Source: Safina Center http://safinacenter.org/

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.

Dredges – The Bottom Scrapers

Photo: NOAA Fish Watch

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 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.

Dredges are dragged along the seafloor to catch bottom-living shellfish. Unfortunately, they can cause severe harm to bottom ocean habitats – **they plow over, dig into, excavate, modify, and destroy habitats.**

Dredges – The Bottom Scrapers

What is a dredge?

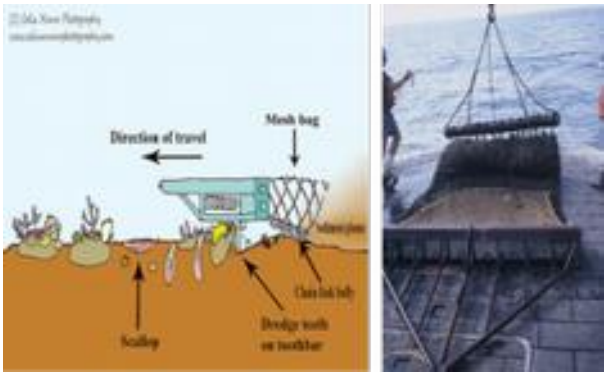
Dredges consist of a metal mouth frame with an attached collection bag. The collection bag is made of metal rings, metal bars, and/or mesh webbing. Fishing vessels drag the dredge along the sea floor to scoop up bottom-living species.

There are two types of dredges:

− **Scraping dredges** have teeth or a cutting bar that dig into the bottom sediment to collect animals that live on or just under the sediment surface.

− **Penetrating dredges** (often called hydraulic dredges) shoot a jet of water into the seafloor to chase animals that live deep in the sediment out and into the collection bag(1).

Dredges used in offshore waters are typically 12-15 feet (3.5-4.5 meters) wide and may weigh 2,600 pounds (1,000 kg) or more.(2) In shallow habitats, smaller dredges are used. Fishing vessels may drag one or more dredges at a time. Typical drag times range from 15 minutes to 1 hour.



Left: Illustration showing the key parts of a scraping dredge, how it works, and how it can affect bottom habitats and species. Credit: Colin Munro Photography, colinmunrophotography.com. Right: Scraping dredge used to collect Atlantic sea scallops. Credit: NOAA.

What does a dredge catch?

Dredges are primarily used to catch **clams, scallops, oysters, or mussels** – collectively referred to as '***bivalves***' because they have two valves or shell parts. Generally, scraping dredges are used to collect scallops, oysters, and mussels. Penetrating or hydraulic dredges are used to catch some clam species (e.g., Atlantic surf clam, Ocean quahog). Dredges are also sometimes used to catch crabs, sea urchins, sea cucumbers, and conch.


Left: A hydraulic clam dredge with water coming from jets as it is lifted out of the water. Right: Catch from a clam dredge. Credit: NOAA.

How do dredges affect the ocean?

Dredges rival bottom trawls for the title "most damaging gear to bottom ocean habitats". As the dredge is dragged along the sea floor, it leaves large scars, stirs up the sediment (which can reduce water quality), plows over or uproots structural features, like rocks, sponges, and seagrass, and may bury, dislodge, or kill bottom-living species such as worms, snails, and crabs. Dredges that have long teeth (like a rake) are particularly damaging because they dig deep into the sediment. Penetrating or hydraulic dredges, which shoot jets of water into the sea floor, also cause a massive disturbance to bottom habitats. They liquefy the sediments and leave a trench in the sea floor that is typically the width of the dredge (12-15 ft) and up to 1 ft deep. These trenches may last for several months to more than a year.(3)

Dredging can negatively affect the habitat of the very species fishermen are trying to catch and the habitats of other ocean animals too. For instance, dredging in seagrass areas greatly reduces the abundance of seagrass. This in turn negatively affects populations of bay scallops, mussels, crabs, lobsters, and fish that rely on seagrass for critical nursery habitat and protection from predators. It may take several years for the seagrass to re-grow.(4) Dredging over oyster beds [a large aggregation of oysters] can reduce the height and alter the structure of the beds. This may make the beds less suitable for oyster growth and survival. And it can reduce the amount of suitable habitat for small fish, shrimp or other species that live in the small spaces between the oysters.(5) In a variety of habitat types, scientists have found that dredged areas have a reduced number and variety of bottom-living species compared to similar un-dredged areas.(6)

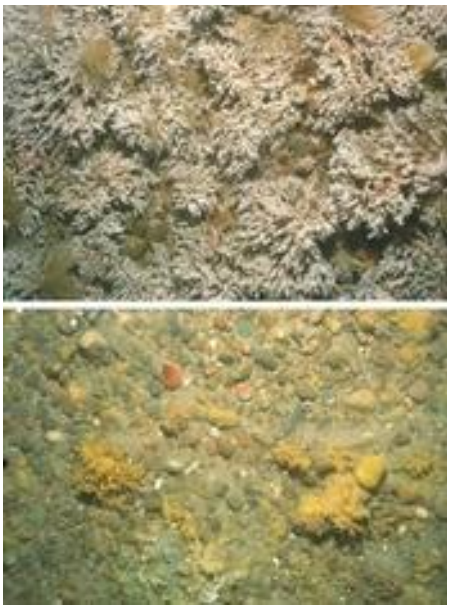
Some dredge fisheries also catch significant amounts of non-target species or 'bycatch'. This is often a concern in scallop fisheries. The U.S. Atlantic sea scallop fishery catches several bottom-living fish species such as monkfish, flounders, and skates, undersized scallops, and sometimes loggerhead sea turtles. The bycatch can be 10-30% of the total catch.(7) The UK Scottish Scallop fishery catches a significant amount of bycatch that includes starfish, sea urchins, whelks, undersized scallops, and other shellfish8. Fishermen discard much of the bycatch – some dead and some alive – back to sea. This can attract predators and it is likely that species damaged during capture are quickly gobbled up.

Other dredge fisheries, however, such as those for oysters, clams, or mussels are fairly selective and capture low amounts of non-target species.

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

To reduce the negative effects dredge fishing has on bottom ocean habitats, fishery managers can restrict the size and number of dredges that are used. In shallow water fisheries, lighter-weight dredges are often used, which helps reduce the amount of penetration into the sediment. But **the best way to reduce negative effects to the habitat is to close off large areas to dredging**. Fishery managers have done this in the Alaska Weathervane Scallop fishery. Fishing for Weathervane Scallops takes place over a very small proportion of the available habitat. This helps ensure a sufficient amount of habitat remains healthy and robust for scallops and other species. **Because of the significant measures to protect habitat in this fishery, the Alaska Weathervane Scallop is rated "green"!**(9) Fishery

managers of the U.S. Atlantic Sea Scallop fishery have also closed some areas to scallop dredging. This has benefited both sea scallops and ocean habitats.



The top photo shows a normal sea floor community on Georges Bank, while the bottom photo shows a similar area after dredges have been used to catch scallops. Credit: Dann Blackwood and Page Valentine, USGS.

To reduce the amount of bycatch or non-target catch in dredge fisheries, fishery managers may require a minimum ring size or a minimum spacing between bars on the collection bag to allow small animals to pass through and avoid capture. [However, this does not necessarily prevent those small animals from getting run over and crushed by the dredge gear]. In some cases, fishery managers have restricted fishing in areas where high bycatch is known to occur and placed limits on the amount of allowed by catch.(7,9)

In the U.S. Atlantic sea scallop fishery, fishermen are required to utilize turtle deflector dredges in certain areas and during certain times when the bycatch of sea turtles is a concern. This modified dredge is designed to deflect sea turtles over the frame and collection bag to prevent them from getting caught or injured.(1)

The Path Forward

It's clear that dredges can cause severe damage to ocean bottom habitats and species. So we must limit the amount of habitat that is affected. **It is imperative that fishery managers close off large areas to dredge fishing to allow destroyed habitats to begin to recover and to protect any remaining undisturbed areas.**

Additionally, **in fisheries where dredging takes place in sensitive habitats, like seagrass areas, oyster beds, or mussel beds, the fishery should consider switching to less damaging fishing methods.** We will cover some of these less damaging methods, which include hand rakes, hand tongs, or diving, later in this series. Reducing damage to these valuable habitats would greatly benefit our coastal ocean ecosystems, since they provide essential habitat for many ocean animals, help limit coastal erosion, and in the case of oysters and mussels, filter the water. *And this* would benefit the very shellfish populations fishermen want to catch!(4,5)

We must remember that the key to a healthy ocean is protecting vibrant habitats.

The Safina Center creates an original blend of science, art and literature that inspires a deeper connection with nature, especially the sea. They translate scientific information into language people can understand and serve as a unique voice of hope, guidance, and encouragement. Their mission is to motivate people to actively engage as constituents for conservation.

Elizabeth Brown *is a research scientist at The Safina Center.*

Notes:

1.) Dredges: Fishing Gear and Risks to Protected Species http://www.nmfs.noaa.gov/pr/interactions/gear/dredges.htm

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

3.) Immediate and longer term impacts of hydraulic clam dredging on an offshore sandy seabed: effects on physical habitat and process of recovery http://www.researchgate.net/profile/Ellen_Kenchington/publication/222182380_Immediate_and_longer-term_impacts_of_hydraulic_clam_dredging_on_an_offshore_sandy_seabed_effects_on_physical_habitat_and_processes_of_recovery/links/00b7d513fec58b4011000000.pdf; Review of the Ecological Effects of Dredging in the Cultivation and Harvest of Molluscan Shellfish http://www.nefsc.noaa.gov/publications/tm/tm220/tm220.pdf

4.) Disturbance of eelgrass Zostera marina by commercial mussel *Mytilus edulis* harvesting in Maine http://www.int-res.com/articles/meps2004/285/m285p057.pdf; Negative effects of commercial mussel dragging on eelgrass beds in Maine http://www.pwrc.usgs.gov/products/factsheets/maquoit_sm.pdf; Effects of harvesting methods on sustainability of a bay scallop fishery: dredging uproots seagrass and displaces recruits http://fishbull.noaa.gov/1034/bish.pdf

5.) Conserving oyster reef habitat by switching from dredging and tonging to diver-harvesting http://fishbull.noaa.gov/1022/lenihan.pdf; Review of the Ecological Effects of Dredging in the Cultivation and Harvest of Molluscan Shellfish http://www.nefsc.noaa.gov/publications/tm/tm220/tm220.pdf

6.) The role of scallop-dredge disturbance in long-term changes in Irish Sea benthic communities: a re-analysis of a historical dataset http://www.sciencedirect.com/science/article/pii/S1385110102000965; Effects of bottom fishing on the benthic megafauna of Georges bank http://www.int-res.com/articles/meps/155/m155p159.pdf; The impact of scallop dredging on benthic megafauna: a comparison of damage levels in captured and non-captured organisms http://www.int-res.com/articles/meps/215/m215p297.pdf; Global analysis of response and recovery of benthic biota to fishing http://www.int-res.com/abstracts/meps/v311/p1-14/; Disturbance to marine benthic habitats by trawling and dredging: Implications for marine biodiversity http://daytonlab.ucsd.edu/publications/thrushetal02.pdf; Immediate impacts and recovery trajectories of macrofaunal communities following hydraulic clam dredging on Banquereau, eastern Canada http://icesjms.oxfordjournals.org/content/62/5/925.full

7.) U.S. Sea Scallop Seafood Report http://safinacenter.org/seafoods/scallop-sea-hotate/; U.S. National Bycatch Report First Addition Update http://www.st.nmfs.noaa.gov/observer-home/first-edition-update-1

8.) Scottish Scallop Seafood Report http://safinacenter.org/seafoods/scallop-scottish-king/

9.) Alaska Weathervane Scallop Seafood Report http://safinacenter.org/seafoods/scallop-weathervane/