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The Safina Center (formerly Blue Ocean Institute) was founded in 2003 by Dr. Carl Safina. It was built on three decades of research, writing and policy work by Dr. Safina. The Institute is based at Stony Brook University on Long Island, NY and is a 501(c)3 nonprofit organization.

Trawls – Bulldozers of the Ocean

By **Elizabeth Brown**

The Safina Center is often asked to describe various types of fishing gear and explain which ones are the most destructive to the ocean. Another frequent question is why our seafood ratings for a particular species differ depending on the fishing method used. In this series, we will describe how common types of gear work, what they catch, how they affect ocean wildlife and habitats, what technologies or regulations can help lessen the gear's negative effects, and what we see as the path forward to ensure healthy oceans in the future.

We want to help seafood consumers, businesses, and chefs who use our seafood ratings better understand what the terms 'trawl', 'longline', or 'handline' really mean. We also hope this series will help everyone understand the collateral damage that fishing can cause to the ocean and the importance of choosing seafood caught in a responsible way.

Trawls, particularly bottom trawls, are bulldozers of the ocean, scooping up and destroying anything in their path.

Trawls – Bulldozers of the Ocean

What is a trawl?

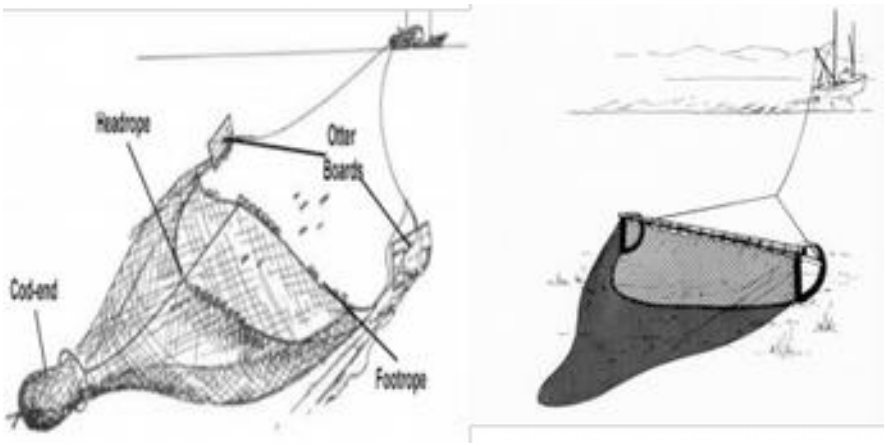
Trawls are enormous, cone-shaped nets that are towed by one or two boats. As the net is towed, it herds and captures thousands of fish and other creatures. The net is wide at the mouth and then narrows to a bag or 'cod-end', where the fish are trapped. When towed by a single vessel, heavy wood or steel doors on each side of the net (called "otter boards") *or* a solid beam, hold the mouth of the net open. When towed by two vessels, the distance between the vessels keeps the mouth of the net open. The spread of the trawl net can be up to 330 feet (100 meters) wide and 40 feet (12 meters) high[1]. Picture it this way – a net as wide as a football field and higher than a three-story house.

Trawl fishing can take place at shallow depths to extreme depths:

—When the net is towed along the bottom of the ocean floor, it is called a "bottom trawl".

—When towed off the bottom, it is called a "mid-water trawl" or "pelagic trawl".

The size of the net openings (or "mesh size"), tow speed and tow duration will vary depending on the species fishermen are targeting.



Left: A trawl held open by otter boards. The force of water pressure against the boards as it is towed keeps the net open. The bottom of the net, 'the footrope' has weights, while the top of the net, 'the headrope' has floats. Photo by NOAA. **Right**: A bottom trawl held open by a solid beam across the net. Photo by NEFSC.

What does a trawl catch?

Bottom trawls are used to catch fish that live on or near the bottom of the ocean floor, such as **cod, haddock, flounder, sole, rockfish, and orange roughy, as well as shrimp, octopus, and squid.**

Mid-water trawls are used to catch species that tend to gather in large groups or "schools" in the top or mid depths of the ocean, like **Alaskan pollock, mackerel, herring, and sardines**.

How do trawls affect the ocean?

Trawls are highly indiscriminate, capturing any and all species in their path. **They catch high amounts of species that fishermen are not trying to catch, termed 'bycatch'.** The unintended catch or bycatch may include many species of fish, invertebrates (such as crabs, scallops, starfish or corals), sharks, skates and rays, endangered sea turtles, and sometimes whales and dolphins. Fishermen often throw much of this unintended catch back to sea dead or dying. This is a giant waste of marine life! **Shrimp trawls in particular catch very high amounts of bycatch– often *2-10 times* the amount of shrimp caught**.

Catch from a trawl net. Photo by Carl Safina.

Because mid-water trawls typically target specific schools of fish, they tend to catch lower amounts of bycatch compared to bottom trawls. But mid-water trawls can still sometimes have a devastating effect on species of fish that are not sought after by the fishery or on ocean wildlife, like sea turtles, dolphins, and whales. For example, U.S. mid-water trawlers that target Atlantic herring and mackerel often catch significant numbers of depleted river herring [an important Atlantic fish that migrates between river waters and ocean waters]. A single trawl tow may catch as many as 250,000 river herring. And the trawls sometimes catch pilot whales, white-sided dolphins, and common dolphins[2].

Bottom trawls also cause significant damage to habitats on the bottom of the ocean. The trawl nets and their associated parts are very heavy. As these nets are dragged along the sea floor, they stir up the sediment, crush bottom-dwelling species like crabs and snails, destroy structural organisms like coral, sponges, or seagrass, and displace rocks and boulders. Because of this damage, trawled areas do not make good habitats for ocean animals. Scientists have found that areas that are frequently bottom trawled often have a reduced number and variety of bottom-living invertebrates (such as worms, snails, clams, or lobster) and fish.[1, 3] **Bottom trawling turns physically diverse environments, teeming with life into barren deserts. Essentially, it is equivalent to clear-cutting the rainforest, especially when trawling over coral reefs.**

It should be noted that while mid-water trawls are towed off the bottom, they can still sometimes contact the ocean bottom and cause damage. For instance, mid-water trawls that target Alaska pollock and Atlantic herring or mackerel are known to occasionally contact the ocean bottom.

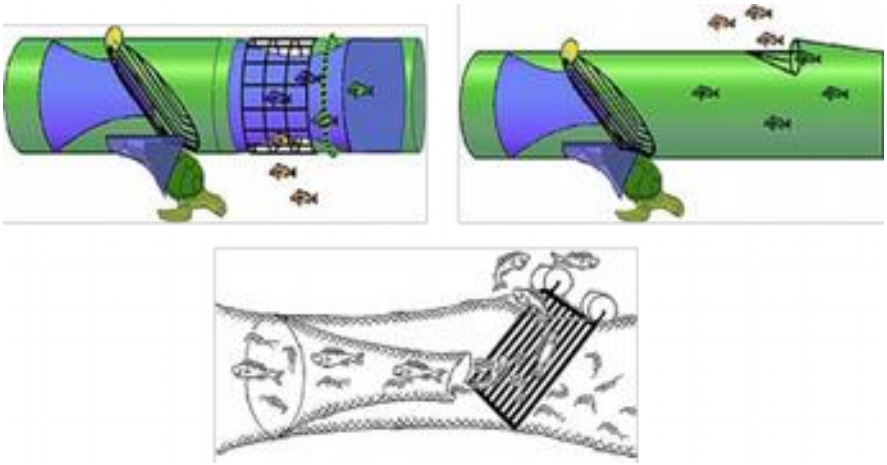
What can be done to lessen the negative effects of this fishing gear?

Turtle excluder devices and bycatch reduction devices are two common types of gear modifications that are used in trawl fisheries to reduce bycatch. The idea of these devices is to

provide a way for large or unwanted animals to escape, while still allowing for the capture of targeted species.

Turtle excluder devices are fitted into the neck of the trawl and consist of a grid of bars plus an escape opening/door at either the top or bottom of the net. When a large animal like a turtle hits the bars, it is directed to the escape opening and is able to swim free. Small animals like shrimp and fish, however, pass through the bars to the bag of the net

Bycatch reduction devices work similar to turtle excluder devices. For trawl fisheries targeting shrimp, these devices are designed to exclude fish, while still allowing shrimp to pass into the bag of the net. In trawl fisheries for fish, bycatch reduction devices are sometimes used to prevent the capture of a particular depleted species. There are various types of bycatch reduction devices[4] – below are a few examples.



Examples of various types of bycatch reduction devices. **Top left**: Funnel bycatch reduction device – Uses an inner small mesh funnel to provide a passage for shrimp to the bag of the net while a large mesh outer layer provides a means for large fish to escape. The design creates an area of reduced water flow so the fish can easily swim out the large mesh openings. **Top right**: The Fisheye – A cone-shaped rigid frame forms on opening in the net for fish to escape. **Bottom**: Sorting grate – Shrimp pass through the grate, while fish that are not large enough to pass through are pushed out through the escape opening. Images and information from NOAA Fisheries.

When used properly, turtle excluder devices and bycatch reduction devices can significantly reduce the deaths of sea turtles and other unintended species. Although they don't reduce bycatch completely, these devices are an important step in the right direction.

In the U.S., the majority of shrimp trawl fisheries are required to install turtle excluder devices and/or bycatch reduction devices in their nets. We have also helped encourage the use of turtle excluder devices in other shrimp fisheries around the world. In fact, the U.S. has a law that prohibits

importing shrimp from countries that do not require the use of turtle excluder devices when fishing in areas where turtles live. Currently, around 40 countries are certified to export shrimp to the U.S[5].

However, there are many trawl fisheries that are not using turtle and bycatch excluder devices, and fishermen compliance with these excluder device regulations remains an issue in many cases – even in some U.S. fisheries (e.g. Louisiana shrimp fishery).

There are also gear modifications or technologies that can help limit the effects trawls have on bottom ocean habitats. For instance, fishermen can add disks to the bottom of the trawl net to elevate it slightly off the seafloor, reducing the amount of contact the gear has with the bottom. This has been implemented in the Alaska flatfish trawl fishery and has been shown to significantly reduce damage to bottom habitats[6].

Of course, **the best way to protect ocean habitats is to limit the areas where trawling is allowed to occur**. It is particularly important that fishery managers prohibit trawling in habitats that are especially sensitive to trawl damage, such as coral reefs, sponges, and seagrass beds and in important fish habitats.

An un-trawled coral reef area in the Oculina Banks off the coast of Florida is pictured on the left, while a trawled area is pictured on the right. Photo Credits: NOAA/R. G. Gilmore & NOAA/University of North Carolina at Wilmington, Undersea Vehicles Program.

As we have learned more about the lasting effects that trawl fishing has on the ocean, several countries are banning bottom trawling in sensitive habitat areas and large areas off their coasts. **The U.S. has banned bottom trawling in large areas off the U.S. Pacific Coast and in some sensitive habitats off the U.S. East Coast. A few countries (e.g., Palau, Belize) have banned bottom trawling in *all* of their waters (kudos to them)**.

The Path Forward

Despite the destruction trawls cause, they remain one of the most common methods for catching fish and shrimp and many ocean areas remain vulnerable to trawl fishing. **Across the globe, fishery managers must take measures to limit the effects of trawling before they turn vast swaths of the ocean into barren wastelands. And managers must take measures to recover places that trawling has destroyed.**

We must ensure that turtle excluder devices and bycatch reduction devices are **used and *enforced*** in all trawl fisheries that catch vulnerable species. However, even with these excluder devices, trawl fisheries can still catch large numbers of unintended marine animals. Therefore **when possible, managers and fishermen should look to fishing with more selective fishing gear.** For example, some shrimp fisheries are using pots instead of trawls (to be covered later in the blog series—so stay tuned).

To protect ocean habitats, **fishery managers must close off more areas to trawling and ensure that bottom trawling is not allowed in any new areas.** (We have trawled enough of the ocean already!) We should prohibit bottom trawling (and mid-water trawls that contact the bottom) in the deep-sea and in any areas with coral reefs, sponges, seamounts, or other sensitive habitat features. But we must also protect large portions of all habitat types from this destructive practice to make sure that all ocean species have healthy places to live.

Notes:

1. Addressing the Collateral Impacts of Fishing Methods in U.S. Waters http://mcbi.marine-conservation.org/publications/pub_pdfs/ShiftingGears.pdf

2. Bycatch in Atlantic herring mid-water trawls
http://www.herringalliance.org/images/Stories/factsheet_bycatch.pdf **and**
http://www.herringalliance.org/images/Stories/factsheet_riverherring.pdf

3. Global analysis of response and recovery of benthic biota to fishing http://www.int-res.com/abstracts/meps/v311/p1-14/**;**
Impacts of bottom trawling on deep-coral ecosystems of seamounts are long-lasting
http://faculty.wwu.edu/~shulld/ESCI%20432/Althaus2009.pdf**;**
Comparison of trawled vs. untrawled mud seafloor assemblages of fishes and macroinvertebrates at Coquille Bank, Oregon
https://research.vancouver.wsu.edu/sites/research.vancouver.wsu.edu/files/14.pdf**;**
Chronic and intensive bottom trawling impairs deep-sea biodiversity and ecosystem functioning
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4066481/

4. Bycatch Reduction Devices
http://sero.nmfs.noaa.gov/sustainable_fisheries/gulf_fisheries/shrimp/brd/index.html **and**
http://www.nwfsc.noaa.gov/research/divisions/fram/groundfish/habitat_videos.cfm

5. Shrimp Import Legislation for Sea Turtle Conservation
http://www.nmfs.noaa.gov/pr/species/turtles/shrimp.htm

6. Trawl Gear Innovations http://www.nmfs.noaa.gov/stories/2012/07/07_26_12trawl_gear_innovation.html

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