MONITORING FISHERY RESPONSE TO WETLAND RESTORATION IN WESTERN LAKE ERIE

A SURVEY OF THE TEMPORAL FISH COMMUNITY IN THE CRANE CREEK ESTUARY:

1997 PROGRESS REPORT

January 30, 1999

Provisional data, not to be cited without permission.

Prepared by:

Anjanette Hintz
U.S. Fish and Wildlife Service
Fishery Resources Office
Alpena, MI 49707
517/ 356-5102

This project was funded in part by the Lake Erie Protection Fund small grant program.

INTRODUCTION

Coastal wetlands are a natural, historic and integral part of a healthy Great Lakes ecosystem. They function as a biological resource to fish by providing spawning, nursery and feeding habitat; and most nearshore species use these areas during some phase of their life cycle. Since 1850, Lake Erie marshland from Vermillion, Ohio to the Detroit River has been reduced from 4,000 km² (1,544 mi²) to 150 km² (58 mi²). Reductions were mainly due to diking, filling, and draining to provide for increasing cultural uses in heavy industry, agriculture, and recreation (Herdendorf and Krieger 1989). Currently efforts are being made to rehabilitate the structure and function of remaining western Lake Erie coastal wetlands in an effort to conserve and enhance the fish and wildlife which use them.

In 1994 the Metzger Marsh Wetland Restoration Project (U.S. Department of the Interior 1994) was initiated to improve the structure and function of Metzger Marsh, a degraded western Lake Erie coastal wetland. In an effort to provide a comparison for measuring fish response to the Metzger Marsh restoration project, the Alpena Fishery Resources Office began to monitor the temporal fishery of nearby Crane Creek. The Crane Creek estuary is similarly degraded to pre-construction Metzger Marsh. Fishery data from Crane Creek will assist in identifying pre- and post-construction fishery values in Metzger Marsh and will be used to smooth out fluctuations in year class strength and species composition to provide a measure of the effectiveness of the restoration project in achieving ecosystem goals. Data was gathered from Crane Creek in 1994 when fishery information was gathered from Metzger Marsh prior to its closure for construction. Data collection has continued annually from Crane Creek while Metzger Marsh is closed, and will continue until the marsh has been re-opened to the lake and a survey of the rehabilitated marsh fishery is conducted.

Observations on the fishery of Crane Creek is not only of value to the Metzger Marsh project but is valuable in evaluating the potential for coastal wetland rehabilitation on Crane Creek as well. This study will also aid in better understanding the value and function of the numerous wetland types remaining within the Lake Erie ecosystem.

STUDY SITE

Crane Creek is a tributary to western Lake Erie west of Port Clinton, Ohio. The creek is slow moving with an average gradient of 0.57 m/min (1.9 ft/min) in 1987 (Ohio Department of Transportation 1987). The majority of the watershed is

located in Wood and Ottawa Counties; although the mouth opens to Lake Erie from Lucas County. The watershed comprises an area of 143.5 km² (55.4 mi²) and supports mainly residential and agricultural uses (Ohio Department of Transportation 1987).

The primary area of interest for this study is the lower one kilometer of the river which opens up into an estuary at the mouth of Crane Creek (Figure 1). This area is located on the Ottawa National Wildlife Refuge and is managed by the U.S. Fish and Wildlife Service. A lakefront dike separates the estuary from the lake and contains a narrow channel which opens to the lake near the original creek mouth. The estuary is composed of pools 4 and 5 (51.1 and 84.0 hectares respectively) of the refuge. The two pools were originally separated by a now eroded internal dike. The natural creek channel enters the estuary from the southwest where it is separated from the open water by an eroding internal dike which remains along the estuary's southern boundary. The creek channel then follows the eastern edge of the estuary to the mouth.

High winds and resulting seiches produce frequent flow direction and water level changes in the estuary. Water depths are shallow (1.5 meter and less) in general but are deeper in the creek channel (1-3 meters). Sediments throughout the estuary consist mainly of silt. However, sandy sediments are present at the mouth. Waters were turbid throughout the study period and transparency was limited at all times. No emergent or floating aquatic vegetation was noted in 1994 and 1995; however, emergent vegetation was present in 1996 to 1998 along margins of the estuary. A limited amount of submerged vegetation, *Potamogeton* sp., was observed near the southeast corner of the estuary.

Seven established study sites have been sampled in the estuary since 1994. Sampling locations were selected in areas that had sufficient water levels to be accessible with boat and sampling equipment. Sites were also established to sample various habitats located within the estuary. Site descriptions are provided in Table 1.

METHODS

In 1997, six sites were sampled once monthly from April to August and in October in the Crane Creek estuary (Figure 1). One site, site 7, was not sampled in 1997 due to erosion of the beach. Sites 1, 3, and 4 were fished with a 1.2 x 1.2 m trapnet (1.3 cm mesh) with a 22.5 m lead; and sites 2 and 5 with a 0.9 m hoopnet (1.3 cm mesh) with 15 m wings. Nets were set in the afternoon and lifted the following morning.

Nighttime beach seining was conducted at one shoreline location, site 6. Sampling consisted of two hauls with a 30 x 1.2 m seine (0.64 cm mesh) anchored from the shore. One site, site 6, was sampled with the beach seine in 1997. Water and currents in early 1997 eroded site 7 causing it to be unseinable during the field season. In May, seining was prevented because of high water levels and beach erosion caused by seiche activity.

Nighttime larval sampling was conducted at sites 1 - 5. A 0.5 m icthyo-plankton net (303 um) was used to sample the upper 0.5 m of water at each of the locations. One ten minute tow was collected at each site. The catch was either preserved in alcohol and later identified or directly identified to family and species when possible. In June, problems with larval sampling gear prevented larval collections at 3 of the 5 sites.

Total lengths (mm) were recorded for all fish captured. Scale samples and weights (g) were taken from all sportfish. Fish were returned to the water following data collection. Surface water temperature (°C) and surface dissolved oxygen (mg/l) were recorded at each sample location with a dissolved oxygen meter. Transparency (m) was recorded at each location with a secchi disk, and maximum and minimum water depths (m) were recorded with a handheld digital sounder. Weather conditions were recorded at each location and determined visually. Catch number by sample date was recorded for all species, biotic data summaries were compiled by date and sample site for each gear type and for sportfish species. A key is provided in Appendix I for abbreviated species codes.

RESULTS AND DISCUSSION

Thirty-five species of fish from thirteen families were represented in the catch from the Crane Creek estuary in 1997 (Table 2). A total of 4,303 captures were made during sampling from April to August and in October. Emerald shiner *Notropis atherinoides* was the most abundant species and comprised 30 percent of the total captures overall. Bowfin *Amia calva*, white sucker *Catostomus commersoni*, yellow bullhead *Ictalurus natalis*, walleye *Stizostedion vitreum*, silver chub *Hybopsis storeriana*, tadpole madtom *Noturus gyrinus*, and sea lamprey *Petromyzon marinus* were among the least abundant species captured. Species diversity was highest in August with 24 species represented and lowest in May (likely due to the lack of seine data) with 15 species. Aside from a one time large number of spawning emerald shiners in April, fish numbers rose from a low in May to a peak in July, then declined to a low in October. A greater number of species and families were

captured in 1997 than in 1996 (24 species and 10 families); although the overall catch was higher in 1996 (7,714 captures) than in 1997. The high overall catch in 1997 was due to high numbers of seining captures from sampling at 2 sites, sites 6 and 7. In 1997 only site 6 was sampled.

Twelve species of fish were captured in spawning condition, and it is likely that these fish are spawning in the estuary. The species included emerald shiner, spottail shiner *Notropis hudsonius*, spotfin shiner *Notropis spilopterus*, yellow perch *Perca flavescens*, logperch *Percina caprodes*, trout-perch *Percopsis omiscomaycus*, quillback carpsucker *Carpiodes cyprinus*, black crappie *Pomoxis nigromaculatus*, bluegill *Lepomis macrochirus*, pumpkinseed *Lepomis gibbosus*, orangespotted sunfish *Lepomis humilis*, freshwater drum *Aplodinotus grunniens*, and common carp *Cyprinus carpio*. In many instances the month when the species was in spawning condition was the same month that the greatest abundances were noted for that species. Emerald shiner, spottail shiner, yellow perch, and trout-perch were in greatest abundance in April when they were also found in spawning condition. Quillback carpsucker was in greatest abundance and spawning condition in May; and bluegill and freshwater drum were in greatest abundance and spawning condition in June. It is also interesting to note that larval and juvenile fish from these species were captured later in the field season. Larval yellow perch, emerald shiner, spottail shiner, quillback carpsucker were captured in the estuary in June and July; and juvenile yellow perch, spottail shiner, quillback carpsucker and freshwater drum were present in July and August.

Larval and juvenile fish began to appear in the catch in June and were present in samples through August. Ten species of larval fish were captured from the Crane Creek estuary in 1997 (Table 3c) and included rainbow smelt *Osmerus mordax*, channel catfish *Ictalurus punctatus*, gizzard shad *Dorosoma cepedianum*, white bass *Morone chrysops*, white perch *Morone americana*, yellow perch, quillback carpsucker, emerald shiner, spottail shiner and other Cyprinidae species. Catches peaked in June and tapered off through August, and only a few fish were captured in October. The greatest diversity of larval fish species was present in July. Larval rainbow smelt were the most abundant fish captured during larval netting in 1997 and comprised 60 percent of the overall catch for June. Rainbow smelt spawn along the lake shore of the Western Basin of Lake Erie (Goodyear et. al 1982) and enter the estuaries with incoming lake water caused by seiche. Because of the in and outward flow and mixing of lake water within the estuary caused by seiche activity, it is difficult to determine if fish are spawning in the area resulting in larval fish or if the larvae are carried into the area. The presence of larval rainbow smelt is an indication that larval fish are indeed carried into the estuary by seiche activity where they may use it as a nursery area. The origin of other larval fish captured

within the estuary is difficult to determine based on our current sampling.

Juvenile fish from nine species were captured from the estuary in 1997 (Table 3b) and included rainbow smelt, quillback carpsucker, gizzard shad, emerald shiner, spottail shiner, channel catfish, white bass, white perch, yellow perch and freshwater drum. Catches of juvenile fish followed larval catches by a month with a peak in July decreasing in number in August and only a few captured in October. The greatest diversity of juvenile fish were captured in August. Gizzard shad and quillback carpsucker were the most abundant juvenile species captured in 1997.

SPORTFISH CATCH

Twelve species of common sportfish were captured from the estuary in 1997 (Table 4) and included black crappie, white crappie *Pomoxis annularis*, bluegill, green sunfish *Lepomis cyanellus*, orange-spotted sunfish, pumpkinseed, rockbass *Ambloplites rupestris*, channel catfish, white bass, white perch, yellow perch, and walleye. Channel catfish was the most abundant sportfish species captured and comprised 29 percent of the total sportfish catch. Walleye and green sunfish were among the least abundant catch. The greatest number of sportfish were captured in August, 45 percent of the monthly total catch. The majority of abundances peaked in August, likely due to a large recruitment of juvenile fish vulnerable to the gear. Spawning condition sportfish captured from the estuary included yellow perch, bluegill, pumpkinseed, orangespotted sunfish, and black crappie. Larval yellow perch, white bass, white perch, and channel catfish were captured from the estuary; and black crappie, white crappie, and white perch juveniles were captured as well.

Sportfish ranged in age from 0 to 5 years. The oldest fish captured was a 5 year old black crappie captured in April. The majority of older sportfish, aged 3 years and up, were yellow perch and rockbass. Bluegill, pumpkinseed, orangespotted sunfish, and black and white crappie averaged 2 years old. White bass, white perch, and green sunfish averaged 1 year old.

WETLAND FISH SPECIES

Twelve fish species considered to be obligate wetland species were captured in the Crane Creek estuary in 1997 (Table 2). Obligate wetland species are species which depend on vegetation or wetland habitat for one or more of their life stages (Johnson 1989). The majority of obligate species were representatives from the family Centrarchidae. Black crappie was the most abundant obligate species captured while bowfin and yellow bullhead were least abundant. Obligate species were consistently represented in the fish community from April to October with 6 to 8 of the twelve species present during each sampling. Five species were most

common, being captured during each sampling and included black crappie, white crappie, pumpkinseed, common carp, and brown bullhead. The greatest number of species was present in June and July; and the greatest abundance was present in August.

The number of obligate wetland species present in the Crane Creek estuary increased from 1996 (9 species) to 1997 (12 species). Since annual surveys began in 1994, the number of obligate species has ranged from 9 to 12 species with the 1997 sampling yielding the greatest number. The Crane Creek estuary has been a degraded wetland for some time. Restoration efforts encouraging vegetative cover and improving water clarity may be important as wetland dependent species are currently using the estuary for some portion of their life cycle. All efforts should be made to preserve habitat, access to Lake Erie, and prevent further degradation.

GEAR COMPARISON

A total of 32 species and 1,083 captures accounting for 25 percent of the overall total catch was made with impoundment gear, 18 species and 2,123 captures 50 percent of the overall total catch was made with a seine, and 10 species and 1,093 captures accounting for 25 percent of the overall total catch by larval netting.

Impoundment gear was selective for larger sized species and adult fish (Table 3a), while juvenile fish and small sized species were more readily captured with the seine. The mesh size of impoundment gear was larger than that of the seine allowing smaller fish to escape. All Centrarchidae species were particularly vulnerable to this form of sampling gear; which captured all 12 sportfish species represented in 1997. Impoundment gear also captured all 12 obligate wetland species. The largest catches made with impoundment gear were in May and October, which comprised 68 and 65 percent of the total catches for those months respectively. Large spring catches were likely due to the presence of spawning adults and large fall catches were likely due to recruitment of juvenile fish to the gear.

Nighttime beach seining was selective for slower, generally smaller sized fish (Table 3b). The physical capture technique allowed larger and faster fish to escape; while capturing slower and smaller fish due to the fine mesh size. Seining yielded the greatest number of captures overall - likely due to the abundance of juvenile and smaller sized fish. Seine catches comprised 61, 74, and 58 percent of the total catch for the months of April, July, and August respectively. April and May catches consisted predominantly of adult spawning Cyprinids, mainly emerald and spottail shiner. July and August catches were comprised mainly of young-of-the-

year gizzard shad, quillback carpsucker, white bass, and channel catfish. October catches were low and consisted mainly of juvenile spottail and emerald shiners - likely the product of spawning adults present in April and May. Only 4 of the 12 sportfish species present and only 4 of the 12 wetland dependent species present within the estuary were captured with this form of gear.

Nighttime larval netting captured small, slow swimming fish present in the upper ½ meter of the water column (Table 3c). Catches consisted of adult spawning emerald shiner in April and larval rainbow smelt, channel catfish, gizzard shad, white bass, white perch, yellow perch, emerald shiner, spottail shiner, and other Cyprinidae species through the rest of the sampling period. The largest larval catch occurred in June, comprising 89 percent of the overall June catch, and consisted of rainbow smelt and Cyprinidae species. Rainbow smelt spawn along the shores of the Western basin and the free floating larvae likely drifted into the estuary with an inward flux of the lake seiche. Catch rates were poor in May as only 1 site was sampled due to problems with gear. No obligate wetland dependent species were captured, and 4 of the 12 sportfish species present were captured with this form of gear.

ACKNOWLEDGEMENTS

This project was funded by the Lake Erie Protection Fund small grant program and the U.S. Fish and Wildlife Service Challenge Cost-Share program in 1996 and 1997. We would like to thank Mr. Larry Martin, Ottawa National Wildlife Refuge Manager, and the staff of the refuge for their continued help with this project.

LITERATURE CITED

Goodyear, C.S., T.A. Edsall, D.M. Ormsby Dempsey, G.D. Moss, and P.E. Polanski. 1982. Atlas of the spawning and nursery areas of Great Lakes fishes. Volume nine: Lake Erie. U.S. Fish and Wildlife Service, Washington DC FWS/OBS-82/52.

Herdendorf, C.E. and K.A. Krieger. 1989. Overview of Lake Erie and its estuaries within the Great Lakes ecosystem. In Lake Erie Estuarine Systems: Issues, resources, status, and management, ed. K.A. Krieger, pp. 1-34. NOAA Estuary-of-the-Month Seminar Series No. 14. NOAA Estuarine Programs Office, Washington, D.C.

Johnson, D.L. 1989. Lake Erie wetlands: fisheries considerations. In Lake Erie Estuarine Systems: Issues, resources, status, and management, ed. K.A. Krieger, pp. 257-274. NOAA Estuary-of-the-Month Seminar Series No. 14. NOAA Estuarine Programs Office, Washington, D.C.

Ohio Department of Transportation. 1987. Bureau of Environmental Services, Biological Survey Report, pages 13-17. Transportation project WOO/OTT 2-0.00/0.00, PF 1247

U.S. Department of the Interior. 1994. Metzger Marsh coastal wetland restoration project: draft environmental assessment and finding of no significant impact.

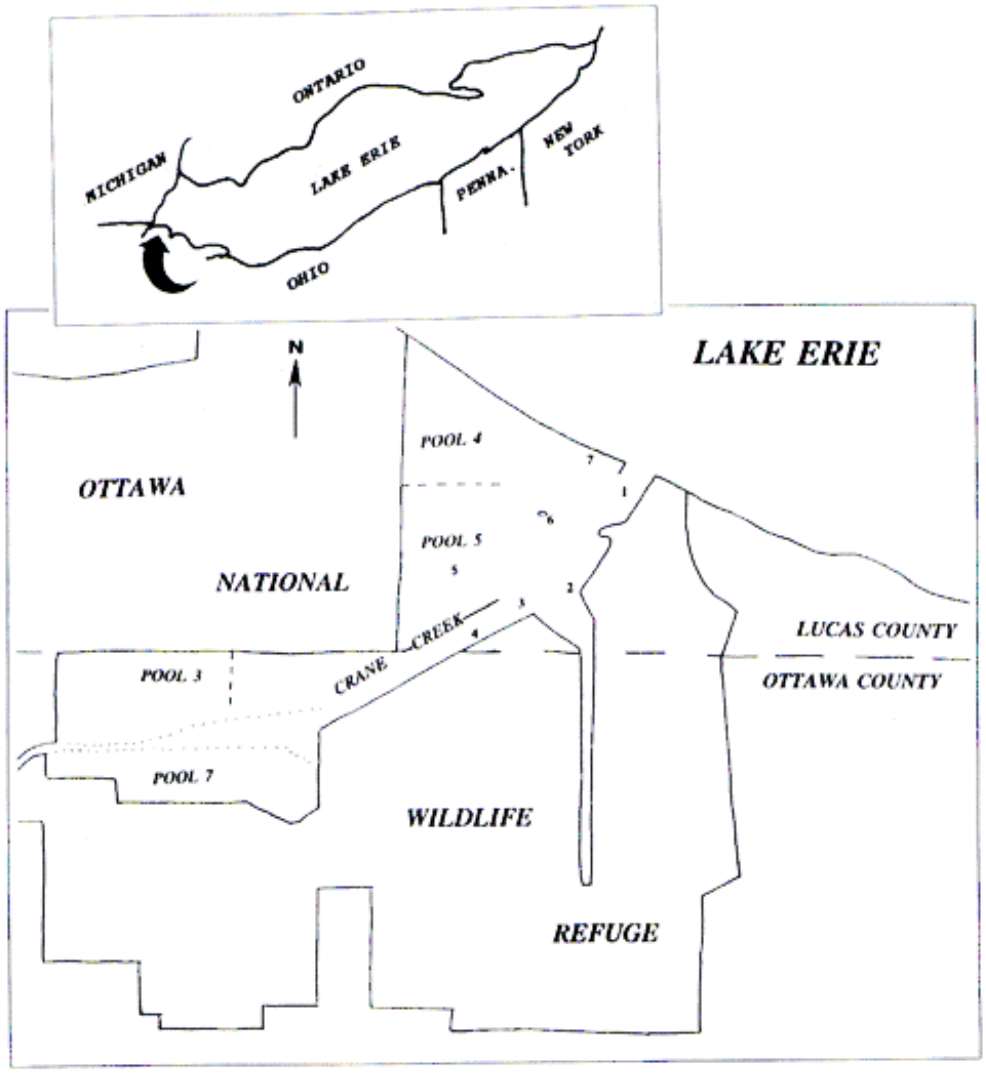

Figure 1. Crane Creek is a tributary to western Lake Erie from the Ottawa National Wildlife Refuge in Lucas County, Ohio. Six locations in the estuary, identified numerically, were sampled in 1997. Site 7 was not sampled due to bank erosion. (Eroded dikes are denoted by "----" and the creek channel is denoted by ".....").

Table 1. Descriptions of Crane Creek fishery survey sites, located on the Ottawa National Wildlife Refuge, Lucas County, Ohio.

Site 1 - Located in the creek channel at the river mouth in the northeast corner of the estuary. Sediments were hard and sandy. Conditions at this site were greatly affected by seiche activity causing variations in intensity and direction of water currents and sampling conditions.

Site 2 - Located in the nearshore area at the opening of a refuge canal to the estuary in the southeast corner. Sediments are soft and silty. Water currents are evident depending upon the direction of the seiche.

Site 3 - Located in the creek channel at the end of the diked channel where it meets the open water along the south shore of the estuary. Sediments are soft and silty. Water currents are evident depending upon the direction of the seiche.

Site 4 - Located in the diked creek channel in a deep hole. Sediments are soft and silty. Water currents are evident depending upon the direction of the seiche.

Site 5 - Located in the middle of pool 5 in shallow open water. There is little water movement outside of weather activity. Sediments are soft and silty and water depths are uniform.

Site 6 - Located on the east end of a depositional island near the creek channel. This is a sandy shore site where sediments to the north are soft and silty and to the south are sandy. Water depths gradually increase away from shore. Water currents are evident depending upon the direction of the seiche.

Site 7 - Located on the west shore of the mouth of the creek at the northeast shore of the estuary. The shore is a sandy depositional area and sediments are soft and silty away from shore. Water depths drop rapidly away from shore and water currents can be high from the west along shore.

Table 2. Number of fish captured from April to October 1997 in Crane Creek estuary on the Ottawa National Wildlife Refuge, Lucas County, Ohio.

Family and species		Date (1997) 4/02-03	5/13-14**	6/17-18***	7/15-16	8/12-13	10/15-16
AMIIDAE							
Bowfin*	*(Amia calva)*	1	0	0	0	0	0
CATOSTOMIDAE							
Largemouth buffalo	*(Ictiobus cyprinellus)*	0	0	0	0	3	0
Quillback carpsucker	*(Carpiodes cyprinus)*	2	7	12	160	126	0
Spotted sucker	*(Minytrema melanops)*	0	0	0	0	0	3
White sucker	*(Catostomus commersoni)*	1	0	0	0	0	0
CENTRARCHIDAE							
Black crappie*	*(Pomoxis nigromaculatus)*	5	1	1	2	53	2
White crappie*	*(Pomoxis annularis)*	1	3	2	1	20	7
Bluegill*	*(Lepomis macrochirus)*	0	3	8	6	0	6
Green sunfish*	*(Lepomis cyanellus)*	0	0	0	1	3	1
Orangespotted sunfish	*(Lepomis humilis)*	0	0	2	2	10	8
Pumpkinseed*	*(Lepomis gibbosus)*	1	1	2	1	16	8
Rockbass	*(Ambloplites rupestris)*	4	1	1	1	1	1
CLUPEIDAE							
Gizzard shad	*(Dorosoma cepedianum)*	0	2	0	386	118	34
CYPRINIDAE							
Cyprinidae spp.		0	0	212	58	18	1
Bluntnose minnow	*(Pimephales notatus)*	0	0	0	0	2	0
Common carp*	*(Cyprinus carpio)*	4	6	6	4	8	3
Goldfish*	*(Carassius auratus)*	11	0	1	0	0	0
Common shiner	*(Notropis chrysocephalus)*	0	0	0	0	2	0
Emerald shiner	*(Notropis atherinoides)*	1081	21	6	39	98	22
Spotfin shiner	*(Notropis spilopterus)*	0	0	1	7	12	0
Spottail shiner	*(Notropis hudsonius)*	364	201	14	31	8	29
Silver chub	*(Hybopsis storeriana)*	0	0	0	0	1	0
ICTALURIDAE							
Brown bullhead*	*(Ameiurus nebulosus)*	7	5	0	2	13	14
Yellow bullhead*	*(Icatlurus natalis)*	0	0	1	0	0	0
Channel catfish	*(Ictalurus punctatus)*	3	0	4	50	92	2
Tadpole madtom*	*(Noturus gyrinus)*	0	0	0	1	0	0
LEPISOSTEIDAE							
Longnose gar*	*(Lepisosteus osseus)*	0	0	1	0	1	0
OSMERIDAE							
Rainbow smelt	*(Osmerus mordax)*	0	0	455	3	0	0
PERCICHTHYIDAE							
White bass	*(Morone chrysops)*	1	1	5	78	18	5
White perch	*(Morone americana)*	6	2	3	2	21	19
PERCIDAE							
Logperch	*(Percina caprodes)*	3	0	0	0	2	0
Walleye	*(Stizostedion vitreum)*	0	0	1	0	0	0
Yellow perch	*(Perca flavescens)*	15	0	4	0	4	1
PERCOPSIDAE							
Trout-perch	*(Percopsis omiscomaycus)*	78	1	0	0	0	0
PETROMYZONIDAE							
Sea lamprey	*(Petromyzon marinus)*	0	0	0	1	0	0
SCIAENIDAE							
Freshwater drum	*(Aplodinotus grunniens)*	6	7	20	32	1	0
N =		1594	262	762	868	651	166
Number of Species		19	15	22	22	25	18

* Denotes species which depend on vegetation or wetland habitat according to Johnson (1989).

** Larval collections made at 2 of 5 sites. *** No seining due to beach erosion.

Table 3a. Biotic data summary for impoundment gear sampling* from Crane Creek estuary, April to October 1997 (total length = mm).

April 02-03

Species	Number	Total Length Mean	Total Length Range
BOW	1	642.0	642
LAB	0	--	--
QUB	2	151.5	140-163
SSU	0	--	--
WHS	1	363.0	363
BLC	4	273.0	196-375
WHC	1	260.0	260
BLG	0	--	--
GRS	0	--	--
ORS	0	--	--
PUM	1	92.0	92
ROB	4	158.2	129-181
GIS	0	--	--
CAP	3	593.3	460-693
GOF	10	127.2	53-286
COS	0	--	--
SFS	0	--	--
STS	343	115.3	88-135
SIC	0	--	--
BRB	7	174.6	55-313
YEB	0	--	--
CHC	3	86.6	85-88
TAM	0	--	--
LNG	0	--	--
WHB	1	312.0	312
WHP	5	101.6	80-116
LOP	1	127.0	127
WAE	0	--	--
YEP	15	173.4	100-239
TRP	76	100.4	78-127
SEL	0	--	--
FRD	6	134.3	86-281
Total =	484	Species =	18

May 13-14

Species	Number	Total Length Mean	Total Length Range
BOW	0	--	--
LAB	0	--	--
QUB	7	435.0	354-470
SSU	0	--	--
WHS	0	--	--
BLC	1	210.0	210
WHC	3	235.6	195-306
BLG	3	115.3	97-130
GRS	0	--	--
ORS	0	--	--
PUM	1	131.0	131
ROB	1	110.0	110
GIS	2	373.0	360-386
CAP	3	430.0	390-461
GOF	0	--	--
COS	0	--	--
SFS	0	--	--
STS	141	109.6	88-135
SIC	0	--	--
BRB	5	222.4	74-310
YEB	0	--	--
CHC	0	--	--
TAM	0	--	--
LNG	0	--	--
WHB	1	125.0	125
WHP	2	127.0	83-171
LOP	0	--	--
WAE	0	--	--
YEP	0	--	--
TRP	1	112.0	112
SEL	0	--	--
FRD	7	118.5	104-132
Total =	178	Species =	14

June 17-18

Species	Number	Total Length Mean	Total Length Range
BOW	0	--	--
LAB	0	--	--
QUB	10	477.8	435-540
SSU	0	--	--
WHS	0	--	--
BLC	1	225.0	225
WHC	2	254.5	254-255
BLG	8	149.0	124-172
GRS	0	--	--
ORS	2	7305.0	67-80
PUM	2	138.5	123-154
ROB	1	174.0	174
GIS	0	--	--
CAP	6	618.8	510-685
GOF	1	227.0	227
COS	0	--	--
SFS	1	N/A	N/A
STS	14	114.5	107-125
SIC	0	--	--
BRB	0	--	--
YEB	1	240.0	240
CHC	4	151.7	80-363
TAM	0	--	--
LNG	1	548.0	548
WHB	5	232.0	149-334
WHP	3	197.3	180-220
LOP	0	--	--
WAE	1	196.0	196
YEP	2	186.5	142-231
TRP	0	--	--
SEL	0	--	--
FRD	20	284.4	135-336
Total =	85	Species =	19

* Effort per month was 5 nights (3 nights effort with 1.2 m trapnet and 2 nights effort with 0.9 m hoopnet).

** Effort for July was 4 nights (site 1 trapnet was fouled) and for August was 4 nights (site 4 trapnet was fouled).

Table 3a. Continued.

July 15-16**				August 12-13**				October 15-16			
Species	Number	Total Length Mean	Total Length Range	Species	Number	Total Length Mean	Total Length Range	Species	Number	Total Length Mean	Total Length Range
BOW	0	--	--	BOW	0	--	--	BOW	0	--	--
LAB	0	--	--	LAB	2	217.5	215-220	LAB	0	--	--
QUB	0	--	--	QUB	0	--	--	QUB	0	--	--
SSU	0	--	--	SSU	0	--	--	SSU	3	325.3	72-520
WHS	0	--	--	WHS	0	--	--	WHS	0	--	--
BLC	2	119.5	107-132	BLC	53	142.5	68-283	BLC	2	171.0	152-190
WHC	1	205.0	205	WHC	20	166.3	116-356	WHC	7	166.4	60-310
BLG	6	135.1	89-156	BLG	0	--	--	BLG	6	103.6	92-147
GRS	1	62.0	62	GRS	3	91.3	81-112	GRS	1	76.0	76
ORS	2	95.0	60-130	ORS	10	71.3	60-115	ORS	8	75.0	69-79
PUM	1	125.0	125	PUM	16	109.0	74-155	PUM	8	102.1	61-133
ROB	1	204.0	204	ROB	1	192.0	192	ROB	1	190.0	190
GIS	0	--	--	GIS	6	70.0	58-100	GIS	34	79.7	64-149
CAP	4	634.6	605-692	CAP	5	492.4	296-591	CAP	2	490.0	490
GOF	0	--	--	GOF	0	--	--	GOF	0	--	--
COS	0	--	--	COS	2	34.5	26-43	COS	0	--	--
SFS	0	--	--	SFS	0	--	--	SFS	0	--	--
STS	10	112.4	94-134	STS	2	48.5	45-52	STS	4	109.7	105-114
SIC	0	--	--	SIC	1	163.0	163	SIC	0	--	--
BRB	2			BRB	13	291.6	213-337	BRB	14	189.6	84-287
YEB	0	--	--	YEB	0	--	--	YEB	0	--	--
CHC	23	134.2	90-396	CHC	5	219.4	105-315	CHC	0	--	--
TAM	1	88.0	88	TAM	0	--	--	TAM	0	--	--
LNG	0	--	--	LNG	0	--	--	LNG	0	--	--
WHB	0	--	--	WHB	9	162.3	76-300	WHB	5	98.4	85-111
WHP	0	--	--	WHP	3	162.6	114-212	WHP	12	75.5	64-79
LOP	0	--	--	LOP	0	--	--	LOP	0	--	--
WAE	0	--	--	WAE	0	--	--	WAE	0	--	--
YEP	0	--	--	YEP	4	144.2	131-160	YEP	1	176.0	176
TRP	0	--	--	TRP	0	--	--	TRP	0	--	--
SEL	1	538.0	538	SEL	0	--	--	SEL	0	--	--
FRD	16	181.7	45-455	FRD	1	68.0	68	FRD	0	--	--
Total =	72	Species =	15	Total =	156	Species =	18	Total =	108	Species =	15

* Effort per month was 5 nights (3 nights effort with 1.2 m trapnet and 2 nights effort with 0.9 m hoopnet).

** Effort for July was 4 nights (site 1 trapnet was fouled) and for August was 4 nights (site 4 trapnet was fouled).

Table 3b. Biotic data summary for seine sampling* from Crane Creek estuary, April to October 1997** (total length = mm).

April 02-03

Species	Number	Total Length Mean	Total Length Range
LAB	0	--	--
QUB	0	--	--
BLC	1	292.0	292
GIS	0	--	--
BLM	0	--	--
CAP	1	740.0	740
GOF	1	113.0	113
EMS	943	53.8	35-87
SFS	0	--	--
STS	21	91.5	70-119
CHC	0	--	--
LNG	0	--	--
WHB	0	--	--
WHP	1	82.0	82
LOP	2	83.5	70-97
TRP	2	82.5	82-83
FRD	0	--	--
Total =	972	Species =	8

May 13-14

Species	Number	Total Length Mean	Total Length Range
LAB	0	--	--
QUB	0	--	--
BLC	0	--	--
GIS	0	--	--
BLM	0	--	--
CAP	3	577.0	577
GOF	0	--	--
EMS	20	67.5	46-83
SFS	0	--	--
STS	60	99.5	52-135
CHC	0	--	--
LNG	0	--	--
WHB	0	--	--
WHP	0	--	--
LOP	0	--	--
TRP	0	--	--
FRD	0	--	--
Total =	83	Species =	3

July 15-16***

Species	Number	Total Length Mean	Total Length Range
LAB	0	--	--
QUB	160	34.4	21-49
BLC	0	--	--
GIS	373	39.5	17-46
BLM	0	--	--
CAP	0	--	--
GOF	0	--	--
EMS	0	--	--
SFS	7	59.5	51-66
STS	16	31.9	23-37
CHC	3	30.6	30-32
LNG	0	--	--
WHB	64	37.0	25-53
WHP	0	--	--
LOP	0	--	--
TRP	0	--	--
FRD	16	43.6	37-51
Total =	639	Species =	7

August 12-13

Species	Number	Total Length Mean	Total Length Range
LAB	1	68.0	68
QUB	126	59.9	42-73
BLC	0	--	--
GIS	111	64.2	51-94
BLM	2	60.0	59-61
CAP	3	458.0	154-650
GOF	0	--	--
EMS	10	73.1	65-81
SFS	12	62.5	55-79
STS	5	72.7	51-93
CHC	73	48.3	39-59
LNG	1	705.0	705
WHB	9	70.1	36-193
WHP	18	52.0	39-142
LOP	2	67.0	61-73
TRP	0	--	--
FRD	0	--	--
Total =	373	Species =	13

October 15-16

Species	Number	Total Length Mean	Total Length Range
LAB	0	--	--
QUB	0	--	--
BLC	0	--	--
GIS	0	--	--
BLM	0	--	--
CAP	1	358.0	358
GOF	0	--	--
EMS	22	72.0	37-100
SFS	0	--	--
STS	24	71.8	14-121
CHC	2	58.0	52-64
LNG	0	--	--
WHB	0	--	--
WHP	7	76.0	65-88
LOP	0	--	--
TRP	0	--	--
FRD	0	--	--
Total =	56	Species =	5

* Effort per month was 2 hauls with a 100' seine.

** Seining was not conducted in June due to bank erosion.

*** Effort for July was 1 haul due to partially eroded beach.

Table 3c. Biotic data summary for larval fish sampling" from Crane Creek estuary, April to October 1997 (total length = mm).

April 02-03

Species	Number	Total Length Mean	Total Length Range
QUB	0	--	--
GIS	0	--	--
EMS	138	50	36-65
STS	0	--	--
CHC	0	--	--
SMT	0	--	--
WHB	0	--	--
WHP	0	--	--
YEP	0	--	--
CYP	0	--	--
Total = 138		Species = 1	

May 13-14**

Species	Number	Total Length Mean	Total Length Range
QUB	0	--	--
GIS	0	--	--
EMS	1	40	40
STS	0	--	--
CHC	0	--	--
SMT	0	--	--
WHB	0	--	--
WHP	0	--	--
YEP	0	--	--
CYP	0	--	--
Total = 1		Species = 1	

June 17-18

Species	Number	Total Length Mean	Total Length Range
QUB	2	N/A	N/A
GIS	0	--	--
EMS	6	56.3	45-70
STS	0	--	--
CHC	0	--	--
SMT	455	N/A	N/A
WHB	0	--	--
WHP	0	--	--
YEP	2	N/A	N/A
CYP	212	N/A	N/A
Total = 677		Species = 5	

July 15-16

Species	Number	Total Length Mean	Total Length Range
QUB	0	--	--
GIS	13	26.8	23-30
EMS	39	35	23-45
STS	5	26.4	19-42
CHC	24	16.8	14-18
SMT	3	13	13
WHB	13	17.4	11-23
WHP	2	16.5	15-18
YEP	0	--	--
CYP	58	16.6	5-45
Total = 157		Species = 8	

August 12-13

Species	Number	Total Length Mean	Total Length Range
QUB	0	--	--
GIS	1	27.0	27
EMS	88	35.3	20-49
STS	1	33.0	33
CHC	14	14.1	10-15
SMT	0	--	--
WHB	0	--	--
WHP	0	--	--
YEP	0	--	--
CYP	18	13.1	10-20
Total = 122		Species = 5	

October 15-16

Species	Number	Total Length Mean	Total Length Range
QUB	0	--	--
GIS	0	--	--
EMS	0	--	--
STS	1	40.0	40
CHC	0	--	--
SMT	0	--	--
WHB	0	--	--
WHP	0	--	--
YEP	0	--	--
CYP	1	40	40
Total = 2		Species = 2	

* Effort per month was 50 minutes (10 minutes effort with a 303 um mesh 1 m icthypolankton net at each of sites 1-5).

** Effort for May was 20 minutes (sites 2-4 were not sampled due to lost sampling gear).

Table 4. Biotic data summary for sportfish captured from Crane Creek estuary, April to October 1997 (length = mm and weight = g).

April 02-03

Species	Number	Total Length Mean	Total Length Range	Mean Weight	Total Weight
BLC	5	276.8	196-375	455.0	2275
WHC	1	260.0	260	295.0	295
BLG	0	--	--	--	--
ROB	4	158.2	129-181	108.7	435
PUM	1	92.0	92	7.0	7
CHC	3	86.6	85-88	5.0	15
WHB	1	312.0	312	450.0	450
WHP	6	98.3	80-116	10.5	63
YEP	15	173.5	100-239	78.3	1175
GRS	0	--	--	--	--
ORS	0	--	--	--	--
WAE	0	--	--	--	--

Total = 36 Species = 8

July 15-16

Species	Number	Total Length Mean	Total Length Range	Mean Weight	Total Weight
BLC	2	119.5	107-132	36.0	72
WHC	1	205.0	205	120.0	120
BLG	6	135.2	89-156	59.0	354
ROB	1	204.0	204	163.0	163
PUM	1	125.0	125	42.0	42
CHC	50	71.7	14-396	47.9	1246
WHB	77	34.9	11-53	2.0	154
WHP	2	16.5	15-18	2.0	2
YEP	0	--	--	--	--
GRS	1	62.0	62	4.0	4
ORS	2	95.0	60-130	32.0	64
WAE	0	--	--	--	--

Total = 143 Species = 10

May 13-14

Species	Number	Total Length Mean	Total Length Range	Mean Weight	Total Weight
BLC	1	210.0	210	150.0	150
WHC	3	235.6	195-306	213.3	640
BLG	3	115.3	97-130	23.3	70
ROB	1	110.0	110	17.4	17
PUM	1	131.0	131	10.0	10
CHC	0	--	--	--	--
WHB	1	125.0	125	10.0	10
WHP	2	127.0	83-171	20.0	40
YEP	0	--	--	--	--
GRS	0	--	--	--	--
ORS	0	--	--	--	--
WAE	0	--	--	--	--

Total = 12 Species = 7

August 12-13

Species	Number	Total Length Mean	Total Length Range	Mean Weight	Total Weight
BLC	53	142.6	68-283	64.3	3217
WHC	20	166.3	116-356	92.0	1840
BLG	0	--	--	--	--
ROB	1	192.0	192	130.0	130
PUM	16	109.1	74-155	32.0	512
CHC	92	52.3	39-315	14.7	1340
WHB	18	116.8	36-300	53.9	917
WHP	21	67.8	39-212	14.1	297
YEP	4	144.2	131-160	25.0	100
GRS	3	91.3	81-112	13.3	40
ORS	10	71.3	53-115	6.0	60
WAE	0	--	--	--	--

Total = 238 Species = 10

June 17-18

Species	Number	Total Length Mean	Total Length Range	Mean Weight	Total Weight
BLC	1	225.0	225	185.0	185
WHC	2	254.5	254-255	255.0	510
BLG	8	149.7	129-172	82.1	657
ROB	1	174.0	174	140.0	140
PUM	2	138.5	123-154	80.0	160
CHC	4	151.8	80-363	146.3	585
WHB	5	232.0	149-334	234.0	1170
WHP	3	197.3	180-220	148.3	445
YEP	4(2 larval)	186.5	142-231	115.0	230
GRS	0	--	--	--	--
ORS	2	73.5	67-80	11.5	23
WAE	1	196.0	196	90.0	90

Total = 33 Species = 11

October 15-16

Species	Number	Total Length Mean	Total Length Range	Mean Weight	Total Weight
BLC	2	171.0	152-190	87.5	175
WHC	7	166.4	59-310	122.1	855
BLG	6	103.6	92-147	23.3	140
ROB	1	190.0	190	160.0	160
PUM	8	102.1	61-133	21.3	170
CHC	2	58.0	52-64	1.0	1
WHB	5	98.4	85-111	10.8	54
WHP	19	75.7	64-88	4.0	76
YEP	1	176.0	176	65.0	65
GRS	1	76.0	76	10.0	10
ORS	8	75.0	69-79	8.6	69
WAE	0	--	--	--	--

Total = 60 Species = 11

APPENDIX I

SPECIES KEY

Common Name	Scientific Name	Abbreviation
Black crappie	*Pomoxis nigromaculatus*	BLC
Bluegill	*Lepomis macrochirus*	BLG
Bluntnose minnow	*Pimephales notatus*	BLM
Bowfin	*Amia calva*	BOW
Brown bullhead	*Ameiurus nebulosus*	BRB
Channel catfish	*Ictalurus punctatus*	CHC
Common carp	*Cyprinus carpio*	CAP
Common shiner	*Notropis chrysocephalus*	COS
Cyprinidae species		
Emerald shiner	*Notropis atherinoides*	EMS
Freshwater drum	*Aplodinotus grunniens*	FRD
Gizzard shad	*Dorosoma cepedianum*	GIS
Goldfish	*Carassius auratus*	GOF
Green sunfish	*Lepomis cyanellus*	GRS
Largemouth buffalo	*Ictiobus cyprinellus*	LAB
Logperch	*Percina caprodes*	LOP
Longnose gar	*Lepisosteus osseus*	LNG
Orangespotted sunfish	*Lepomis humilis*	ORS
Pumpkinseed	*Lepomis gibbosus*	PUM
Quillback carpsucker	*Carpiodes cyprinus*	QUB
Rainbow smelt	*Osmerus mordax*	SMT
Rockbass	*Ambloplites rupestris*	ROB
Sea lamprey	*Petromyzon marinus*	SEL
Silver chub	*Hybopsis storeriana*	SIC
Spotfin shiner	*Notropis spilopterus*	SFS
Spottail shiner	*Notropis hudsonius*	STS
Spotted sucker	*Minytrema melanops*	SSU
Tadpole madtom	*Noturus gyrinus*	TAM
Trout-perch	*Percopsis omiscomaycus*	TRP
Walleye	*Stizostedion vitreum*	WAE
White bass	*Morone chrysops*	WHB
White crappie	*Pomoxis annularis*	WHC
White perch	*Morone americana*	WHP
White sucker	*Catostomus commersoni*	WHS
Yellow bullhead	*Ictalurus natalis*	YEB
Yellow perch	*Perca flavescens*	YEP