Bass Habitat Use
by Liz Duff

Learning Goals:
Concept: The Ocean is largely unexplored. New technologies, sensors and tools are expanding our ability to explore the ocean and estuaries.

Objectives: Inquiry skills: Students will make predictions and analyze data.

Timeframe: (Prep, implementation)
Prep: 30 minutes to review the materials.
Implementation: One Class time.

Grade Level(s): Middle School and High School

Engaging Experience: Introductory Question: How are striped bass using the estuary? Are they randomly distributed or clumped in groups?

Print worksheets for students. Answersheet for yourself.

Facilitation Guidelines: Have students take notes on the worksheet as they watch the video. Discuss the answers at the end.
Do the graph analysis in class, or as homework.

Assessment: You may choose to use the handout as a quiz.

Connections to Frameworks:
Inquiry SIS3 Life Science Gr. 3-5 Adaptations of Living Things, Energy and Living Things, Life Science Gr. 6-8 Living Things & Their Environment, 13, 14, H.S.
Ecology 6.3

Vocabulary: abundance, anesthetic, caloric, coastal migratory stock, distribution, ectotherm, estuary, foraging, gastric lavage, invertebrates

Handouts (attached):
“Bass Habitat Use” Vocabulary:

**Acoustic telemetry:** Telemetry is the science and technology of automatic measurement and transmission of data by wire, radio, or other means from remote sources. Acoustic means sound.

**Angling:** fishing with a hook and line (and usually a pole)

**Contingent:** a group forming part of a larger group

**Estuary:** Coastal water body where ocean tides and river water merge;

**Foraging:** Searching for food

**Migratory:** animals that move seasonally

**Natal Ground:** Area of water where fish come each year to produce their eggs.

**Schoolie:** “Teenager” fish, probably not spawning. 3-5 years old

**Spawn:** To produce or deposit (eggs), as fishes or frogs do.

**Spawning or Natal Ground:** Area of water where fish come each year to produce their eggs.

**Telemetry:** The science and technology of automatic measurement and transmission of data by wire, radio, or other means from remote sources.

**Trajectory:** the path that a moving object follows as it moves.
Part 1

1. Where do striped bass spawn?
   ____________________________________
   ____________________________________
   ____________________________________

2. When were striped bass populations in decline?
   ____________________________________

3. Why were they in decline?
   ____________________________________

4. How did they make a comeback?
   ____________________________________

5. Angling targets: _______________________

6. What question are they investigating?
   ____________________________________

7. Years this study was done: ______________

8. How many fish were studied for in this research? ____________

9. Dots on the maps are ____________ that pick up a signal of the fish.

10. Do you think striped bass migrate to your region?
    Discuss this as a class. Look at a map to think about it. Example: Beverly, MA is located between Delaware Bay and Plum Island Sound. They likely pass through the waters near Beverly, and may even stop and stay there.

11. Where did the fish travel to?
   ____________________________________

12. The Two boxes represent
    ____________________________________
    ____________________________________

13. What question are they asking?
    ____________________________________

14. What do you think will be the dominant pattern for striped bass? Explain your answer. (There is no one correct answer here.)

   "Moving Sidewalk" One group sticks together and stops briefly then moves on.
   "Summer cottage": Groups of fish will come and stay for the entire summer.
Summer Vacation of a Striped Bass.

Describe the journey of this striped bass based on the graph and map below.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

Imagine you are that striped bass and make up a reality based story about why you think you traveled where you did.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

What choices might the striped bass be making?
___________________________________________________________________________________________
___________________________________________________________________________________________

What questions do you have about this habitat?
___________________________________________________________________________________________
___________________________________________________________________________________________
What is this graph telling us?

1. 

2. 

3. 

4. 

5. 

What questions does looking at this graph raise?

1. 

2. 

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5. 

Do striped bass stay in PIE for long during the summer?
What is this graph telling us?

1. 

2. 

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4. 

5. 

What questions does looking at this graph raise?

1. 

2. 

3.
What is this graph telling us?

1. 

2. 

3. 

4. 

5. 

What questions does looking at this graph raise?

1. 

2. 

3. 
Part 1

1. **Where do striped bass spawn?**
   - Hudson River ______________________
   - Delaware Bay ______________________
   - Chesapeake Bay _____________________

2. **When were striped bass populations in decline?**
   - 1980s ______________________________

3. **Why were they in decline?**
   - Water quality in spawning grounds, changes in fish community, overfishing

4. **How did they make a comeback?**
   - State and federal managers agreed to work together. Management helped solve the problem.

5. **Angling targets:** Actively feeding fish.

6. **What question are they investigating?**
   - Is it the same individuals that come and stay or different ones that stay short amounts of time.

7. **Years this study was done:** 2005-2006

8. **How many fish were studied for in this research?** 60

9. Dots on the maps are __recievers__ that pick up a signal of the fish.

10. Do you think striped bass migrate to your region?
    - Discuss this as a class. Look at a map to think about it. Example: Salem, MA is located between Delaware Bay and Plum Island Sound. They likely pass through Salem, and may even stop and stay there.

11. **Where did the fish travel to?**
    - Rowley Mouth, Rowley River, Spindle Yacht Club, Mouth of Ipswich River, Middle Ground.

12. **The Two boxes represent**
    - Rowley River ______________________
    - Plum Island Sound

13. **What question are they asking?**
    - What are the movement options that striped bass have in summer migration? How does it move north?

14. **What do you think will be the dominant pattern for striped bass?** Explain your answer. (There is no one correct answer here.)
    - "Moving Sidewalk" One group sticks together and stops briefly then moves on.
    - "Summer cottage": Groups of fish will come and stay for the entire summer.
Summer vacation of a striped bass.

1. Describe the journey of this striped bass based on the graph and map below.

The bass starts at the mouth of the Rowley and then it primarily swims back and forth from there to the west clam beds, the east clam beds and the Rowley Mouth. During a few days time it swims to the yacht club and back. It then takes a long journey to the Spindle and travels back and forth between there and the Yacht club. It swims to the mouth of the Ipswich River, and then to Middle Ground, and then back to the Spindle.

2. Imagine you are that striped bass and make up a reality based story about why you think you traveled where you did. (Answers will vary based on prior knowledge, imagination, etc.)

I am a bass that knows there is a lot to feed on the fish that swim in the narrow channels of the Rowley River, but that tastier fish arrive in the later summer in Plum Island Sound. I swam for a couple days, and then went to check to see if there was any good food by the yacht club. There was nothing yet, so I went back to the Rowley river for a few more days. On August 6th I checked again and there was a big school of fish that had arrived. I think they were sand lance. I stayed in the area between the yacht club and the spindle with this school and followed them out to the mouth as they were leaving. Then I checked back to the middle ground looking for more fish to eat.

What choices might the striped bass be making?
- Food type, Avoiding predation, Habitat type

3. What questions do you have about this habitat? What type of prey is found in these different habitats? Do different types of prey arrive at different times? How does current affect the bass. Etc.
What is this graph telling us? (Sample responses may include:

1. Some fish stay a short time (a few days).
2. Some fish stay a long time (over 100 days.)
3. More fish stay longer than thirty days than less than thirty days.
4. This includes fish from two sampling years: 2005 and 2006.
5. 59 fish are on this graph.

What questions does looking at this graph raise? (Answers will vary. Sample responses may include:

1. Why do some striped bass stay longer than others?
2. Do the ones who are “just passing through” stay longer at another site further north?
3. Do the ones that stay grow faster or slower than the ones who are just passing through?
What is this graph and image telling us?

1. Fish spend more time in two locations: The lower Rowley river and Middle Plum Island Sound.
2. Fish spend the least amount of time in the Tidal Creeks in the Rowley River.
3. Time spent by fish varies within the locations.
4. The areas where they spend the most time are adjacent to each other.
5. Fish spent over 150 hours in the Rowley River.

What questions does looking at this graph raise? (Answers will vary. Examples may include:

1. Are the tidal creeks too shallow for the fish?
2. Are the prey fish “tastier” in the Plum Island Sound?
3. What prey species are found in these two locations?
What is this graph telling us? (Answers will vary. Some examples could be:

1. __11 fish spend more time in the Rowley River.
2. __18 Fish spend more time tin Plum Island Sound.
3. __17 Fish spend just a few days showing no particular preference.
4. __The Rowley River Fish spent over 500 hours in the Rowley River.
5. __The Plum Island Sound fish spent over 200 days in Middle Plum Island Sound.

What questions does looking at this graph raise? Answers will vary. Some examples could be:

1. __Did the short term fish head up to the Merrimack River to stay longer?
2. __Do they learn this behavior, swimming with other bass?
3. __Do the schoolies travel in schools of the same age class?
Summer vacation of a striped bass.

1. Describe the journey of this striped bass based on the graph and map below.

___________________________________________________________________________________________
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___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

2. Imagine you are that striped bass and make up a reality based story about why you think you traveled where you did. (Answers will vary based on prior knowledge, imagination, etc.)

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________
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What choices might the striped bass be making?
3. What questions do you have about this habitat? What type of prey is found in these different habitats? Do different types of prey arrive at different times? How does current affect the bass. Etc.

![Graph showing the number of days individual striped bass stayed in PIE during the summer.](image)

**Do striped bass stay in PIE for long during the summer?**

**Part 2**

**What is this graph telling us?**

1. 

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4. 

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**What questions does looking at this graph raise?**

1. 

2. 

3. 
What is this graph telling us?

1. 
2. 
3. 
4. 
5. 

What questions does looking at this graph raise?

1. 
2. 
3.
What is this graph telling us?

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**Summer vacation of a striped bass.**

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   What choices might the striped bass be making?
   - Food type
   - Avoiding predation
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3. What questions do you have about this habitat? What type of prey is found in these different habitats? Do different types of prey arrive at different times? How does current affect the bass. Etc.

**Do striped bass stay in PIE for long during the summer?**

What is this graph telling us? (Sample responses may include:

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2. Do they learn this behavior, swimming with other bass?
3. Do the schoolies travel in schools of the same age class?
**Slide 1**

**Habitat Use, Behavior and Movements of Migratory Striped Bass During Summer Residence in Plum Island Sound, MA**

Sarah Pautzke
Mark L. Mather
Linda Deegan
Jack Fine
Bob Muth

Salt Marsh - River, MA

**Schoolie:** “Teenager” fish, probably not spawning. 3-5 years old

**Spawn:** To produce or deposit (eggs), as fishes or frogs do.

**Estuary:** Coastal water body where ocean tides and river water merge;

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**Slide 2**

**Cooperators:**

- Massachusetts Cooperative Fish and Wildlife Research Unit, USGS-BRD
- University of Massachusetts School of Marine Sciences
- Plum Island Long Term Ecological Research Site, Marine Biological Laboratory

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**Slide 3**

**Research Questions:**

1. What movement options are available to migratory striped bass along the Atlantic Coast?
2. Do migratory striped bass tagged in Plum Island Estuary (PIE) (MA) stay for the summer?
3. For those fish that stay the whole summer in PIE, are they evenly distributed throughout the estuary or are there hot spots?
4. Is there any variation in behavior of striped bass that stay in PIE?
5. Do the tagged striped bass return to their traditional natal grounds (Chesapeake, Delaware, Hudson) and along same routes?

**Migratory:** animals that move seasonally

**Spawning or Natal Ground:** Area of water where fish come each year to produce their eggs.
Where do striped bass spawn?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Slide 5

Striped Bass Migration Routes

Boston
Hudson
Delaware
Chesapeake

General assumption: Migration north of coastal bass has to do with feeding choices.

Slide 6

When were striped bass populations in decline?

________________________________________________________________________

Why were they in decline?

________________________________________________________________________

How did they make a comeback?

________________________________________________________________________

Slide 7

Striped Bass Coastal Migratory Stock:

• Atlantic coast stocks: originate in Hudson and Delaware Rivers, and Chesapeake Bay; undergo seasonal coastal migrations (Shepard 2006)
• Increased population
• In 2004: 20% of Atlantic coast catch was in NE

When were striped bass populations in decline?

________________________________________________________________________

Why were they in decline?

________________________________________________________________________

How did they make a comeback?

________________________________________________________________________
**Angling**: fishing with a hook and line (and usually a pole)

**Acoustic telemetry**: Telemetry is the science and technology of automatic measurement and transmission of data by wire, radio, or other means from remote sources. Acoustic means sound.

**Trajectory**: the path that a moving object follows as it moves, with

Dots on the maps are ____________________ that pick up a signal of the fish.

Do you think striped bass migrate to your region?

What question are they investigating? ____________________________

Years this study was done: ____________________________

How many fish were studied for in this research? ____________________________
Slide 11

Where did the fish travel to?

___________________________________

___________________________________

___________________________________

___________________________________

___________________________________

___________________________________

Y axis

X axis

Slide 12

Study Area:
2 areas
6 reaches

The two boxes represent

___________________________________

___________________________________

Slide 13

What are striped bass summer migration options?

Moving Sidewalk
- 1 group sticks together
- Visit multiple estuaries
- Prediction: fish stay briefly

What question are they asking?

___________________________________

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What are striped bass summer migration options?

**Moving Sidewalk**
- 1 group sticks together
- Visit multiple estuaries
- Prediction: fish stay briefly

**Estuary-Specific**
- Multiple groups
- Stay all summer in specific estuary
- Prediction: fish stay all summer

**Summer cottage:** Groups of fish will come and stay for the entire summer.

End of Part 1

What do you think will be the dominant pattern for striped bass? Moving sidewalk, or summer cottage?

Explain your answer. ________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________
Slide 15

Do striped bass stay in PIE for long during the summer?

Part 2

How long does a striped bass tagged in Plum Island Estuary stay?

What question are they investigating?

What areas are they staying longer in?

How many in each of those groups?

Rowley River behavioral group
The Plum Island Sound
Short Term fish

Slide 16

2006: Use of PIE by All Fish

KIR: Rowley River
PIE: Plum Island Estuary

Part 3

Slide 17

Foraging: Searching for food
Contingent: a group forming part of a larger group
Slide 18

Do striped bass return to their traditional natal grounds and along same routes?

How many total fish were seen in other locations?

__________________________________

__________________________________

__________________________________

__________________________________

Slide 19

Summary:

1. What movement options are available to migratory striped bass along the Atlantic Coast?
   - Cannot learn estuary, so less impact on prey
   - Possibly PIE isn't important for striped bass growth
   - Possible adverse impact on prey
   - PIE could be important for striped bass growth

2. Do migratory striped bass tagged in Plum Island Estuary (PIE) (MA) during the summer stay for long?
   - 60% use estuary-specific strategy, however, 40% do not

What are the conclusions of this study?

__________________________________

__________________________________

__________________________________

__________________________________

Slide 20

Summary:

3. Do the tagged striped bass return to their traditional natal grounds (Chesapeake, Delaware, Hudson) and along same routes?

Of 35 fish seen again:
- LIS = 15 fish
- DB = 5 fish
- Both = 15 fish

Conclusion:

__________________________________

__________________________________

__________________________________

__________________________________
Slide 21

Summary:

3. Do the tagged striped bass return to their traditional natal grounds (Chesapeake, Delaware, Hudson) and along same routes?

Of 35 fish seen again:
LIS = 15 fish
DB = 5 fish
Both = 15 fish

___________________________________
___________________________________
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Slide 22

4. For those fish that stay the whole summer in PIE, are they evenly distributed throughout the estuary or are there hot spots?

Conclusion: ______________________

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___________________________________

What is a new question they are asking?

___________________________________
___________________________________
___________________________________
___________________________________
___________________________________

Slide 23

Summary:

5. Is there any variation in behavior of striped bass that stay in PIE?

Conclusion:

___________________________________
___________________________________
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___________________________________
___________________________________
What are two new questions they are asking?

__________________________________
__________________________________
__________________________________
__________________________________
__________________________________

What are your thoughts about the new questions? What additional questions do you have? Do you have any prior connection to striped bass?
Schoolie: “Teenagers” probably not spawning. 3-5 years old
Spawn: To produce or deposit (eggs), as fishes or frogs do.

**Estuary**: Coastal water body where ocean tides and river water merge;

**Migratory**: animals that move seasonally

**Spawning or Natal Ground**: Area of water where fish come each year to produce their eggs.
Where do striped bass spawn?

Hudson River ______________________
Delaware Bay ______________________
Chesapeake Bay ______________________

When were striped bass populations in decline?
1980s

Why were they in decline?
Water quality in spawning grounds, changes in fish community, overfishing

How did they make a comeback?
State and federal managers agreed to work together. Management helped solve the problem.
**Angling**: fishing with a hook and line (and usually a pole)

**Materials and Methods**

**Acoustic telemetry**: Telemetry is the science and technology of automatic measurement and transmission of data by wire, radio, or other means from remote sources. Acoustic means sound.

**Trajectory**: the path that a moving object follows as it moves.

**What question are they investigating?**

Is it the same individuals that come and stay or different ones that stay short amounts of time.

**Years this study was done**: 2005-2006

**How many fish were studied for in this research?**

60

Dots on the maps are receivers that pick up a signal of the fish.

Do you think striped bass migrate to your region?
Where did the fish travel to?
Rowley Mouth, Rowley River, Spindle Yacht Club, Mouth of Ipswich River, Middle Ground.

The Two boxes represent
Rowley River
Plum Island Sound

What are striped bass summer migration options?
Moving Sidewalk
- 1 group sticks together
- Visit multiple estuaries
- Prediction: fish stay briefly

What question are they asking? What are the movement options that striped bass have in summer migration? How does it move north?
One group sticks together and stops briefly=moving sidewalk option.
What are striped bass summer migration options?

- **Moving Sidewalk**
  - 1 group sticks together
  - Visit multiple estuaries
  - Prediction: fish stay briefly

- **Estuary-Specific**
  - Multiple groups
  - Stay all summer in specific estuary
  - Prediction: fish stay all summer

**Summer cottage:** Groups of fish will come and stay for the entire summer.

End of Part 1

What do you think will be the dominant pattern for striped bass?

“Moving sidewalk”, or “summer cottage”? Explain your answer.

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
Slide 15

Do striped bass stay in PIE for long during the summer?

How long does a striped bass tagged in Plum Island Estuary stay? 3-4 to over 100 days. Some are using it for short stays. Others stay longer than 30 days.

Slide 16

What are they investigating?

Where are they spending their time?

Which 2 areas are they staying the longest in?

Middle PIS and Lower Rowley river.

Slide 17

Foraging: Searching for food

Contingent: a group forming part of a larger group

Rowley River behavioral group: 11
The Plum Island Sound Group: 18
Short term fish: 17
How many total fish were seen in other locations?

35

What are the conclusions of this study?

Conclusion: 60% used estuary specific, 40% used it as a MacDonalds. Fish use it both ways.

________________________

Conclusion: The striped bass studied in Plum Island sound were found in other locations and are part of the “Coastal Migratory stock”.

________________________
Slide 21

Summary:
3. Do the tagged striped bass return to their traditional natal grounds (Chesapeake, Delaware, Hudson) and along same routes?

Of 35 fish seen again:
LIS = 15 fish
DB = 5 fish
Both = 15 fish

Slide 22

4. For those fish that stay the whole summer in PIE, are they evenly distributed throughout the estuary or are there hot spots?

Conclusion: Some sites are “hot spots”.

What is a new question for these researchers?

What attracts the fish those hot spots is our new question.

Slide 23

Summary:
5. Is there any variation in behavior of striped bass that stay in PIE?

Conclusion:
Groups of fish favor different parts of the estuary.
What are additional new questions:
How do the striped bass fit with other animals in the estuary?
   How should we manage them better?

What are your thoughts about the new questions?
What additional questions do you have? Do you have any connection to striped bass?

Acknowledgements:
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- Volunteers
- More Audubon
- National Science Foundation