



# FISH CENSUS:

MONITORING FINFISH POPULATIONS  
IN CHESAPEAKE BAY

**Rachel Dixon**

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**Grade Level**

Middle & High School

**Subject area**

Life Science, Biology, Oceanography

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- Title** Fish Census: Monitoring Finfish Populations in Chesapeake Bay
- Focus** Utilize data collected from a scientific survey to explore where different fishes live in a coastal estuary, and how their populations change through time
- Grade Level** 7<sup>th</sup> Grade Life Science; with ability to scale up to HS Biology

### VA Science Standards

LS.1 The student will demonstrate an understanding of scientific and engineering practices by:

- a) asking questions and defining problems
  - ask questions and develop hypotheses to determine relationships between independent and dependent variables
- c) interpreting, analyzing, and evaluating data
  - identify, interpret, and evaluate patterns in data
  - construct, analyze, and interpret graphical displays of data
  - compare and contrast data collected by different groups and discuss similarities and differences in their findings
- d) constructing and critiquing conclusions and explanations
  - construct explanations that include qualitative or quantitative relationships between variables
  - construct scientific explanations based on valid and reliable evidence obtained from sources (including the students' own investigations)

LS.7 The student will investigate and understand that adaptations support an organism's survival in an ecosystem. Key ideas include:

- a) biotic and abiotic factors define land, marine, and freshwater ecosystems; and
- b) physical and behavioral characteristics enable organisms to survive within a specific ecosystem.

LS.8 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time. Key ideas include:

- a) organisms respond to daily, seasonal, and long-term changes; and
- b) changes in the environment may increase or decrease population size

BIO.7 The student will investigate and understand that populations change through time. Key ideas include:

- b) genetic variation, reproductive strategies, and environmental pressures affect the survival of populations

### Learning Objectives

- ✓ Students will identify a selection of fish species common to Chesapeake Bay
- ✓ Students will generate hypotheses concerning which fishes they would expect to find in different habitats, based on that species' ecology
- ✓ Students will count fishes collected in a research survey trawl, and graph their data
- ✓ Students will compare and contrast their results to those from other groups in the class

- ✓ Students will assess how scientific data can be used to draw conclusions about how fish populations change over time

### **Total Length of Time Required**

Total Time: 1 hour for prep (max), up to 120 minutes for lesson. Total lesson time will depend on time allotted for class discussion before and after the activity.

Advance preparation of materials: Approximately 1 hour to set up trawl 'nets' for first time; set-up for subsequent lessons should be time required to print handouts.

### **Key Words & Vocabulary**

Abundance: The number of individual fish that live in an area.

Commercial fishery: Any activity that involves catching fish to sell or trade.

Distribution: The geographic area where fish live.

Estuary: An ecosystem that contains a mixture of fresh water from the land and salt water from the ocean.

Forage: Prey species used as food by a predator.

Index of abundance: An estimate of the number of fish in a population, or part of the population. This can be collected through scientific surveys.

Invasive species: An introduced species that competes with native species for space and food.

Juvenile: A young fish that has not reached sexual maturity.

Mainstem: The primary or central segment of a river or Bay.

Nursery habitat: A habitat that supports the growth and survival of juvenile fish.

Population: A group of individuals of the same species living in an area or region.

Recreational fishery: Any activity that involves catching fish to eat or for sport.

Trawl: A cone-shaped net towed behind a boat. It can be used to sample aquatic environments.

Tributary: A river or stream that flows into a larger body of water, such as a Bay.

### **Background Information**

The Chesapeake Bay is the largest estuary in the United States and the third largest in the world. The Bay and its tributaries are home to nearly 350 species of fish. Some species live in the Bay year-round. Others migrate into the Bay from the ocean to seek food, shelter, or reproduce.

Many fish species live in different habitats throughout their life cycle. Important nursery habitats for many species can be found in Chesapeake Bay. Nurseries provide juvenile fishes with food, refuge from predators, and ideal environmental conditions during their first few months or years of life. These habitats help young fish survive and grow up to join the adult population.

A species' distribution is based on their unique ecology. This is based on how that species interacts with other organisms and the environment. Many fishes in the Bay can tolerate a wide range of salinity, but some can only survive in either fresh or salt water. Fish also prefer a certain range of water temperatures. Water that is too cold will lower a fish's metabolism. Water that is too warm will contain less oxygen that fish need to breathe. The environmental conditions in an estuary can change from season to season and year to year. Scientists need to better understand how biotic and abiotic changes in the ecosystem can impact fish communities and the habitats they live in.

To collect this data, scientists use a trawl net to survey fish populations at different locations around the Bay. At each site, they identify and sort the different species caught, count and measure each fish, and record environmental conditions. This fish "census" helps track trends in the number of different species, and the number of individual fish, present in a given habitat over time. On these surveys, scientists can also gather information on fish diets and whether they show signs of disease in order to monitor the overall health of the Bay's fish populations.

Many of these species are an important part of the Bay's ecosystems and support valuable commercial and recreational fisheries. Survey data is used to create an index of abundance for each species. This index is a relative measure of the size of a population or part of a population, like the number of juveniles. Fishery managers use this information to set fishing regulations and make sure that populations are healthy enough to fish from in the future.

During this activity, students will conduct a 'census' with mock survey data to study how the abundance of five species can vary among different Bay habitats. Students will also consider how fish populations can change over time.

The five species highlighted in this activity have ecological and economic importance in the Bay region:

- **Bay Anchovy (*Anchoa mitchilli*):** A small, translucent fish that lives in large schools. Bay Anchovies are found in a wide range of salinities. The Bay Anchovy is the most abundant fish species in the Bay and its tributaries. This species feeds mostly on zooplankton, but to larger fishes like Striped Bass or Summer Flounder, they are an important forage (prey) fish.
- **Striped Bass (*Morone saxatilis*):** An iconic Chesapeake Bay species, Striped Bass is a large predatory fish with dark horizontal stripes. They live in various habitats in the Bay throughout their life. Adult Striped Bass migrate up rivers from the ocean to reproduce, like salmon. Juveniles spend the summer and fall in freshwater portions of the tributaries. Also known as rockfish or striper, Striped Bass are the state saltwater fish of both Virginia and Maryland. Striped Bass support important commercial and recreational fisheries.
- **Summer Flounder (*Paralichthys dentatus*):** Like other flatfishes, Summer Flounder conceal themselves by burying in bottom sediments and blending in with their surroundings. Summer Flounder are brown on their dorsal (top) side, with various large spots. The mouth and both eyes are on one side of its body. While Summer Flounder reproduce on the continental shelf, juveniles can be

found at higher salinities throughout the Bay and its tributaries from spring to fall. Summer Flounder support important commercial and recreational fisheries.

- **Spot (*Leiostomus xanthurus*):** Spot are small to medium sized, bottom-dwelling fishes that feed on invertebrates such as worms or crustaceans. They are a very common Chesapeake Bay species. Though typically found at higher salinities, Spot can occasionally be found in more fresh waters.
- **Blue Catfish (*Ictalurus furcatus*):** There are several species of catfish found in the Bay, but Blue Catfish are considered an invasive species. Introduced in the 1970s, their growing numbers and rapid expansion in the region has raised concerns about their impact on other native species. Blue Catfish are found mainly in the freshwater portions of tributaries. Blue Catfish are omnivorous and opportunistic feeders. Because they can grow very large, Blue Catfish have become a popular sport fish in recent years.

### Student Handouts

- Map of Chesapeake Bay, with site labels (one per group, also included in PowerPoint)
- Chesapeake Bay Fish Field Guide (one per group)
- Survey Data Sheet & Graph Template (one per student, 3 pages; key provided for instructor)
- Index of Abundance Worksheet (one species per group, 2 pages; key provided for instructor)

### Materials & Supplies

- Computer and projector for PowerPoint (Introduction)
- Five (5) 'trawl net' samples with fish, one for each site. Each sample will need:
  - A piece of fabric or plastic sandwich bag 'trawl net' (About 8 in x 8 in fabric square)
  - String or twist-tie to close trawl net opening, if using fabric
  - Site Labels (#1 - #5)
  - Fish collected in the sample. Instructors may use either option A or B:
    - A. Cut-out fish images (See "Fish Census Appendix"); instructor may wish to laminate prior to cutting to reuse
    - B. Different colors/sizes of beads (most needed of one color is 180)
      - 4 bead colors, one each for Bay Anchovy, Spot, Blue Catfish, and Summer Flounder
      - 1 bead color, with small and large beads for 'juvenile' and 'adult' Striped Bass
- Colored pencils / markers / etc. for graphing
- Calculator
- Dry erase board / chalkboard / easel for sharing group data

### Teacher Preparation & Classroom Setup

Students should be divided into five groups; set up classroom space accordingly.

Instructors should prepare by printing enough copies of the map and fish field guide for each group. If possible, these can be laminated for repeat use. Ideally these should be printed in color but will work in grayscale. For Part I, each student should receive (1) survey data worksheet. For Part II, each group will receive (1) index of abundance worksheet for one of the five focal species.

Each 'trawl net' sample should be filled with the five fish species according to the following chart. While a typical survey sample will catch far greater numbers of fish (and more species!), the proportion of each species in the total catch and the relative abundance at different sites are representative of data from the VIMS Juvenile Fish Trawl Survey (link to more information in References).

Site	Location	Bay Anchovy	Spot	Blue Catfish	Summer Flounder	Striped Bass		TOTAL
						Juvenile	Adult	
1	Mainstem	41	18	0	8	0	5	72
2	Mainstem	48	12	0	3	0	6	69
3	Tributary; central	29	7	28	0	4	2	70
4	Tributary; downriver	37	13	0	3	1	4	58
5	Tributary; upriver	25	6	20	0	4	1	56
TOTAL		180	56	48	14	8	19	325

## Procedure

### I. Background and Introduce Activity:

- Instructors should load the accompanying PowerPoint presentation and walk-through slides #1-7. Suggested talking points and discussion questions are included in the comments section of each slide. Key ideas to highlight:
  - The Chesapeake Bay is home to a wide diversity of fishes.
  - A fishes' distribution (the habitats or space it occupies) will depend on its ecology, especially how it relates to its physical environment (ex. freshwater vs. saltwater) and life history (ex. juvenile vs. adult habitats). The distribution and abundance of a particular species can vary over time in response to changes in the ecosystem.
  - Scientists monitor fish populations by conducting surveys – this 'census' shows us how many fishes are in the Bay and where they are living.
- Instructors should introduce the activity and the student's main objectives on slides #8-12.
  - We are only focusing on five species here.
    - These focal species are examples of how different species not only play important roles as key prey (ex. Bay Anchovy) or predators (ex. Striped Bass/Summer Flounder/Blue Catfish) in the food chain, but are important to humans as species that we fish for, either commercially or recreationally (ex. Striped Bass/Summer Flounder)

### II. Activity:

#### *Part I: Examine Trawl Data*

- Each group will be assigned one of the five sites around the Bay. Working together, students should use the Map of Trawl Sampling Sites to identify where their sample came from and answer questions #Q1-3 on the Survey Data Sheet.
  - Slide #13 in the PowerPoint also has these questions. If desired and if time permits, instructors could ask groups to share their predictions and hypotheses.
- Each group will then receive a single trawl sample. Students should work together to sort and count the number of fish caught, using the presented background information and the Chesapeake Bay Fish Field Guide for assistance.
  - Students can either ‘divide and conquer’, with each student responsible for counting one of the species, or one student can be the recorder as others sort and count. Science is a collaborative, team effort!
- When sorting and counting is complete, students should complete the graphing exercise on the Survey Data Sheet.

When all groups are finished, ask students to share their data with their classmates. If the instructors choose, the total numbers of each species caught at a site could be put up on the board for all groups to see and discuss. Instructors should encourage students to note what the other groups caught at their site, and answer questions #Q4-6 on the Survey Data Sheet. Slide #14 in the PowerPoint also has these questions. The general conclusions should be that:

- Bay Anchovy are by far the most abundant fish at all sites. This species is the most common fish in the Bay and is an important forage fish or prey item for many larger fishes and seabirds. This species also lives in large schools, so the trawl can sometimes capture a whole school at once.
- Not all species are present at all sites. A fish’s ecology, especially whether it is a freshwater or saltwater fish, will determine what habitats it occupies.
- A single sample is like a snapshot - to get a truly accurate estimate of the fishes in the Bay, a real survey samples many different locations, multiple times throughout the year. Instructors can remind students that real surveys in the Chesapeake Bay will catch far greater numbers of fish and many more species.

#### *Part II: Index of Abundance*

- Instructors should review slide #15 in the PowerPoint to introduce how scientists use survey data once it is collected. Key ideas to highlight:
  - Fish populations change through time in response to daily, seasonal, and long-term changes in the environment, AND external factors such as fishing pressure and habitat degradation. These two factors are not the focus of this activity, but instructors can make this connection here if relevant.
  - Discuss the importance of sampling fish populations for the conservation and management of our Bay resources. Survey data helps scientists monitor the health of the Bay’s ecosystems and gather information for fishery managers on whether populations are large and stable enough for future harvests.
  - Students are helping provide this information by adding the latest “year” in the fish census that they collected, then making conclusions about how the population has changed through time.



- Instructors can now hand out an Index of Abundance worksheet to each group, one species per group. Species can be decided ahead of time, or groups can decide which fish they want to be the experts on. (\*\*Note: The Striped Bass group should pool juveniles and adults).
  - One person from each group will go around and gather the total number of fish of their species that were caught at the other sites.
  - Each group will sum the counts from each site to determine the total number of fish of their species caught in the Bay.
  - Each group will graph that total count to the line graph on their index and connect the datapoint from this “year” to the rest of the series.

Instructors should encourage students to answer the two questions on the Index of Abundance worksheet, which asks students to conclude whether that species’ population is rising, declining, or staying the same. When all groups are finished, ask a student from each group to be the “species representative” to share their results with their classmates.

- Slides #16-17 include a copy of this overarching question, and additional discussion points for each species, which instructors can use to expand on based on the student’s observations and conclusions as time permits.

### **Assessment**

Instructors should assess students based on both worksheets and graphing exercises, participation within their group, and contributions to the class discussion.

### **References**

For more information, visit:

VIMS Juvenile Fish Trawl Survey

[https://www.vims.edu/research/departments/fisheries/programs/juvenile\\_surveys/index.php](https://www.vims.edu/research/departments/fisheries/programs/juvenile_surveys/index.php)

Chesapeake Bay Program – Field Guide for Fishes found in the Chesapeake Bay watershed

<https://www.chesapeakebay.net/discover/field-guide/all/fish/all>

## Fish Census of Chesapeake Bay – Survey Data Sheet (KEY)

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Site No: #1 - 5 based on their “net” label

Scientists conduct surveys to monitor how fish populations change. Your class is going to collect survey data for next fish census of Chesapeake Bay! In groups, you will work as a crew of scientists to identify, sort, and count the fish you caught in your trawl net. We will observe five different fish species today:

- Bay Anchovy
- Blue Catfish
- Spot
- Summer Flounder
- Striped Bass (juveniles and adults)

### Pre-Survey Questions:

Q1. Is your sample site in the mainstem of the Bay or one of its tributaries? Do you think the habitats at this site will be mostly fresh water or mostly salt water?

Sites # 1 and 2 are in the mainstem, Sites # 3, 4, and 5 are in a tributary. Salinity in the tributaries will be lower (i.e., more freshwater) than in the mainstem. The mainstem is closer to the ocean, where the water in the tributaries is flowing off the land.

Q2. Develop a hypothesis for which fish species you think you will catch the most of at this site. What evidence supports your hypothesis?

Each student will come up with the own hypothesis, but students should hopefully make the connection that not all species will be found at all sites, and a fish’s ecology, especially whether it is a freshwater or saltwater fish, will determine where it is found. Students might also note that fish will need to find plenty of prey wherever they live, and that some species live in different habitats as juveniles and as adults.

Q3. Are there any species you do not expect to find at this site? Why or why not?

Answers will vary, for same reasons as above (ecology and life history of different species).

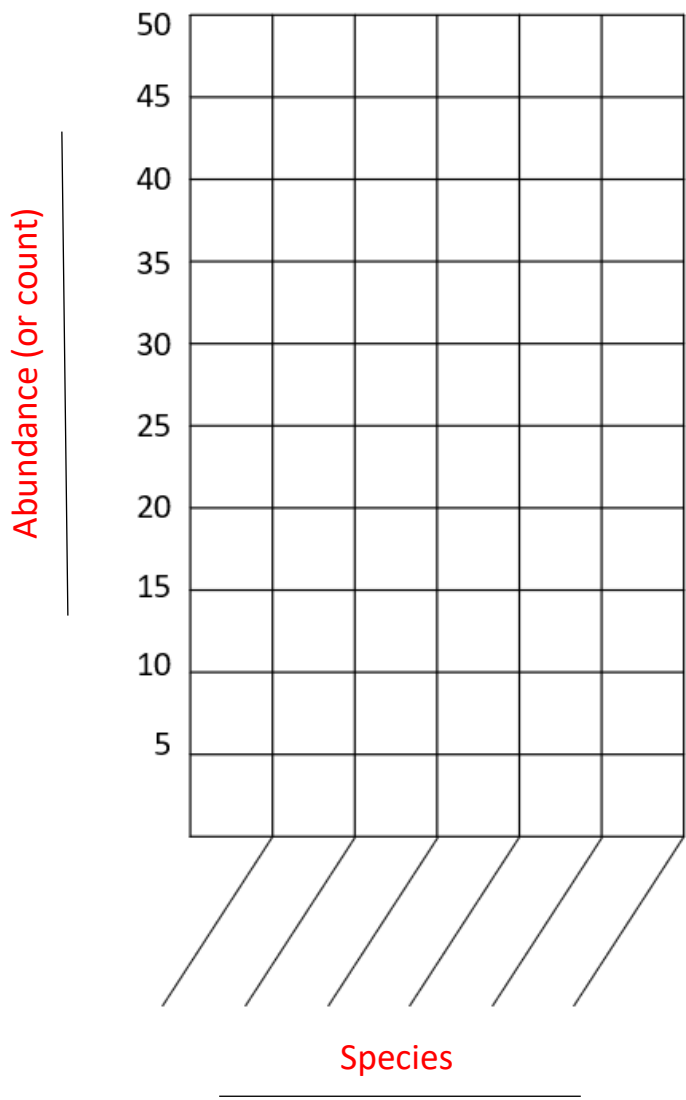
**Instructions:**

- 1) Open your trawl net and sort the fish by species.
- 2) Count how many fish of each species were collected. If your sample did not contain some of the species, record a count of 0. Record the number of fish of each species caught in your sample.

Species	Fish Count
Bay Anchovy	
Spot	
Blue Catfish	
Summer Flounder	
Striped Bass (juvenile)	
Striped Bass (adult)	
TOTAL	

Exact counts in the table will match the master key and be different for each site.

**Graphing:** Fill in the X-axis with the different species observed at your site. Create a bar graph to demonstrate the abundance, or number, of each species that you caught. Label each of your axes.



3) Answer the post-survey questions and prepare to share what you found with the class.

**Post-Survey Questions:**

Q4. What fish did you catch at your site, and how many? Which species is most abundant? Least abundant?

At all sites, Bay Anchovy will be the most abundant. Least abundant (will be a count of 0) will vary by site, but not all species will be present at all sites. Reasons for both can be discussed further as a class.

Q5. How does your site compare to the other sites around the Bay? Did you catch more or less species, or more or less fish overall?

Students should observe that certain species (Blue Catfish, juvenile Striped Bass) were only observed at tributary sites, whereas Summer Flounder were only observed in the mainstem or near the mouth of a tributary where the water is saltier. Bay Anchovy and Spot are present at all sites.

Q6. Do you think this survey was an accurate estimate of all the fish in Chesapeake Bay? Why or why not?

Just because a fish was not caught, does not mean it is not there! Students might note that you would want to survey other places around the Bay, or sample more frequently. This survey is also only focusing on 5 species – a real survey would catch far greater numbers of fish, and many more species.

## Fish Census of Chesapeake Bay – Index of Abundance Worksheet (KEY)

Species: \_\_\_\_\_ **Species Name will be pre-filled here** \_\_\_\_\_

We learned that there are many reasons fish populations may change through time. Scientists use survey data to track these trends in an index of abundance.

Your task is to summarize the latest “year” in the fish census your class collected. You will then make conclusions about how the **[species]** population has changed over time.

### Instructions:

- 1) One person from your group will gather the total number of fish of your species that were caught at the other sites.

Survey Site	Total Number of <b>[Species]</b> Collected
Site #1	
Site #2	
Site #3	
Site #4	
Site #5	
<b>TOTAL</b>	

- 2) Find the sum of the counts from each site to determine the total number of fish of their species caught in the Bay this year.
- 3) Plot that total count to the line graph on the index below for Year 6 and connect the datapoint to the rest of the series.

### Questions:

Q1. Compared to last year (Year 5), does your species population appear to increase, decrease, or stay about the same? Over the past six years, what is the population doing?

See index plots below for each species’ population trend. Students may note that there is some variation regardless of species, again hopefully making the connection that changes in the ecosystem from year to year can impact fish populations.

Q2. **[This question will be species-specific, and differ on each handout]**

**[Bay Anchovy]** Why would it be important to have high numbers of this fish species present in the Bay?

**A:** Bay Anchovy are an important forage fish or prey item for many larger fishes, seabirds, and other marine life. Organisms higher up on the food chain need to have ample prey to be able to grow and maintain their own populations.

[Spot] A new, delicious way to cook Spot was just created, and now everyone wants to fish for them. What would you expect to happen if you conducted another year of the census? What would happen to the populations of their prey and predators as a result?

A. If fishing increased, Spot populations would likely decline. The fish that they prey upon might therefore see a population increase, but their predators might see a decrease since one of their prey items was removed through fishing.

[Blue Catfish] Blue Catfish are an invasive species, which we know means that they out-compete native species for space and food. Based on the trend you observed, is this a positive or negative outcome for the Bay?

A. Both are correct, depending on who you are asking. To an ecologist, a population increase would have a negative outcome on other native fishes. However, a fisherman who wants to catch big, trophy catfish might see it as a positive.

[Summer Flounder] If you were a fishery manager, based on the trend you observed would you allow fishing for Summer Flounder to increase, or would you want to limit the amount of fishing? Why or why not?

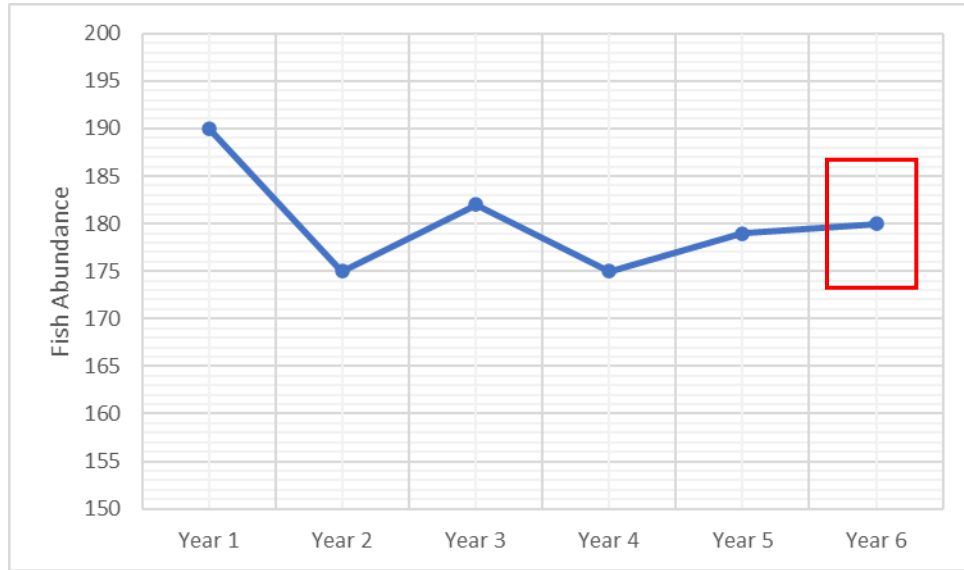
A. If there is evidence that the population is decreasing, fishery managers may want to recommend stricter fishing regulations (for example, shorter fishing seasons, reduce harvest limits, etc.) to limit the number of fish being removed.

[Striped Bass] The trend you observed includes both juvenile and adult Striped Bass. Why might scientists be interested in keeping track of the number of juveniles?

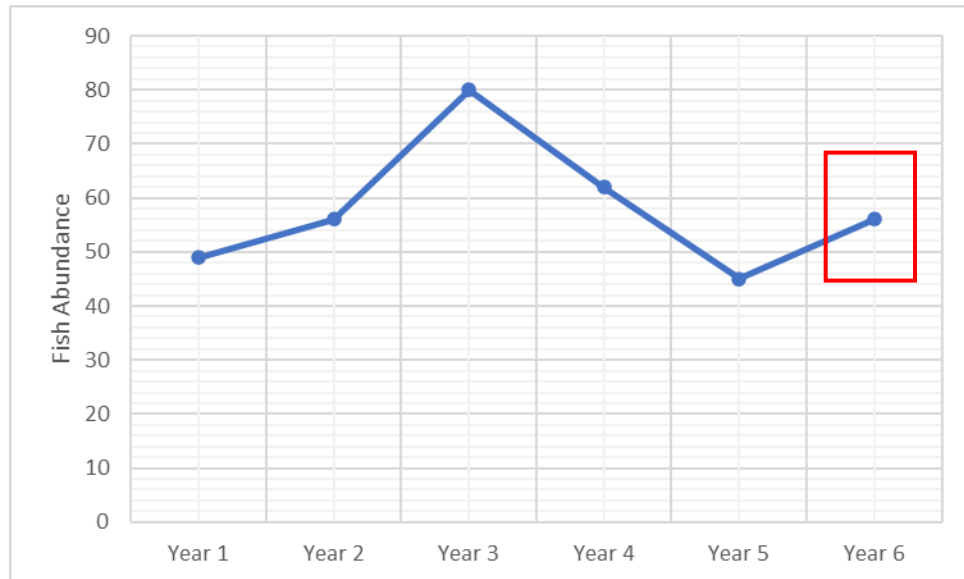
A. Juveniles and adults occupy different habitats, with juveniles spending their first few years of life in nursery habitats in freshwater portions of the Bay's tributaries. Environmental changes in the tributaries (ex. increased precipitation and runoff from land) might have a larger impact on juveniles of the species, which would influence how many fish grow up to join the adult population.

(The datapoint in the red box will be plotted by the students. This total should equal the column total for each species in the instructors' master key)

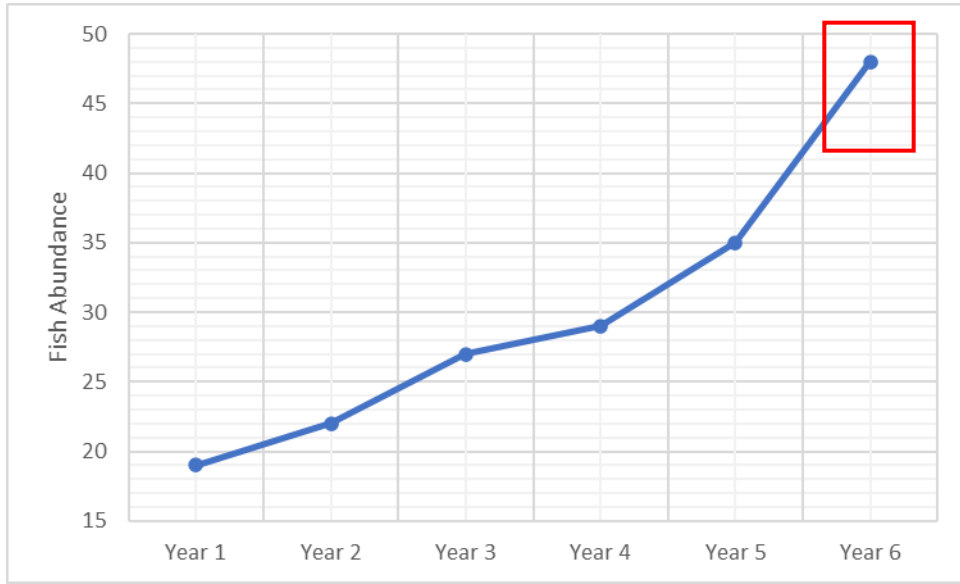
Bay Anchovy – Population stays about the same



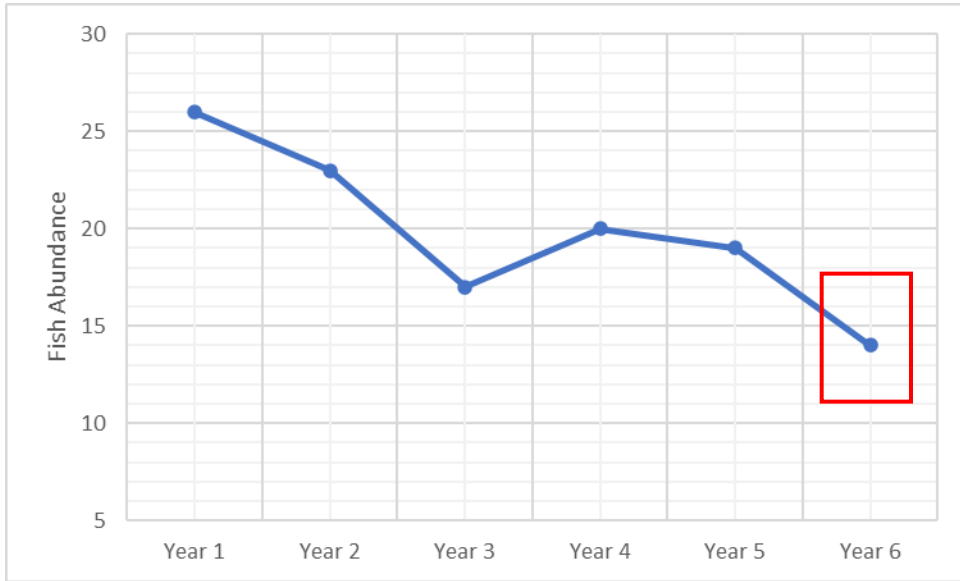
Spot – Population increases slightly



Blue Catfish – Population is increasing

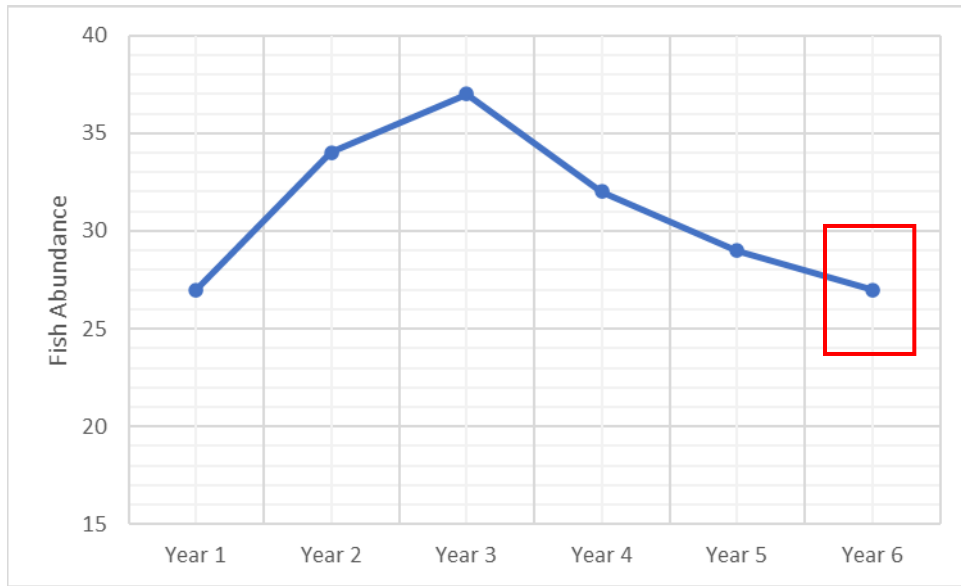


Summer Flounder – Population is decreasing





Striped Bass (Students should pool juvenile and adult catch) – Population is decreasing



## Fish Census of Chesapeake Bay – Survey Data Sheet

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Site No: \_\_\_\_\_

Scientists conduct surveys to monitor how fish populations change. Your class is going to collect survey data for next fish census of Chesapeake Bay! In groups, you will work as a crew of scientists to identify, sort, and count the fish you caught in your trawl net. We will observe five different fish species today:

- Bay Anchovy
- Blue Catfish
- Spot
- Summer Flounder
- Striped Bass (juveniles and adults)

### Pre-Survey Questions:

Q1. Is your sample site in the mainstem of the Bay or one of its tributaries? Do you think the habitats at this site will be mostly fresh water or mostly salt water?

Q2. Develop a hypothesis for which fish species you think you will catch the most of at this site. What evidence supports your hypothesis?

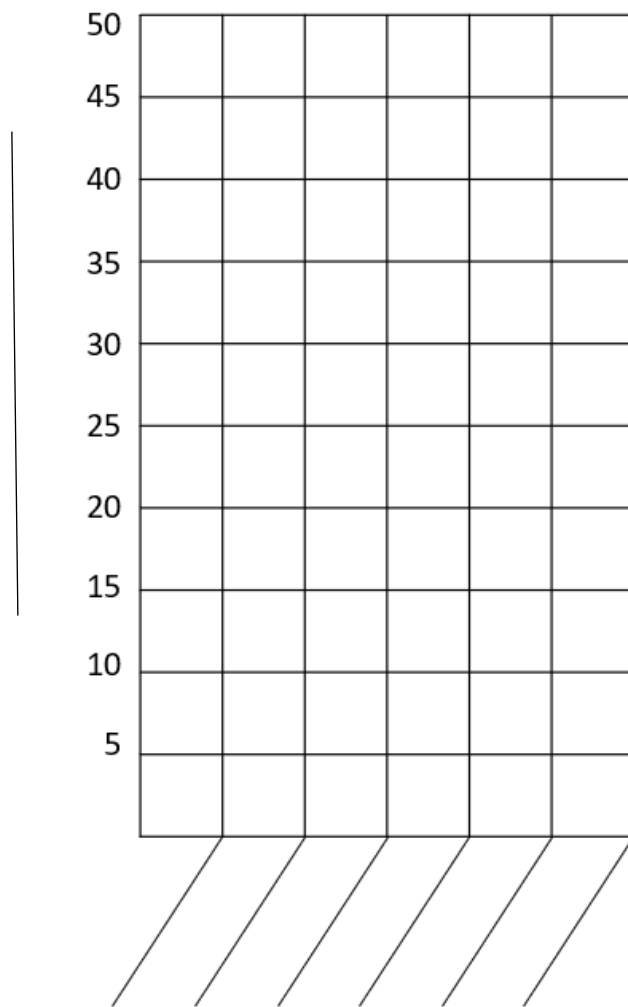
Q3. Are there any species you do not expect to find at this site? Why or why not?

**Instructions:**

- 1) Open your trawl net and sort the fish by species.
- 2) Count how many fish of each species were collected. If your sample did not contain some of the species, record a count of 0. Record the number of fish of each species caught in your sample.

Species	Fish Count
Bay Anchovy	
Spot	
Blue Catfish	
Summer Flounder	
Striped Bass (juvenile)	
Striped Bass (adult)	
TOTAL	

**Graphing:** Fill in the X-axis with the different species observed at your site. Create a bar graph to demonstrate the abundance, or number, of each species that you caught. Label each of your axes.



3) Answer the post-survey questions and prepare to share what you found with the class.

**Post-Survey Questions:**

Q4. What fish did you catch at your site, and how many? Which species is most abundant? Least abundant?

Q5. How does your site compare to the other sites around the Bay? Did you catch more or less species, or more or less fish overall?

Q6. Do you think this survey was an accurate estimate of all the fish in Chesapeake Bay? Why or why not?

# Fish Census of Chesapeake Bay – Index of Abundance Worksheet



## Species: Bay Anchovy

We learned that there are many reasons fish populations may change through time. Scientists use survey data to track these trends in an index of abundance.

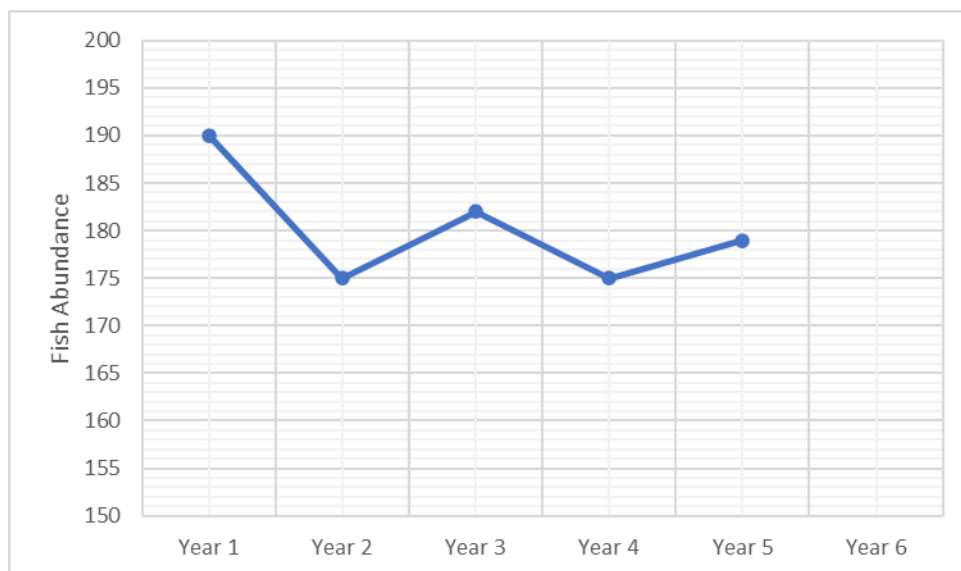
Your task is to summarize the latest “year” in the fish census your class collected. You will then make conclusions about how the Bay Anchovy population has changed over time.

### Instructions:

- 1) One person from your group will gather the total number of fish of your species that were caught at the other sites.

Survey Site	Total Number of Bay Anchovy Collected
Site #1	
Site #2	
Site #3	
Site #4	
Site #5	
<b>TOTAL</b>	

- 2) Find the sum of the counts from each site to determine the total number of fish of your species caught in the Bay this year.
- 3) Plot that total count to the line graph on the index below for Year 6 and connect the datapoint to the rest of the series.



**Questions:**

Q1. Compared to last year (Year 5), does your population appear to increase, decrease, or stay about the same? Over the past six years, what is the population doing?

Q2. Why would it be important to have high numbers of this fish species present in the Bay?

# Fish Census of Chesapeake Bay – Index of Abundance Worksheet



## Species: Spot

We learned that there are many reasons fish populations may change through time. Scientists use survey data to track these trends in an index of abundance.

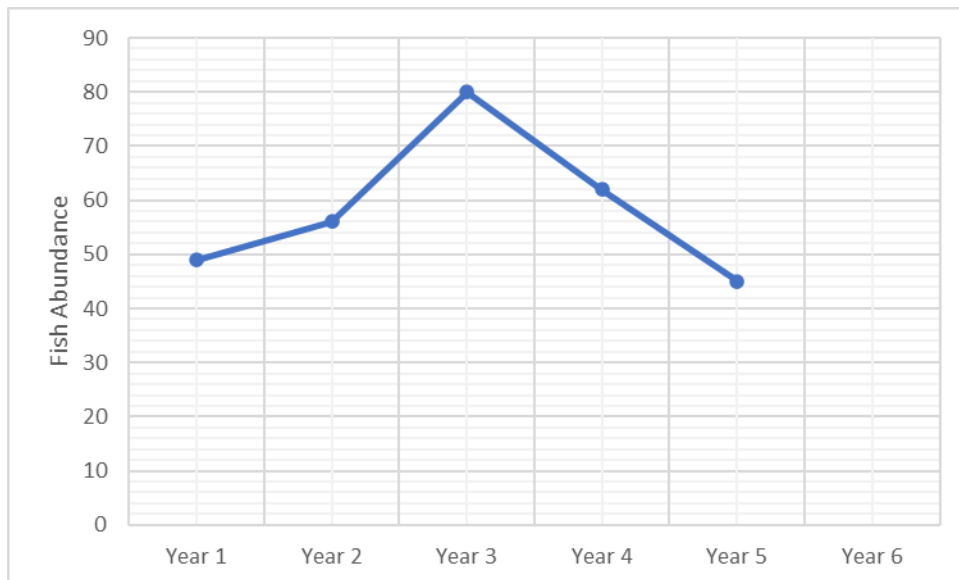
Your task is to summarize the latest “year” in the fish census your class collected. You will then make conclusions about how the Spot population has changed over time.

### Instructions:

- 1) One person from your group will gather the total number of fish of your species that were caught at the other sites.

Survey Site	Total Number of Spot Collected
Site #1	
Site #2	
Site #3	
Site #4	
Site #5	
<b>TOTAL</b>	

- 2) Find the sum of the counts from each site to determine the total number of fish of your species caught in the Bay this year.
- 3) Plot that total count to the line graph on the index below for Year 6 and connect the datapoint to the rest of the series.



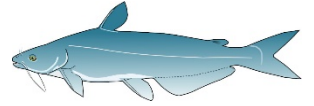
**Questions:**

Q1. Compared to last year (Year 5), does your population appear to increase, decrease, or stay about the same? Over the past six years, what is the population doing?

Q2. A new, delicious way to cook Spot was just created, and now everyone wants to fish for them. What would you expect to happen if you conducted another year of the census? What would happen to the populations of their prey and predators as a result?



# Fish Census of Chesapeake Bay – Index of Abundance Worksheet



## Species: Blue Catfish

We learned that there are many reasons fish populations may change through time. Scientists use survey data to track these trends in an index of abundance.

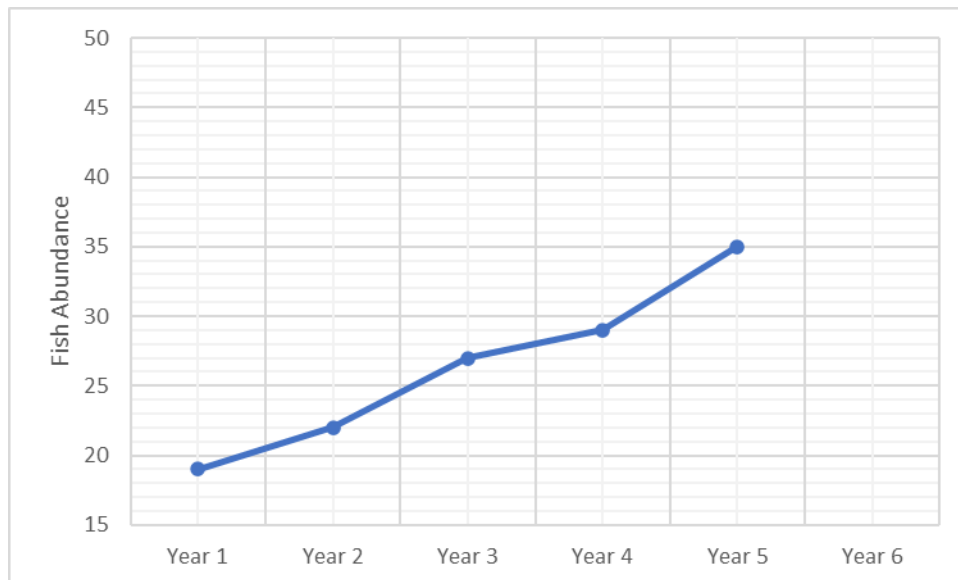
Your task is to summarize the latest “year” in the fish census your class collected. You will then make conclusions about how the Blue Catfish population has changed over time.

### Instructions:

- 1) One person from your group will gather the total number of fish of your species that were caught at the other sites.

Survey Site	Total Number of Blue Catfish Collected
Site #1	
Site #2	
Site #3	
Site #4	
Site #5	
<b>TOTAL</b>	

- 2) Find the sum of the counts from each site to determine the total number of fish of your species caught in the Bay this year.
- 3) Plot that total count to the line graph on the index below for Year 6 and connect the datapoint to the rest of the series.

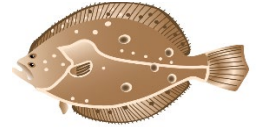


**Questions:**

Q1. Compared to last year (Year 5), does your population appear to increase, decrease, or stay about the same? Over the past six years, what is the population doing?

Q2. Blue Catfish are an invasive species, which we know means that they out-compete native species for space and food. Based on the trend you observed, is this a positive or negative outcome for the Bay?

# Fish Census of Chesapeake Bay – Index of Abundance Worksheet



## Species: Summer Flounder

We learned that there are many reasons fish populations may change through time. Scientists use survey data to track these trends in an index of abundance.

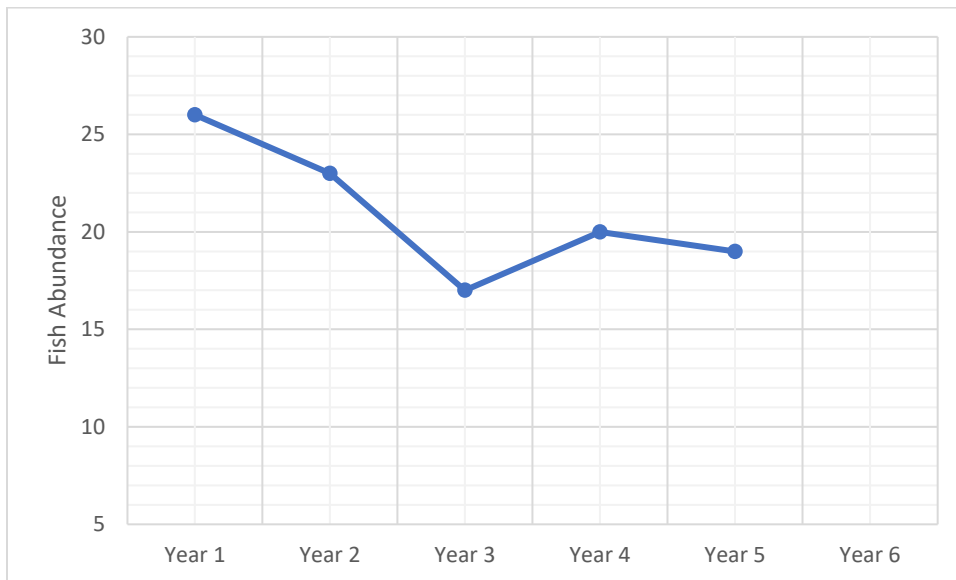
Your task is to summarize the latest “year” in the fish census your class collected. You will then make conclusions about how the Summer Flounder population has changed over time.

### Instructions:

- 1) One person from your group will gather the total number of fish of your species that were caught at the other sites.

Survey Site	Total Number of Summer Flounder Collected
Site #1	
Site #2	
Site #3	
Site #4	
Site #5	
<b>TOTAL</b>	

- 2) Find the sum of the counts from each site to determine the total number of fish of your species caught in the Bay this year.
- 3) Plot that total count to the line graph on the index below for Year 6 and connect the datapoint to the rest of the series.



**Questions:**

Q1. Compared to last year (Year 5), does your population appear to increase, decrease, or stay about the same? Over the past six years, what is the population doing?

Q2. If you were a fishery manager, based on the trend you observed would you allow fishing for Summer Flounder to increase, or would you want to limit the amount of fishing? Why or why not?

# Fish Census of Chesapeake Bay – Index of Abundance Worksheet



## Species: Striped Bass

We learned that there are many reasons fish populations may change through time. Scientists use survey data to track these trends in an index of abundance.

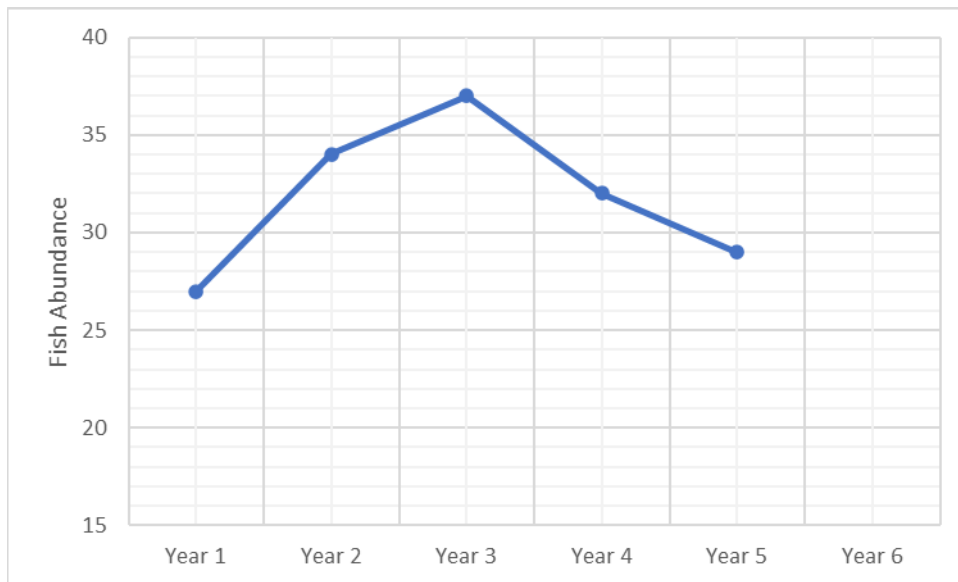
Your task is to summarize the latest “year” in the fish census your class collected. You will then make conclusions about how the Striped Bass population has changed over time.

### Instructions:

- 1) One person from your group will gather the total number of fish of your species that were caught at the other sites. **Include both juvenile and adult Striped Bass in your total.**

Survey Site	Total Number of Striped Bass Collected
Site #1	
Site #2	
Site #3	
Site #4	
Site #5	
<b>TOTAL</b>	

- 2) Find the sum of the counts from each site to determine the total number of fish of your species caught in the Bay this year.
- 3) Plot that total count to the line graph on the index below for Year 6 and connect the datapoint to the rest of the series.

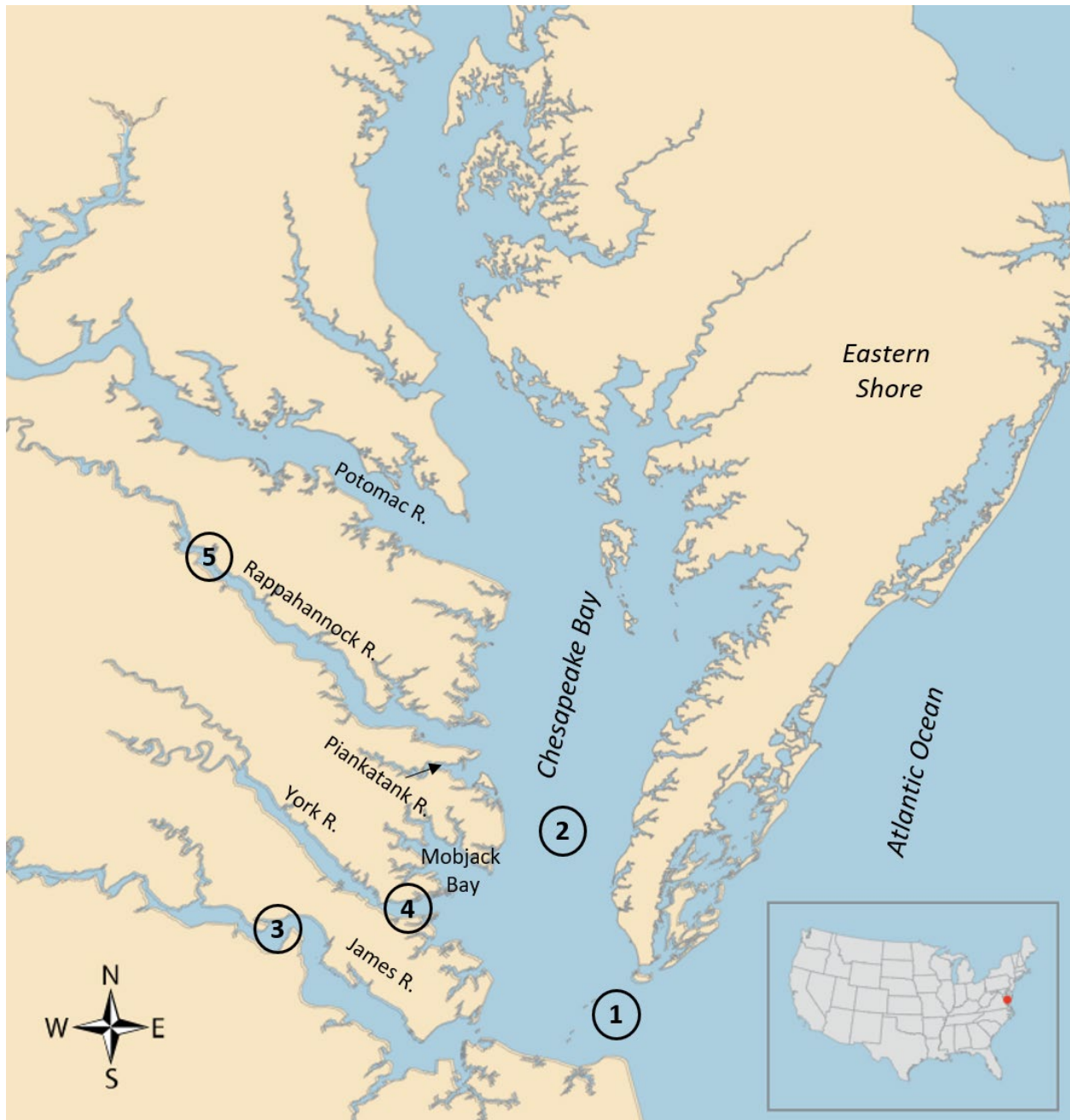


**Questions:**

Q1. Compared to last year (Year 5), does your population appear to increase, decrease, or stay about the same? Over the past six years, what is the population doing?

Q2. The trend you observed includes both juvenile and adult Striped Bass. Why might scientists be interested in keeping track of the number of juveniles?

## Map of Trawl Sampling Sites - Lower Chesapeake Bay



Map Photo Credit: UMCES Integration and Application Network

## Chesapeake Bay Fish Field Guide

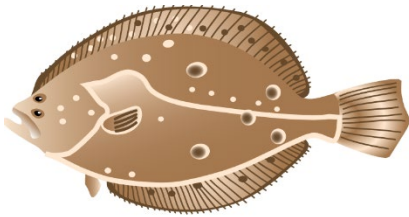


### **Spot (*Leiostomus xanthurus*)**

Description: Small to medium sized, bottom-dwelling fish.

Diet: Invertebrates, such as worms and crustaceans.

Habitat: Very common Chesapeake Bay species and are widely distributed. Though typically found in brackish waters at higher salinities, they can occasionally be found in fresh waters.

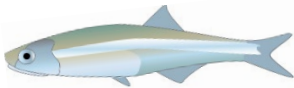


### **Summer Flounder (*Paralichthys dentatus*)**

Description: Flatfish; both eyes are on the top side of its body. Conceal themselves by burying in bottom sediments and blending in with their surroundings.

Diet: Invertebrates (crustaceans, worms) and other fishes.

Habitat: Summer flounder migrate into the Bay. They can be found at higher salinities throughout the Bay and its tributaries.

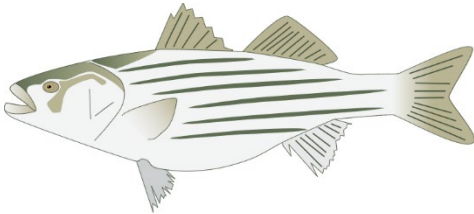


### **Bay Anchovy (*Anchoa mitchilli*)**

Description: Small, translucent fish with a silver stripe and large mouth. Live in large schools.

Diet: Feed mostly on zooplankton, but are an important forage (prey) fish for larger fishes like Striped Bass or Summer Flounder.

Habitat: The most abundant fish species in the Bay and its tributaries – found at a wide range of salinities (both fresh and saltwater).

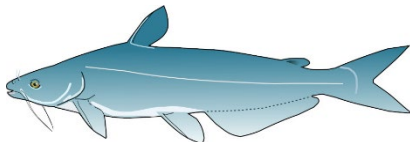


### **Striped Bass (*Morone saxatilis*)**

Description: Large fish with dark horizontal stripes along their sides.

Diet: Predatory fish, eat small fish (like anchovies) and invertebrates

Habitat: They live in various habitats throughout their life: juveniles spend their first year of life in freshwater portions of tributaries before moving to saltier water as they grow older.



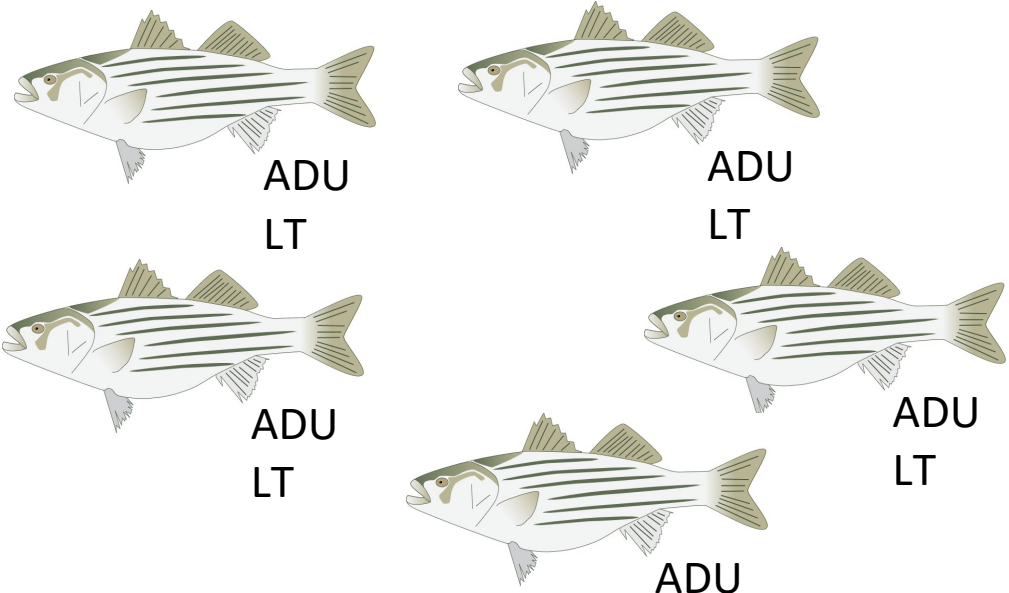
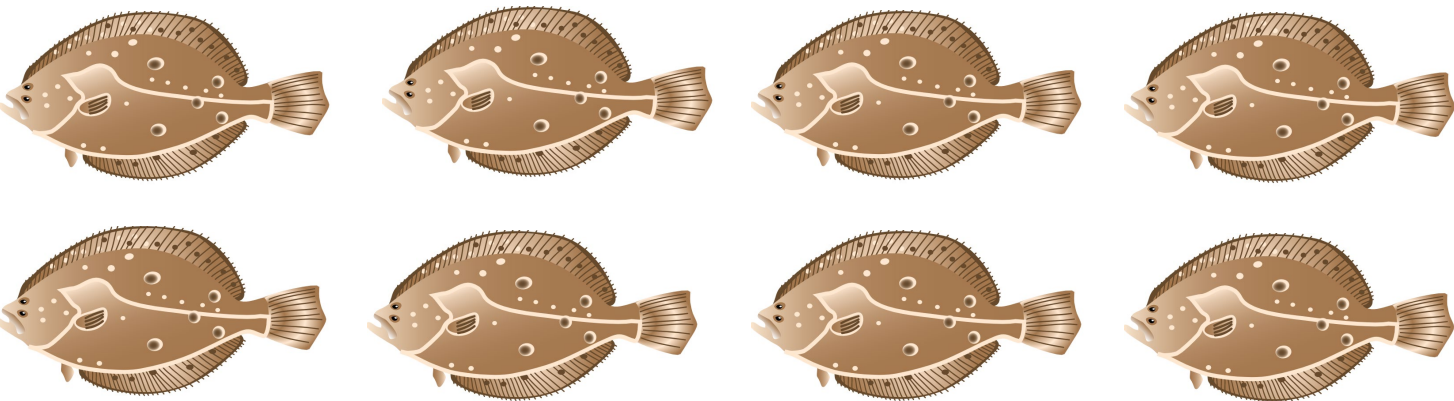
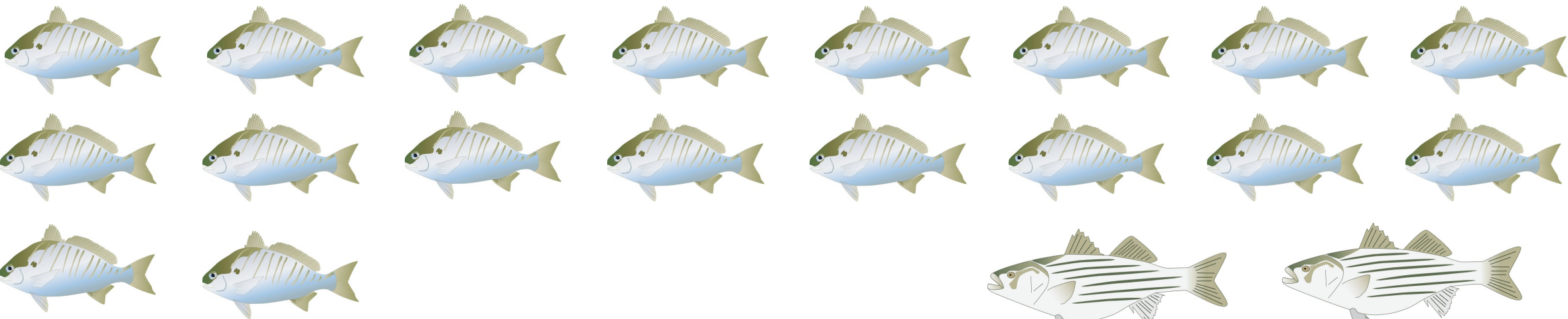
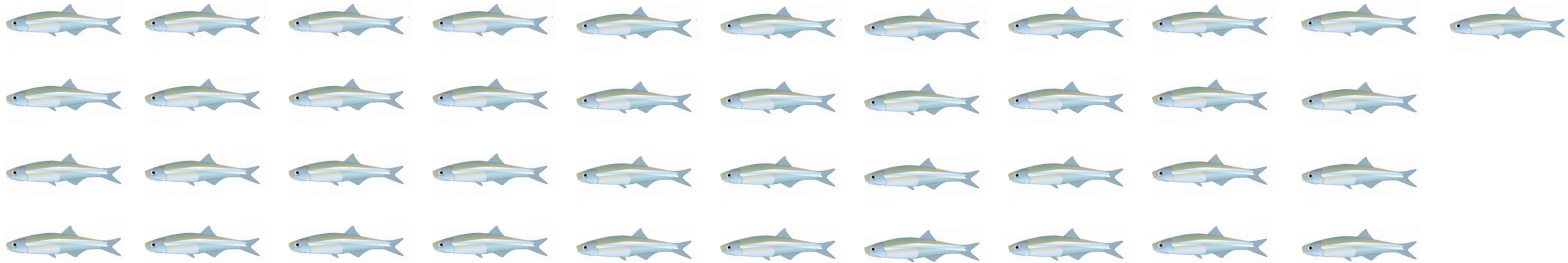
### **Blue Catfish (*Ictalurus furcatus*)**

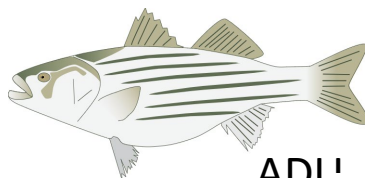
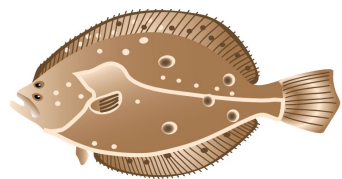
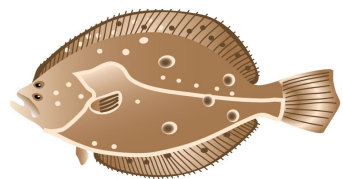
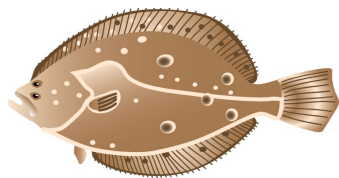
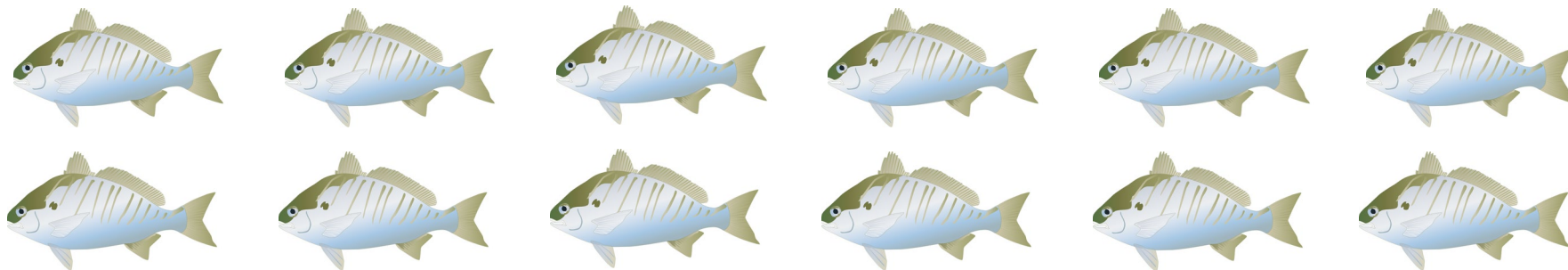
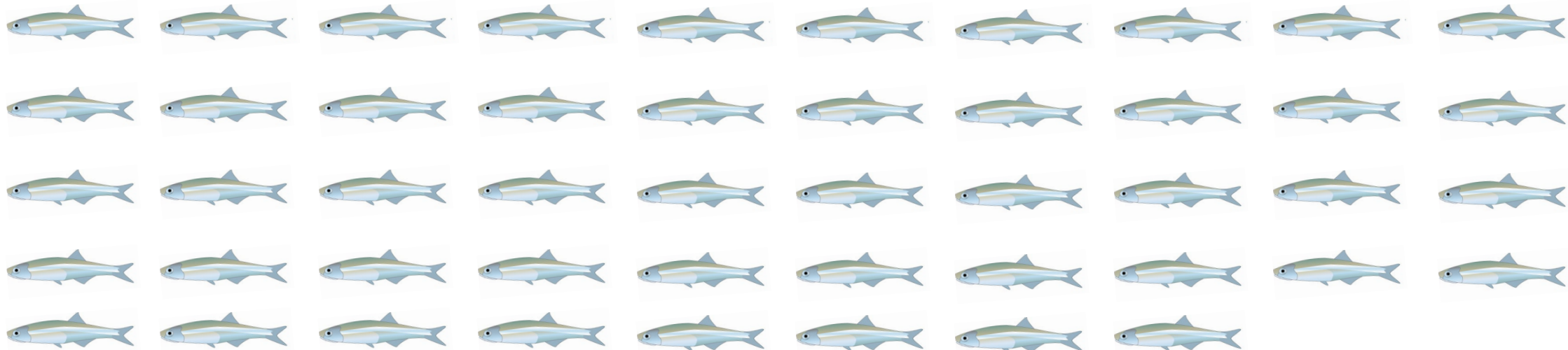
Description: Long fish with smooth, scale-less skin. Have four pairs of whisker-like barbels around their mouth. Can grow very large.

Diet: Omnivorous and opportunistic feeders (they will eat just about anything!) including invertebrates, insects, and other fish.

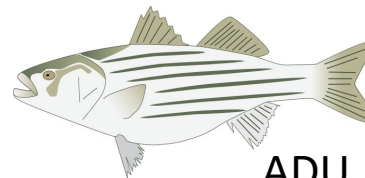
Habitat: Found mainly in the freshwater portions of tributaries. An invasive species, growing numbers of this fish will likely have negative impacts on other native fish species.



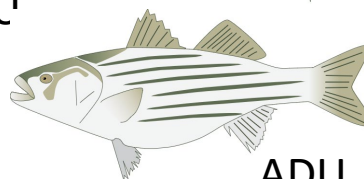




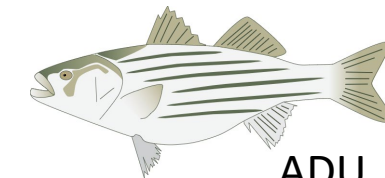
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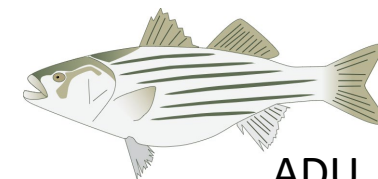
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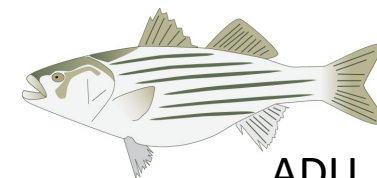
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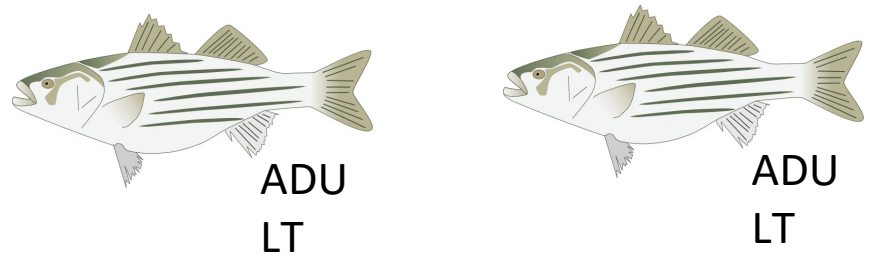
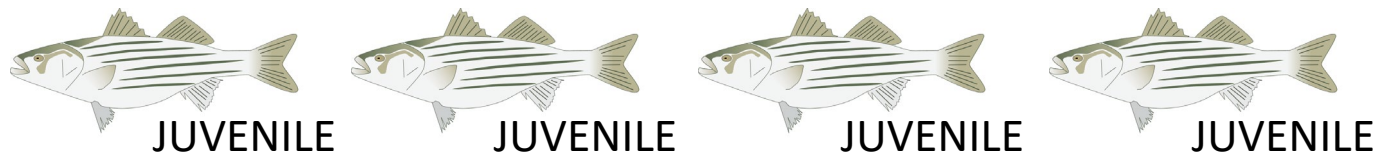
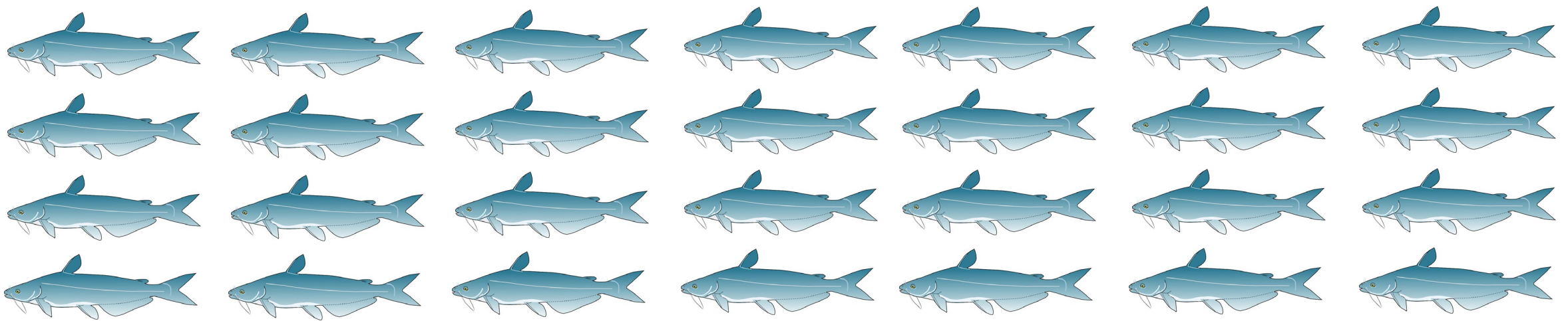
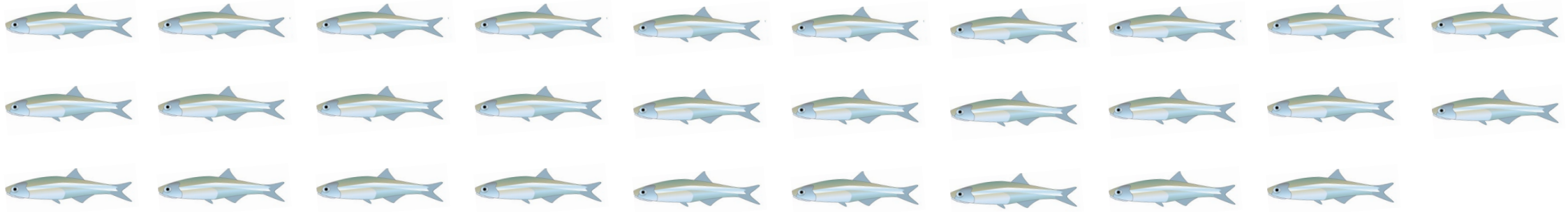
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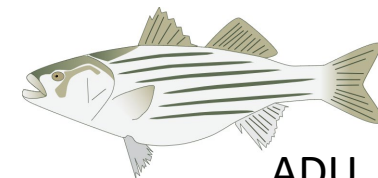
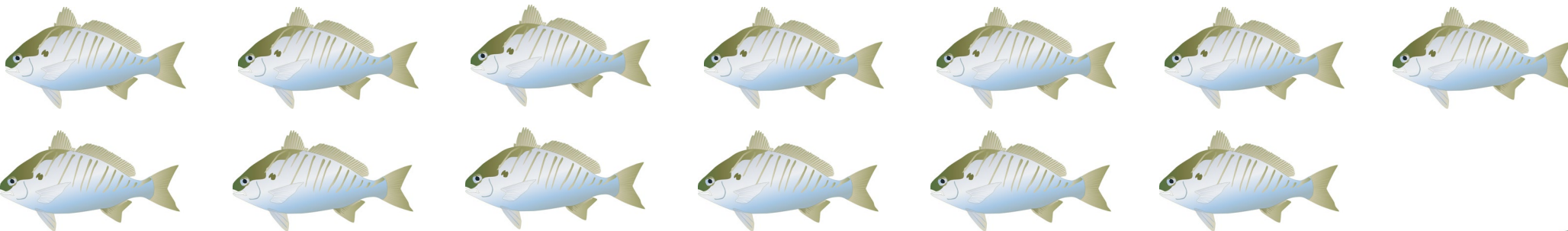
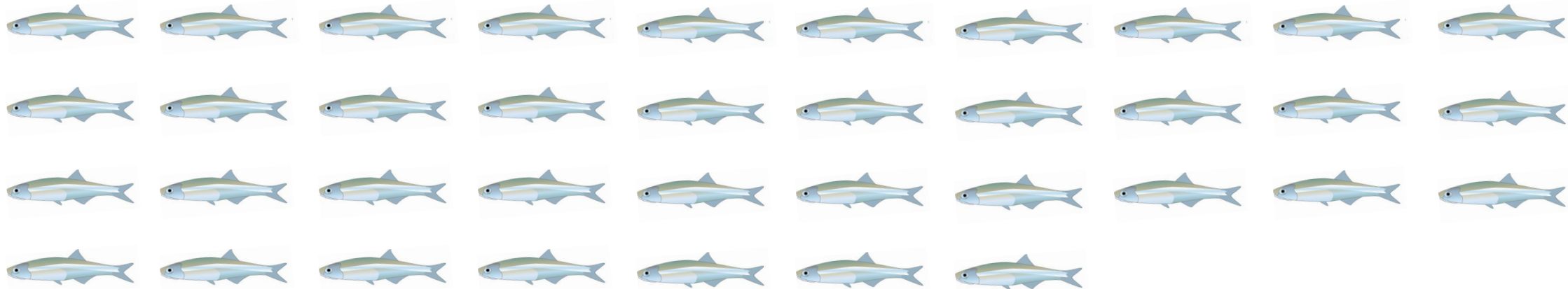
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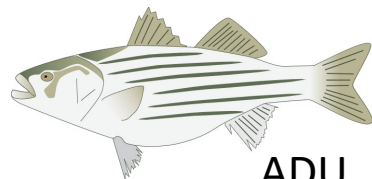
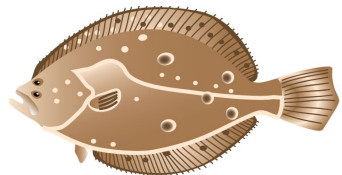
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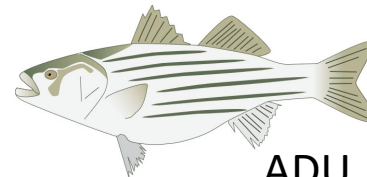




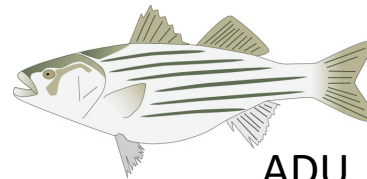
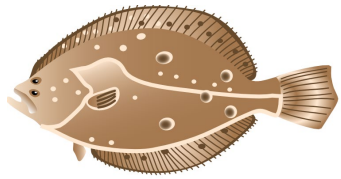
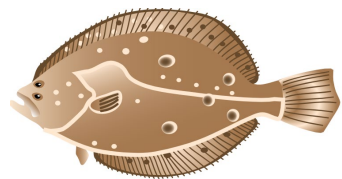
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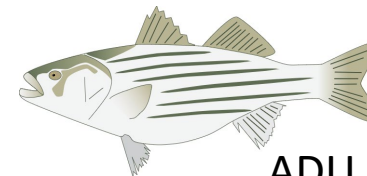
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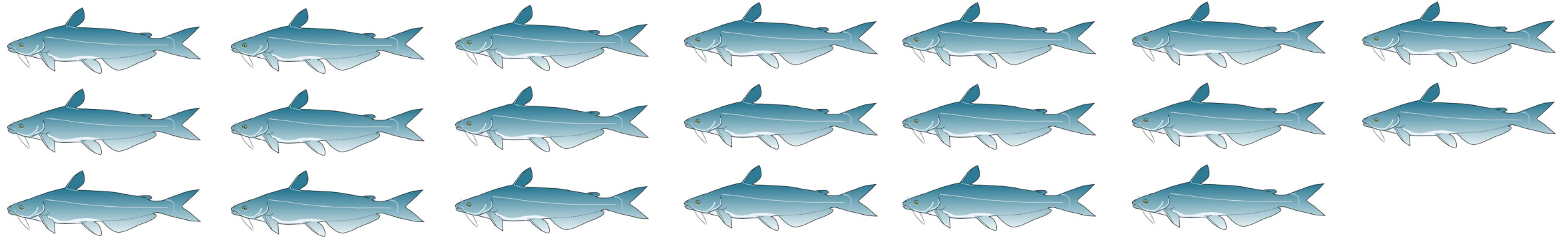
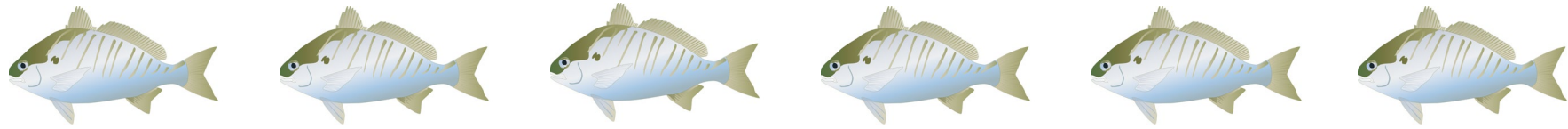
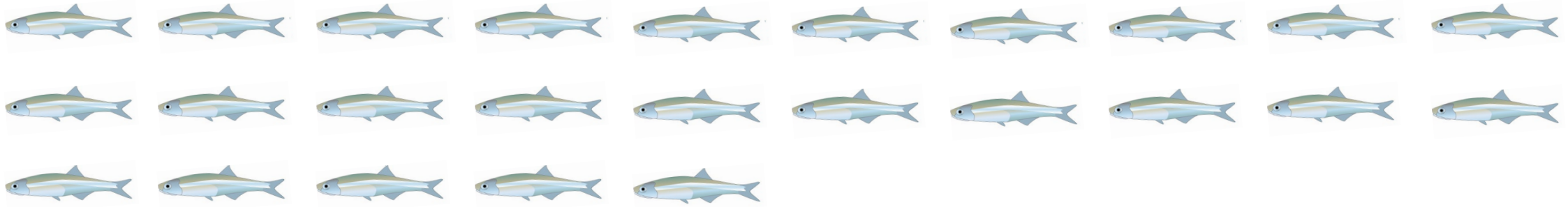
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