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Correlation Between the Pelagic Species *Morone Saxatilis* and Sea Lice
in the Gulf of Maine

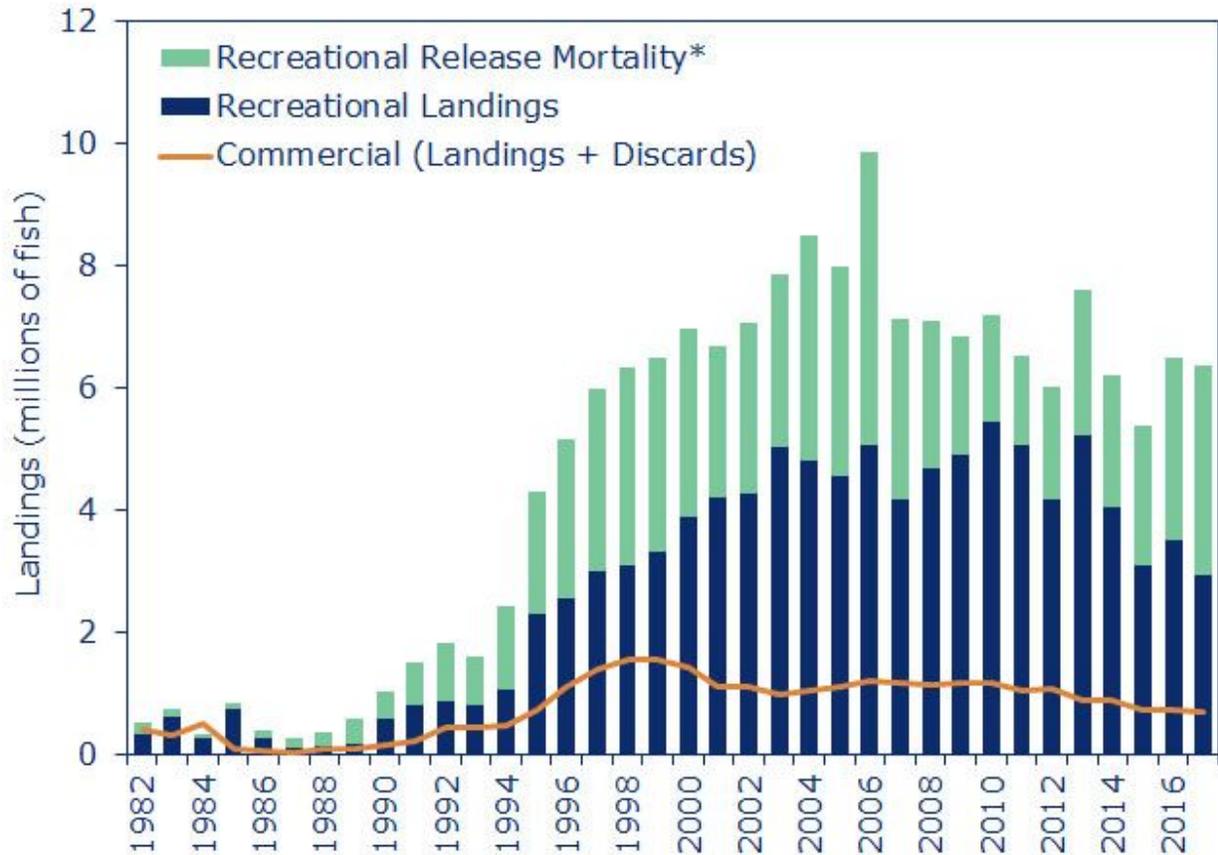
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Research Article

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Abstract:

Striped bass (stripers) are one of Maine's most important natural resources. They attract tourism, are a form of sustenance, and keep Maine's complex marine food web in balance. In fact, according to <http://www.asmfc.org>, from 2015-2017, recreational anglers harvested an estimated 16 million fish annually. The graph below created by the Atlantic States Marine Fisheries Commission shows the number of landings (in millions of fish) per year. Although this fish is one of the most important fish to the economy of the Atlantic Coast, the information on this species is limited, to say the least. Also, this fish is a migratory species, giving researchers in Maine very little time to collect data. The goal of this project was to analyze over 1,300 different pieces of data relating to the migration patterns of one of Maine's most important natural resources: the striped bass. The long term goal of this project is to figure out the origin data of striped bass, or where they were born. This would be extremely important to both the fishing economy and the conservation of the striped bass. The data used was collected by the Snap-a-Striper program. The data consisted of the length of the fish, the date caught, the location caught, the presence of sea lice, the age of the fish, and the number of line breaks in the fish. The variable chosen to determine if striped bass in Maine were migratory or not was the presence of sea lice. The results suggest that the presence of sea lice can be used as an identification marker of migratory striped bass.

**Atlantic Striped Bass Commercial Landings and Discards
& Recreational Landings and Release Mortality**
Source: ASMFC Atlantic Striped Bass Technical Committee, 2018



*Recreational release mortality assumes that 9% of fish released alive die.

(Figure 1)

Introduction:

Striped bass are migratory fish, meaning that they don't stay in Maine year round. This makes data collection extremely hard and rushed. However, striped bass attract both tourism and money to Maine, making them an important natural resource. Because these fish are migratory, the information on this species is limited, to say the least. If scientists were able to fully or partly understand the migratory patterns of this fish, it could lead to amazing revelations in both the conservation and understanding of striped bass. By analyzing data and photos of these fish I was able to answer the question, "How can sea lice, a parasitic species commonly found on striped bass help prove if a fish is migratory or not?" My hypothesis was that, "If sea lice are present on striped bass, then they can be used to determine if a striped bass is migratory or not because sea lice only attach in deep water, where migratory fish travel through in order to reach the Gulf of Maine." The research was conducted by first finding data that could contain information on the striped bass migration. Luckily, a research project located at Gulf of Maine Research Institute, GMRI, had already collected over one thousand pieces of data relating to striped bass. GMRI is an organization that collects and analyzes data on the fisheries and ecology of the Gulf of Maine. Because

GMRI already had data on the striped bass, I was able to spend all my time analyzing the data instead of collecting data. The first piece of data that was analyzed turned out to be extremely important.

Sea lice are parasitic organisms that attach themselves to fish in order to survive. This symbiotic relationship rarely leads to fish fatality. The species of sea lice that are most commonly found on striped bass are found in the open ocean where striped bass migrate. This would be a clear indication that the striped bass had migrated to Maine, and would provide more evidence to answer the question, “How can scientists use citizen scientist data to find out if a striped bass is native or not native to Maine?” This would be the first research project on this matter, other than the ongoing Snap-A-Striper project at GMRI that focused more on exact origin data (where and when the striped bass were born) of striped bass instead of their migratory patterns or proving whether or not a certain fish was migratory. The pictures sent had been analyzed and the sea lice (with the appearance of small brown spots) were found visually in each photo.

Methods:

The photos were submitted to the Snap-A-Striper program, a program led by Dr. Lisa Kerr and Zachary Whitener, through a citizen scientist program. Any angler who wished to send a photo of their catch next to a 5-inch index card for scale would have their data recorded. They would also give information such as the location caught, in what type of water source they were caught, and the date caught. The presence of sea lice was then determined by examining each photo. Sea lice tend to look like small brown splotches on the side or belly of striped bass.



(Figure 2)

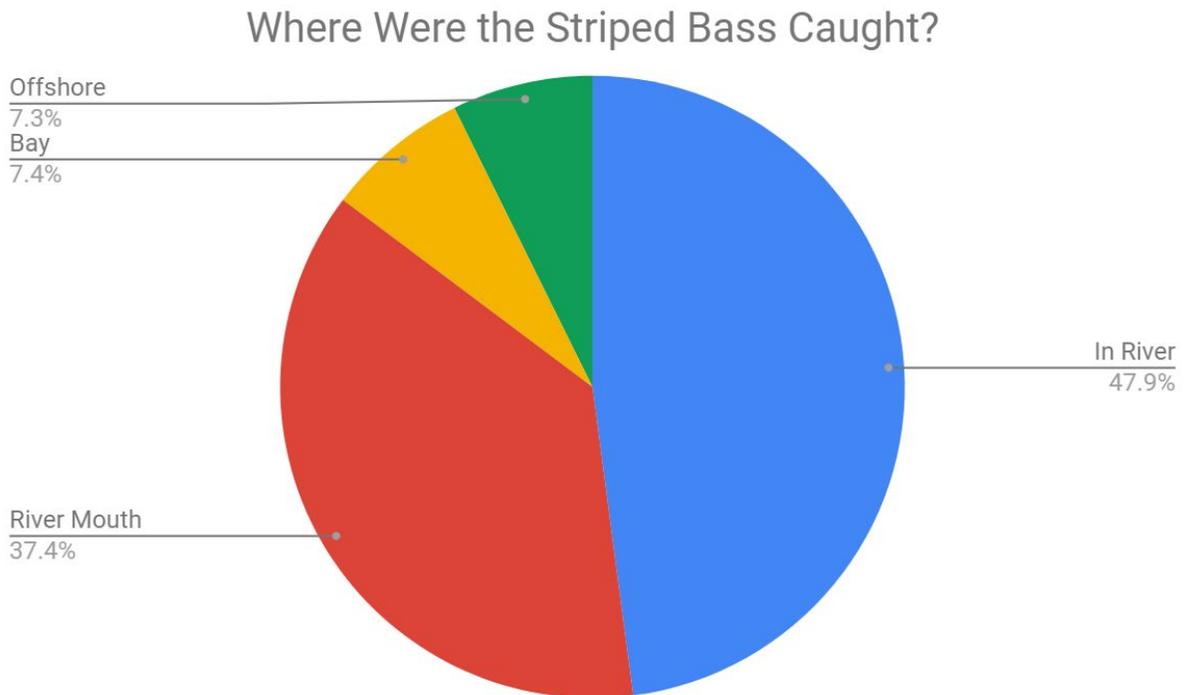
This is an example of a picture that we would receive

The data given to me had been collected for about 3 years. The lengths of the fish was measured by a computer program using morphometrics, which is the study of the shape of something, in this case the striped bass. This allowed for me to have accurate results, due to the large sample size (almost 1350 submissions). The data was organized originally in an Excel spreadsheet but was then exported to Google

Sheets for greater ease with data manipulation. Any person could submit data as long as they caught the fish in Maine and filled out the proper data recording requirements. However, early in the program, the fisherman who caught the fish would either only choose their biggest fish and neglect the small fish, or they would not submit their fish in the proper way. This changed once the program gained popularity among fishermen.

Results:

1344 striped bass pictures were submitted to the Snap-A-Striper program. Of these, 644 were caught in rivers, while 700 were caught in river mouths, bays, or offshore areas (see Figure 3).



(Figure 3)

242 sea lice were identified. Of these, 215 (89%) were found on fish caught in river mouths, bays, or offshore areas. 27 sea lice (11%) were found on fish caught in rivers.

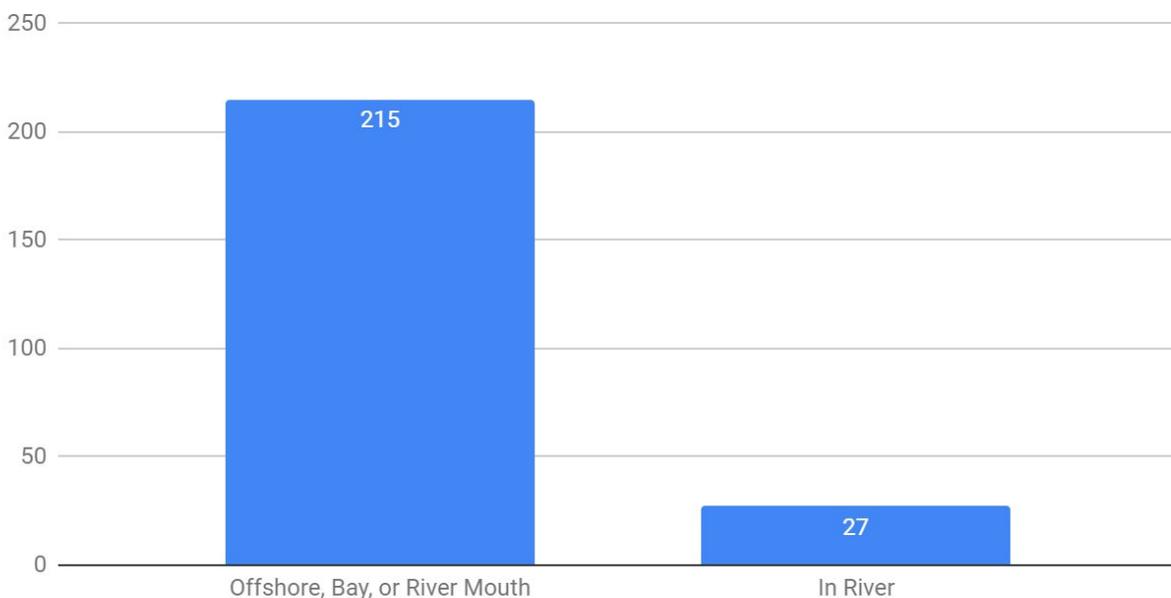
Notably, river-caught bass hosting sea lice tended to be caught later in the season (an average of 28 days later) than river-caught bass unaffected by sea lice due to the fact that it took more time for the migratory striped bass to find rivers.

These data support the use of sea lice as a marker for migratory fish. Most fish caught in rivers represent “holdovers”. Holdovers are fish running down river from lakes, where they have stayed all winter. A holdover would therefore never have the opportunity to be infested with sea lice. The data demonstrates that river-caught fish are much less likely to exhibit sea lice. Those that do exhibit sea lice are caught much later in the season, and likely represent migratory bass running far up river.

Conversely, the majority of fish infested with sea lice were caught in offshore, in bays, or in river mouths. This distribution is much more characteristic for migratory fish. Unlike their upriver counterparts, these migratory fish have had the opportunity to be infected with sea lice in deep water en route to Maine.

Certain factors may influence the observed data. It is known that when sea lice experience a major change in salinity, they die. Migratory fish affected with lice that make their way up river may lose their sea lice in this way, and this may contribute to the lack of sea lice seen on river-caught fish.

What Was the Total Number of Sea Lice Found in Each Location?



(Figure 4)

Conclusion:

The goal of this study was to identify a marker for migratory fish. As the data demonstrates, migratory fish were much more likely than holdovers to be affected with sea lice. Because holdover striped bass would rest in rivers or lakes over the winter, and never get the chance to travel to deep saltwater, where sea lice live. Although there are factors that might influence this data (for example, the effect of salinity on sea lice), the general trend seems to favor the use of sea lice as a marker for migratory fish. My hypothesis appears to be correct: “If sea lice are present on striped bass, then they can be used to determine if a striped bass is migratory or not because sea lice only attach in deep water, where migratory fish travel through in order to reach the Gulf of Maine.” Because this study has shown that sea lice could be used as a marker of a migratory striped bass, it has not only proved my hypothesis, but also added new findings to the scientific community’s knowledge of striped bass. Further investigations might focus on examining chemical data from the striped bass otoliths (ear bones) in order to find the exact origin data of

each migratory fish. The program could be enhanced by using the location data of migratory striped bass and plotting those locations on a map of the Gulf of Maine. The final conclusion of this research proved that sea lice can be used as a marker of a migratory striped bass.

Citations:

Atlantic States Marine Fisheries Commission. "Atlantic States Marine Fisheries Commission." *Species - Atlantic States Marine Fisheries Commission*, 2019 Atlantic States Marine Fisheries Commission, 2019, www.asmfc.org/species/atlantic-striped-bass. This was published by the Atlantic States Marine Fisheries Commission, a source that monitors the prosperity of sea life along the Atlantic Coast. Many researchers work together to create and sustain this page.

MontiSpecial, Dave. "Study: Striped Bass Has Been Overfished." *Providencejournal.com*, Providencejournal.com, 2 May 2019, www.providencejournal.com/sports/20190502/study-striped-bass-has-been-overfished. This site supported the idea that striped bass that were migratory had sea lice. This news source had no bias on this issue and had many fishing guides to support their claim.