Great Lakes Science Center

Biological Resources Division - US Geological Survey

Final Report and Accounting

1998 Lake Huron Coastal Habitats Study

For the Michigan Chapter - The Nature Conservancy

October 1, 1998

Introduction

The northern coastline of Lake Huron is comprised of a variety of habitats, both terrestrial and aquatic. Much is known about the terrestrial environment because it is easily accessible. In contrast, very little is known about the aquatic environment in this region. There is only a general idea of what lies underwater as far as habitat type and its relationship to the biota contained within it. Specific "keystone" species of fish and invertebrates were chosen for this study due to their sociological and ecological importance to the Les Cheneaux Islands area. Yellow perch (*Perca flavescens*) is an important sportfish in the area. Previous studies (Lucchesi 1988) have shown that the size of the yellow perch population in this area is quite limited. Therefore, future environmental perturbations, particularly in yellow perch spawning and nursery habitats, could potentially have a profound effect on the yellow perch fishery.

In the insect world, mayflies, specifically *Hexagenia limbata*, are a leading indicator of water quality and healthy marsh ecosystems (The Nature Conservancy 1997) and are abundant in the Les Cheneaux Islands area. They have been found to be an important food source for percids (Ritchie and Colby 1988) and may provide an important link in sustaining a limited yellow perch fishery. The following studies will focus on these "keystone" species to elucidate a better understanding of their life histories and interactions.

YELLOW PERCH SPAWNING HABITAT STUDY

Yellow perch egg skein surveys were performed in Cedarville, Duck, Dudley, Flower, and Mackinac bays. Cursory surveys were made from a boat, walking along the shore, and by snorkling in order to determine the presence of egg skeins in the various bays. In addition, divers in Duck Bay using either SCUBA or snorkels, swam transects parallel to the shoreline in depth increments of 0-0.5 m, 0.5-0.75 m, and 0.75+ m to quantify the abundance of skeins.

No eggs were located in Dudley Bay by walking the shoreline. Only one egg skein was located in in the portion of Mackinac Bay located near M134 after swiming at least 3-100 m transects. Observations from a boat in Mackinac Bay in the vicinity of Hessel Point and Lone Susan Island did not yield any egg masses. Walking along the Flower Bay causeway on the east bank yielded 6 skeins over a distance of approximately 100 m. Extensive snorkling in the vicinity of the Cedarville boat ramp yielded no egg skiens. The area was covered with a dense population of submersed macrophytes and filamentous algae. Fourteen skeins were found on west shoreline of Cedarville Bay heading towards Islington Point, between just north of Carl TerHaar house and Tassier Boat Shop by snorkling and walking the shoreline. No skeins were found on the shoreline opposite this site by boat observation.

The Duck Bay site, located on the west end of the bay, contained the greatest abundance of egg skeins (70) of any bay. Transects of 150 m in length (located at 45_ 58' 02.78"N, 84_ 23' 12.93"W) were swum and yielded the largest numbers in the shallowest depths with 37 in <0.5 m, 8 in 0.5-0.75 m, and 5 in >0.75 m. Skeins were exclusively found among large stemmed aquatic macrophytes in this area. A separate 100 m transect immediately east of the 150 m transects yielded 20 egg skeins on old submerged timbers in water 0.5-0.75 m in depth.

In general, we found skeins along the western shores in the lee of the prevailing winds (North to West), in areas typically with minimal amounts of fine sediments, associated with sparse stands of emergent vegetation such as *Scirpus* and *Typha*, and sometime appearing to associated with other structure such as discarded saw timber, large rocks or tires, and in water that was < 1 m in depth. Thick stands of emergent or submersed vegetation and areas of soft seditments with alot of large organic particulate matter did not have egg skeins. Areas with suitable substrate and structure but exposed to prevailing winds also were devoid of skeins. All three methods of locating yellow perch egg skeins (snorkling, walking shoreline, and from a boat) requires relatively calm weather and ample sun light. All three methods can be ineffective by the presence of large concentrations of carp which move into warmer waters soon after perch spawn, easily roiling the sediments once disturbed. This impact could be minimized by monitoring egg skeins early in the spawning cycle.

ASSESSMENT OF YOUNG-OF-YEAR YELLOW PERCH POPULATIONS AND DIETS IN NEARSHORE AREAS

To supplement the results of our yellow perch egg skein search, we used activity traps and ichthyoplankton tows to assess the status of larval yellow perch from a time soon after their hatching, through the spring, and into early summer. We surveyed those areas where we had found egg skeins earlier in the season as well as some locations that we did not get to previously. By looking at several methods, we hoped to determine which method was best suited for use in a long-term, community-operated monitoring project; to pick out trends in population numbers; to establish a baseline against which to compare future collections; and to look at the feeding habits of the different populations.

The activity traps and tow-nets also provided collections of larger and more mobile invertebrate taxa not collected by some of our other sampling devices. For example, we added *Chaoborus punctipennis*, the phantom midge, and *Macrocyclops fuscus*, a relatively large cyclopoid copepod, to the Les Cheneaux Island faunal list based on material found in the activity traps. Additionally, we could look at differences in the invertebrate community structure among the areas sampled. The most abundant and diverse populations of invertebrates were typically found in areas where yellow perch eggs were found.

Larval Yellow Perch Surveys - Activity Traps

The activity traps consist of a clear, cylindrical, hollow trap body closed at one end and with a funnel leading into the body of the trap at the other. The traps are attached to poles which are secured in the sediment. Each pole supports two traps which allows for a shallow and deep sample to be taken at those depths which will allow it (the 30 cm set had only one trap as it was too shallow to fit two trap bodies). The top trap is held in a vertical position with the opening facing the bottom while the bottom trap and those set in shallow water are set in horizontal postion. An activated light stick was placed in the trap in the evening, the trap was submerged and fastened to the pole at the appropriate height, and in the morning the trap was retrieved. The contents of each trap were concentrated by sieving, placed in a jar, preserved with ethyl alcohol, labeled, and brought back to the lab for further processing. In the lab larval fish were sorted, identified, and enumerated; the insects were saved for later identification; and the micro-invertebrates were subsampled abd enumerated.

These traps were placed along a transect at depths of 30 cm, 50 cm, and 1 m in Cedarville and Duck bays. The bays were selected based on our finding numerous skeins in these two areas. The premise behind the light trap is that for certain periods in a fish's life, it is attracted to light. Different fish are affected to varying degrees and for varying windows of time. As the larval fish are attracted to the light, they enter the trap (along with the invertebrates present) and are unable to find their way back out. The Cedarville transect was sampled for two nights the first week of May and one night the second week of May, while the Duck transect was sampled for one night during the second week of May only. Trap availability was the limiting factor which necessitated this design.

The Cedarville samples from the first week of May showed that many of the larval perch were in water that was 1 m deep as opposed to water 50 cm deep or less. There did not seem to be a marked and consistent preference on the fish's part for the shallower or deeper set at each depth. The following week, no fish were caught at Cedarville and few were caught at Duck. The wind on the night that these traps were set was rather strong. It is possible that the fish were less active as a result of the rougher weather.

After the second week of May, a community member was enlisted to assist in the collection of the data and the experimental design was slimmed down. At the Cedarville location, a pole with one trap was set at a depth of approximately 75 cm and a jar light-trap was set between 30 and 40 cm. These traps were set out and sampled weekly or every other week for the rest of the summer. Based on these additional collections, there was a peak in larval perch numbers the third week of May which dwindled quickly until the second week of June, after which time no perch were recruited to the traps. Other larval fish captured in these traps included cyprinids (minnows), centrarchids (bass and sunfish), coregonids (herring and whitefish), and percopsids (trout-perch).

The jar light-trap alluded to in the previous paragraph is a variation on the activity trap theme. A plastic, gallon jug is fitted with a funnel and upon insertion of a rock (used for ballast) and an activated light stick, the jar is placed in the area of choice and left overnight. Jars outfitted in this manner were set out during the first and second weeks of May at the following locations: Cedarville Bay, Duck Bay, Smith (Sheppard) Bay, Flower Bay (east and west of the causeway), Search Bay, Mismer Bay, Bush Bay, McKay Bay, Prentiss Bay, and Dudley Bay. As mentioned before, the Cedarville location was sampled with a jar light-trap weekly throughout the summer.

Unfortunately, these jar traps proved to be ineffective. They only caught perch larvae at Cedarville and even then, the numbers generally were far less than those of the activity trap samples taken at the same time. The only samples that had numbers that were comparable were during the first and second weeks of May. The jar light-trap method as described here, although easily enough executed and rather inexpensive to run, can not be recommended at this point in time for use in a long-term monitoring project. The activity traps, on the other hand, show definite promise.

In addition to monitoring larval fish with the activity traps we estimated abundances of invertebrates. The traps retained a wide variety of taxa of which many can be found in the stomachs of juvenile yellow perch. The first food of larval yellow perch, nauplii and copepodites, are the immature forms of copepod species such as *Mesocyclops edax*, *Eucyclops prionophorus*, and *Eurytemora affinis* which were abundant in the traps, with all the females carrying egg sacs. The hatching of these eggs into nauplii and subsequent growth into copepodites appeared to be synchronized with the first feeding of larval yellow perch. As the young perch get larger they also begin to feed on the cladoceran, *Bosmina longirostris*, which in some traps reach densities estimated around half a million individuals. These feeding habits follow those patterns found in the literature (Siefert 1972). It is our preliminary conclusion that there is enough food in the nearshore areas adjacent to the spawning sites to sustain larval yellow perch through their first year of life. There appears to be no need for juvenile perch to migrate offshore into deeper areas of the bays to feed on forms that are very abundant in the nearshore. The most productive sites are protected from the prevailing winds with emergent and submergent vegetation.

Larval Yellow Perch Surveys - Ichthyoplankton Tows

The use of the ichthyoplankton tow-net allowed us to sample a wider range of water depths as well as a greater number of locations. The 0.5 m diameter net with a _____ micron mesh was towed behind our boat at _____ ___/hr for a maximum of 5 minutes. Most of the tows lasted only three minutes and some were even shorter than this due to underwater obstructions in the area or our wish to not collect more larvae than necessary. The contents of the net after retrieval were washed into the bucket, rinsed into a jar, preserved with formalin, and labeled. A few of the fish saved for aging were preserved in alcohol. In the lab, the samples were sorted and the larval fish were identified and enumerated and the insects were saved for later identification.

The areas sampled using the tow included Hessel Bay, Flower Bay, Cedarville Bay (in the channel, through the marshy edges along the channel, and near the boat ramp), Snows Channel (near the golf course), Smith (Sheppard) Bay, Duck Bay, Mackinac Bay, Hill Island Channel, Moscoe Channel, Peck Bay, and Government Bay. Sampling occurred the second week of May. Catch per unit of effort (CPUE) in terms of yellow perch larvae caught per minute ranged from zero to 204. The bays exhibiting the highest numbers were Smith (Sheppard) and Flower bays with 204 and 181 yellow perch, respectively. The next highest numbers of perch caught were in Cedarville Bay in the marshy edge along the channel with 74 perch/min and Duck Bay where 26 perch were taken per minute. These sites are known as being prime spawning areas historically and have been closed to anglers during the early spring yellow perch spawning season. All the other locations had 20 or fewer fish captured per minute.

During the third week in June we revisited the bays which had the greatest numbers of yellow perch larvae as determined by our May tows. We felt that in these bays we would have the best chance of catching the now larger juvenile perch, which had managed to elude capture by researchers in the preceding years of the project. No yellow perch were taken by our tows at these locations. It is possible and highly probable that the young perch were still in these areas, hiding in the now more abundant vegetation and better able to evade the towed net which was encumbered by the same plants which were sheltering the perch. In support of this supposition we went electroshocking along the shallow, weedy shore of Duck Bay during July where we had found many skeins that spring and easily collecte 20? yearling yellow perch.

MAYFLY HABITAT STUDY

The mayfly study consisted of three different projects: the impact of mayflies on the substrate, their depth distribution, and the annual fall monitoring of population densities in Cedarville and Mackinac bays. At the time of the writing of this report there is still a final field trip to be made. As such, the paragraphs below represent the work undertaken and completed to this point in time.

Mayfly - Substrate Study

To obtain sediment samples, cores were taken by divers using clear acrylic cylinders (5.1 cm diam. x 60 cm ht.). The first step in taking a sample was to carefully push the corer into the substrate, capping the top to avoid disturbance. Next, the diver gently excavated around the sample, capped the bottom, and lifted the corer and its contents from the substrate. The sample was transported to the surface where it was given to researchers on the boat who photographed the core and its contents, placed the sample in a jar, labeled it, and prepared it for transportion to the lab in Ann Arbor. Core depth in the substrate was measured using a ruler and recorded underwater.
Samples were taken to the laboratory and dried in an oven set at 65_C. Dried samples were poured back into the acrylic corers, measured for volume, and compared to the original wet volume to attain resultant percentage volume loss. Volume of cores was calculated using the formula for a cylinder $V=pr^2h$.

Clear cores were taken on June 17, 1998, shortly after reports of large *Hexagenia* hatches in the area. Water temperatures were 68 F, indicative of the warm temperatures we observed earlier in the spring. Results of the clear core analyses showed an average volume decrease of 10% after drying. Had these sediment cores been taken prior to the emergence of the majority of the mayflies, it is highly probable that the change in volume would have been much more pronounced. HEY MARC, HOW WOULD YOU DESCRIBE WHAT YOU SAW UNDERH2O (THE PRE-HATCH FLUFF VS THE POST-HATCH FLATTER?)

Mayflies were sampled using a 10 cm. diameter PVC pipe corer with metric increments marked on its external surface for depth penetration measurements. Divers inserted the corer into the sediment, noted the depth of penetration, and followed the same steps as those listed above for the retrieval of sediment samples in the clear acrylic cores. Once aboard the research vessel, however, the contents of the corer were emptied into a sieve and washed. Thus, the mayflies were separated from the sediments and preserved in buffered formalin. At the lab, the mayflies were identified, counted, and measurements of their lengths were made.

ADDITIONAL STUDIES

A baseline study of periphyton (algae attached to relatively solid structures such as rocks, macrophytes, sand grains etc.) species distribution and relative abundance by habitat and structure was begun in 1998. Collections were made in April and June at several locations and aquatic communities using a variety of collecting techniques. Rebecca Bixby, a doctoral student from the University of Michigan who specializes in algal taxonomy and ecology, collected the material, processed the samples, and identified the taxa. In addition to this material, she has studied algal material found in the stomachs of fish and chironomid larvae taken during the course of this project. Since periphyton is probably one of the main sources of energy at the base of the food chain in the Les Cheneaux Islands, it behooves us to understand which species, communities, and habitats play a dominant role in driving food chain dynamics. This pilot study should provide the details for further study. Attached as Appendix A is a brief description of the methods used, collection locations, and some taxa lists from 5 sites plus a taxa list from some fish and chironomid stomachs.

COMMUNITY WORK

The following interactions occurred with the local community:

1. Involved the local DNR CO, Carl TerHaar, in sampling for larval yellow perch and aquatic insects. Carl serviced the activity traps set along his beach front on a weekly basis in May and June and biweekly in July, August, and September.

2. Based on our knowledge of yellow perch spawning habits we were able to suggest to the Cedarville Golf Course to place their new dock in deeper water thus avoiding disturbing some potential shoreline spawning habitat in waters less than 1 m.

3. Attended a meeting in which community representatives and researchers discussed what we know about the marshes in the Les Cheneaux Island area and how they relate to local conservation issues.

4. Led a field trip of the Les Cheneaux Island marshes as part of the activities of the Annual Meeting of the Michigan Chapter of the TNC.

TOTAL BUDGET OF ALL STUDIES

	Proposed	Actual
TRAVEL		
per diem +lodging	$1835	$2200
ground travel	$1230	$2100
boat costs	$1800	$2400
SALARIES	$10,535	$11,300
EQUIPMENT $ SUPPLIES	$3600	$1000
ANALYSES & REPORTS	$3000	$3000
	$22,000	$22,000
Overhead		

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