Annual Report

Ecological Role of Adult and Juvenile Anadromous Forage Fish in Downeast Maine Estuaries: Sea-Run Alewife and Groundfish Predators

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Submitted by

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Work completed to date

- Sampling of the St. George and Damariscotta River estuaries in May/June 2007.
  - We expanded our sampling in 2007 to include two midcoast estuaries, as suggested in the original proposal reviews, with the hopes of catching more cod and other commercially viable groundfish. Two additional fishermen, both currently lobstermen, were contracted to work in the waters in and around the St. George and Damariscotta River Estuaries. Our St. George River fishermen fished groundfish through the 1980s. Neither had ever actually fished in the estuary proper, but rather just outside of it. We initiated the use of baited groundlines to augment our catch, but found that in the midcoast region most hooks were stripped of bait within the 3-hour soak period by small non-target fish or crustaceans (see below).
- Assessing alewife spawning run abundance through the:
  - Successful installation of video counting equipment at Damariscotta Mills fish ladder.
    - We will be able to evaluate the assumption that Damariscotta Mills is a "high alewife" system for 2007. Video equipment installed at the top of the fish ladder will provide an accurate count of spawning escapement to the lake. When combined with harvest data from 2007 we should have a relatively complete accounting of how many alewives reached the harvest point at Damariscotta Mills, and therefore traversed the estuary during their migration.
  - Construction and installation of experimental weir at Sennebec Pond, St. George River, as well as video assessment equipment.
    - The majority of adult alewife data from the St. George River will come from harvest records from 2007. However, we did make a first step towards establishing harvest-independent counts in 2007. A floating weir design was tested in the upper watershed. The site chosen actually receives a small proportion of the total run, but

the weir design was sound and should be deployable in areas lower in the watershed where all of the spawning adults pass through. This design should be able to withstand the higher flows in this lower portion of the river, thus making a more complete accounting and assessment of "high alewife" possible in 2008.

- Completed diet assessment from 2006 sampling. All of the diets from the 2006 sampling season catch (Table 1) have been processed.

Table 1: Handline catch from Gleason Cove and Eastport area in 2006. An additional seven fish (two longhorn sculpin and five shorthorn sculpin) were caught in the Dennys River estuary in 2006 but are not included in these totals.

Species	Month	May	July	August
shorthorn sculpin	#individuals	26	26	36
	Ave. length	29.8 cm	31.9cm	32.4 cm
	Ave. weight	522 g	569 g	612 g
Mackerel	#individuals			56
	Ave. length			28.5cm
	Ave. weight			194.5 g
Dogfish	#individuals			3
	Ave. length			78.2 cm
	Ave. weight			1916 g
longhorn sculpin	#individuals	8	12	2
	Ave. length	31.1 cm	30.6 cm	31.1 cm
	Ave. weight	302 g	311 g	466g

Diet composition was assessed using the Index of Relative Importance (IRI). The IRI combines the occurrence of diet items across the catch, the numerical abundance of diet items, and the weight of diet items into a single index value that summarizes the importance of individual items in the diet of a species. For longhorn sculpin and shorthorn sculpin across all three sampling periods amphipods in the family Gammaridae were the most important diet item (Figs. 1 & 2). Fish were the most important diet item for mackerel followed by copepods (Fig. 3). However, the importance of copepods may reflect the occurrence of copepods in the stomachs of prey fish (primarily herring) found in the mackerel. Amphipods were again an important food item suggesting that for many fish species in the region amphipods play an important role in the food web. Alewife were not found in any diets.

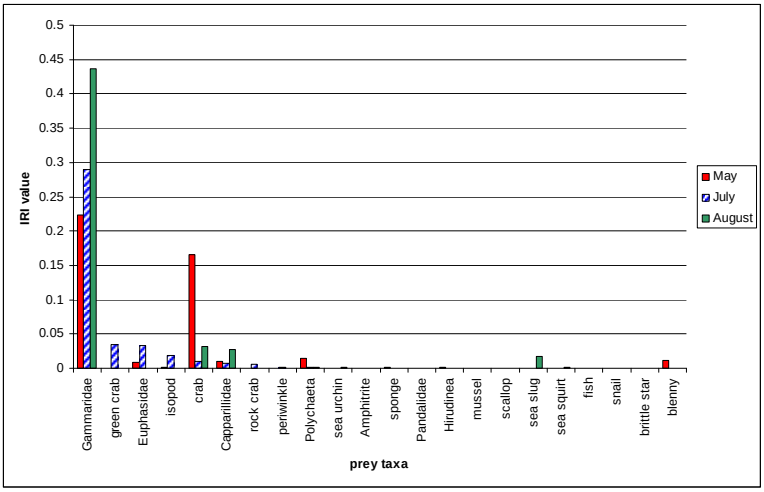
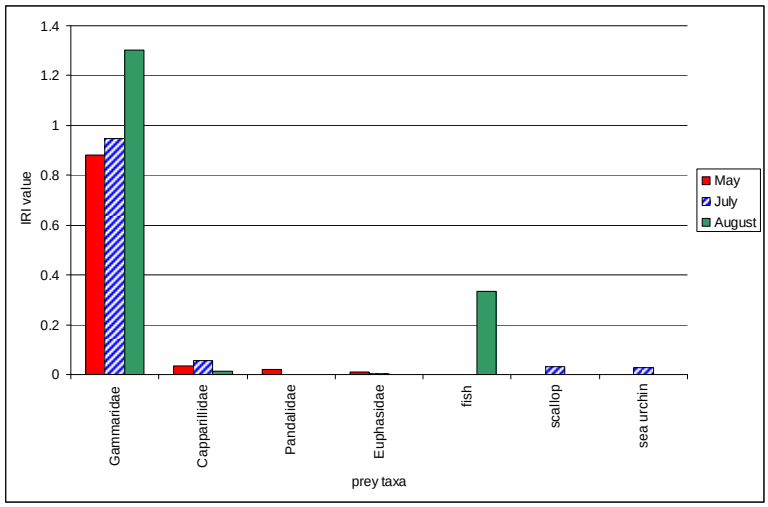


Figure 1: Shorthorn sculpin major diet items and Index of Relative Importance values, Passamaquoddy Bay, 2006.

Figure 2: Longhorn sculpin major diet items and Index of Relative Importance values, Passamaquoddy Bay, 2006.



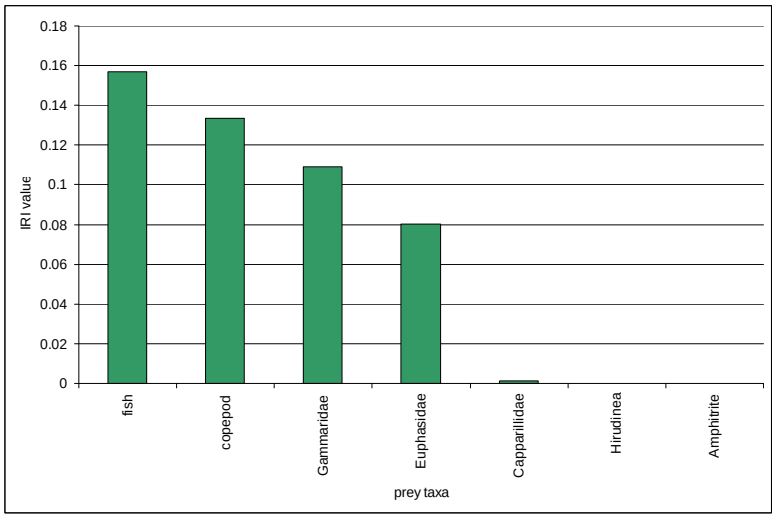


Figure 3: Mackerel major diet items and Index of Relative Importance values for Passamaquoddy Bay, August 2006. Fish diet items were almost exclusively Atlantic herring.

Methods and work plans - 2007

1. **Lack of large fish predators.** Despite considerable fishing effort (Table 2), and adding sampling sites in midcoast estuaries, we encountered relatively few predatory groundfish in our spring 2007 sampling session. This suggests several potential issues: (1) that predatory groundfish large enough to prey upon spawning alewife in the spring are scarce in nearshore waters, leaving birds, marine mammals, and humans as the major predators of spawning

Table 2: Fishing effort expended in the St. George and Damariscotta River Estuaries in May 2007. Catch rates were very low.

Damariscotta Estuary 2007		
Gear	**Total set time (hours)**	**Effort per fish (hours)**
Handlines	149.88	21.41
Groundlines	1911.88	637.29
Traps	75.00	9.38

St. George Estuary 2007		
handlines	122.43	no fish caught
groundlines	1419.87	1419.87
traps	69.37	34.69

alewife. The role of alewife as forage for nearshore commercially important fish species may be greatest in the late summer and fall when smaller, more easily consumed young-of-year alewife migrate into estuarine and nearshore habitats. Sampling scheduled for August and October will explore this hypothesis. (2) Baited tub trawls and baited and unbaited hand lines are insufficient to catch groundfish in the nearshore. It is possible that spring water temperatures were too low for active feeding, but we were able to catch sculpin in the nearshore (Passamaquoddy Bay) in spring 2006 at similar temperatures. (3) Bait loss from groundline hooks appeared to reduce the effectivness of the groundlines. In most cases less than 10% of the hooks still had bait when retrieved after a three hour soak. Our initial thought was that it was difficult to secure bait to a size 10/0 circle hook and thus bait was falling off. However, bait retention for a larger J style hook was similar to what we recorded for circle hooks, despite being baited by experienced fishermen. We suspect that, in the nearshore midcoast region, demersal scavenger densities may be high enough to completely denude hooks in the 3 hours set period. To assess this possibility, we will be adding a Baited Video Observation Station (BVOS) to our sampling efforts in July and August to assess bait retention on the hooks and identify if bait is being lost to demersal scavengers, groundfish that are not being hooked, or if the bait is simply falling off the hooks.

2. **Inability to replicate May/June sampling in Passamaquoddy Bay.** We were unable to work with our 2006 Downeast fisherman due to (1) policy changes at the University of Southern Maine concerning liability insurance on fishing boats used for collaborative research, (2) financial difficulties on the part of the fisherman (i.e., engine troubles after a mishap in the fall). We plan on sampling Passamaquoddy again in August 2007 with another fisherman in the area. We are currently in negotiation concerning price per day and methodology. The average 15' tides in Passamaquoddy Bay may make it impossible to set groundlines for only three hours (as in our mid-coast protocol) although handlining will still be possible.

Project objectives and scientific hypotheses

Our original objectives were to compare the diets of potential predators in one high alewife estuary to one low alewife estuary per summer, with a total of four estuaries in the experimental design. Several changes have been made (Table 3), and this year we have yet to sample an estuary we consider to be a low alewife system. At this stage we have had enough difficulty catching groundfish predators in early spring that it appears that groundfish predators are not present in the estuaries and bays when alewives are on their spawning run. We expect that the July/August sampling will confirm that our methods are effective and that either the water temperatures were too low and/or there were no fish present in May/June at our study sites. If the BVOS is effective, we may expand use of that method in 2008 to address presence/absence questions regarding groundfish in the nearshore.

Table 3: Sampling design

	High alewife numbers	**Low alewife numbers**
2006	Denny's Bay	Gleason Cove
2007 (using remaining funds from 2006)	Damariscotta River Estuary, St. George Estuary	Gleason Cove/mouth of Passamaquoddy Bay
2008 (possible no cost extension from 2007)	Damariscotta River Estuary, St. George Estuary	Gleason Cove/mouth of Passamaquoddy Bay

Steps/tasks for next 6 months

- Begin processing diets collected in May/June 2007.
- Continue processing recorded video of alewives entering Damariscotta Lake.
- Sample Damariscotta and St. George estuaries again in July/August 2007.
- Sample Passamaquoddy Bay in August 2007.
- Assess bait retention and scavenging in July/August 2007

Impacts and applications

Thus far, our largest impact on the fishing community is one of raising awareness of alewife runs and their potential impact on marine fisheries resources. The process of arranging to count alewife runs has brought us as scientists in contact with many members of the local community, including local lobstermen who sell or buy alewives for early spring bait, and has proven to be a foray into a politically charged fishery with many competing interests.

Our second largest impact would be with the fishermen we work with directly. During the June sampling both boat captains and their crew members recounted stories of fishing in the areas where we were working and catching fish. They were surprised that as far out as 6 miles from the mainland they could not catch any fish, let alone a cod or other large predator, in areas where a decade earlier a 24 hr. tub trawl/groundline would have caught at least some desirable species.

We have increased the educational aspect of this effort by involving more fishermen in our midcoast sampling. We have also created opportunities for collaboration with municipalities in Nobleboro, Newcastle, Warren, and Waldoboro, and community groups with a resource focus (e.g., Quebec Labrador Foundation/Atlantic Center for the Environment, Trout Unlimited, Georges River Land Trust, Damariscotta River Association).

Partnerships with fishermen

Although our collaborating fishermen were not involved with the initial design of this project, they contribute greatly to the day to day operations, helping us find historical fishing areas and imparting invaluable local knowledge. When your livelihood depends on catching fish, its rare to have the 'luxury' of catching zeros, which has spawn some interesting conversations on board.

Related projects

Work on counting alewives in the St. George River was funded through a Gulf of Maine Council/NOAA habitat restoration partnership grant to T. Willis. Alewife spawning run counts in the Little River (Gleason Cove, Passamaquoddy Bay site) were conducted this spring by collaborators associated with the Passamaquoddy Tribe with advice based on our experiences in the summer of 2006. The Passamaquoddy Tribe has a deep-seated interest in the alewife fisheries of old (as does the Town of Perry).

Presentations

Karen Wilson, Theodore Willis and David Turner. Ecological Role of Adult and Juvenile Anadromous Forage Fish in Downeast Maine Estuaries: Sea-Run Alewife and Groundfish Predators. Poster, NEC Annual Meeting, Fall 2006.

Student participation

Three undergraduate students from the University of Southern Maine and University of Maine have assisted in diet analyses and fieldwork during 2006-2007. All three students have an interest in marine biology, and, as importantly, in fisheries issues.

Signature and date

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Karen A. Wilson Date

Attachments: An electronic copy of our NEC 2006 poster is available by request, as are numerous photos.