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Resident Fish Inventory of Amanka Lake, Togiak National Wildlife Refuge, 2004.

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Abstract

As part of an ongoing effort to inventory fish assemblages in the waters of Togiak National Wildlife Refuge, an inventory of the resident fish species occurring in Amanka Lake, was performed June 30 -- July 9, 2004. Fish were collected with gillnets of varying mesh sizes, baited minnow traps, and hook and line angling. Fish were identified to species and released or retained as voucher specimens. A genetic sample was retained and total length was measured from a sub-sample of 50 specimens of each species. Photographs were taken of 10 individuals of each species. Taxa identified were Alaska blackfish *Dallia pectoralis*, Arctic char *Salvelinus alpinus*, slimy sculpin *Cottus cognatus*, threespine stickleback *Gasterosteus aculeatus*, ninespine stickleback *Pungitius pungitius*, round whitefish *Prosopium cylindraceum*, northern pike *Esox lucius*, rainbow trout *Oncorhynchus mykiss*, and lamprey species *Lampetra sp*.

Introduction

The resident fish of the Togiak National Wildlife Refuge (Togiak Refuge) play an important role in the ecology and economy of the Bristol Bay region. In recognition of this importance, the Alaska National Interest Lands Conservation Act (P.L. 96-487) mandates conservation of fish and wildlife populations in their natural diversity while continuing to provide subsistence opportunities as primary purposes of the Togiak Refuge. This mandate is implemented by the Fisheries Management Plan for the Togiak Refuge (USFWS 1990) in which a wild stock management policy specifically for resident species is established. The wild stock management concept emphasizes providing opportunities to catch fish from naturally reproducing populations while preserving the historic size and age structure of stocks. To meet the directive of conserving fish populations, baseline biological information on species distributions is essential. To this end, surveys of resident fish have been conducted in Togiak Refuge waters since 1984 (e.g MacDonald 1997, MacDonald and Lisac 1998, Lisac and MacDonald 1996, MacDonald 1996, Nelle 2002). The refuge has surveyed 26 lakes and 20 rivers throughout its history.

Amanka Lake is located on the 1.9 million ha Togiak Refuge located in southwest Alaska (Figure 1). Amanka Lake is a clear-water, oligotrophic lake that forms the headwaters of the Igushik River, which flows into Nushagak Bay on the southeastern side of the refuge. Amanka Lake is located within the southern end of the Wood River Mountain Range, and is surrounded by mountains, forming a "c" shape around Sugtutlik Peak. The lake has six inlet streams, including the Ongoke River as the main inlet. The outlet is located at the southwestern margin of the lake. The lake is located approximately 11.6 m above mean sea level and is approximately 16.3 km long by 2.7 km wide. The surface area is approximately 3,369 ha and the depth is up to 60 meters. Water quality measurements, including temperature, pH, DO, conductivity, and

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clarity were recorded in 1984, although no fish inventory was performed then (MacDonald 1996).

The nearest village to Amanka Lake is Manokotak. The village of Manokotak has a population of approximately 400 residents which rely heavily on the fishery of the Igushik River system including Ualik Lake, Ongoke River, and Amanka Lake. An Alaska Department of Fish and Game subsistence survey in 2000 reported 21,026 kg of fish harvested through subsistence means (Coiley-Kenner *et al*. 2003). Non-salmon species made up 6,686 kg of this catch. Per capita harvest totaled 70 kg of all fish per person, including 17 kg of freshwater fish and 53 kg of anadromous fish.

The purpose of this project was to document the occurrence of and collect genetic samples from the resident fish species in Amanka Lake.

Methods

Fish were sampled on Amanka Lake for 10 continuous days beginning June 30, 2005. Sampling locations were selected to maximize the probability of encountering all members of the fish community inhabiting Amanka Lake. Habitat requirements of expected fish species were examined and used to select sampling locations throughout the lake. Habitats of specific interest were vegetated backwater habitats, deep open water habitats, relatively shallow cobble and gravel bottom habitats, mouth of inlet stream habitats, and benthic shelf habitats. Topographical and bathymetric maps were utilized to locate these potential sampling areas as well as an initial exploration of the lake. Efforts were made to identify sampling areas through the use of the traditional ecological knowledge of local residents before being deployed to the field, though most sampling locations were identified in the field.

Sampling targeted, but was not limited to, northern pike, Alaska blackfish, burbot *Lota lota*, coastrange sculpin *Cottus aleuticus*, slimy sculpin, round whitefish, pigmy whitefish *Prosopium coulterii*, humpback whitefish *Coregonus pidschian*, ninespine stickleback, threespine stickleback, Arctic char, rainbow trout, Arctic grayling *Thymallus arcticus*, and lake trout *Salvelinus namaycush*. Experimental gill nets, seines, minnow traps, baited lines, and hook and line angling, were used to sample all habitats.

Experimental gill nets were fished in all target areas. Two different designs of experimental gill nets were used to increase the probability of obtaining a sample that contained representatives of all members of the fish community. Gill nets were 125 feet (38.1 m) long, 8 feet (2.4 m) deep and constructed of clear monofilament. Two different mesh size patterns were used: ½”, ¾”, 1”, 1 ¼”, 1 ½” bar mesh and 1”, 1 ½”, 2”, 2 ½”, 3” bar mesh.

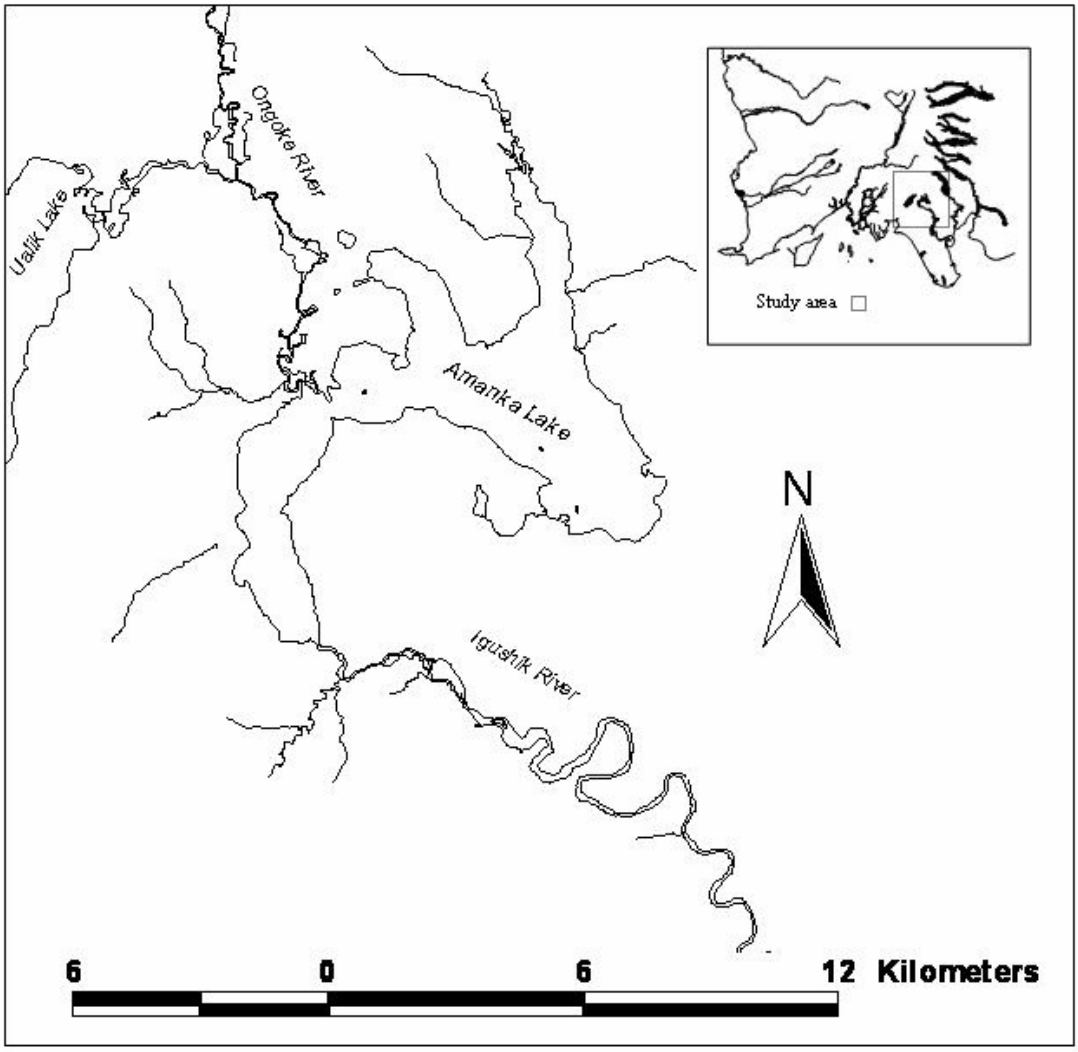

Figure 1. Amanka Lake, Togiak National Wildlife Refuge, Alaska.

Upon arrival at each sampling site, the latitude and longitude, time, water depth, and a brief habitat assessment were recorded. The brief habitat assessment included descriptions of water movement, substrate size and type, water clarity, aquatic vegetation, and bottom structures. The time was recorded at the start and conclusion of the net set as well as the direction of set and depth of set.

During the day, nets were checked every 1 to 3 hours. To sample the full diel activity cycle of potential fish species, gill nets were also fished over night for 12-14 hour periods. These night net sets were fished infrequently to avoid mortalities. Gill nets were fished at all depths.

Minnow traps were baited with salmon flesh and eggs and fished at all depths. Traps were checked and redeployed every morning and evening. Coordinates, water depth, start and stop time, bait type, and a brief habitat assessment were recorded for each trap set.

Hook and line angling techniques were employed minimally due to time constraints. Artificial flies and lures as well as bait were utilized. Start and stop times were recorded as well as a brief

description of the sampling area. Coordinates were recorded at the start and end of rod and reel sampling, for each fish sampled and at various intervals during sampling to estimate the areas sampled. Location, time and habitat descriptions were recorded for all samples.

All captured fish were cataloged for location and method of capture, and species. Fork length was measured on the first 50 of each species captured. Genetic samples were collected from 50 random individuals of each fish species captured in the form of a partial bony fin clip. Genetic samples were placed in scale envelopes and labeled with date, species, lake, project title, and sample number. Otoliths of all white fish sp., rainbow trout, and char sp. mortalities were removed and placed in scale envelopes with genetic samples. A photograph was taken of 10 representatives of each fish species sampled. Fish species that could not be sight identified were retained for later identification. All samples collected were archived at Togiak Refuge headquarters in Dillingham, Alaska.

Catch per unit effort (CPUE) was calculated for each species and gear type by determining number of individuals caught per hour by gear type. Length composition of each species and gear type and of the combined samples of each species was reported.

Results and Discussion

Between 6/30/2004 and 7/9/2004, 596 fish representing 9 species were sampled (Table 1). All fish were collected with hook and line angling, minnow trap, and gill net except for a single lamprey specimen found in the digestive tract of a northern pike. Seine and baited line use was discontinued early on due to apparent ineffectiveness.

Baited minnow traps were fished for a total of 478.75 hours and produced the highest catch rate of 0.95 fish per hour (Table 2). Large mesh gill nets were fished for 130.43 hours and produced the lowest catch rate of 0.173 fish per hour. Different sampling methods demonstrated variation in effectiveness at catching different species and different sized fish. Gillnets were most effective at sampling Arctic char, round whitefish, and northern pike. Although this survey was not designed for the comparison of different mesh sized gillnets, the smaller mesh gillnet appeared to produce a higher catch rate than the larger mesh gillnets (Table 3). Baited minnow traps proved to be most effective at sampling stickleback species, slimy sculpin, and Alaska blackfish (Table 4). Hook and line angling was used minimally due to time limitations, but produced a high catch rate when used (Table 5). Fish caught by hook and line angling was limited to rainbow trout, Arctic char, and northern pike. Hook and line angling appeared to be ineffective for sampling other larger resident fish such as round whitefish. Length statistics of species are presented in Table 6 not as a representative of the central tendency and variation of the each population, but as a representative of what may be expected in a sample with the given methods.

Table 1. Species encountered in Amanka Lake, Togiak National Wildlife Refuge, Alaska, 2004.

Scientific Name	Common Name
Salvelinus alpinus	Arctic char
Esox lucius	Northern pike
Prosopium pungitius	Round whitefish
Dallia pectoralis	Alaska blackfish
Pungitius pungitius	Ninespine stickleback
Gasterosteus aculeatus	Threespine stickleback
Cottus cognatus	Slimy sculpin
Oncorhynchus mykiss	Rainbow trout
Lampetra sp.	Lamprey species

Table 2. Effort, catch number, and CPUE of sampling gears.

Gear	Hours of Effort	Total Fish Caught	CPUE
Large mesh gill net	130.43	52	0.399
Small mesh gill net	170.68	76	0.445
Angling	15.37	12	0.781
Minnow trap	478.75	455	0.950

Table 3. Species and CPUE of samples from large and small mesh gillnets.

	Large mesh		Small mesh		Combined mesh	
Species	Total	CPUE	Total	CPUE	Total	CPUE
Alaska blackfish	0	0.000	2	0.012	2	0.007
Round whitefish	4	0.031	17	0.100	21	0.070
Arctic char	47	0.360	37	0.217	84	0.279
Northern pike	1	0.008	20	0.117	21	0.070
Total	52	0.399	76	0.445	128	0.426

Table 4. Species and CPUE of samples from baited minnow traps.

Species	Total	CPUE
Alaska blackfish	50	0.104
Ninespine stickleback	15	0.031
Arctic char	1	0.002
Slimy sculpin	132	0.276
Threespine stickleback	257	0.537
Total	455	0.950

Table 5. Species and CPUE of samples from angling.

Species	Total	CPUE
Rainbow trout	4	0.260
Arctic char	7	0.455
Northern pike	1	0.065
Total	12	0.780

Table 6. Summary statistics of length (mm) of all species sampled by all methods at Amanka Lake.

	Arctic char	Northern pike	Round whitefish	Alaska blackfish	Ninespine stickleback	Threespine stickleback	Slimy sculpin	Rainbow trout
Mean	390.3	441.1	340.4	81.4	51.9	58.0	60.7	444.5
SE (mean)	10.22	18.26	17.47	1.98	1.40	0.56	1.3	41.72
Median	411.5	440.5	375.0	80.8	53.0	59.0	60.0	474.5
Mode	452	405	na	83	53	60	61	na
Minimum	114	301	191	53	41	50	42	323
Maximum	605	598	448	114	61	66	90	506
n	92	22	21	52	14	51	53	4

The species sampled during this study represent a typical fish community in lakes of comparable size in the Togiak Refuge (MacDonald 1997). Although documenting presence of species is an obtainable goal, determining absence is much more difficult. There are other species of fish that could be present in this system that were never encountered. For example, burbot and Arctic grayling are reported to occur in the Igushik River drainage. Arctic grayling have been documented in the Ongoke River in large numbers (MacDonald 1997) and burbot are reported to inhabit smaller lakes of the lower Igushik River (J. Dyasuk, U.S. Fish and Wildlife Service, Dillingham, personal communication.)

A species of particular interest to the Togiak Refuge is lake trout. Lake trout exhibit a patchy distribution throughout the refuge. They only appear to occur in 11 of the 26 lakes surveyed by refuge staff (MacDonald 1996, Nelle 2002, B. Sweeney, formerly U.S. Fish and Wildlife Service, Dillingham, personal communication.) The reasons for this patchy distribution are not understood. Anecdotal information has never been presented that suggest lake trout inhabit the Igushik River drainage. Furthermore, this study did not reveal the presence of this species. Based on these finding, it appears unlikely that lake trout naturally occur in Amanka Lake or the Igushik River drainage.

One lamprey was collected from the stomach contents of a northern pike captured in Amanka Lake. The specimen was partially digested and could not be identified to species. Three species of lamprey are known to occur in the Bristol Bay region: Pacific lamprey *Lampetra tridentate*, Arctic lamprey *Lampetra camtschatica*, and Alaskan brook lamprey *Lampetra alaskense*. Although sightings of lamprey occur commonly on the Togiak Refuge, the occurrence and distribution of species within the refuge boundaries is unknown.

Although many lakes and rivers of the Togiak Refuge have been surveyed for fish species, there are still many more information gaps. To address these information needs, future studies should continue to focus on the distribution of species within the refuge. Efforts should focus on water bodies of interest to local communities, apparently isolated water bodies, and previously unsurveyed water bodies. Further efforts should be made to understand the distribution and ecological role of lamprey species and to understand the distribution of lake trout within the Togiak Refuge.

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