Where Does Your Seafood Come From?

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NCSR curriculum modules are designed as comprehensive instructions for students and supporting materials for faculty. The student instructions are designed to facilitate adaptation in a variety of settings. In addition to the instructional materials for students, the modules contain separate supporting information in the "Notes to Instructors" section, and when appropriate, *PowerPoint* slides. The modules also contain other sections which contain additional supporting information such as assessment strategies and suggested resources.

Acknowledgements

We thank David Lonsdale and Richard O'Hara of Chemeketa Community College for their thoughtful reviews. Their comments and suggestions greatly improved the quality of this module. We thank NCSR administrative assistant, Liz Traver, for the review, graphic design and layout of this module.

Table of Contents

NCSR Marine Fisheries Series

The marine fisheries issue is complex and represents an opportunity to approach the nature and management of a natural resource from several different perspectives in courses in natural resource or environmental science programs. Complete coverage of all fisheries-related topics is probably impractical for most courses unless the course is entirely devoted to fisheries. Instructors may select some topics for coverage and de-emphasize or ignore others. Thus, these curriculum materials are designed to meet a variety of instructional needs and strategies. The *NCSR Marine Fisheries Series* is comprised of the following:

1. *PowerPoint* Presentations

These presentations include *PowerPoint* slides, lecture outlines and detailed instructor notes on various marine fisheries topics.

- *Marine Fisheries Overview*
- *Marine Fisheries – Introduction and Status*
- *Marine Fisheries – Causes for Decline and Impacts*
- *Marine Fisheries – Management and Proposed Solutions*
- *Declining Expectations – The Phenomenon of Shifting Baselines*
- *The Role of Marine Reserves in Ecosystem-based Fishery Management*

2. *The Decline of Atlantic Cod – A Case Study*

This module provides a comprehensive examination of the decline of the Atlantic cod. Instructional materials include student learning objectives, a *PowerPoint* presentation with instructor notes, student handouts, suggested resources and assessment. Brief descriptions of other fisheries for development as case studies are also provided.

3. *Comprehensive Resources for NCSR Marine Fisheries Series*

This module provides detailed summaries for six excellent videos that examine various aspects of the marine fisheries issue:

- *Empty Oceans, Empty Nets* (2002) – an overview of major marine fisheries issues (one-hour) – student handout provided
- *Farming the Seas* (2004) – an examination of issues associated with aquaculture (one-hour) – student handout provided
- *Deep Crisis* (2003) – an examination of current research on salmon and bluefin tuna using modern technology (one-hour)
- *Strange Days on Planet Earth – Episode 3- Predators*
- *Strange Days on Planet Earth – Episode 5 – Dangerous Catch*
- *Journey to Planet Earth – The State of the Planet's Oceans*

This module also provides a comprehensive glossary of terms commonly used in marine fisheries.

In addition, complete citations and brief summaries of web, print and video resources are provided that can be used to:

- Enhance existing lecture topics
- Develop lectures on new topics
- Develop geographically relevant case studies
- Update fishery statistics
- Select articles for student reading
- Access video and photos for presentation purposes

4. Activity-based Instructional Modules

    - *Shrimp Farming – Environmental and Social Impacts* – an evaluation of the environmental and social impacts of shrimp aquaculture (one hour)
    - *Where Does Your Seafood Come From?* – students evaluate the sustainability of locally available seafood and the criteria that are used to make that determination (3-4 hours)

The manner in which instructors use the modules in this series will depend upon:

- The course in which the module will be used

The marine fisheries modules are most appropriate for inclusion in undergraduate courses such as *Environmental Science*, *Introduction to Natural Resources*, *Marine Biology*, *Introduction to Fisheries* and *Fisheries Management*. Parts of the modules may also have application in courses with a broader scope such as *General Ecology* and *General Biology*.

- The background of the students

The marine fisheries modules assume some understanding of basic ecology including populations, communities and ecosystem structure and function. The treatment of ecology in either a college-level or high school-level general biology course should be sufficient. Instructors may need to provide additional background to students who are not familiar with this material.

- The time that will be dedicated to the study of marine fisheries

There is sufficient information and resources in the marine fisheries modules to present anything from a single one-hour lecture to a major portion of a full academic term, lecture-only course. Instructors may select from the various components depending on course objectives and the amount of time allocated for marine fisheries topics.

Where Does Your Seafood Come From?

MODULE DESCRIPTION

This activity is designed to familiarize students with seafood products that are being sold in their community and to have them investigate the conservation characteristics (stock status, harvest method, wild-caught or aquaculture product, etc.) of those species.

INTRODUCTION

According to a 2001 public opinion survey conducted by the Seafood Choices Alliance, American consumers have little awareness of sustainability issues associated with the capture or production of seafood. Seafood consumers were much more aware of health issues associated with seafood consumption than the environmental effects associated with commercial fishing. Even fewer were aware of the environmental impacts associated with aquaculture. The same survey asked consumers questions about the source of the fish and shellfish they ate. The majority were unable to say whether the seafood they purchased was wild-caught or farmed.

Thus, it appears that there is a rather low degree of awareness on both the impacts of commercial fishing and how the seafood that Americans consume is produced. Given recent reports that document the depletion of fishery stocks and marine ecosystems that support them, this lack of awareness by consumers raises additional concern. Choices made by consumers can influence those fishery stocks that are exploited and the methods that are used in their capture or production. This module attempts to increase student awareness of fisheries issues by examining locally-available seafoods and using various resources to determine the environmental impacts associated with their capture or production.

OBJECTIVES

Upon successful completion of this module, students should be able to:

1. Describe the various criteria that are used to determine the sustainability of seafood products
2. Evaluate the sustainability of locally-available seafood

STUDENT HANDOUT

Where Does Your Seafood Come From?

INTRODUCTION

According to a 2001 public opinion survey conducted by the Seafood Choices Alliance, American consumers have little awareness of sustainability issues associated with the capture or production of seafood. Seafood consumers were much more aware of health issues associated with seafood consumption (57% reporting "high awareness") than the environmental effects associated with commercial fishing (33%). Even fewer (12%) were aware of environmental impacts associated with aquaculture.

The same survey asked consumers questions about the source of the fish and shellfish they ate. The majority (52%) were unable to say whether the seafood they purchased was wild-caught or farmed.

Thus, it appears that there is a rather high degree of ignorance on both the impacts of commercial fishing and an awareness of how the seafood that Americans consume is produced. This module attempts to fill some of that void by examining locally-available seafoods and using various resources to determine the environmental impacts associated with their capture or production.

OBJECTIVES

Upon successful completion of this module, students should be able to:

1. Describe the various criteria that are used to determine the sustainability of seafood products
2. Evaluate the sustainability of locally-available seafood

PROCEDURE "A"

1. View the short segment from the "Farming the Seas" video, which describes the consumer perspective on seafood consumption including "seafood certification."

2. Sometime over the next several days visit a local establishment that sells seafood. A local fish market is preferred, but if unavailable, a grocery store that sells seafood or a restaurant that serves seafood would also work. Your instructor will provide a list of local vendors for this purpose.

3. The primary objective of your visit is to observe what species are being sold and to determine their unit price (e.g., $ per pound). You should also note which species, if any, have received Marine Stewardship Council (MSC) certification. Limit your observations to 5 species. If more than 5 are available for sale, select 5 by sampling systematically. For example, if 10 are available, select every other species; if 15 are available, select every third species, etc. until 5 are selected. In a fish market or grocery store you will probably be able to make your observations through the glass display case. Record the price per pound for each of the species you have selected. At a restaurant, you will probably need to ask to see a menu. For restaurant dishes, select those that have only one type of seafood and record the price for the meal.

4. Local vendors should have someone on staff who is knowledgeable about the sources for some or all of the seafood being sold. If this person is available, ask if it would be possible to ask a few questions. Describe what you are doing and why (Be sure they know you are not a health inspector!). You may want to call first to set up an appointment with this person.

5. For each of the five species you have selected, determine the following:

- Price per pound
- Is this product "wild-caught" or "farmed?"
- What fishing method (trawl, seine, longline, etc.) is used to harvest this species? Brief descriptions of each of these fishing methods are provided after the "Seafood Product Data Sheet."
- Harvest location
- MSC certification status

Record your results on the "Seafood Product Data Sheet" provided at the end of this handout.

6. If a knowledgeable person is available and willing, determine the following:

- How frequently do customers ask about the source of the seafood product being sold?
- Do any customers ask specifically for "sustainably caught fish," "MSC-certified fish" or similar questions?
- What criteria, if any, do they use to determine who they purchase their fish from.

Record your results on the "Seafood Product Data Sheet."

7. For each of the species you have selected, determine the "sustainability status" of each using the resources page included in your handout. Most of these sites have developed a simple rating system for seafood products based on the degree to which they are "sustainably produced." One organization for example, uses "red," "yellow" and "green" for "poor," "possibly good" and "good" choices, respectively. The goal of this approach is to provide consumers with information on the seafood they are purchasing in hopes that, armed with this information, consumers will make more sustainable choices.

Record all of your results on the "Seafood Product Data Sheet."

8. Several criteria are used to assign a seafood product to a particular sustainability category. Although each organization uses slightly different criteria, usually some combination of the following is used:

Life History Characteristics – intrinsic rate of increase, age to maturity, life span, etc.
Abundance – population size and trajectory (increasing, decreasing, stable)
Habitat Quality and Fishing Gear Impact – general condition of habitat for the species and the degree of impact on the habitat by fishing gear
Management – How effective is current management (e.g., restrictions, quotas, lack of management)?
Bycatch – the degree of "collateral damage" on non-target species

For each of the species you have selected, describe the average status of each of these criteria as reported by the various evaluating organizations? (The "Blue Ocean Institute" and "FishWatch" sites have detailed information for most species).

Record your results on the "Sustainability Criteria Data Sheet."

9. Approximately one week will be allowed for you to collect the information indicated above. Come to class with both data sheets and questions #1- 5 below completed. Be prepared to share your information with others in your lab group.

ANALYSIS

Use the information you have collected to respond to the questions below. Place your answer in the space provided.

1. Are any of the species you selected MSC-certified? If so, which ones? Are any in the process of MSC certification? Which ones?

2. For those species that are <u>not</u> MSC-certified, what changes (if any) do you think would have to occur for that certification to be approved?

3. Do you think MSC certification influences consumer choices today? How do you know?

4. Do you think this will change in the future? Why or why not?

5. Would MSC-certification or other sustainability designations such as those provided by the Blue Ocean Institute influence <u>your</u> decisions as a consumer of seafood? Why or why not?

Seafood Product Data Sheet

Observer _____ Date of Survey _____

Name of Vendor _____ Location of Vendor _____

Product Name	Price ($/lb)	Farmed or Wild-caught	Harvest Method	Harvest Location	MSC	Sustainability Status	Resources Used				
							1	2	3	4	5

Questions for vendor:

- How frequently do customers ask about the source of the seafood product being sold?
- Do any customers ask specifically for "sustainably caught fish," "MSC-certified fish" or similar questions?
- What criteria do you use to determine where you purchase your seafood?

See following page for details on how to complete the data sheet.

Description of column headings for *Seafood Product Data Sheet*

Product Name – specific name and form of product (e.g., Fresh Pacific halibut steaks)
Price – price per pound (or "price per meal" if vendor is a restaurant)
Farmed or Wild-caught – enter "F," if the product was produced in an aquaculture operation; enter "W," if the product was "wild-caught"
Harvest Method – enter dredge, gill net, longline, purse seine, traps or pots, trawl, trolling (see fishing gear descriptions on the following page); enter "NA" ("not applicable") here for farmed species
Harvest Location – be as specific as possible (e.g., "Pacific Ocean off Oregon Coast," "Aquaculture operation in Vietnam")
MSC – has this product been certified by the Marine Stewardship Council? Enter "Y," if yes; "N," if no and "P," if pending
Sustainability Status – most organizations use a simple three or four-category system for assessing "sustainability" of seafood products (e.g., "best choice", "good choice," "poor choice"). Use the sources included in the activity to research the status of each of the products you have selected.

If any of the above criteria cannot be determined, enter "U," indicating "unknown."

Use the following abbreviations to indicate (in columns #1-5) which resources you used:

BOI – Blue Ocean Institute
CC – Chef's Collaborative
FW - FishWatch
ED – Environmental Defense
MBA – Monterey Bay Aquarium
SCA – Seafood Choices Alliance

A Note on Reading Labels

Reading labels on canned, dried or frozen seafood products can be a challenge. In some cases a fish is harvested in one location, shipped to another location for processing and packaging, transported to a distributor and then finally to a retail outlet. Each of these locations may be in a different country. As a result, you may find it difficult to track the path that the product has followed and complete information is often lacking. If a website is given on the label, more detailed information is sometimes available there.

As you begin reading seafood labels, you will find it useful to know what the following terms mean:

"**Harvested in** …." – This is where the product was initially harvested ("harvest location").

"**A product of** …" – This might be the same as harvest location but not necessarily; any company that modifies or processes the seafood in any way (filleting, freezing, packaging, etc.) can lay claim to that product with this statement.

"**Distributed by** …" – This is generally used by a wholesaler who distributes the product to retail outlets; distributors may or may not be involved in the harvest or processing of the seafood product.

Fishing Gear Descriptions (for "Harvest Method" column on *Seafood Product Data Sheet)*

The harvest method that is used influences the sustainability of a fishery because methods vary in their impact on benthic habitats and their selectivity. Non-selective methods capture larger numbers of non-target species (bycatch), whereas more selective methods minimize bycatch.

Dredge – A heavy metal frame and mesh dragged along the seafloor usually to harvest shellfish (e.g., clams, scallops, cockles). The catch is held in a terminal bag that allows water, sand and mud to wash out, leaving shellfish behind. Dredges disturb benthic habitats.

Gill net – A vertical, wall-like net that is usually set perpendicular to the flow of water. Mesh size allows the heads of fish to pass through, but the gill covers get caught, trapping the fish. Bycatch can be high as gill nets are somewhat non-selective.

Longline – Many short lines, each with a single, baited hook, suspended vertically from a main line that is usually suspended between two floating buoys. Longlines may be over 40 miles long and contain thousands of hooks. Bycatch can be high as gear is quite non-selective – birds, marine mammals and sea turtles are often taken in addition to non-target fish.

Purse seine – A large net usually set by two boats to catch open-ocean, pelagic fish such as tuna and herring. The boats encircle a school of fish and then draw the bottom of the net together much like a purse. Mesh size regulates the size of fish that are allowed to escape. Bycatch of dolphins by tuna purse seiners raised public awareness of the issue in the 1970s.

Traps and Pots – Species-specific (e.g., crab pots, lobster pots, tuna traps) stationary gear that allows the entry but not exit of the target species. The gear can take many forms such as baskets or cages. Gear is usually quite specific and bycatch is minimal.

Trawl – An open, cone-shaped net that tapers to a small "cod-end" where fish accumulate while the trawl is dragged behind the fishing vessel. A system of cables, net wings and "doors" keeps the net open while fishing. Trawls can be towed behind a fishing vessel at any depth, but most are designed to travel along the bottom where they can disrupt benthic habitats. Bycatch can also be quite high as the net scoops up everything in its path.

Trolling - This is a hook-and-line method with some similarity to rod and reel recreational fishing. Fish are attracted by natural or artificial bait placed on a hook at the end of a line. Trolling gear is composed of several unconnected lines slowly dragged behind the boat. Bycatch for this method is generally quite low.

Sustainability Criteria Data Sheet

	SUSTAINABILITY CRITERIA				
Seafood Product	Life History	Abundance	Habitat Quality and Fishing Gear Impact	Management	Bycatch

SPECIES-SPECIFIC RESOURCES

The resources below will provide you with information on the conservation status, harvest method and sustainability designation for the species you have observed. Use several sources to get a complete picture of the status of each species you have selected.

Blue Ocean Institute
www.blueocean.org/Seafood

In addition to on-line information, try using FishPhone, Blue Ocean's sustainable seafood information service. To determine the sustainability status for any seafood, text, 30644 with the message "FISH" along with the name of the fish in question. Blue Ocean will text you back with their assessment.

Environmental Defense
www.edf.org/page.cfm?tagID=1521

NOAA Fisheries FishWatch Program
www.nmfs.noaa.gov/fishwatch/

This site describes the sustainability status of all U.S. commercial fisheries. Additional information on life history, habitat, stock biomass and management is also provided.

Marine Stewardship Council
www.msc.org

The Marine Stewardship Council (MSC) establishes the criteria that must be met for seafood products to be certified as sustainable. MSC also accredits third party certification bodies that conduct the actual assessment. The mission of MSC is "to safeguard the world's seafood supply by promoting the best environmental choices."

Three main criteria are used to determine if a fishery is to be certified:

1. *Status of the target fish stock*
2. *Impact of the fishery on the ecosystem*
3. *Performance and effectiveness of the fishery management system*

The web site also includes a list of those fisheries that have been certified and those whose certification is pending ("in assessment").
www.msc.org/html/content_484.htm

Monterey Bay Aquarium Seafood Watch Program
www.mbayaq.org/cr/seafoodwatch.asp

ADDITIONAL RESOURCES

Chef's Collaborative
www.chefscollaborative.org

Chef's Collaborative is a nonprofit network of chefs that fosters a sustainable food system through advocacy, education, and collaboration with others in the food industry. The group provides chefs with the information necessary to make sustainable purchasing decisions and facilitates connections between chefs and sustainable food producers. Their publication "Seafood Solutions – A chef's guide to sourcing sustainable seafood" *(see* "Programs"*) provides chefs with some guidelines to use while making seafood purchasing decisions. Most of these guidelines also apply to "non-chefs" and students should find it interesting reading. Given the amount of seafood that is consumed by American's in restaurants, seafood choices made by chefs play an important role in achieving sustainable fisheries.*

Seafood Choices Alliance
www.seafoodchoices.org

Seafood Choices Alliance (SCA) is an international program that provides a bridge between the seafood industry and the marine conservation community. Based in the United States, SCA helps the seafood industry to make the seafood we buy environmentally, economically and socially sustainable. The SCA website includes a number of useful resources, publications and links to help individuals and businesses make sound seafood purchasing decisions and to learn more about seafood-related issues.

Information on the sustainability of various seafood species can be obtained from the SCA, including The Good Catch Manual, *which can be downloaded from this website:*
www.seafoodchoices.org/whatwedo/goodcatch.php

Although The Good Catch Manual *is designed primarily for chefs and others in the restaurant industry, students will find a wealth of information here that centers on purchasing sustainably-produced seafood. Background information on the general principles of seafood sustainability is provided, including wild capture and fish farming methods and environmental issues associated with seafood. There are also summaries of the sustainability of more than 50 types of seafood, including conservation status and ratings from the Marine Conservation Society and a list of Marine Stewardship Council certified suppliers.*

PROCEDURE "B"

After you have completed "PROCEDURE A," meet with your lab group (3-4 students each) to discuss the results. Use your group's combined data to answer the following questions. Record your answers in the space provided.

1. Of the species your group observed and recorded, which are the "best choices" as judged by these organizations?

2. What characteristics of the fishery were used to assign these species to this category?

3. Which are the "worst choices?"

4. Why were these species assigned to this category?

5. One might suspect that those species that are assigned to the "best choices" category are more abundant and cheaper than those that are assigned to the "worst choices," which one would assume are less abundant. Evaluate this claim, by creating a graph in the spreadsheet program, *EXCEL*, that plots "price per pound" against "conservation status."

   Hint: You may want to assign a numerical value to each of the categories of sustainability status (e.g., "worst" = 1, "best" = 4, etc.).

   - Does there appear to be any correlation between these two variables?

   - What reasons can you offer for this correlation (or lack of correlation, if that is what you find)?

6. Which of the seafood products surveyed by your group were “locally produced?”

7. Which ones were U.S. products but produced or harvested in another region of the country?

8. Which ones were produced or harvested outside of the U.S.?

9. Describe the relationship between “harvest location” and “sustainability.”

NOTES TO INSTRUCTORS

Prior to the activity develop a list of local vendors of seafood for students. If available, a variety of outlets is preferred – local fish markets, local grocery markets, large chain grocery stores and restaurants. Instructors may want to contact vendors prior to the activity, but I have generally not found this to be necessary.

Provide students with handouts prior to the activity.

To introduce the activity, show the 10-minute segment from "Farming the Seas" video, which can be ordered from:

> *Farming the Seas*. 2004. Habitat Media. VHS 56 min.
> 734 A Street
> San Rafael, CA 94901
> 415-458-1696
> www.habitatmedia.org

The segment at the 50-minute to 60-minute interval in the video describes consumer perspectives on seafood consumption including:

- shellfish as a potentially more sustainable choice for aquaculture than carnivorous fish
- certification of sustainably-produced seafood by the Marine Stewardship Council
- the development of "seafood guides" that inform and direct consumers toward more sustainable products
- the role of consumers and chefs in restaurants in the selection of seafood
- the desire by the American consumer to know where their food comes from
- the connection between choices made by consumers and pressure put on retailers, wholesalers and producers

Also, as part of your introduction you may find it useful to introduce students to the various methods used to harvest seafood. In addition to the descriptions included on the student handout, a *PowerPoint* presentation on harvest methods is provided for that purpose. Additional information on fishing gear can be accessed at:

Oregon Sea Grant Program
http://seagrant.oregonstate.edu/sgpubs/onlinepubs.html

See "Commercial Fishing" section for descriptions and diagrams of the most common gear types used in West Coast fisheries.

Monterey Bay Aquarium
www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_gear.aspx

For a detailed assessment of the environmental impacts of various types of fishing gear, see: How we fish matters: Addressing the ecological impacts of Canadian fishing gear.

www.howwefish.ca or
www.ecologyaction.ca/content/how-we-fish#documents

Allow approximately one week for students to collect data and complete "PROCEDURE A." Then, have students complete "PROCEDURE B" in small groups as described.

The following background information may be used by the instructor to enhance further classroom discussion or may be provided to students as a handout.

SOME ADDITIONAL BACKGROUND

The most commonly consumed seafood in the U.S on a per capita basis are (in order) shrimp, tuna, salmon, Alaska pollock and catfish. Thus, some additional information on these species may be useful to provide to students as background.

1. SHRIMP

Shrimp are the most commonly consumed seafood in the U.S. with a per capita consumption of 4.2 pounds in 2004. The U.S. imported $3.6 B worth of shrimp in 2001 from over 40 countries. Thailand is the leading supplier. Shrimp are caught in the wild and farmed. The sustainability of shrimp fisheries is highly dependent on species, location and methods of harvest; and varies from "sustainable" to "highly unsustainable." The terms "shrimp" and "prawns" are used interchangeably although "prawns" tend to be larger. Some of the more common shrimp in the U.S. marketplace are described below. For more information see the Monterey Bay Aquarium web site at: www.montereybayaquarium.org.

Northern shrimp/Pink shrimp – These small, "salad" shrimp are wild-caught in trawls in the Atlantic (northern) and Pacific (pink) and are generally seen as being sustainably managed. The Oregon pink shrimp fishery has recently obtained MSC certification.

White shrimp/Brown shrimp – These larger shrimp are wild-caught in trawls in the Gulf of Mexico and the southern Atlantic Ocean. They comprise the majority of domestic shrimp harvested from this region. Although not overfished, bycatch and habitat damage by trawls remain an issue. The problem of bycatch of sea turtles has been addressed by requiring "turtle excluder devices" on all U.S. trawls.

Rock shrimp – These thick-shelled, lobster-like shrimp have been commercially harvested only since the 1960s. Like white and brown shrimp, they are caught in trawls in the Gulf of Mexico and the southern Atlantic Ocean, but usually in deeper waters. Bycatch and habitat damage issues are similar to those for white and brown shrimp.

Tiger prawns – These shrimp are imported to the U.S. from Asia and Latin American countries where they are both wild-caught and farmed. Because bycatch reduction devices are not required by most countries outside the U.S. these species are seen as a less desirable choice for consumers. The environmental impacts of shrimp aquaculture, including the loss of mangrove forests, artificial enrichment of natural waterways and the harvest of other fish to feed captive shrimp, further reduce the appeal of tiger prawns as a consumer choice.

Spot prawn – These very large shrimp are caught in traps off the U.S. Pacific Coast and British Columbia, where populations are healthy and abundant and considered a good consumer choice. Since traps may be set on fragile benthic habitats there may be some habitat damage, but bycatch is relatively low.

2. TUNA

Americans consume 3.3 pounds of tuna per year on a per capita basis. Most of this is consumed as canned tuna caught outside of U.S. waters. A number of different species are harvested; all are large members of the family Scombridae, a group of fast-swimming pelagic fish. It may be difficult for consumers to know which species they are purchasing because a number of different market names are applied to canned tuna. The most commonly used market terms are:

"Solid" – larger, firmer pieces with fewer flakes
"Chunk" – shredded into smaller pieces
"White" – albacore
"Light" – a number of species, frequently in combination (skipjack is most common)

Several species are harvested and their popularity has driven some species to critically low levels. In March 2009, the world's major tuna processors (*Bumble Bee*, *StarKist* and *Chicken of the Sea*) formed the International Seafood Sustainability Foundation (ISSF). ISSF members are committed to sustainability of tuna stocks and have pledged to purchase only sustainably-caught tuna after 1 September 2009.

Albacore tuna – This is the only tuna in the U.S. that is marketed as "white" (e.g., "white meat," "solid white," "chunk white"). Pacific stocks are not overfished, but Atlantic stocks are severely depleted. The U.S. North Pacific and South Pacific pole and troll fisheries (sold under the *American Tuna* label) are the only MSC-certified tuna fisheries in the world.

Yellowfin Tuna – This species is also marketed as "Ahi Tuna" and is becoming a popular replacement for southern Bluefin. It may be served raw (sashimi) or is commonly served rare in restaurants. When canned, it is one of several species sold as "light tuna." This species tends to school with dolphins and other marine mammals. It is caught in purse seines (for canning) and trolling and longlines (for sashimi, which requires fish of higher quality). Some populations are severely depleted due to overfishing and E.U. quotas for 2009 are well above scientific recommendations.

Bigeye Tuna – Closely related to yellowfin tuna and, in Hawaii, is also known as "Ahi Tuna." This species is fished primarily by purse seines set under fish aggregation devices (FADs) – purposely set floating devices that are designed to attract and aggregate fish. Some are also caught by troll, pole and longline. Troll-caught fish bring higher value and are sold as sashimi grade.

Skipjack Tuna – This is the most commonly caught species in the world and the largest source of canned "light tuna" where it is often mixed with yellowfin tuna. It is also sold fresh, frozen, salted, dried and smoked. Typically netted under FADs, the primary concern is bycatch of sea turtles, sharks, and juvenile bluefin and yellowfin tuna, which are also attracted to these devices. Pole and line-caught skipjack is considered by some environmental groups to be a more sustainable option. The quality of the fish is higher since each fish is landed individually and alive, and thus, commands a higher price. Operating costs are also lower than purse seining, allowing for higher profit margins for fishers.

Northern Bluefin Tuna – There are several species of closely-related bluefin tuna. The northern bluefin is native to the Atlantic Ocean (and the Mediterranean and Black Seas). It is also commercially "ranched" in the Mediterranean, Japan, Mexico, Canada and Australia. Juvenile tuna are captured and fattened on forage fish in specialized aquaculture facilities. This species is especially important for sushi and is not usually canned. Sushi-grade bluefin is extremely valuable – a single large bluefin sold in Japan for over $100,000. Its high value has contributed to its demise – populations have declined 90% since 1970. In 2009, Monaco, which has a long tradition of fishing and eating bluefin tuna, became the first country in the world to ban its sale in shops and restaurants.

Southern Bluefin Tuna – A southern hemisphere species that has been severely overfished and has declined about 92% from the 1950s when commercial fishing began. It is currently listed as "critically endangered." Japan is the main buyer for sashimi and sushi.

Pacific Bluefin Tuna – A western Pacific Ocean species that is caught with longlines and nets. As with other bluefin species, this one is also being overfished. When harvested, it is marketed similar to other bluefin species

3. SALMON – 2.2 lbs per capita.

U.S. consumption of fresh, frozen and canned salmon increased over 300% between 1988 and 2001. The increase was driven primarily by a dramatic increase in aquaculture production outside the U.S., particularly in Chile. Over 80% of the fresh and frozen salmon consumed in the U.S. is farmed salmon. Most wild-caught salmon comes from Alaska. Several species are harvested including chinook, coho, sockeye, pink, and chum. Steelhead, an ocean-going rainbow trout, is also closely related to salmon and is marketed in a similar manner. All are anadromous and certain discrete stocks of all salmon species have declined to levels that require protection under the Endangered Species Act.

4. ALASKA POLLOCK – 1.3 lbs per capita.

Alaska Pollock is harvested primarily with large trawls in the cold waters of the north Pacific Ocean. Most Americans know this species as surimi ("artificial crab"), fish sticks, fast-food fish sandwiches and low-priced fillets. The Alaska fishery for Pollock is MSC-certified, but the Russian fishery is not.

5. CATFISH – 1.1 lbs per capita.

The supply and consumption of catfish has steadily increased in the U.S. over the past decade. Almost all catfish comes from aquaculture operations in the southern U.S. It is sold across the U.S. primarily as catfish fillets.

6. JAPANESE-STYLE SEAFOOD

With the growing popularity of Japanese-style seafood in U.S. markets, instructors may find it useful to have definitions of these types of seafood:

Sashimi – fresh, raw seafood sliced into thin pieces and served only with a dipping sauce, condiment or simple garnish; many species are used including salmon and tuna

Sushi – often confused with sashimi, but various combinations of vinagered rice and fish that is usually raw (but sometimes cooked); one popular combination includes raw fish and rice rolled in nori (dried sheets of seaweed)

Surimi – pulverized, white-fleshed fish such as pollock or hake that attains a rubbery texture when cooked; most commonly marketed in the U.S. as "krab" or "artificial crab legs"

The following article appeared in the Fall 2008 issue of the *NCSR Newsletter*. It describes the relationship between the application of market names to fish species and the sustainability of fisheries. Instructors may wish to incorporate this information into discussion of the "*Where Does Your Seafood Come From?*" module or provide it to students as a handout.

A Fish By Any Other Name

Wynn W. Cudmore, Ph.D.

As federal agencies and the fishing industry struggle with how to achieve sustainable fisheries, those who market seafood are finding new ways to add appeal to their products. It has become common practice to change the names of those species that have been assigned a common name that might turn consumers away from the fish case and toward the meat aisle. Thus, silver hake magically becomes "whiting," Patagonian toothfish becomes "Chilean sea bass," and slimeheads become "orange roughy" in hopes that the consumer will find these names more appealing. Even the National Marine Fisheries Service (NMFS), the federal agency responsible for the management of marine fish, has contributed to the deception. The NMFS Underutilized Species Program initiated in the 1970s had the original intention of shifting more demand to species that were being discarded, yet were perfectly good to eat. In an effort to create a market for these less desirable species, it was often necessary to provide them with more attractive names. In the north Atlantic, for example, the deep sea angler was routinely discarded by fishermen who were after more traditional quarry such as Atlantic cod and haddock. More head and teeth than fillet, only the tail of the deep sea angler reached the grocery store where it became known as "monkfish." Spiny dogfish, an abundant small shark with little market value, was renamed "rock salmon" or "cape shark" and became the preferred species for "fish and chips" in Great Britain.

At first glance, the renaming of fish species by the seafood industry may be seen as nothing more than a creative way to increase market share by giving a species a name that is somewhat more appealing to the consumer. In addition, improving the image of a fish that had not been routinely consumed may make use of a species that would otherwise be discarded as bycatch. As a result, fishing pressure may be reduced on species more familiar to the consumer, contributing to the sustainability of fishery stocks.

There is, however, a darker side to these "extreme make-overs." Renaming species may provide consumers with a confusing message concerning the abundance of some species. "Pacific red snapper," for example, is commonly seen for sale throughout the western United States. In reality, there is no such species. "Pacific red snapper" is actually represented by as many as 13 species of rockfish (*Sebastes* species), some of which have declined precipitously in recent years. Consumers who find "red snapper" routinely in fish markets may have a hard time being convinced that some of these species have declined to the point that they warrant special protection. Additionally, some of these renamed fish with "American names" come from foreign waters where regulations either do not exist or are not strictly enforced. The American consumer may, as a result, unwittingly contribute to the decline of a species they know nothing about.

Seafood certification programs, much like organic certification programs, are based on the premise that the consumer will make sustainable choices if they are given good information. Independent third parties such as the Marine Stewardship Council (MSC) have gone to great lengths to research species and determine which ones are being sustainably harvested. Those that meet certain criteria are provided with their seal of approval. Consumers who choose to purchase sustainably-caught seafood need only look for the MSC seal, knowing that it has been independently evaluated. However, for certification to be an effective conservation measure, it is imperative that the species under consideration for certification be properly identified.

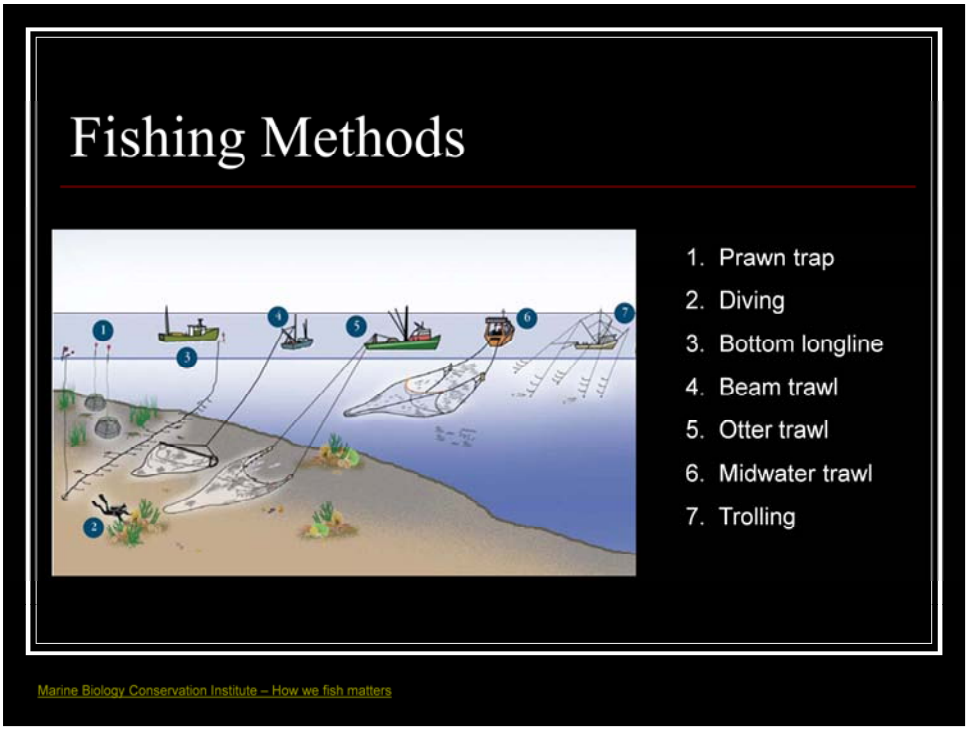
Assigning new market names to species confuses the process and may provide the consumer with erroneous information. Additionally, recent studies using sophisticated DNA analysis have found that fish products are frequently mislabeled in the marketplace even when more familiar names are used. Farmed salmon, for example, was often labeled as "wild," and tilapia, a farmed low quality fish, was sometimes substituted for fish of higher market value.

An examination of the consequences of renaming and improperly naming seafood species is an interesting opportunity for students to explore the relationship between natural resource management and the marketplace. NCSR is developing a number of new modules that examine marine fisheries declines including coverage of market-based solutions such as certification. In one module, "*Where does your seafood come from?*", students examine seafood species available in local markets, determine their identity and investigate the degree to which they have been sustainably harvested.

PowerPoint **Presentation Illustrating Fishing Methods**

for use with:

Where does your Seafood Come from?

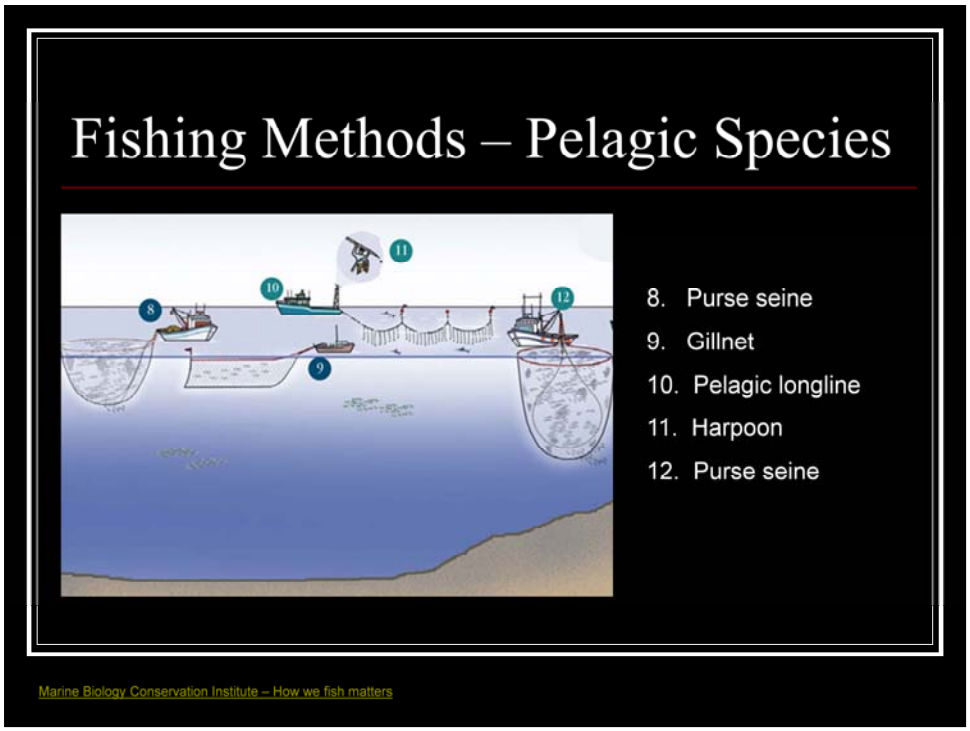


A number of different fishing methods are employed to capture fish. The method used is dependent upon the species being harvested, available technology and local conditions such as bottom type and water depth. Fishing methods vary in their impact on other species (bycatch) and benthic habitats, thus the selection of fishing method is an important determination in whether or not a particular fishery is sustainable.

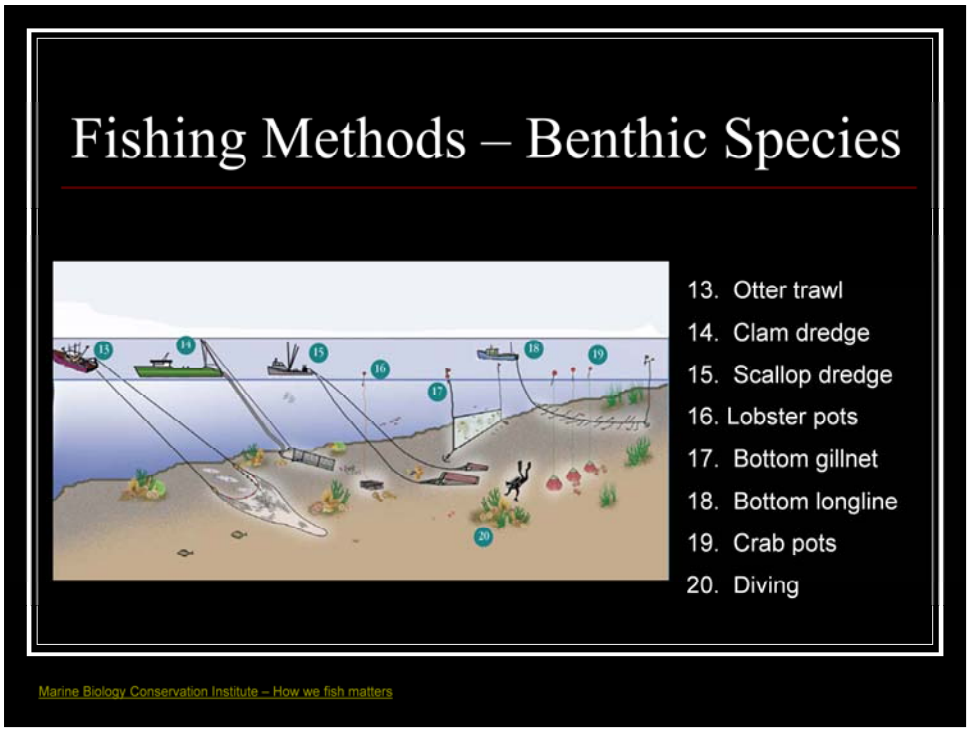
The type of fishing method used to capture a species is one of several considerations for the certification of a fishery. Consumers who wish to make sustainable choices may also need to take into account, the fishing method used to capture the seafood they plan to purchase.

A 2001 public opinion survey conducted by the Seafood Choices Alliance found that American consumers have little awareness of sustainability issues associated with the capture or production or seafood. The same survey found that most consumers were unable to say whether the seafood they purchased was wild-caught or farmed. This presentation attempts to fill some of that void by describing the more commonly used commercial methods to capture marine fish.

Graphics provided by MBCIs report: *How we fish matters: Addressing the Ecological Impacts of Canadian Fishing Gear*. Susanna D. Fuller, Candace Picco, Jennifer Ford, Chih-Fan Tsao, Lance E. Morgan, Dorthea Hangaard, Ratana Chuenpagdee.

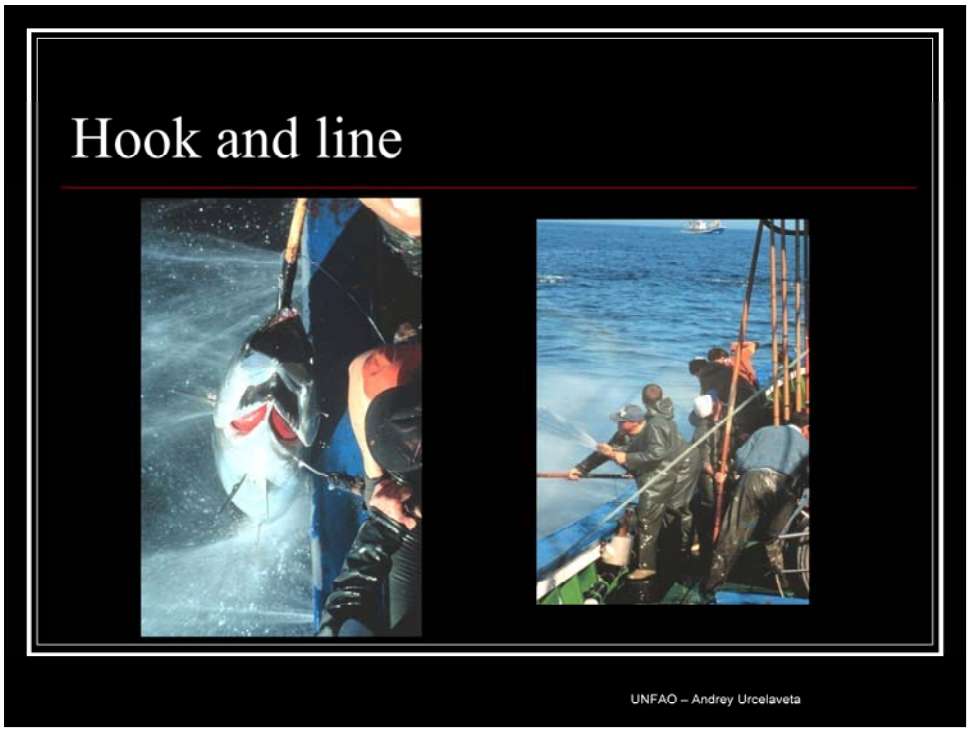


Pelagic (open water) species are harvested by gear deployed high in the water column (e.g., purse seines, gillnets and pelagic longlines).



Benthic species are harvested by a variety of gear types deployed in deep water (e.g., trawls, dredges, pots and traps).

Longline – Many short lines, each with a single, baited hook, suspended vertically from a main line that is usually suspended between two floating buoys. Longlines may be suspended in the water column close to the surface where they are intended to capture pelagic species such as tuna or swordfish (shown at right) or they may lay on the ocean floor where they capture benthic species such as cod or halibut. Longlines may be over 40 miles long and contain thousands of hooks. Bycatch can be high as gear is quite non-selective – birds, marine mammals and sea turtles are often taken in addition to non-target fish such as the shark shown in this photograph.



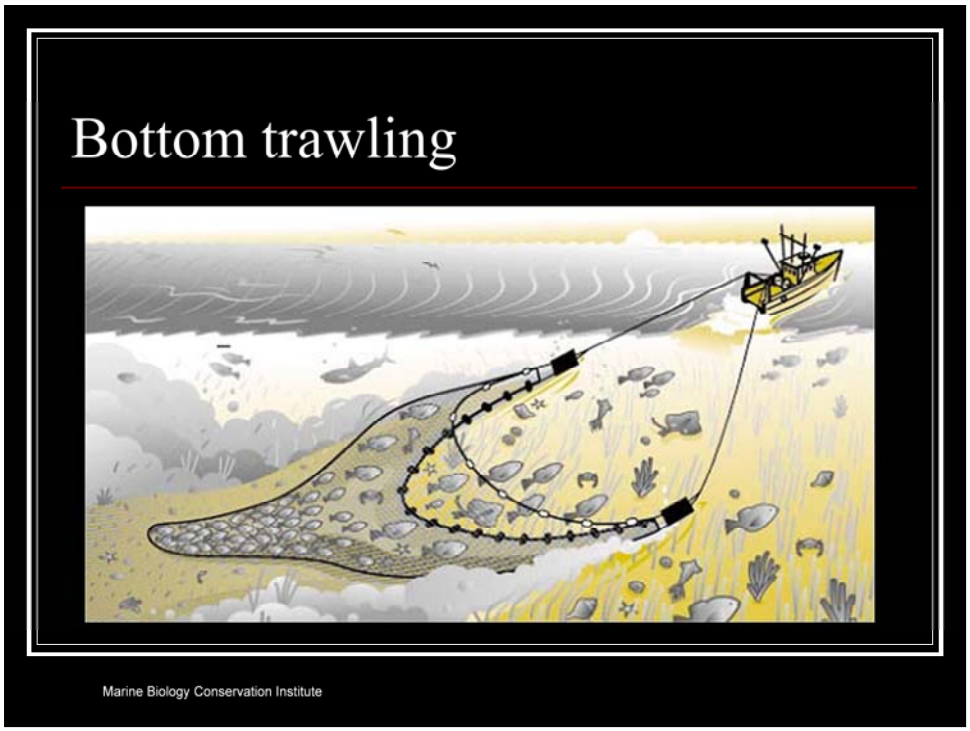
Hook and line methods have some similarity to rod and reel recreational fishing. Fish are attracted by natural or artificial bait placed on a hook at the end of a line. The method has limited application in some fisheries such as the hook and line tuna fishery shown here. Jets of water from the side of the boat (shown in image at left) are used to prevent the fish from seeing the fishermen. Bycatch using this method is relatively low and there is no impact on aquatic habitats.

Trolling is an adaptation of a hook-and-line method in which fish are attracted by natural or artificial bait placed on a hook at the end of a line. Trolling gear is composed of several unconnected lines slowly dragged behind the boat.

It is sometimes used for pelagic species such as salmon and tuna. Troll-caught fish are often preferred over those caught by other methods since it tends to be more selective than longlining and there is less lag time between capture and harvest. Therefore, a higher quality product is often obtained when compared to fish caught by other methods.

Purse seine – A large net usually set by two boats to catch open-ocean, pelagic fish such as tuna, mackerel and herring. The boats encircle a school of fish and then draw the bottom of the net together much like a purse (see diagram). Photo on right shows a large Chilean purse seiner catching chub mackerel. Mesh size regulates the size of fish that are allowed to escape. Bycatch of dolphins by tuna purse seiners raised public awareness of the issue in the 1970s.

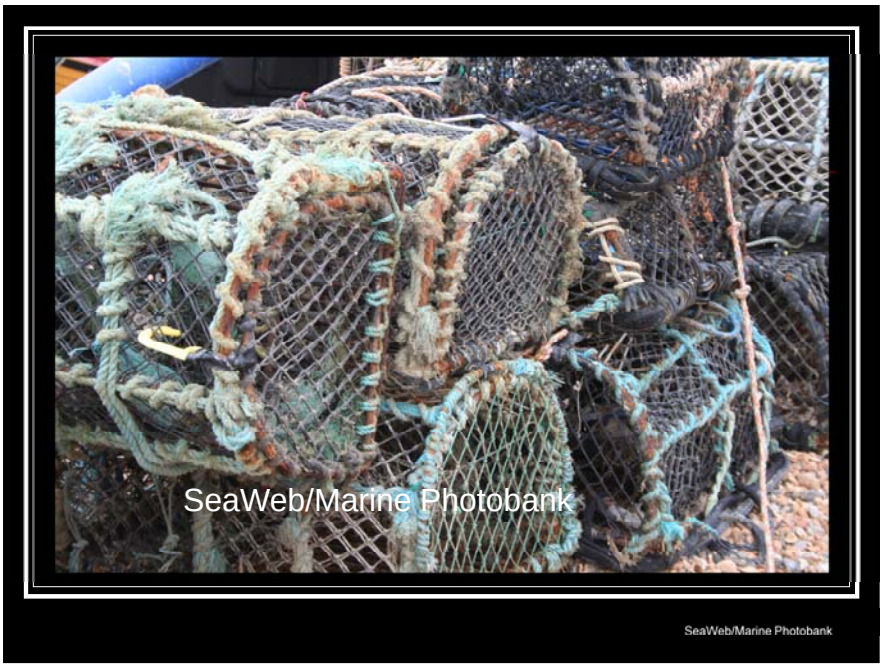
Gill net – A vertical, wall-like net that is usually set perpendicular to the flow of water. Mesh size allows the heads of fish to pass through, but the gill covers get caught, trapping the fish. Bycatch can be high as gill nets are somewhat non-selective; however, mesh size regulations can help reduce the capture of non-target fish. Salmon are commonly caught in gillnets.



Bottom trawl - An open, cone-shaped net that tapers to a small “cod-end” where fish accumulate while the trawl is dragged behind the fishing vessel. A system of cables, net wings and “doors” keeps the net open while fishing. Trawls can be towed behind a fishing vessel at any depth, but most are designed to travel along the bottom where they can disrupt benthic habitats. “Roller gear” at the opening of the net allows bottom trawl nets to fish rocky, complex habitats where, in the past, gear would become damaged or lost. Bycatch can also be quite high as the net scoops up everything in its path. Bottom trawls are typically used to capture groundfish (e.g., cod, haddock) and flatfish (e.g., flounder, sole).

Traps and Pots – Species-specific (e.g., crab pots, lobster pots, tuna traps) stationary gear that allows the entry but not exit of the target species. The gear can take many forms such as baskets or cages. Gear is usually quite specific and bycatch for most fisheries is minimal. However, lost or abandoned traps and pots can cause damage to benthic habitats and marine mammals can become entangled in gear.

The 700 lb. Alaskan red king crab pot shown here is first baited and then lifted by the winch and set in about 400 ft. of water. Alaskan red king crabs weigh 6.5 pounds on average.



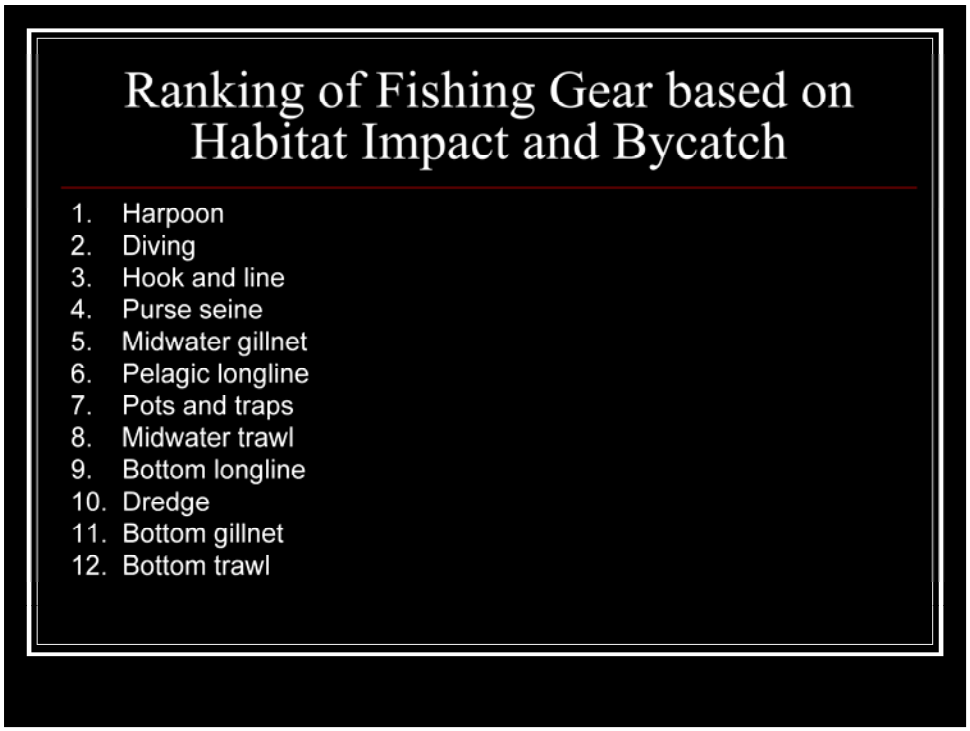
Fish pots lie on the beach among fishing boats at Hastings Stade on the south coast of Britain.

The town of Hastings has been a center of a unique small-scale fishery for over 1000 years. The harbor offers little protection from the weather; therefore, all boats and fishing gear are hauled onto the beach and stored until their next use. Fishing vessels are generally less than 10 meters in length and operate just a few miles from shore. A number of different gear types are used including various modifications of gill nets (for sole, mackerel and herring) and fish pots (shown here).

Dredge – a heavy metal frame and mesh dragged along the seafloor usually to harvest shellfish (e.g., clams, scallops, cockles). The catch is held in a terminal bag that allows water, sand and mud to wash out, leaving shellfish behind. Bycatch is highly variable with the fishery and dredges can be highly damaging to benthic habitats.

Photo at left shows dredge being hauled on board scallop vessel.

Photo on right shows sea scallop haul.



This ranking of Canadian fishing gear based on habitat impact and bycatch was developed by the *Living Oceans Society* in cooperation with the *Ecology Action Centre* and the *Marine Conservation Biology Institute* of the U.S. The ranking was initially developed by a panel of 19 fishermen, scientists and marine professionals and later refined by the results of surveys sent to 260 fishermen, scientists and academics, fisheries managers and fisheries professionals.

Highly selective gear that minimizes habitat disruption (e.g., harpooning, diving, hook and line and purse seining) rank highest, while less selective methods that alter benthic habitats (e.g., bottom trawls and dredges) rank lowest.

Source:

www.livingoceans.org/programs/sustainable_fisheries/gears/ranking.aspx

Fishing methods rating from *How We Fish Matters: Addressing the Ecological Impacts of Canadian Fishing Gear*

Note that different gear types have different impacts on various marine ecosystem components:

Invertebrates

Groundfish

Forage fish

Sharks and large pelagic fish

Seabirds

Marine mammals

Corals and sponges

Seafloor

Photo Credits

- *How We Fish Matters: Addressing the Ecological Impacts of Canadian Fishing Gear*
  - Susanna D. Fuller (Ecology Action Centre)
  - Candace Picco (Living Oceans Society)
  - Jennifer Ford (Ecology Action Centre)
  - Chih-Fan Tsao (Marine Conservation Biology Institute)
  - Lance E. Morgan (Marine Conservation Biology Institute)
  - Dorthea Hangaard (Living Oceans Society)
  - Ratana Chuenpagdee (Memorial University of Newfoundland)
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