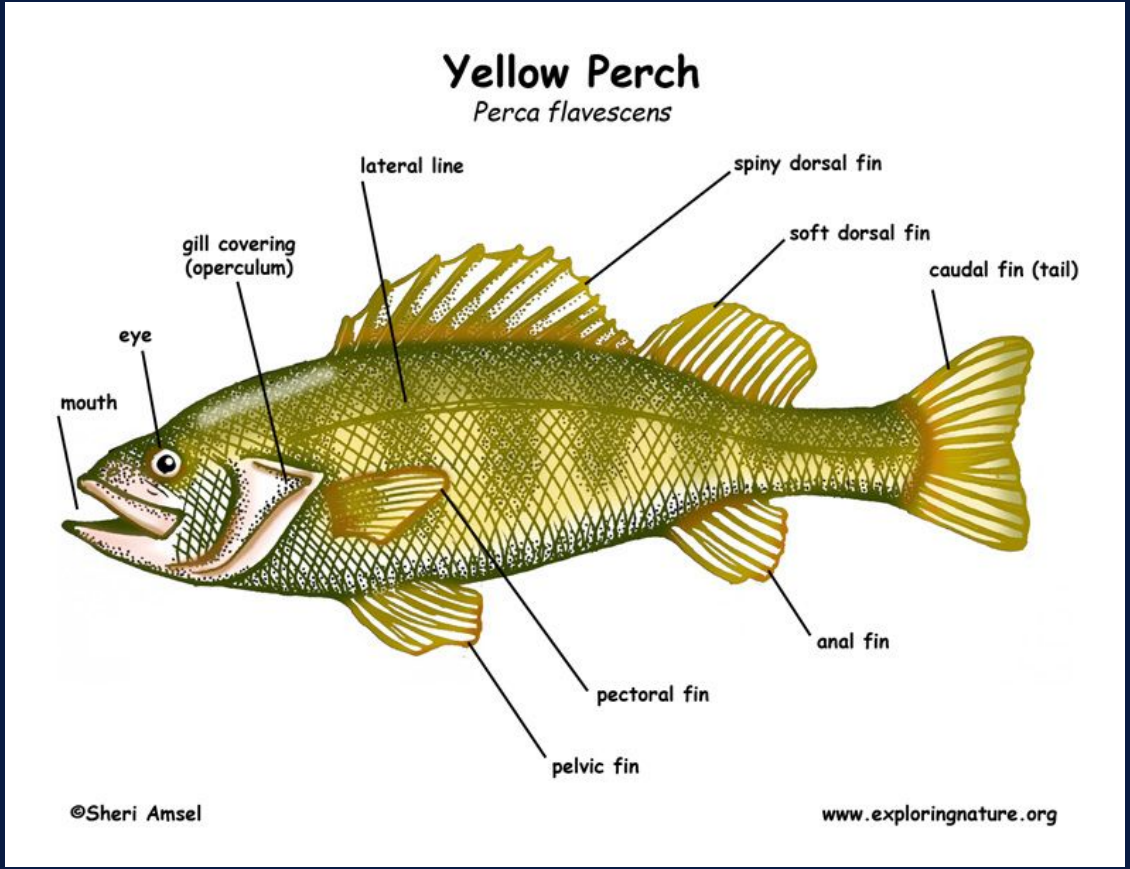
Fishing Industry: What is Overfishing?

Oceanography

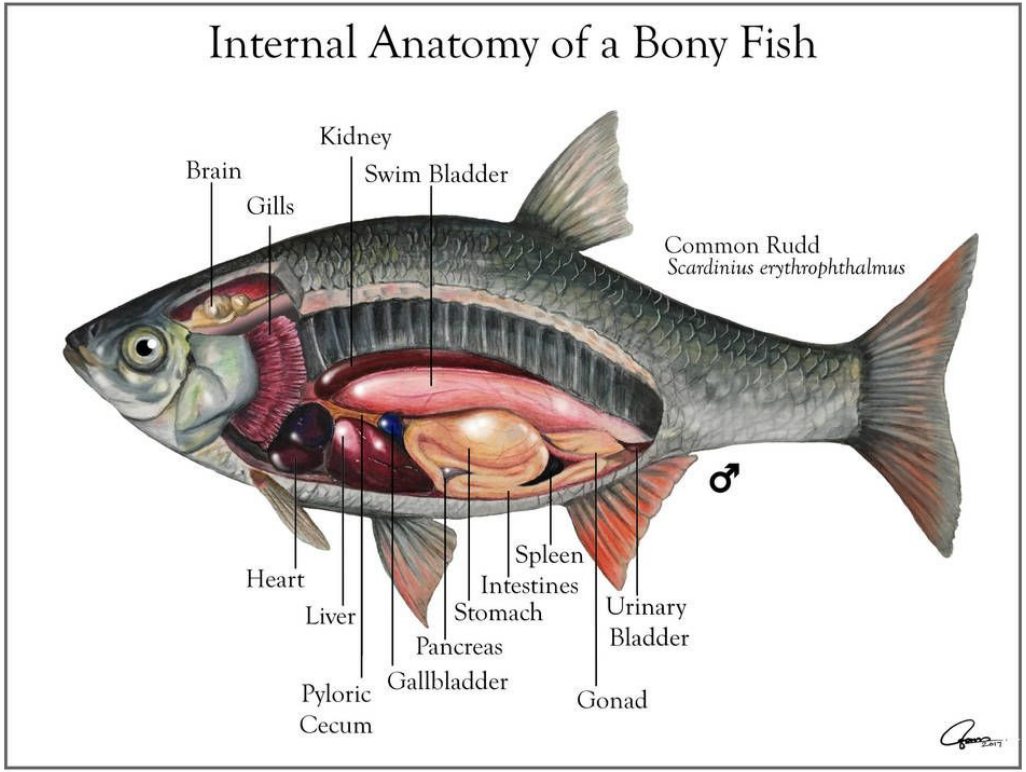
Fish 101

- Fish have many adaptations to help them survive in the environment.
- We will be looking at the class of bony fish or *Osteichthyes*
- Many of these fish have wide spanning migratory patterns know as diadromous behavior: where they travel across both fresh and saltwater
    - FIsh that do this based on reproduction are known as Anadromous (river) or Catadromous (ocean).

Anatomy of a Fish: External



Anatomy of a Fish: Internal



Common Species of Fish in MA


Winter flounder


Summer flounder


Halibut


Tautog


Black sea bass


Scup


Cusk


Wolffish

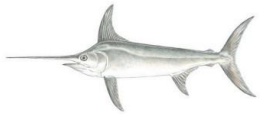

Yellowfin tuna


Bluefin tuna


False albacore


Bonito


Atlantic Mackerel


Swordfish


Yellow marlin


Blue marlin

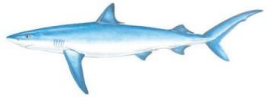

Bluefish

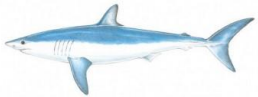

Striped Bass


Weakfish


Spiny dogfish


Porbeagle shark


Blue shark


Shortfin mako


Atlantic cod


Haddock


Pollock

What makes a fish a "fish"? Fish live in water, have gills, are vertebrates, and most are cold blooded.

What is Overfishing?

The ocean is a source of both renewable and nonrenewable resources. While fish and shellfish are considered renewable, many species are being taken at such a rate that the stocks are unable to rebound. This is known as **overfishing.**

Humans have lived along the coastline and relied on the ocean as a food source for thousands of years. Seafood, including fish and invertebrates (ie. shrimp, crabs, lobsters, clams) are a major part of diets globally.

As the human population increases and technologies for catching fish improve, the amount of fish taken from the ocean on a yearly basis has skyrocketed. Sport, commercial, and personal fishing have all contributed to a reduction in the number of fish from each species, the **fish stocks.**

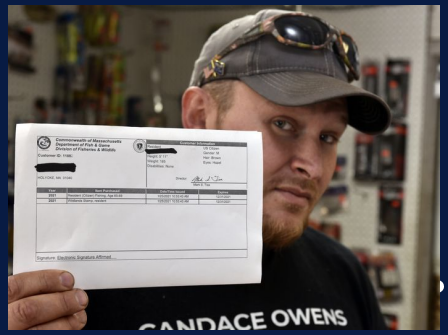
The Tragedy of the Commons

Garrett Hardin, an author and environmentalist, wrote an essay in 1968 called the “Tragedy of the Commons”. In the essay he describes a situation in which many shepards and cattlemen allow their animals to graze on a public field.

“Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.”

Importance of Fishing Industry

- The commercial and recreational saltwater fishing industries brought in approximately $212 billion dollars worth of sales and over $100 billion dollars were contributed to the country's gross domestic product (GDP)
    - Supports over 1.7 million jobs (2016)
- Recreational fishing creates space for individuals to support ongoing environmental efforts and instill passion and stewardship
- Increase in "Eco-Tourism" and overall revenue
- Cultural importance



Traditional Fishing and Whaling

- People who fish regularly to feed their families or their local communities are known as subsistence fishers. Many cultures across the world have practiced subsistence fishing for thousands of years. Most subsistence and recreational fishers use either simple nets or fishing poles with baited hooks, aka rod and reel or pole fishing.

  Spearfishing: The oldest method of fishing by using a long pole with an arrow-shaped metal point attached.

  Whaling has been practiced for thousands of years using larger tools called harpoons.

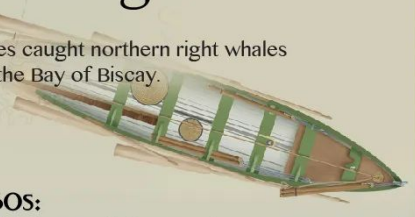
  Whales are used for a variety of purposes, including: meat and blubber for food, skin and baleen for food, clothing, buildings, and more. Any part of the whale not used are returned to the sea and are eating by scavengers/decompose.

A Brief History of Whaling

EARLY HUNTING

3000 BCE: Whaling was practiced by Inuit peoples and others in the North Atlantic and North Pacific oceans.

1000 BCE: The Basques caught northern right whales that gathered to breed in the Bay of Biscay.



17TH CENTURY:

Smeerenburg ("Blubbertown") was built on Spitsbergen after 1619. During its heyday in the 1630s and '40s, the settlement had 150 men servicing whalers that hunted the whales in the surrounding Arctic Ocean.

Arctic bay whaling ended in the mid-1650s because of the onset of a miniature ice age that lasted for the rest of the 17th century.

1850S:

The quarry of slow-moving 1850s-era vessels was sperm whales (*Physeter catodon*) and right whales (family Balaenidae, four species).

MODERN ERA

1950S TO 1980S:

Larger 1950s-era vessels allowed for greater range as well as the capability to process hunted whales at sea.

Floating factories made it possible to process a 100-ton blue whale (*Balaenoptera musculus*) in one hour.

Carcasses were winched up onto an open butchering deck via a slipway through the stern.

Modern vessels were equipped with helicopters and diesel engines, which allowed whalers to locate and overtake faster quarry.

THE PRESENT:

Minke whales (*Balaenoptera acutorostrata* and *B. bonaerensis*) are frequently listed as the quarry of Iceland, Norway, and Japan—the last remaining whaling countries—for food and research. Nearly 200 minke whales per year are harvested by aboriginal peoples in Greenland.

Modern Fishing and Whaling

In the 20th century improvements to fishing technology greatly increased the amount of fish that could be caught. Companies using these technologies to catch large amounts of fish at sea and then transport them to be sold are known as **commercial fisheries**.

- Provides food for a large population of people
- Many fish are transported to inland areas that typically had less seafood availability
- Takes fish out of our oceans above the maximum sustainable yield, aka the carrying capacity

Methods of Modern Fishing

01

Longlines

Used to primarily catch large pelagic fish such as swordfish.

Along the main 80 mile long line, smaller lines are strung at even intervals with baited hooks attached.

02

Trawling

A large net is dragged behind a boat at various depths to collect specific species of fish.

Trawling in the middle of the water column catches tuna, anchovies, and squid. Haddock and flounder are caught during bottom trawling.

03

Gill Netting

A net stretched across the water intended to interrupt swimming fish by catching their gills in the netting.

04

Purse Seine

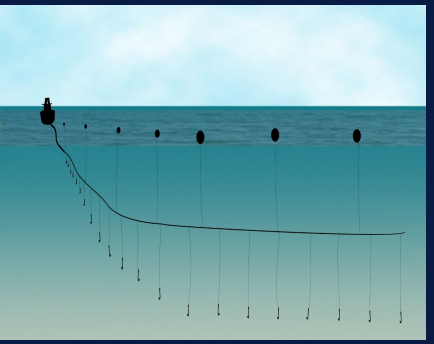
Used to trap schooling fish such as mackerel and sardines.

A boat may loop a large net in a circle around a school of fish and pull the net in toward the boat.

Methods of Modern Fishing

01

Longlines



02

Trawling

03

Gill Netting

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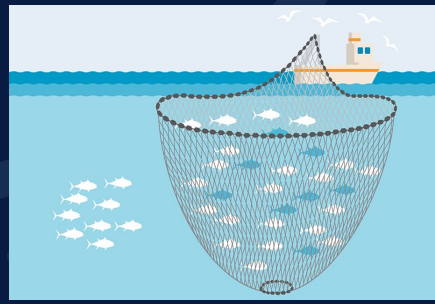
Purse Seine



Illegal Fishing Practices

Local fishers sometimes throw sticks of dynamite into an area of the ocean, often on a coral reef, known as **blast fishing. Blast fishing** causes all of the organisms in an area to die and to be quickly and easily collected and sold.

Although **spearfishing**, as traditionally practiced, is considered sustainable because few fish are taken at a time, newer techniques have allowed some fish species to become locally depleted. Modern spears can include compressed gas or elastic bands to launch the spears long distances.

Bycatch

Modern fishing methods also accidentally catch non targeted marine animals such as seabirds, mammals, and sea turtles in the nets or lines. These mistakenly caught creatures are known as **bycatch.**

Other kinds of bycatch include young fish that are too small to be sold at market.

Bycatch results in a lot of unnecessary waste:

- For every five pounds of seafood caught in the U.S., at least one pound will be discarded
- For every pound of shrimp caught via trawling, three to ten pounds of other animals are discarded.

Sustainable Fishing

- Maintaining fish populations to ensure that they are not depleted is critical to protecting biodiversity, as well as for the sustainability of the ocean as a resource. Individuals and governments are working together to take ownership of the oceans assets and manage them responsibly.
- Sustainable fishing practices involve protecting the physical environments where fish live, limit the amount of bycatch discarded, and do minimal harm to fish populations.
- In order to maintain fish populations, governments set regulations on fishing quotas, seasons, and size limits of fish collected.

Aquaculture

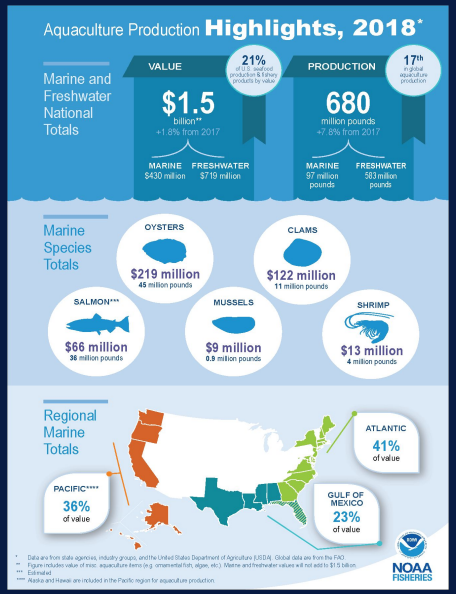
- As wild fish stocks continue to become depleted, one large scale solution for the fishing industry is the introduction of aquaculture: aka fish farming.
- There are two major methods of aquaculture
  1. **Fish farming in a natural environment**
     Fish like salmon, trout, sea bass, sea bream are farmed in **floating cages anchored to the seabed in seawater**. The cages are made of nets. Fish like trout, arctic char, or smolt (young salmon) are raised in **ponds or cages in freshwater**. These will also be anchored in place.
  2. **Fish farming in onshore tanks**
     This is where fish grow in **special rearing tanks filled with water**. The tanks will be filled with either freshwater or seawater, depending on the species being farmed. In some farms the water is used only once (open system), in others the water is recycled (closed or recirculation system). Shrimp farming is carried out in brackish water, **in ponds or open ground tanks**, in tropical and subtropical zones. Shellfish such as oysters, mussels and clams can be **grown on rope or in pockets**.

Aquaculture

- Aquaculture helps us meet the need of our growing population while aiming to maintain our wild fish stocks.
- Aquaculture is also a tool to restore habitats and species. Hatchery stock is used to rebuild oyster reefs, grow wild fish populations, and rebuild threatened and endangered abalone and corals.

- There are both positives and negatives to utilizing aquaculture. Some of the disadvantages include:
  - Space needed for facilities
  - Decrease in water quality in the area
  - Increase of invasive species
  - Reliance on wild fish for food sources

Major Fish Production



Certain marine species are more desirable as part of the seafood industry, the species below are majorly produced via aquaculture

01

Bivalves

This includes oysters, clams, mussels, etc.

02

Salmon

03

Shrimp

17

U.S. Ranking

The U.S. is considered a “minor” aquaculture producer

While the worldwide amount of wild-caught seafood has stayed the same year to year, the amount raised through aquaculture has risen dramatically. The United States imports 70 to 85 percent of its seafood, and nearly 50 percent of this imported seafood is produced via aquaculture.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