FINAL REPORT

Contributing Factors in Habitat Selection by Lake Sturgeon (*Acipenser fulvescens)*

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Great Lakes National Program Office

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EXECUTIVE SUMMARY

Lake sturgeon diets were examined over three different size classes obtained from the mainstem St. Lawrence River below the St. Lawrence – FDR Power Project during the early summer and late fall / winter seasons. The benthic evaluations to determine prey densities and substrate types were conducted within juvenile and adult habitats. Total fish captures ranged in size from 341 mm to 1498 mm total length. Stomach contents were removed for examination using a gastric lavage method. The dominant prey type for the 300-650 mm size class was determined to be Dipteran larvae (chironomidae) in the summer and Malacostraca (gammaridae) in the fall. Molluscs (Dreissenidae) and gastropods first appeared in the 651–1001 mm size class and were the dominant prey type identified within the 1002 -1352 mm size class during the summer and fall sampling events. Chironomidae and brachycentridae were the two most abundant prey types found in samples of macrobenthos samples collected from areas identified as juvenile habitat.

ACKNOWLEDGEMENTS

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INTRODUCTION

The lake sturgeon (*Acipenser fulvescens*), once widely distributed among the Great Lakes, Hudson Bay and Mississippi drainages maintains only a fraction of its former range and abundance due to habitat loss and over-exploitation. The New York State Department of Environmental Conservation (NYSDEC) closed the sturgeon fishery in 1976 (Carlson 1995) and listed the species as "Threatened" in 1983. The single largest stock of lake sturgeon remaining in New York State waters is located in the St. Lawrence River below the FDR St. Lawrence Power Project (power project) located at Massena, New York. This remnant stock has been the focus of ongoing research efforts conducted by scientists at the State University of New York, College of Environmental Science and Forestry (SUNY CESF) to determine the population dynamics, movement and habitat requirements of this threatened species in a large riverine system modified by the development of the St. Lawrence Seaway and large hydropower projects.

The life history requirements of lake sturgeon are associated with the use of a broad range of habitat types for spawning, nursery, juvenile and adult forage areas and their respective migration corridors (Threader 1998). Identification of the habitats utilized throughout a species life history is key to the successful restoration and recovery efforts which may involve habitat enhancements, reintroduction or protection of the existing stock and the remaining viable habitat. Telemetry results and catch per unit effort data indicate that juvenile lake sturgeon below the St. Lawrence-FDR Power project demonstrate high levels of site fidelity to patches of substrate dominated by silt (Hayes and Werner 2002). During the same study, chironomidae and brachycentridae were the two most abundant prey types identified in macrobenthos samples collected from areas considered juvenile habitat. Correspondingly, preliminary diet samples collected from juvenile sturgeon indicated that soft bodied invertebrates were the dominant prey type represented within that size group. Adult sturgeon within the same study area were found over a larger range of heterogeneous habitat type. Evidence of large scale bivalve mussel predation in adult areas along with preliminary diet evaluations and direct observation of adults feeding on the bivalves suggested that the invasive Dreissenid bivalves may comprise a significant component of the sturgeon diet.

Differences in preferred prey densities could account for the apparent habitat partitioning observed between juvenile and adult lake sturgeon and the patchy distribution of the smallest of sturgeon size classes. This study examines the diet of different size classes of lake sturgeon to investigate shifts in prey preference related to body size and to determine if exotic Dreissenid mussels comprise a significant component of the sturgeon diet. This study also examines the apparent differences in juveniles and adult habitat relative to preferred prey items.

STUDY LOCATION

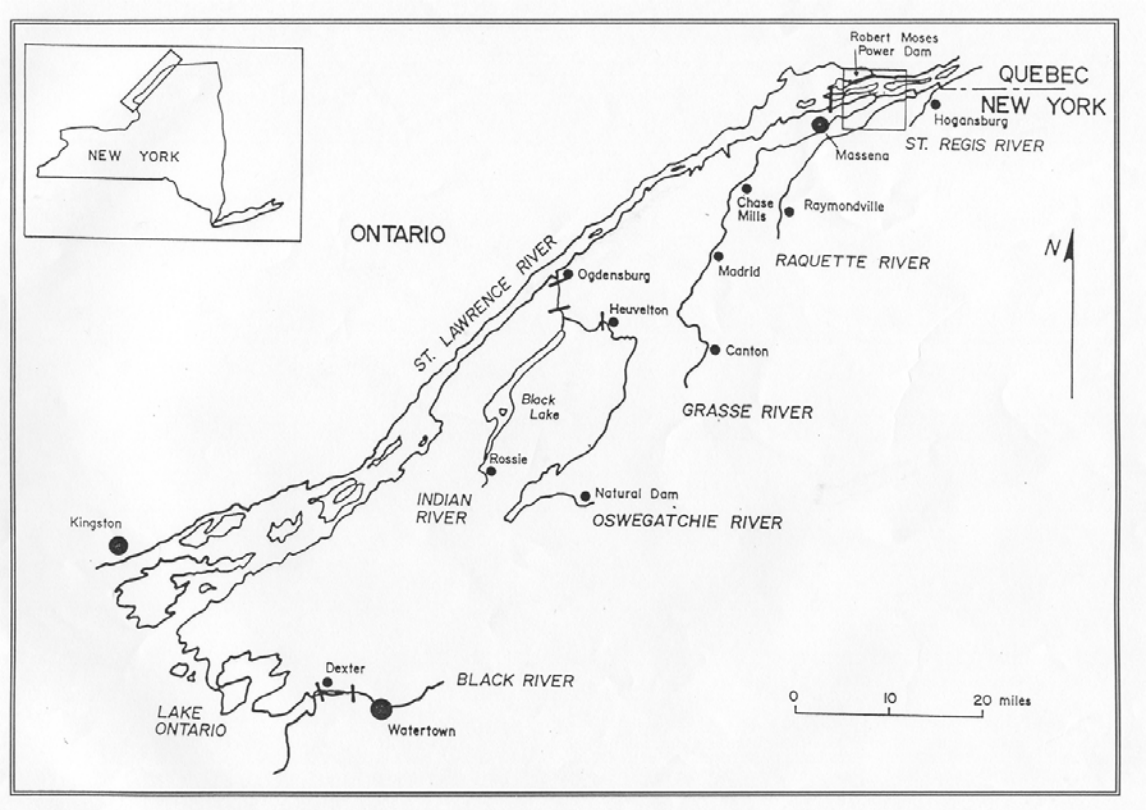
The St. Lawrence River, the 14th largest drainage basin in the world, connects the Great Lakes with the Atlantic Ocean. The river, approximately 800 km long is divided into three sections: the freshwater river, extending from Lake Ontario to Quebec; the St. Lawrence estuary, extending from Quebec to Anticosti Island; and the Gulf of St. Lawrence, which opens to the Atlantic. Within New York State the river acts as the international boundary between the U.S. and Canada for approximately 200 km with the upper reach extending from Cape Vincent, N.Y. to Morristown, N.Y. and the lower reach extending from Morristown to Massena, N.Y (Figure 1).

This report describes the diet preferences of juvenile and adult lake sturgeon within the St. Lawrence River in the vicinity of the St. Lawrence - FDR Power project located at latitude 45^{o} 00’ 15” and longitude 74^{o} 47’ 45” . The power project, completed in 1958, straddles the border between the United States and Canada and is one of the largest non-federal hydro-electric facilities in North America measuring 3,200 feet in length and equipped with 32 turbine generators. The impoundment created by the power project is Lake St. Lawrence which stores 244 billion gallons of water and has a surface area of approximately 39,100 acres. The vertical drop at the dam is 81 feet and an average 243,000 cubic feet of water pass through each second.

The Long Sault control dam discharges into a bypass channel, referred to as the south channel, which is part of the original channel of the river that now reconnects with tailrace waters from the southwest. The south channel is generally characteristic of a lentic environment with intermittent discharges though the control dam which create temporary lotic conditions.

Lake St Francis, an impoundment created by the Beauharnois Dam in Quebec is located 13 miles downstream.

Figure 1. Site location map of lake sturgeon study area in St. Lawrence River



OBJECTIVES

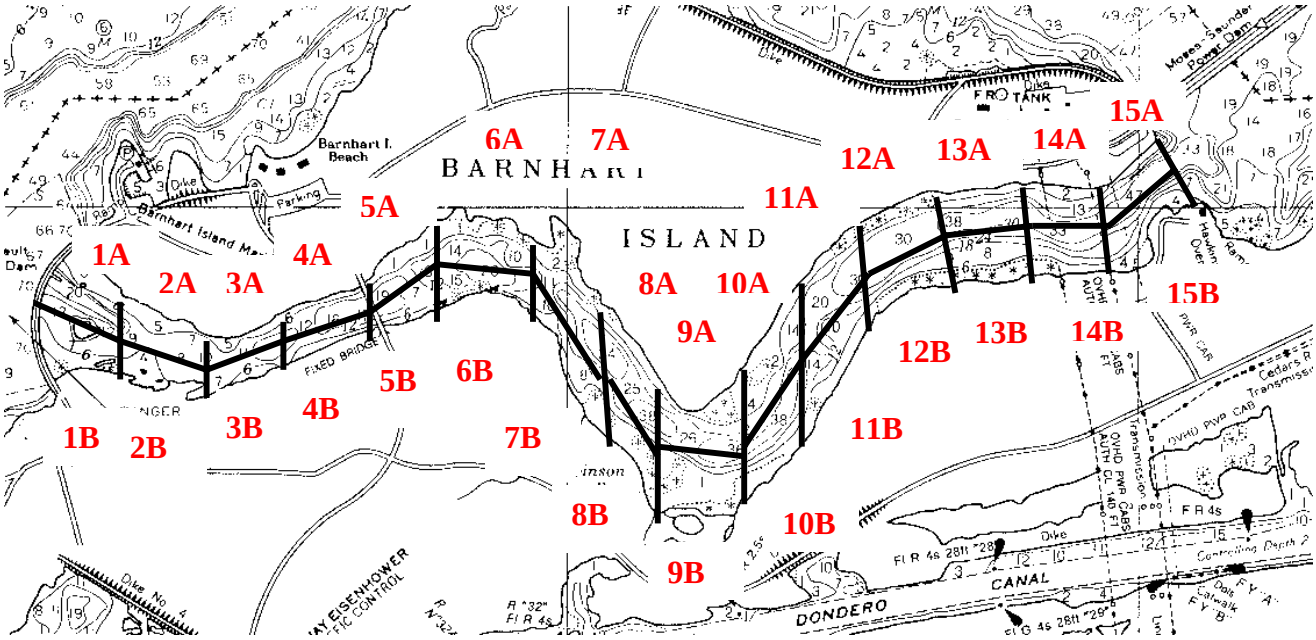
1. Determine the preferred prey types of juvenile and adult lake sturgeon in the St. Lawrence River below the FDR Power Project at Massena.
2. Determine the size threshold of lake sturgeon for consumption of Dreissenid mussels.
3. Examine the relationship between feeding characteristics of juvenile and adult lake sturgeon and the benthic invertebrate community within their preferred habitats.

METHODS

Lake sturgeon capture and handling

Sampling for lake sturgeon in the summer and late fall of 2002 was accomplished within the bypass channel below the St. Lawrence - FDR Power Project using a suite of multifilament experimental gillnets 61.0 m (200 ft.) long and 2.4 m (8 ft.) deep consisting of 7.6 m (25 ft.) panels arranged in order of increasing mesh size from 38 mm (1.5 in.) to 152 mm (6 in.) and large mesh gillnets 91 m long ranging from 200 mm to 254 mm stretch mesh. This compliment of nets was chosen to capture a range lake sturgeon sizes. The entire compliment of nets consisting of two experimental gillnets and two large mesh nets were fished in areas identified in previous studies as juvenile (cells 15 A and 15 B) and adult habitat (cells 14 A and 14 B) as noted in Figure 2. Four net sets were deployed each night and retrieved in early morning. This sampling strategy was employed to evaluate similarity in diet between sizes of fish and sampling sites. Lake sturgeon captures were removed from the nets, noting the origin of their capture and placed into a holding tank aboard the boat for transport to the shore research station. Sturgeon were then transferred to 1700 liter tanks receiving a continuous flow of water from the St. Lawrence River. Fork and total length were measured to the nearest mm for each captured fish.

Figure 2. Sampling cells within power project bypass channel study area



Diet evaluation

Attempts were made to obtain diet samples from twenty-five sturgeon within three size classes of 350 mm intervals during two sample periods: late spring – summer and late fall /winter. The three size intervals were 300-650mm, 651-1001mm and 1002-1352mm or greater. A gastric lavage method was employed to avoid the sacrifice of this threatened species. The stomach contents of smaller specimens were removed using a stomach pump consisting of a 500 cc syringe equipped with a tube size appropriate for that size class, generally 1.8 mm exterior diameter. Stomach contents from larger sturgeon were obtained using a one-gallon polyethylene container equipped with a hand pump and interchangeable tubing of various diameters. Stomach contents were captured in a number 100 sieve (149 microns), removed for fixation in 10% formalin and preserved in 70% alcohol. Prey taxa were identified into major groups and counted. The importance of different prey items to each size class was then determined.by percent composition by number.

Figure 3. Gastric lavage method used to extract stomach contents of adult sturgeon.

Substrate Evaluations

Substrate evaluations were accomplished using direct observation by two divers within the juvenile and adult gillnet sampling areas. Substrate evaluations were performed using direct observations along two transects 100 m long centrally located within the sampling areas and generally coincident with gillnet sampling locations. Each transect consisted of five one-meter square sampling stations positioned approximately every 23 meters .The parallel transects were located approximately 125 meters apart. Individual sampling stations were marked for identification and resampling purposes.

The direct observations recorded at each sampling station during the summer and fall substrate assessment included: % Dreissenid mussel coverage, % vegetation cover and evidence of Dreissenid mussel consumption. The physical attributes of substrate composition were evaluated during the summer diet sampling phase and not repeated during the fall phase. % Dreissenid mussel coverage, vegetation cover and evidence of mussel consumption was evaluated during each of the two sampling seasons. The physical substrate was described in accordance with a modified Wentworth classification (Bovee 1986): organic, clay, silt (<0.012 cm), fine sand (0.012-0.1 cm), coarse sand (0.1 - 0.4 cm), fine gravel (0.4 - 0.8 cm), medium gravel (0.8 - 1.6 cm), coarse gravel (1.6 - 3.2 cm), pebble (3.2 - 6.4 cm), small cobble (6.4 - 13 cm), large cobble (13 - 25.6 cm) boulder (>25.6 cm) and bedrock.

Macroinvertebrate Sampling

Macroinvertebrate samples were collected from the juvenile and adult areas during the summer and late fall / winter diet sampling phases. Substrate samples for benthic macroinvertebrates were collected at each sampling station using a 4” long, schedule 20 PVC 4” cylinder with end caps. The contents of each sample were placed in glass jars and preserved with 5% formalin-Rose Bengal Dye solution for one week and then transferred to 70% ethanol. The separation of benthic organisms from sediments and debris was accomplished using a 50μm sieve. Identification of benthos was accomplished to the lowest practical level.

RESULTS

Lake Sturgeon Capture and Diet Sampling

Spring / Summer

Sampling to obtain lake sturgeon for the summer phase of this diet study began in May 2002 and was completed in July 2002. The summer sampling effort to capture 25 lake sturgeon within each of the three target size classes (300-650 mm, 651-1001 mm, 1002-1352 mm and larger) was successful. Summer lake sturgeon captures ranged in size from 341mm to 1498 mm total length. The results from this sampling period were consistent with results reported in the USEPA Grant Report GL985675-01 which described the habitat partitioning that occurs between juvenile and adult lake sturgeon within the bypass channel below the FDR Power project. A total of 92% (n=23) of the smallest size class were captured within areas previously identified as juvenile habitat (cells 15A and 15B). 68% (n=17) of the mid-size class and 72% (n=18) of the largest size class were captured within areas previously identified as adult habitat (cells 14A and 14B).

Fall

Sampling to obtain lake sturgeon for the late fall phase of this diet study began October 28, 2002 and was completed December 21, 2002. Field efforts to capture 25 specimens from each target size class were again successful. Fall lake sturgeon captures ranged in size from 354 mm to 1604 mm total length. Fall sturgeon captures were consistent with earlier results that suggested size dependent spatial partitioning. During fall sampling 84% (n=21) of juveniles less than 650 mm in length were captured within cells 15A and 15B, known juvenile habitat. 48% (n=12) of the mid-size class and 76% (n=19) of the largest size class were captured within areas previously identified as adult habitat (cells 14A and 14B). A lower percentage of fall sturgeon captures had food in their stomachs than did the summer sampling component. This trend was consistent within each of the three size categories.

Diet Evaluation

Summer

Efforts to obtain a diet sample from each of the 25 fish within each size class during the summer using a simple gastric lavage method resulted in a total 61 diet samples extracted from 75 fish

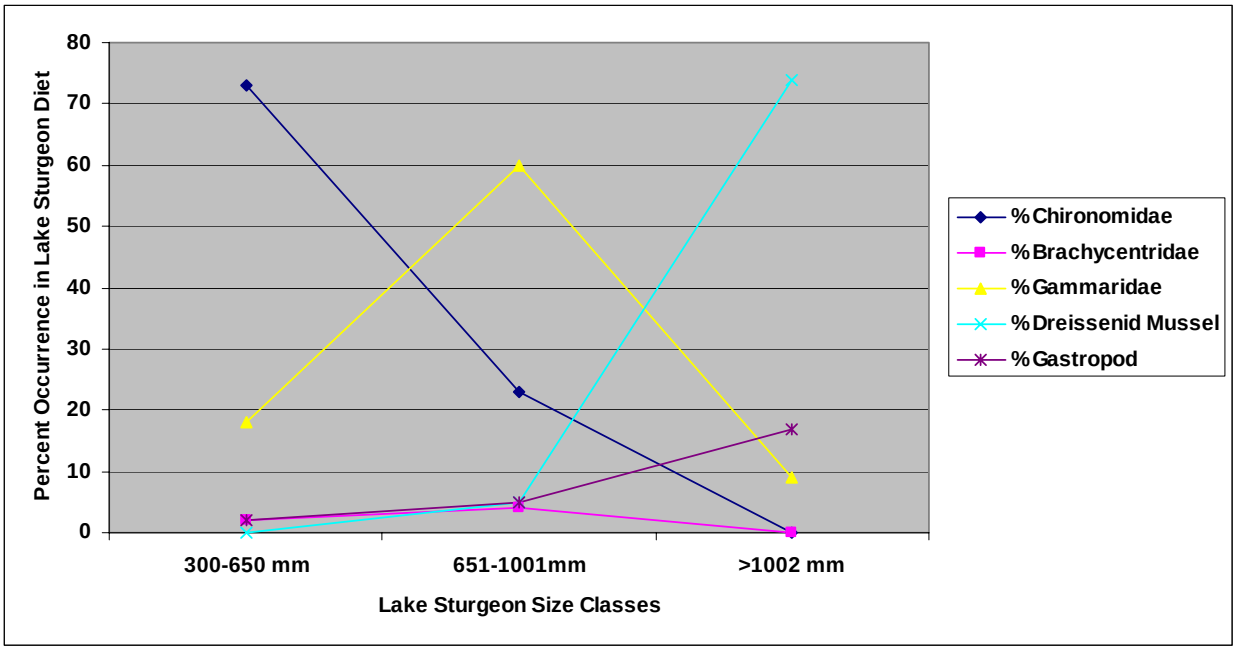
captures. The term diet sample in this study refers to any materials whole or in part extracted from the alimentary tract during the lavage procedure. Samples were obtained from 88% (n=22) of fish captured in the 300-650 mm size class, 80% (n=21) from the 651-1001 size class and 72% (n=18) from the largest size class. No diet sample contents were determined to be unidentifiable. Sturgeon that did not yield a diet sample were presumed to have zero gut contents.

A total of 1003 prey items were collected from the smallest size class (300-650 mm). The dominant prey items within this size class were chironomidae (72.9%) and gammaridae (17.9%). Other prey taxa included brachycentridae (1.9%), gastropods (1.8%), ceratopogonidae (2.5%) and larval fish (1%). Molluscs in the form of bivalve mussels were not identified in diet samples extracted from lake sturgeon smaller than 650mm however gastropods were present in six (1.8%) samples including the smallest fish captured (385 mm TL).

Fewer prey items (n=661) were collected from 651-1001 mm size class during the summer sampling event. There was a notable decrease in the consumption of chironomids (22.8%) and increase in gammaridae (59.7%). Concentrations of brachycentridae (3.9%) and ceratopogonidae (2%) remained relatively unchanged. Molluscs accounted for greater than 10% of the prey items identified in this mid-size class of sturgeon. Molluscs include gastropods which account for 5.5% of the prey items and Dreissenid mussels. Intact Dreissenid mussels first appeared in the diet of a 682 mm specimen and were identified in 36% of the diet samples collected. Dreissenid mussels account for 4.6% of all prey items identified in this group.

A total of 167 prey items were collected from the largest sturgeon size class (>1002 mm) during the summer sampling event. Molluscs were the dominant prey items in this size class. Dreissenid mussels were the most common prey item and accounted for 73.5% of the diet in this size class followed by gastropods which contributed 16.7% to the diet. Gammaridae and brachycentridae contribute less than 1% of the total diet and chironomids were not identified in any of the diet samples collected.

Figure 4. Summer diet composition of lake sturgeon in St. Lawrence River below the FDR Power Project



Late Fall / Winter

As expected, fewer sturgeon had stomach contents and prey items were less numerous in diet samples obtained from sturgeon in all size classes during the fall / winter sampling event. A total of 47 diet samples were extracted from 75 fish captures. The term diet sample in this study refers to any materials whole or in part extracted from the alimentary tract during the lavage procedure. Samples were obtained from 72% (n=18) of fish captured in the 300-650 mm size class, 64% (n=16) from the 651-1001 size class and 52% (n=13) from the largest size class. . No diet sample contents were determined to be unidentifiable. Sturgeon that did not yield a diet sample were presumed to have zero gut contents.

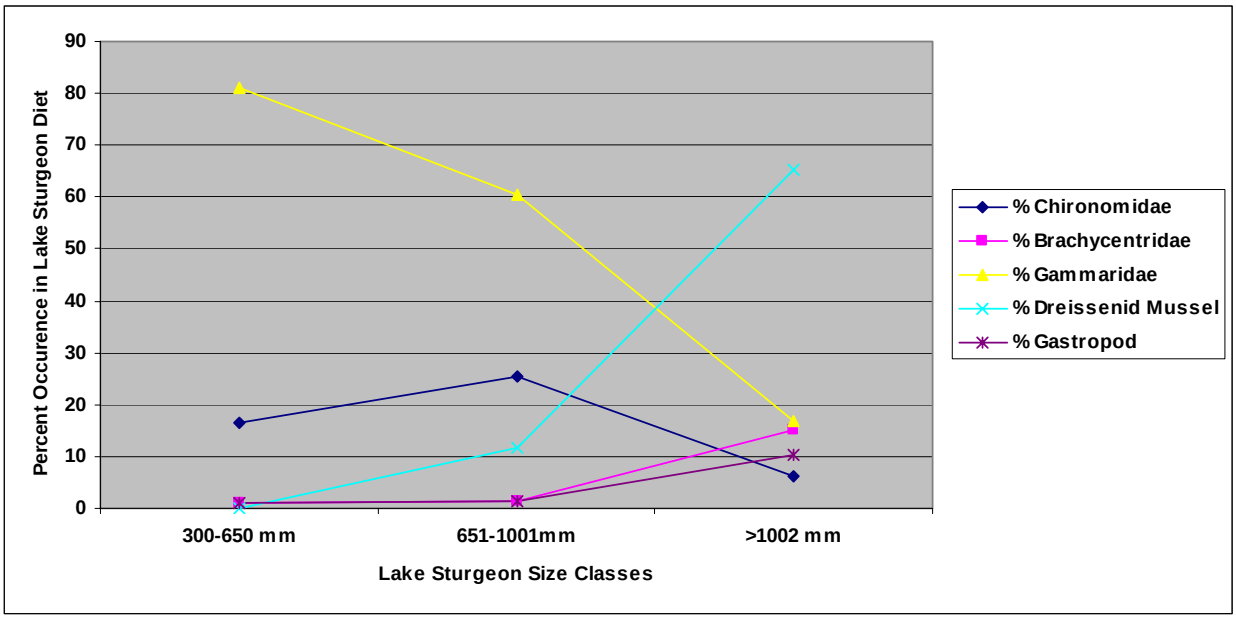
A total of 433 prey items were collected from the smallest size class (300-650 mm). Prey items were less diverse than in the summer. Gammaridae was by far the dominant prey (80.9%) in the smallest size class followed by chironomidae (16.6%) which is the reverse trend compared to the summer diet sample results which demonstrated dominant concentrations of chironomids.

Brachycentridae (1.9%) varied little from the summer sampling results and molluscs contributed less than 0.1% in the form of gastropods.

Fewer prey items (n=396) were collected from the next larger size class (651-1001 mm) during the fall/winter sampling event. Gammaridae was again the dominant taxa contributing 60.3% of the diet followed by an increase in chironomids (25.3%) and little change in concentrations of brachycentridae (1.5%). Molluscs contributed 13.1% of the total diet. Dreissenid mussels contributed the majority (11.6%) of the hard shell prey items in this size class. Intact mussels first appeared in the diet of a 666 mm specimen in this sampling event.

A total of 264 prey items were collected from the largest sturgeon size class (>1002 mm) during the fall/winter sampling event. Molluscs remained the dominant prey items in this size class. Dreissenid mussels were the most common prey item and accounted for 65.2% of the diet. Gastropods accounted for 10.2% of the diet. The contribution of gammaridae was much higher (17%) in this sampling period and concentrations of brachycentridae (1.5%) and chironomidae (6%) were higher as well in comparison to the summer sampling event.

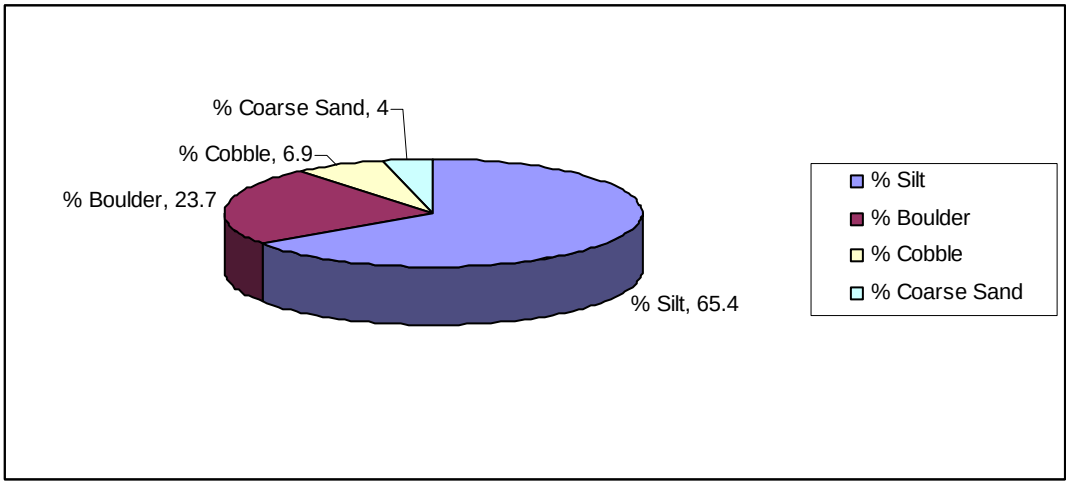
Figure 5. Late fall/winter diet composition of lake sturgeon in the St. Lawrence River below the FDR Power Project.



Substrate Evaluations of Juvenile Habitat

The physical substrate attributes of the overall substrate evaluation for the juvenile habitat sampled were recorded during the summer diet sampling phase and not repeated during the fall based on the premise that actual substrate composition would remain stable. The dominant substrate component of the juvenile habitat sampled was silt (65.4%), followed by random dispersions of boulder accounting for 23.7% of the substrate described and 6.9% cobble. Boulders and some larger cobbles within the sampling area did support concentrations of Dreissenid mussels that ranged from 30% surface coverage in summer to 19% surface coverage in fall. There was no direct evidence of Dreissenid mussel consumption noted during either the summer or fall sampling event. There was zero percent vegetation cover noted along the juvenile habitat sampling transects during the summer and late fall benthic evaluations.

Figure 6. Dominant substrate type associated with juvenile lake sturgeon habitat in FDR Power Project bypass channel, St. Lawrence River.

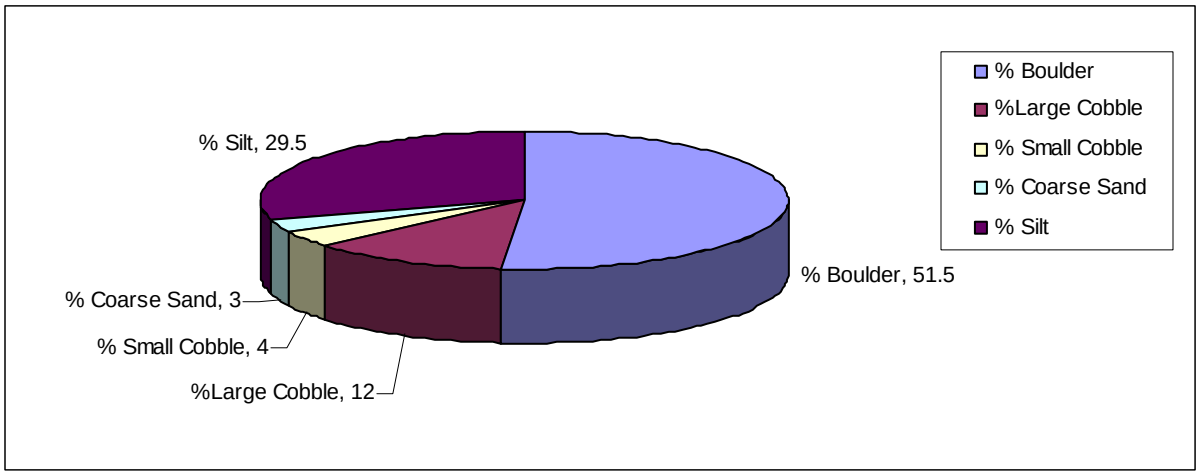


Substrate Evaluations of Adult Habitat

The physical substrate attributes of the overall substrate evaluation of the adult habitat sampled were recorded during the summer diet sampling phase and not repeated during the fall. The dominant substrate components of the adult habitat sampled were boulder (51.5%) and silt

(29.5%) followed by large cobble (12%), small cobble(4%) and coarse sand 3%. Boulders and some larger cobbles within the sampling area did support concentrations of Dreissenid mussels that ranged from 35% surface coverage in summer to 20% surface coverage in fall. There was some evidence of mussel consumption noted during the summer sampling event in the form of damaged and destroyed patches of mussels on the tops of larger boulders. There was zero percent vegetation cover noted along the juvenile habitat sampling transects during the summer and late fall benthic evaluations.

Figure 7. Dominant substrate type associated with adult lake sturgeon habitat in FDR Power Project bypass channel, St. Lawrence River.



Macroinvertebrate Sampling

Juvenile Habitat

A total of 572 intact invertebrate organisms were collected and identified from 10 benthic samples collected within the juvenile sampling area during the summer sampling event. Chironomidae (n=341), brachycentridae (n=149) and gammaridae (n=58) were the three dominant taxa within the substrate sampled and accounted for 59%, 26% and 10% of the total respectively. Other invertebrates identified include oligochaeta (n=18), platyhelminthes (n=3), leptoceridae (n=3), bivalves (n=6) and gastropods (n=1). Live Dreissenid mussel coverage averaged 30% over boulder and cobbles which comprised 30.6% of the substrate evaluated.

A total of 387 intact invertebrate organisms were collected and identified from the 10 benthic sampling stations within the juvenile habitat during the late fall/winter sampling event conducted December 22-23, 2002. Chironomidae (n=228), gammaridae (n=89) and brachycentridae (n=59) were the dominant taxa and accounted for 59%, 23% and 15% respectively. Other invertebrates identified included oligochaeta (n=5), platyhelminthes (n=4) and ephemeridae (n=2). Live Dreissenid mussel coverage averaged 19% over boulder and cobble substrates which comprised 30.6% of the substrate evaluated in the juvenile habitat.

Adult Habitat

A total of 186 intact invertebrates were collected and identified from 6 benthic sampling stations during the summer sampling event. Benthic samples were not collected from four stations comprised primarily of boulder substrate. Chironomidae (n=94), gammaridae (n=43) and brachycentridae (n=37) were the dominant taxa present in adult sturgeon habitat. Other invertebrates identified included ephemeridae (hexagenia sp.) (n=9) and oligochaeta (n=3). Live Dreissenid mussel coverage averaged 35% over boulder and large cobble substrate which comprised 63.5 % of the substrate evaluated in the adult habitat.

A total of 154 intact invertebrates were collected and identified from 6 benthic sampling stations during the late fall/winter sampling event conducted December 22-23, 2002. Benthic samples were not collected from four stations comprised primarily of boulder substrate. Chironomidae (n=60), gammaridae (n=67) and brachycentridae (n=24) were the dominant taxa present in adult sturgeon habitat. Other invertebrates identified included ephemeridae (hexagenia sp.) (n=2) and oligochaeta (n=1). Live Dreissenid mussel coverage averaged 20% over boulder and large cobble substrate which comprised 63.5 % of the substrate evaluated in the adult habitat.

DISCUSSION

This study demonstrates a change in diet in relation to fish size and a relationship to habitat preference based upon prey availability.

Qualitative assessments of lake sturgeon diet in the St. Lawrence River below the FDR Power Project indicate that lake sturgeon within the smallest size classes demonstrate a preference for chironomids and amphipods (gammaridae) with some minor consumption of caddisfly larvae (brachycentridae). Diet samples indicate that that there is an increase in consumption of amphipods by the smallest size class in the fall sampling period. This observed increase may be related to an increase in fall abundance of this prey item. Benthic sampling results indicate an approximate 35% increase in amphipod concentrations in both adult and juvenile habitats during the fall sampling period. As sturgeon increase in size, mussels become a preferential prey item to the extent that the bivalves are sometimes foraged upon to the exclusion of other available prey. The size threshold for mussel consumption in this population appears to be in the mid to upper 600 mm total length range.

Chaisson, et.al. (1997) and Threader (1998) suggest that silt, sand and gravel are assumed to be optimal for juvenile lake sturgeon because smaller size substrates contain smaller-size benthos. Habitat preference, which is often directly related to prey preference and prey availability directly and indirectly influences the distribution of organisms. In our study area, the abundance and distribution of lake sturgeon of various size classes appears to reflect that of their preferred prey. The highest concentration of juveniles which are unable to consume molluscs as a major food source are found in small areas with the highest concentrations of silt substrate which in turn support the highest concentrations of soft bodied invertebrates such as chironomids, amphipods and caddisfly larvae. Uninterrupted expanses of silt substrate are valuable biological real-estate to juvenile lake sturgeon and are not abundantly available in large flowing riverine systems such as the St. Lawrence River. The limited availability of this type of habitat has resulted in large congregations of smaller size classes of this threatened species within small and specific areas of the rivers which dramatically increases their vulnerability at this delicate life history stage.

Adult lake sturgeon appear to have a greater range of dietary preference with a greater predation on molluscs with an increase in size. In our study area the largest concentration of adult sturgeon are found over substrates that are characteristic of a heterogeneous mix of boulder cobble and silt. This mixture of substrates support a more heterogeneous forage base consisting of insect

larvae within soft silt substrates and molluscs such as Dreissenid mussels which generously cover the mix boulder and large cobble substrate. The presence of soft bodied invertebrates and molluscs in their diet suggest that increase in body size affords this species greater foraging latitude tending toward a generalists diet with preference given to the invasive mussels. This trend toward generalization allows for expanded habitat utilization with regard to forage which we see reflected in our study area. Lake sturgeon catch per unit effort data demonstrates that larger sturgeon are captured within known juvenile areas but juveniles are rarely captured in known adult foraging areas (Hayes and Werner, 2002). It is of positive note for this recovering population that the ability of larger sturgeon to utilize a larger range of habitat decreases their vulnerability in comparison to smaller size classes which are forage habitat limited.

CONCLUSIONS AND RECOMMENDATIONS

Most fish species will exhibit habitat preferences in order to complete specific components of their life histories (Seyler 1997). Fish life history strategies include the selection of optimal or preferential habitat types and fish are constrained by their morphology and physical attributes which change with time and development. Lake sturgeon require a very distinct range of habitat types throughout their life cycle encompassing egg, larval, juvenile and adult phase. In our St. Lawrence River studies we have determined that juvenile lake sturgeon are more abundant over silt/sand substrate in areas of low velocity which typically support benthic invertebrate communities (Hayes and Werner 2002). As sturgeon increase in size they are physically capable of exploiting a wider forage base and occur over a wider range of habitat types that demonstrate spatial heterogeneity.

This study reveals a shift in the lake sturgeon's diet in relation to its size and its ability to process prey. As lake sturgeon approach 700 mm in total length there is a shift from an almost exclusive dependence upon insect larvae to include the most abundant bivalve in their midst, the Dreissenid mussel. The adult lake sturgeon's large scale exploitation of the invasive mussel as a primary food source is not as surprising as other studies would suggest. Although Dreissenid mussels have been found in the diet contents of lake sturgeon (French 1993, Hughes 2002) , many researchers contend that well-developed molariform pharyngeal teeth are clearly the key

characteristic identifying effective molluscivores and that fish lacking these structures will likely be only minor consumers of bivalves (Molley et. al. 1997). Despite their lack of shell-crushing pharyngeal teeth, lake sturgeon, known molluscivores, are alternatively equipped with a dense tongue pad and muscular stomach capable of crushing gastropods and bivalves.

Sturgeon have become the aquatic signature species of late, fulfilling the role of the large charismatic flagship species such as the grizzly bear. Populations everywhere, domestically and internationally are now in the spotlight and under the scrutiny of fish managers intent on rehabilitating or restoring depleted or extirpated stocks of this ancient and marvelous fish. It is perhaps fortuitous that this group of fishes, dangerously close to extirpation in many systems can exploit this invasive new resource that has established itself in freshwater systems. We offer caution though, that while many studies suggest additional efforts to determine what impact sturgeon may have on controlling invasive mussel populations, it may be more critical to determine the impact of the Dreissenid mussel on the sturgeon bioenergetics. A dramatic dietary shift to one that depends almost exclusively on this new resource may have unrecognized effects on this threatened species. The effect may be positive in the case of expanding the available forage base or deleterious in this new resource may be bioenergetically sub-optimal with a negative impact on growth and condition factors.

This study also demonstrates a relationship between lake sturgeon habitat preference based upon prey availability. The result of this relationship in this particular region of the St. Lawrence River is mass congregation of smaller size classes of lake sturgeon over small expanses of favored substrate that supports greater densities of their favored prey. It is to say, that the distribution of smaller size classes are likely more constrained by available habitat than their larger counterparts. The combination of factors that contribute to this critical habitat is complex but the implications are simple: juvenile sturgeon congregating in a small area are more vulnerable to localized natural disturbances and anthropogenic induced disturbance such as intermittent lotic events that may occur as flows are passed through the Long Sault control dam. Efforts to protect these identified habitats critical to the juvenile life history stage should be paramount. A large scale survey to identify the extent of preferred habitat available would be useful in terms of identifying what critical habitat is currently available and what enhancement measures may be

required to sustain viable and growing populations of this species. Such system-wide data would provide the basis for developing a model to predict the viability of restoration efforts for this and countless other species targeted for stock management, rehabilitation or restoration.

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