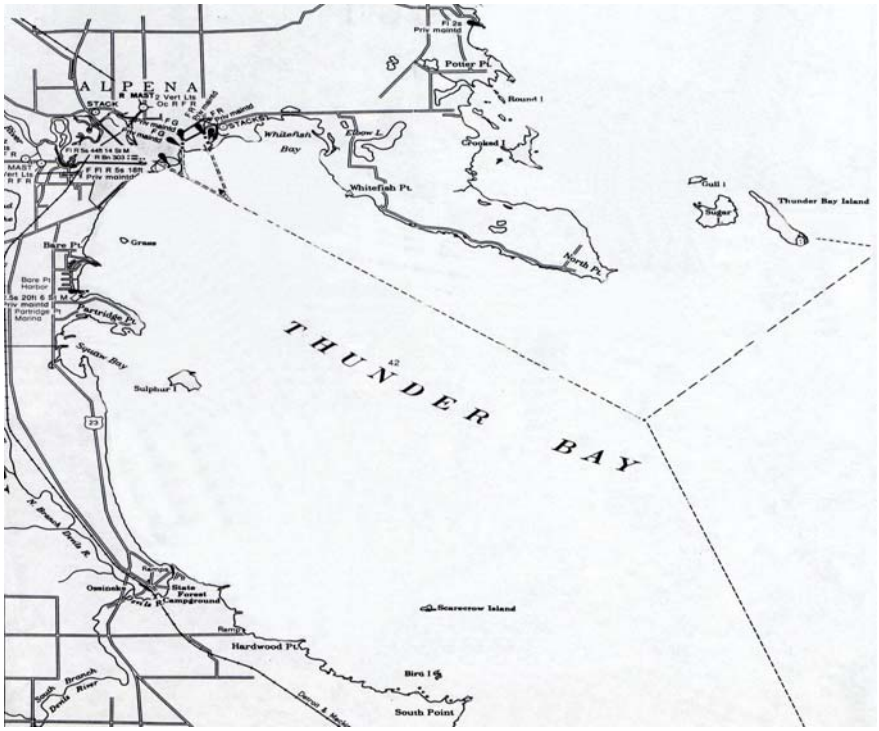
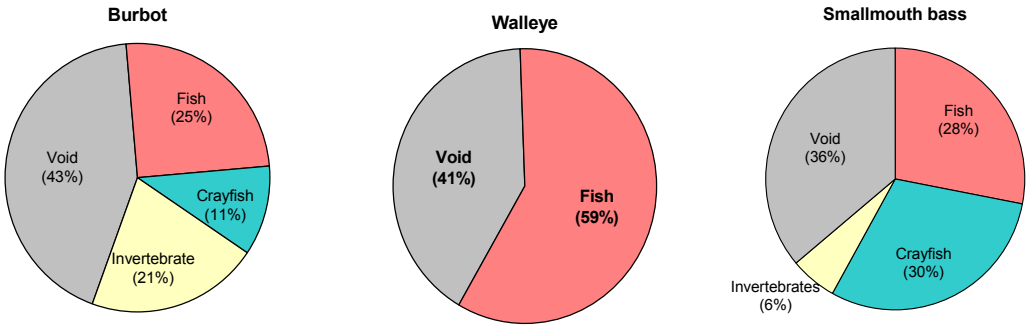
Evaluation of Predator Diets Following Ruffe Colonization Of Thunder Bay, Lake Huron 1997-1998





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INTRODUCTION

The Eurasian ruffe (ruffe), (*Gymnocephalus cernuus*) is an exotic fish species from Eastern Europe that has become established in portions of Lake Superior and Lake Huron (Figure 1) (Czypinski 1998). The ruffe is a member of the perch family that was designated as an aquatic nuisance species (Ruffe Task Force 1992) because it is thought to compete with native fish for food and habitat.

Figure 1. Ruffe captured with bottom trawling gear from the Thunder Bay River, Lake Huron.

The ruffe was first discovered in the Great Lakes in 1987 (Pratt *et* al. 1992) from western Lake Superior at the St. Louis River in Duluth-Superior (Figure 2). It is thought to have been transported from its native Eurasia to Lake Superior in the ballast of ocean-going vessels. From 1987 to 1991 the relative abundance of ruffe increased in the St. Louis River until it became the most abundant

benthic fish captured (Bronte *et* al. 1998). Ruffe spread along the Lake Superior shoreline north and east of the St. Louis River.

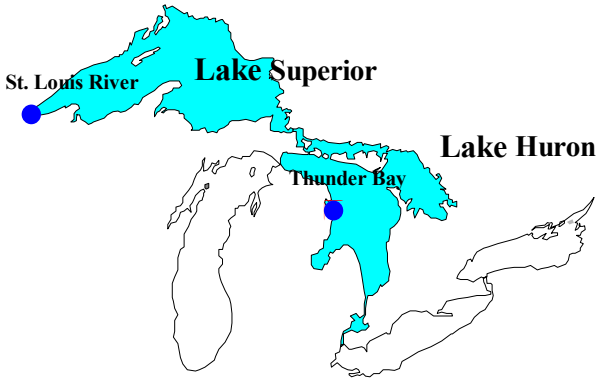

Figure 2. Ruffe were initially discovered from the St. Louis River in Lake Superior in 1987 and were later found in Lake Huron in the Thunder Bay River in 1995.

In 1995, ruffe were discovered in Lake Huron (Kindt 1996) from the Thunder Bay River in Alpena County, Michigan (Figure 2). Annual bottom trawl surveys from the Thunder Bay River have indicated that the relative abundance of ruffe has increased since 1995 (Figure 3). The relative abundance of ruffe (catch per minute) has increased from a catch of 0.48 /minute in 1996 to 0.89 /minute in 1998.

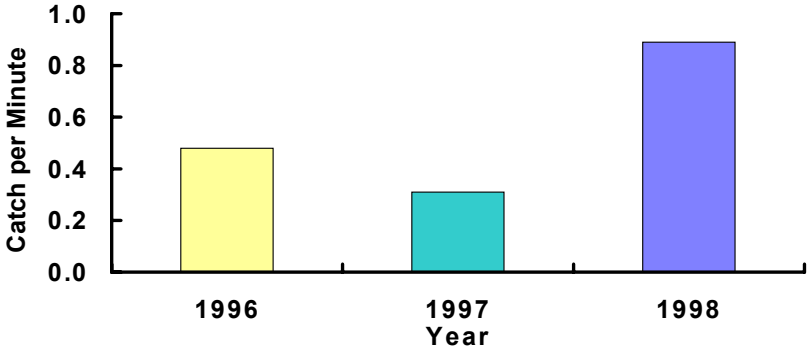

Figure 3. Relative abundance (catch per minute) of ruffe captured bottom trawling from the Thunder Bay River in September of 1996, 1997, and 1998.

Predatory fish were proposed as a method to control large ruffe populations in the St. Louis River, Lake Superior (Mayo *et* al. 1998). Predator diet analysis in the St. Louis River from 1991-94 indicated that northern pike, walleye, brown bullhead, smallmouth bass, and yellow perch consumed ruffe following predator stocking (Mayo *et* al. 1998).

Thunder Bay and the Thunder Bay River support natural populations of predatory fish that could potentially be consuming the growing population of ruffe. Naturally reproducing smallmouth bass (*Micropterus dolomieui*) and northern pike (*Esox lucius*) populations exist, and brown trout (*Salmo trutta*) and walleye (*Stizostedion vitreum*) are stocked locally. In 1997 and 1998 the U.S. Fish and Wildlife Service, Fishery Resources Office (FRO) in Alpena, Michigan initiated a predator diet analysis study to determine if ruffe were being consumed in Thunder Bay, Lake Huron.

STUDY SITE

The Thunder Bay River is located in Alpena County, Michigan on Thunder Bay in northwestern Lake Huron (Figure 2). The Thunder Bay River is extensive and drains a large portion of northeastern Michigan into Thunder Bay from the city of Alpena. A dam 1.8 km upstream from the river mouth limits upstream movement of fish from Lake Huron, and thereby limits the range of ruffe in the river. Thunder Bay is 5,120 acres and ranges from 0.6 to 20.4 meters in depth.

METHODS

Predatory fish were sampled from spring through fall during 1997 and 1998 at seven near shore sites in Thunder Bay and eight sites in the Thunder Bay River. A variety of sampling gears were used including experimental (1.8 m x 37.5 m of 5 - 7.5 m panels of stretch mesh sizes 3.8 cm, 5.1 cm, 6.3 cm, 7.6 cm, and 10.1 cm) and small mesh gillnets (1.2 m x 30 m of 3.8 cm stretch mesh), a semi-balloon bottom trawl (4.9 m width with 3.8 cm stretch mesh body and 12.7 mm stretch mesh cod liner), and boom electrofishing.

Predatory fish were identified to species. Total length (mm), weight (g), sex, and maturity were recorded. Stomachs were removed and frozen until they could be analyzed. Upon analysis, stomachs were thawed, examined to note the presence or absence of ruffe, and contents documented. Stomach contents were separated into 5 categories: fish, crayfish, aquatic insects, miscellaneous, and void. Miscellaneous items noted included fish eggs, algae, snails, and amphipods. Consumed fish were identified to species (Eddy and Underhill 1978) and aquatic insects were identified to order where possible (Merritt and Cummins 1984).

RESULTS

A total of 517 stomachs from six predatory fish species were examined. Similar numbers of predators were examined in 1997 (N=274) and 1998 (N=243). Although a fewer number of species were examined in 1997 (four species) than in 1998 (six species). Sixty-seven percent of predators were captured from the Thunder Bay River and 33 % of predators were captured in Thunder Bay.

Predators

Predators analyzed included bowfin (*Amia calva*), brown bullhead (*Ameiurus nebulosus*), burbot (*Lota lota*), northern pike, smallmouth bass, and walleye. Brown bullhead and walleye made up the greatest proportions of predator stomachs examined, 44 and 33 % of the total number of

stomachs examined (Figure 4). Bowfin and burbot were among the least represented, 2 and 3 % of the total number of stomachs examined.

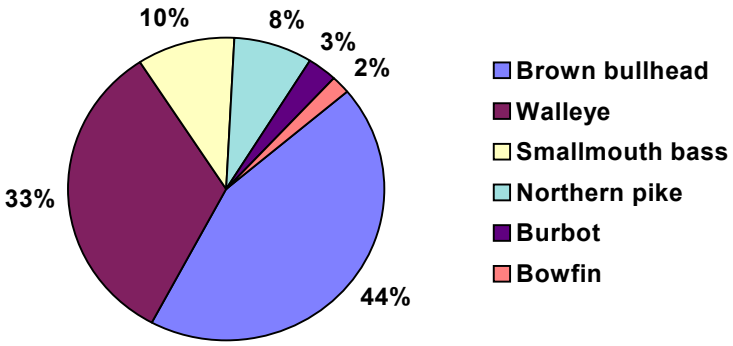

Figure 4. Species composition of predators (N=517) examined for dietary analysis from the Thunder Bay River and Thunder Bay, Lake Huron in 1997-1998.

Brown bullhead (N=222) ranged in total length from 169 to 560 mm, with a mean length of 269 mm (Figure 5). They were captured in 1997 (N=160) and 1998 (N=62). Eighty-six percent was captured from the Thunder Bay River and 14 % from Thunder Bay. They were captured during the months of April (29 %) and July (40 %). Sixty-one percent were captured with experimental gillnets, 17.5 % with electrofishing gear, 17 % with bottom trawling gear, and 4 % with modified Windemere traps.

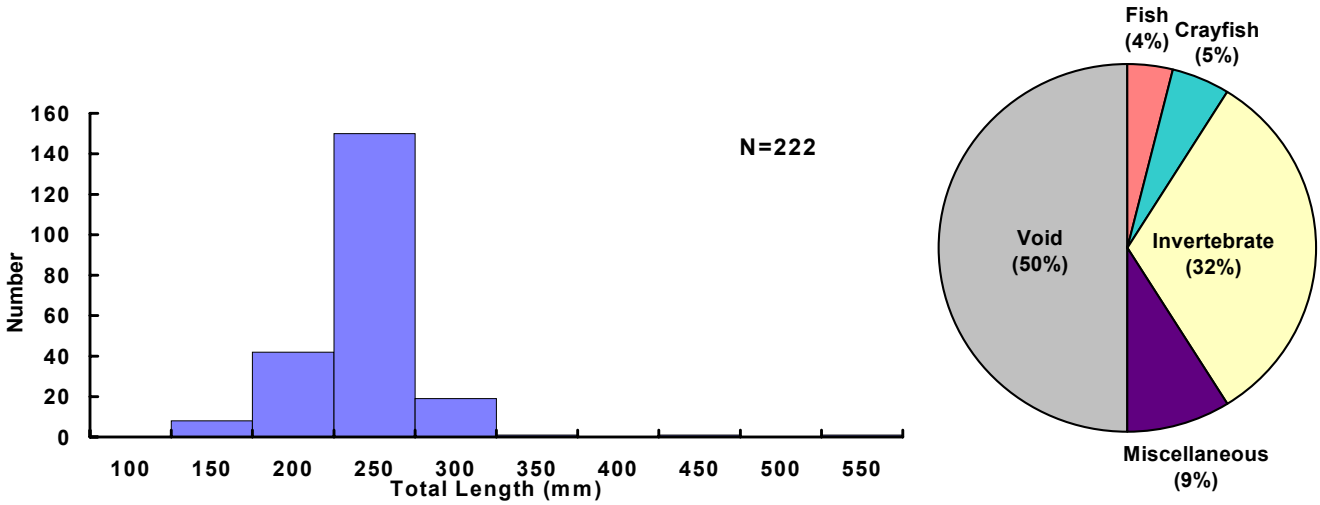

Figure 5. Length frequency and dietary analysis of brown bullhead captured from the Thunder Bay River and Thunder Bay, Lake Huron in 1997-1998.

Bowfin (N=11) ranged in total length from 367 to 620 mm, with a mean length of 517 mm (Figure 6). All bowfin were captured in 1998. Ninety percent was captured from the Thunder Bay River and 10 % from Thunder Bay. All bowfin were captured in April and August with electrofishing gear.

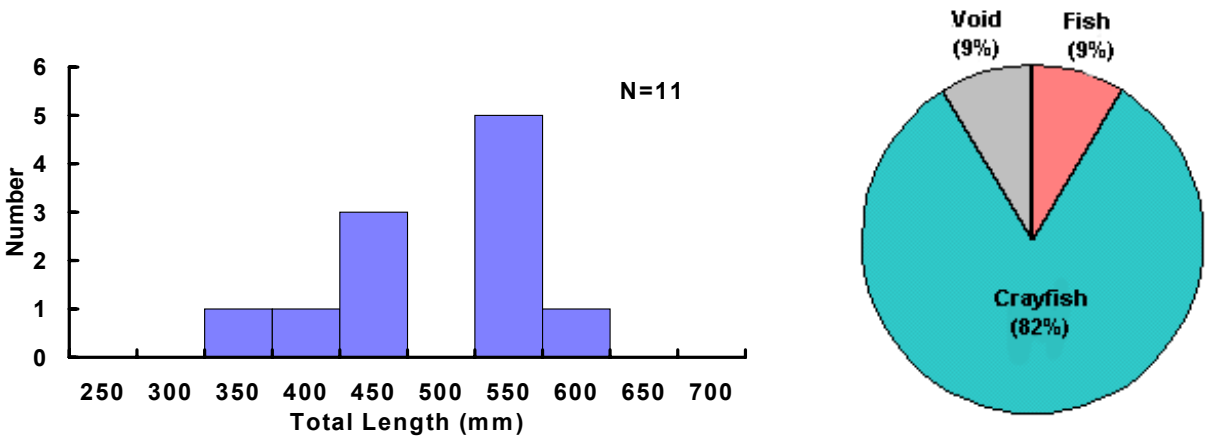

Figure 6*.* Length frequency and dietary analysis of bowfin captured from the Thunder Bay River and Thunder Bay, Lake Huron in 1998.

Burbot (N=14) ranged in total length from 169 to 396 mm, with a mean length of 289 mm (Figure 7). They were captured in 1997 (N=7) and 1998 (N=7). Sixty-five percent of burbot were captured from Thunder Bay and 35 % from the Thunder Bay River. Sixty-one percent were captured with electrofishing gear, 23 % with experimental gillnets, and less than 10 % with each of bottom trawl and Windemere trap gear.

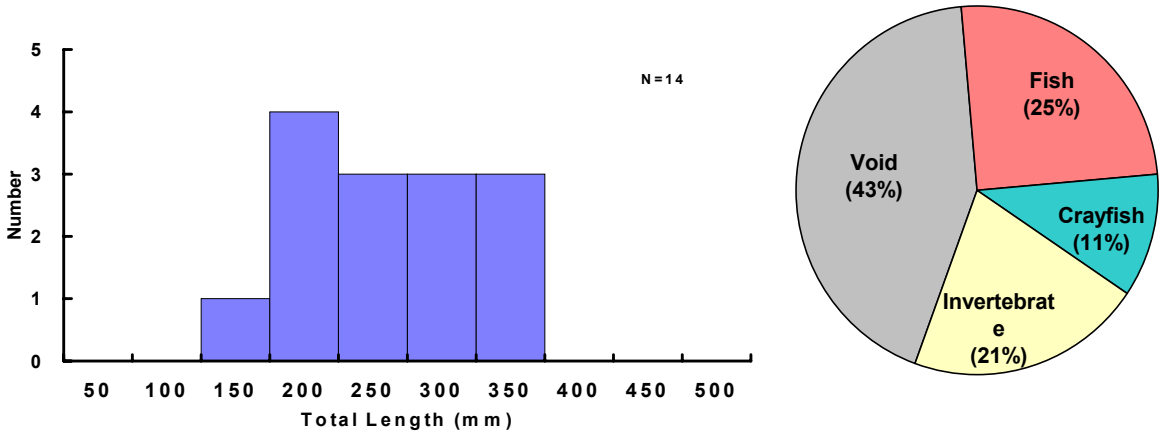

Figure 7. Length frequency and dietary analysis of burbot captured from the Thunder Bay River and Thunder Bay, Lake Huron in 1998.

Northern pike (N=40) ranged in total length from 285 to 1110 mm, with a mean length of 571 mm (Figure 8). They were captured in 1997 (N=18) and 1998 (N=22). All northern pike were captured from the Thunder Bay River; mainly during April, June, and August. The majority, 87.5 %, were captured with experimental gillnets. Less than 5 % was captured electrofishing or with small mesh gillnets.

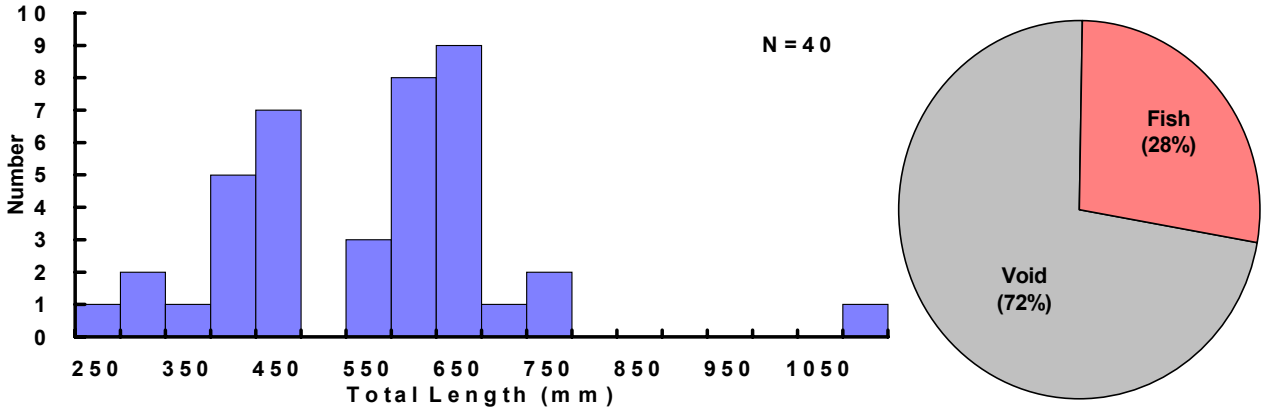

Figure 8. Length frequency and dietary analysis of northern pike captured from the Thunder Bay River and Thunder Bay, Lake Huron in 1997-1998.

Smallmouth bass (N=52) ranged in total length from 136 to 490 mm, with a mean of 266 mm (Figure 9). All smallmouth bass were captured in 1998. Sixty-two percent were captured from the Thunder Bay River and 37 % from Thunder Bay. Thirteen percent were captured in April as ripe adults and 85 % were captured in August. The majority, 98 %, was captured with electrofishing gear.

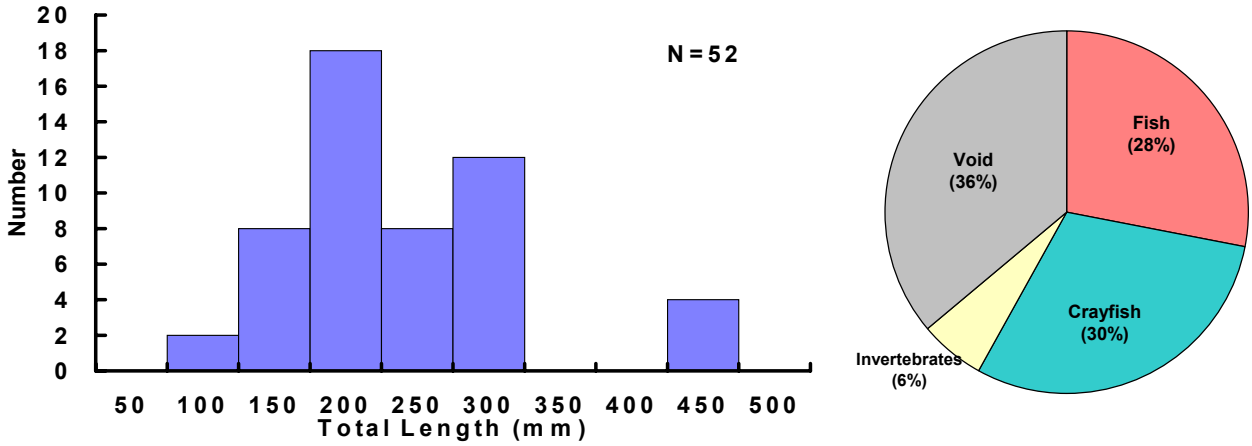

Figure 9. Length frequency and dietary analysis of smallmouth bass captured from the Thunder Bay River and Thunder Bay, Lake Huron in 1998.

Walleye (N=169) ranged in total length from 164 to 690 mm, with a mean of 374 mm (Figure 10). They were captured in 1997 (N=90) and 1998 (N=79). The majority was captured from Thunder Bay. Seventy-five percent of walleye were captured with experimental gillnets, 20 % with small mesh gillnets, and 5 % with electrofishing gear. The majority, 59 %, was captured during the month of July.

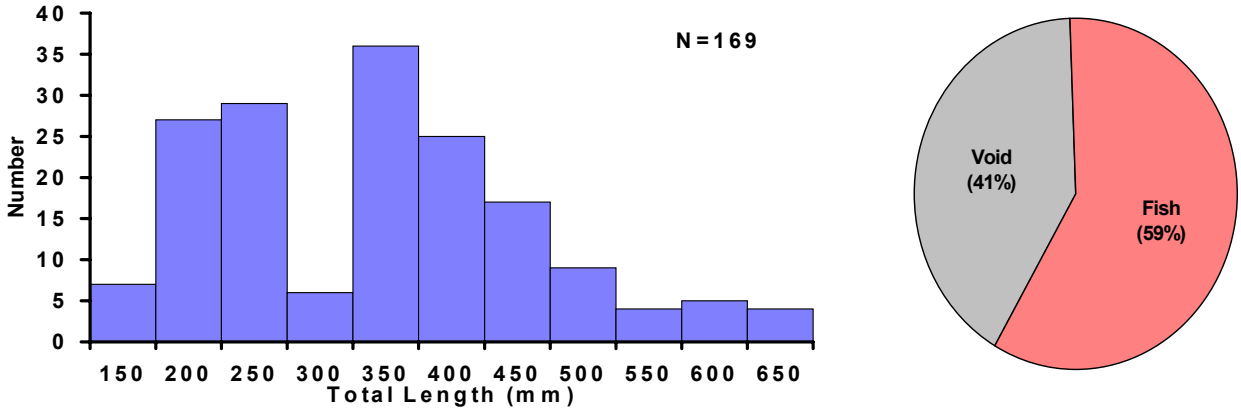

Figure 10. Length frequency and dietary analysis of walleye captured from the Thunder Bay River and Thunder Bay, Lake Huron in 1997-1998.

Dietary Analysis

No ruffe were detected in the stomach contents of predators. Approximately half, 46 %, of predator stomachs were void (Figure 11). Among prey items, fish was the most common food category, 27 %, followed by aquatic insects, 15 %, crayfish, 7%, and miscellaneous items, 5 %.

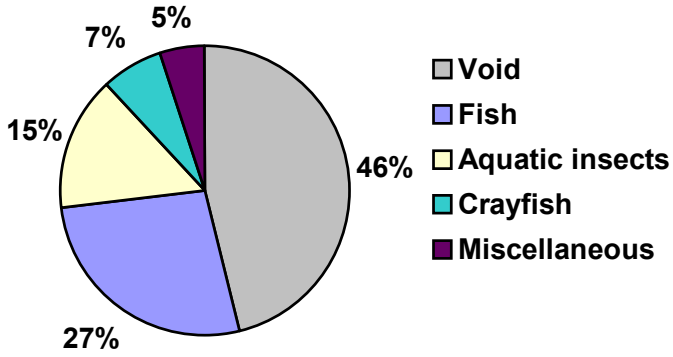

Figure 11. Stomach contents of predators captured from the Thunder Bay River and Thunder Bay, Lake Huron in 1997-1998.

Alewife (*Alosa pseudoharengus*) was the most common fish prey consumed, occurring in 58% of predators that had consumed fish (Figure 12). Unidentifiable fish remains comprised 28 %, rainbow smelt (*Osmerus mordax*) comprised 4 %, and trout-perch (*Percopsis omiscomaycus*) and slimy sculpin (*Cottus cognatus*) each comprised 2 % of fish prey items consumed. Spottail shiner (*Notropis hudsonius*), emerald shiner (*Notropis atherinoides*), johnny darter (*Etheostoma nigrum*), ninespine stickleback (*Pungitius pungitius*), smallmouth bass, walleye, and round goby (*Neogobious melanostomus*) each represented 1 % or less of fish prey items consumed.

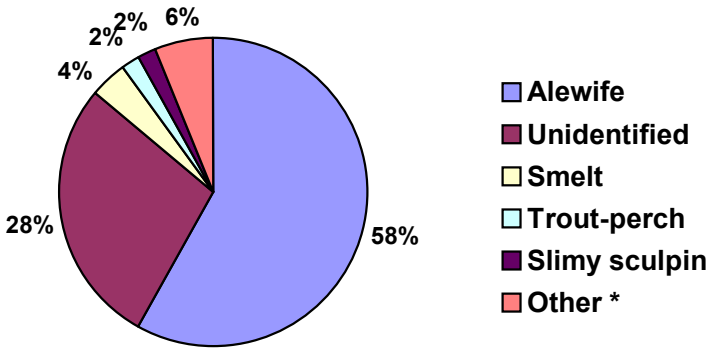

Figure 12. Species composition of prey fish in predators captured from the Thunder Bay River and Thunder Bay, Lake Huron in 1997-1998.

*** Other is a sum of: Emerald shiner, Johnny darter, Ninespine stickleback, Smallmouth bass, Spottail shiner, Round goby, and Walleye.**

Brown bullhead had the most varied diet and consumed all food categories including miscellaneous items such as fish eggs, algae, snails, and amphipods (Figure 5). Northern pike (Figure 8) and walleye (Figure 10) consumed only fish and had the least varied diets.

DISCUSSION

Ruffe were not identified as food items for predators examined in Thunder Bay. However, the dietary fish category contained unidentified fish remains, which could have included ruffe. Although the number of ruffe captured from the Thunder Bay area has increased annually since 1995 (Figure 3), it is possible that ruffe population abundance is too low for them to be encountered often by predatory fish and used as a major prey item. Their spiny morphology and their sensitive lateral line sensory system (Ogle 1999) may increase their awareness of the presence of potential predators and deter their value as a prey species. Predator dietary analysis will continue and be conducted on alternate years to ascertain if predatory fish will consume ruffe.

Predator diet analysis in the St. Louis River, Lake Superior in 1991-94 indicated that walleye, northern pike, brown bullhead, smallmouth bass, and yellow perch consumed ruffe following predator stocking (Mayo *et* al. 1998). Walleye and northern pike were the only predators that consumed a significant number of ruffe in the St. Louis River. In the Thunder Bay River walleye and northern pike were the only species examined that consumed only fish as a prey item. Based on this information, walleye and northern pike may be more likely to be the first predatory fish to encounter ruffe as a prey item in the Thunder Bay River. Walleye and northern pike are opportunistic feeders and are likely to feed on ruffe should ruffe become abundant.

Ruffe prefer bottom habitats (Ogle 1999) and bottom dwelling predators such as burbot and brown bullhead may also encounter ruffe as a prey item due to overlap of habitat. Burbot captured from the Thunder Bay River were found to eat juvenile yellow perch (A. Hintz, U.S. Fish and Wildlife Service, Alpena, Michigan, personal observation), which are morphologically similar in size and shape to ruffe. It is assumed that once ruffe abundance increases to certain levels, they will likely be used as a prey item by these local predatory fish.

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