Ecological and Management Implications of Climate Change Induced Shifts in the Phenology of Alewife (Alosa pseudoharengus)

Ecological and management implications of climate change induced shifts in phenology of alewife

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ABSTRACT

This project seeks to improve our understanding of shifts in the timing of seasonal migration and spawning of adult anadromous alewife, *Alosa psuedoherengus* in seven natal stream systems within Massachusetts (see Table 1 below): Acushnet, Agawam, Herring, Jones, Nemasket, Stoney Brook, and Town Brook Rivers. Project results will help managers assess the vulnerability of alewife and other coastal species to the interactive effects of environmental and anthropogenic stressors influencing their populations across the region.

OBJECTIVES

- Synthesize timing data of alewife spawning migration runs in Massachusetts
- Evaluate trends in phenology across Massachusetts spawning runs
- Determine the relationship between the area of downstream wetland habitat and spawning run strength among alewife populations in Massachusetts

METHODOLOGY

- Conduct preliminary literature search
- Synthesize alewife phenological datasets from Massachusetts spawning runs
- Assemble and organize datasets into a single database
- Examine if and how the direction and magnitude of annual spawning run initiation, peak and end dates have shifted over recent decades using linear regression
- Use ArcGIS and MassGIS wetlands and hydrology layers to quantify wetlands around study sites

Table 1: SUMMARY OF STUDY SITES

SITE	YEARS OF DATA COLLECTED	LOCATION	# OBSTRUCTIONS*
Acushnet	2005 - 2015	New Bedford	3
Agawam	2006 - 2015	Wareham	5
Herring	2009 - 2015	Harwich	3
Jones	2005 - 2015	Kingston	3
Nemasket	1998 - 2015	Middleboro	6
Stoney Brook	2007 - 2015	Brewster	1
Town Brook	2010 - 2015	Plymouth	6

* # Obstructions refers to barriers for fish passage within each run, i.e. dams with fishways, culverts, etc.

PRELIMINARY RESULTS

Initial analyses examined if and how the direction and magnitude of annual spawning run initiation, peak and end dates have shifted over recent decades. Preliminary results suggest that changes in alewife migration timing are not consistent across runs within Massachusetts.

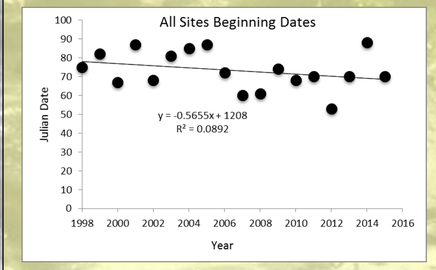


Figure A

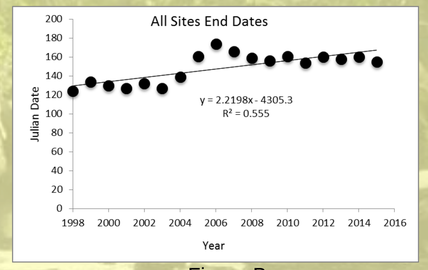


Figure B

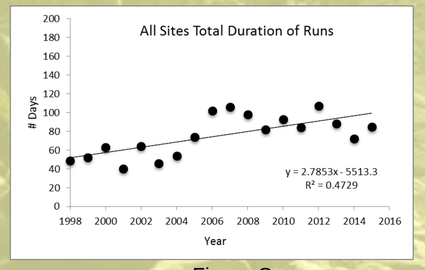


Figure C

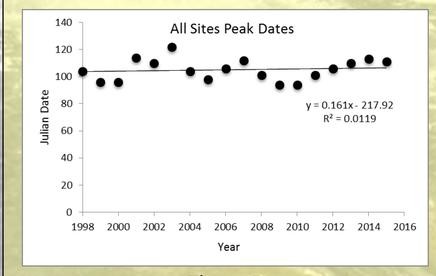


Figure D

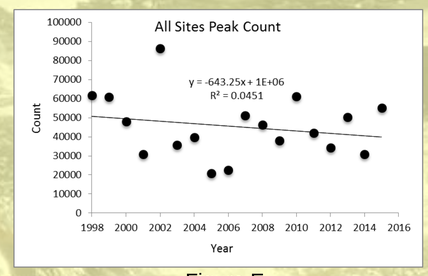


Figure E

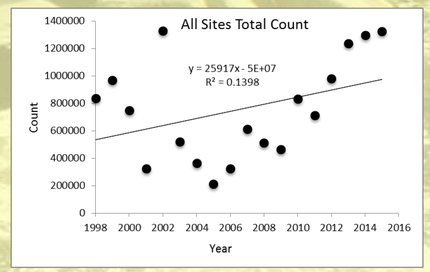
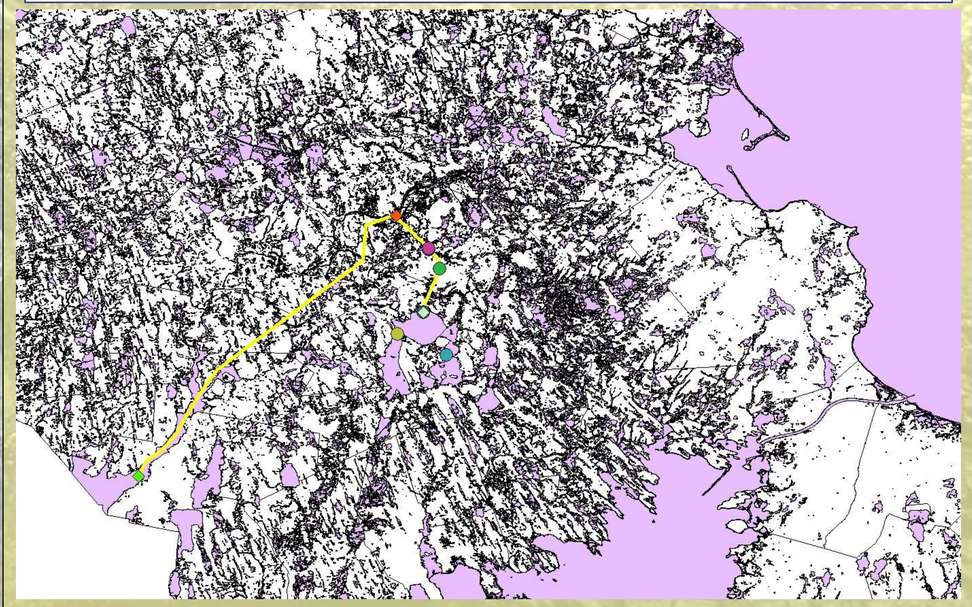


Figure F

Trends from an analysis of all sites show a shift to earlier timing in run initiation dates (A) and later run end dates (B). Average run length has increased over the study period (C). Peak dates of the runs have remained consistent on average (D), while peak count is simultaneously decreasing (E). Total count of alewife spawning per year across all sites has increased (F).

Figure 2: GIS Map of the Nemasket spawning run, and major points of passage



The approximated length of the Nemasket run is 45,000 meters.

Alewife in Nemasket River, MA
Image courtesy of NOAA Photo Library

DISCUSSION

Preliminary analysis shows that changes in run timing and counts of alewife are variable across study sites. However, the timelines (# of years) of data collection at different sites vary, potentially affecting results. For example, Town Brook count data is only available for the past five years, while Nemasket counts extend back to 1998. Ongoing analysis of temperature, river flow, area of downstream wetland habitat and other environmental factors will likely explain differences among sites. If populations are indeed found to be declining over time with warming temperatures and loss of wetland habitat, this study could be useful to policy makers attempting to enact protections for alewife populations.

FUTURE WORK

Ongoing work seeks to evaluate the extent of estuarine habitat availability around each of the seven alewife run sites; this will be accomplished by measuring the area of continuous wetland habitat downstream from alewife spawning ponds.

ACKNOWLEDGEMENTS

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