



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?

Materials: On-Line Bass Habitat Use Video at

<http://www.massaudubon.org/saltmarsh/fish.php>

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.)

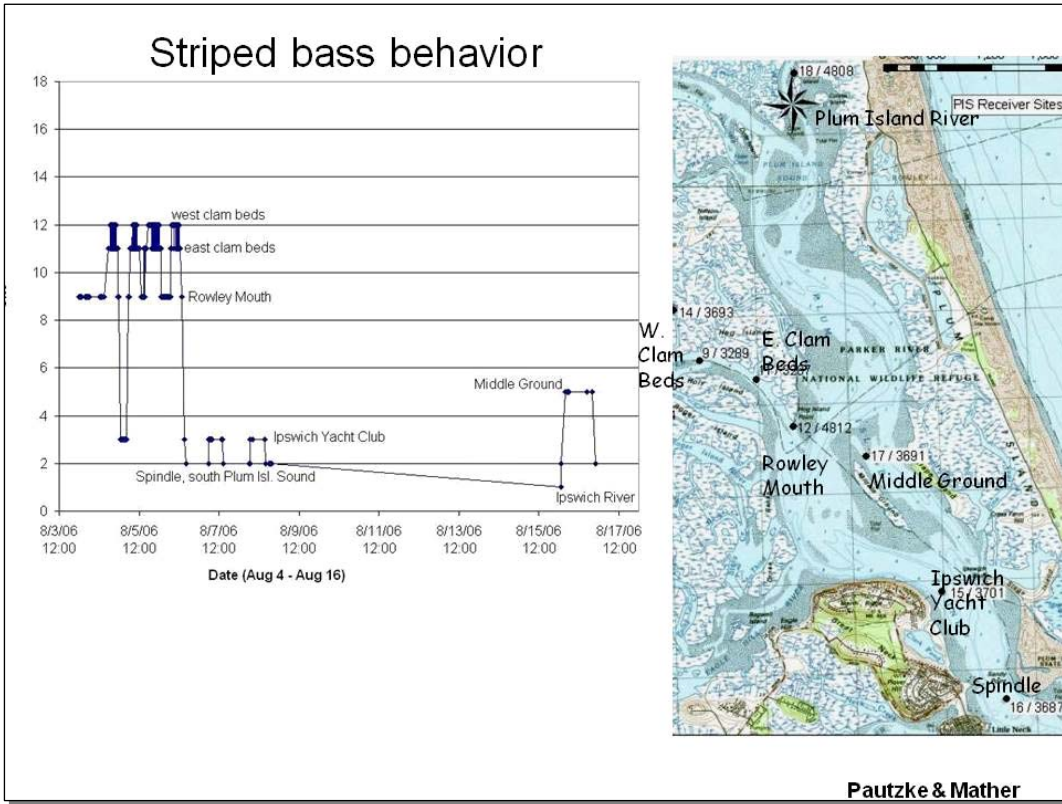
“Moving Sidewalk” One group sticks together and stops briefly then moves on.

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

Name _____ Date: _____

Summer Vacation of a Striped Bass.

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

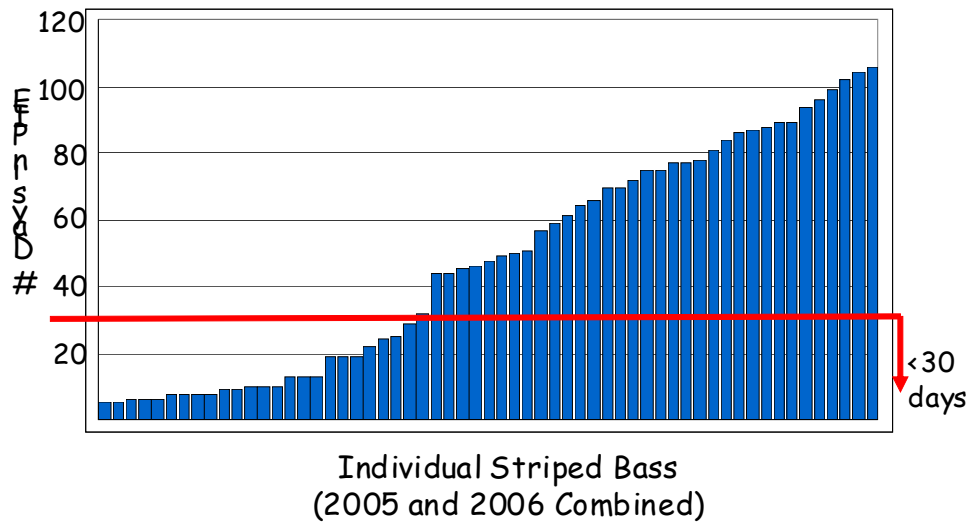


Imagine you are that striped bass and make up a reality based story about why you think you traveled where you did.

What choices might the striped bass be making?

What questions do you have about this habitat?

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



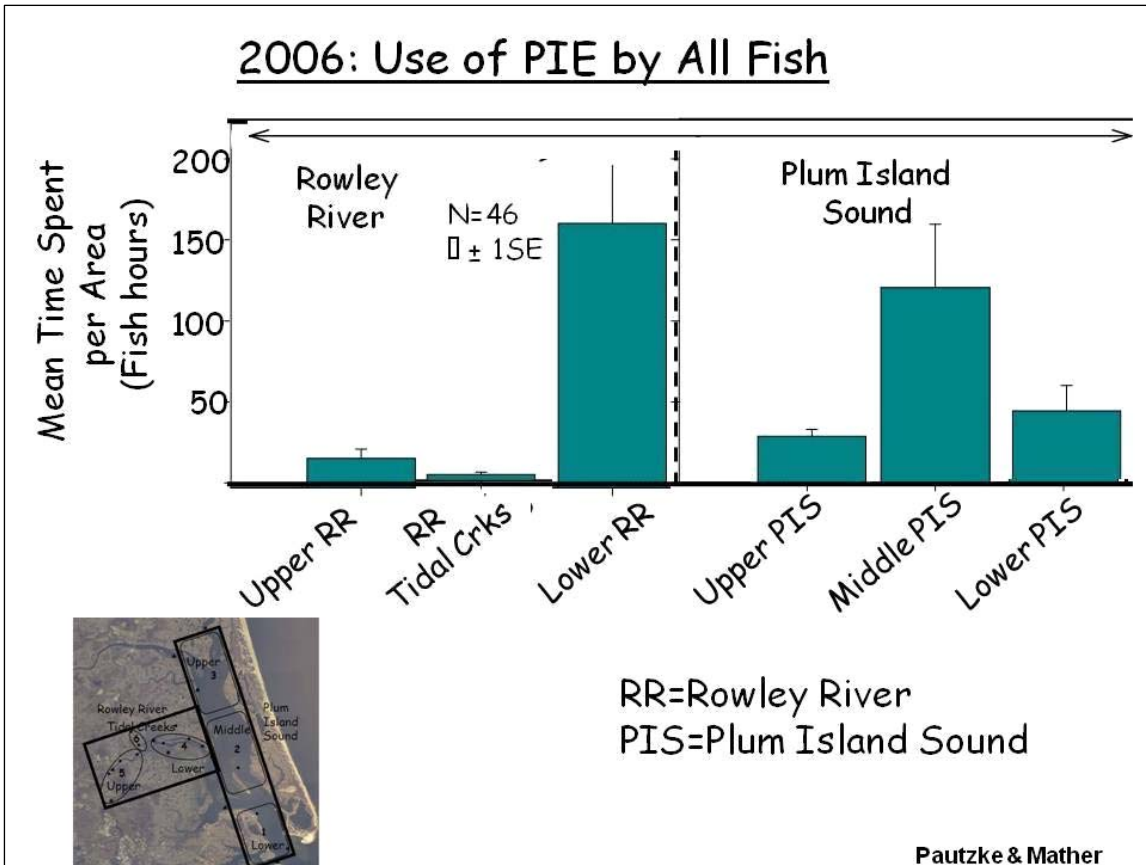
Part 2

What is this graph telling us?

1. _____
2. _____
3. _____
4. _____
5. _____

What questions does looking at this graph raise?

1. _____
2. _____
3. _____

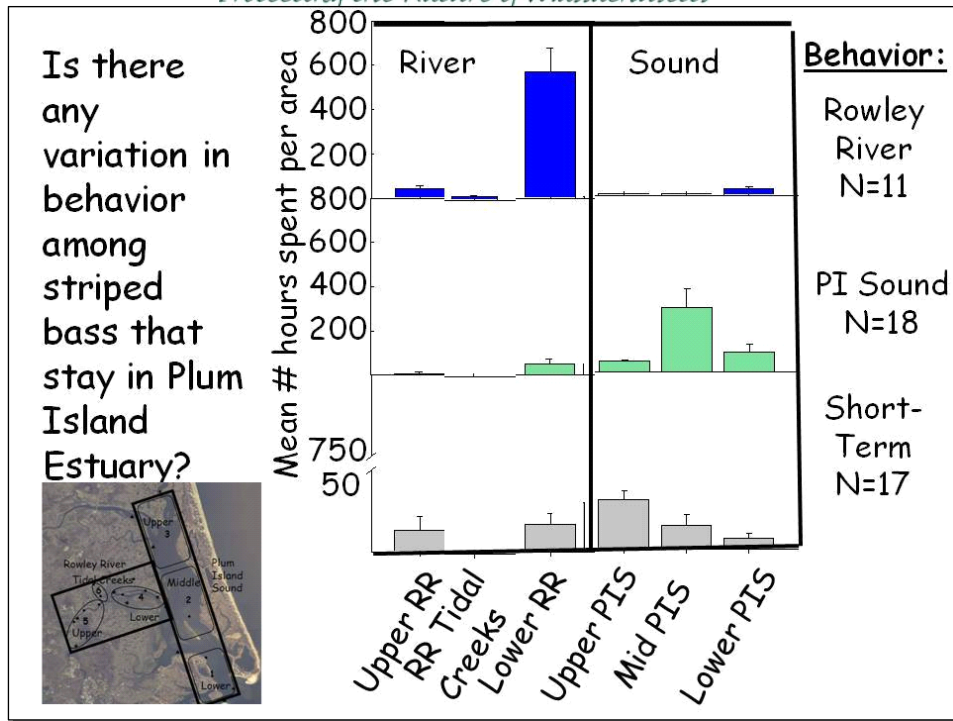


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1. _____
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Part 1

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 receivers 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.)

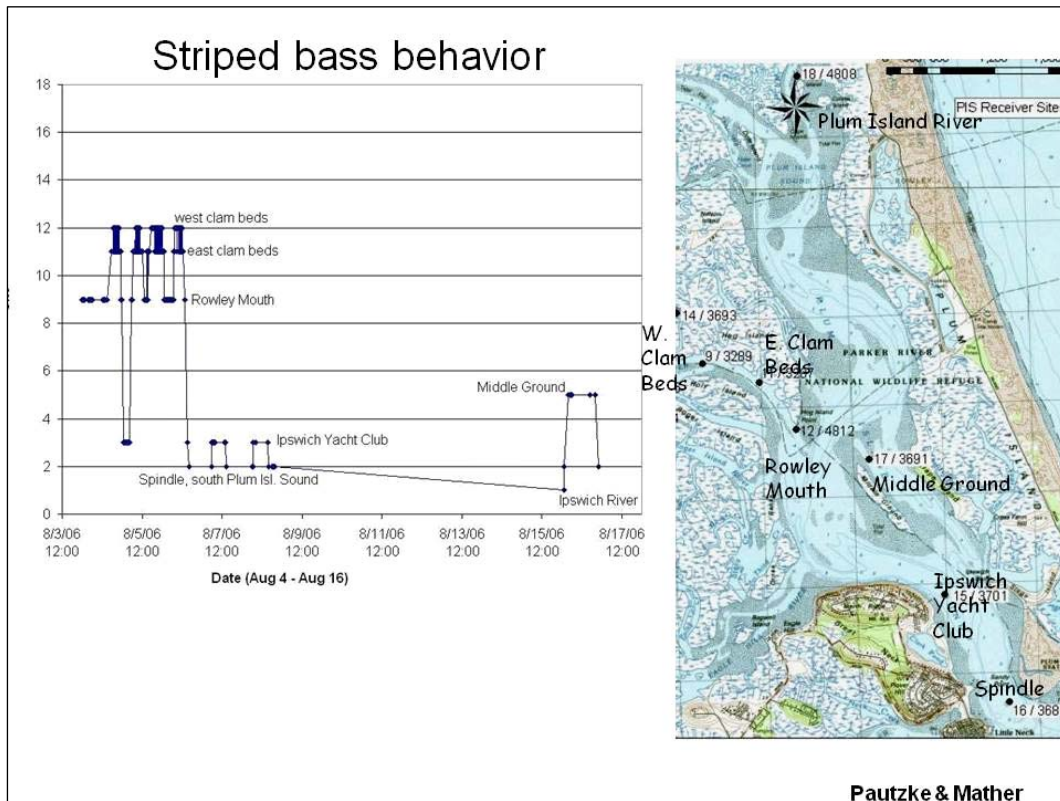
“Moving Sidewalk” One group sticks together and stops briefly then moves on.

“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.)

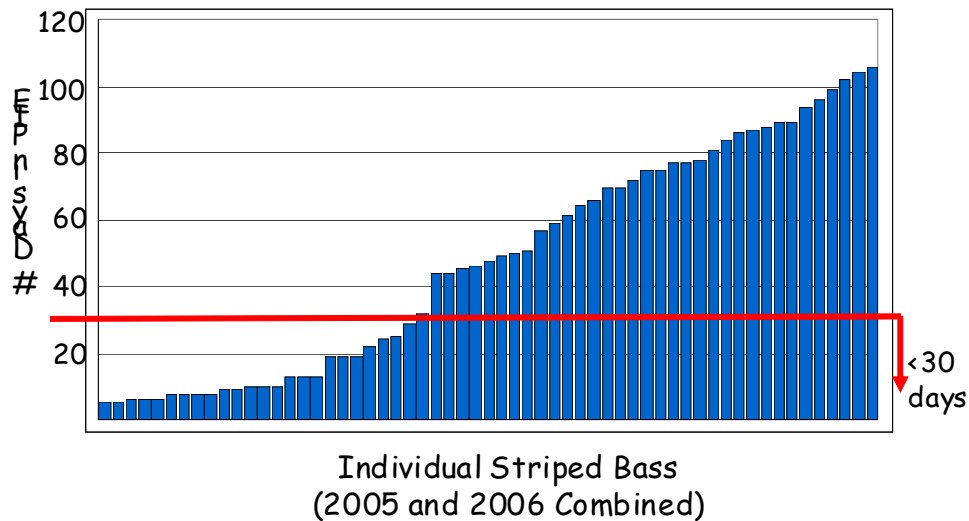
I am a bass that knows there is a lot to feed on the fish that swim in the narrow channels of the Rowley River, but that tastier fish arrive in the later summer in Plum Island Sound. I swam for a couple days, and then went to check to see if there was any good food by the yacht club. There was nothing 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.

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



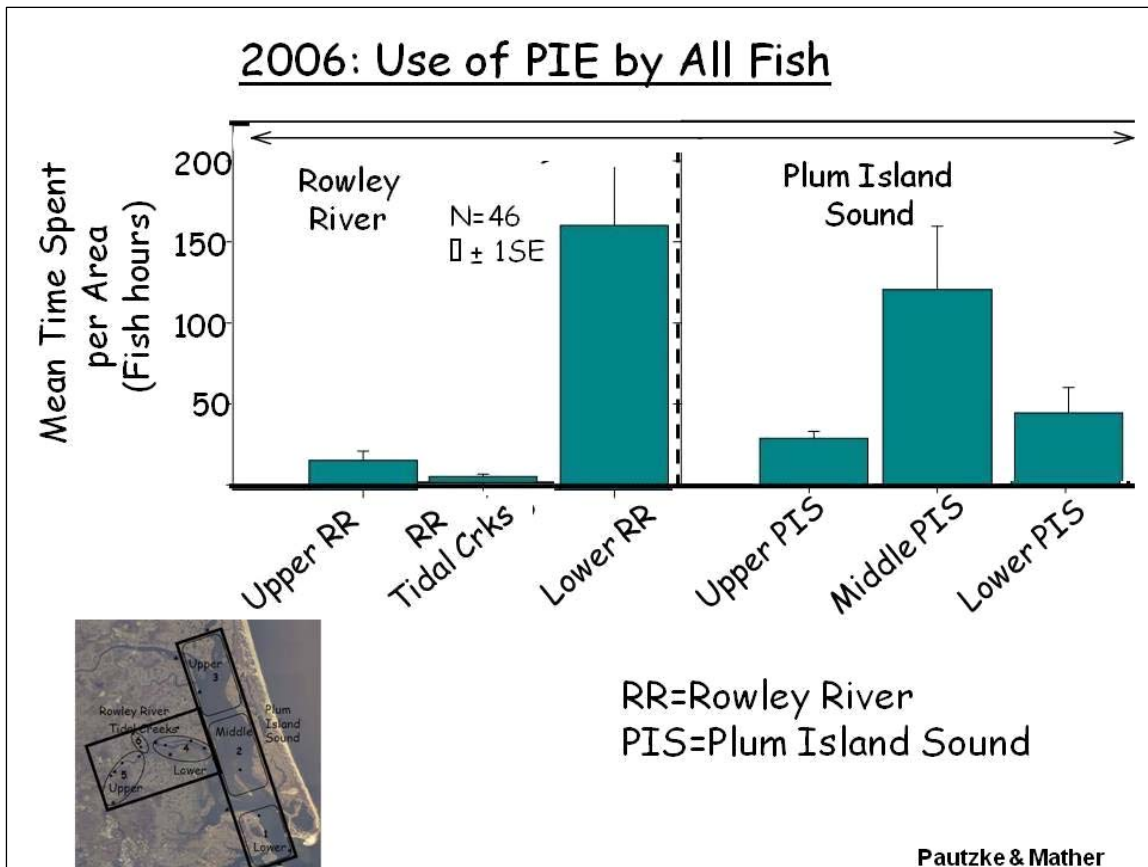
Part 2

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?

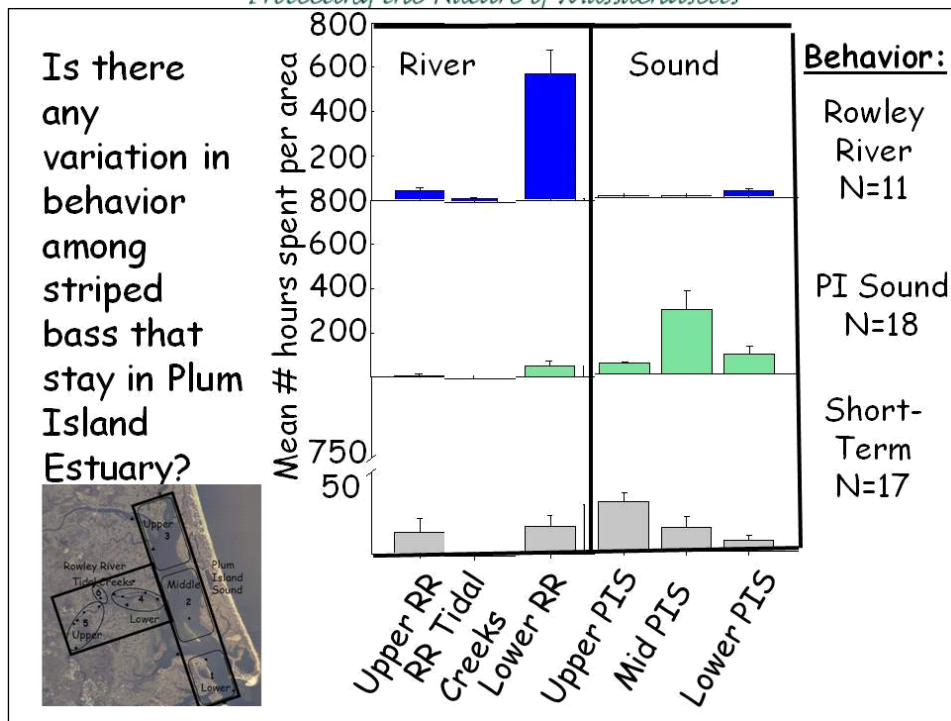


What is this graph and image telling us?

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 in 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.

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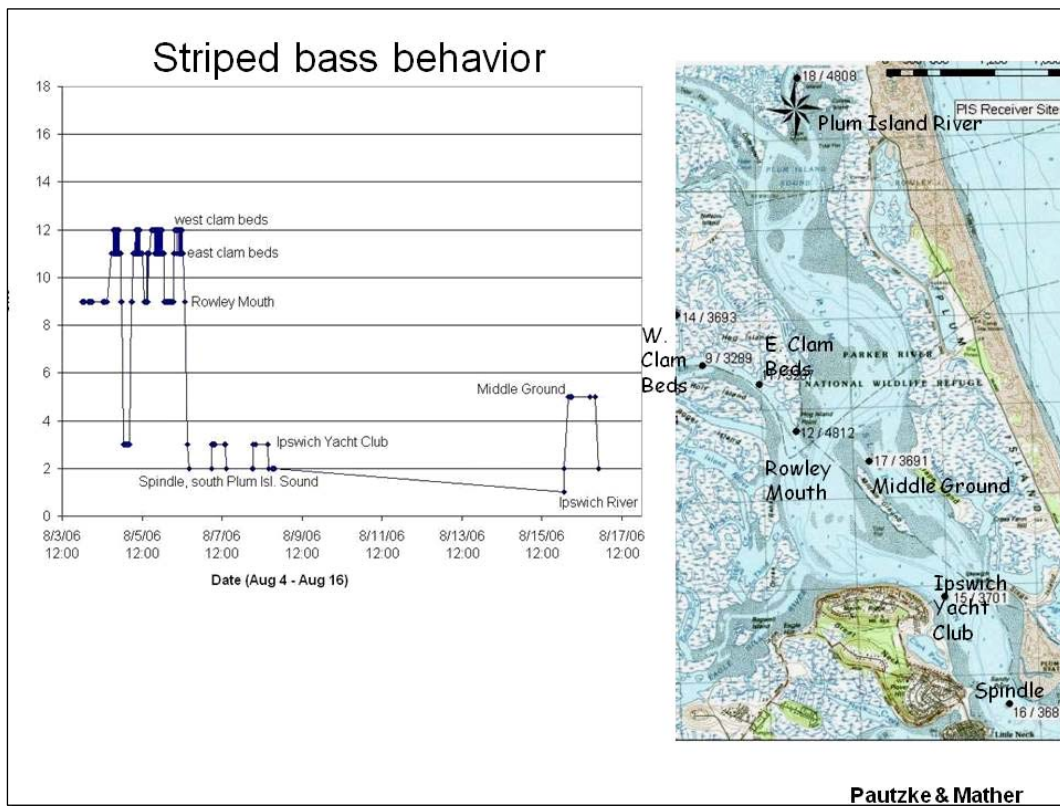
1. Did the short term fish head up to the Merrimack River to stay longer?
2. Do they learn this behavior, swimming with other bass?
3. Do the schoolies travel in schools of the same age class?

Name _____

Date: _____

Summer vacation of a striped bass.

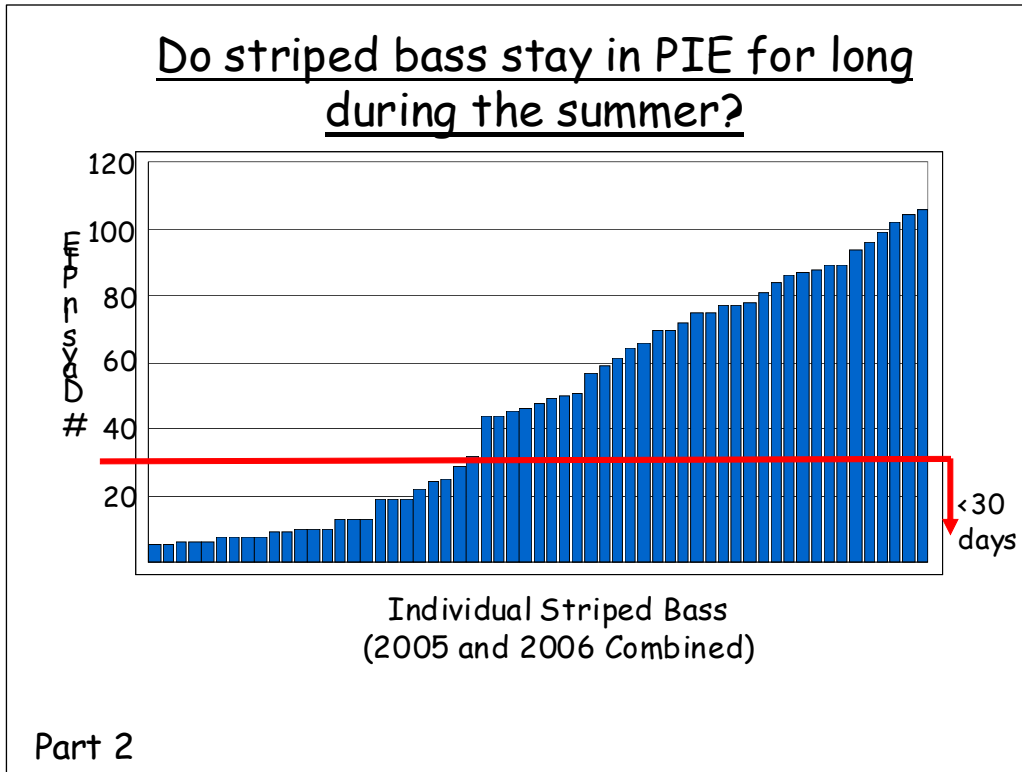
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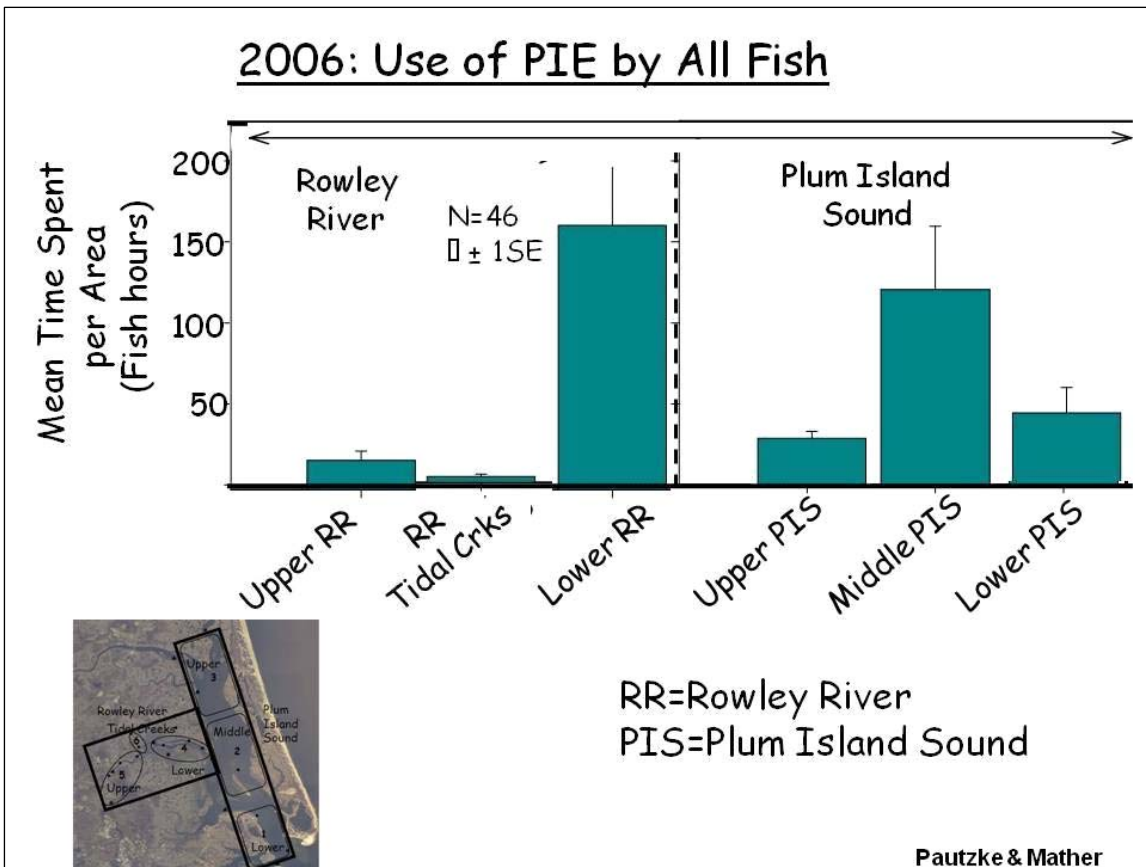


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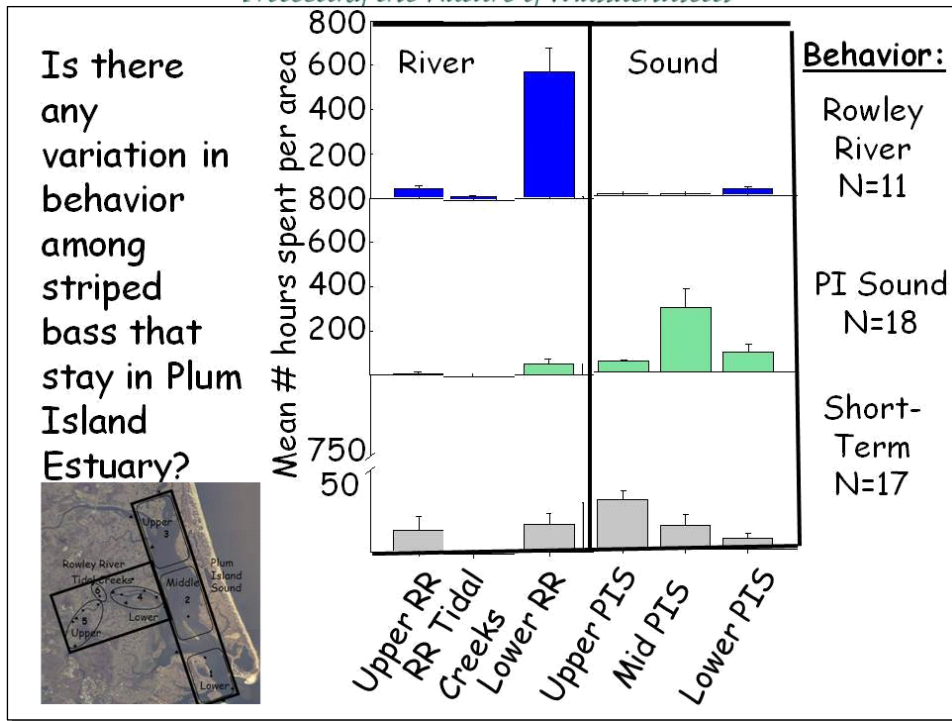


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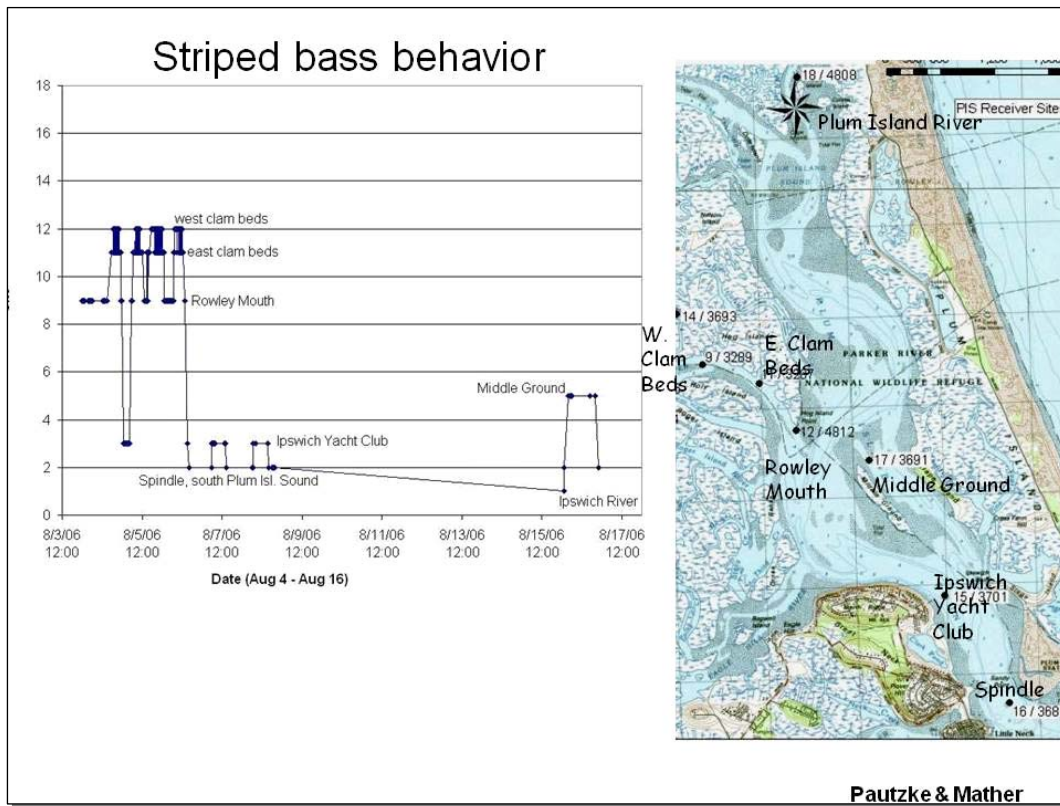
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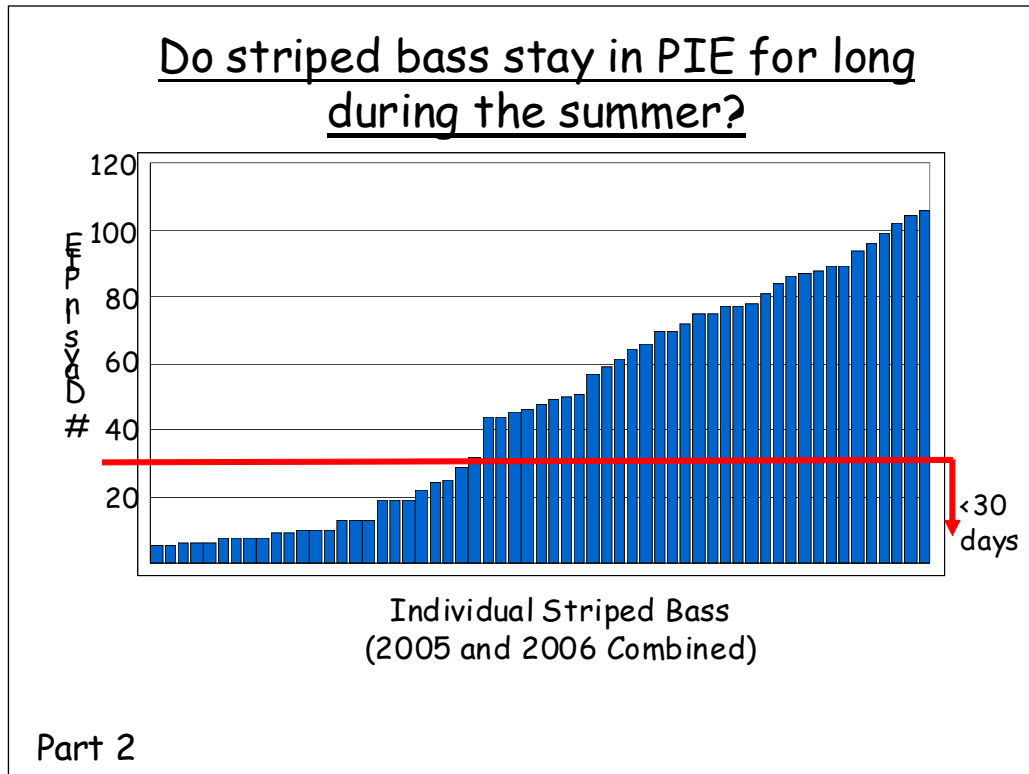
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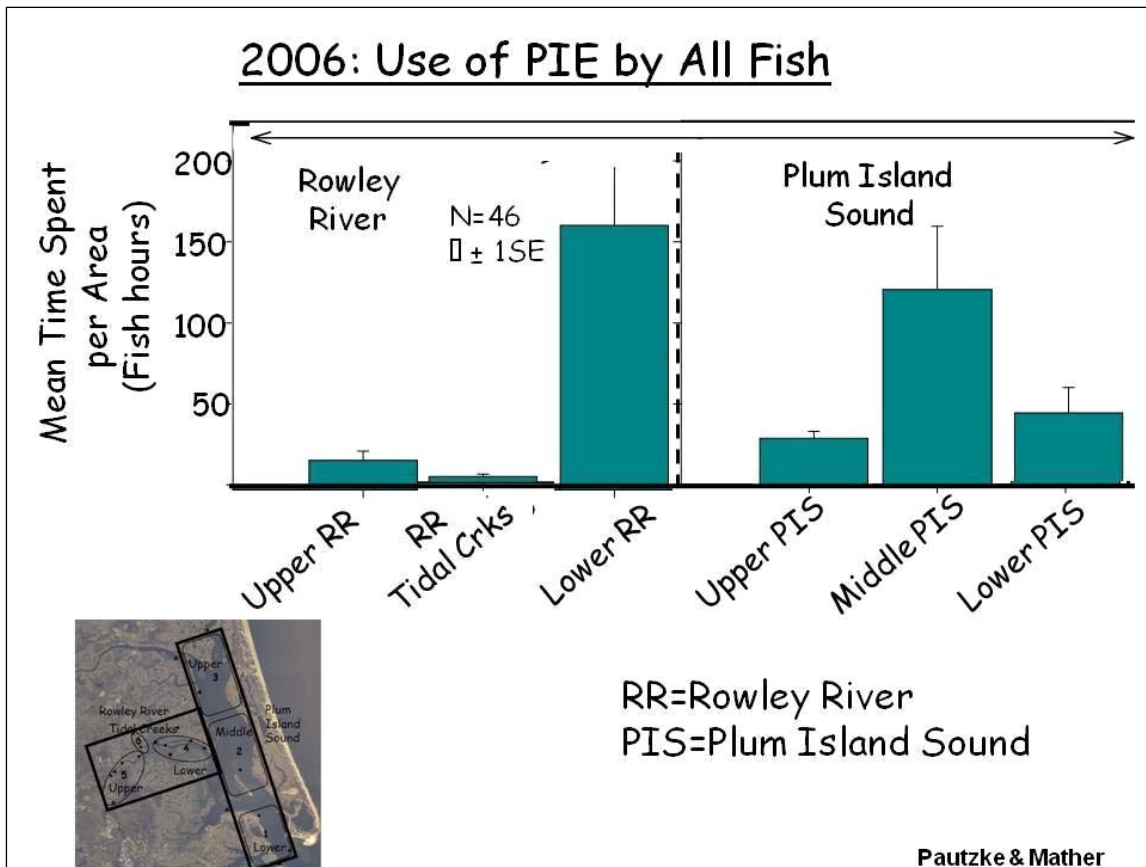


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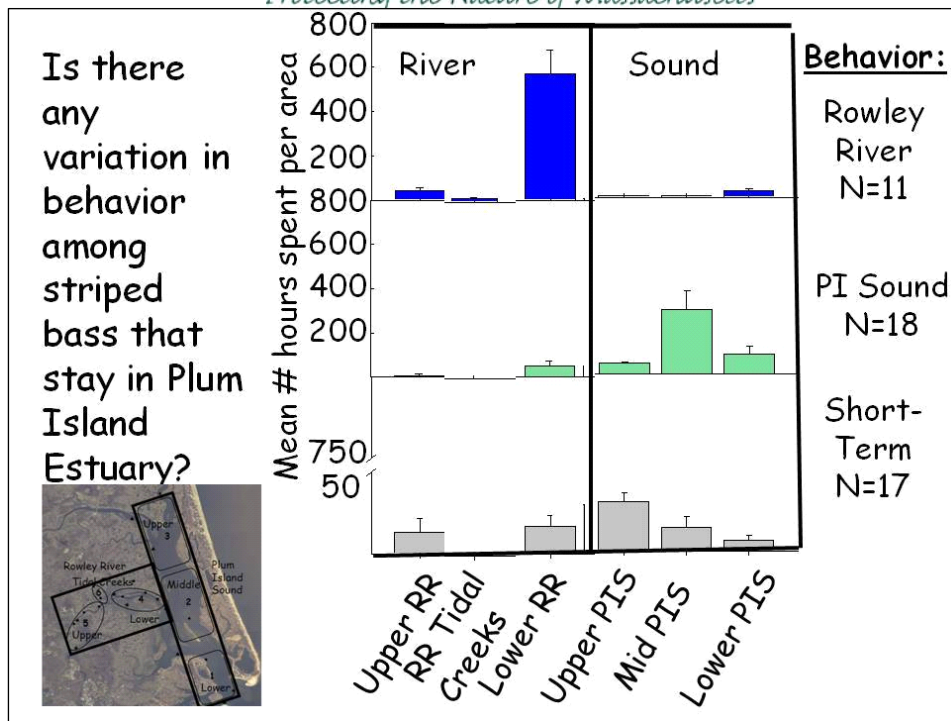


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Slide 1

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



Sarah Pautzke
Martha Mather
Linda Deegan
Jack Finn
Bob Muth

Salt Marsh- Rowley River, MA



Striped Bass "Schoolie" Pautzke & Mather

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;

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

Slide 3

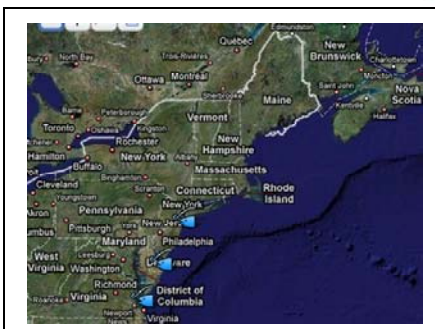
Research Questions:

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.

Slide 4



Where do striped bass spawn?

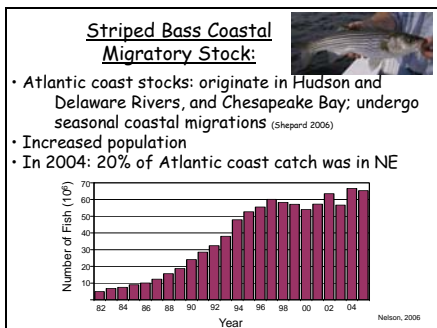
Slide 5



Slide 6



Slide 7

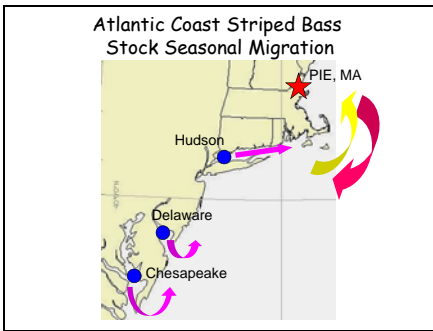


When were striped bass populations in decline?

Why were they in decline?

How did they make a comeback?

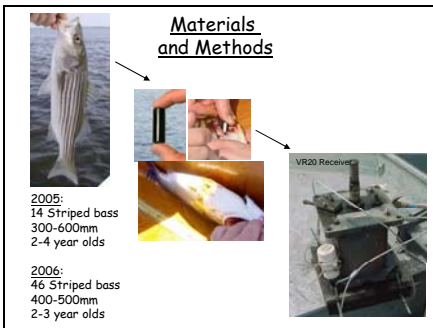
Slide 8



Angling targets:

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

Slide 9



What question are they investigating?

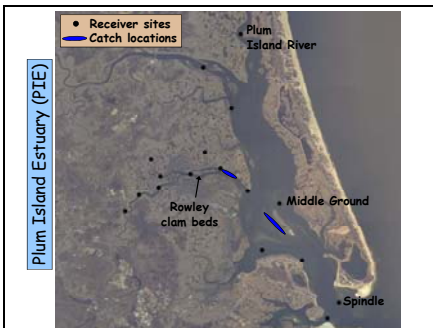
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How many fish were studied for in this research?

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

Slide 10

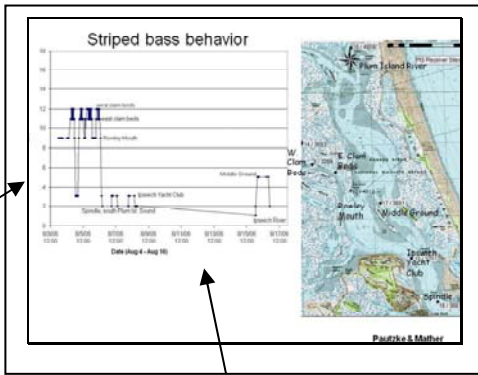


Dots on the maps are _____ that pick up a signal of the fish.

Do you think striped bass migrate to your region?

Slide 11

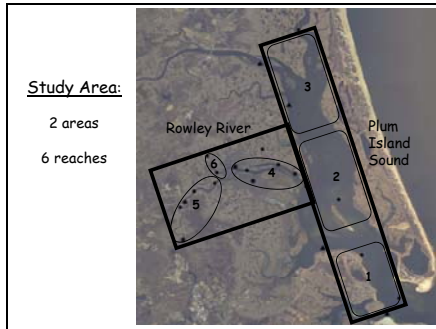
Y axis



X axis

Where did the fish travel to?

Slide 12



The two boxes represent


Slide 13



What question are they asking?

Slide 14

What are striped bass summer migration options?



<p><u>Moving Sidewalk</u></p> <ul style="list-style-type: none"> • 1 group sticks together • Visit multiple estuaries • <u>Prediction:</u> fish stay briefly 	<p><u>Estuary-Specific</u></p> <ul style="list-style-type: none"> • Multiple groups • Stay all summer in specific estuary • <u>Prediction:</u> fish stay all summer
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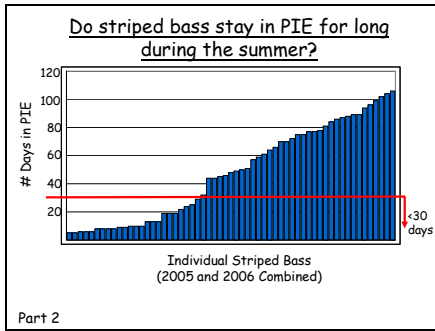
Summer cottage: Groups of fish will come and stay for the entire summer.

End of Part 1

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

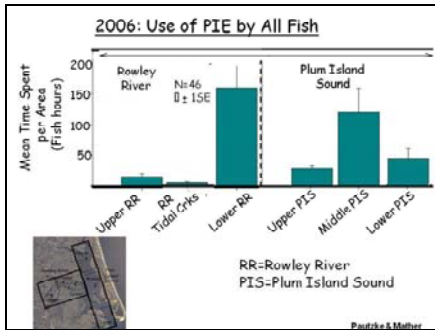
Explain your answer. _____

Slide 15



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

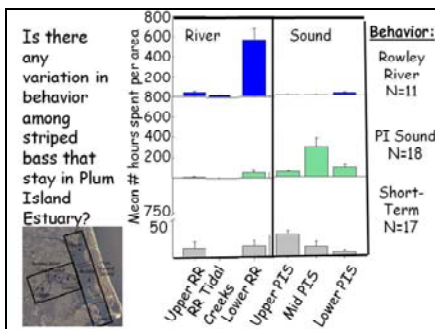
Slide 16



What question are they investigating?

What areas are they staying longer in?

Slide 17



How many in each of those groups?

Rowley River behavioral group _____

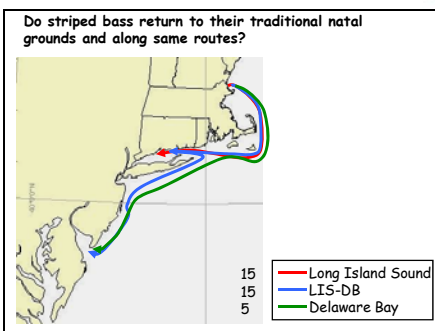
The Plum Island Sound _____

Short Term fish. _____

Foraging: Searching for food

Contingent: a group forming part of a larger group

Slide 18




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?



Moving Sidewalk

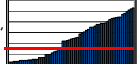


Estuary Specific

- 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?



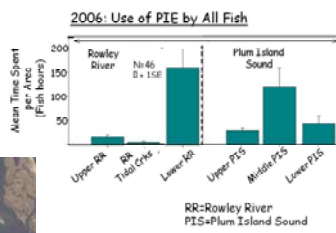
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Slide 22

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

2006: Use of PIE by All Fish



RR-Rowley River
PIS=Plum Island Sound



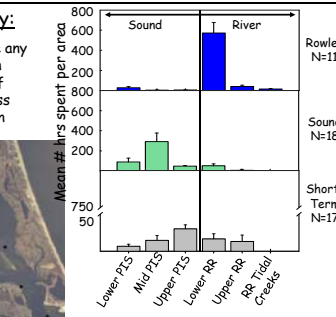
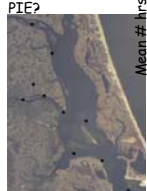
Conclusion: _____

What is a new question the are asking?

Slide 23

Summary:

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

Conclusion: _____

Slide 24



What are two new questions they are asking?

Slide 25

Acknowledgements:

- Sarah Pautzke
- Martha Mather
- Linda Deegan
- Jack Finn
- Bob Muth
- National Marine Fisheries Service
- Telemetry Colleagues in DE and CT
- VEMCO
- PIE LTER
- Umass
- Volunteers
- Mass Audubon
- National Science Foundation



Pautzke & Mather

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

Slide 1

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University of Massachusetts School of Marine Sciences



Plum Island Long Term Ecological Research Site, Marine Biological Laboratory

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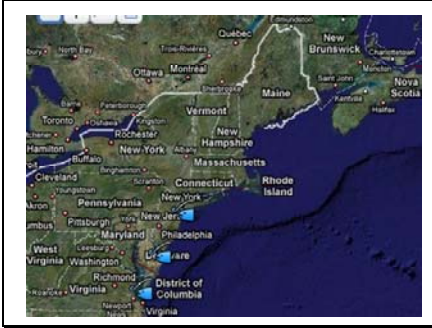
Research Questions:

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.

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Where do striped bass spawn?

Hudson River _____

Delaware Bay _____

Chesapeake Bay _____

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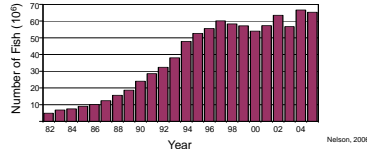
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Striped Bass Coastal Migratory Stock:

- 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



Number of Fish (10⁶) vs Year

Nelson, 2006

When were striped bass populations in decline?

1980s _____

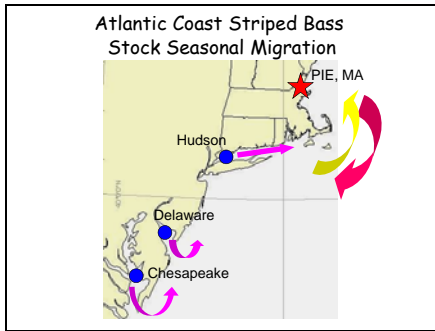
Why were they in decline?

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.

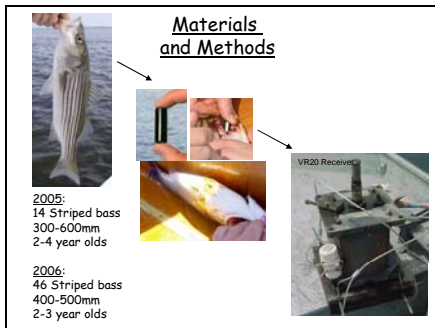
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Angling targets: Actively feeding fish.

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

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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

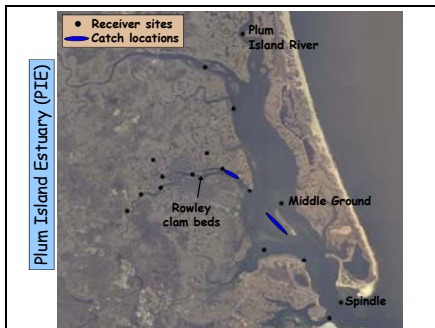
How many fish were studied for in this research?

60

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

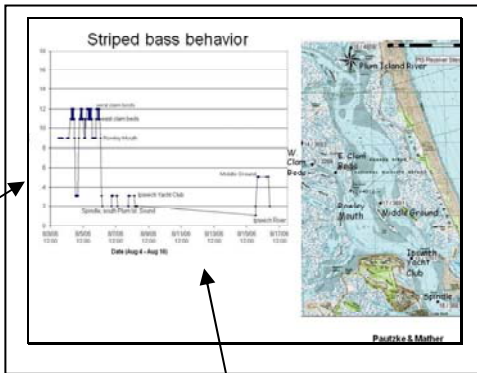
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Dots on the maps are receivers that pick up a signal of the fish.

Do you think striped bass migrate to your region?

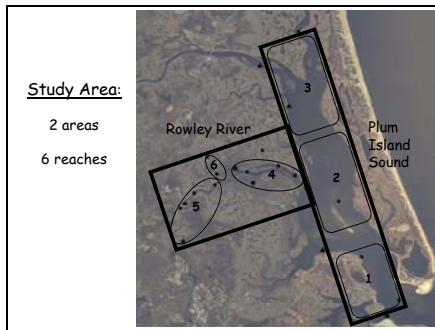
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Where did the fish travel to?

Rowley Mouth, Rowley River, Spindle Yacht Club, Mouth of Ipswich River, Middle Ground.

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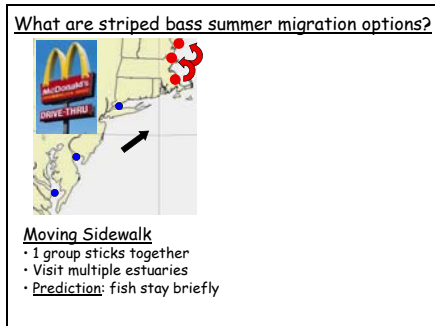


The Two boxes represent

Rowley River

Plum Island Sound

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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.

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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

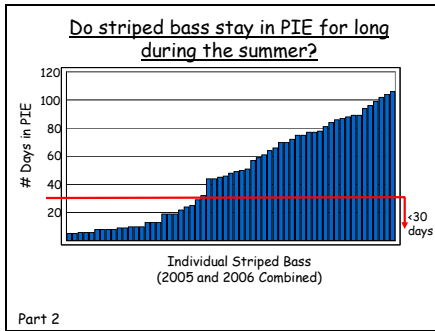
Summer cottage: Groups of fish will come and stay for the entire summer.

End of Part 1

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

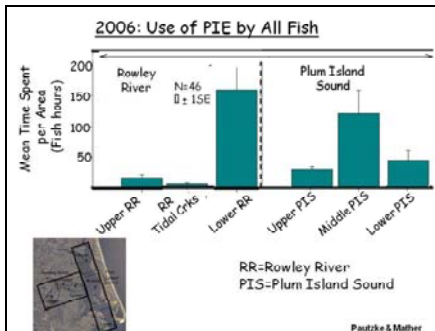
“Moving sidewalk”, or “summer cottage”? Explain your answer.

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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.

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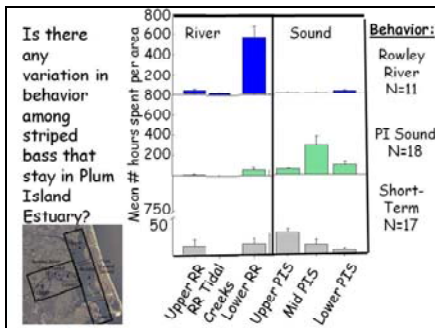
What question are they investigating?

Where are they spending their time?

Which 2 areas are they staying the longest in?

Middle PIS and Lower Rowley river.

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How many fish are in each of those groups?

Rowley River behavioral group: 11

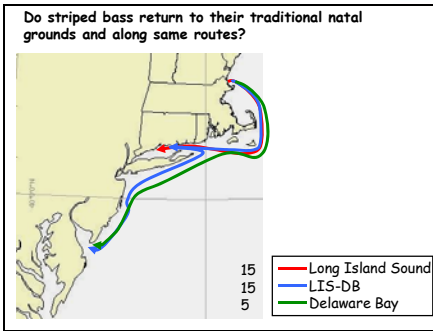
The Plum Island Sound Group: 18

Short term fish: 17

Foraging: Searching for food

Contingent: a group forming part of a larger group

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How many total fish were seen in other locations?

35

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Summary:

1. What movement options are available to migratory striped bass along the Atlantic Coast?



Moving Sidewalk

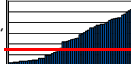
- Cannot learn estuary, so less impact on prey
- Possibly PIE isn't important for striped bass growth



Estuary Specific

- 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?

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

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


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Summary:

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



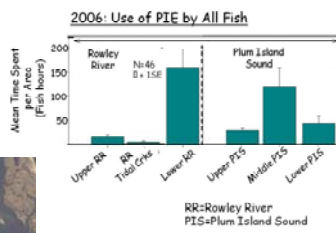
Of 35 fish seen again:
LIS = 15 fish
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4. For those fish that stay the whole summer in PIE, are they evenly distributed throughout the estuary or are there hot spots?

2006: Use of PIE by All Fish



RR=Rowley River
PIS=Plum Island Sound



Conclusion: Some sites are "hot spots".

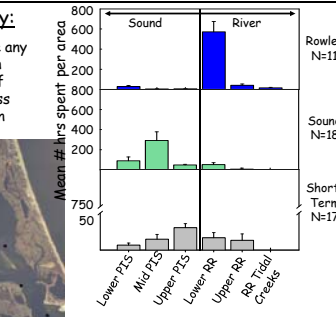
What is a new question for these researchers.?

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

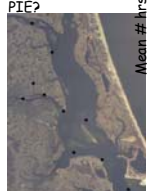
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Summary:

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



Rowley N=11
Sound N=18
Short-Term N=17



Conclusion:

Groups of fish favor different parts of the estuary.

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What are additional new questions:


How do the striped bass fit with other animals in the estuary?

How should we manage them better?

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Acknowledgements:

- Sarah Pautzke
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- PIE LTER
- Umass
- Volunteers
- Mass Audubon
- National Science Foundation



Pautzke & Mather

What are your thoughts about the new questions?

What additional questions do you have? Do you have any connection to striped bass?