



## A Spin on Seafood NYSG Lesson Plan



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# A Spin on Seafood Lesson Plan

Grade Level(s): 7<sup>th</sup> – 12<sup>th</sup>

Time: 45 minutes (very flexible)

NGSS: MSPS, MSLS, HSPS, HSLs

Vocab: Seafood, Aquaculture, Science, Fish, Environment

## Summary

A Spin on Seafood introduces students to fish and shellfish farmed or fished in New York waters and to key seafood topics including: seafood science, fisheries, seafood safety, aquaculture (fish-farming), and seafood sustainability. It also serves as a platform for facilitating further discussion on the seafood science and aquaculture curriculum produced in conjunction with this lesson plan (SGSSC2017 & SGAQC2017).

## Objectives

After this activity, students will:

- Be more familiar with a variety of different food fish and their origins.
- Understand general seafood nutrition (i.e. its tendency to be high in protein and low in fat)
- Have a deeper understanding of what aquaculture is and the different types that exist.
- Understand a few examples of environmental impacts of the different seafood production methods.

## Materials

Spin wheel (provided)

Fish illustrations (provided)

Trivia questions (provided)

Optional: Paper clips and a magnetic fishing rod (can pick up by hand)

## Introduction

A Spin on Seafood is a fun and engaging activity that provides a platform to incorporate key concepts in seafood science and aquaculture into the classroom. The activity combines trivia questions and a “go fish” activity. The trivia questions are separated into five categories including: seafood science, aquaculture, fisheries, seafood safety and seafood sustainability. Summaries of each category are provided below and more information can be found in the Seafood Science and Aquaculture curriculums (SGSSC2017 & SGAQC2017).

Category 1. – Seafood Science.

Food Science is the multidisciplinary study of the chemical makeup of food, nutrition, food processing, and food safety. The chemical and physical properties of food affect the look, taste, smell, texture and mouthfeel of foods. These properties can also affect how the food is prepared and how long it lasts (shelf-life). **Seafood science is the branch of food science that deals with foods that are primarily sourced from the water, such as fish, shellfish and seaweeds.**

Category 2. – Fisheries.

**Fisheries represent fish and shellfish caught from the wild for use by humans.** In order to produce seafood efficiently and maintain high quality, fisheries use a variety of equipment to haul fish and a number of different harvesting methods. Many Americans fish recreationally, especially in New York.

Category 3. – Seafood Safety.

**Seafood safety addresses the biological and chemical hazards associated with many seafood products that affect its safety.** There are a number of potential biological, chemical, and environmental contaminants that can affect the safety of seafood. Proper sanitation, sourcing and handling or processing can be used to effectively control for many of these hazards.

Category 4. – Aquaculture.

Sometimes referred to as fish farming, **aquaculture is the controlled rearing (growing) of plants or animals that spend all or a portion of their lives in water.** Wild fisheries cannot support the growing demand for seafood products so global production of seafood on farms (aquaculture) has been growing rapidly. There are many different types of aquaculture operations, which can utilize salt or freshwater; be located on land, near the coast or in the open ocean; and grow either a single species or multiple species in one system.

Category 5. – Seafood Sustainability.

**Sustainability is maintaining and protecting resources and existing in productive harmony to support present and future generations.** Every human activity uses natural resources and effects the environment in some way, so what is considered sustainable may vary from one person to another and change over time. In general sustainability will focus on protecting and preserving the environment, the economic feasibility of a farm or fishery and social impacts of an operation.

Alternate Category. – Go Fish.

The Go Fish cards provide illustrations of popular food fish species farmed or fished in the U.S. and the following information: species name, range, nutrition, and a fun fact. Many of the fish are commonly caught in New York waters. This activity can be set up as elaborate or simple as you like. In place of a magnetic fishing pole (store bought or hand crafted) being used to pick up the cards by the attached paperclip, participants can simply select each card by hand.

### Activity Instructions

**Step 1.** Print the trivia wheel (Appendix A), trivia questions (Appendix B) and go fish cards (Appendix D). Insert spinner in the wheel’s center and fasten using a paper fastener clip.

**Step 2.** Spread the fish prints out, with the ‘Go Fish’ side facing up.

**Note:** It may be beneficial to divide students into teams of around 4-5 (more or less depending on the class size and whether or not you want to make it into a competition).

**Step 3.** Have each student or team spin the wheel.

**Step 4.** When the wheel lands on:

4a. **“Go Fish.”** Have a student “fish” with the magnet until a fish illustration is picked up, or pick a card by hand. Next have them read the information attached (species, range, season, nutrition, and fun fact). Further discussion optional.

Optional: Use the information on the cards and species to expand on the topics and start a discussion with the class. The NYSG Seafood Science and Aquaculture curriculums can help provide more detail for this purpose. See **Expanding on the topics** below for ideas on how to do this.

4b. **Trivia category.** Ask a question for the given category from the Trivia Question Table (Appendix B).

**Note:** For questions that require illustrations, see the Trivia Illustrations document (Appendix C).

Optional: Use the questions to expand on the topics. The NYSG Seafood Science and Aquaculture curriculums can help provide more detail for this purpose. See **Expanding on the topics** below for ideas on how to do this.

### **Expanding on Topics**

This activity provides the opportunity for further discussion of the information outlined in the Seafood Science and Aquaculture curriculums. In addition to introducing students to food science, for example, when a student “catches” a fish illustration and explain its nutrition, they can be prompted to explain the role of proteins in the body or review their chemical structure, depending on the content of your class. Likewise, following a trivia question on seafood safety, students can be prompted to explain what bacteria are, why controlling temperature can be an effective way to slow or stop their growth, or what can be done to eliminate the potential for this hazard.

### **Resources**

NY Sea Grant Seafood Science Curriculum – SGSSC.pdf

NY Sea Grant Aquaculture Curriculum – SGAQC.pdf



This Seafood Science curriculum was produced by NY Sea Grant with funds supporting the project and associated workshops and trainings from NOAA Sea Grant project number NA16OAR4170251 and the CALS CCE Summer Internship Program.

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Instructions:

1. Print out page (a heavy weight cardstock is best)
2. Cut out wheel and arrow.
3. Punch a hole into the center of the arrow and cut a slit or hole into the center of the wheel.
4. Secure the arrow to the wheel with a metal paper fastener. See image to the right.
5. Spin to make sure the arrow spins freely. If not you may have to adjust the tightness of the fastener or make the hole in the arrow larger.

NOTE: The sturdier the wheel and arrow the better it will spin. Heavy cardstock or lamination will help with this.







## Seafood Science

Question	Answer
<b>What is the shelf-life of most fish?</b>	Shelf-life represents the length of time that a product can be stored before it will begin to spoil. The typical shelf life of most fresh fish is 2-3 days, but with most foods it will depend on how the product was handled and the physical and chemical characteristics of that food. Temperature will play an important role in controlling shelf-life. Live shellfish maintained live will have a longer shelf life.
<b>What percentage of your body is water? How about a fish?</b>	The average adult's body is 55-60% water. Fish can range 30-90% water, with most around 80%.
<b>Some seafood, like salmon, is a great source of what types of healthy fats?</b>	Some fish are a dense source of Omega-3 fatty acids- a group of unsaturated fats important to brain, eye and heart health.
<b>What is "fresh" fish?</b>	<p>"Fresh" fish at your local supermarket is simply minimally processed fish held at refrigerated temperatures. The word "fresh" is not an indication of quality, as many consumers may be led to assume. It is important to understand how to identify good quality seafood when purchasing. Purchasing from a reputable and reliable source is recommended as they will often ensure quality for you.</p> <p><b>Just because fish is frozen does not mean it is not fresh either.</b> In many cases the quality of frozen fish can be better than what is marketed as "Fresh" at your local grocer. Consider where your seafood is coming from when making "Fresh" selections. "Fresh" fish from overseas will have been maintained in a thawed (unfrozen) state for days or weeks before it ends up at your local grocer.</p>
<b>Amino acids are the building blocks of what important food category?</b>	Proteins. All proteins are made of long chains of amino acids. There are 20 amino acids total and some are essential amino acids, which are those that your body cannot synthesize and must be obtained through your diet. Not only do fish contain a highly digestible protein content, but also all essential amino acids.
<b>What is the best way to thaw seafood?</b> <b>A. In the Refrigerator</b> <b>B. Room Temperature</b> <b>C. Under Cold Running Water</b> <b>D. Microwave</b>	<p><b>A. In the Refrigerator</b></p> <p>Thawing fish slowly under refrigerated temperatures is the best and safest method for thawing. Under cold running water and in the microwave, are each acceptable alternatives as long as they are done properly and closely monitored. Fish should never be thawed at room temperature, this can promote the growth of microbes that could cause illness if not cooked properly.</p>

Appendix B: Trivia Questions

<b>What should you look for when buying frozen seafood?</b>	The packaging should not be opened or damaged, nor should ice crystals be present in the package, which is a sign of temperature abuse. You should always purchase seafood from below the defrost line (Top Shelf) in the freezer.
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## Fisheries

Question	Answer
<b>Fishing has been around for a LONG time. How many thousands of years ago do we have evidence that people were fishing?</b>	40,000 years ago, based on dating of archaeological evidence of the bones of deep sea fish. Though people may have eaten shellfish and smaller schools of fish inland for even longer. The earliest definitive evidence for fishhook manufacture is between 16,000 and 23,000 years old.
<b>What percentage of the U.S. population fishes recreationally?</b>	Approximately 13% of Americans fish recreationally. Some commonly recreationally caught species in NY are.... Black Sea Bass Striped Bass Fluke Porgy Squid Blue Crab
<b>When you catch a fish that you want to release, what should you never touch on the fish so it can be released safely?</b>	The gills. They use these to breathe and they are very sensitive.
<b>What type of fishing gear is this?</b> <i>Show Illustration F1.</i>	Gill Net – Gill nets are made of fine mesh netting that fish can't see. When placed in front of fish they run into it and get tangled. The fine mesh net gets caught on the gill cover (Operculum).
<b>What is this piece of fishing equipment called?</b> <i>Show Illustration F2.</i>	This is a trawl net, used by trawlers. A boat pulls the nets to trap fish at the back of the net before being lifted out of the water for harvesting.

## Seafood Safety

Question	Answer
<b>Why is it important to wash your hands before and after handling raw seafood?</b>	When handling seafood, any dirt, bacteria or viruses on your hands may transfer onto the food. After you have handled it, you risk transferring the bacteria already on the fish to everything else you touch.
<b>What are parasites?</b>	Parasites are organisms that require a host to survive. Certain worms and protozoa use fish as a host and can also infect humans when undercooked or raw.
<b>How should whole finfish be stored?</b>	Under refrigeration 32-40°F, on ice, is best. The closer to 32°F the better quality and longer shelf-life you will have.
<b>How should fish fillets be stored?</b>	Fish fillets should be maintained under refrigeration temperatures (32-40 °F). As with whole fish, the closer to 32°F the better. Unlike whole fish, fillets should be wrapped to avoid contact with ice.
<b>How should live shellfish be stored?</b>	Live shellfish should be stored between 35-40°F. Storing directly on ice should be avoided. If necessary be sure it is in a container that will drain to avoid submerging the shellfish in freshwater. Shucked shellfish can be stored on ice to maintain temperatures as close to 32°F as possible.
<b>Can you give some examples of seafood contaminants or hazards?</b>	Bacteria, viruses, parasites, natural toxins, and environmental chemicals.
<b>What temperature should you cook seafood to?</b>	Fish should be cooked to an internal temperature of 145°F to ensure any bacteria or viruses that could cause illness are killed.

## Aquaculture

Question	Answer
<b>What is Aquaculture?</b>	Fish farming – the growing or rearing of organisms in water for all or part of their life.
<b>What is marine aquaculture and what are the most common species grown in the US?</b>	Growing species that live in saltwater environments, including oceans. Atlantic salmon is the most common fin fish in marine farms and oysters are the most common shellfish farmed in the US.
<b>What is freshwater aquaculture and what are the most common species grown in the US?</b>	Species growing native to rivers, lakes, & streams. Catfish and crawfish.
<b>How much of the world’s fish food supply is farmed?</b>	Just a little over half.
<b>What type of aquaculture is this?</b> <i>Show Illustration A1.</i>	This is a net pen system designed to confine aquatic life in larger bodies of water, which can protect from predation and allow better control over the diet and water quality surrounding the fish. Saltwater designs tend to be much larger than freshwater counterparts and are typically subject to more intense currents and storm events.
<b>What type of aquaculture is this?</b> <i>Show Illustration A2.</i>	This is a rack and bag bottom culture. This system involves placing oysters in grow-out mesh bags tied to racks, which can be placed on the sea floor.
<b>What type of aquaculture is this?</b> <i>Show Illustration A3.</i>	This is an example of aquaponics, which combines terrestrial plants and freshwater fish. In this system, the waste produced by the fish is broken down into micronutrients that the plants can then use to grow. The plants act as a filtration system for the fish.
<b>What type of aquaculture is this?</b> <i>Show Illustration A4.</i>	This is an example of integrated multitrophic aquaculture: a system that combines finfish, filter feeding shellfish and photosynthesizing seaweeds to effectively use all nutrients input into the system. <ul style="list-style-type: none"> <li>• The fish are fed and generate waste full of macronutrients.</li> <li>• The shellfish filter out the macronutrients and produce waste full of dissolved micronutrients.</li> <li>• The seaweeds remove the micronutrients from the system and use the energy of the sun to grow.</li> </ul>

**What type of aquaculture is this?**

*Show Illustration A5.*

Surface culture of shellfish takes place at the surface of the water column. Some of the different practices include:

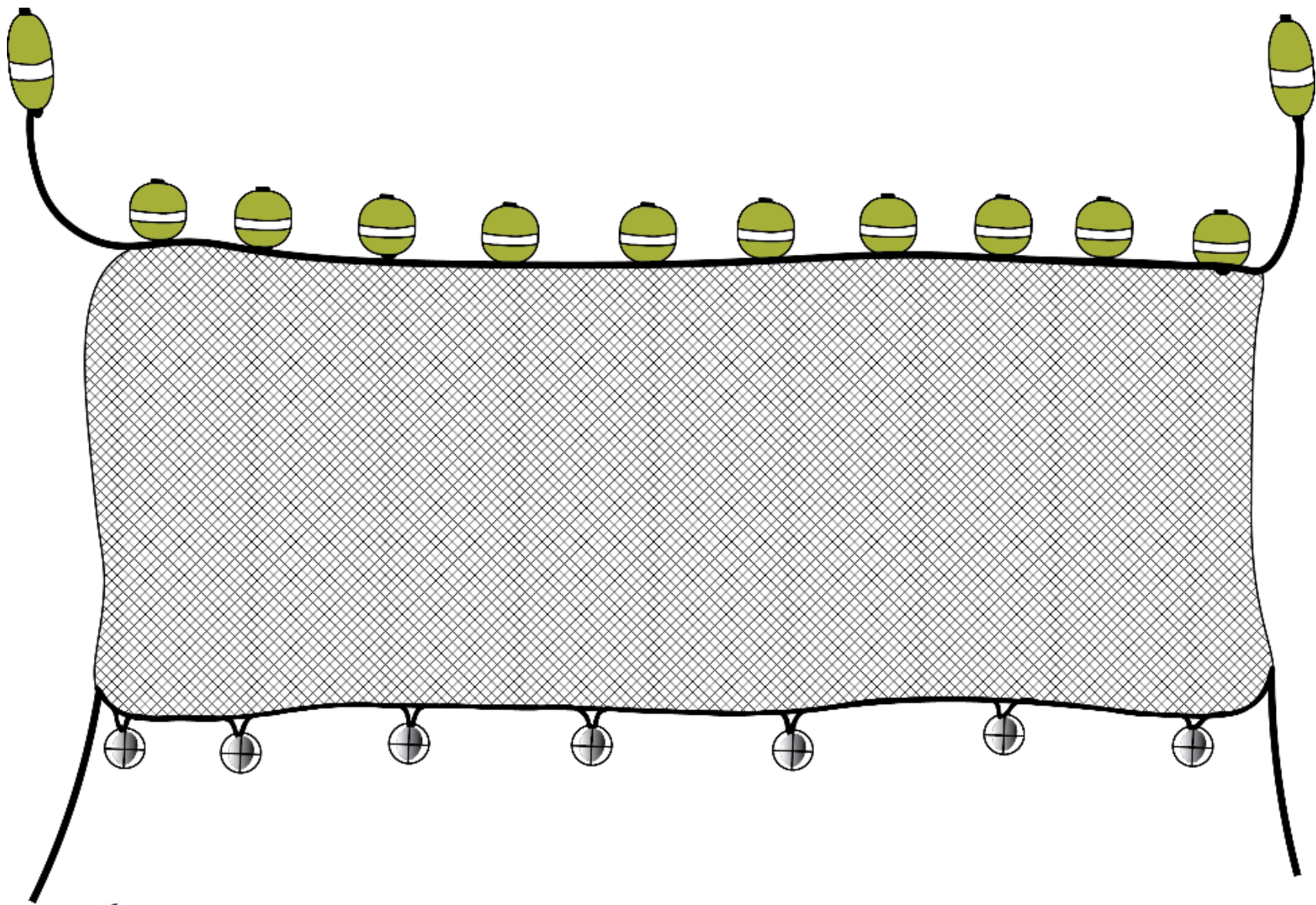
- Mesh bags can be filled with shellfish and maintained at the surface with floatation or lines attached to posts.
- Shellfish are placed in “socks” (long narrow bags) or lantern nets that are suspended from lines between two floating structure to hang down in the water column and feed on macronutrients and plankton that pass by with the currents.

<b>Seafood Sustainability</b>	
Question	Answer
<b>What is sustainability?</b>	Maintaining and protecting resources and existing in productive harmony to support present and future generations.
<b>Are fisheries and aquaculture practices in the United States sustainable?</b>	Yes, the U.S. has a highly regulated fishery and aquaculture industry. Universities, research groups, industry and government agencies are constantly re-evaluating practices and research new technologies and techniques to enhance fisheries and aquaculture.
<b>Can you think of any environmental concerns or impacts of aquaculture?</b>	A dense fish farm may pollute the surrounding environment if effluent waste is not properly treated or diluted; fish can escape into the environment and interbreed with wild fish, which may compromise the genetic diversity of the wild population. Dense populations of fish in an area can increase the occurrence and spread of disease.
<b>Can you think of any environmental concerns or impacts of fisheries?</b>	Overfishing can result in the loss of an entire population, which can significantly affect the entire ecosystem and food chain. Certain fishing gear can impact the habitat in negative ways. Bycatch can result in declines in non-target potentially endangered species.
<b>Can you name one way that fisheries managers maintain sustainable fisheries?</b>	Quotas, size and species restrictions, seasonal closures, gear type and size restrictions, counting the fish.
<b>What are some challenges facing sustainable fisheries?</b>	Overfishing, pollution, habitat degradation, invasive species, careful research and management.
<b>What is the most environmentally friendly fishing method?</b>	Angling (line and hook)

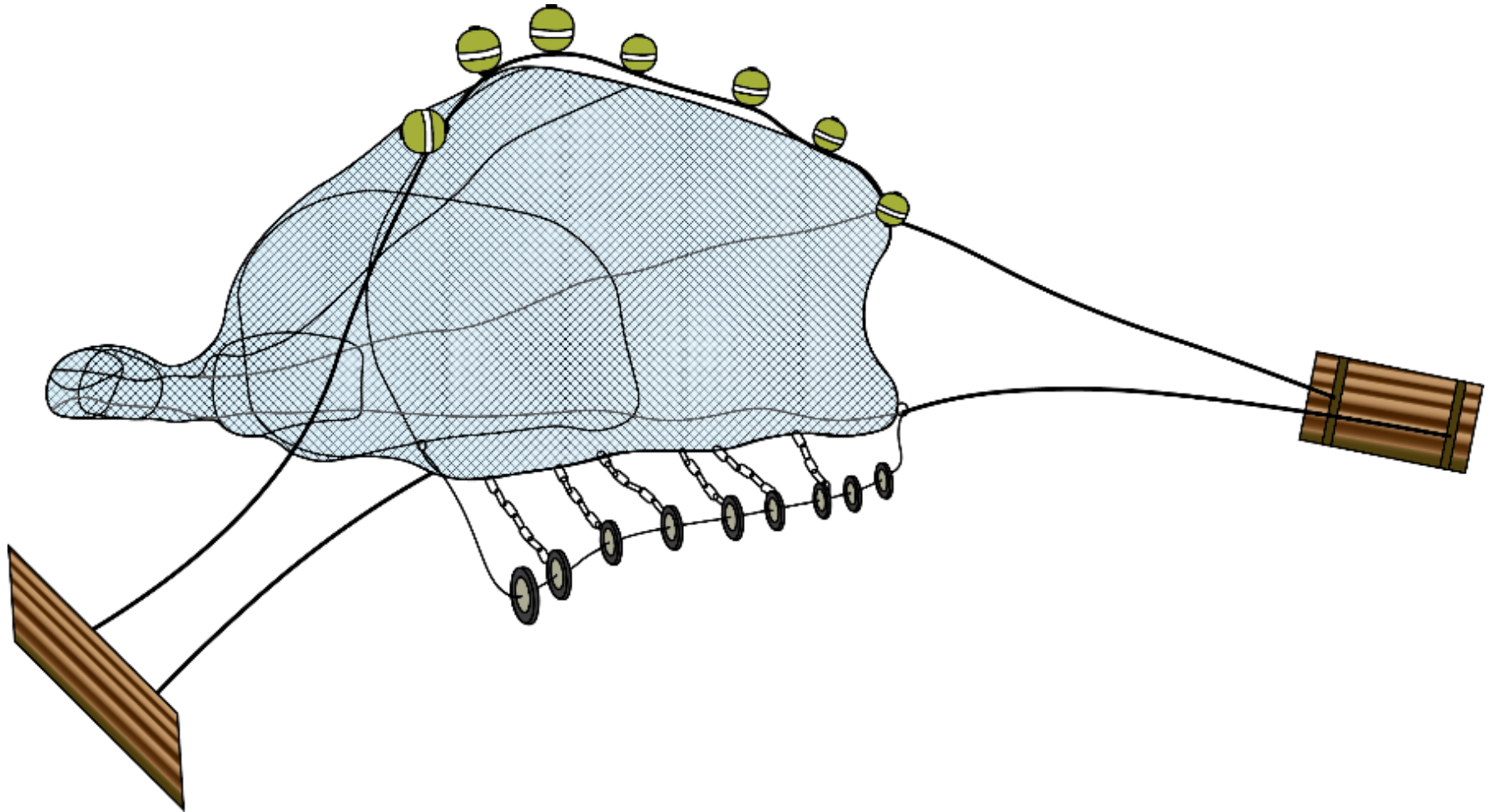


# Begin Illustrations

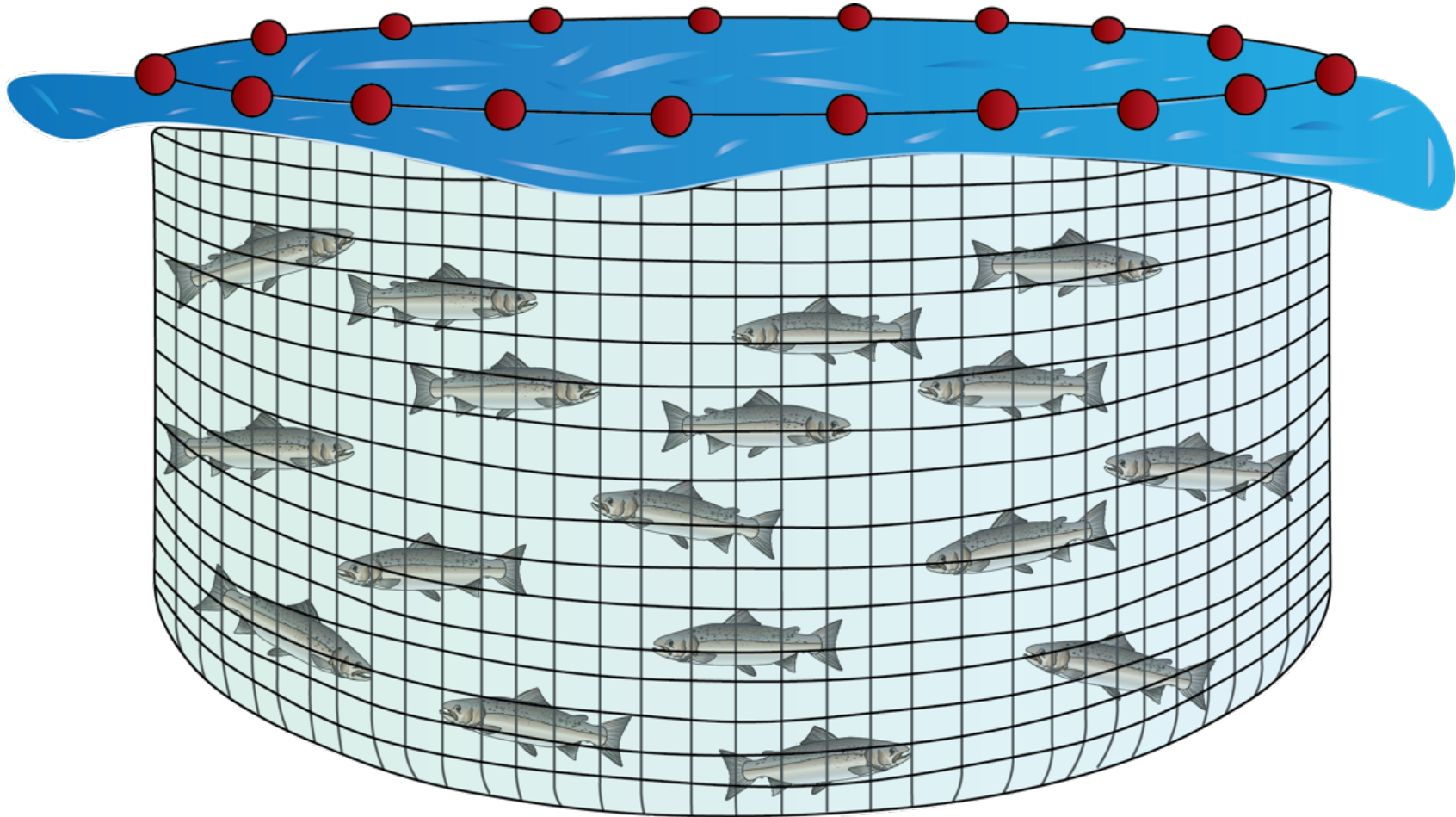
F1.



F2.

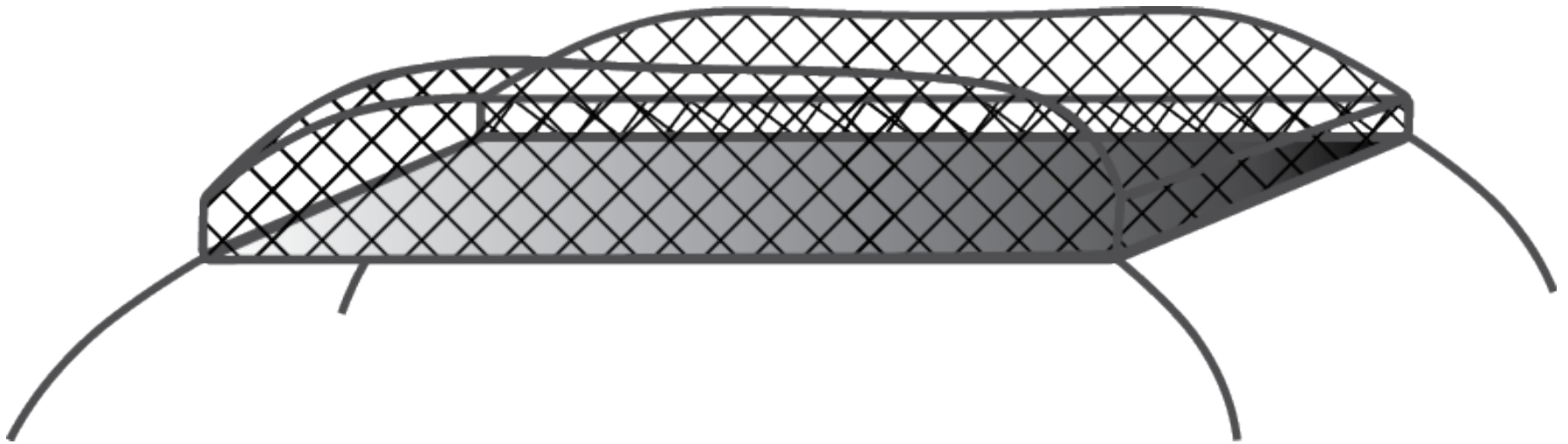


A1.

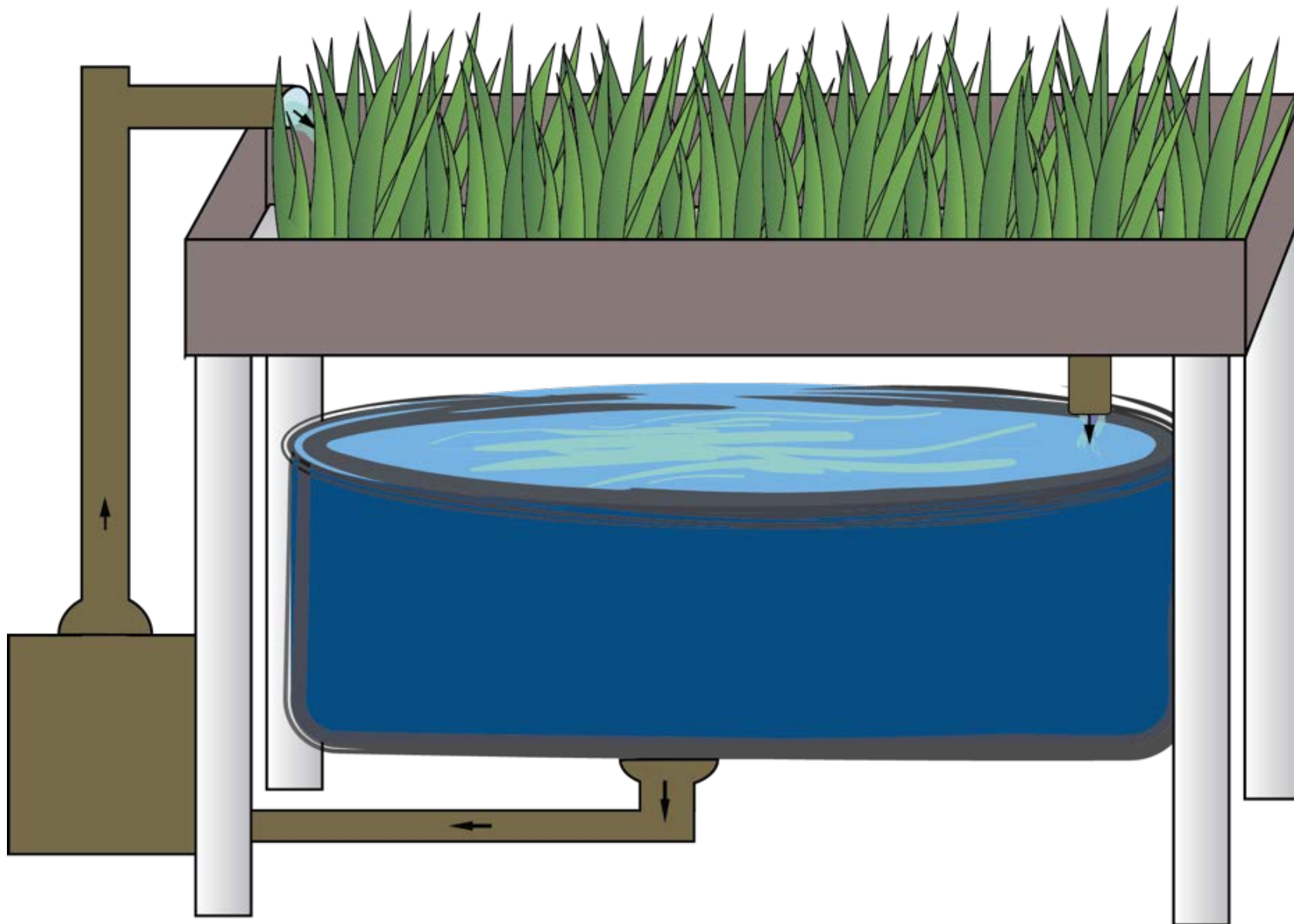




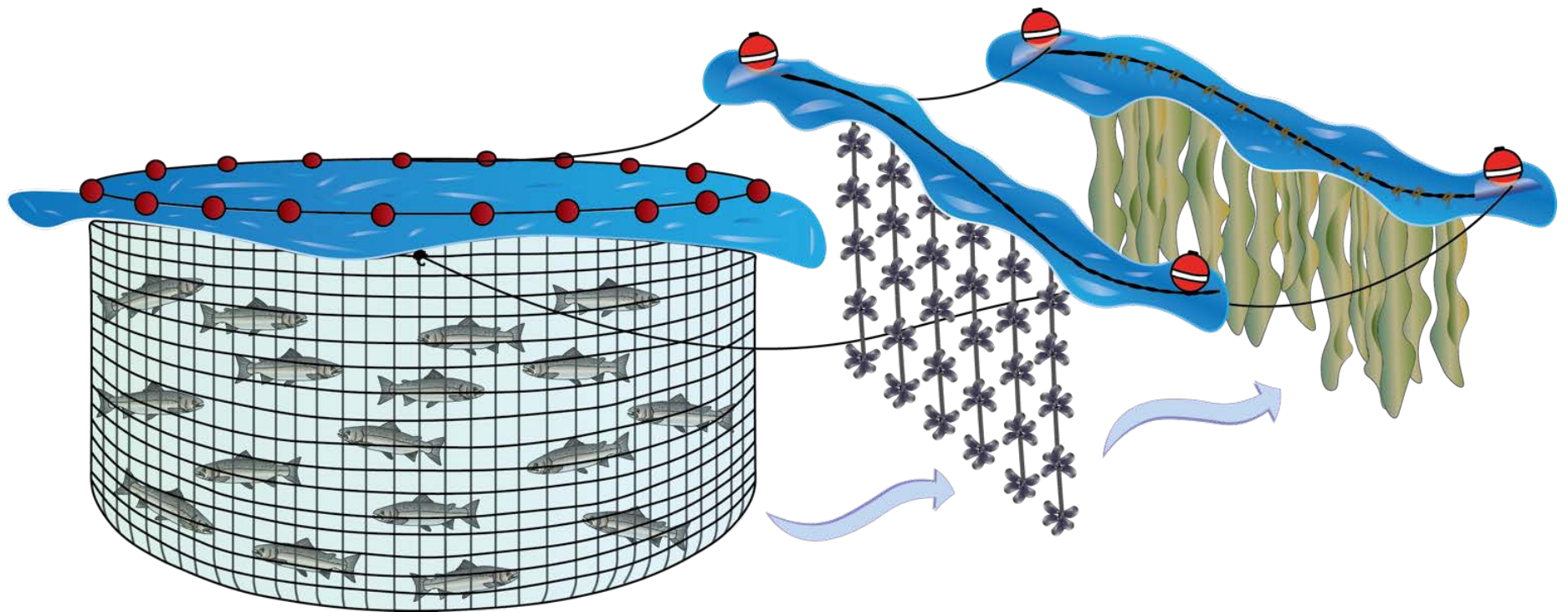
A2.



A3.

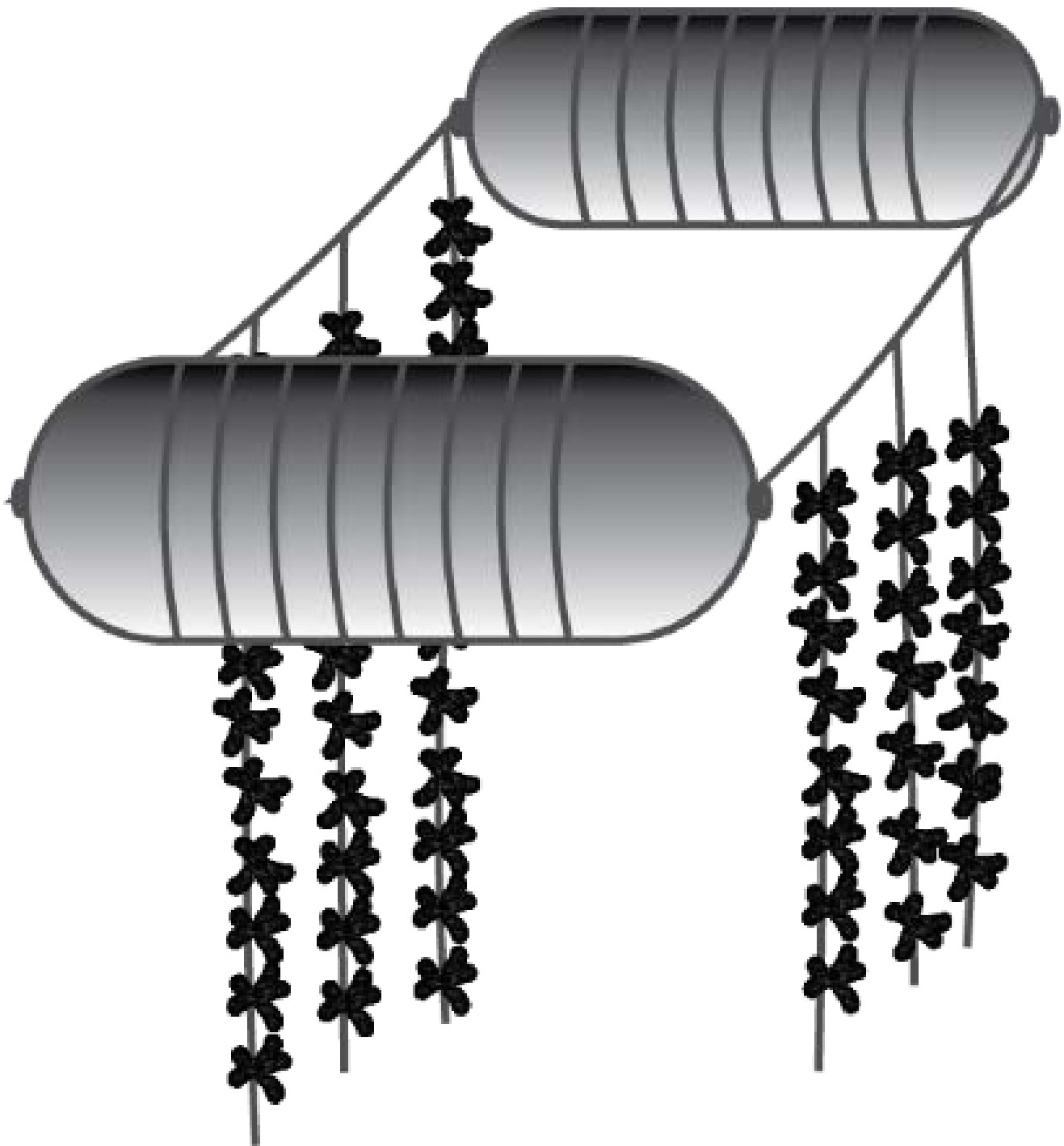


A4.





A5.



# GO FISH

**The rest of the document contains the Go Fish Cards, which are designed as 5x8 index cards. They can be printed back and front directly on unlined index cards or simply printed onto 8.5 x 11 inch printer paper.**

**When Printing be sure to select “auto portrait/landscape” under orientation to be sure that the appropriate pages print in portrait and landscape formats respectively.**



# Go Fish



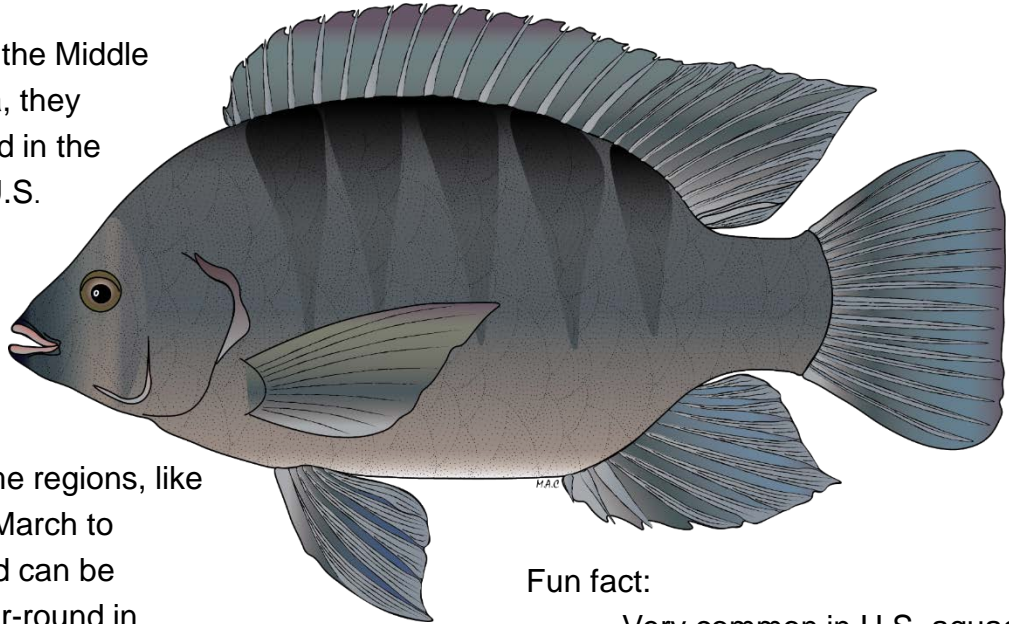
# Tilapia

## Nutrition:

A great source of selenium with a low-to-moderate fat content and high-quality protein content.

## Where is it from?

Originally from the Middle East and Africa, they were introduced in the southeastern U.S.



## When is it available?

Caught in some regions, like Florida, from March to November and can be harvested year-round in aquaculture facilities.

## Fun fact:

Very common in U.S. aquaculture and aquaponics operations.



# Go Fish



# Blue Mussel

Where is it from?

Tidal areas and offshore in New England, Washington and California.

When is it available?

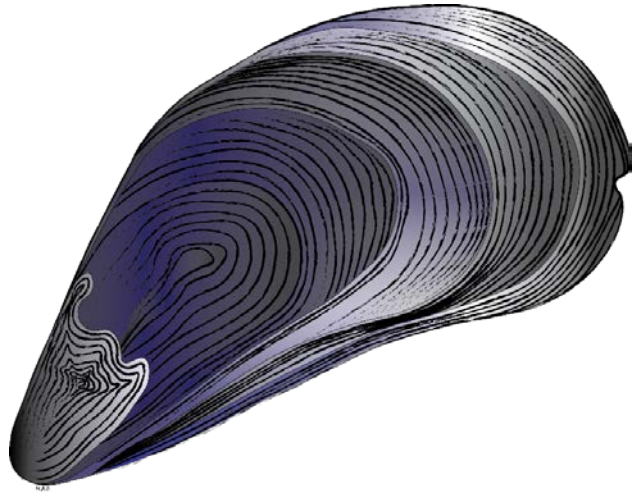
Year-round.

Nutrition:

Low in saturated fat and an excellent source of omega-3 fatty acids.

Fun fact:

Growing mussels requires no feed; they filter phytoplankton directly from the water.





# Go Fish





# Clam

Where is it from?

U.S. wild-caught from New England to North Carolina.

When is it available?

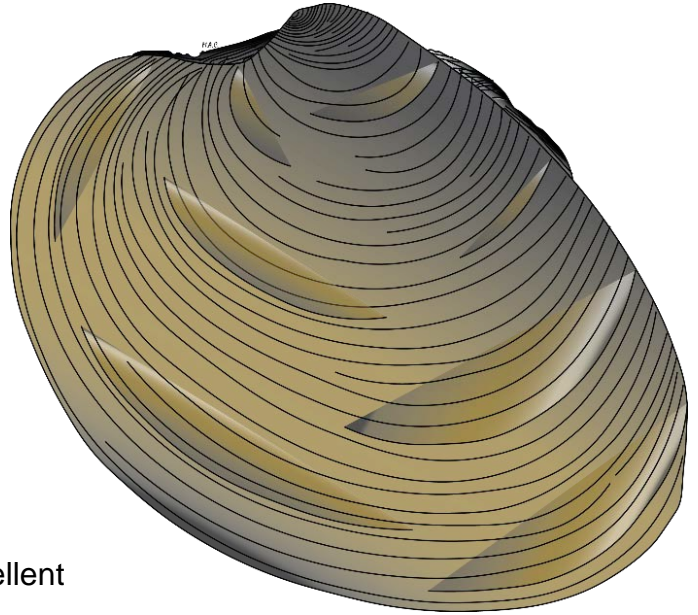
Year-round.

Nutrition:

Low-fat, high-quality protein and an excellent source of selenium and niacin.

Fun fact:

Can get as large as 8 inches!





# Go Fish



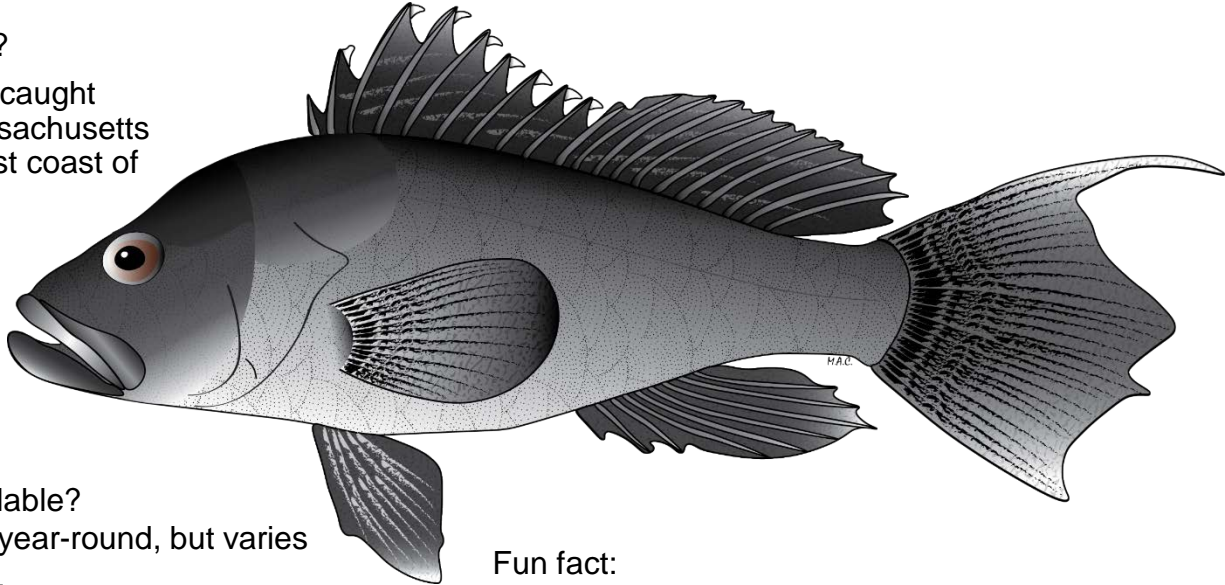
# Black Sea Bass

## Nutrition:

A good, low-fat source of protein and magnesium.

## Where is it from?

U.S. wild-caught from Massachusetts to the west coast of Florida.



## When is it available?

Usually year-round, but varies by state.

## Fun fact:

Generally overwinter in water 240 to 600 feet deep.



# Go Fish



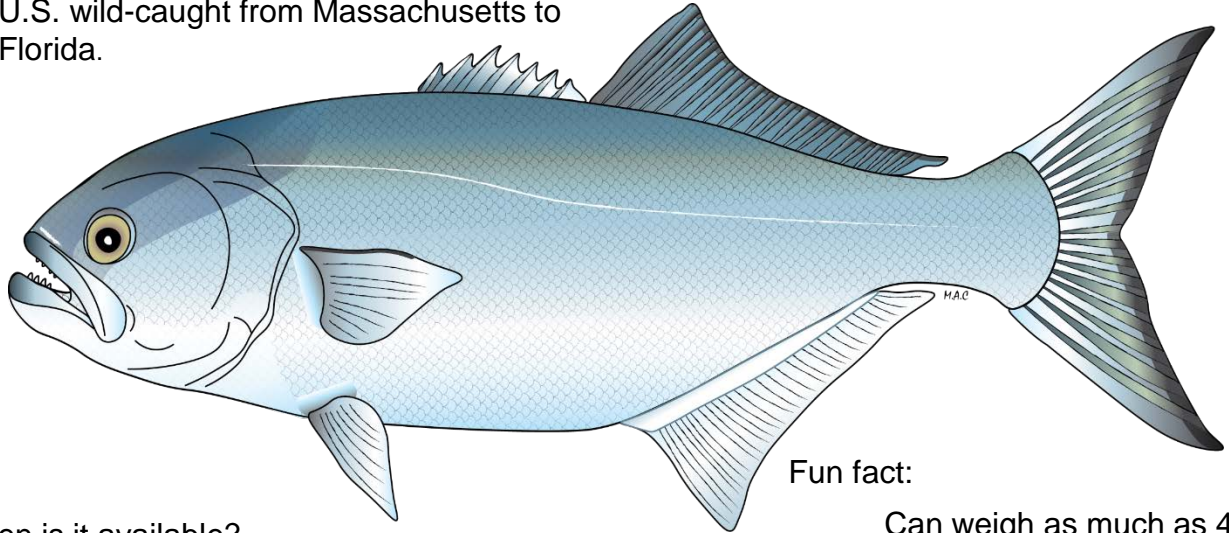
# Bluefish

Where is it from?

U.S. wild-caught from Massachusetts to Florida.

Nutrition:

A good source of selenium, niacin, vitamin B12, magnesium, and potassium.



When is it available?

Depending on the area, they are fresh year-round and not available frozen.

Fun fact:

Can weigh as much as 40 lbs!  
That's the weight of a microwave.



# Go Fish





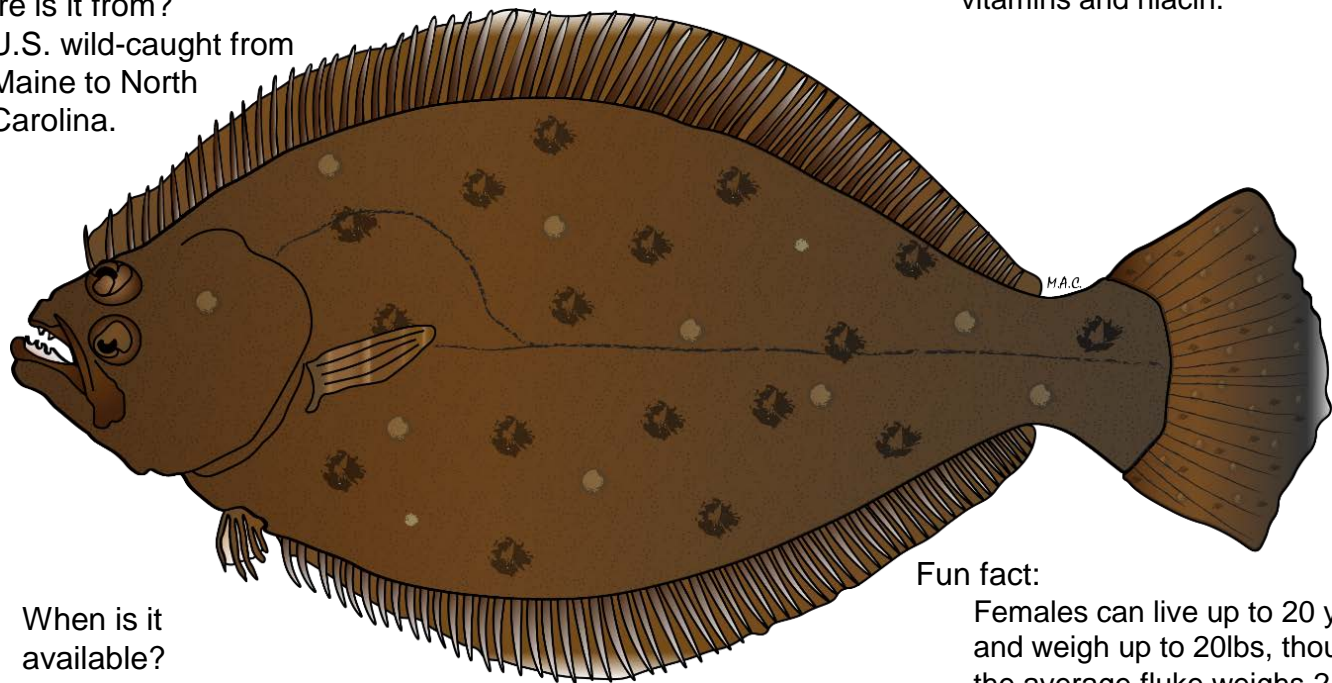
# Fluke

Where is it from?

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

Nutrition:

A good low-fat source of B  
vitamins and niacin.



When is it  
available?

Year-round.

Fun fact:

Females can live up to 20 years  
and weigh up to 20lbs, though  
the average fluke weighs 2-5  
lbs. and is 1-2 feet long.



# Go Fish





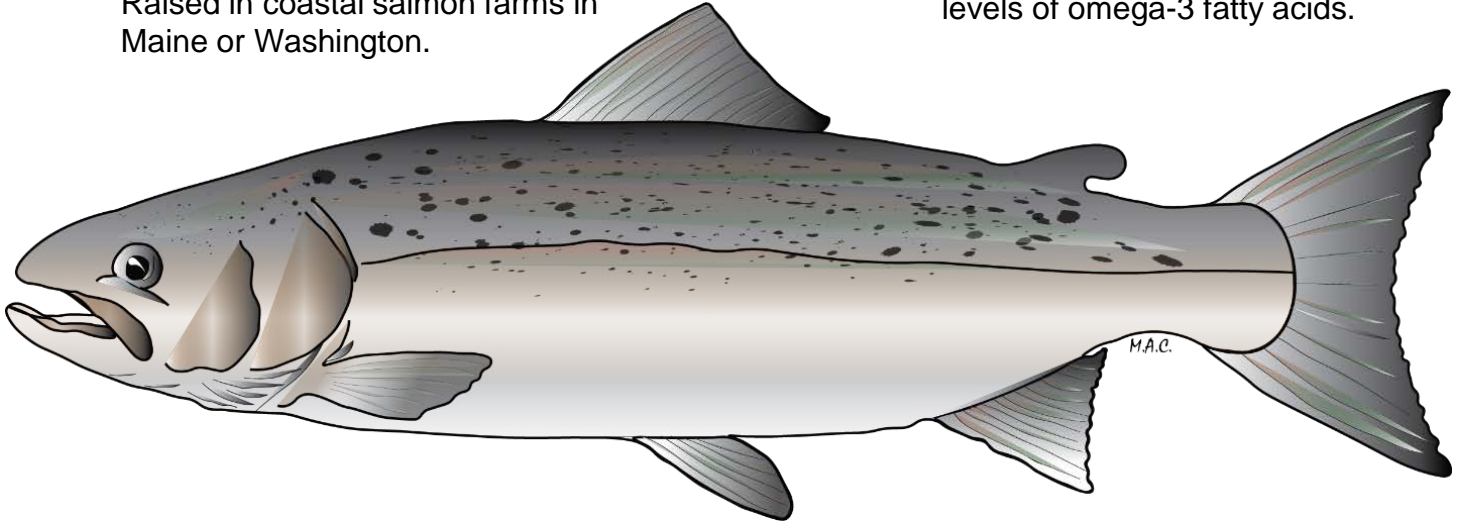
# Atlantic Salmon

Where is it from?

Raised in coastal salmon farms in  
Maine or Washington.

Nutrition:

Low in sodium and contains high  
levels of omega-3 fatty acids.



When is it available?

Year-round.

Fun fact:

ALL edible Atlantic Salmon is farmed.



# Go Fish



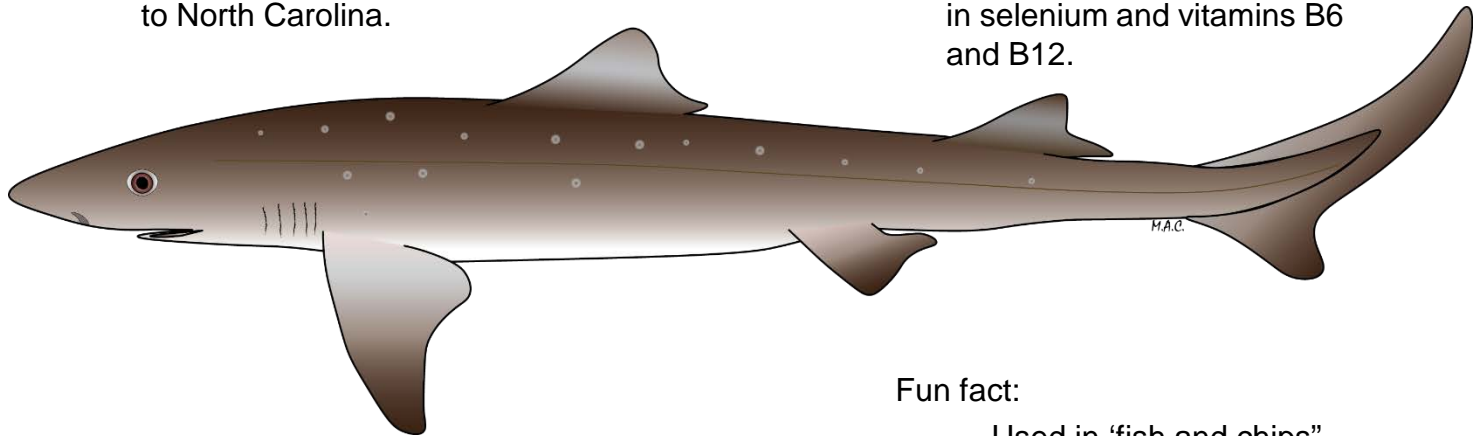
# Spiny Dogfish

Where is it from?

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

Nutrition:

A low-fat source of protein, high in selenium and vitamins B6 and B12.



When is it available?

Year-round.

Fun fact:

Used in 'fish and chips' dish in Europe!



# Go Fish



# Oyster

Where is it from?

Estuaries along the East Coast and the Gulf of Mexico.

When is it available?

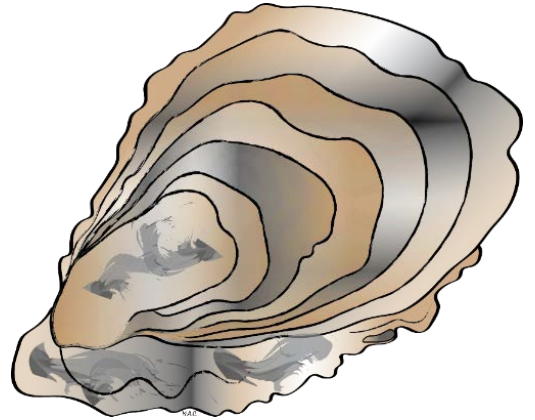
Year-round.

Nutrition:

Low in saturated fat and an excellent source of omega-3 fatty acids, iron, magnesium, iodine, copper, manganese, phosphorus, and zinc.

Fun fact:

Oysters have the ability to change their sex!





# Go Fish



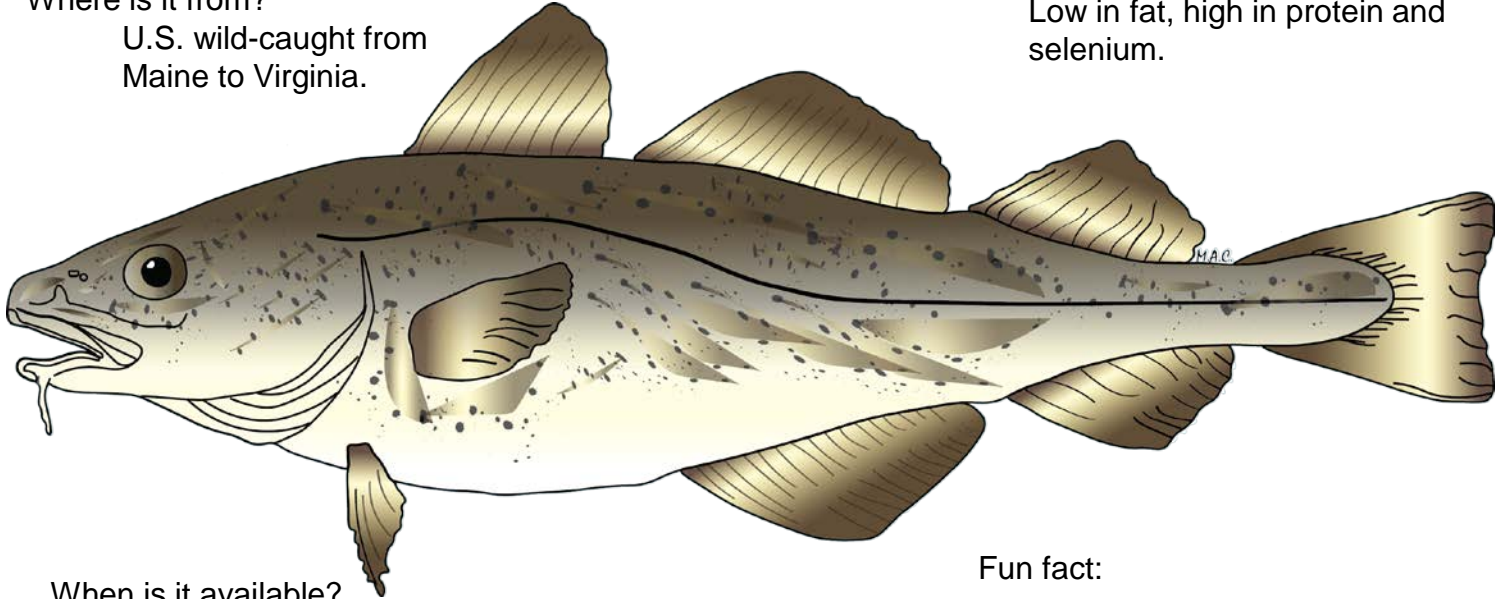
# Atlantic Cod

Where is it from?

U.S. wild-caught from  
Maine to Virginia.

Nutrition:

Low in fat, high in protein and  
selenium.



When is it available?

Year-round.

Fun fact:

Commonly used in 'fish  
and chips' in the U.S.!





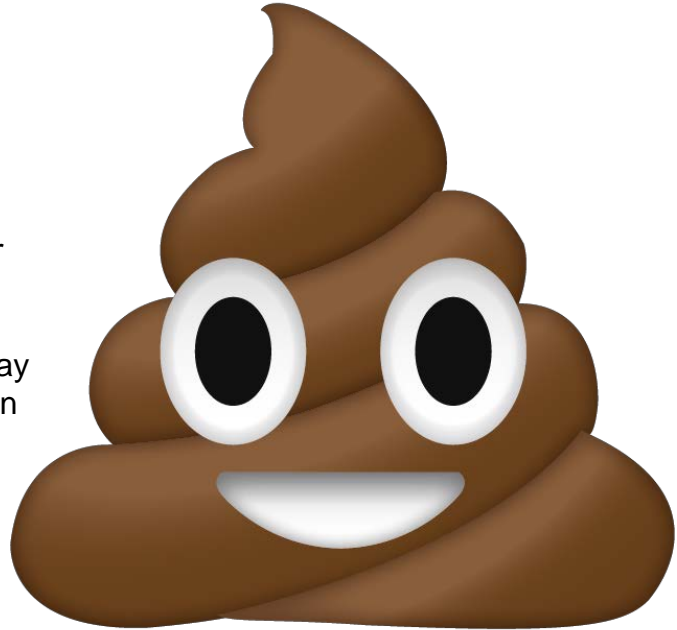
# Go Fish



# Poop!

## Impact on seafood:

Feces (poop) contains bacteria and other chemicals that may be harmful to the environment. High levels of bacteria and chemical contaminants can make their way into fish and shellfish through the water. In some cases they can harm the fish, in others they only harm humans after consuming them.



## How does it end up in the water?

Unattended pet and agriculture waste and improperly treated human waste from poorly maintained septic systems can end up in the water, especially during storm events with heavy rainfall.



# Go Fish



# Fertilizer

How does it end up in the water?

Rain washes fertilizers from farms and homes into storm drains and waterways that empty into larger bodies of water.

Impact on seafood:

The nutrients in fertilizers that help plants grow can also be used by algae growing in the water. When a lot of nutrients are present algae can grow to high concentrations (algal blooms). Some of these algae produce toxins, which can be taken up by seafood and cause illness when people consume them.





# Go Fish



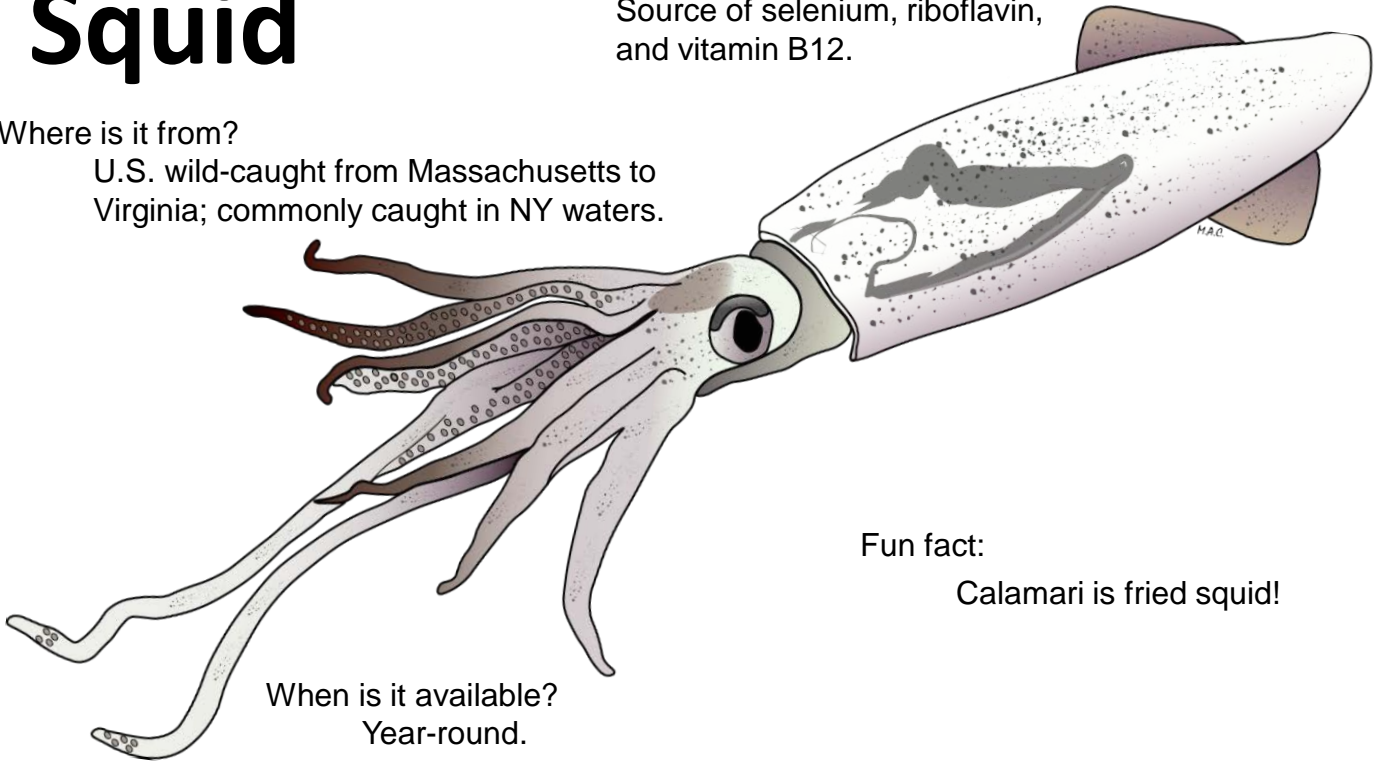
# Squid

Nutrition:

Source of selenium, riboflavin,  
and vitamin B12.

Where is it from?

U.S. wild-caught from Massachusetts to  
Virginia; commonly caught in NY waters.



When is it available?  
Year-round.

Fun fact:

Calamari is fried squid!



# Go Fish

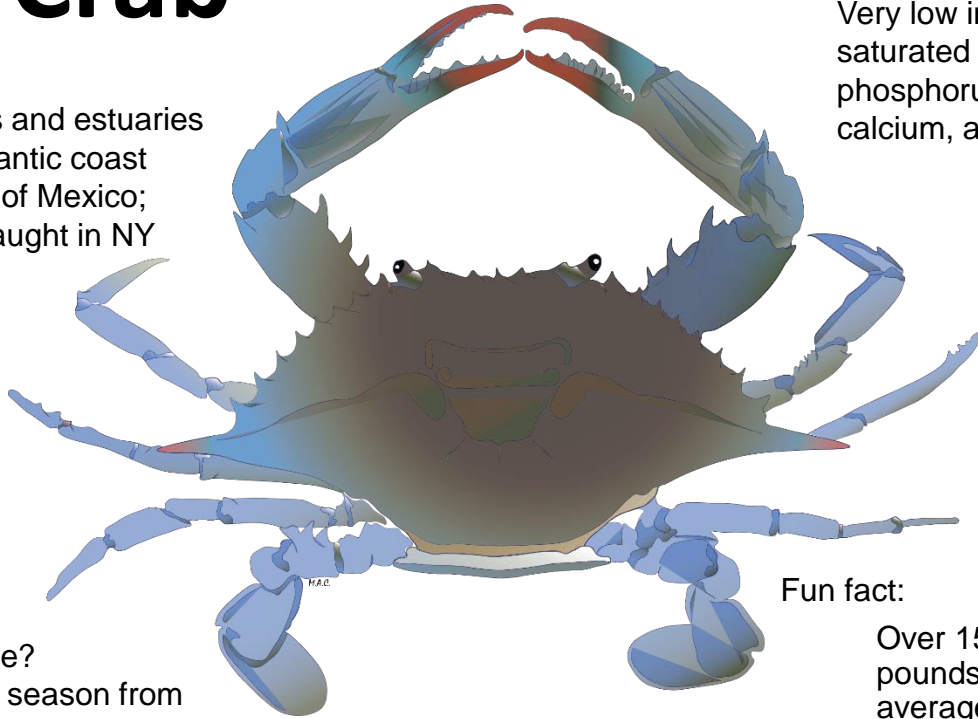




# Blue Crab

Where is it from?

Coastal bays and estuaries along the Atlantic coast and the Gulf of Mexico; commonly caught in NY waters.



Nutrition:

Very low in fat, especially saturated fat, and contains phosphorus, zinc, copper, calcium, and iron.

When is it available?

They are in season from April to November.

Fun fact:

Over 150 million pounds are landed on average in the U.S., with a value of over \$200 million in 2010.



# Go Fish



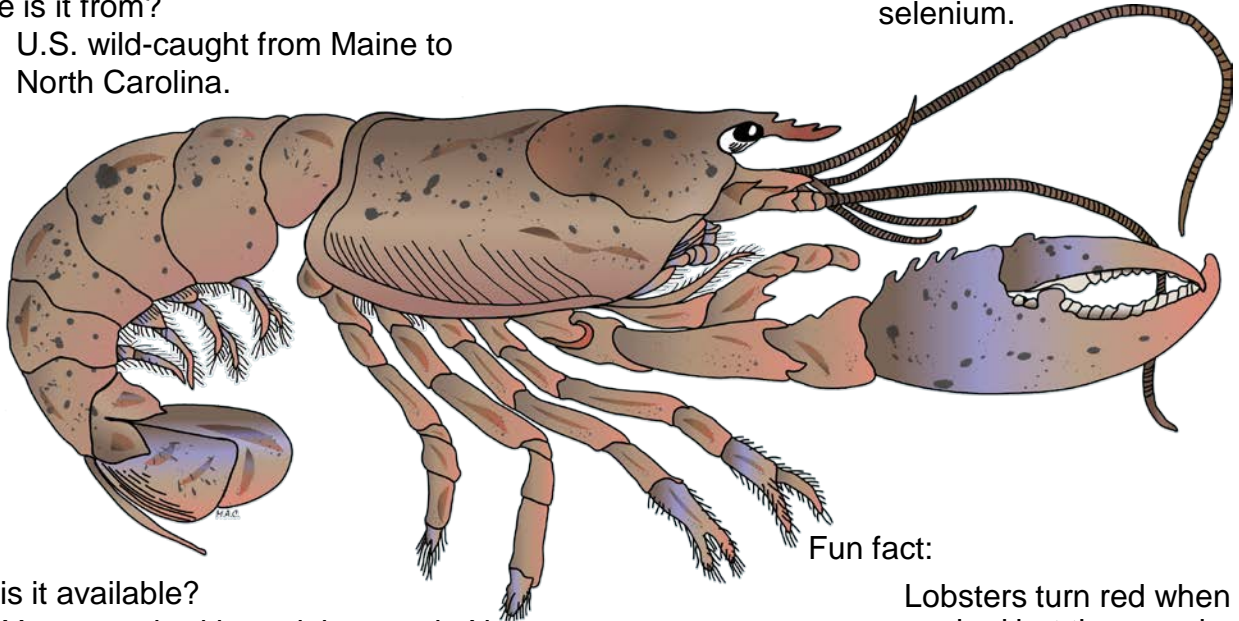
# Lobster

Where is it from?

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

Nutrition:

Low in saturated fat and a great source of protein and selenium.



When is it available?

Year-round, with peak harvest in New England from May to November.

Fun fact:

Lobsters turn red when cooked but they can be green, yellow (brown), or even bright blue when they are caught!



# Go Fish



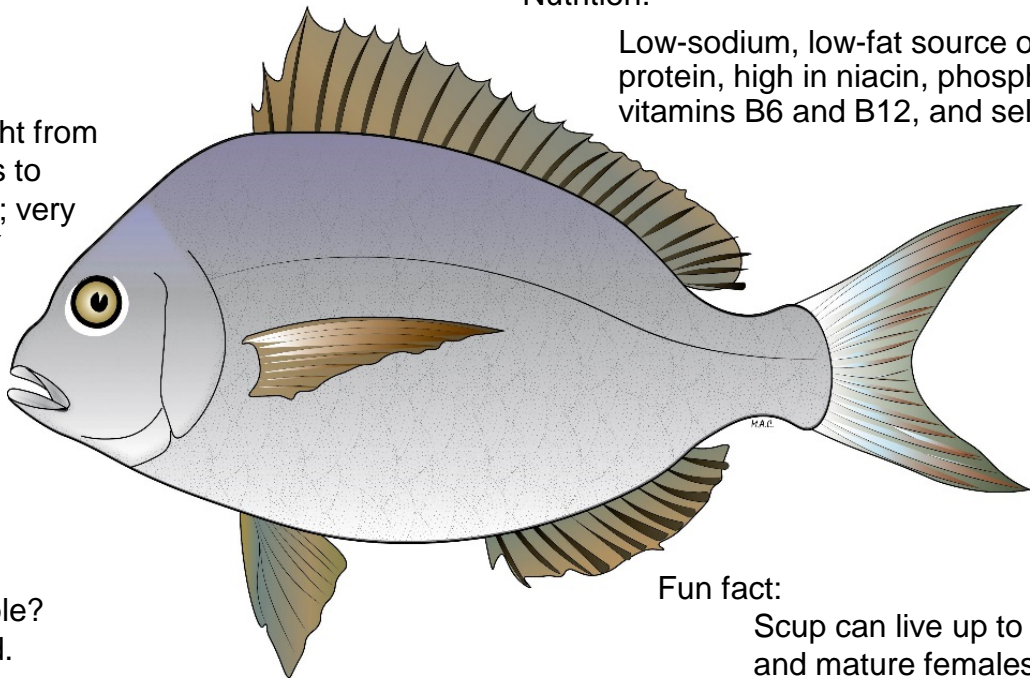
# Scup

Where is it from?

U.S. wild-caught from Massachusetts to North Carolina; very common in NY waters.

Nutrition:

Low-sodium, low-fat source of protein, high in niacin, phosphorus, vitamins B6 and B12, and selenium.



When is it available?

Year-round.

Fun fact:

Scup can live up to 20 years and mature females spawn an average of 7,000 eggs annually.



# Go Fish



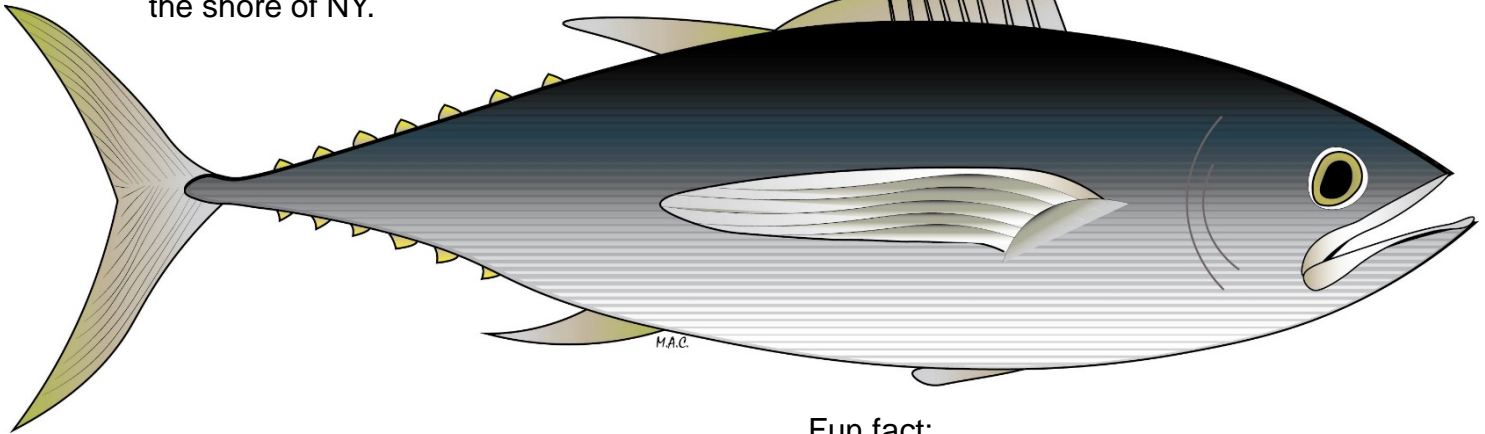
# Albacore Tuna

Where is it from?

U.S. wild-caught from Massachusetts to Louisiana; commonly caught off the shore of NY.

Nutrition:

Low in fat and cholesterol, with the most omega-3 fatty acids of any tuna.



When is it available?

Fresh and frozen year-round.

Fun fact:

Can get as large as 4 feet and weight up to 90lbs, but average 30-60 lbs. off New York.





# Go Fish



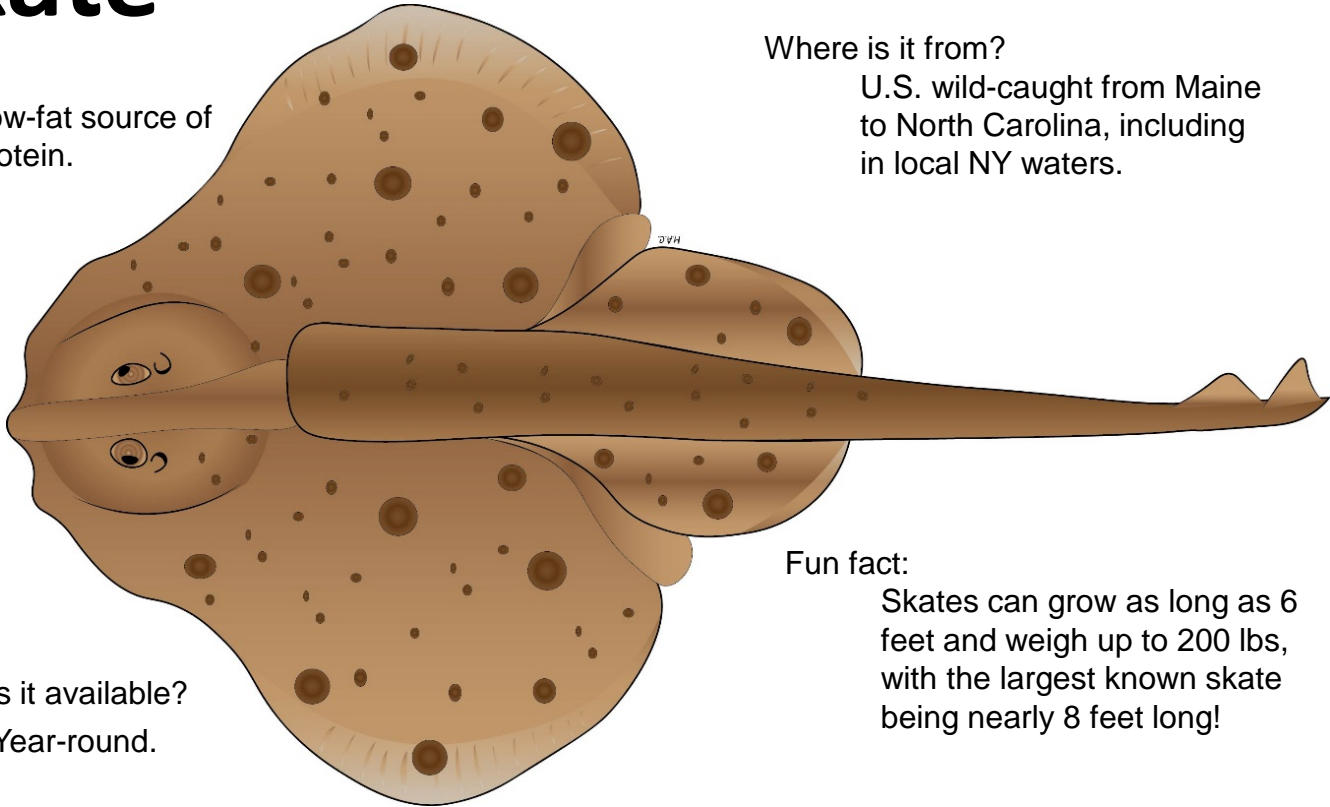
# Skate

## Nutrition:

Low-fat source of protein.

## Where is it from?

U.S. wild-caught from Maine to North Carolina, including in local NY waters.



## When is it available?

Year-round.

## Fun fact:

Skates can grow as long as 6 feet and weigh up to 200 lbs, with the largest known skate being nearly 8 feet long!



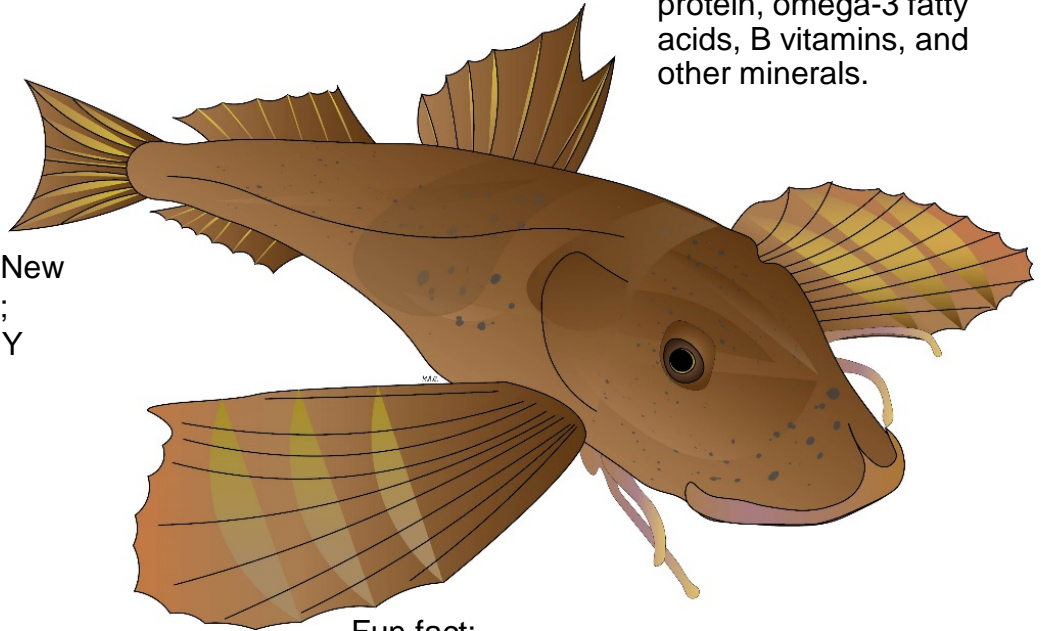
# Go Fish



# Sea Robin

## Nutrition:

Good source of protein, omega-3 fatty acids, B vitamins, and other minerals.



## Where is it from?

U.S. wild-caught from New York to North Carolina; commonly caught in NY waters.

## When is it available?

Year-round.

## Fun fact:

Using its swim bladder, they make a croaking sound similar to a frog croak.