



NOAA FISHERIES

Grade Level
9-12

Materials

- Chesapeake Bay watershed map
- State map
- County map
- Stakeholder list, below
- Striped bass stakeholder case study scenarios, below
- Student Handout: Stakeholder Scenarios
- File: Striped Bass Presentation
- File: Fisheries Sustainability Presentation
- Google Earth

Audio/Visual Materials
Computer with Google Earth

Teaching Time
Four or five 45 minute class periods

Seating Arrangement
Groups of three or four

Key Words

- Overfishing
- Stakeholder
- Viability
- Estuary
- Climate change
- Ocean acidification
- Waterman

Ocean Resource Sustainability

For use with Fish Watch at www.fishwatch.gov



Focus

- Stakeholder views and sustainability

Focus Questions

- How do citizens and governments work together to solve problems and make decisions?
- Which factors should be considered in using ocean resources in a sustainable way?

Learning Objectives

- Analyze and discuss the issues involved in maintaining a sustainable striped bass population and viable fishery
- Recommend a decision that will keep striped bass populations sustainable that also ensures the social and economic sustainability of the communities that depend on them

Background Information

In this case study investigation, students will learn about how different stakeholders' perspectives challenge us to take a broad view of sustainability and how citizens and governments work together to make decisions and solve problems. In doing this, students will learn about the geography, science, and social science of the Chesapeake Bay. They will learn about a watershed and

Key Words (cont'd)

- Regulation
- Poaching
- Turbidity
- Spawning
- Larvae
- Forage Fish
- Predation/Predacious/Predator
- Hydroelectric
- Biodiversity
- Adaptations
- Brackish
- Hypoxia

National Science Education Standards

Grades 9-12

Content Standard C: Life Science

- Matter, energy, and organization in living systems
- Behavior of organisms
-

Content Standard F: Science in Personal and Social Perspectives

- Natural resources
- Environmental quality

Ocean Literacy Essential Principles

Essential Principle 1

The earth has one big ocean with many features.

Fundamental Concept a

The ocean is the dominant physical feature on our planet Earth—covering approximately 70% of the planet's surface. There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian and Arctic.

and how environmental factors, such as temperature, salinity, dissolved oxygen, etc., affect the health of natural populations, biodiversity, and the availability of resources.

Students will work in small groups to analyze and discuss the issues involved in maintaining a sustainable striped bass population and viable fishery. They will recommend a decision that will keep striped bass populations sustainable that also ensures the social and economic sustainability of the communities that depend on them for their social, economic, and cultural livelihoods. They will also explore the connection between their local watershed and the viability of all major aspects of sustainability: environmental, social/cultural, and economic.

The background content for this lesson is contained in two attachments:

1. Striped Bass Presentation
2. Fisheries Sustainability Presentation

Learning Procedure

1. Present the background content in the two attachments to students to introduce them to fisheries sustainability and the striped bass.
2. If students are not already familiar with the concept of a watershed, introduce the concept and show students a map of the Chesapeake Bay watershed from ehs.virginia.edu/ehs/ehs.stormwater/stormwater.watersheds.html. Lead a discussion with the following guiding points that relate to this watershed:
 - States in Chesapeake Bay watershed (including D.C.)
 - Over 100,000 streams in watershed
 - Drains more water than the Great Lakes
 - Locate local watersheds
 - Diagram flow of water to Chesapeake Bay – note names of creeks, streams, rivers; and smaller to larger pattern
 - Development – roads, homes, businesses and impact on watershed
3. Present the content in the attachment *Striped Bass Presentation* and call students' attention to the factors that striped bass need to survive. Ask students how they can determine if a local stream is healthy. What observations can be made? What data can be collected? If students do not mention the following, guide them toward these answers:
 - Temperature
 - Surrounding land use
 - Dissolved particulate matter
 - Pervious and impervious surface
 - pH
 - Dissolved Oxygen
 - Turbidity

Essential Principle 5

The ocean supports a great diversity of life and ecosystems.

Fundamental Concept f

Ocean life ranges in size from the smallest virus to the largest animal that has lived on earth, the blue whale.

Essential Principle 6

The oceans and humans are inextricably connected.

Fundamental Concept a

The ocean affects every human life. It supplies freshwater (most rain comes from the ocean) and nearly all Earth's oxygen. It moderates the Earth's climate, influences our weather, and affects human health.

Fundamental concept b

From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.

Fundamental Concept e

Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

Fundamental Concept g

Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

4. Present the content in the attachment *Fisheries Sustainability Presentation*. Tell students that sustainable ocean resources require that many interested people and organizations work together toward this common goal. Discuss examples of different stakeholders in the striped bass fishery, and their motivations:

- a) Average Citizen: bought that waterfront property, wants the environment to be clean, does not want big government or “environmentalists” infringing upon property rights
- b) Fishing Industry: wants the maximum amount of fish, at the cheapest cost, to be sold to the highest bidder
- c) Conservation Organization: 100% motivated to preserve natural resources and protect the environment
- d) Management: Must create regulatory framework that supports economic development yet uses resources in a sustainable fashion
- e) Fisheries Scientist: responsible for providing research that answers the questions needed to inform management and the public

5. Divide students into five groups and hand out the *Stakeholder Scenarios* to each group. Each group should take the role of their assigned stakeholder. Explain that each scenario simulates real-life issues that require stakeholders to collectively make decisions (e.g. land development, use of natural resources) that will balance the economic, social, and environmental needs of communities in the Chesapeake Bay. Tell students that each scenario, if implemented, may have a positive or negative impact on the health of striped bass in the Chesapeake Bay as well as the stakeholders in the region.

6. Each group should apply the facts and concepts learned to discuss all three scenarios and make a recommendation of “For” or “Against” each proposal. The group must fully justify its recommendations. Stakeholders should keep in mind their primary motivations as listed above and how their decisions will impact their ability to utilize striped bass now and in the future.

Students should consider:

- A. What requirements are needed for a healthy striped bass population (think of striped bass adaptations)
- B. What types of stressors do humans put on the ecosystem that impact striped bass populations?
 - Water quality
 - Impacts of habitat alterations throughout the watershed (development, impervious surfaces, hydro-electric dams, etc.)
 - Fishing
 - Environmental (e.g.): Hurricanes, Climate Change (warming waters, etc.)
- C. All three legs of the sustainability stool (environmental, social/cultural, and economic)

7. Have students conduct a “Town Hall Meeting” on the three scenarios/proposals to defend the position of their stakeholder group and agree on a final decision.

The Bridge Connection

www.vims.edu/bridge

In the search box on the main page, type in "striped bass" or “watershed” or “sustainability” for a list of resources which focus on these topics.

The “Me” Connection

Have students discuss how their actions toward the ocean and environment impact the livelihoods of families they may know.

Connections to Other Subjects

Social science, Economics, Environmental science

Evaluation

Monitoring of group work, class discussions, and justifications of final decisions in the Town Hall Meeting allow opportunities for assessment.

Extension

Use your local watershed map or Google Earth to locate the stream nearest to your school. Which river does the stream drain into? Where does the river end? Write an essay discussing three major environmental issues affecting your watershed and include the three major elements of sustainability, and three ways humans are connected to the ocean.

Student Handout Stakeholder Scenarios

Scenario #1

Acme Industrials is looking to open a new processing facility on a tidal creek of the Potomac River. When completed, this facility will employ 1500 highly skilled workers, many of which may also buy homes/property in the area. This facility will require the withdrawal of water from the creek to cool its furnaces while returning warm water back into the creek. The company has a relatively clean environmental record (no major spills), but accidents resulting in multiple small-scale spills of chemicals containing copper, benzene, and organophosphates do occur almost every month.

Proposal: Provide Acme Industrials a streamlined permitting process that will allow them to build/operate their new facility with a minimum of regulation.

Scenario #2

Alpha Protein is applying for permits that will allow them to add an additional 5 boats to their Atlantic menhaden purse seine operation in the Chesapeake Bay. This will increase the capacity of their operations by over 50%. That's a 50% increase in the amount of fish captured, people employed, and profits (tax revenue for the state and local government). Alpha Protein is extremely efficient at capturing fish even when those fish are at low numbers.

Proposal: Grant full permits to Alpha Protein to add more boats to the fleet

Scenario #3

Tree Huggers of America is worried about another crash in striped bass stocks after seeing several local fish kills in the Chesapeake Bay. They are not sure of the cause of these fish kills as yet, but want to make sure that we are not harvesting even more striped bass when it seems so many fish are already dying. Tree Huggers of America would like to place a moratorium on all striped bass fishing until the issue is fully investigated and the exact cause of these multiple fish kills can be detected. This is Maryland's state fish.

Proposal: Implement a full moratorium on all striped bass fishing in the Chesapeake Bay

Understanding the ocean's influence on you...

*(Among other things) the ocean
provides us with an abundance of
delicious, nutritious seafood.*

Understanding your influence on the ocean...

*Responsible use and careful stewardship
of the ocean and its resources (so we
can continue to enjoy what it provides
to us, e.g. seafood).*



86%





Wild-caught

VS.



Farm-raised

Sustainable Seafood

**Catching or farming seafood responsibly,
with consideration for
the long-term health of the environment and
the livelihoods of the people that depend upon
the environment.**

People
rofit
lanet

The Basics

Renewable
vs.
nonrenewable
resources

A large school of silver fish, possibly snappers or similar species, swimming in clear blue water. The fish are densely packed and moving in a coordinated manner. The background shows some rocky seabed with green algae.

Renewable resources like fish and shellfish are living things that replenish themselves naturally.

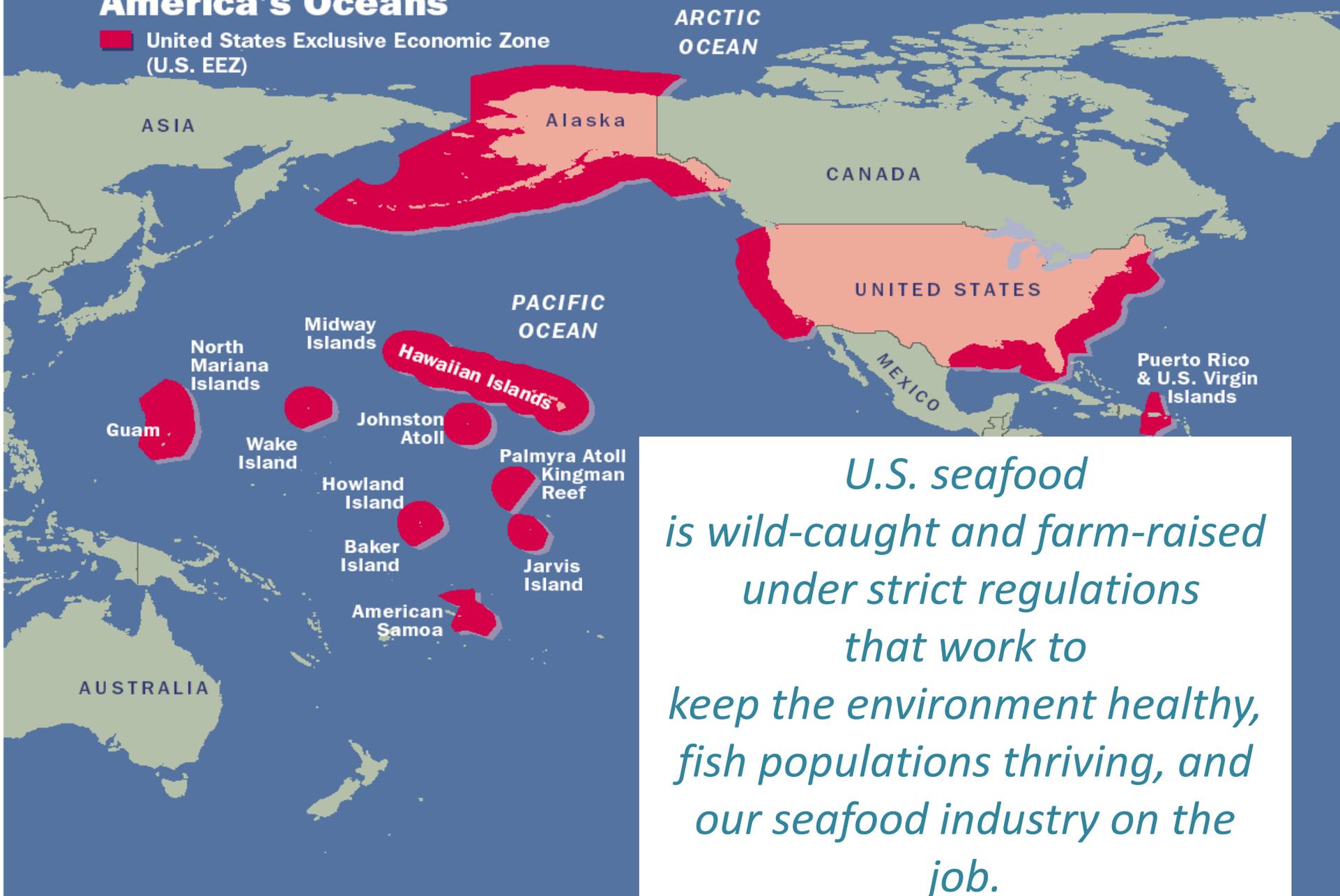
They can be harvested, **within limits**, on a continuing basis without being eliminated.



Fisheries management
establishes these limits.
It involves regulating
when, where, how, and
how much fishermen
can fish.

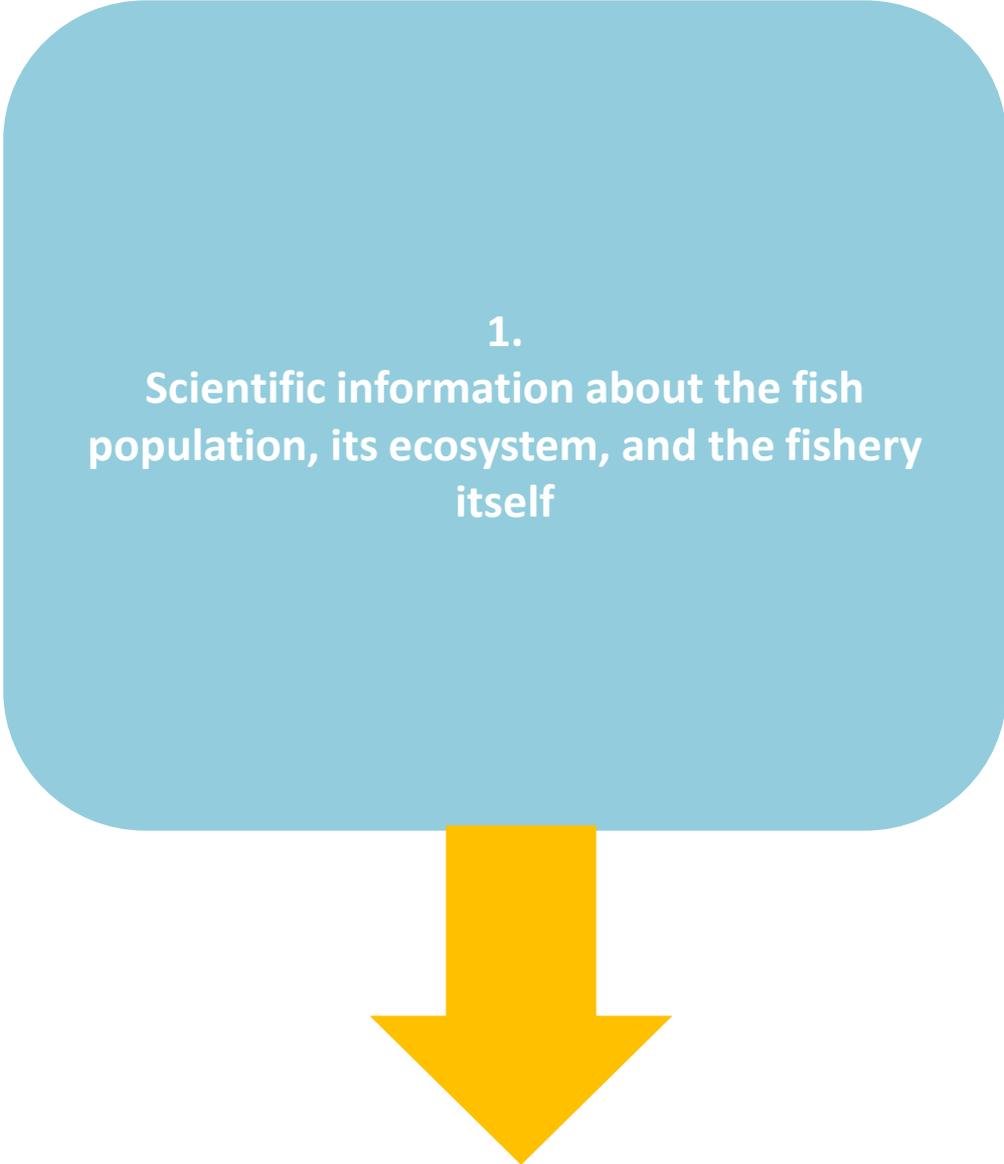
America's Oceans

 United States Exclusive Economic Zone (U.S. EEZ)



U.S. seafood is wild-caught and farm-raised under strict regulations that work to keep the environment healthy, fish populations thriving, and our seafood industry on the job.

1.
Scientific information about the fish
population, its ecosystem, and the fishery
itself



- Assess stocks (sort of a census of fish populations) through various sampling technologies and modeling techniques
- Research the biology of fish species - what they eat, how they reproduce, and how quickly they grow - as well as the ecosystems in which they live - their habitat, other marine species that share that habitat, and environmental conditions
- Research historical information about the fishery including economic and social factors
- Collect data on current harvests

Technical Terms

- Maximum sustainable yield
 - The highest long term average catch that a fish population can support, based on factors such as how quickly the fish can reproduce, how quickly they grow, and how long they live
 - The goal of fisheries management

Technical Terms



Overfishing

- Refers to the rate of fishing
- When the fishing rate is too high to provide the maximum sustainable yield
- A priority for the U.S. is ending overfishing so that all stocks can rebuild and be capable of producing the maximum sustainable yield.

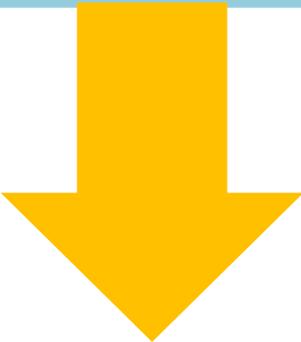
Technical Terms



Overfished

- Refers to the abundance of the fish population
- When the population declines to the point that it may not be able to produce the maximum sustainable yield
- **Overfished does not mean a population is endangered or threatened.**
- In the U.S., **overfished stocks are required to be managed under rebuilding plans that, over time, increase the stock** to the level that can produce the maximum sustainable yield.
- A fish population is influenced by environmental conditions as well as fishing; **a population can be overfished even if there is no fishing.**

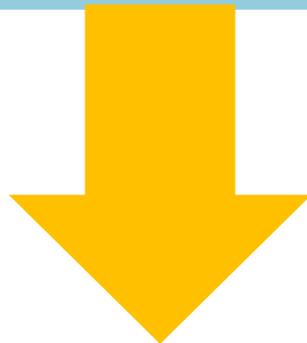
2.
Managers establish standards and guidelines for the operation of fisheries based on this scientific information as well as viewpoints of fishery stakeholders and the general public



- Variety of tools to ensure our fisheries operate sustainably :
 - Limits on the amount of fish that can be harvested, the amount of fishermen that can participate in a fishery, and where, when, and how fish can be caught.
 - Limits are based on levels determined by scientists to ensure that fish are not being caught too quickly and that enough fish are left in the ocean to reproduce and keep the population and ecosystem healthy.
- Other measures to address a fishery's potential impacts on habitat or other species, the safety of fishermen, and marketability of the catch.
- All of these measures support the goals of sustaining fish populations, protecting habitat and other species, and keeping fishermen working.
Reaching this balance is not easy.

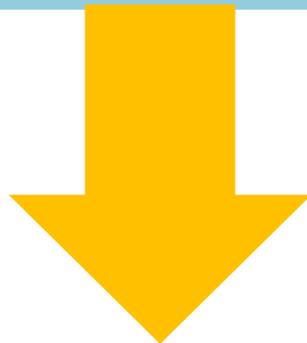
3.
Fishermen harvest seafood following these regulations (enforcement just in case)

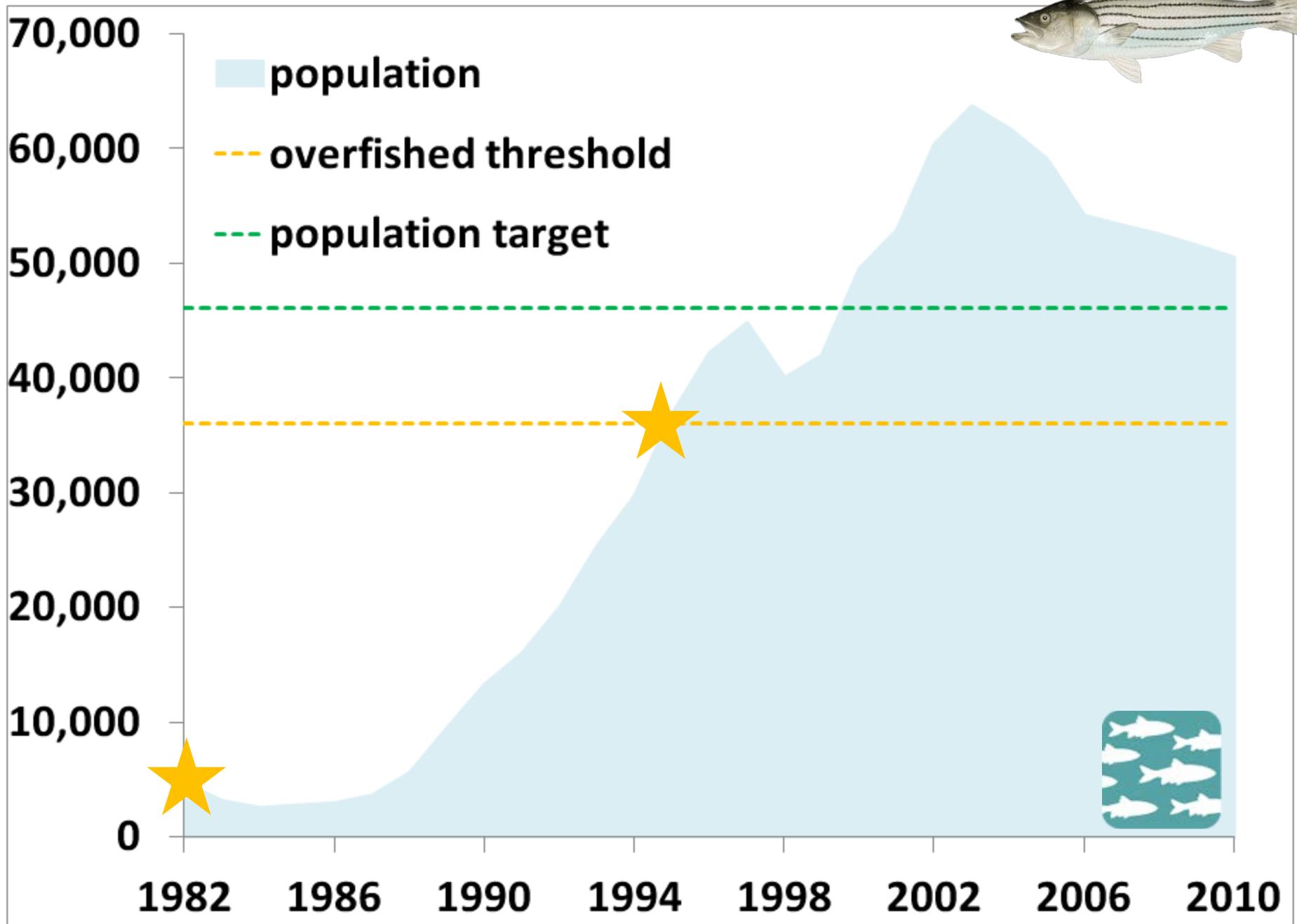
- Most fishermen comply with fishery regulations - when fishermen follow the rules, everybody wins: the fish, the fishermen, and future generations.
- Law enforcement is there to ensure fair competition and a level playing field for those who obey the rules.
- Traditional enforcement techniques such as patrols and investigations as well as satellite tracking systems and education

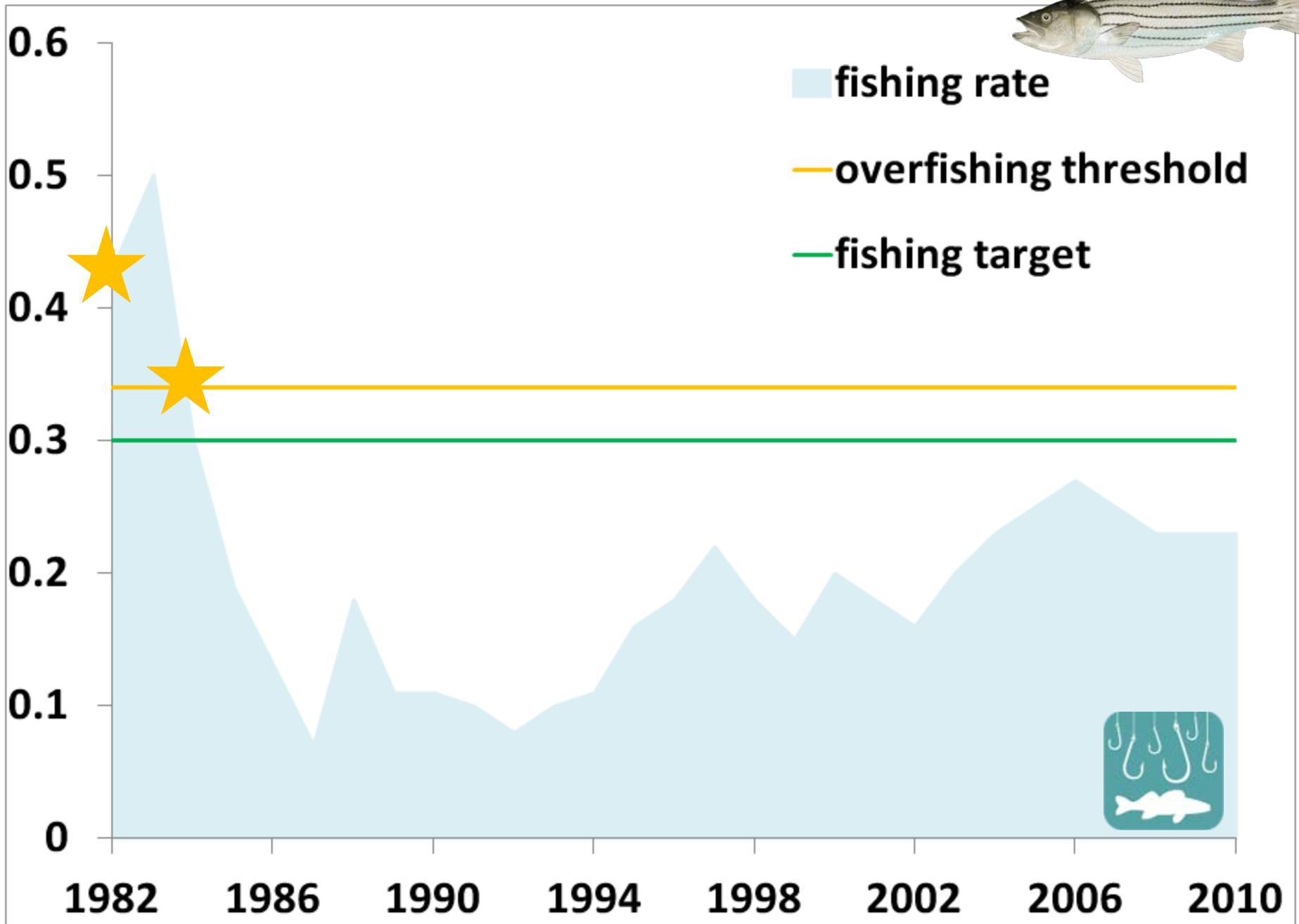


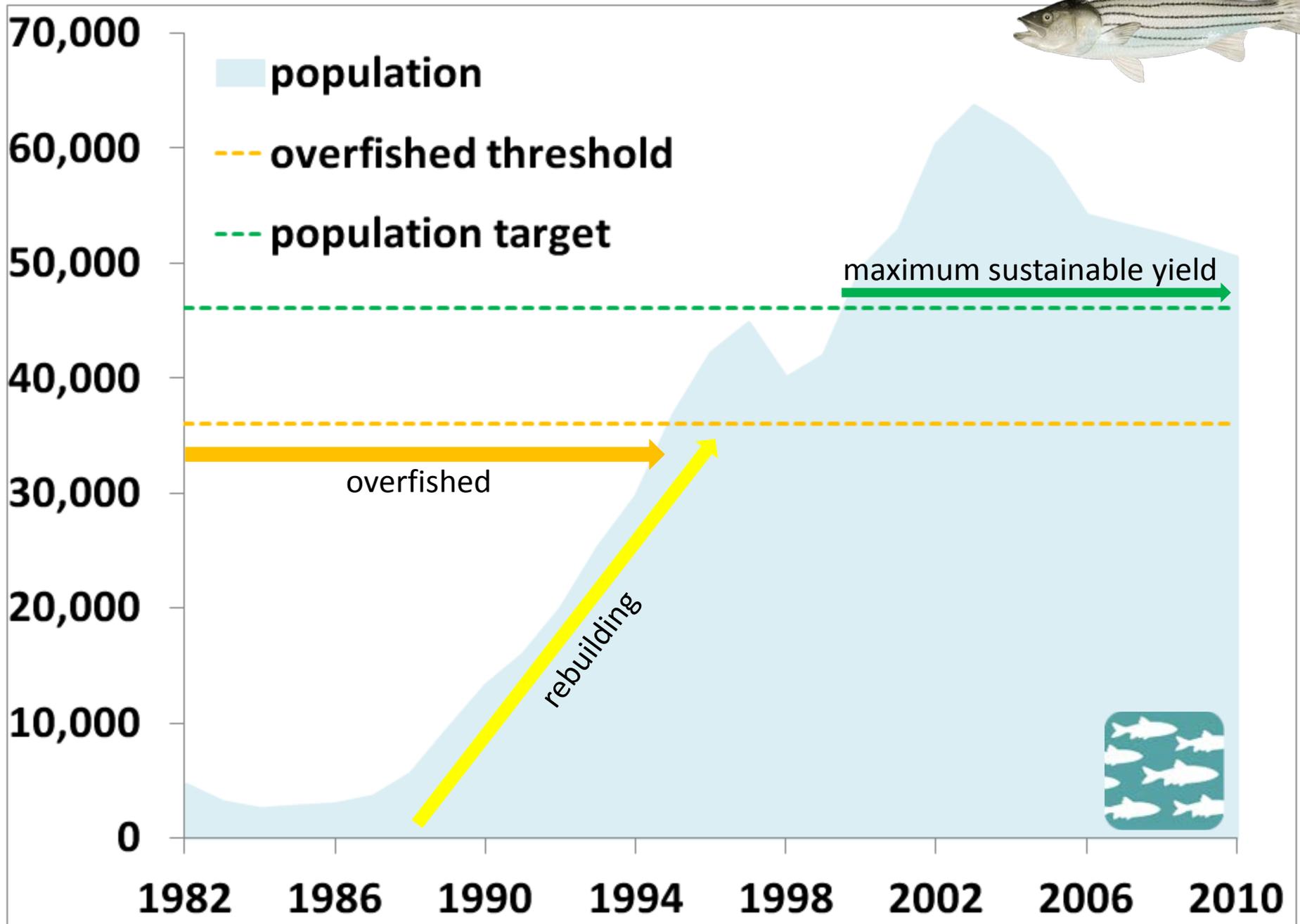
4.
Return to step 1.

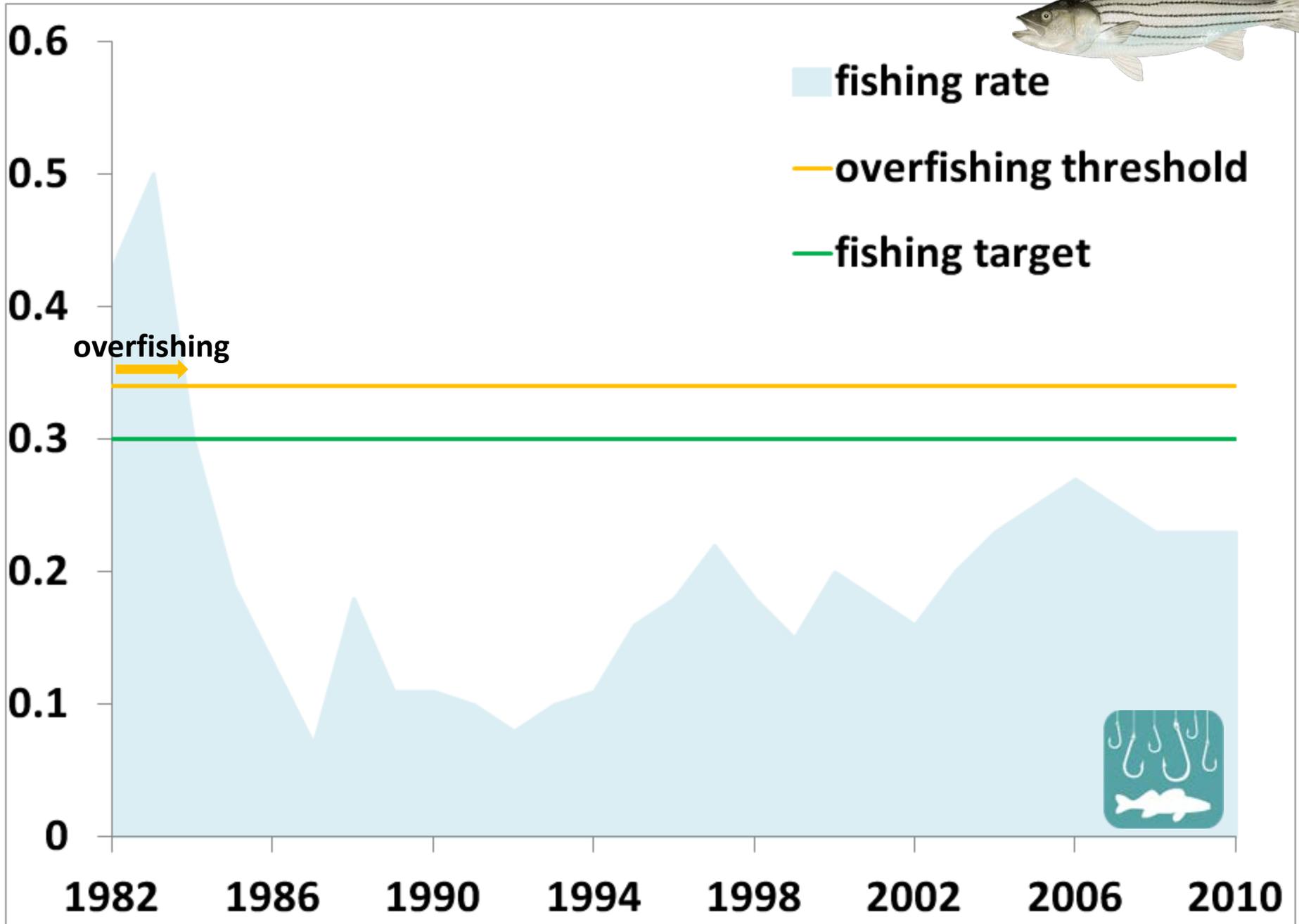
- Managing fisheries sustainably is a dynamic process. It requires constant and routine adjustment between what we learn from science and how we need to modify human behavior to adjust to changes in the ecosystem and fish populations.

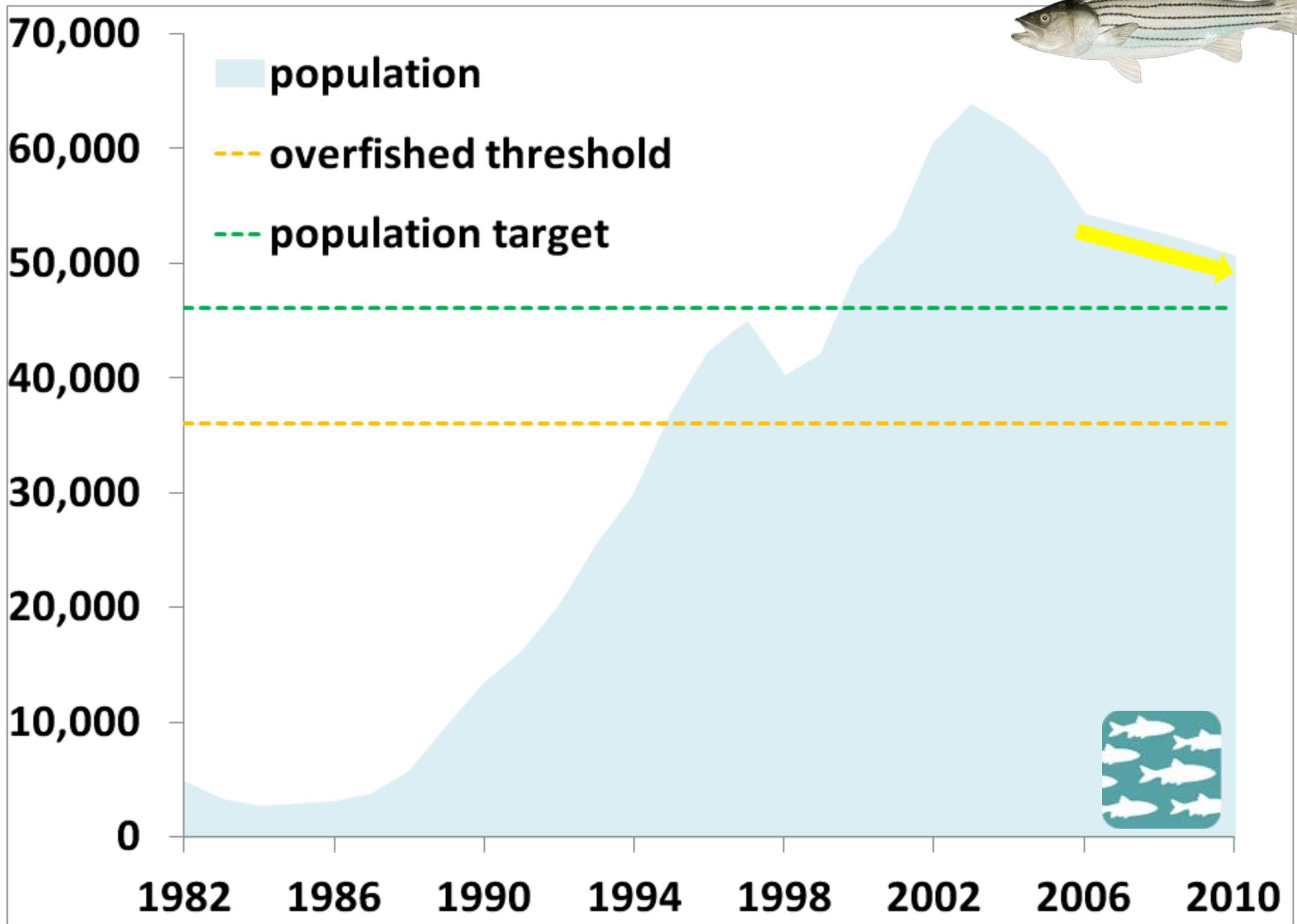






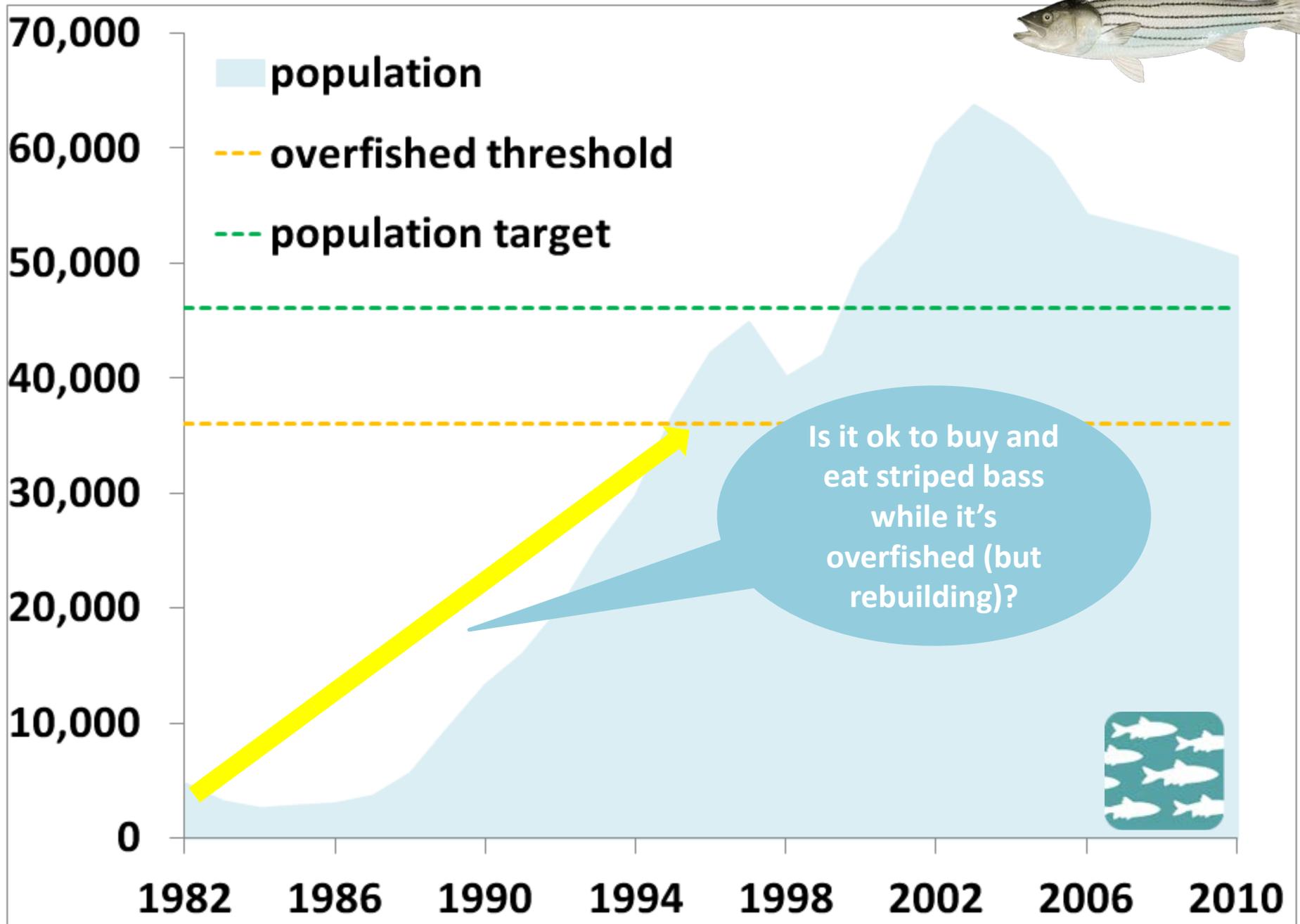






Other Important Considerations

- Habitat
 - Protecting and restoring coastal and marine habitat. Like all animals, fish need a healthy living space to survive, grow, and reproduce.
- Other animals
 - Protecting marine mammals and endangered marine life from human impacts



Other Important Considerations

- Livelihoods of the fishermen
- Livelihoods of the businesses that depend on the fishery
- Livelihoods of the fishing community

Bringing it all home

- What goes into creating a sustainable fishery?
 - Less about the abundance of a fish population, more about the strength of the management system
 - Monitoring the trends in the fish population and ecosystem
 - Science-based management system
 - Responsive management system
 - Balances views of varied stakeholders
- When practiced responsibly, aquaculture can be sustainable, too, with minimal impact to the environment and positive benefits for the economy and communities.
- Like our fisheries, U.S. aquaculture is managed and heavily regulated to ensure it is environmentally and economically sustainable.
 - (More on this in your packets and bags)

Seafood choices

- To eat or not to eat
 - Red, yellow, green lists
 - A good start but not comprehensive enough
 - No real impact
 - Certified sustainable
 - A reliable option, but not all sustainable seafood is certified

Seafood choices

- What can you do?
 - Stay informed using the most up-to-date, credible resources
 - Buy seafood from knowledgeable, reputable dealers
 - Ask questions
 - Get involved
 - You have a choice – make it a smart one



FISHWATCH

U.S. SEAFOOD FACTS

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Search This site All of NMFS

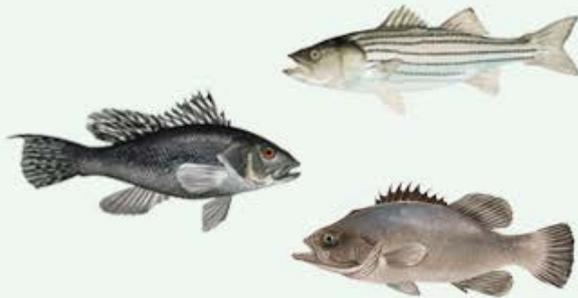
- SEAFOOD PROFILES
- WILD-CAUGHT SEAFOOD
- FARMED SEAFOOD
- BUYING SEAFOOD
- EATING SEAFOOD

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Anchovy



Bass



Bluefish

FISH FINDER



New Bering Sea Research Reveals How Changing Ecosystems Impact Our Most Valuable Fisheries

MORE...

FishWatch provides easy-to-understand science-based facts to help

SEAFOOD NEWS

6.11.12
[Maine Dam Removal Will](#)

SUSTAINABILITY FACTS

[OVERFISHING VS. OVERFISHED: THE SAME THING?](#)

SCIENCE BEHIND SEAFOOD





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SEAFOOD PROFILES

WILD-CAUGHT SEAFOOD

FARMED SEAFOOD

BUYING SEAFOOD

EATING SEAFOOD

FISH FINDER



ATLANTIC STRIPED BASS



Morone saxatilis

ALSO KNOWN AS:
Bass, Rockfish,
Striper, Linesides

SOURCE:
U.S. wild-caught
from Maine to
North Carolina

STATUS

POPULATION



FISHING RATE



HABITAT IMPACTS



BYCATCH



CLICK THE ICONS TO LEARN MORE ABOUT EACH CRITERIA

OVERVIEW

ABOUT THE SPECIES

THE SCIENCE

THE FISHERY

THE SEAFOOD

RELATED LINKS

OVERVIEW

Striped bass are both wild-caught and farm-raised. Wild striped bass, often called striper or rockfish, are caught along the East Coast, mainly in Virginia and Maryland. Most farmed striped bass are actually hybrids, a cross between striped bass and white bass. Both wild-caught and farmed striped bass have a slightly sweet



Atlantic striped bass.

LOOKING AHEAD

Two important management issues currently under review are mycobacteriosis (a bacterial disease found in striped bass in the Chesapeake Bay and beyond) and illegal harvest (poaching). Scientists are uncertain about the effect of mycobacteriosis on the striped bass population and continue research to better understand the disease, predator-prey relationships

www.fishwatch.gov

- 80+ seafood profiles
- General information on:
 - Wild-caught seafood and fisheries management
 - Farmed seafood and aquaculture regulation
 - Buying seafood – how seafood is inspected and how to choose quality, sustainable seafood
 - Eating seafood – health and safety information, guidelines for handling and preparing including recipes
- Features on research, special projects, people in the seafood world from scientists and managers to fishermen and fish farmers to chefs and retailers
- Frequently asked questions and the latest seafood news

Classroom Connections

- What's for lunch?
 - Is seafood served in the cafeteria? If so, where does it come from?
 - Research different species on www.fishwatch.gov
 - See D.C. Farm to School Network - <http://dcfarmtoschool.org/> - think about Fisheries to School? Sea to Tray?
 - Working with 4H or other organizations on recipes contests – ex: Michelle Obama's recent project <http://www.recipesforkidschallenge.com/> (seafood is super healthy!)
 - See Scotland's Seafood in Schools program - <http://www.seafoodinschools.org/>
- We all live downstream
 - Every one of us lives in a watershed. Everything we do can affect water, ecosystems, and people downstream.
 - Check out sewer grates – are they labeled with where the water flows to?
 - Think about how what you do upstream might impact communities downstream. Ex: How might our actions upstream affect striped bass downstream (the population, their habitat, those that fish striped bass, etc.)?
- Maryland watermen and recreational fishermen
 - Does anyone fish or have family members that fish?
 - Maryland has an important commercial fishing heritage
 - Maryland has an active recreational fishing community
- What you can do as citizens, decision-makers, future marine biologists and fishery managers, etc.?
 - <http://youthsustainability.challenge.gov/>

Resources

- Articles and op-eds (see packet)
- Meet a ...
 - Commercial fisherman
 - http://www.nmfs.noaa.gov/stories/2012/05/5_07_bob_keese.html
 - http://www.fishwatch.gov/features/meet_phil_harris_black_cod_fisherman.htm
 - Shellfish farmer
 - http://www.nmfs.noaa.gov/stories/2011/12/8_voicesmeetdewey.html
 - Restaurant owner
 - http://www.nmfs.noaa.gov/stories/2011/10/05_voices_laura_anderson.html
 - Fisherman and retailer
 - http://www.nmfs.noaa.gov/stories/2012/05/05_07_12rich_cook_voices.html
 - Fisheries observer
 - http://www.nmfs.noaa.gov/stories/2012/05/4_30_12observers.html
- Other features:
 - <http://www.nmfs.noaa.gov/stories/2012/index.html>
 - <http://www.nmfs.noaa.gov/stories/2011/index.html>
 - <http://www.fishwatch.gov/features/index.htm>

Name one type of seafood we get
from the ocean.

How can we ensure we're always
able to enjoy this?

Did your idea of sustainable seafood (or overfishing and overfished) change?

Is U.S. seafood sustainable? If so, why?