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Integration of Larval and Juvenile/Adult Studies of Ichthyofauna in Les Cheneaux Great Lakes Marshes

Paul W. Webb,
University of Michigan Biological Station,
and
School of Natural Resources and Environment,
Department of Biology,
The University of Michigan,
Ann Arbor, MI 48109-1115.

Telephone: 734-763-2332
FAX: 734-936-2195
e-mail: pwebb@umich.edu

James S. Diana,
School of Natural Resources and Environment,
The University of Michigan,
Ann Arbor, MI 48109-1115.

Telephone: 734-763-5834
FAX: 734-936-2195
e-mail: jimd@umich.edu

and

James S. Teeri,
The University of Michigan Biological Station,
1111 Natural Science,
Ann Arbor, MI 48109-1046.

Telephone: 734 763-4461
FAX: 734-647-1952
e-mail: jateeri@umich.edu

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I. Integration of Larval and Juvenile/Adult Studies of Ichthyofauna in Les Cheneaux Great Lakes Marshes

A. Studies Performed

Fishes of the Great Lakes marshes in Les Cheneaux have been sampled for the past three years. The individual studies performed have been described in annual reports, although the project is sufficiently large that data analysis is ongoing for most of these as additional data are obtained. Studies are:

- Phenology of post-larval fish communities in seasonal marsh and adjacent open waters of Cedarville, Mackinac, Mismar (1996, 1997, 1998) and St. Martins Bays (1996).
- Phenology of larval fishes in permanent, seasonal and adjacent open waters of Cedarville, Mackinac and Mismar Bays (1997, 1998).
- Growth and age structure of post-larval fish populations from scale analyses (1996, 1997).
- Growth and age structure of post-larval, small-bodied fish populations using analysis of length-frequency data (1996, 1997).
- Growth and age structure of larval fish populations using analysis of length-frequency data (1997).
- Food habits of post-larval fishes from stomach analysis (1998).
- Macrophyte characteristics of permanent marsh fish habitat for Cedarville, Mackinac and Mismar Bays (1998).
- Water chemistry in permanent marsh fish habitat for Cedarville, Mackinac and Mismar Bays (1998).
- Quantification of human development indicators for Cedarville, Mackinac, Mismar Prentiss, McKay and Bays (1998).
- Preliminary test of rapid assessment method in Cedarville, Mackinac, Mismar Bays, Prentiss, McKay bays (1998).
- Assessment of light trapping for larvae in Cedarville Bay (1998).

B. Personnel

The project to date has provided rich educational opportunities for graduate and undergraduate students. Education components are summarized in Table 1. To date, three faculty, five graduate students and 14 undergraduate students have been involved as field crew, in research theses, independent studies, and as part of classes at the University of Michigan Biological Station.

Table 1: Personnel and primary products deriving from the Les Cheneaux Great Lakes Marsh bay fish sampling studies from 1996 to 1998.			
Principal Investigators		Student Theses	
Paul W. Webb. James S. Diana. James A. Teeri.		Megan Conlon. Natalya Eagan. Tomas Hook. Laura Welsh.	
Class projects derived from the Les Cheneaux data.			
Natalya Eagan - Water resources policy and development in Les Cheneaux. Tomas Hook - statistical analysis of age and size data from scales. Heather Farrington - human impacts on Les Cheneaux Bays. Amy Schrank - application of GIS for spatial data organization and analysis. Laura Welsh - further application of GIS techniques. Michelle Jacques, Erica Gwynn, Sara Marcotte-McKay - preliminary tests of simple sampling techniques towards a rapid assessment method for fish communities.			
Independent Studies and Class Projects			
1996	1997	1998	1999
Melissa Slotnick.	Lisa Galbravi. Francesca Ivaldi. Melissa Slotnick.	Kyle Hogg. Erica Gwynn. Sarah Marcotte-McKay. Michelle Jacques. Heather Farrington.	Kyle Hogg Justin Keanear.
Field Crews (* crew leaders)			
1996	1997	1998	
*Amy Schrank. Laura Welsh.	*Amy Schrank. *Cynthia Gerstner. *Natalya Eagan. Megan Conlon. Joseph Bump. Kirk Watera.	*Tomas Hook. *Megan Conlon. Amy Schrank. Joseph Bump. Melissa Slotnick. Mona Hanna. Matthew Diana.	

C. Current conclusions

1. Larval and post-larval stages

- Three habitats of permanent and seasonal aquatic bed marshes and beaches are the major inshore fish habitats in St. Martins, Cedarville, Mackinac and Mismar Bays.

2. Larval Fishes

- Larval seines, hand tows, boat tows and light-traps are effective for sampling bays, but only boat tows and light traps can be used in all habitats. Light traps may be more effective than the pursuit capture methods.
- Larvae are most abundant and speciose in permanent marshes, but some taxa are found only in seasonal marsh and open water.
- Ten families of larval fishes were identified, but available keys do not permit analysis of most larvae below the family level.
- Breeding occurs in all habitats and differences in larval fish communities among bays is small.
- Numbers of individuals in larval taxa common to every bay are too variable for analysis of cohort growth using size-frequency analysis.
- The number of larval taxa and larval abundance are more strongly affected by habitat diversity due to macrophyte composition than human impacts due to development.
- Human development appears to have some impact on cyprinid representation.
- The ichthyofauna in permanent marsh is more speciose and abundant, and more susceptible to impacts from human development.
- Human development is believed to have its greatest impact through loss of marsh area and boat traffic.
- The small number of useful larval taxa, variation in capture rates, laboratory needs and expertise in identification suggests that although larvae are critical links in fish communities, they are not suitable for a monitoring or rapid assessment program managed by non-experts.

3. Juvenile/Adult Fishes

- Gill nets, seines, electroshocking, fyke nets and minnow traps are effective methods for fish collection. Seines are limited to beach areas with little *Scirpus* growth. Electroshocking is not considered effective in the shallow marsh areas. Gill nets are useful in seasonal and open-water habitat. Fyke nets are most effective in marshes.
- Differences among bays can be detected using minnow traps.
- Richness and abundances peak in June-July.
- Compared to other degraded Great Lakes marshes, juvenile and adult fish communities are in good condition.
- Although differences are found in growth rates of fish from different marshes, this variation occurs in early years only and may be attributed to gear bias.
- As with larvae, numbers of individuals in species common to every bay are too variable for analysis of cohort growth using size-frequency analysis.
- The ichthyofauna in permanent marsh is more speciose and abundant, and more susceptible to impacts from human development.

- Cedarville Bay shows species losses, especially among cyprinids, lower abundance, and higher densities of fish characteristic of degraded habitat than other bays, and these are correlated with several measures of human development.
- Mackinac Bay, although having much less human development than Cedarville Bay, shows some of the same trends, notably loss of cyprinids, suggesting changes in this group may provide early warning of marsh degradation.

D. Proposed Research for 1999

1. Integration

Phase 1 has involved a large number of studies. To end this phase, these studies must be integrated for larval and post-larval fishes among bays, sample sites and years. In view of the large amount of data, this is no mean feat. Therefore, funds are requested to support a student to assist in this integration (25 hours a week from January to May 1999).

The task to achieve integration are:

- Integration of ichthyofaunal data across sites, years and life-history stages to describe the fish community and differences among the bays sampled.
- Seek relationships with fish community variables and habitat-macrophyte structure and human development.
- Provide a summary to be integrated with other components of the Les Cheneaux study.
- Make data more widely accessible via conversion to a common EXCEL-based form.

2. Field Work - Summer 1999 - Towards a Rapid Assessment Method for Fish Communities

a) Background

An original goal of the overall project in Les Cheneaux was long-term monitoring of the local fauna and flora. Fish are an appropriate target group for such long-term monitoring because they are important components of a healthy marsh, play a major role in the local economy, and are easily identified. However, on the basis of our work-to-date, we do not believe that the intensive monitoring is required or cost-effective for long-term monitoring. Instead, we believe this would be better performed using selective measurements, executed by the local populace.

On the basis of our results to date, we believe an Index of Biological Integrity approach based on discrete sampling (rapid assessment) is feasible, focusing on minnow trapping in marsh habitats. A pilot study was performed in 1998 which showed that differences among bays could be shown among five bays, consistent with discrimination from intensive sampling in three of these, and related to human development measures.

A rapid assessment protocol would allow the residents to take ownership and manage an ongoing monitoring program. In addition, a resident-operated monitoring programs could provide a valuable tool for local leadership in planning development.

b) Proposed Methodology

We will develop and test materials for a rapid assessment of marsh fishes, to be interpreted within an Index of Biological Integrity framework.

Minnow traps will be set in up to five permanent marsh sites. Safety is a key issue and sites will be accessed from land. Traps will be monitored during June and July when richness and abundance are maximal. From these data, the number of samples needed to show differences among bays will be determined using standard bootstrap methods.

Materials describing safety issues, protocols, fish identification, and interpretation will be designed. Preliminary materials will be developed before collections, and refined through use, with materials being completed at the end of the project. Field work will be completed during June and July and data analyzed during the remainder of the summer. Support materials will be completed during the fall semester.

3. Timelines

Proposed Schedule and Activities for 1999			
January - April	May	June - July	Sept.- Dec.
Integration of research studies performed to date.			
	Develop initial rapid assessment protocol materials.	Data collection for rapid assessment tests.	Data evaluation and development of final assessment materials as appropriate.

4. Budget

Integration of Larval and Juvenile/Adult Studies of Ichthyofauna in Les Cheneaux Great Lakes Marshes. Budget for 1999	
Salaries.	
P. Webb	\$800
J. Diana	\$750
Hourly support for field crew	\$4,320
Hourly support for integrator	\$4,560
Benefits	
P. Webb	\$248
J, Diana	\$233
Benefits for field crew	\$367
Benefits for integrator	\$388
Travel	
Food	\$900
Lease SNRE station wagon	600
Equipment	
10 minnow traps	150
Supplies	
Postage from UMBS and EUP	50
fuel, formalin, jars, fuel, engine maintenance	135
Grand total	\$13,500

Cost sharing will include \$8,440 (\$6,443 salary plus \$1,997 benefits) for time during the academic year between 1 Jan. to 31 May, 1999 and 1 Sept. to 31 Dec., 1999. Note that costs are incurred outside of the usual grant period ending 30 Sept.

In-kind equipment is also provided: trap nets to be added to the total used (original cost approx. \$150), boat and motor (original cost approx. \$ 3,500).