The Potential Impact of the Asian Isopod, Synidotea laevidorsalis (Miers 1881), on the Delaware Bay, USA

Basic Information

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2. Boyd, S. An Ecological Assessment of the Non-Indigenous Isopod, Synidotea laticauda, in Delaware Bay. Masters Thesis. Rutgers, The State University of New Jersey, New Brunswick, NJ. In Prep.

Project Summary

i. Problem and Research Objective

The non-indigenous isopod *Synidotea laticauda*[1] was first documented in Delaware Bay in 1999 and recent data indicates extremely high seasonal abundances (Bushek and Boyd 2006). These observations suggest a potentially strong impact on the local ecosystem. To better understand the extent of any impact and the potential for further spread we need to know how *S. laticauda* is distributed in Delaware Bay and how its niche characteristics are likely to influence further establishment. These questions fall under the research goals of the NJWRRI. Specifically, they address the integrity of a New Jersey aquatic ecosystem impacted by a new exotic species. Because its arrival to the Northeast coast is relatively recent, there is a general lack of scientific knowledge about the impact this isopod may have on local ecosystems. This study is the first to address issues relating to the presence of *S. laticauda* in Delaware Bay, and was conducted during its establishment rather than after the fact.

Specific Objectives and Hypotheses

1. Catalogue the distribution and abundance of *S. laticauda* with respect to environmental parameters of the isopod

2. Determine environmental tolerances to temperature and salinity as a mechanism for identifying potential limits to its aquatic distribution

3. Identify potential food resources for *S. laticauda* in Delaware Bay

4. Identify potential predators of *S. laticauda* in Delaware Bay[2]

ii. Methodology Implemented

Distribution

A presence-absence survey was conducted June through September 2006 to establish the distribution of *S. laticauda* throughout Delaware Bay and along the Atlantic coast of New Jersey. Survey sites included marinas, bridges, and beaches, as well as sites accessible only by boat, such as buoy lines and channel markers deployed by local fishermen, researchers and government agencies. Geographic coordinates along with water temperature and salinity were recorded for each site. Local topography and biota were noted and photographed when possible.

Thirty-five sites were surveyed along the New Jersey coastline of Delaware Bay from Pennsville Township (39º 38’ 20 N, 75º 32’ 48 W) to Douglass Park (38º 58’ 05 N, 74º 57’ 45

[1] During the course of this research the taxonomic classification of the species investigated was changed from *S. laevidorsalis* to *S. laticauda*

[2] Objective not initially identified as part of this study but was added during the course of the investigation

W). Twelve sites along the Delaware coastline were surveyed between Fort Delaware Park (39º 34' 17 N, 75º 35' 25 W) and Indian Bay (38º 34 50 N, 75 º 05' 12 W). The Atlantic coast of New Jersey was surveyed at 23 sites between Liberty State Park (40º 43' 34 N, 74º 03' 31 W) and Cape May (38º 56' 43 N, 74º 53' 53 W). Thirty-six navigational channel markers were surveyed by boat on September 16, 2006 between Tuckerton (39º 30' 12 N, 74º 20' 36 W) and Cape May, NJ (48º 58' 15 N, 74º 51' 48 W) along a 150 km stretch of the Intracoastal Waterway. Finally, the Haskin Shellfish Research Laboratory (HSRL) monitors monthly oyster recruitment on Delaware Bay shellfish beds and technicians involved in this project reported appearances of *S. laticauda* on their sampling equipment.

Acute Exposure to Temperature and Salinity

A 48 h acute temperature-salinity challenge assessed the ability of *S. laticauda* to survive an array of temperature and salinity regimes associated with Delaware Bay. Isopods were collected from the Maurice River (39º 13' 58" N, 75º 01' 57" W) and acclimated without food for 72 h in a 10-L aerated aquarium containing room temperature (18-23ºC) river water (20 psu). Twenty liter batches of 5, 15, 20, 25, 30, and 35 psu water were prepared by adjusting water from the Maurice River (18 psu) with Instant Ocean® or de-ionized water and then filtering the water to 1µm. Untreated HSRL well water was used for a salinity of 0. For each salinity treatment, 200 ml of water was added to 15 Carolina culture dishes and divided between five temperature chambers set at 5, 12, 25, 30, and 35 °C. Six isopods were added to each culture dish and survival monitored for 48 h at 4 h intervals. Death was defined according to criteria modified from Kivivuori and Lahdes (1996). Specifically, isopods exhibiting no movement following three prods with a metal probe were scored as dead. Movement included any voluntary swimming, movement of antennae and perepods, or the beating of pleopods (Kensley and Schotte 1989).

Identification of Available Food Resources

Single-choice *in vitro* feeding trials were conducted at HSRL June through August 2006 to identify potential food resources being exploited by *S. laticauda* in Delaware Bay. Isopods were collected from the Maurice River (39º 13' 58" N, 75º 01' 57" W) and acclimated without food for 72 h in a 10-L aerated aquarium containing room temperature (18-23ºC) artificial seawater (25 psu). Eleven commonly occurring aquatic biota were collected from the Maurice River and split among three Carolina culture dishes, each containing 200 ml of artificial seawater. Four isopods were added to two of the three cultures dishes while the third dish was used as a control. Qualitative observations were recorded periodically over 48 h and included the condition of the prey item as well as the level of isopod activity.

Predation Pressure

Gut content analysis assessed whether trophic interactions exist between *Synidotea laticauda* and eight species of fish present in Delaware Bay. Fish were collected June through August, either from a multi-species trap deployed in the Maurice and Nantuxent Rivers or were provided by New Jersey State Biologist and recreational fishermen. Fish collected from the multi-species

trap, as well as those provided by state biologist, were anesthetized in ice water before a scalpel was used to remove the stomach. Recreational fishermen provided filleted fish carcasses which allowed the easy removal of the exposed stomachs. Individual fork length and weight of each fish was recorded when possible. Stomachs were placed in labeled plastic bags and stored at -25°C. In January 2007, stomachs were thawed overnight at room temperature and the entire contents examined under a dissecting microscope for evidence of *S. laticauda*. The distinctive concave shape of the *S. laticauda* telson was used to positively identify the presence of the isopod.

iii. Principle findings and significance

Synidotea laticauda was documented along portions of both the New Jersey and Delaware coastlines of Delaware Bay. However, they were only present in areas where the salinity was between 2 and 20 psu and were generally associated with anthropogenic structures, particularly marinas. Isopods were not observed along the Atlantic coast of New Jersey. At the present time it is unlikely that the northern range of *S. laticauda* in the bay will expand into freshwater portions of the estuary. Temperature-salinity challenges found that isopods died quickly in the freshwater treatments. However, isopods were able to survive in salinities of 30 and 35 psu. This tolerance may allow isopods to expand their range farther south into portions of the bay where higher salinities are prevalent. Temperature-salinity trials also found that *S. laticauda* were capable of surviving in water temperatures typical for Delaware Bay. Although lethargic, isopods experienced very little mortality at 5ºC; however, high mortality (> 65 %) was experienced above 30ºC. The normal upper temperature limit for Delaware Bay is 28ºC (Sharp 1988) and appears to be close to upper limit for this isopod, but is not likely to be limiting, although isopods trapped in tidal pools and shallow waters during summer may not survive the increased temperatures these areas experience.

Several trophic interactions between *S. laticauda* and the biota of Delaware Bay were identified through this study. Single-choice feeding trials identified nine different native fauna and flora that were readily consumed and establish *S. laticauda* as an omnivore capable of exploiting multiple food resources within the Bay. Gut content analysis of fish collected from the Maurice and Nantuxent Rivers indicate that at least four predatory species may consume *S. laticauda*, although the isopod did not appear to be an important component of their diets.

References

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