Community Study of a Section of the West Branch of the Maple River

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Introduction

On the dates from July 30 to August 10, 1993, a community study was completed of a forty meter section of the West Branch of the Maple River located at T36N, R4W, S3. The West Branch originates in Larks Lake and Pleasant View Swamp. Brush Creek, from Larks Lake, meets Pleasant View Swamp at T36, R5W, S25 and both of these tributaries contribute to the West Branch of the Maple River. The West Branch flows east until meeting the East Branch of the Maple River at T36, R4W, S10 where it becomes the Maple River which flows south.

The purpose of the study is to determine the uniqueness of the West Branch site as well as its similarities and differences to other sites. To accomplish this, all of the techniques used throughout the semester were employed. Examination of this site in comparison to others studied will determine the factors that cause communities to be structured. The goal of this investigation is to discover what determines the community of the West Branch site and why the species found there are living there.

Materials and Methods

The site consisted of forty meters of the West Branch of the Maple River. An attempt to sein with a ten foot bag was made on July 30, 1993, at 12:00 AM. Straight hauls upriver and into the bank were used as well as thrashing amongst the structure to chase fish into the sein. Due to high flow velocities and abundant structure, only three fish were caught, therefore, electrofishing was the major method used to sample fish.

Electrofishing was used to sample fish for the "mark-recapture" study on July 30 at 3:30 PM. The fish were collected; the adipose fins of the trout were cut, and the caudal fins of the sculpin were cut. After the fish were marked they were released in the area in which they were

caught to minimize territorial disturbance. On the morning of August 1 (9:00 AM) an attempt to recapture the fish was made using the electroshocker. Numbers of fish that were marked and unmarked were recorded (Table 1), and six trout and twelve sculpin were kept for laboratory analysis.

Sampling for the food eaten by the populations of fish was accomplished using drift nets set on the evening of July 1, 1993 at 9:15 PM. The were checked every three hours throughout the night to make sure they were not overfilled with sediment or floating down the river. The nets were left in the river until 7:30 AM on the morning of August 1 in order to cover the two periods (dusk and dawn) of high invertebrate activity. Serber sampling was done after the drift net samples were removed and preserved in formalin. The serber samples were used in the same areas as the drift nets to obtain samples of benthic invertebrates. These organisms were preserved in formalin as well (Appendix 2).

The physical aspects of the site were taken at various locations within the site. Flow velocities were taken before and after the rain storms at locations throughout the site using the Gurley meter. Temperature readings were taken at every visit to the site using a standard mercurial thermometer. A final visit to the site, August 3, 1993, was made to collect data for a detailed map of the river bottom (map 1). Two intersecting transects were used to describe every meter of the depth, bottom composition, and structure within the river.

Laboratory analysis consisted of gut analyses of trout and sculpin and identification of drift/serber samples. The invertebrates from the drift and serber samples were compared to the stomach contents of the fish to find correlations between the food items available and those eaten

(Table 2, Appendix 3).

Results

Physical Habitat

The West Branch site can be divided into four subhabitats. The stretch downriver from the railroad bridge is a shallow riffle with depths ranging from 25 to 38 cm and cobble throughout. There are a few underwater macrophytes growing in the cobble but the bottom is largely clear of vegetation. There are a few branches overhanging the river to provide shade, and the only structure in this section is a large log. The trees lining the shore provide shade for the majority of the day. The flow readings in this area were 62 m/s, 120 m/s, and 56 m/s Appendix 4). The current in this subhabitat is quicker than the flow upriver because of the disturbance caused by the bridge and the debris that it has trapped.

The structure of the old railroad bridge provides another subhabitat. The bridge has altered the habitat by providing shade, overhangs, and trapped debris. The debris has built up against the bridge and created small pockets where the fish can find refuge from the increased current. There is a large log trapped against three bridge supports at water level; it has created a deep rocky pool (66 cm) on the downriver side under the bridge. The fourth open area under the bridge carries all the water that has been diverted by the log at high velocities (133 m/s). There are also numerous railroad ties jutting out from the main supports under and along which fish can find sanctuary. In the main flow area the substrate is cobble and large rocks with an average depth of 46 cm. In the other three sections, the diverted current from the railroad ties leaves sandy deposits mixed with a little cobble (map 1).

The trout that were caught in this bridge area were all in the one

year age class. This could be due to the fact that the larger trout get fished out. It is also possible that the microhabitats available for the trout in this section of the river are not suitable for larger trout. As the trout grow, their territories must increase as well (Hunter 1991). If the microhabitats are too small to adequately support them then the trout will migrate elsewhere. Additionally, only one baby trout was found. It is likely that the trout grow up somewhere else and as they become to large for the microhabitats in that area, they migrate and end up in the West Branch until they outgrow this habitat as well.

The third subhabitat includes the margins and small overhangs upriver from the railroad bridge. This stretch of river is sunny with the only shade located under the overhanging banks and weeds. The substrate is comprised of sand, detritus, few rocks, and some cobble. The flow along this stretch is reduced due to the backup of water from the bridge and its debris. The cross-section of this stream is more basin shaped than that downriver; the edges are shallow, and depth increases towards the middle (46, 55, 65 cm).

A fourth subhabitat is a small area on the north bank of this upriver section. The depth is shallow (17 cm), and the substrate is rich in silty detritus.

Biotic Habitat

In each of the three subhabitats a different species is dominant, although sculpin were found everywhere. The trout were found predominantly in the pools under the bridge protected from the current. They live along the sides and underneath of the railroad ties, behind the logs that are trapped under the bridge, and underneath cement pilings near the bridge. Sculpin were found in each of the three subhabitats either on

the substratum or under the overhanging banks. The sculpin were the only species found in the cobble area downriver from the railroad bridge. Two northern redbelly dace were captured upriver from the railroad bridge underneath the shallow overhanging bank. One brook stickleback was caught with the seine in the area near the north bank rich in detritus. No parasites were observed on any of the fish. A few frogs were seen on the logs and branches projecting into the river. Invertebrates included dragonflies and other insects.

Predation

The food web in this section of the West Branch is relatively simple with few trophic levels. No evidence of piscivory was discovered through gut analysis, however, one sculpin was caught with a smaller fish in its mouth. According to stomach contents, trout eat predominately insects as do the sculpin. The dace prey primarily on aquatic insect larvae (Scott & Crossman 1973). The aquatic insect populatin sustains most of the species of fish found in this area.

There are many areas which offer refuge for the smaller fish from predators. The structure in the river such as the projecting branches, logs, and overhanging banks provide havens that would be too small for larger predators. The bridge offers protection, however, the trout inhabit these areas so the small fish probably would not choose these railroad ties and supports as shelter.

The biggest predator of the trout in the area is most likely humans. The site sampled is a popular place for fishing, everyday the site was visited fisher people appeared and inquired about the methods being used. Any larger trout that may have lived there have probably been fished out.

Discussion

The best way to understand a habitat is to compare it to others with both similar and different characteristics. The defining factors of a habitat determines what communities of fish will be equipped to live there. The only way to prove that there is structure in communities is to observe the habitats and establish the species that are consistently found in similar areas and why they are situated there.

By comparing the West Branch site to the Douglas Lake habitats the differing factors defining the communities living in each can be discovered. The physical habitat of Douglas Lake is entirely different than that of the site on the West Branch. The most obvious difference is the substrate of Douglas Lake versus that of the West Branch. Douglas is predominantly sand and detritus, while the majority of the Maple consists of cobble with some small sand and detritus areas. Additionally, the temperature of the Maple is cooler than most of Douglas. Sculpin prefer water of 8.9 to 13.9 degrees Celsius for spawning (Becker 1983). Therefore the temperature of Douglas would not be suitable for the sculpin.

Another important factor that the species of the Maple River require that Douglas lacks is adequate cover. Trout choose their territory predominantly for the availability of cover. Trout prefer to be visually isolated from other trout in the shade of logs, rocks, or undercut banks (Hunter 1991). These areas also provide protection from predation and physical disruptions (Wilzbach et al. 1986). The W. Branch stream habitat is abundant in structure including logs, boulders, and the struts of the railroad bridge. These are ideal cover areas for trout adjacent to the current where, in fact, all of the trout were caught. Sculpin, as well, prefer cobble areas where they can grasp the substrate and be

camouflaged from predators and for predation. Sculpin habitats are also dependent on available cover even more than substrate type. Sculpin nest under large flat rocks at depths of 22 cm where there is enough silt to cover the eggs (Becker 1983). Douglas Lake offers almost no opportunity for protection because the bottom is entirely sand.

Related to adequate cover, the flow of a stream is a necessary factor in the habitats of both trout and sculpin. The trout rely on the flow to transport food for which they will dart out from their "focal point" under cover and snatch as it drifts past (Hunter 1991). In Douglas there is no flow that would carry the food to the trout and no areas in which they could lay in wait for passing drift. Morphologically, sculpin are designed to live on the substrate of fast flowing streams and rivers. The pectoral fins are large and used to support the body against strong currents while the head is pointed upstream. Additionally the fast flowing rivers ensure that when sculpin lay their eggs that there is no silting (Becker 1983). In a lake the sculpin eggs would quickly become covered in silt. The species found in Douglas such as Cyprinids and Percidae do not need to rely on the current to bring food. Additionally, they are not morphologically designed to hold position in a strong current. These species of fish would use up too much energy battling the swift flow and it would not be profitable for them to forage in these areas.

The food found in the stomachs of the Douglas species and the Maple species was similar. Species from both sites contained abundant aquatic insects. The Douglas stomach contents included crayfish and other fish while the Maple species only contained aquatic insects and annelids.

It was assumed that the Douglas habitat would be extremely different than the Maple habitat because lakes are expected to be

different than rivers. However, river habitats can vary from site to site as remarkably as rivers differ from lakes. While Carp River was more similar to the Maple River habitat than Douglas Lake, the communities of the Carp River overlapped only slightly with the populations found in the West Branch. The differences in physical habitat result in distinct species in each habitat.

The majority of the species in both Carp River and West Branch are found in areas of little or no flow (Table 3). These areas differed in that the Carp Lake River areas include marginal overhangs of the river while Maple River's low flow areas vary from these overhangs to logs, branches, and bridge structure. The Cyprinids in both Carp Lake River (shiners) and Maple River (dace) utilize the marginal overhangs as protection from the larger predators. However, trout require more structure, such as that found in the Maple River, to constitute their territories. Sculpin, too, require more shelter in the form of rocky structures than is found in the sand, silt, and macrophytes of Carp Lake River.

The morphological differences in the species account for their location in the habitat. The smaller Cyprinids are not as well equipped to station holding in a swift current as the trout are. Additionally, the Cyprinids do not have the fins to grasp the bottom in the way typical of sculpin. The presence of an air bladder, which the sculpin lacks, would cause Cyprinids or Percidae to float to the surface. All these characteristics make Cyprinids and Percidae ideal for the vegetated sandy environments in which they dwell. Because the Maple River is so fast flowing in all sectors, large populations of Cyprinids or Percidae can not survive there.

The organisms in the stomachs of the Carp River species were

similar to the organisms found in the stomachs of the Maple species. Trichoptera and Diptera were numerous in the stomachs of fish in both habitats. There were more varieties of organisms found in the stomachs of the Carp Lake River than in the Maple River. This could be due to the preference of the Cyprinids versus the preferences of the trout. Also the organisms found in the trout could be the most likely to be found in the drift of the river.

The section of the Sturgeon River studied was the habitat that most resembles the West Branch site. The water temperature was similar and the flows were as well. Again, the fish were caught in areas where there was little flow. There are structures such as logs and debris along the edges to divert the flow and provide cover. The banks have a large overhang to provide protection from predators. The substrate is cobble, similar to the West Branch site although the water depth was deeper in the middle. The species found in Sturgeon River were also the same as those caught in the West Branch. Trout can live in the pools adjacent to the current provided by the debris, logs and overhang, and sculpin dwell on the cobble substrate on the edges.

The similarity of the Sturgeon River habitat to the Maple River site reinforces the fact that communities are structured and that species do not live together randomly. The physical habitat of the two rivers are almost identical as are the species that inhabit both areas. Different habitats require specific functional morphologies of species that without these specializations would not survive. Communities are not random but are structured, with similar species living in corresponding environments.

The site studied on the Maple River is unique in that it contains two separate habitats. The section upriver from the railroad bridge is similar

to the type of habitat found in the Carp Lake River. Numerous species were not caught, but the dace and sculpin we did find were located in habitats identical to the Carp River. The lower half of the habitat is almost identical to the Sturgeon River site. It is the physical characteristics of these habitats that demand the structure of the communities.

Table 1. Population estimates using electroshocking collection

Species	Tot. Marked	# Rec. Mk.	Tot. Recap.	Pop. Est.
Salvelinus fontinalis	6	2	8	24
Salmo trutto	2	0	3	——
Oncorhynchus mykiss	1	0	2	——
Cottus bairdi	22	3	33	242

Mark day-Sunny; 4:00 pm; H2O temp=17°C
Recap. day- Overcast, morning after rain, 9:00 am: H2O temp=15°C
—— indicates division by zero

Table 2. Numerical Indeces of stomach contents

Fish Type	Stom. Cont.	Numerical Index
Trout	Trichoptera	0.17
	Diptera	0.37
	Night Crawler	0.07
	Annelid	0.27
Sculpin	Isopod	0.13
	Trichoptera	0.58
	Diptera	0.19

Fish captured on August 1, 1993 at 9:30 AM

Table 3. T-test on flow velocities in areas with and without fish

	Fish m/s	No Fish m/s		
	58	62		
	45	120		
	48	67		
	56	133		
	34	46		
	42	39		
	28	17		
	30	22		
	34	67		
	25	121		
	12	110		
	27	47		
	11	48		
	82	101		
	59			
Mean	39.4	71.4285714		
St. Dev.	19.138	38.578		
Variance	366.257	1488.264		
T-Test	t-calc=2.73	d.f.=19.5	t-crit=2.09	p=0.05 Ho Rejected

Ho= Mean current velocities in areas with fish
are equal to the velocities in areas without fish

Appendix 1. Species List-West Branch Maple River as captured by electroshocking

Com. Name	Sci. Name	Raw Numbers	Rel. Abund.	Location
Brook Trout	*Salvelinus fontinalis*	12	3	Bridge pools
Brown Trout	*Salmo trutto*	5	2	"
Rainbow Trout	*Oncorhynchus mykiss*	3	2	"
Mottled Sculpin	*Cottus bairdi*	74	5	Ripples/cobble
White Sucker	*Cattostomis comersonni*	1	1	Sandy/currentless
Northern Redbelly Dace	*Phoxinus eos*	1	1	River margin
Brook Stickleback	*Culea inconstans*	1	1	Emergent veg.
American Brook Lamprey	*Lampettra lamotenni*	1	1	Brige strut

Appendix 2. Contents of drift nets and serber samplers

Downstream samples, cobble riffle

Organism	Raw numbers	Rel. Abund.
Trichoptera	24	5
Plecoptera	2	1

Upstream samples; Sand/detritus

Organism	Raw #	Rel. Abund.
Trichoptera	3	2
Diptera	14	4
Annelid	4	2
Fingernail-clam	1	1
Ephemeroptera	1	1
Coeleoptera	1	1

Net locations are labelled on Map 1.

Appendix 3. Stomach analyses

Fish	St. In. (mm)	Age (yrs)	Stom. Cont.	# of item
Brook Trout	126	1	Trichoptera	4
			Diptera	4
			Insect Parts	———
Brook Trout	131	1	Night Crawler	2
			Annelid	2
Brook Trout	137	1	Diptera	2
			Annelid	6
			Isopod	4
			Trichoptera	1
Brown Trout	137	1	Diptera	5
			Insect parts	———
Brown Trout	142	1	———	———
Mot. Sculpin	47	———	Insect Parts	———
Mot. Sculpin	52	———	Trichoptera	1.5
			Insect Parts	———
Mot. Sculpin	53	———	Trichoptera	3
Mot. Sculpin	54	———	Trichoptera	1
Mot. Sculpin	62	———	Trichoptera	2
			Diptera	2
			Insecta Heads	3
Mot. Sculpin	64	———	Diptera	0.5
			Insect Parts	———

Appendix 4. Current velocities (m/s), taken with Gurley Meter

7/30/93:Sunny and clear; light rain on 7/29

Day	H2O/Air °C	Time	Location	Speed, m/s	Depth (cm)
7/30/93	17/22 °C	2:10 PM	D. River 1	62	38
"	"	"	D. River 2	120	30
"	"	"	D. River 3	56	25
"	"	"	Bridge 4	133	45
"	"	"	Bridge 5	30	48
"	"	"	U. River 6	46	65
"	"	"	U. River 7	12	46
"	"	"	U. River 8	27	55

8/3/93: Cloudy and scattered showers; 2 days of previous rain

8/3/93	18/21 °C	3:15 PM	1	101	40
"	"	"	2	122	30
"	"	"	3	82	28
"	"	"	4	143	45
"	"	"	5	48	50
"	"	"	6	51	68
"	"	"	7	15	48
"	"	"	8	30	56

This data includes readings from key sampled areas

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