ME Unit Annual Report

Loftin 2006

FISH HOSTS AND POPULATION STRUCTURE OF THE YELLOW LAMPMUSSEL (*Lampsilis cariosa*) AND TIDEWATER MUCKET (*Leptodea ochracea*) IN MAINE

Investigator: J. M. Rhymer
A. Huryn
M. Kelly
P. Wick
S. Kneeland

Cooperators/ Project Support:
Maine Department of Inland Fisheries and Wildlife
Maine Outdoor Heritage Fund
USGS-BRD Eastern Region State Partnership Program
USFWS Endangered Species Program
Maine Cooperative Fish and Wildlife Unit
University of Maine
Department of Wildlife Ecology
MAFES (Hatch)

Objectives:

1) Increase our understanding of the demography and genetic structure of populations of yellow lampmussel and tidewater mucket in Maine.
2) Identify host fish species for these mussel species and relate host fish and mussel distributions.
3) Spatially relate the genetic and demographic composition of existing populations of tidewater mucket and yellow lampmussel to landscape factors.

We are collaborating with Dr. Cynthia Loftin (MCFWRU) to identify landscape scale factors that indicate suitable mussel and host fish habitat (Landscape Control of the Distribution of Two Rare Atlantic Slope Freshwater Mussels in Maine). Results of that study are presented in a separate report entry (page 7).

SCOPE: Maine's rarest mussels, the tidewater mucket, *Lampsilis ochracea* and yellow lampmussel, *Lampsilis cariosa*, are listed as threatened in the state and as endangered, threatened or of special concern by states elsewhere in their northeastern range. They occur as fragmented populations in three watersheds in central Maine - the Kennebec, Penobscot and St. George. By virtue of the high quality of its water resources and the absence of zebra mussels, Maine has some of the last significant populations of these mussels. These watersheds could well serve as important refugia for *Lampsilis ochracea* and *Lampsilis cariosa* if populations along the Atlantic slope are extirpated. Although the current distributions of the tidewater mucket and yellow lampmussel have been well documented in Maine, conservation efforts are hampered by lack of knowledge of: 1) fish host(s) and factors affecting their distribution, 2) population age (viability) and genetic structure (degree of isolation), and 3) effects of disconnected or deteriorating habitat quality on mussel distribution. Isolation of mussel populations could affect their age structure, reproductive potential and population viability, and also promote genetic divergence among populations. Understanding patterns of genetic differentiation among populations will provide a rationale for determining whether their metapopulation should be managed as one or several distinct conservable units, and may provide a more logical basis for understanding factors responsible for the present-day distribution of these mussels in Maine.

PROJECT STATUS: Laboratory experiments revealed that white perch (*Morone americana*) is a probable host for both yellow lampmussel and tidewater mucket and yellow perch (*Perca flavescens*) may also be a host for yellow lampmussel. Population age structure has been analyzed for several populations of each mussel species and genetic analyses are complete.

FUTURE PLANS: DNA analysis is underway to determine if fish species other than those identified in the lab are used in nature by tidewater mucket and yellow lampmussel. MS theses on fish hosts and population structure will

the island of Newfoundland. Since the early 1900s, the Newfoundland marten has declined both in numbers and distribution; excessive trapping, in combination with habitat loss due to logging and fire, are suggested as the major factors contributing to the early decline. In 1934, commercial trapping for marten was closed on the island. Despite this protection, marten populations continued to decline. Today, trapping for marten remains closed, but some number of marten are killed each year in traps and snares set for other furbearers and snowshoe hares (*Lepus americanus*). In 1973, the Pine Marten Study Area (PMSA) was established in southwestern Newfoundland and is generally considered to contain the largest concentration marten remaining on the Island. The PMSA is closed to all land-based trapping and snaring. In 1986, the status was uplisted to Endangered.

Earlier work on Newfoundland marten was conducted within the PMSA and focused on the effects of timber harvesting on "old growth" habitat and addressed the underlying association of Newfoundland marten with old growth (81 + year-old balsam fir (*Abies balsamea*) forests. In general, these studies concluded that loss of old growth habitat through clearcut logging was limiting the distribution and recovery of marten in Newfoundland. Subsequent work in the mid 1990's, examined forest structure and prey densities in forest of various ages, and suggested that marten in Newfoundland are restricted to mature and overmature balsam fir due to the lack of prey in younger stands. An alternative hypothesis is that marten in Newfoundland are restricted in distribution due to habitat security, that is, marten occupying second-growth stands have increased mortality due to incidental snaring and trapping.

In 1995, a 5-year cooperative project to determine the basic population characteristics of Newfoundland marten, particularly in relation to old-growth habitat was initiated. The goal of the project is to evaluate these competing explanations for the historical decline and current restricted distribution of Newfoundland marten. Field work began in June 1995 and in 1996 a second study area was added. This second area was outside the PMSA and was centred near Red Indian Lake in south-central Newfoundland. This area had what was believed to be a newly-established (< 10 years) marten population. It was assumed, that due to past forest harvesting, the RIL study area had a recently established, low-density marten population occurring in sink habitat. Following the analysis of factors influencing habitat selection and restriction, we hope to develop forest and wildlife management recommendations for the conservation and management of Newfoundland marten.

PROJECT STATUS: Between January and March 2005, a landscape-scale habitat analysis was completed as a companion analysis to the stand-scale habitat selection conducted in 2004. The landscape-scale analysis was a cooperative research effort with A. Fuller (PhD Candidate – Department of Wildlife Ecology – University of Maine) and complementary to her efforts to develop a predictive habitat model for Newfoundland marten. Results of the landscape-scale analysis were combined with the previous stand-scale habitat analysis in a final contract report entitled: *Scale-dependent habitat Selection by Newfoundland Marten 2005: B. J. Hearn, D. J. Harrison, C. Lundrigan, W. J. Curran, and A. K. Fuller*. This report was submitted to project co-operators in May 2005. The report was also presented to the national COSEWIC (Committee on the Status of Endangered Wildlife in Canada) Newfoundland Marten Recovery Team, as well as provincial natural resource managers, and forest industry partners. In June 2005, the habitat definitions, guidelines and management recommendations outlined in the report were adopted by the Newfoundland Wildlife Service and the Marten Habitat Assessment Working Group as the new provincial standards.

Additionally, we completed a meta analysis of marten diet in Newfoundland as a companion study to out habitat selection work to further investigate the potential mechanisms underlying local habitat associations. The research paper summarizing the work is in press in Canadian Field Naturalist.

FUTURE PLANS: Future work will focus on the preparation of 2 journal manuscripts (dissertation chapters) from the results presented within the final contract report prepared in 2005. The first paper will focus on spatial characteristics of Newfoundland marten while the second paper will summarize the analysis concerning habitat selection patterns of Newfoundland marten. A third and final journal manuscript (dissertation chapter) will be developed during winter 2006 concentrating on survival, cause-specific mortality, and population demography of marten in Newfoundland. The three chapters will comprise the Ph.D. dissertation, which is scheduled for completion in 2006.

be completed.

LANDSCAPE CONTROL OF THE DISTRIBUTION OF TWO RARE ATLANTIC SLOPE FRESHWATER MUSSELS IN MAINE, THE YELLOW LAMPMUSSEL (*Lampsilis cariosa*) AND THE TIDEWATER MUCKET (*Leptodea ochracea*)

Investigators: C.S. Loftin

Cooperators: USGS-BRD Eastern Region State Partnership Program
University of Maine
Department of Wildlife Ecology
Department of Biological Sciences
Maine Cooperative Fish and Wildlife Research Unit

Objectives: Identify landscape-scale factors indicating suitable habitat for yellow lampmussels and tidewater muckets in Maine.

(This study is part of larger study developed under the USGS State Partnership Program with Drs. Judith Rhymer and Alex Huryn at the University of Maine. The final project report combined with the results of Dr. Rhymer's and Dr. Huryn's study (reported in the previous project summary).

SCOPE: The declining condition of the world's aquatic environments is resulting in a loss of aquatic biodiversity. Freshwater bivalves are experiencing drastic declines in distribution and number due to a variety of disturbances. North America contains the greatest diversity of freshwater bivalves in the world, yet more than half of the remaining species are threatened with extinction. Although in many cases mussel decline can be attributed to manipulations of the local environment, forces at a larger scale may contribute to the occurrence and structure of mussel communities. Cumulative effects of upstream and stream-side land uses and hydrological modifications may affect mussel occurrence in a watershed, potentially deteriorating quality of occupied sites or leading to population isolation due to unsuitable hydrological conditions between occupied sites. These modifications may lead not only to a change in mussel community composition, but also to a change in ecosystem structure and function resulting from modification of the density and composition of the bivalve community. However, mussel distributions may also be somewhat independent of habitat conditions and more tightly regulated by abundance and diversity of host fish. Efforts to conserve North America's remaining mussel populations must recognize the complexity of relationships among potential determinants of mussel community composition, distribution, and demography and the multiple scales at which those relationships occur.

Distributions of Maine's mussel species have been documented by Maine's Department of Inland Fisheries and Wildlife (MDIFW). The tidewater mucket (*Leptodea ochracea*) and the yellow lampmussel (*Lampsilis cariosa*) are state-listed as threatened species due to their scattered, declining populations. The relationships of these mussel distributions to watershed conditions such as stream connectivity, dam locations, riparian land use, and hydrological condition have not been examined. Identification of landscape- and local-scale conditions of stream reaches, river segments, and ponds and lakes occupied by these mussels is critical to conservation of these mussel species. Given that Maine contains some of the last, significant populations of the tidewater mucket and yellow lampmussel in eastern North America, and its watersheds are relatively undeveloped, conservation of these species may hinge on protection of the populations that remain in Maine.

PROJECT STATUS: The spatial database of mussel population distribution and watershed characteristics was developed, data analysis was completed, and a final report was prepared. Watershed analysis indicated that tidewater muckets and yellow lampmussels occupy aquatic sites with similar characteristics. Both species were found in streams with forested riparian zones as the dominant cover type. There was a greater proportion of wetland area in the reach and contributing watersheds where these species were found than was present statewide,

and wetland comprised a greater proportion of the buffer of reaches occupied by tidewater muckets than in reaches where yellow lampmussels were found. In the region where these species occur, streams that did not contain these species had more forest cover and less wetland streamside in the reach catchments than in reaches where the species was present. Yellow lampmussels and tidewater muckets occupy reaches that are longer, have larger contributing areas, more upstream connecting first order streams, and lower gradients than reaches that are not occupied by these species. These reach characteristics indicate conditions that create hydrological stability, a feature suggested in other mussel studies to be a useful predictor of yellow lampmussel occurrence and mussel community composition. Tidewater muckets were found more often in reaches connected upstream to shorelines of large streams or rivers and downstream in reaches connected to shorelines of large streams and lakes; downstream connections were less often to small streams. The number of dams did not differ between reaches with and without tidewater muckets, but the total dam height per stream mile in the contributing area of sites without muckets exceeded the cumulative height per stream mile for sites with muckets. Percent calcareous bedrock in the cumulative upstream drainage area was greater in reaches containing tidewater muckets than where they were not found, reflecting the near-coastal distribution of the species in Maine. Yellow lampmussels were found at sites most often connected to streams and shorelines of large rivers and less often to lakes, and stream order was greater and cumulative watersheds larger where this species was found. Number of upstreams dams was not different between reaches with and without yellow lampmussels, although cumulative dam height per stream mile in the contributing area was less where the species occurred than where it was not found. In contrast to watersheds occupied by tidewater muckets, those where yellow lampmussels were found contained less calcareous bedrock in the cumulative upstream drainage area. Attempts to develop logistic regression models of watershed features where tidewater muckets and yellow lampmussels were found were unsuccessful; the low numbers of sites containing mussels distributed across a broad range of conditions resulted in unreliable models.

FUTURE PLANS: The final project report will be completed in December 2005.

EFFECTS OF SNOWSHOE HARE (*Lepus americanus*) DENSITY AND LANDSCAPE CHARACTERISTICS ON HABITAT USE BY CANADA LYNX (*Lynx canadensis*) IN MAINE

Investigator: L. L. Robinson

Advisors:
D. J. Harrison, Co-chair
W. B. Krohn, Co-chair
J. S. Wilson
M. A. McCollough
W. J. Jakubus

Cooperators/ Project Support:
Maine Cooperative Fish and Wildlife Research Unit
Maine Department of Inland Fisheries and Wildlife
Maine Cooperative Forestry Research Unit
U.S. Fish and Wildlife Service
University of Maine
Department of Wildlife Ecology
McIntire-Stennis
Graduate Research Assistantship
The Nature Conservancy
Clayton Lake Woodlands
Huber Resources Corporation
Irving LLC
National Council on Air and Stream Improvement

GENETIC IDENTIFICATION OF FISH HOSTS FOR THE YELLOW LAMPMUSSEL (*Lampsilis cariosa*) AND TIDEWATER MUCKET (*Leptodea ochracea*)

Investigator: S. C. Kneeland

Advisors:
J. M. Rhymer, Chair
C. S. Loftin
M. Kinnison
J. Zydlewski

Cooperators/ Project Support:
Maine Department of Inland Fisheries and Wildlife
Maine Outdoor Heritage Fund
USGS State Partnerships Program
Maine Agricultural and Forestry Experiment Station - Hatch
University of Maine
Department of Wildlife Ecology

Objectives:

1) Develop a genetic identification key for *Lampsilis cariosa* and *Leptodea ochracea* and other freshwater mussel species in Maine with overlapping distributions.
2) Compare known distributions of *Lampsilis. cariosa* and *Leptodea ochracea* and life history characteristics of these species with fish in Maine to predict likely hosts in the wild.
3) Sample naturally parasitized fish in localities where *Lampsilis. cariosa* and *Leptodea ochracea* occur to confirm and/or designate fish as suitable hosts.

SCOPE: North America has nearly 300 species of freshwater mussels, yet nearly 72% are of special concern, threatened, endangered, or possibly extirpated. Reasons for decline are largely anthropogenic, as mussels have been subjected to habitat loss or alteration due to channelization, siltation, eutrophication, and river impoundment. In Maine, the yellow lampmussel (*Lampsilis cariosa*) and tidewater mucket (*Leptodea ochracea*) are found in only three watersheds and are state listed as threatened.

Yellow perch (*Perca flavescens*) and white perch (*Morone americana*) are probable hosts for the yellow lampmussel, and white perch is a probable host for the tidewater mucket. However, it is possible that other host species not yet tested exist for both mussel species. This study will involve creating a genetic identification key that will be used to identify glochidia attached to naturally parasitized fish in the wild. The genetic identification key will be developed by collecting tissue samples from known adult mussel species. Glochidia will be removed from naturally parasitized fish and identified with the key to confirm or designate fish as suitable hosts for the yellow lampmussel and tidewater mucket.

The conservation of some freshwater mussels is limited by inadequate knowledge of host species. The spread of exotic species, illegal stocking, and dam removal has caused some fish communities to change in many areas. Therefore, knowledge of host species in changing or stable fish communities is essential for mussel conservation.

PROJECT STATUS: A total of 256 tissue samples have been obtained representing eight mussel species that coexist with the yellow lampmussel and the tidewater mucket. Samples were obtained from multiple populations throughout the Kennebec, St. George, and Penobscot River drainages. Laboratory work is underway to develop a genetic identification key.

A pilot study to evaluate methods of catching fish, rates of parasitism, and species parasitized was performed. Fish capture continued in the following field season throughout the Kennebec, St. George, and Penobscot River drainages. A total of 396 fish gill or fin specimens with glochidia attached were kept for identification of glochidia using the genetic identification key. Laboratory work to identify glochidia is currently underway.

FUTURE PLANS: Complete laboratory work to identify glochidia on naturally parasitized fish, write and defend thesis.

HABITAT SELECTION, RELOCATIONS, AND FISH HOSTS OF THE YELLOW LAMPMUSSEL (*Lampsilis cariosa*) AND TIDEWATER MUCKET (*Leptodea ochracea*) IN MAINE

Investigator: J. Kurth

Advisors:
J. M. Rhymer, Co-chair
C. S. Loftin, Co-chair
J. Zydlewski
M. Kinnison

Cooperators/ Project Support:
Maine Department of Inland Fisheries and Wildlife
Maine Outdoor Heritage Fund
USGS – State Partnerships Program
Maine Cooperative Fish and Wildlife Research Unit
University of Maine
Department of Wildlife Ecology
MAFES (Hatch)

Objectives:
1) Analyze habitat selection of yellow lampmussel and tidewater mucket in Maine to determine potential suitable locations for these species in the Kennebec drainage and elsewhere in Maine.
2) Measure survival, growth and movements of resident and translocated populations of these species to determine efficacy of experimental relocations in the Sebasticook River drainage.

SCOPE: Potential removal of the Fort Halifax dam on the Sebasticook River is currently under review. Its removal would strand populations of yellow lampmussel and tidewater mucket during dewatering, and as such, would present a unique situation in North America, in that dam removals have not affected listed mussel species in other cases. Even if the Fort Halifax dam is not removed, petitions to remove dams in Maine are expected in the future. Our data will provide insight into the current and potential distribution of these species and their fish hosts, as well as provide information on the potential success of using mussel relocation as a tool to minimize effects of dam removals. This information will assist agencies in conservation planning for and recovery of protected mussel species.

PROJECT STATUS: Qualitative mussel surveys of the Sebasticook impoundment and experimental translocations were completed within the impoundment and at two other localities within the same drainage. Experimental use of PIT tags for freshwater mussel relocations was explored. Quantitative mussel surveys in the Sebasticook River impoundment were completed, and translocation experiments will continue for another year.

FUTURE PLANS: Mussels in the three study areas will be resurveyed in early summer 2006 to determine survival and recapture success. Summary of PIT tagging experiments are underway. Project completion is anticipated in December 2006.
