injuries and mortalities since 2004, and the government continues to stall on completing the required environmental review and solving the problem.

## SOLUTIONS

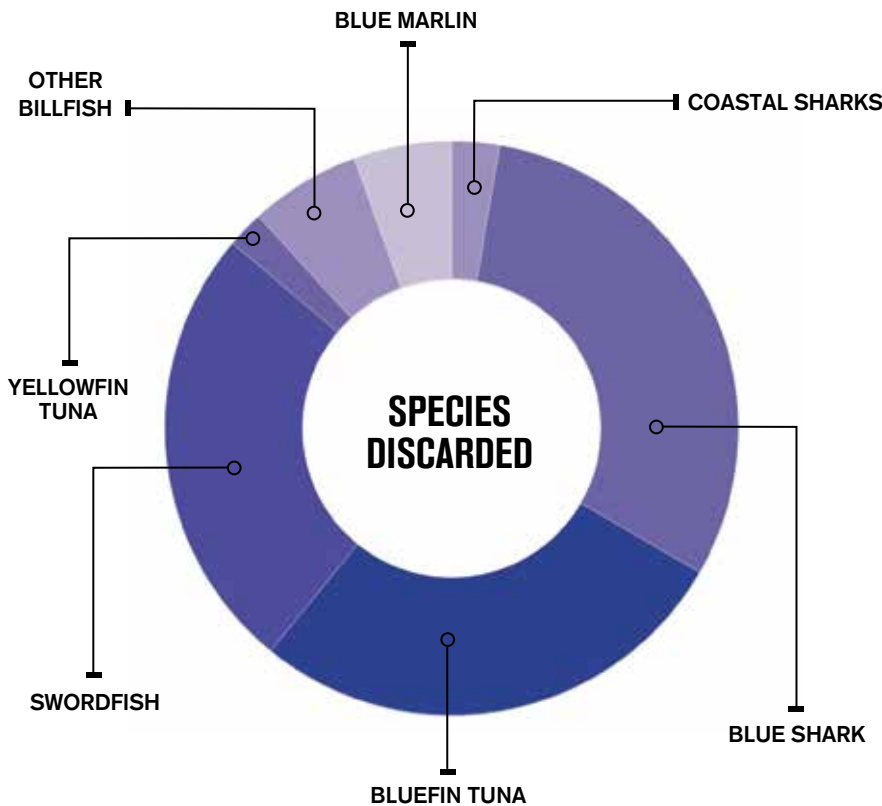
Transition to cleaner, more selective fishing methods such as greenstick and buoy gear.

Avoid catching threatened and endangered sea turtles, marine mammals and valuable fish by reporting bycatch hotspots in real-time and disseminating this information across the fleet.

Close areas in the Gulf of Mexico and South Atlantic to surface longlining to protect spawning bluefin tuna and foraging sea turtles.

Use electronic monitoring to supplement onboard observers to derive accurate and precise bycatch estimates that include sea turtles, sharks and valuable fish that are discarded or injured.

1,200,300 LBS DISCARDED



YEARLY NUMBERS

**VESSELS:** 94<sup>60</sup>

**DISCARDS:** 1.2 million lbs. (23% of total catch)<sup>7</sup>

**MARINE MAMMALS:** 450 interactions, including 300 pilot whales<sup>61</sup>

**SEA TURTLES:** More than 675 mortalities<sup>61</sup>

**OBSERVER COVERAGE:** 10%<sup>61</sup>

**DISCARD OF TARGET SPECIES:** 1 million lbs.

**VALUE OF FISHERY:** \$52 million<sup>59</sup>



# NEW ENGLAND AND MID-ATLANTIC GILLNET FISHERY

# 16%

## DISCARDED

## PROBLEMS

Gillnets have been deemed too harmful to use by many states and have been banned on the high seas, yet many U.S. fishermen are still permitted to use them even though better methods are available.

Some gillnets are not removed from the water for long periods of time, leading to significant bycatch.

Fishermen discard the same fish they are targeting if they are too small or if the catch has rotted from staying in the water too long.

Observer coverage remains insufficient to accurately estimate bycatch.

Anecdotal information suggests that sea turtle bycatch is high, but no official estimates exist because of low observer coverage.

## SOLUTIONS

Limit the amount of time gillnets can remain in the water before being retrieved.

Restrict where gillnets can be set to avoid fishing when marine mammals, sea turtles and sturgeon are most likely to be in the area.

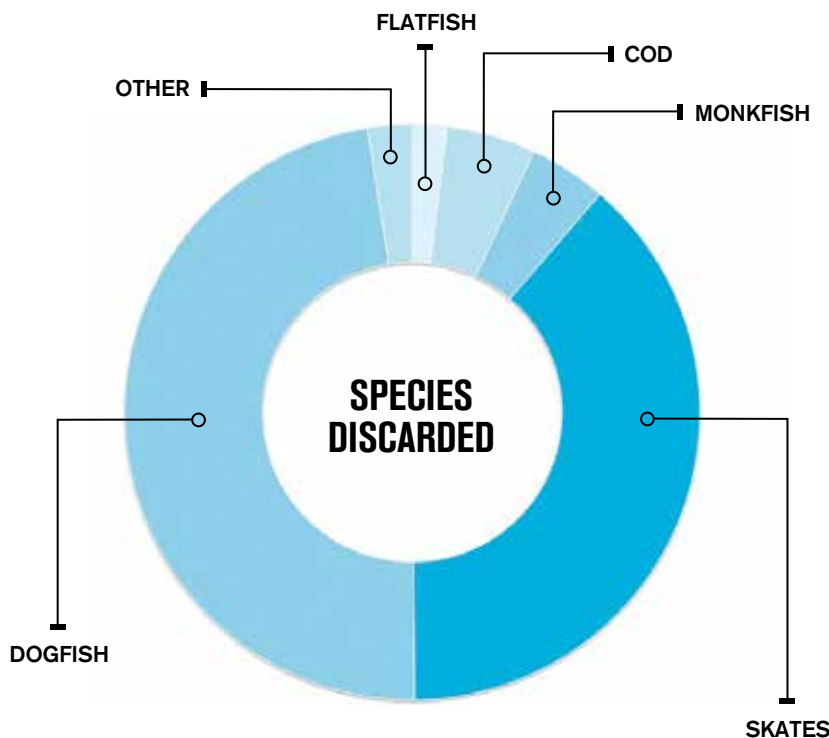
Allocate sufficient observers to accurately and precisely estimate bycatch for each species, including sea turtles, marine mammals, skates, sturgeon and other commonly discarded fish.

Ensure that all of the nets are retrieved and evaluated when an observer is present rather than just small portions.

Examine the feasibility of using video monitoring to enforce regulations requiring full retention and better catch accounting.

Off the coast of New England and the Mid-Atlantic, more than 2,000 fishermen target monkfish and groundfish like cod and haddock using drift and sink gillnets that also entrap marine mammals, sea turtles and sturgeon. These gillnet fishermen discard more than 16 percent of what they catch, including more than 3 million pounds of dogfish and almost half a million pounds of the monkfish they target. Although the number of participants in this fishery has grown ten-fold in the last two decades, observer coverage has not grown with the fishery. An average of more than 1,200 endangered sturgeon were captured as bycatch each year from 2006-2010, and as many as 750 dolphins and porpoises were captured in these gillnets each year throughout the early 2000s. The full extent of sea turtle bycatch remains unknown.

7,065,000 LBS DISCARDED



YEARLY NUMBERS

**FISHERMEN:** 2,140<sup>62</sup>

**DISCARDS:** 7 million lbs. (16% of total catch)<sup>7</sup>

**MARINE MAMMALS:** 2,400 mortalities<sup>7</sup>

**SEA TURTLES:** 350 mortalities<sup>7</sup>

**STURGEON:** More than 1,200 mortalities<sup>63</sup>

**OBSERVER COVERAGE:** Less than 5%<sup>64</sup>

**VALUE OF FISHERY:** \$32 million<sup>62</sup>

# NATIONAL POLICIES TO MINIMIZE BYCATCH

For more than a decade, Oceana has advocated to reduce bycatch and bycatch mortality in the U.S. Oceana works fishery-by-fishery, as well as at the national level, to promote the Oceana Approach to bycatch: count all catch (including bycatch), cap bycatch using science-based limits, and control bycatch through effective management measures that will ensure bycatch limits are not exceeded and that bycatch is reduced over time.

## COUNT

Sustainable fisheries management requires accounting for all species that are killed by a fishery, whether landed or discarded. Transparent catch accounting and robust estimates of discard mortality (the portion of discarded catch that does not survive after release) are essential for effective fisheries management.

To understand the full scope of bycatch, fisheries managers and the public must have access to recent, accurate and precise reports of catch in every fishery. The MSA requires that every fishery establish a Standardized Bycatch Reporting Methodology (SBRM) to collect, process, analyze and publish this information to identify and assess bycatch problems. A fully established SBRM should require all vessels to monitor catch to provide accurate bycatch estimates, require that the fishing

industry assume responsibility for funding monitoring costs, and make all catch information available to the public in a timely manner.

## CAP

Fisheries managers are required to set scientifically based annual catch limits in all U.S. fisheries, but often non-target species caught as bycatch are ignored. Fisheries managers and stakeholders should evaluate the catch of each fishery to identify bycatch interactions that require attention based on population status, management objectives for the species, bycatch mortality and the ecological roles of each species. If regional fishermen are discarding other fishermen's targeted species, that bycatch must be accounted for when establishing and allocating quotas in the directed fishery. When bycatch reaches the established limit, either the area should be closed for the season or the quota should be reduced by the exceeded amount in future fishing years.

## CONTROL

Establishing bycatch caps is a notable step in managing bycatch, but it is not enough to reduce bycatch. To reduce bycatch in U.S. fisheries, Oceana supports the following measures as effective means to implement and maximize the conservation benefits of bycatch caps:

**Avoid Bycatch:** Fisheries should develop catch monitoring programs that identify and disseminate information about bycatch hotspots across the fleet. The fishing industry and their academic partners have

SUSTAINABLE FISHERIES MANAGEMENT REQUIRES

# ACCOUNTING FOR ALL SPECIES

THAT ARE KILLED BY A FISHERY, WHETHER LANDED OR DISCARDED



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developed such systems that enable them to stay within the established limits and are particularly effective when there are requirements or incentives to participate. These programs can be even more effective when exceeding bycatch limits results in seasonal closures.

**Adjust and Improve Bycatch Caps:** Bycatch caps must be set using the best available science, like annual catch limits. Currently, bycatch caps are not always set as low as they should be in the limited fisheries where they do exist. Therefore, bycatch limits must be regularly evaluated and adjusted based on the best available information. Ideally, bycatch caps should be reduced to as close to zero as possible over time as fishing methods become more selective.

**Gear Modifications:** Fishermen can use a range of gears to catch most species. Fisheries managers should incentivize fishermen to use the gears with the lowest bycatch rates and prohibit gears with unacceptably high bycatch rates. The upfront cost of alternative gears is outweighed by the immediate economic benefits of

improved catch efficiency and the long-term ecological benefit of minimizing bycatch and rebuilding stocks. Effective bycatch caps will hasten gear changes if existing, non-selective gears result in early closures or time-area restrictions that limit fishing opportunities. These incentives should be coupled with baseline gear requirements to reduce bycatch such as restrictions on longline configuration, bait and hook requirements, and soak time limits on gillnets and tow times on trawls.

**PROTECT KEY SPECIES**

Certain species, such as those that are depleted, overfished, ecologically important, long-lived or subject to additional conservation and management, require special consideration to ensure that bycatch does not undermine management goals such as recovery, rebuilding and maintaining optimal population levels. To minimize and mitigate the higher risk these species face from bycatch, fisheries managers must consider additional options, including precautionary mortality limits, enhanced catch monitoring, spatial closures and alternative gears proven to reduce bycatch and bycatch mortality.

# RECOMMENDATIONS

## Count Everything, Everything Counts

Everything that is captured, even if discarded, should be counted and documented with accuracy and precision.

## Establish Bycatch Caps In All Fisheries

Bycatch limits for non-target fish, sea turtles, marine mammals, seabirds and depleted shark populations must be based on scientific information. Once these limits are reached, fisheries should be shut down for the remainder of the season.

## Document Catch With Statistical Accuracy And Precision

Councils must implement standard bycatch reporting procedures across Fishery Management Plans and must produce accurate and precise bycatch estimates. Increased resources must be dedicated to fund higher levels of observer coverage to ensure that catch limits and bycatch caps are not exceeded.

## Implement Bycatch Reduction Incentives

Councils must encourage fishermen to reduce bycatch by creating incentives within Fishery Management Plans to avoid hotspots, use cleaner gear or install devices that deter marine animals.

## Minimize Discards And Improve Seafood Use

Councils must facilitate quota sharing and collaboration between fishermen targeting and incidentally capturing the same species so that the amount of discarded marketable fish is minimized.

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## Implement Ecosystem-based Management

The National Marine Fisheries Service must account for the cumulative impacts of fishing activities on all protected species when authorizing additional injuries and mortality across different fisheries and regions of the country. The detrimental impacts of bycatch on habitat and the amount of forage fish that are in an ecosystem must also be accounted for.

## Promote Cleaner Gear

When possible, fisheries managers should facilitate the transition to cleaner, more selective fishing gear and prohibit harmful fishing methods with high bycatch.

# CONCLUSION

Bycatch is a significant problem in the U.S. that continues to undermine successful fisheries management and waste the ocean's living marine resources. Despite some recent progress in establishing bycatch limits and beginning to use more selective fishing methods, improvements must be made in accurately reporting bycatch and reducing the amount of fish that are discarded at sea. Making key changes such as counting everything that is caught, establishing bycatch limits, and using innovative management measures to avoid and reduce bycatch over time will improve the resilience and economic viability of U.S. fisheries for generations to come.



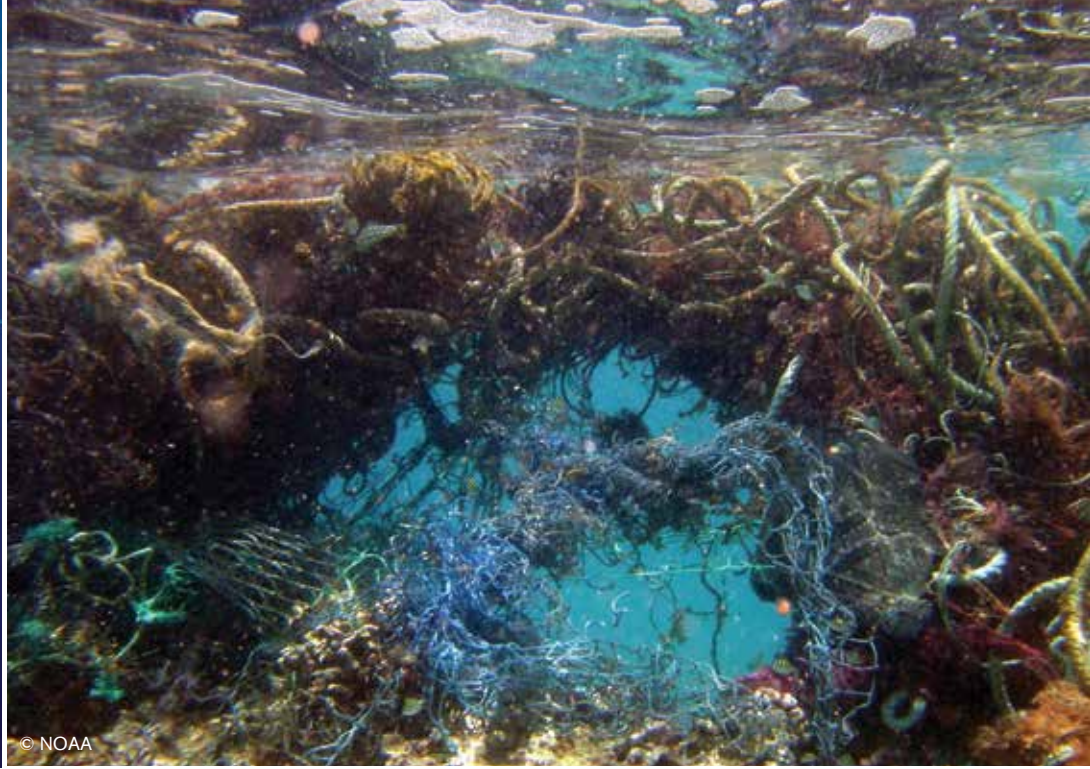
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## OCEANA REDUCING BYCATCH: A TIMELINE

- 2001** Courts order the New England groundfish fishery to develop a Standardized Bycatch Reporting Methodology.
- 2002** Courts uphold the NMFS decision to close large areas of the North Atlantic to pelagic longline fishing gear to protect sea turtles.
- 2002** Courts find that the government violated the law when it failed to assess bycatch or to minimize bycatch and bycatch mortality in the Pacific groundfish fishery.
- 2002** Oceana petitions the U.S. Department of Commerce to fulfill its legal obligations and immediately promulgate a rule to count, cap and control bycatch in U.S. fisheries.
- 2003** NMFS releases a National Bycatch Strategy and regional implementation plans.
- 2003** Oceana pressures the government to require larger TEDs in shrimp nets in the Gulf of Mexico and south Atlantic Ocean.
- 2004** Congress doubles funding for fisheries observer programs.
- 2004** Strong advocacy by Oceana prompts the New England Fishery Management Council to establish bycatch caps for eight critical groundfish species.
- 2005** The court rules that NMFS failed to establish a standardized bycatch reporting methodology and failed to respond to scientific evidence generated by Oceana showing that at least 20 percent of fishing boats must carry observers to obtain accurate information about discards.
- 2005** NMFS issues emergency measures to address unintended (but illegal) haddock catch in the Atlantic herring fishery, including a bycatch limit that stopped fishing activity once reached.
- 2005** Oceana releases a new study, *Wasted Resources: Bycatch and Discards in U.S. Fisheries*, showing that approximately 22 percent of commercial fisheries catch is discarded each year.
- 2005** NMFS announces it will conduct a comprehensive assessment of bycatch and provide regular updates to the data.
- 2006** NMFS implements a regulation requiring the scallop dredge fleet to fund observers to monitor threatened and endangered sea turtles.





- 2007** Oceana and NOAA win lawsuit requiring large Alaska trawl fleets to retain approximately two-thirds of their catch, serving as an incentive to reduce bycatch.
- 2007** NMFS denies a proposal from the Pacific Fishery Management Council to allow drift gillnet vessels to operate in an area off the California and Oregon coasts, where such fishing had been seasonally banned to protect the critically endangered Pacific leatherback sea turtle.
- 2009** The Gulf of Mexico Fishery Management Council voted for emergency action to protect sea turtles by prohibiting bottom longline gear for six months in waters shallower than 50 fathoms, where nearly all of the sea turtle deaths occurred.
- 2009** The North Pacific Fishery Management Council votes to set a bycatch cap of 60,000 Chinook salmon in the Bering Sea pollock fishery, the first time that federal policy makers have set such a cap in the world's largest fishery by weight.
- 2011** Courts require NMFS to establish a standardized bycatch reporting methodology for commercial fisheries from North Carolina to the Canadian border under the Magnuson Stevens Act.
- 2011** Oceana releases a new report disclosing serious compliance problems with the use of TEDs in the Gulf of Mexico shrimp trawls, highlighting continued threats to sea turtles.
- 2011** The New England Fishery Management Council approved the use of a modified dredge that was developed by the scallop industry to reduce sea turtle mortality.
- 2012** North Pacific Management Council votes to reduce the halibut bycatch limit by 15 percent in the Gulf of Alaska trawl fishery.
- 2012** Oceana challenges the failure to count bycatch in the New England groundfish fishery. The government has yet to comply with the court's 2011 decision, so Oceana has filed suit.
- 2012** Oceana settles with NMFS to ensure that observer data from the New England groundfish fishery is accurate, precise and timely. NMFS implements new regulations for the fishery, including accountability measures for newly managed species.

# REFERENCES

- <sup>1</sup> Food and Agriculture Organization. 2012. 2011 Yearbook Fishery and Aquaculture Statistics. Capture Production, Inc.
- <sup>2</sup> Kelleher, K. 2004. Discards in the world's marine fisheries: An Update. Food and Agricultural Organization of the United Nations Fisheries Technical Paper 470, p. 134.
- <sup>3</sup> Davies, R., Cripps, S., Nickson, A., and Porter, G. 2009. Defining and estimating global marine fisheries bycatch. *Marine Policy*, doi:10.1016/j.marpol.2009.01.003.
- <sup>4</sup> Read, A., Drinker, P., and Northridge, S. 2005. Bycatch of marine mammals in U.S. and global fisheries. *Conservation Biology* 20: 163-9.
- <sup>5</sup> Harrington, J., Myers, R., and Rosenberg, A. 2005. Wasted fishery resources: discarded bycatch in the USA. *Fish and Fisheries* 6: 350-361.
- <sup>6</sup> National Marine Fisheries Service. 2011. National bycatch report. W.A. Karp, L.L. Desfosse, and S. G. Brook, eds. NOAA Technical Memo, Silver Spring, MD.
- <sup>7</sup> National Marine Fisheries Service. 2014. Updated National bycatch report. W.A. Karp, L.L. Desfosse, and S. G. Brook, eds. NOAA Technical Memo, Silver Spring, MD.
- <sup>8</sup> Wigley SE, Blaylock J, Rago PJ, Tang J, Haas HL, and Shield G. 2011. Standardized Bycatch Reporting Methodology 3-year Review Report 2011-Part 1. US Department Commerce, Northeast Fish Sci Cent Ref Doc. 1 1-09; 285 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.
- <sup>9</sup> Faunce, C. and Barbeaux, S. 2002. Deployment and Observer Effects as Evidenced from Alaskan Groundfish Landing Reports. [ftp://ftp.afsc.noaa.gov/posters/pFaunce02\\_deployment-observer.pdf](ftp://ftp.afsc.noaa.gov/posters/pFaunce02_deployment-observer.pdf).
- <sup>10</sup> Burns, R., and Kerr, G. 2008. Observer effect on fisher bycatch reports in the New Zealand ling bottom longlining fishery, *New Zealand Journal of Marine and Freshwater Research*, 42(1): 23-32.
- <sup>11</sup> Marine Fish Conservation Network. 2010. Meeting the Information Demands of 21st Century Fisheries: A Needs Assessment for Fisheries Observer Programs. [http://www.conservefish.org/storage/marinefish3/documents/ts-mfcn0101\\_report\\_web.pdf](http://www.conservefish.org/storage/marinefish3/documents/ts-mfcn0101_report_web.pdf)
- <sup>12</sup> Babcock, E. and Pikitch, E. 2003. How much observer coverage is enough to adequately estimate bycatch? <http://oceana.org/sites/default/files/reports/BabcockPikitchGray2003FinalReport1.pdf>
- <sup>13</sup> Larese, J. P. 2009. Fish and invertebrate bycatch estimates for the California set gillnet fishery targeting halibut and white seabass, 1990-2006, NOAA Technical Memorandum, NOAA-TM-NMFS-SWFSC-441
- <sup>14</sup> Wallace, R. 1996. Catch and bycatch: is there really a difference? In *Fisheries Bycatch: Consequences and Management*. Alaska Sea Grant Report 97-01.
- <sup>15</sup> Brogan, G. 2006. Comment letter: Scoping comments of Oceana on Amendment 16 to the Northeast Multispecies Fishery Management Plan. Submitted to the *Federal Register* via e-rulemaking portal.
- <sup>16</sup> Brogan, G. 2009. Comment letter to the Mid-Atlantic Council: Omnibus amendment: National Standard 1 requirements scoping comments. Submitted to the *Federal Register* via e-rulemaking portal.
- <sup>17</sup> National Marine Fisheries Service. 2007. Loggerhead sea turtle 5-year review: Summary and Evaluation. U.S. Department of Commerce, National Oceanic and Atmospheric Administration Office of Protected Resources, Silver Spring, MD.
- <sup>18</sup> Camhi, M., S. Fowler, J. Musick, A. Bräutigam, and Fordham, S. 1998. Sharks and their relatives—ecology and conservation. Occasional Paper of the IUCN Species Survival Commission no. 20, p. 39.
- <sup>19</sup> Worm, B., Davis, B., Kettner, L., Ward-Paige, C., Chapman, D., Heithaus, M., Kessel, S., and Gruber, S. 2013. Global catches, exploitation rates, and rebuilding options for sharks. *Marine Policy* 40: 194-204.
- <sup>20</sup> Cortés, E., E. Brooks, P. Apostolaki and C.A. Brown. 2006. Stock assessment of the dusky shark in the U.S. Atlantic and Gulf of Mexico. Sustainable Fisheries Division Contribution SFD-2006-014
- <sup>21</sup> Morgan, A. and Burgess, G.H. 2007. At-vessel fishing mortality for six species of sharks caught in the northwest Atlantic and Gulf of Mexico. Gulf and Caribbean Research Institute 19:123-129.
- <sup>22</sup> Baum, J., Myers, R.A., Kehler, D.G., Worm, B., Harley, S.J., and Doherty, P.A. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. *Science* 299: 389-392.
- <sup>23</sup> National Marine Fisheries Service. 2013. Atlantic Highly Migratory Species annual catch limits and specifications. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD.
- <sup>24</sup> Mandelman, J., Cooper, P., Werner, T., and Lagueux, K. 2008. Shark bycatch and depredation in the U.S. Atlantic pelagic longline fishery. *Reviews in Fish Biology and Fisheries*, 18: 427-442.
- <sup>25</sup> Gilman, E., S. Clarke, N. Brothers, J. Alfaro-Shigueto, J. Mandelman, J. Mangel, S. Petersen, S. Piovano, N. Thomson, P. Dalzell, M. Donoso, M. Goren, and Werner, T. 2008. Shark interactions in pelagic longline fisheries. *Marine Policy*, 32:1–18.
- <sup>26</sup> National Marine Fisheries Service. 2012. Draft Environmental Impact Statement to reduce incidental bycatch and mortality of sea turtles in the southeastern U.S. shrimp fisheries. NOAA Southeast Regional Office, St. Petersburg, FL.
- <sup>27</sup> National Marine Fisheries Service. 2012. Reinitiation of ESA Section 7 Consultation on the continued implementation of the sea turtle conservation regulations, as proposed to be amended, and the continued authorization of the southeast U.S. shrimp fisheries in Federal waters under the Magnuson-Stevens Act. NOAA Southeast Regional Office, Protected Resources Division, St. Petersburg, FL.
- <sup>28</sup> Oceana, Inc. 2011. Unacceptable Violations of Sea Turtle Protections in the U.S. Shrimp Fishery. [http://oceana.org/sites/default/files/Gulf\\_TED\\_Compliance\\_Report.pdf](http://oceana.org/sites/default/files/Gulf_TED_Compliance_Report.pdf), Accessed online 9/30/2013.
- <sup>29</sup> National Marine Fisheries Service. 2012. Reinitiated ESA Section 7 Consultation on the southeast U.S. shrimp fishery; Section 7(a)(2) and 7(d) determination. NOAA Southeast Regional Office, St. Petersburg, FL.
- <sup>30</sup> Gilman, E., Kobayashi, D., Swenarton, T., Brothers, N., Dalzell, P., and Kinan-Kelly, I. 2007. Reducing sea turtle interactions in the Hawaii-based longline swordfish fishery. *Biological Conservation* 139: 19-28.
- <sup>31</sup> Reilly, Paul N. and Geibel, J. 2002. Results of California Department of Fish and Game spot prawn trawl and trap fisheries bycatch observer program 2000-2001. California Department of Fish and Game, Monterey, CA.
- <sup>32</sup> Haflinger, K. E. 2003. Reducing Bycatch Through Avoidance: Utilizing near real-time catch sampling and analysis of spatial patterns in occurrence of bycatch species to provide fleets with the information needed to avoid bycatch. Abstract of poster presented at the conference "Managing Our Nation's Fisheries: Past, Present, and Future."
- <sup>33</sup> Ianelli, J., J.R. Gauvin, D.L. Stram, and Stabeno, P. 2010. Temperature/depth data collections on Bering Sea groundfish vessels to reduce bycatch. North Pacific Research Board Final Report 731.
- <sup>34</sup> Morgan, L. E. and Chuenpagdee, R. 2003. Shifting gears: addressing the collateral impacts of fishing methods in U.S. waters. *Pew Science Series*, pp. 52.
- <sup>35</sup> Gulf of Mexico Fishery Management Council, 2007. Amendment 27 to the

- reef fish FMP and amendment 14 to the shrimp fishery management plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service Southeast Regional Office, St. Petersburg, FL.
- <sup>36</sup> Watling, L. and Norse, E. 1998. Disturbance of the seabed by mobile fishing gear: a comparison to forest clear-cutting. *Conservation Biology* 1180-1197.
- <sup>37</sup> NMFS, 2012. Marine Mammal Protection Act List of Fisheries for 2012: Hawaii deep-set longline fishery fact sheet. NOAA Office of Protected Resources, U.S. Department of Commerce, Silver Spring, MD.
- <sup>38</sup> National Marine Fisheries Service. 2012. Marine Mammal Protection Act List of Fisheries for 2012: CA Yellowtail gillnet fishery fact sheet. NOAA Fisheries Office of Protected Resources, U.S. Department of Commerce, Silver Spring, MD.
- <sup>39</sup> National Marine Fisheries Service. 2012. Marine Mammal Protection Act List of Fisheries for 2012: New England Sink gillnet fishery fact sheet. NOAA Fisheries Office of Protected Resources, U.S. Department of Commerce, Silver Spring, MD.
- <sup>40</sup> National Marine Fisheries Service. 2012. Marine Mammal Protection Act List of Fisheries for 2012: Summary Table. NOAA Office of Protected Resources, U.S. Department of Commerce, Silver Spring, MD.
- <sup>41</sup> South Atlantic Fishery Management Council, 2010. Amendment 17A to the FMP for the snapper grouper fishery of the south Atlantic region with final EIS. In collaboration with the National Marine Fisheries Service. North Charleston, SC.
- <sup>42</sup> Servik, K. 2013. "Permit system puts tougher regulation on fishermen, scientists who catch great white shark" published in the Santa Cruz Sentinel. [http://www.santacruzsentinel.com/ci\\_22716932/permit-system-puts-tougher-regulation-fishermen-scientists-who](http://www.santacruzsentinel.com/ci_22716932/permit-system-puts-tougher-regulation-fishermen-scientists-who)
- <sup>43</sup> National Marine Fisheries Service. 2013. Section 7 Consultation on the management of the drift gillnet fishery under the Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species. NOAA Southwest Regional Office, Protected Resources Division, Long Beach, CA.
- <sup>44</sup> National Marine Fisheries Service. 2012. Southwest Fisheries Observer Program Annual Reports. NOAA Fisheries Southwest Fisheries Science Center. La Jolla, CA.
- <sup>45</sup> California Department of Fish and Game. 2012. Review of selected California fisheries for 2011: ocean salmon, California sheephead, California halibut, longnose skate, petrale sole, California spiny lobster, Dungeness crab, garibaldi, white shark, and algal blooms. CalCOFI Report Volume 53, Los Alamitos, CA.
- <sup>46</sup> Wildearth Guardians. 2012. Petition to list the northeastern Pacific Ocean Distinct Population Segment of the great white shark under the U.S. Endangered Species Act. Submitted to the U.S. Secretary of Commerce and the National Marine Fisheries Service. NOAA Southwest Regional Office, Long Beach, CA.
- <sup>47</sup> National Marine Fisheries Service, 2009. Economics of the Federal Gulf shrimp fishery: Annual Report. NOAA Fisheries Southeast Science Center, Pascagoula, FL.
- <sup>48</sup> Pacific Fishery Management Council, 2012. Status of the U.S. west coast fisheries for highly migratory species through 2011: Stock Assessment and Fishery Evaluation Report. Portland, OR.
- <sup>49</sup> Murphy T, Kitts A, Records D, Demarest C, McPherson M, Walden J, Caless D, Bing-Sawyer E, Steinback S, Olson J. 2012. 2011 Final Report on the Performance of the Northeast Multispecies (Groundfish) Fishery (May 2011-April 2012). US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 12-30; 111 p. National Marine Fisheries Service, 166 Water Street, Woods Hole, MA.
- <sup>50</sup> Wigley SE, Blaylock J, Rago PJ, Tang J, Haas HL, and Shield G. 2011. Standardized Bycatch Reporting Methodology 3-year Review Report 2011- Part 1. US Department Commerce, Northeast Fish Sci Cent Ref Doc. 11-09; 285 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.
- <sup>51</sup> National Marine Fisheries Service, 2013. FSSI Status of the Stocks: 2012 Summary. U.S. Department of Commerce, Silver Spring, MD.
- <sup>52</sup> Lee, Min-Yang, and Eric Thunberg. "An Inverse Demand System for New England Groundfish: Welfare Analysis of the Transition to Catch Share Management." Abstract presented at the Agricultural and Applied Economics Association Annual Meeting. 2012.
- <sup>53</sup> North Pacific Fishery Management Council, 2012. Proposed amendment to the FMP for the Gulf of Alaska Management Plan to require trawl sweep modification in the flatfish fishery in the central Gulf of Alaska. Anchorage, AK.
- <sup>54</sup> National Marine Fisheries Service. 2013. Draft 2014 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska. 31 pages plus appendices. National Oceanic and Atmospheric Administration. Juneau, AK.
- <sup>55</sup> National Marine Fisheries Service. 2013. Stock assessment and fishery evaluation report: Gulf of Alaska flatfish trawl fishery. National Oceanic and Atmospheric Administration, National Marine Fisheries Service Alaska Regional Office, Juneau, AK.
- <sup>56</sup> Oceana, Inc. *In preparation*. Economics of Bycatch: Valuation of Discards in U.S. Fisheries.
- <sup>57</sup> Mid-Atlantic Fishery Management Council, 2013. Omnibus amendment to Mid-Atlantic Fishery Management Plans. National Marine Fisheries Service, available online, accessed 10/2/2013.
- <sup>58</sup> NMFS, 2012. Marine Mammal Protection Act List of Fisheries for 2012: Mid-Atlantic bottom trawl fishery fact sheet. NOAA Fisheries Office of Protected Resources, U.S. Department of Commerce, Silver Spring, MD.
- <sup>59</sup> National Marine Fisheries Service, 2012. Stock Assessment and Fishery Evaluation Report: Atlantic Highly Migratory Species. NOAA Fisheries Highly Migratory Species Management Division. U.S. Department of Commerce, Silver Spring, MD.
- <sup>60</sup> National Marine Fisheries Service. 2012. Marine Mammal Protection Act List of Fisheries for 2012: Atlantic pelagic longline fishery fact sheet. NOAA Fisheries Office of Protected Resources, U.S. Department of Commerce, Silver Spring, MD.
- <sup>61</sup> Garrison, L. and Stokes, L. 2012. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2011. NOAA Technical Memorandum NMFS-SEFSC-632: 61 p.
- <sup>62</sup> New England & Mid-Atlantic Fishery Management Councils, 2008. Monkfish Fishery Management Plan Framework Adjustment 6 Incorporating SAFE Report for the 2006 Fishing Year. NOAA Fisheries Northeast Regional Office, Gloucester, MA.
- <sup>63</sup> National Marine Fisheries Service. 2013. Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries. Northeast Regional Office, Consultation No. F/NER/2012/01956, Gloucester, MA.
- <sup>64</sup> National Marine Fisheries Service. 2012. Marine Mammal Protection Act List of Fisheries for 2012: Mid-Atlantic gillnet fishery fact sheet. NOAA Fisheries Office of Protected Resources, U.S. Department of Commerce, Silver Spring, MD.



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