



A Synoptic Study of Food Habits of 30 Fish Species from Western Lake Superior

Agricultural Experiment Station
University of Minnesota

**A SYNOPTIC STUDY OF FOOD HABITS OF 30 FISH
SPECIES FROM WESTERN LAKE SUPERIOR**

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**Technical Bulletin 279, Minnesota Agricultural Experiment Station, St. Paul,
Minnesota 55101.**

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INTRODUCTION

Stocks of fish species in Lake Superior have changed in recent years. Numbers of lake trout (*Salvelinus namaycush*) and lake herring (*Coregonus artedii*) have been reduced severely, and the bloater (*Coregonus hoyi*) and American smelt (*Osmerus mordax*) have increased.

An extensive investigation of species interrelationships of fish to western Lake Superior was initiated in 1965 by the University of Minnesota. The work reported herein constituted an important part of that investigation. The objectives were to: (1) describe the food habits of the fish in western Lake Superior and (2) evaluate the food interrelationships of the species. In line with the objectives, fish were sampled during a 4-year field program.

Financial support was obtained from Public Law 88-309, Project No. 4-8-R of the Minnesota Department of Conservation. The field study was conducted in cooperation with the U.S. Bureau of Commercial Fisheries field laboratory in Ashland, Wisconsin.

Food habits studies of Lake Superior fish are limited. Eschmeyer (1956) and Dryer *et al.* (1965) reported lake trout food habits, and Dryer and Beil (1964) presented data for lake herring. Dryer and Beil (1968) also reported on the bloater. Publications by Eschmeyer and Bailey (1955) reported food habits of pygmy whitefish (*Prosopium coulteri*) and Hale (1959) reported on food of smelt. Some data on lake herring, smelt, and bloaters are presented by Anderson and Smith (1970). There have been no previous food studies of a synoptic nature in Lake Superior or the other Great Lakes. This paper presents a number of ecological relationships and will serve also, with its appendices, as a starting point for future related studies on the various species.

MATERIALS AND METHODS

Study Areas

The study areas in western Lake Superior included the Apostle Islands in Wisconsin and the Duluth-Superior area in the extreme western end of the lake. Sampling was done at index stations of the U.S. Bureau of Commercial Fisheries (figure 1, table 1) with special emphasis on Stations 112, 35, 12, and 75.

Station 112, in the Duluth-Superior area, was approximately 12 miles in diameter. Water depths varied from 1 to 27 fathoms over a substrate consisting predominantly of silt, with textures from silty clay to loam, and assorted small debris.

The other stations were in the Apostle Islands area. Station 35 was a 4- by 7-mile area north of Sand Island, where depths varied from 28 to 63 fathoms. Substrates were a predominantly sand soil with coal, clinker, and rock debris. Sampling at Station 12, located southeast of Madeline Island in the Big Bay vicinity, was done at several locations within a 4-mile diameter area. Outside the bay, samples were taken in approximately 25 fathoms of water, and inside the open eastern end of the bay in 11-14 fathoms. The substrate was commonly sandy loam and usual debris. Station 75, southeast of Bear Island, was a 2- by 3-mile area, where depths were from 4 to 25 fathoms and substrate soils were primarily sand. Conditions at other stations essentially were similar to those previously described.

Table 1. Sampling periods when fish were collected, stations sampled, and number of tows or sets of each gear used in western Lake Superior.

Date	Station	Gear			
		Bottom trawl	Midwater trawl	Larvae net	Gill net*
1965					
Sep 9-Sep 10	32,86	5	-	-	1 600'
Oct 17-Oct 19	26,45	3	-	-	1 4,025'
Nov 15-Nov 18	2,70	6	-	-	1 1,500'
Nov 28-Nov 30	32,48	-	-	-	2 2,450'
1966					
Feb 7-Feb 11	32,86	-	-	-	10 7,200'
Apr 25-May 5	12,35,75,112	29	-	61	-
May 31-Jun 2	35,75	9	-	22	-
Jun 6-Jun 10	12,75,86	35	-	19	-
Jun 20-Jun 23	112	19	-	30	-
Jul 7-Jul 8	35,75	4	-	20	-
Jul 25-Jul 27	2,12,24,69,86	7	-	61	-
Oct 31-Nov 3	32	-	4	-	-
Nov 30-Dec 2	112	2	-	-	1 1,800'
Dec 7-Dec 9	32	2	-	-	1 1,800'

* Listed as the number of sets and the number of feet of net lifted.

Table 1. (Continued)

Date	Station	Gear			
		Bottom trawl	Midwater trawl	Larvae net	Gill net*
1967					
Apr 17-Apr 21	35,72,75,86,91	2	5	39	-
Apr 24-Apr 28	12,35,112	10	1	56	-
May 3-May 5	112	1	5	39	-
May 22-May 26	12,73,112	-	7	69	-
Jun 19-Jun 23	12,112	8	5	56	-
Jul 12-Jul 14	12,75	11	6	21	-
Jul 24-Jul 28	12,35,72,112	11	9	23	-
Sep 18-Sep 22	3,12,32,35,75,112	26	3	-	-
Nov 14	112	-	-	-	1 3,600'
Nov 27-Dec 1	75,112	9	-	4	2 7,200'
1968					
Apr 15-Apr 19	12,35,112	12	-	56	-
May 20-May 24	12,35,112	8	-	57	1 500'
Jul 8-Jul 12	12,35,112	12	-	44	-
Dec 4	112	-	-	-	1 3,600'
Total		231	45	677	22 34,325'

* Listed as the number of sets and the number of feet of net lifted.

Fish Collections

Fish were obtained at 17 stations during 28 sampling periods from September 1965 through December 1968 (table 1). Samples were secured with the U.S. Bureau of Commercial Fisheries research vessel, R/V *Siscowet*, stationed at Bayfield, Wisconsin. Approximately 60,600 adult and juvenile fish were taken with a 39-foot, semi-balloon bottom otter trawl (2-inch-mesh body and 1/2-inch-mesh cod end), a 38-foot, mid-water otter trawl (4-inch-, 2-inch-, and 1-inch-mesh body and 1/8-inch-mesh cod end), and experimental and commercial gill nets (1- to 6-inch mesh, stretch measure). Of these fish, 49,800 were taken with the bottom trawl, 4,800 with the mid-water trawl, and 6,000 with gill nets. In addition, many larval fish (including 7,100 *Coregonus* spp.) were collected with 1/16-inch-mesh larvae nets. Preliminary examination of catches in the vessel's laboratory included identification and enumeration of species. Samples were preserved in 10 percent formalin for future analysis.

Stomach Analysis

Stomachs from 5,871 fish, including 30 species (table 2) collected on 84 sampling dates, were examined. Total length of fish with no adjustments for formalin preservation was measured. Analysis was made on 517 frozen fish. Stomach contents from the upper esophagus to the pyloric sphincter was measured by water displacement. Food items were identified and enumerated. Crustaceans and insects were identified to order, and molluscs as Sphaeriidae or Gastropoda. Fish eggs were identified by comparison with known specimens. The identity of partially digested organisms was determined, when possible, from recognizable morphological components. The percentage each item comprised in the contents of each stomach was estimated.

Food habit data are reported as the percentage of occurrence and percentage of total volume for each food item. The former is the percentage of the number of stomachs containing a specific item compared with the total number of stomachs containing any food. The latter is the percentage of the total volume percentage for a specific item from all stomachs compared to the total volume percentage for all items from all stomachs containing food.

Table 2 presents data by months for all species. Limited information is available for many of the less-numerous species. Separate tabulations, when sufficient numbers of fish existed, are made for the two study areas (Duluth-Superior and Apostle Islands) and for different size categories of the fish.

FOOD HABITS

Lake Herring

Stomachs of 27 larvae taken in the Duluth-Superior area and 49 in the Apostle Islands were examined (table 3). Fish lengths varied from 11 to 21 mm. In every month, food was restricted to copepods. Lake herring shorter than 10 inches (exclusive of larvae) were scarce in the samples. Copepods were the predominant food item in both study areas (tables 4 and 5). Cladocerans were eaten only in September, and insects in June and September.

Table 2. Fish caught in western Lake Superior during 1965-1968 from which stomachs were examined.

Species*		Number of stomachs
Common name	Scientific name	
Lake herring	<i>Coregonus artedii</i>	427
Bloater	<i>Coregonus hoyi</i>	836
Lake whitefish	<i>Coregonus olupeaformis</i>	62
Kiyi	<i>Coregonus kiyi</i>	40
Blackfin cisco	<i>Coregonus nigripinnis</i>	3
Shortjaw cisco	<i>Coregonus zenithicus</i>	63
Shortnose cisco	<i>Coregonus reighardi</i>	3
Pygmy whitefish	<i>Prosopium coulteri</i>	39
Round whitefish	<i>Prosopium cylindraceum</i>	146
Lake trout	<i>Salvelinus namaycush</i>	490
Rainbow trout	<i>Salmo gairdneri</i>	3
Brown trout	<i>Salmo trutta</i>	2
American smelt	<i>Osmerus mordax</i>	1,697
Longnose sucker	<i>Catostomus catostomus</i>	231
White sucker	<i>Catostomus commersoni</i>	24
Slimy sculpin	<i>Cottus cognatus</i>	710
Spoonhead sculpin	<i>Cottus ricei</i>	141

*Common and scientific names conform with the approved list of the American Fisheries Society (1960).

Table 2. (Continued)

Species*		Number of stomachs
Common name	Scientific name	
Mottled sculpin	<i>Cottus bairdi</i>	3
Fourhorn sculpin	<i>Myoxocephalus quadricornis</i>	120
Ninespine stickleback	<i>Pungitius pungitius</i>	295
Trout-perch	<i>Percopsis omiscomaycus</i>	349
Burbot	<i>Lota lota</i>	78
Alewife	<i>Alosa pseudoharengus</i>	9
Walleye	<i>Stizostedion v. vitreum</i>	13
Yellow perch	<i>Perca flavescens</i>	29
Northern pike	<i>Esox lucius</i>	4
Johnny darter	<i>Etheostoma nigrum</i>	5
Lake chub	<i>Hybopsis plumbea</i>	26
Spottail shiner	<i>Notropis hudsonius</i>	17
Emerald shiner	<i>Notropis atherinoides</i>	6
Total		5,871

*Common and scientific names conform with the approved list of the American Fisheries Society (1960).

Table 3. Food of lake herring larvae of western Lake Superior expressed as the percentage frequency of occurrence and percentage of total volume for each food item (parentheses).

Item	April	May	June	July
Number of stomachs	20	34	21	1
Number empty	3	7	3	0
Crustaceans	100 (100)	100 (100)	100 (100)	100 (100)
Copepoda	100 (100)	100 (100)	100 (100)	100 (100)

Table 4. Food of Duluth-Superior lake herring shorter than 10 inches (exclusive of larvae) expressed as the percentage frequency of occurrence and percentage of total volume for each food item (parentheses).

Item	April	May	June	July	September	November
Number of stomachs	3	3	4	1	4	1
Number empty	1	3	1	0	0	0
Crustaceans	100 (100)	- -	100 (95)	100 (2)	100 (69)	100 (100)
Amphipoda	- -	- -	- -	- -	25 (2)	- -
Copepoda	100 (100)	- -	100 (95)	100 (2)	75 (41)	100 (100)
Cladocera	- -	- -	- -	- -	25 (25)	- -
Insects	- -	- -	67 (5)	- -	50 (16)	- -
Chironomidae	- -	- -	- -	- -	50 (16)	- -
Other Diptera	- -	- -	33 (3)	- -	- -	- -
Unidentified	- -	- -	33 (2)	- -	- -	- -
Other	- -	- -	- -	100 (98)	25 (15)	- -
Unidentified	- -	- -	- -	100 (98)	25 (15)	- -

Table 5. Food of Apostle Islands lake herring shorter than 10 inches (exclusive of larvae) expressed as the percentage frequency of occurrence and percentage of total volume for each food item (parentheses).

Item	June	September
Number of stomachs	3	4
Number empty	2	0
Crustaceans	100 (100)	100 (100)
Copepoda	100 (100)	75 (4)
Cladocera	- -	100 (96)

Sixty-one lake herring 10 inches and longer from the Duluth-Superior area (table 6) and 267 from the Apostle Islands (table 7) were examined. They were captured primarily by gill nets and occasionally in bottom trawls, particularly from turbid waters in the Duluth-Superior area. Crustaceans were the principal food in all months in both areas, with copepods the major item. Insects, coregonid eggs, plant material, and some unidentified items were noted also.

Amphipods (*Pontoporeia affinis*) were eaten only in April (Duluth-Superior), while cladocerans were present only in September (Duluth-Superior) and November (both areas). *Mysis relicta* was consumed during November in the Duluth-Superior area and during May, September, and November in the Apostle Islands. Chironomids were eaten in June and November (Apostle Islands). In the Apostle Islands during November, coregonid eggs (probably herring) were found in 33 percent of the stomachs. Food habits were very similar to those found by Dryer and Beil (1964).

Bloater

Stomachs of 286 bloaters shorter than 8 inches collected primarily in bottom trawls were examined (tables 8 and 9). Crustaceans, particularly copepods, formed the greatest part of the diet in both study areas. *Mysis*, cladocerans, amphipods, and ostracods were taken also. Insects, chironomids, and molluscs were the only other recognizable organisms found. Copepods were the principal food item in both areas during all months except September, while cladocerans were equal in importance to copepods at Duluth-Superior and more important in the Apostle Islands. *Mysis* and amphipods were eaten at Duluth-Superior only during September, but from May through November in the Apostles. Insects were consumed during June, July, and September, while molluscs and ostracods were consumed only in September (Apostle Islands).

Five hundred and fifty bloaters 8 inches and longer were analyzed (tables 10 and 11). Crustaceans were the primary item in the diet, which also included insects, molluscs, and fish eggs. Copepods were predominant during all months except July and September in the Duluth-Superior area, and except May, July, September, and November in the Apostle Islands when *Mysis* was most important. Amphipods were consumed during most months in both areas. Cladocerans were used slightly from June through November, and ostracods and isopods were taken occasionally during several months in the Apostle Islands.

Table 6. Food of Duluth-Superior lake herring 10 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (parentheses).

Item	April	May	June	July	September	November
Number of stomachs	15	12	11	1	4	18
Number empty	10	10	10	1	0	9
Crustaceans	80 (80)	100 (100)	100 (100)	- -	100 (64)	100 (100)
Mysidacea	- -	- -	- -	- -	- -	11 (11)
Amphipoda	40 (40)	- -	- -	- -	- -	- -
Copepoda	40 (40)	100 (100)	100 (100)	- -	- -	89 (72)
Cladocera	- -	- -	- -	- -	100 (64)	44 (17)
Other	20 (20)	- -	- -	- -	50 (36)	- -
Unidentified	20 (20)	- -	- -	- -	50 (36)	- -

Table 7. Food of Apostle Islands lake herring 10 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (parentheses).

Item	February	May	June	September	November	December
Number of stomachs	26	4	1	1	225	10
Number empty	7	1	0	0	55	9
Crustaceans	100 (100)	67 (67)	100 (90)	100 (100)	88 (73)	100 (100)
Mysidacea	- -	33 (33)	- -	100 (100)	5 (4)	- -
Copepoda	100 (100)	33 (33)	100 (90)	- -	80 (57)	100 (100)
Cladocera	- -	- -	- -	- -	43 (14)	- -
Insects	- -	- -	100 (10)	- -	1 (1)	- -
Chironomidae	- -	- -	100 (10)	- -	1 (1)	- -
Fish eggs	- -	- -	- -	- -	33 (24)	- -
Coregonid	- -	- -	- -	- -	33 (24)	- -
Other	- -	33 (33)	- -	- -	2 (2)	- -
Plant material	- -	- -	- -	- -	1 (1)	- -
Unidentified	- -	33 (33)	- -	- -	1 (1)	- -

Table 8. Food of Duluth-Superior bloaters shorter than 8 inches expressed as the percentage frequency of occurrence and percentage of total volume for each food item (parentheses).

Item	April	May	June	July	September	November
Number of stomachs	24	20	39	15	8	19
Number empty	13	12	7	13	0	0
Crustaceans	100 (100)	88 (88)	100 (93)	50 (50)	88 (52)	100 (100)
Mysidacea	- -	- -	- -	- -	12 (12)	- -
Amphipoda	- -	- -	- -	- -	12 (9)	- -
Copepoda	100 (99)	88 (88)	100 (92)	50 (50)	62 (16)	100 (99)
Cladocera	9 (1)	- -	19 (1)	- -	62 (16)	5 (<1)
Insects	- -	- -	16 (7)	- -	50 (7)	- -
Chironomidae	- -	- -	9 (5)	- -	38 (4)	- -
Unidentified	- -	- -	6 (2)	- -	12 (3)	- -
Other	- -	12 (12)	- -	50 (50)	62 (41)	- -
Unidentified	- -	12 (12)	- -	50 (50)	62 (41)	- -

Table 9. Food of Apostle Islands bloaters shorter than 8 inches expressed as the percentage frequency of occurrence and percentage of total volume for each food item (parentheses).

Item	February	April	May	June	July	September	November
Number of stomachs	4	8	23	81	13	20	12
Number empty	0	0	8	1	0	2	1
Crustaceans	100 (100)	100 (100)	93 (93)	100 (98)	92 (73)	89 (82)	91 (91)
Mysidacea	-	-	20 (14)	4 (2)	31 (23)	33 (32)	-
Amphipoda	-	-	-	4 (2)	8 (1)	17 (3)	9 (5)
Copepoda	100 (100)	100 (100)	80 (79)	98 (94)	46 (43)	33 (10)	91 (86)
Cladocera	-	-	-	1 (<1)	30 (15)	50 (36)	-
Ostracoda	-	-	-	-	-	6 (<1)	-
Molluscs	-	-	-	-	-	6 (<1)	-
Sphaeriidae	-	-	-	-	-	6 (<1)	-
Insects	-	-	-	20 (2)	11 (8)	11 (1)	-
Chironomidae	-	-	-	18 (1)	-	11 (1)	-
Unidentified	-	-	-	2 (1)	11 (8)	-	-
Other	-	-	7 (7)	-	30 (19)	28 (17)	9 (9)
Unidentified	-	-	7 (7)	-	30 (19)	28 (17)	9 (9)

Table 10. Food of Duluth-Superior bloaters 8 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November
Number of stomachs	35	15	51	56	17	2
Number empty	23	10	23	18	0	0
Crustaceans	59 (45)	100 (100)	82 (78)	42 (34)	82 (62)	100 (52)
Mysidacea	25 (18)	- -	11 (7)	24 (18)	53 (48)	- -
Amphipoda	16 (2)	20 (20)	36 (26)	18 (16)	12 (1)	- -
Copepoda	33 (25)	80 (80)	54 (45)	- -	18 (11)	100 (52)
Cladocera	- -	- -	7 (<1)	5 (<1)	18 (2)	- -
Molluscs	8 (1)	- -	11 (<1)	- -	- -	50 (<1)
Sphaeriidae	8 (1)	- -	11 (<1)	- -	- -	50 (<1)

Table 10. (Continued)

Item	April	May	June	July	September	November
Insects	8 (8)	- -	28 (10)	13 (5)	24 (5)	- -
Chironomidae	8 (8)	- -	21 (5)	8 (1)	6 (1)	- -
Ephemeroptera	- -	- -	- -	- -	6 (1)	- -
Hemiptera	- -	- -	4 (1)	- -	- -	- -
Unidentified	- -	- -	7 (4)	5 (4)	12 (3)	- -
Fish eggs	16 (16)	- -	- -	- -	- -	50 (48)
Coregonid	16 (16)	- -	- -	- -	- -	50 (48)
Other	33 (30)	- -	18 (11)	63 (60)	47 (32)	- -
Plant material	8 (6)	- -	7 (4)	5 (5)	- -	- -
Araneae	- -	- -	4 (<1)	- -	- -	- -
Oligochaeta	- -	- -	- -	- -	6 (<1)	- -
Unidentified	25 (24)	- -	7 (7)	58 (55)	41 (32)	- -

Table 11. Food of Apostle Islands bloaters 8 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (parentheses).

Item	February	April	May	June	July	September	November	December
Number of stomachs	65	17	70	59	54	61	43	5
Number empty	12	0	22	2	7	1	25	1
Crustaceans	98 (98)	77 (77)	92 (92)	98 (94)	85 (61)	100 (93)	89 (88)	100 (100)
Mysidacea	6 (3)	12 (3)	68 (65)	12 (8)	41 (32)	77 (63)	44 (44)	50 (18)
Amphipoda	-	-	6 (6)	14 (6)	9 (5)	22 (14)	6 (3)	25 (20)
Copepoda	98 (95)	77 (74)	38 (21)	93 (79)	39 (21)	23 (13)	44 (41)	75 (62)
Cladocera	-	-	-	4 (<1)	13 (2)	5 (3)	3 (<1)	-
Ostracoda	-	-	2 (<1)	2 (<1)	-	2 (<1)	-	-
Isopoda	-	-	-	-	4 (1)	2 (1)	-	-
Molluscs	-	-	2 (<1)	2 (<1)	-	10 (<1)	-	-
Sphaeriidae	-	-	2 (<1)	2 (<1)	-	10 (<1)	-	-
Insects	-	6 (1)	-	28 (5)	9 (4)	12 (2)	-	-
Chironomidae	-	-	-	21 (3)	4 (<1)	10 (1)	-	-
Other Diptera	-	-	-	2 (<1)	-	3 (1)	-	-
Ephemeroptera	-	-	-	-	2 (2)	2 (<1)	-	-
Unidentified	-	6 (1)	-	5 (2)	4 (2)	-	-	-
Fish eggs	4 (2)	-	2 (<1)	2 (<1)	2 (<1)	-	17 (7)	-
Coregonid	4 (2)	-	2 (<1)	2 (<1)	-	-	17 (7)	-
Unidentified	-	-	-	-	2 (<1)	-	-	-
Other	4 (<1)	41 (22)	10 (8)	2 (<1)	45 (35)	11 (5)	6 (4)	-
Plant material	-	6 (1)	2 (<1)	2 (<1)	-	-	-	-
Bryozoa	-	23 (14)	-	-	-	-	-	-
Oligochaeta	-	-	-	-	2 (<1)	-	-	-
Nematodea	-	-	-	-	2 (<1)	-	-	-
Unidentified	4 (<1)	12 (7)	8 (8)	-	43 (35)	11 (5)	6 (4)	-

Chironomids were present in small numbers from June through September, and Diptera, Ephemeroptera, Hemiptera, and unidentified remains in lesser amounts were present also. Fingernail clams (Sphaeriidae) were a very small part of the diet in both areas. Coregonid eggs were eaten in large numbers during April and November in the Duluth-Superior area, and during February and November in the Apostle Islands. Other food items included plant material, oligochaetes, nematodes, Bryozoa, Araneae, and some unidentified material. Food habits were essentially similar to those reported by Dryer and Beil (1968).

Kiyi

Forty kiyis (*Coregonus kiyi*), a deep-water species taken primarily from Station 35 in the Apostle Islands, were examined (table 12). Crustaceans, principally *Mysis*, were the predominant food item. Copepods were consumed in May and September, while cladocerans were used in September. Chironomids and coregonid eggs formed a small proportion of total food. Unidentified material and nematodes were found also.

Shortjaw Cisco

Contents of stomachs from 63 shortjaw ciscoes (*Coregonus zenithicus*) were analyzed (table 13). Crustaceans were the main diet item. *Mysis* was predominant in May, September, and November, and amphipods in June. Copepods were taken occasionally in various months. Chironomids were eaten in September and coregonid eggs in May.

Blackfin Cisco

Only three blackfin ciscoes (*Coregonus nigripinnis*) were available for examination (table 14). One stomach in May contained only *Mysis*, while one in July contained only smelt.

Shortnose Cisco

Three shortnose ciscoes (*Coregonus reighardi*) were examined (table 14). Only a single stomach from May contained food items, with *Mysis* predominant and copepods less important.

Lake Whitefish

Sixty-two lake whitefish (*Coregonus clupeaformis*) were analyzed (table 15). The length of most was less than 10 inches. Crustaceans were the most important food, but insects and molluscs formed a substantial portion of total food. Fish eggs, plant material, and other matter were included also. Amphipods were the predominant item during most months and were followed in importance by *Mysis*, copepods, and ostracods. Chironomids and fingernail clams occurred frequently during most months, but generally represented a low portion of the food volume. Fish eggs were consumed during February and December. Other material eaten included nematodes, Hirudinea, Hydracarina, and unidentified matter.

Table 12. Food of western Lake Superior kiyi expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	May	July	September	November
Number of stomachs	29	4	4	3
Number empty	8	1	1	1
Crustaceans	95 (95)	67 (67)	100 (70)	100 (99)
Mysidacea	90 (85)	67 (67)	33 (33)	100 (99)
Copepoda	33 (10)	- -	67 (33)	- -
Cladocera	- -	- -	67 (3)	- -
Insects	- -	- -	33 (7)	- -
Chironomidae	- -	- -	33 (7)	- -
Fish eggs	5 (<1)	- -	- -	50 (1)
Coregonid	5 (<1)	- -	- -	50 (1)
Other	10 (5)	33 (33)	67 (23)	- -
Nematodea	5 (<1)	- -	- -	- -
Unidentified	5 (5)	33 (33)	67 (23)	- -

Table 13. Food of western Lake Superior shortjaw ciscoes expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	May	June	July	September	November
Number of stomachs	28	1	1	8	25
Number empty	4	0	1	2	12
Crustaceans	96 (95)	100 (100)	- -	100 (95)	92 (92)
Mysidacea	96 (93)	- -	- -	100 (93)	61 (61)
Amphipoda	8 (<1)	100 (100)	- -	17 (<1)	- -
Copepoda	29 (2)	- -	- -	17 (2)	31 (31)
Insects	- -	- -	- -	17 (5)	- -
Chironomidae	- -	- -	- -	17 (5)	- -
Fish eggs	4 (<1)	- -	- -	- -	- -
Coregonid	4 (<1)	- -	- -	- -	- -
Other	8 (5)	- -	- -	17 (<1)	8 (8)
Unidentified	8 (5)	- -	- -	17 (<1)	8 (8)

Table 14. Food of western Lake Superior blackfin and shortnose ciscoes expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	May	July
Blackfin cisco		
Number of stomachs	2	1
Number empty	1	0
Crustaceans	100 (100)	- -
Mysidacea	100 (100)	- -
Fish	- -	100 (100)
Smelt	- -	100 (100)
Shortnose cisco		
Number of stomachs	2	1
Number empty	1	1
Crustaceans	100 (100)	- -
Mysidacea	100 (97)	- -
Copepoda	100 (3)	- -

Table 15. Food of western Lake Superior lake whitefish expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	May	June	July	September	November	December
Number of stomachs	8	1	22	9	8	13	1
Number empty	1	0	2	0	0	8	0
Crustaceans	100 (85)	100 (100)	90 (85)	78 (55)	88 (50)	80 (72)	100 (30)
Mysidacea	- -	- -	50 (36)	44 (12)	- -	20 (16)	- -
Amphipoda	100 (85)	- -	50 (39)	67 (26)	88 (50)	80 (56)	100 (30)
Copepoda	- -	100 (100)	15 (9)	11 (11)	- -	- -	- -
Ostracoda	- -	- -	5 (<1)	11 (6)	- -	- -	- -
Molluscs	71 (5)	- -	20 (2)	44 (15)	88 (18)	20 (8)	100 (60)
Sphaeriidae	71 (5)	- -	20 (2)	44 (15)	88 (18)	20 (8)	100 (60)

Table 15. (Continued)

Item	February	May	June	July	September	November	December
Insects	57 (7)	- -	45 (12)	67 (11)	88 (3)	- -	100 (7)
Chironomidae	57 (7)	- -	45 (12)	67 (10)	88 (3)	- -	100 (7)
Other Diptera	- -	- -	- -	44 (1)	- -	- -	- -
Fish eggs	43 (3)	- -	- -	- -	- -	- -	100 (3)
Coregonid	- -	- -	- -	- -	- -	- -	100 (3)
Unidentified	43 (3)	- -	- -	- -	- -	- -	- -
Other	- -	- -	10 (1)	33 (18)	75 (28)	20 (20)	- -
Plant material	- -	- -	5 (<1)	22 (11)	- -	- -	- -
Nematodea	- -	- -	- -	- -	12 (<1)	- -	- -
Hirudinea	- -	- -	- -	11 (<1)	- -	- -	- -
Hydracarina	- -	- -	- -	- -	12 (<1)	- -	- -
Unidentified	- -	- -	5 (1)	22 (7)	62 (28)	20 (20)	- -

Round Whitefish

FISH SHORTER THAN 10 INCHES

Stomachs of 73 round whitefish (*Prosopium cylindraceum*) shorter than 10 inches were examined (table 16). Crustaceans were generally the major food, but insects were predominant during several months. Snails (Gastropoda) and fingernail clams contributed a very small part to the diet during October and November, respectively. Other food consisted of plant material, oligochaetes, nematodes, Hydracarina, and unidentified material. *Mysis* was the major food item during June and October, but was surpassed by insects during May, July, and November, cladocerans in July, and copepods in September. Copepods were eaten during May, July, September, and October, and cladocerans in July, October, and November. Ostracods, isopods, and amphipods were consumed during several months. Insects were the predominant food during May and November and very important in July. Chironomids were usually the major insect consumed. Plecoptera, Tricoptera, Hemiptera, and Ephemeroptera were also important.

FISH 10 INCHES AND LONGER

Analyses of 73 round whitefish 10 inches and longer are shown in table 17. The predominant food item varied among months. Without unidentified material, which was predominant in September and October, crustaceans were the most important during February and September; insects ranked first in June and were frequent during October and November; molluscs were first in volume during October; and coregonid eggs were first by volume in November. Other identified material included plant debris, Bryozoa, oligochaetes, nematodes, Hirudinea, and Hydracarina.

Mysis was the principal crustacean taken during September and November, while isopods (primarily *Asellus*) were the most important during February. Amphipods were eaten in all 3 months. Snails were consumed during 4 months, and were predominant in October. Fingernail clams were included only in September. Chironomids, Tricoptera, Ephemeroptera, and other Diptera were all important food items in various months.

Pygmy Whitefish

Thirty-nine pygmy whitefish were examined (table 18). Crustaceans were predominant, and occurred in most stomachs analyzed. Amphipods were most important in all months except April, when copepods were most abundant. *Mysis*, cladocerans, and ostracods were found also. Insects were eaten during May, June, July, and September, their frequency of occurrence varying from 33 to 50 percent and their volume from 7 to 16 percent in those months. Chironomids were the principal insect consumed; other Diptera and unidentified remains were present in September. Coregonoid eggs were the primary item in the stomach of the single fish examined in April, but were consumed also in May. Fingernail clams, although eaten by 20-25 percent of the sample, constituted only 1 percent of the food volume in June and July. Other food included plant material and unidentified matter. Data reported from an earlier study by Eschmeyer and Bailey (1955) agree with these findings.

Table 16. Food of western Lake Superior round whitefish shorter than 10 inches expressed as the percentage frequency of occurrence and percentage total volume for each food item (in parentheses).

Item	May	June	July	September	October	November
Number of stomachs	10	2	28	1	10	22
Number empty	1	0	0	0	3	0
Crustaceans	22 (20)	100 (90)	82 (65)	100 (100)	71 (67)	50 (33)
Mysidacea	11 (10)	100 (90)	18 (11)	- -	29 (28)	36 (32)
Amphipoda	- -	- -	4 (<1)	- -	- -	- -
Copepoda	11 (10)	- -	29 (13)	100 (100)	14 (14)	- -
Cladocera	- -	- -	50 (41)	- -	14 (11)	9 (1)
Ostracoda	- -	- -	- -	- -	14 (13)	4 (<1)
Isopoda	- -	- -	- -	- -	14 (1)	- -
Molluscs	- -	- -	- -	- -	14 (3)	9 (<1)
Sphaeriidae	- -	- -	- -	- -	- -	9 (<1)
Gastropoda	- -	- -	- -	- -	14 (3)	- -

Table 16. (Continued)

Item	May	June	July	September	October	November
Insects	78 (49)	- -	61 (35)	- -	14 (14)	68 (45)
Chironomidae	56 (22)	- -	43 (11)	- -	- -	58 (34)
Ephemeroptera	- -	- -	- -	- -	14 (14)	- -
Plecoptera	44 (27)	- -	29 (12)	- -	- -	- -
Tricoptera	- -	- -	4 (1)	- -	- -	27 (11)
Hemiptera	- -	- -	29 (11)	- -	- -	- -
Unidentified	- -	- -	4 (<1)	- -	- -	- -
Other	33 (31)	100 (10)	4 (<1)	- -	29 (16)	59 (21)
Plant material	- -	100 (10)	- -	- -	- -	- -
Oligochaeta	- -	- -	- -	- -	- -	9 (2)
Nematodea	- -	- -	- -	- -	29 (16)	9 (2)
Hydracarina	- -	- -	4 (<1)	- -	- -	- -
Unidentified	33 (31)	- -	- -	- -	- -	45 (17)

Table 17. Food of western Lake Superior round whitefish 10 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	June	September	October	November
Number of stomachs	23	1	6	5	38
Number empty	0	0	0	2	8
Crustaceans	96 (66)	- -	67 (40)	- -	33 (17)
Mysidacea	- -	- -	50 (28)	- -	17 (10)
Amphipoda	26 (4)	- -	50 (12)	- -	7 (1)
Isopoda	96 (62)	- -	- -	- -	13 (6)
Molluscs	4 (<1)	- -	33 (5)	33 (30)	20 (7)
Sphaeriidae	- -	- -	17 (4)	- -	- -
Gastropoda	4 (<1)	- -	17 (1)	33 (30)	20 (7)
Insects	61 (22)	100 (100)	33 (8)	67 (5)	63 (23)
Chironomidae	39 (4)	- -	17 (<1)	33 (2)	43 (6)
Other Diptera	- -	- -	- -	33 (3)	3 (<1)

Table 17. (Continued)

Item	February	June	September	October	November
Ephemeroptera	13 (3)	- -	17 (8)	- -	10 (2)
Tricoptera	26 (15)	100 (100)	- -	- -	30 (15)
Fish eggs	- -	- -	- -	- -	43 (33)
Coregonid	- -	- -	- -	- -	43 (33)
Other	39 (13)	- -	67 (47)	67 (65)	37 (19)
Plant material	35 (6)	- -	- -	- -	7 (4)
Bryozoa	- - ^x	- -	- -	- -	3 (<1)
Oligochaeta	- -	- -	- -	- -	7 (1)
Nematodea	- -	- -	- -	- -	13 (9)
Hirudinea	26 (7)	- -	- -	- -	- -
Hydracarina	- -	- -	17 (1)	- -	- -
Unidentified	- -	- -	67 (46)	67 (65)	10 (5)

Table 18. Food of western Lake Superior pygmy whitefish expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November
Number of stomachs	1	6	20	6	4	2
Number empty	0	0	0	1	0	2
Crustaceans	100 (15)	100 (68)	90 (87)	100 (92)	100 (81)	- -
Mysidacea	- -	17 (6)	- -	- -	- -	- -
Amphipoda	- -	50 (43)	85 (79)	100 (92)	100 (81)	- -
Copepoda	100 (14)	67 (19)	5 (5)	20 (<1)	- -	- -
Cladocera	- -	- -	35 (3)	- -	- -	- -
Ostracoda	100 (1)	- -	10 (<1)	- -	- -	- -
Molluscs	- -	- -	25 (1)	20 (1)	- -	- -
Sphaeriidae	- -	- -	25 (1)	20 (1)	- -	- -

Table 18. (Continued)

Item	April	May	June	July	September	November
Insects	- -	33 (16)	40 (13)	40 (7)	50 (11)	- -
Chironomidae	- -	33 (16)	40 (13)	40 (7)	25 (1)	- -
Other Diptera	- -	- -	- -	- -	25 (4)	- -
Unidentified	- -	- -	- -	- -	25 (6)	- -
Fish eggs	100 (85)	17 (16)	- -	- -	- -	- -
Coregonid	100 (85)	17 (16)	- -	- -	- -	- -
Other	- -	- -	- -	- -	50 (8)	- -
Plant material	- -	- -	- -	- -	25 (2)	- -
Unidentified	- -	- -	- -	- -	25 (5)	- -

Lake Trout

FISH SHORTER THAN 10 INCHES

Twenty-two lake trout shorter than 10 inches from the Duluth-Superior area (table 19) and 321 from the Apostle Islands (table 20) were analyzed. Crustaceans were the principal food item of Duluth-Superior trout in all months, followed by insects, fish, and unidentified material. *Mysis* was predominant during July and September, amphipods in June, and copepods during April. Cladocerans were eaten only in June. Insects contributed strongly to the diet in June and July and lesser during September. The principal identified insects were chironomids, other Diptera, and Ephemeroptera. Smelt and unidentified fish remains were found in stomachs in April and September, respectively.

In all months, Apostle Islands trout shorter than 10 inches depended for food primarily on crustaceans, particularly *Mysis*, followed by fish and insects. Amphipods contributed heavily to the crustacean portion of the diet, with only a slight usage of copepods, cladocerans, and isopods. Fish were the principal item by volume during November and December (54 and 51 percent, respectively) and contributed 5 to 33 percent of the food volume during all other months. Smelt were the most common fish eaten, followed by ninespine sticklebacks (*Pungitius pungitius*), and sculpins (Cottidae). Unidentified fish remains were common. Insects were eaten during most months, with many types represented. Coregonid eggs were utilized in February and April, and sculpin eggs during May and June. Sphaeriidae contributed very slightly to the diet in several months. Various other organisms and unidentified material were present.

FISH 10 INCHES AND LONGER

Stomachs from 11 Duluth-Superior lake trout 10 inches and longer (table 21) and 136 Apostle Islands trout (table 22) were examined. The diet of the former group included fish, crustaceans, and insects. Fish predominated in 3 of 4 months and were primarily smelt, but yellow perch (*Perca flavescens*) and unidentified remains were present also. *Mysis* was used in June and July and amphipods in June. Hemiptera were eaten during July.

In the Apostle Islands, lake trout 10 inches and longer took mainly fish and crustaceans. Crustaceans which were most important during June, July, and September were primarily *Mysis* but included amphipods and a few copepods also. Fish were predominant in all months except those noted above and were a close second in them. Fish were smelt, ninespine sticklebacks, sculpins, and unidentified remains. The relative abundance of each species varied from month to month. Insects were abundant only during June. Coregonid eggs were eaten in minimal amounts in February, June, and November. Sphaeriidae were found in samples in several months. Other items were plant material, rotifers, and unidentified material.

These data are consistent with an earlier work by Eschmeyer (1956) and Dryer *et al.* (1965). The latter investigation, however, showed that *Coregonus* spp. were the most common fish in lake trout stomachs (52 to 88 percent of the volume). None were found in stomachs examined in the current study, however.

Rainbow Trout

Three rainbow trout (*Salmo gairdneri*), gill netted in the Apostle Islands in February, were examined (table 23). Stomach contents included, in equal amounts, smelt and stonefly larvae (Plecoptera).

Table 19. Food of Duluth-Superior lake trout shorter than 10 inches expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	June	July	September
Number of stomachs	3	8	4	7
Number empty	1	1	1	0
Crustaceans	50 (50)	86 (69)	100 (66)	100 (81)
Mysidacea	- -	57 (21)	100 (64)	71 (63)
Amphipoda	- -	86 (48)	33 (2)	29 (18)
Copepoda	50 (50)	- -	- -	- -
Cladocera	- -	14 (<1)	- -	- -
Insects	- -	71 (29)	67 (24)	29 (12)
Chironomidae	- -	- -	33 (2)	29 (11)
Other Diptera	- -	43 (9)	- -	14 (1)
Ephemeroptera	- -	14 (1)	33 (7)	- -
Plecoptera	- -	14 (1)	- -	- -
Coleoptera	- -	14 (4)	- -	- -
Hemiptera	- -	14 (<1)	- -	- -
Unidentified	- -	57 (14)	67 (15)	- -
Fish	50 (50)	- -	- -	14 (7)
Smelt	50 (50)	- -	- -	- -
Unidentified	- -	- -	- -	14 (7)
Other	- -	28 (2)	67 (11)	- -
Plant material	- -	14 (<1)	33 (1)	- -
Unidentified	- -	14 (1)	33 (10)	- -

Table 20. Food of Apostle Islands lake trout shorter than 10 inches expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	April	May	June	July	September	November	December
Number of stomachs	7	6	17	140	22	111	13	5
Number empty	0	0	3	0	1	0	0	0
Crustaceans	86 (62)	50 (47)	86 (75)	94 (82)	95 (78)	96 (90)	69 ()	100 (47)
Mysidacea	86 (62)	33 (20)	64 (48)	73 (47)	62 (36)	95 (83)	62 (37)	100 (20)
Amphipoda	-	33 (27)	50 (27)	80 (35)	66 (36)	60 (7)	15 (8)	100 (27)
Copepoda	14 (<1)	-	7 (<1)	2 (<1)	19 (6)	-	8 (<1)	-
Cladocera	-	-	-	1 (<1)	-	-	-	-
Isopoda	-	-	-	1 (<1)	-	-	-	-
Molluscs	14 (1)	-	-	13 (<1)	-	19 (<1)	-	20 (<1)
Sphaeriidae	14 (1)	-	-	13 (<1)	-	19 (<1)	-	20 (<1)
Insects	-	17 (17)	15 (4)	44 (4)	33 (7)	23 (<1)	7 (<1)	-
Chironomidae	-	-	7 (2)	29 (1)	9 (1)	21 (<1)	-	-
Other Diptera	-	-	-	8 (1)	-	-	-	-
Ephemeroptera	-	-	-	-	5 (5)	-	7 (<1)	-
Plecoptera	-	-	7 (2)	-	-	-	-	-
Tricoptera	-	-	-	1 (1)	-	-	-	-
Hymenoptera	-	-	7 (1)	1 (<1)	-	-	-	-
Coleoptera	-	-	-	2 (<1)	-	-	-	-
Hemiptera	-	-	-	1 (<1)	-	1 (<1)	-	-
Unidentified	-	17 (17)	-	6 (1)	19 (2)	1 (<1)	-	-

Table 20. (Continued)

Item	February	April	May	June	July	September	November	December
Fish eggs	43 (8)	17 (3)	7 (<1)	1 (<1)	- -	- -	- -	- -
Sculpin	- -	- -	7 (<1)	1 (<1)	- -	- -	- -	- -
Coregonid	43 (8)	17 (3)	- -	- -	- -	- -	- -	- -
Fish	43 (29)	33 (33)	21 (20)	16 (13)	14 (11)	8 (5)	62 (54)	60 (51)
Smelt	29 (27)	- -	- -	3 (1)	- -	3 (<1)	39 (22)	60 (51)
Stickleback	- -	- -	7 (7)	9 (9)	5 (4)	3 (3)	- -	- -
Sculpin	- -	- -	- -	- -	9 (7)	1 (1)	23 (17)	- -
Johnny darter	- -	- -	- -	- -	- -	- -	7 (7)	- -
Trout-perch	- -	- -	- -	- -	- -	- -	7 (7)	- -
Unidentified	14 (1)	33 (33)	14 (13)	4 (3)	- -	2 (1)	- -	- -
Other	- -	- -	- -	4 (<1)	24 (4)	24 (5)	7 (<1)	20 (2)
Plant material	- -	- -	- -	3 (<1)	5 (<1)	- -	- -	20 (2)
Bryozoa	- -	- -	- -	1 (<1)	- -	- -	- -	- -
Oligochaeta	- -	- -	- -	- -	5 (<1)	3 (<1)	- -	- -
Hirudinea	- -	- -	- -	- -	5 (<1)	1 (<1)	7 (<1)	- -
Unidentified	- -	- -	- -	- -	9 (4)	20 (5)	- -	- -

Table 21. Food of Duluth-Superior lake trout 10 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	May	June	July	November
Number of stomachs	1	2	1	7
Number empty	0	0	0	0
Crustaceans	- -	50 (22)	100 (40)	- -
Mysidacea	- -	50 (20)	100 (40)	- -
Amphipoda	- -	50 (2)	- -	- -
Insects	- -	- -	100 (60)	- -
Hemiptera	- -	- -	100 (60)	- -
Fish	100 (100)	100 (78)	- -	100 (100)
Smelt	100 (100)	50 (50)	- -	29 (29)
Yellow perch	- -	- -	- -	14 (14)
Unidentified	- -	50 (28)	- -	57 (57)

Table 22. Food of Apostle Islands lake trout 10 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	April	May	June	July	September	October	November	December
Number of stomachs	16	1	2	54	12	20	16	14	1
Number empty	5	0	0	1	1	1	15	1	0
Crustaceans	27 (17)	- -	50 (17)	70 (44)	64 (46)	69 (42)	- -	61 (19)	100 (4)
Mysidacea	27 (17)	- -	50 (5)	62 (34)	64 (32)	69 (41)	- -	46 (11)	100 (3)
Amphipoda	- -	- -	50 (12)	58 (10)	55 (14)	21 (<1)	- -	23 (8)	100 (1)
Copepoda	- -	- -	- -	2 (<1)	9 (<1)	- -	- -	- -	- -
Molluscs	9 (<1)	- -	- -	2 (<1)	- -	- -	- -	- -	- -
Sphaeriidae	9 (<1)	- -	- -	2 (<1)	- -	- -	- -	- -	- -
Insects	- -	- -	- -	42 (6)	9 (<1)	5 (<1)	- -	- -	- -
Chironomidae	- -	- -	- -	26 (3)	9 (<1)	- -	- -	- -	- -
Other Diptera	- -	- -	- -	8 (1)	- -	- -	- -	- -	- -
Ephemeroptera	- -	- -	- -	2 (<1)	- -	5 (<1)	- -	- -	- -
Plecoptera	- -	- -	- -	2 (<1)	- -	- -	- -	- -	- -
Tricoptera	- -	- -	- -	8 (2)	- -	- -	- -	- -	- -
Coleoptera	- -	- -	- -	4 (<1)	- -	- -	- -	- -	- -
Hemiptera	- -	- -	- -	2 (<1)	- -	- -	- -	- -	- -
Unidentified	- -	- -	- -	2 (<1)	- -	- -	- -	- -	- -

Table 22. (Continued)

Item	February	April	May	June	July	September	October	November	December
Fish eggs	18 (1)	- -	- -	2 (<1)	- -	- -	- -	7 (1)	- -
Coregonid	18 (1)	- -	- -	2 (<1)	- -	- -	- -	7 (1)	- -
Fish	82 (82)	100 (100)	100 (83)	55 (49)	36 (36)	53 (47)	100 (100)	85 (81)	100 (96)
Smelt	55 (50)	- -	- -	8 (7)	9 (9)	26 (24)	- -	15 (15)	100 (90)
Stickleback	9 (4)	- -	- -	28 (24)	18 (15)	21 (18)	- -	7 (5)	- -
Sculpin	- -	- -	50 (50)	8 (6)	9 (9)	5 (3)	100 (100)	23 (21)	- -
Unidentified	27 (27)	100 (100)	50 (33)	15 (11)	9 (4)	10 (3)	- -	46 (39)	100 (6)
Other	- -	- -	- -	8 (1)	27 (18)	21 (11)	- -	- -	- -
Plant material	- -	- -	- -	6 (<1)	- -	- -	- -	- -	- -
Rotatoria	- -	- -	- -	- -	- -	5 (<1)	- -	- -	- -
Unidentified	- -	- -	- -	2 (1)	27 (18)	16 (11)	- -	- -	- -

Table 23. Food of western Lake Superior rainbow and brown trout expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	September	November
Rainbow trout			
Number of stomachs	3	-	-
Number empty	1	-	-
Insects	50 (50)	- -	- -
Plecoptera	50 (50)	- -	- -
Fish	50 (50)	- -	- -
Smelt	50 (50)	- -	- -
Brown trout			
Number of stomachs	-	1	1
Number empty	-	0	1
Crustaceans	- -	100 (10)	- -
Mysidacea	- -	100 (10)	- -
Other	- -	100 (90)	- -
Unidentified	- -	100 (90)	- -

Brown Trout

Two brown trout (*Salmo trutta*) stomachs were examined (table 23). The only one containing food (in September) included *Mysis* and unidentified material.

American Smelt

FISH SHORTER THAN 5 INCHES

Stomachs of 492 smelt shorter than 5 inches were analyzed, 164 from Duluth-Superior (table 24) and 328 from the Apostle Islands (table 25). In each area, the diet was almost exclusively crustaceans. Insects, plant material, oligochaetes, and unidentified matter constituted an insignificant portion of the total. Copepods were the predominant item in the Duluth-Superior area during all months except April, when *Mysis* was most important. In the Apostle Islands, *Mysis* ranked highest during 6 out of 8 months, while copepods were predominant in the other 2 months. Other crustaceans eaten in both areas included amphipods, cladocerans, and ostracods. Chironomids, Ephemeroptera, Hemiptera, and Tricoptera were taken in small amounts.

FISH 5 INCHES AND LONGER

Five hundred and six smelt 5 inches and longer from the Duluth-Superior area (table 26) and 699 from the Apostle Islands (table 27) were examined. The majority of food consisted of crustaceans. Insects, fish, molluscs, fish eggs, and other material were much less important.

In the Duluth-Superior area, *Mysis* was predominant during all months except May and June. Copepods and amphipods were next in importance, with copepods ranking first in May and June. Cladocerans, ostracods, and isopods were consumed also. In contrast to these results, earlier work by Hale (1959) indicated that copepods rarely were consumed by smelt caught along the Minnesota shore of Lake Superior.

In the Apostle Islands, *Mysis* was the principal food in every month except February and December. Copepods ranked first in the former month and amphipods during the latter month. Copepods and amphipods (both *Pontoporeia* and *Gammarus*) were important during most months, while cladocerans and ostracods contributed only slightly.

Insects, primarily chironomids, were small contributors to the diet in most months, with their greatest importance in June and September. Most insect groups were represented in the diet. Fish included smelt, sculpins, and unidentified remains. Fingernail clams were used occasionally. Consumption of smelt and coregonid eggs occurred primarily from April to June. Other material eaten included plant remains, oligochaetes, Hirudinea, and unidentified items.

Sucker

Food of two species of sucker, the longnose sucker (*Catostomus catostomus*) and the white sucker (*Catostomus commersoni*), was summarized together. Two hundred and thirty-one of the former species and 24 of the latter were examined. Of the total number of stomachs analyzed, 88 were from the Duluth-Superior area (table 28) and 167 from the Apostle Islands (table 29). Crustaceans were generally the predominant item followed closely, and in one month superseded, by insects. Molluscs and fish eggs were used also. Unidentified material constituted a very large portion of the stomach contents.

Amphipods were the most important crustacean taken in both areas. Only during February in the Apostle Islands were cladocerans and isopods more important. Copepods, ostracods, and *Mysis* were used also. Chironomids were the commonly eaten insect in the two areas, although many other groups were represented. Fingernail clams and snails were eaten also. Coregonid eggs were consumed during April, October, and November. Other food included plant material, Araneae, oligochaetes, Hydracarina, and a substantial amount of unidentified material.

Table 24. Food of Duluth-Superior smelt shorter than 5 inches expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November
Number of stomachs	75	17	27	2	31	12
Number empty	47	5	8	2	2	3
Crustaceans	100 (100)	100 (100)	100 (94)	- -	100 (95)	100 (100)
Mysidacea	60 (58)	16 (10)	42 (40)	- -	3 (3)	11 (11)
Amphipoda	14 (7)	8 (2)	5 (1)	- -	14 (5)	- -
Copepoda	40 (33)	92 (89)	63 (43)	- -	72 (49)	89 (88)
Cladocera	- -	- -	32 (10)	- -	69 (38)	11 (1)
Ostracoda	- -	- -	- -	- -	3 (<1)	- -
Insects	- -	- -	16 (6)	- -	10 (5)	- -
Chironomidae	- -	- -	11 (1)	- -	7 (4)	- -
Ephemeroptera	- -	- -	- -	- -	3 (1)	- -
Hemiptera	- -	- -	11 (5)	- -	- -	- -

Table 25. Food of Apostle Islands smelt shorter than 5 inches expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	October	November	December
Number of stomachs	34	54	100	41	37	10	46	6
Number empty	12	14	28	16	6	2	20	3
Crustaceans	95 (92)	100 (100)	100 (98)	92 (87)	100 (96)	100 (100)	100 (100)	100 (100)
Mysidacea	59 (55)	85 (82)	71 (64)	64 (61)	65 (57)	- -	57 (57)	33 (20)
Amphipoda	9 (5)	10 (7)	18 (13)	20 (7)	10 (3)	- -	- -	100 (47)
Copepoda	50 (32)	12 (10)	33 (20)	32 (16)	35 (23)	100 (100)	42 (39)	100 (33)
Cladocera	- -	- -	- -	8 (3)	26 (13)	- -	4 (4)	- -
Ostracoda	- -	- -	1 (<1)	- -	- -	- -	- -	- -
Insects	- -	- -	3 (1)	4 (<1)	3 (2)	- -	- -	- -
Chironomidae	- -	- -	1 (<1)	- -	3 (2)	- -	- -	- -
Ephemeroptera	- -	- -	1 (1)	- -	- -	- -	- -	- -
Tricoptera	- -	- -	- -	4 (<1)	- -	- -	- -	- -
Other	9 (8)	- -	1 (1)	16 (12)	6 (2)	- -	- -	- -
Plant material	9 (8)	- -	- -	- -	- -	- -	- -	- -
Oligochaeta	- -	- -	- -	4 (<1)	- -	- -	- -	- -
Unidentified	- -	- -	1 (1)	16 (12)	6 (2)	- -	- -	- -

Table 26. Food of Duluth-Superior smelt 5 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November
Number of stomachs	147	48	170	60	53	28
Number empty	72	20	19	5	5	5
Crustaceans	87 (79)	89 (87)	96 (93)	100 (99)	90 (80)	96 (91)
Mysidacea	54 (44)	39 (29)	49 (28)	91 (84)	44 (37)	65 (51)
Amphipoda	34 (20)	32 (19)	25 (13)	13 (4)	10 (2)	13 (7)
Copepoda	24 (16)	53 (39)	76 (48)	5 (5)	23 (6)	48 (30)
Cladocera	- -	- -	14 (3)	11 (7)	44 (35)	22 (3)
Ostracoda	- -	- -	7 (<1)	- -	2 (<1)	- -
Isopoda	- -	- -	- -	2 (<1)	- -	- -
Molluscs	1 (<1)	4 (<1)	10 (<1)	- -	2 (<1)	- -
Sphaeriidae	1 (<1)	4 (<1)	10 (<1)	- -	2 (<1)	- -
Insects	1 (<1)	3 (1)	20 (4)	5 (1)	25 (7)	5 (1)
Chironomidae	1 (<1)	- -	9 (2)	2 (<1)	21 (4)	- -
Other Diptera	- -	- -	1 (<1)	- -	2 (<1)	- -
Ephemeroptera	- -	- -	1 (<1)	- -	- -	- -
Hymenoptera	- -	- -	1 (<1)	- -	- -	- -
Coleoptera	- -	- -	1 (<1)	- -	- -	- -
Hemiptera	- -	- -	3 (<1)	- -	- -	- -
Orthoptera	- -	- -	1 (<1)	- -	- -	- -
Unidentified	- -	3 (1)	6 (1)	4 (1)	4 (3)	5 (1)

Table 26. (Continued)

Item	April	May	June	July	September	November
Fish eggs	5 (3)	- -	1 (<1)	- -	- -	- -
Smelt	4 (2)	- -	- -	- -	- -	- -
Coregonid	1 (<1)	- -	1 (<1)	- -	- -	- -
Fish	8 (7)	7 (7)	1 (1)	2 (<1)	8 (6)	- -
Smelt	4 (4)	3 (3)	1 (<1)	- -	6 (4)	- -
Sculpin	3 (3)	- -	1 (1)	- -	- -	- -
Unidentified	1 (1)	3 (3)	- -	2 (<1)	2 (2)	- -
Other	16 (12)	3 (3)	9 (2)	2 (<1)	6 (6)	9 (9)
Plant material	- -	- -	9 (2)	2 (<1)	- -	- -
Unidentified	16 (12)	3 (3)	- -	- -	6 (6)	9 (9)

Table 27. Food of Apostle Islands smelt 5 inches and longer expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	April	May	June	July	September	November	December
Number of stomachs	135	51	41	250	80	88	40	14
Number empty	34	27	11	24	5	8	17	4
Crustaceans	100 (99)	75 (75)	97 (96)	96 (91)	99 (96)	99 (94)	96 (93)	90 (90)
Mysidacea	38 (28)	54 (49)	63 (59)	87 (72)	84 (71)	84 (76)	91 (68)	40 (20)
Amphipoda	11 (6)	4 (<1)	30 (20)	28 (13)	16 (7)	16 (4)	46 (26)	80 (70)
Copepoda	85 (65)	42 (26)	13 (13)	18 (6)	36 (14)	6 (1)	-	-
Cladocera	-	-	3 (3)	-	9 (4)	16 (13)	-	-
Ostracoda	-	-	-	-	1 (<1)	-	-	-
Molluscs	-	-	-	2 (<1)	1 (<1)	5 (<1)	-	-
Sphaeriidae	-	-	-	2 (<1)	1 (<1)	5 (<1)	-	-
Insects	-	-	3 (<1)	17 (7)	9 (1)	11 (2)	-	-
Chironomidae	-	-	-	13 (3)	8 (1)	6 (1)	-	-
Other Diptera	-	-	3 (<1)	-	-	-	-	-
Ephemeroptera	-	-	-	5 (4)	1 (<1)	-	-	-
Plecoptera	-	-	-	-	-	1 (<1)	-	-
Tricoptera	-	-	-	-	-	1 (1)	-	-
Coleoptera	-	-	-	-	-	1 (<1)	-	-
Odonata	-	-	-	<1 (<1)	-	-	-	-
Unidentified	-	-	-	-	-	1 (<1)	-	-
Fish eggs	-	-	3 (3)	-	-	1 (<1)	-	-
Smelt	-	-	3 (3)	-	-	-	-	-
Unidentified	-	-	-	-	-	1 (<1)	-	-

Table 27. (Continued)

Item	February	April	May	June	July	September	November	December
Fish	2 (1)	- -	- -	1 (1)	1 (1)	8 (2)	9 (7)	- -
Smelt	1 (1)	- -	- -	- -	1 (1)	8 (2)	4 (4)	- -
Unidentified	1 (<1)	- -	- -	1 (1)	- -	- -	5 (3)	- -
Other	2 (1)	25 (25)	- -	2 (<1)	11 (2)	11 (1)	- -	10 (10)
Plant material	- -	17 (17)	- -	2 (<1)	- -	1 (<1)	- -	- -
Oligochaeta	- -	- -	- -	- -	1 (<1)	- -	- -	- -
Hirudinea	- -	- -	- -	- -	3 (<1)	- -	- -	- -
Unidentified	2 (1)	8 (8)	- -	<1 (<1)	10 (2)	10 (1)	- -	10 (10)

Table 28. Food of Duluth-Superior longnose and white suckers expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	June	September	November
Number of stomachs	44	20	15	9
Number empty	5	0	0	2
Crustaceans	95 (59)	90 (67)	13 (<1)	57 (21)
Mysidacea	3 (<1)	- -	- -	- -
Amphipoda	92 (56)	85 (64)	13 (<1)	57 (21)
Copepoda	8 (<1)	- -	- -	- -
Cladocera	3 (3)	- -	- -	- -
Isopoda	- -	10 (3)	- -	- -
Molluscs	- -	5 (<1)	13 (<1)	- -
Sphaeriidae	- -	5 (<1)	7 (<1)	- -
Gastropoda	- -	- -	6 (<1)	- -

Table 28. (Continued)

Item	April	June	September	November
Insects	56 (5)	75 (18)	60 (2)	- -
Chironomidae	56 (5)	65 (15)	27 (<1)	- -
Other Diptera	- -	- -	20 (<1)	- -
Ephemeroptera	- -	5 (2)	27 (1)	- -
Tricoptera	- -	- -	20 (<1)	- -
Coleoptera	- -	5 (<1)	- -	- -
Hemiptera	- -	5 (1)	- -	- -
Unidentified	- -	10 (<1)	- -	- -
Fish eggs	8 (<1)	- -	- -	- -
Coregonid	8 (<1)	- -	- -	- -
Other	64 (36)	30 (14)	100 (97)	100 (79)
Plant material	- -	20 (4)	- -	- -
Araneae	- -	- -	20 (<1)	- -
Oligochaeta	3 (<1)	- -	7 (<1)	- -
Unidentified	62 (35)	10 (10)	100 (97)	100 (79)

Table 29. Food of Apostle Islands longnose and white suckers expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	June	September	October	November	December
Number of stomachs	7	3	11	112	32	2
Number empty	4	0	1	24	7	0
Crustaceans	67 (67)	100 (99)	30 (9)	36 (12)	76 (59)	100 (35)
Amphipoda	- -	100 (99)	30 (9)	18 (5)	72 (59)	100 (35)
Copepoda	- -	- -	10 (<1)	3 (2)	- -	- -
Cladocera	33 (33)	- -	10 (<1)	20 (2)	8 (<1)	- -
Ostracoda	- -	- -	- -	8 (<1)	4 (<1)	- -
Isopoda	33 (33)	- -	- -	7 (2)	4 (<1)	- -
Molluscs	- -	- -	30 (3)	17 (4)	12 (1)	- -
Sphaeriidae	- -	- -	30 (2)	2 (1)	8 (<1)	- -
Gastropoda	- -	- -	20 (1)	15 (3)	8 (1)	- -

Table 29. (Continued)

Item	February	June	September	October	November	December
Insects	- -	33 (1)	30 (4)	18 (1)	32 (5)	50 (2)
Chironomidae	- -	33 (1)	20 (<1)	16 (1)	20 (1)	50 (2)
Plecoptera	- -	- -	- -	- -	4 (<1)	- -
Tricoptera	- -	- -	- -	1 (<1)	16 (4)	- -
Unidentified	- -	- -	10 (4)	1 (<1)	- -	- -
Fish eggs	- -	- -	- -	4 (1)	16 (1)	- -
Coregonid	- -	- -	- -	4 (1)	16 (1)	- -
Other	33 (33)	- -	100 (83)	91 (82)	36 (34)	100 (62)
Plant material	- -	- -	- -	28 (2)	- -	- -
Hydracarina	- -	- -	- -	8 (<1)	- -	- -
Unidentified	33 (33)	- -	100 (83)	86 (80)	36 (34)	100 (62)

Slimy Sculpin

Stomachs of 252 slimy sculpins (*Cottus cognatus*) from Duluth-Superior (table 30) and 458 from the Apostle Islands (table 31) were examined. Crustaceans were predominant in a diet that also included insects, fish eggs, molluscs, and other material. In both areas, amphipods were the most prevalent item during all months. All other crustaceans, including *Mysis*, copepods, cladocerans, isopods, and ostracods, were much less important. Chironomid larvae were the principal insects consumed, but many other insect groups were used also. Insect consumption was greatest during June at Duluth-Superior and during November in the Apostle Islands. Fish eggs were represented in the diet during various months, with the consumption of coregonid and sculpin eggs occurring principally in April and May. Molluscs were used occasionally. Plant material, oligochaetes, Hirudinea, and unidentified material, the last of which sometimes constituted an important segment of the stomach contents, were present also.

Spoonhead Sculpin

Seventy-seven spoonhead sculpins (*Cottus ricei*) from Duluth-Superior (table 32) and 64 from the Apostle Islands (table 33) were analyzed. The diet was dominated by crustaceans but also included insects, fish eggs, and other material. Amphipods were the principal food in both areas during all months. *Mysis* and copepods were consumed in lesser amounts in the two areas and isopods were used only at Duluth-Superior. The use of insects, primarily chironomids, was not as important in the Apostle Islands as in the Duluth-Superior area. Coregonid eggs were eaten during April and May in both areas. Plant material, oligochaetes, Hirudinea, and unidentified material constituted the balance of stomach contents.

Fourhorn Sculpin

Stomachs from 120 fourhorn sculpins (*Myoxocephalus quadricornis*) were examined (table 34). Crustaceans were taken almost exclusively, with *Mysis* and amphipods equally important in most months. Copepods and cladocerans were eaten occasionally. Unidentified insect remains and small numbers of coregonid eggs were taken in April. Plant material was taken in September and unidentified items in May, July, and September.

Mottled Sculpin

Three stomachs from mottled sculpins (*Cottus bairdi*) were examined (table 35). The two obtained during July contained, by volume, 98 percent amphipods and 2 percent chironomids. The single stomach from November contained 10 percent unidentified insect remains and 90 percent unidentified matter.

Table 30. Food of Duluth-Superior slimy sculpins expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November
Number of stomachs	87	6	88	50	15	6
Number empty	2	0	2	1	0	0
Crustaceans	79 (65)	100 (80)	94 (77)	100 (98)	87 (40)	100 (90)
Mysidacea	9 (3)	- -	5 (1)	6 (3)	20 (5)	- -
Amphipoda	75 (61)	100 (76)	91 (72)	100 (95)	87 (34)	100 (90)
Copepoda	1 (1)	33 (4)	- -	- -	- -	- -
Cladocera	1 (<1)	- -	1 (<1)	- -	7 (<1)	- -
Isopoda	- -	- -	13 (4)	- -	- -	- -
Molluscs	2 (1)	- -	- -	- -	- -	- -
Sphaeriidae	2 (1)	- -	- -	- -	- -	- -

Table 30. (Continued)

Item	April	May	June	July	September	November
Insects	8 (2)	- -	46 (18)	10 (1)	20 (14)	- -
Chironomidae	6 (1)	- -	44 (18)	10 (1)	7 (5)	- -
Ephemeroptera	2 (1)	- -	1 (<1)	- -	- -	- -
Hemiptera	- -	- -	1 (<1)	- -	- -	- -
Unidentified	1 (<1)	- -	2 (<1)	- -	13 (9)	- -
Fish eggs	26 (10)	33 (12)	2 (<1)	- -	- -	- -
Smelt	- -	- -	1 (<1)	- -	- -	- -
Sculpin	3 (2)	- -	- -	- -	- -	- -
Coregonid	22 (7)	33 (12)	1 (<1)	- -	- -	- -
Other	36 (22)	33 (8)	15 (4)	6 (1)	73 (46)	17 (10)
Plant material	1 (<1)	33 (8)	9 (2)	- -	7 (1)	17 (7)
Oligochaeta	- -	- -	- -	4 (<1)	- -	- -
Hirudinea	2 (2)	- -	2 (1)	- -	- -	- -
Unidentified	32 (20)	- -	3 (1)	2 (<1)	73 (46)	17 (3)

Table 31. Food of Apostle Islands slimy sculpins expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	October	November	December
Number of stomachs	33	81	121	104	72	12	34	1
Number empty	0	0	0	3	0	2	0	0
Crustaceans	97 (86)	95 (78)	100 (98)	91 (78)	92 (76)	90 (88)	82 (65)	100 (95)
Mysidacea	15 (12)	19 (10)	8 (2)	11 (5)	12 (6)	10 (2)	12 (7)	- -
Amphipoda	91 (73)	92 (68)	100 (95)	84 (68)	89 (70)	90 (86)	65 (53)	100 (95)
Copepoda	6 (1)	3 (<1)	1 (<1)	12 (3)	3 (<1)	- -	3 (1)	- -
Cladocera	- -	- -	1 (<1)	2 (1)	- -	- -	3 (<1)	- -
Ostracoda	- -	- -	- -	- -	- -	- -	6 (3)	- -
Isopoda	- -	1 (1)	2 (<1)	- -	- -	- -	3 (1)	- -
Molluscs	- -	- -	- -	2 (<1)	7 (<1)	10 (1)	- -	- -
Sphaeriidae	- -	- -	- -	2 (<1)	- -	- -	- -	- -
Gastropoda	- -	- -	- -	- -	7 (<1)	10 (1)	- -	- -
Insects	- -	5 (2)	21 (1)	29 (11)	15 (3)	20 (4)	41 (13)	- -
Chironomidae	- -	2 (<1)	14 (1)	21 (7)	12 (1)	20 (4)	32 (11)	- -
Other Diptera	- -	1 (<1)	- -	1 (<1)	1 (1)	- -	- -	- -
Ephemeroptera	- -	- -	1 (<1)	1 (<1)	- -	- -	- -	- -
Plecoptera	- -	1 (1)	- -	- -	- -	- -	- -	- -
Tricoptera	- -	- -	5 (<1)	1 (<1)	- -	- -	6 (1)	- -
Coleoptera	- -	- -	- -	- -	- -	- -	3 (<1)	- -
Unidentified	- -	- -	2 (<1)	5 (3)	1 (<1)	- -	- -	- -

Table 31. (Continued)

Item	April	May	June	July	September	October	November	December
Fish eggs	18 (9)	18 (8)	2 (<1)	1 (<1)	- -	- -	6 (<1)	100 (5)
Sculpin	6 (3)	8 (3)	- -	- -	- -	- -	- -	- -
Coregonid	12 (6)	10 (5)	2 (<1)	1 (<1)	- -	- -	6 (<1)	100 (5)
Other	9 (6)	21 (11)	2 (<1)	29 (11)	54 (22)	10 (8)	26 (22)	- -
Plant material	- -	- -	1 (<1)	6 (1)	1 (<1)	- -	- -	- -
Oligochaeta	- -	- -	- -	4 (1)	1 (1)	- -	- -	- -
Hirudinea	- -	- -	- -	4 (<1)	4 (<1)	- -	- -	- -
Unidentified	9 (6)	21 (11)	2 (<1)	20 (9)	47 (20)	10 (8)	26 (22)	- -

Table 32. Food of Duluth-Superior spoonhead sculpins expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	June	July	September	November
Number of stomachs	8	17	38	13	1
Number empty	0	2	1	0	0
Crustaceans	100 (84)	93 (75)	97 (82)	100 (75)	100 (100)
Mysidacea	12 (2)	- -	8 (1)	100 (53)	- -
Amphipoda	100 (78)	80 (52)	97 (81)	100 (22)	100 (100)
Copepoda	- -	20 (8)	- -	8 (<1)	- -
Isopoda	12 (3)	33 (16)	- -	- -	- -
Insects	25 (4)	53 (15)	38 (10)	23 (5)	- -
Chironomidae	25 (2)	53 (14)	35 (8)	8 (<1)	- -
Ephemeroptera	- -	7 (1)	- -	- -	- -
Tricoptera	- -	- -	3 (1)	- -	- -
Coleoptera	12 (2)	- -	- -	- -	- -
Odonata	- -	- -	- -	8 (3)	- -
Unidentified	- -	- -	- -	8 (1)	- -
Fish eggs	38 (6)	7 (1)	- -	- -	- -
Coregonid	38 (6)	7 (1)	- -	- -	- -
Other	25 (7)	27 (8)	11 (8)	38 (20)	- -
Plant material	- -	20 (2)	- -	- -	- -
Oligochaeta	- -	- -	3 (<1)	- -	- -
Unidentified	25 (7)	7 (7)	11 (8)	38 (20)	- -

Table 33. Food of Apostle Islands spoonhead sculpins expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November	December
Number of stomachs	15	8	5	17	15	3	1
Number empty	0	0	0	1	0	0	0
Crustaceans	100 (92)	100 (86)	100 (100)	100 (94)	100 (98)	67 (50)	100 (100)
Mysidacea	7 (1)	25 (25)	20 (2)	12 (2)	13 (8)	- -	- -
Amphipoda	100 (91)	75 (57)	100 (98)	100 (92)	100 (90)	67 (50)	100 (99)
Copepoda	- -	38 (3)	- -	- -	- -	- -	100 (1)
Insects	13 (5)	- -	- -	19 (2)	13 (2)	- -	- -
Chironomidae	7 (1)	- -	- -	12 (1)	7 (2)	- -	- -
Unidentified	7 (4)	- -	- -	6 (1)	7 (1)	- -	- -
Fish eggs	7 (3)	12 (3)	- -	- -	- -	- -	- -
Coregonid	7 (3)	12 (3)	- -	- -	- -	- -	- -
Other	7 (<1)	25 (11)	- -	25 (4)	7 (1)	67 (50)	- -
Plant material	7 (<1)	- -	- -	- -	- -	- -	- -
Hirudinea	- -	- -	- -	- -	7 (1)	- -	- -
Unidentified	- -	25 (11)	- -	25 (4)	- -	67 (50)	- -

Table 34. Food of western Lake Superior fourhorn sculpins expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November
Number of stomachs	25	18	39	26	9	3
Number empty	0	0	0	0	0	0
Crustaceans	100 (99)	94 (90)	100 (100)	100 (95)	100 (89)	100 (100)
Mysidacea	76 (57)	78 (42)	72 (40)	73 (48)	56 (37)	- -
Amphipoda	68 (42)	72 (47)	90 (60)	77 (47)	67 (52)	100 (100)
Copepoda	12 (<1)	11 (1)	3 (<1)	- -	- -	- -
Cladocera	- -	- -	3 (<1)	4 (<1)	- -	- -
Insects	4 (<1)	- -	- -	- -	- -	- -
Unidentified	4 (<1)	- -	- -	- -	- -	- -
Fish eggs	20 (1)	- -	- -	- -	- -	- -
Coregonid	20 (1)	- -	- -	- -	- -	- -
Other	- -	33 (11)	- -	12 (5)	22 (11)	- -
Plant material	- -	- -	- -	- -	11 (6)	- -
Unidentified	- -	33 (11)	- -	12 (5)	11 (5)	- -

Table 35. Food of western Lake Superior mottled sculpins expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	July	November
Number of stomachs	2	1
Number empty	0	0
Crustaceans	100 (98)	- -
Amphipods	100 (98)	- -
Insects	100 (2)	100 (10)
Chironomidae	100 (2)	- -
Unidentified	- -	100 (10)
Other	- -	100 (90)
Unidentified	- -	100 (90)

Ninespine Stickleback

Two hundred and ninety-five ninespine sticklebacks were analyzed (table 36). Crustaceans constituted the bulk of the diet, with amphipods being the major component during all months except October. Copepods ranked first that month and second during July and November. *Mysis* was second in importance during May, June, and September. The use of cladocerans was greatest in July and October. Chironomid larvae were the principal insects eaten, with insect consumption occurring from May through September. Coregonid and sculpin eggs were eaten during May. Small amounts of plant material, and nematodes were found.

Trout-perch

Three hundred and forty-nine trout-perch (*Percopsis omiscomaycus*), 178 from the Duluth-Superior area (table 37) and 171 from the Apostle Islands (table 38) were examined. Crustaceans were the predominant food, followed closely by insects. Molluscs, plant material, oligochaetes, Hirudinea, and unidentified items also were consumed. In the Duluth-Superior area, crustaceans were most important in all months except June; but in the other area, they were predominant in every month. In both areas, amphipods were the principal crustacean during all months except April and May, when *Mysis* was most important. Copepods, cladocerans, ostracods, and isopods were consumed during various months in the two areas.

Insects used were primarily chironomids. During June in the Duluth-Superior area, insects, primarily chironomids, were the predominant food item. They were important during most months in both areas. Sphaeriidae were found only during June at Duluth-Superior. The use of plant material, oligochaetes, Hirudinea, and unidentified matter was not important.

Table 36. Food of western Lake Superior nine-spine sticklebacks expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	October	November
Number of stomachs	3	72	117	33	56	10	4
Number empty	1	10	6	4	8	1	0
Crustaceans	50 (50)	98 (95)	99 (95)	97 (90)	100 (94)	100 (100)	100 (100)
Mysidacea	-	61 (44)	29 (16)	10 (8)	44 (30)	11 (3)	-
Amphipoda	50 (50)	63 (48)	90 (74)	48 (43)	83 (62)	33 (21)	100 (90)
Copepoda	-	13 (3)	8 (5)	48 (31)	6 (1)	78 (74)	25 (10)
Cladocera	-	-	1 (<1)	28 (7)	2 (<1)	11 (2)	-
Insects	-	2 (<1)	13 (2)	10 (4)	17 (3)	-	-
Chironomidae	-	-	10 (2)	10 (4)	17 (3)	-	-
Other Diptera	-	-	2 (<1)	-	-	-	-
Ephemeroptera	-	2 (<1)	-	-	-	-	-
Unidentified	-	-	1 (<1)	-	-	-	-
Fish eggs	-	13 (3)	-	-	-	-	-
Sculpin	-	2 (<1)	-	-	-	-	-
Coregonid	-	11 (3)	-	-	-	-	-
Other	50 (50)	3 (2)	5 (3)	7 (6)	24 (3)	-	-
Plant material	-	-	2 (1)	-	-	-	-
Nematodea	-	2 (<1)	-	-	2 (<1)	-	-
Unidentified	50 (50)	2 (2)	3 (2)	7 (6)	22 (3)	-	-

Table 37. Food of Duluth-Superior trout-perch expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November
Number of stomachs	118	13	20	6	12	9
Number empty	14	4	1	0	5	0
Crustaceans	92 (87)	78 (77)	84 (37)	100 (78)	86 (79)	100 (89)
Mysidacea	76 (53)	56 (45)	16 (1)	33 (3)	- -	11 (6)
Amphipoda	66 (34)	67 (32)	58 (14)	83 (57)	71 (68)	100 (82)
Copepoda	2 (<1)	- -	37 (12)	17 (<1)	14 (11)	11 (1)
Cladocera	- -	- -	16 (2)	50 (18)	- -	- -
Ostracoda	- -	- -	- -	- -	- -	22 (<1)
Isopoda	- -	- -	26 (9)	- -	- -	- -
Molluscs	- -	- -	5 (<1)	- -	- -	- -
Sphaeriidae	- -	- -	5 (<1)	- -	- -	- -
Insects	28 (11)	33 (11)	84 (57)	83 (20)	57 (7)	44 (11)
Chironomidae	28 (10)	33 (11)	84 (55)	83 (20)	57 (7)	44 (11)
Other Diptera	3 (1)	- -	- -	- -	- -	- -
Tricoptera	- -	- -	5 (2)	- -	- -	- -
Hemiptera	- -	- -	5 (1)	- -	- -	- -
Other	5 (2)	22 (12)	- -	17 (2)	14 (14)	- -
Plant material	1 (<1)	- -	- -	- -	- -	- -
Hirudinea	- -	11 (1)	- -	- -	- -	- -
Unidentified	4 (2)	11 (11)	- -	17 (2)	14 (14)	- -

Table 38. Food of Apostle Islands trout-perch expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	July	September	November	December
Number of stomachs	18	22	60	11	10	47	3
Number empty	5	3	13	5	1	0	1
Crustaceans	92 (75)	84 (60)	91 (69)	83 (83)	89 (74)	74 (61)	100 (98)
Mysidacea	69 (55)	47 (32)	13 (10)	- -	- -	18 (11)	50 (48)
Amphipoda	31 (30)	47 (26)	85 (57)	67 (67)	89 (74)	55 (43)	50 (50)
Copepoda	- -	11 (1)	- -	17 (17)	- -	5 (1)	- -
Cladocera	- -	- -	2 (<1)	- -	- -	5 (3)	- -
Ostracoda	- -	5 (1)	- -	- -	- -	- -	- -
Isopoda	- -	- -	4 (2)	- -	- -	5 (4)	- -
Insects	38 (25)	58 (40)	53 (29)	- -	44 (19)	42 (25)	50 (2)
Chironomidae	38 (25)	58 (40)	53 (28)	- -	44 (19)	39 (22)	50 (3)
Other Diptera	- -	- -	- -	- -	11 (<1)	- -	- -
Ephemeroptera	- -	- -	- -	- -	- -	3 (3)	- -
Unidentified	- -	- -	2 (<1)	- -	- -	- -	- -
Other	- -	- -	2 (2)	17 (17)	22 (6)	21 (14)	- -
Plant material	- -	- -	2 (2)	- -	- -	- -	- -
Oligochaeta	- -	- -	- -	- -	11 (4)	- -	- -
Unidentified	- -	- -	- -	17 (17)	11 (2)	21 (14)	- -

Burbot

Stomachs of 30 burbot (*Lota lota*) from Duluth-Superior (table 39) and 48 from the Apostle Islands (table 40) were analyzed. Crustaceans and fish were the principal foods, with the larger burbot favoring the latter item. Insects, fish eggs, molluscs, and other material also were taken. The predominant item for Duluth-Superior burbot was fish in all months but April, when crustaceans were most important. Smelt was the principal fish consumed, followed by sculpins, coregonids, trout-perch, and unidentified fish remains. Both *Mysis* and amphipods were important crustaceans in the diet. Isopods were less common. Coregonid eggs, fingernail clams, and plant material were used only during April, while chironomids were taken in April and September.

Burbot examined from the Apostle Islands depended heavily on crustaceans during all months with *Mysis* and amphipods being the most common, and isopods, cladocerans, and copepods less so. Fish were the principal food in several months, with sculpins being the most common type, followed by bloaters, ninespine sticklebacks, smelt, and unidentified remains. Fish eggs, primarily coregonids, were frequent during April, May, June, and November, but never constituted more than 6 percent of the volume. Molluscs and insects also were used frequently during several months, but were not important in volume.

Alewife

Nine alewives (*Alosa pseudoharengus*) obtained during April, May, and November were examined (table 41). Identified food consisted entirely of crustaceans, with *Mysis* predominant. Cladocerans and copepods were found only in November.

Walleye

Stomachs of 13 walleyes (*Stizostedion v. vitreum*) were analyzed (table 42). The entire diet of the single fish containing food in April was unidentified fish eggs. None of the three examined from June contained food items, while the single specimen from September contained only unidentified matter. Food in the November-caught fish was 75 percent *Mysis* and 25 percent unidentified matter.

Northern Pike

Four northern pike (*Esox lucius*), gill-netted during February, were examined (table 42). Fish were the only identified diet items, with smelt the most important followed by yellow perch and unidentified remains.

Yellow Perch

In stomachs of 29 yellow perch examined (table 43), crustaceans were the predominant food during all months except February. Amphipods were the principal crustacean during April and May, *Mysis* during November, and isopods in February. Copepods and cladocerans also were used. Unidentified fish remains were the most important item in February. Fish eggs were eaten in February and November and plant material in February.

Table 39. Food of Duluth-Superior burbot expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	September	November
Number of stomachs	13	1	5	7	4
Number empty	1	0	2	3	0
Crustaceans	83 (44)	- -	33 (<1)	25 (24)	50 (28)
Mysidacea	75 (30)	- -	- -	25 (5)	50 (28)
Amphipoda	75 (12)	- -	33 (<1)	25 (19)	- -
Isopoda	17 (2)	- -	- -	- -	- -
Molluscs	17 (<1)	- -	- -	- -	- -
Sphaeriidae	17 (<1)	- -	- -	- -	- -
Insects	50 (4)	- -	- -	25 (1)	- -
Chironomidae	50 (4)	- -	- -	25 (1)	- -

Table 39. (Continued)

Item	April	May	June	September	November
Fish eggs	33 (1)	- -	- -	- -	- -
Coregonid	33 (1)	- -	- -	- -	- -
Fish	42 (34)	100 (100)	100 (100)	75 (75)	75 (72)
Smelt	25 (23)	100 (70)	100 (90)	25 (25)	25 (22)
Sculpin	8 (8)	- -	33 (10)	- -	- -
Coregonid	- -	- -	- -	- -	25 (25)
Trout-perch	- -	100 (30)	- -	- -	- -
Unidentified	8 (3)	- -	- -	50 (50)	25 (25)
Other	33 (17)	- -	- -	- -	- -
Plant material	8 (2)	- -	- -	- -	- -
Unidentified	33 (15)	- -	- -	- -	- -

Table 40. Food of Apostle Islands burbot expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	June	September	October	November
Number of stomachs	5	3	5	13	2	20
Number empty	1	0	0	7	1	4
Crustaceans	75 (54)	67 (19)	80 (79)	83 (39)	100 (100)	88 (42)
Mysidacea	75 (26)	67 (9)	40 (3)	83 (15)	-	88 (36)
Amphipoda	50 (28)	33 (10)	80 (75)	67 (24)	100 (30)	69 (6)
Copepoda	-	-	20 (<1)	-	-	-
Cladocera	-	-	20 (<1)	-	-	-
Isopoda	-	-	20 (1)	17 (<1)	100 (70)	-
Molluscs	-	-	60 (1)	-	-	19 (<1)
Sphaeriidae	-	-	60 (1)	-	-	19 (<1)
Insects	-	-	20 (<1)	17 (<1)	-	6 (<1)
Chironomidae	-	-	20 (<1)	17 (<1)	-	-
Unidentified	-	-	-	-	-	6 (<1)

Table 40. (Continued)

Item	April		May		June		September		October		November	
Fish eggs	25	(6)	33	(2)	20	(<1)	-	-	-	-	56	(1)
Sculpin	-	-	33	(2)	-	-	-	-	-	-	-	-
Coregonid	25	(6)	-	-	20	(<1)	-	-	-	-	56	(1)
Fish	50	(40)	100	(79)	-	-	83	(43)	-	-	2	(50)
Smelt	-	-	-	-	-	-	17	(12)	-	-	-	-
Stickleback	-	-	33	(6)	-	-	17	(7)	-	-	12	(5)
Sculpin	25	(15)	67	(40)	-	-	33	(11)	-	-	38	(27)
Bloater	25	(25)	33	(33)	-	-	-	-	-	-	6	(3)
Unidentified	-	-	-	-	-	-	17	(13)	-	-	19	(15)
Other	-	-	-	-	40	(20)	33	(18)	-	-	6	(6)
Nematodea	-	-	-	-	20	(2)	-	-	-	-	6	(6)
Unidentified	-	-	-	-	20	(18)	33	(18)	-	-	-	-

Table 41. Food of western Lake Superior alewives expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	May	November
Number of stomachs	2	1	6
Number empty	0	0	1
Crustaceans	50 (50)	- -	100 (100)
Mysidacea	50 (50)	- -	80 (80)
Copepoda	- -	- -	20 (1)
Cladocera	- -	- -	20 (20)
Other	50 (50)	100 (100)	- -
Unidentified	50 (50)	100 (100)	- -

Table 42. Food of western Lake Superior walleyes and northern pike expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	April	June	September	November
Walleye					
Number of stomachs	-	3	3	1	6
Number empty	-	2	3	0	4
Crustaceans	- -	- -	- -	- -	100 (75)
Mysidacea	- -	- -	- -	- -	100 (75)
Fish eggs	- -	100 (100)	- -	- -	- -
Unidentified	- -	100 (100)	- -	- -	- -
Other	- -	- -	- -	100 (100)	50 (25)
Unidentified	- -	- -	- -	100 (100)	50 (25)

Table 42. (Continued)

Item	February	April	June	September	November
Northern pike					
Number of stomachs	4	-	-	-	-
Number empty	0	-	-	-	-
Fish	75 (75)	- -	- -	- -	- -
Smelt	50 (45)	- -	- -	- -	- -
Yellow perch	25 (5)	- -	- -	- -	- -
Unidentified	25 (25)	- -	- -	- -	- -
Other	25 (25)	- -	- -	- -	- -
Unidentified	25 (25)	- -	- -	- -	- -

Table 43. Food of western Lake Superior yellow perch expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	February	April	September	November
Number of stomachs	13	9	2	5
Number empty	8	3	0	1
Crustaceans	20 (18)	100 (100)	50 (50)	100 (95)
Mysidacea	- -	17 (3)	- -	100 (80)
Amphipoda	- -	83 (83)	50 (50)	25 (15)
Copepoda	20 (<1)	17 (14)	- -	- -
Cladocera	- -	- -	- -	25 (<1)
Isopoda	20 (18)	- -	- -	- -
Fish eggs	20 (<1)	- -	- -	25 (5)
Coregonid	- -	- -	- -	25 (5)
Unidentified	20 (<1)	- -	- -	- -
Fish	40 (40)	- -	- -	- -
Unidentified	40 (40)	- -	- -	- -
Other	60 (42)	- -	50 (50)	- -
Plant material	20 (2)	- -	- -	- -
Unidentified	40 (40)	- -	50 (50)	- -

Johnny Darter

Five Johnny darters (*Etheostoma nigrum*) were examined (table 44). Only two stomachs from November samples contained food — 50 percent were chironomids and 50 percent was unidentified.

Emerald Shiner

Six emerald shiners (*Notropis atherinoides*), caught during April, were examined (table 44). Stomach contents were entirely mayfly larvae (*Ephemeroptera*).

Lake Chub

Stomachs of 26 lake chubs (*Hybopsis plumbea*) which were analyzed (table 45) contained a variety of items, with crustaceans and insects being most common. Crustaceans included *Mysis*, copepods, and cladocerans, while insects were chironomids or other Diptera. Snails and lake chub eggs were found in October and unidentified fish remains in July.

Spottail Shiner

Seventeen spottail shiner (*Notropis hudsonius*) stomachs from April and November samples were examined (table 46). Crustaceans, principally amphipods, were eaten both months, while *Mysis* and cladocerans were found only in November. Unidentified insect remains were found during November. Other items of the diet included nematodes and Hirudinea.

FISH-SPECIES COMPLEX

Composition of Trawl Catches

Twenty-seven of the 30 fish species listed in table 2 were taken by 231 bottom trawl tows during the field study. Rainbow trout, brown trout, and northern pike were caught only with gill nets. Twenty-one species were obtained from the Duluth-Superior area and 24 species from the Apostle Islands. One of the species caught in the Duluth-Superior area, a single brook stickleback (*Eucalia inconstans*), was not listed in table 2 because the stomach was not examined. Species caught only in the Duluth-Superior area, in addition to the brook stickleback, were lake chub, walleye, and emerald shiner. Those present only in the Apostle Islands included lake whitefish, round whitefish, kiyi, blackfin cisco, shortjaw cisco, shortnose cisco, and Johnny darter.

Table 44. Food of western Lake Superior Johnny darters and emerald shiners expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April		October		November	
Johnny darter						
Number of stomachs	-		1		4	
Number empty	-		1		2	
Insects	-	-	-	-	50 (50)	
Chironomidae	-	-	-	-	50 (50)	
Other	-	-	-	-	50 (50)	
Unidentified	-	-	-	-	50 (50)	
Emerald shiner						
Number of stomachs	6		-		-	
Number empty	4		-		-	
Insects	100 (100)		-		-	
Ephemeroptera	100 (100)		-		-	

Table 45. Food of western Lake Superior lake chubs expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	July	September	October
Number of stomachs	1	3	22
Number empty	0	0	13
Crustaceans	100 (5)	33 (3)	11 (11)
Mysidacea	100 (5)	-	-
Copepoda	-	33 (3)	-
Cladocera	-	-	11 (11)
Molluscs	-	-	11 (11)
Gastropoda	-	-	11 (11)
Insects	100 (75)	-	33 (31)
Chironomidae	-	-	33 (31)
Other Diptera	100 (75)	-	-
Fish eggs	-	-	22 (4)
Lake chub	-	-	22 (4)
Fish	100 (20)	-	-
Unidentified	100 (20)	-	-
Other	-	100 (97)	44 (42)
Unidentified	-	100 (97)	44 (42)

Table 46. Food of western Lake Superior spottail shiners expressed as the percentage frequency of occurrence and percentage of total volume for each food item (in parentheses).

Item	April	November
Number of stomachs	11	6
Number empty	7	0
Crustaceans	25 (25)	100 (74)
Mysidacea	- -	33 (25)
Amphipoda	25 (25)	83 (48)
Cladocera	- -	17 (1)
Insects	- -	17 (10)
Unidentified	- -	17 (10)
Other	75 (75)	67 (16)
Nematodea	- -	33 (2)
Hirudinea	25 (<1)	- -
Unidentified	75 (75)	33 (14)

Abundance of Species

Estimates of abundance of the various fish species at each sampling station were based on the number caught per 15-minute bottom trawl tow. Average number per tow and percentage of each species in the average catch were calculated by month and year at each station (Appendix tables 1-14, tables 47-51).

DULUTH-SUPERIOR

Smelt were the most abundant fish in trawl catches from the Duluth-Superior area. Yearly percentages varied from 55.5 in 1968 to 70.1 in 1966 (table 47). During the 1966-1968 period, smelt were predominant in all months except July 1967 (Appendix table 2) and July 1968 (Appendix table 3). The minimum percentage was 11.7 in July 1968, while the maximum was 90.2 for April 1967.

Trout-perch ranked second in abundance (15.2 percent) in 1966 and third and fourth in 1968 and 1967, respectively. Monthly abundance during the 3-year period fluctuated considerably between 0.0 percent in July 1968 to 29.2 percent in April 1968 (Appendix table 3). Slimy sculpins were second in importance in 1968 and third in both 1966 and 1967. They were the predominant species in the average July 1968 catch at 63.8 percent (Appendix table 3) and in the July 1967 catch at 34.5 percent (Appendix table 2). Bloaters ranked next to smelt in abundance in 1967 and were fourth in 1966 and 1968. Maximum percentage during any month was 33.2 in November 1967 (Appendix table 2). Longnose suckers, the only other important species, represented from 2.6 to 4.9 percent of the annual catch, with a monthly maximum of 20.1 percent in May 1967 (Appendix table 2).

APOSTLE ISLANDS

Station 35. Slimy sculpins were generally the predominant species at Station 35 in the Apostle Islands, with annual percentages ranging from 45.3 in 1966 to 50.1 in 1968 (table 48). On a monthly basis, the species was the most abundant except during May 1966, April 1967, and April 1968 (Appendix tables 4-6). Monthly percentages varied from 10.1 in April 1967 to 80.7 in September 1967.

Ninespine sticklebacks, bloaters, smelt, and fourhorn sculpins constituted the bulk of the remaining species in the catch. The relative importance of each specie varied considerably among monthly and yearly averages. In 1966, fourhorn sculpins ranked second with 20.6 percent followed by sticklebacks at 14.4 percent. Bloaters were second with 23.9 percent in 1967, and sticklebacks third with 20.8 percent. Smelt were second in 1968 with 17.6 percent, followed closely by bloaters at 17.4 percent.

Monthly bloater percentages ranged from 0.5 in June 1966 (Appendix table 4) to 37.2 in April (Appendix table 5). Ninespine sticklebacks were most abundant with 41.2 percent in May 1966, but were absent from catches in July 1966 and July 1967. The abundance of fourhorn sculpins varied from 0.0 during May 1968 (Appendix table 6) to 33.6 in June 1966. Smelt were not taken during June and July 1966, but had a maximum abundance percentage of 45.0 in April 1968.

Station 12. Smelt were the principal fish in trawl catches at Station 12, followed by ninespine sticklebacks, trout-perch, slimy sculpins, bloaters, and lake trout (table 49). Annual percentages of abundance for smelt varied from 57.0 in 1967 to 66.1 in 1966. Bloaters were second at 7.4 percent in 1966. Sticklebacks ranked next to smelt in 1967 and 1968 at 14.0 and 17.9 percent, respectively. Trout-perch abundance during the 1966-1968 period varied from 2.8 to 12.0 percent, stickleback from 7.0 to 17.9 percent, slimy sculpin from 7.0 to 9.3 percent, bloater from 0.1 to 7.4 percent, and lake trout from 0.2 to 5.0 percent.

Table 47. Annual average number of fish caught and (in parentheses) annual average percentage contribution of each species to the catch per 15-minute bottom trawl tow at Station 112 in the Duluth-Superior area of western Lake Superior.*

Species	1966	1967	1968
Lake herring	0.4 (0.2)	1.7 (2.1)	1.5 (0.5)
Bloater	6.1 (3.4)	10.3 (12.5)	10.6 (6.2)
Pygmy whitefish	0.0 (0.0)	0.0 (0.0)	0.1 (<0.1)
Lake trout	0.4 (0.2)	0.1 (<0.1)	0.8 (0.5)
American smelt	282.3 (70.1)	141.4 (63.0)	172.7 (55.5)
Longnose sucker	6.1 (3.3)	8.9 (4.9)	2.8 (2.6)
White sucker	0.1 (0.1)	0.0 (0.0)	0.0 (0.0)
Slimy sculpin	11.6 (6.5)	10.0 (9.3)	15.1 (21.8)
Spoonhead sculpin	0.6 (0.2)	0.6 (0.4)	1.3 (1.9)
Fourhorn sculpin	<0.1 (<0.1)	<0.1 (<0.1)	0.0 (0.0)
Mottled sculpin	0.0 (0.0)	0.0 (0.0)	<0.1 (0.1)
Ninespine stickleback	0.1 (0.1)	0.1 (0.2)	0.2 (0.2)

* Values obtained from Appendix tables 1, 2, and 3.

Table 47. (Continued)

Species	1966	1967	1968
Brook stickleback	<0.1 (<0.1)	0.0 (0.0)	0.0 (0.0)
Trout-perch	55.7 (15.2)	12.9 (7.1)	37.9 (10.3)
Burbot	0.1 (0.1)	0.5 (0.2)	0.8 (0.2)
Alewife	0.0 (0.0)	0.0 (0.0)	0.1 (<0.1)
Walleye	0.2 (<0.1)	0.1 (0.1)	0.1 (<0.1)
Yellow perch	0.1 (0.1)	<0.1 (<0.1)	0.0 (0.0)
Lake chub	0.0 (0.0)	<0.1 (<0.1)	0.0 (0.0)
Spottail shiner	0.2 (0.1)	0.0 (0.0)	<0.1 (<0.1)
Emerald shiner	0.1 (0.1)	0.0 (0.0)	0.0 (0.0)
Number of tows	39	32	19

* Values obtained from Appendix tables 1, 2, and 3.

Table 48. Annual average number of fish caught and (in parentheses) annual average percentage contribution of each species to the catch per 15-minute bottom trawl tow at Station 35 in the Apostle Islands area of western Lake Superior.*

Species	1966	1967	1968
Lake herring	0.1 (0.1)	0.0 (0.0)	0.0 (0.0)
Bloater	8.4 (10.1)	29.7 (23.9)	25.0 (17.4)
Kiyi	1.2 (1.0)	0.6 (0.8)	0.0 (0.0)
Blackfin cisco	0.1 (<0.1)	0.0 (0.0)	0.0 (0.0)
Shortjaw cisco	1.0 (0.8)	0.0 (0.0)	0.0 (0.0)
Shortnose cisco	0.1 (<0.1)	0.0 (0.0)	0.0 (0.0)
Pygmy whitefish	0.1 (<0.1)	0.0 (0.0)	0.2 (0.1)
Lake trout	1.1 (1.4)	0.2 (0.2)	1.5 (1.3)
American smelt	6.1 (4.5)	4.4 (3.1)	35.7 (17.6)
Slimy sculpin	39.1 (45.3)	52.4 (48.0)	76.2 (50.1)
Spoonhead sculpin	0.4 (0.3)	0.1 (0.2)	1.3 (0.8)
Fourhorn sculpin	16.8 (20.6)	3.1 (2.4)	3.3 (1.9)
Mottled sculpin	0.0 (0.0)	0.1 (0.2)	0.0 (0.0)
Ninespine stickleback	19.3 (14.4)	28.6 (20.8)	9.8 (10.4)
Trout-perch	1.7 (1.2)	0.0 (0.0)	0.7 (0.3)
Burbot	0.1 (0.1)	0.4 (0.3)	0.3 (0.1)
Alewife	0.0 (0.0)	0.0 (0.0)	0.2 (0.1)
Yellow perch	0.0 (0.0)	0.1 (0.1)	0.0 (0.0)
Number of tows	13	9	6

* Values obtained from Appendix tables 4, 5, and 6.

Table 49. Annual average number of fish caught and (in parentheses) annual average percentage contribution of each species to the catch per 15-minute bottom trawl tow at Station 12 in the Apostle Islands area of western Lake Superior.*

Species	1966		1967		1968	
Lake herring	0.1	(0.2)	0.0	(0.0)	0.0	(0.0)
Bloater	4.0	(7.4)	4.6	(3.1)	0.1	(0.1)
Pygmy whitefish	0.7	(1.2)	0.6	(0.4)	0.3	(0.5)
Round whitefish	0.0	(0.0)	0.1	(<0.1)	0.0	(0.0)
Lake trout	2.5	(5.0)	2.9	(3.1)	0.3	(0.2)
American smelt	75.8	(66.1)	57.6	(57.0)	73.1	(63.1)
Slimy sculpin	6.4	(7.0)	6.7	(9.3)	8.8	(7.1)
Spoonhead sculpin	<0.1	(0.1)	0.6	(0.3)	2.8	(2.2)
Fourhorn sculpin	1.6	(2.8)	0.4	(0.4)	1.8	(1.4)
Ninespine stickleback	7.4	(7.0)	22.7	(14.0)	12.7	(17.9)
Trout-perch	4.2	(2.8)	10.4	(12.0)	6.4	(7.4)
Burbot	0.1	(0.2)	0.4	(0.3)	0.1	(0.1)
Number of tows	17		15		7	

* Values obtained from Appendix tables 7, 8, and 9.

Monthly percentages of the principal species varied as follows: smelt, 31.3 in May 1968 to 88.1 in July 1968 (Appendix table 9); ninespine stickleback, 1.3 in April 1968 to 50.0 in May 1968 (Appendix table 9); trout-perch, 0.0 in several months to 24.4 in July 1967 (Appendix table 8); slimy sculpin, 1.5 in May 1968 (Appendix table 9) to 17.2 in June 1967 (Appendix table 8); bloater, 0.0 in various months to 14.4 in June 1966 (Appendix table 7); and lake trout, 0.0 in several months to 10.0 in June 1966 (Appendix table 7).

Station 75. Smelt predominated the trawl catches at Station 75 in 1966 and 1967, constituting annual percentages of 46.5 and 51.1, respectively (table 50). Smelt were most abundant in all months except July and September 1967 (Appendix table 11). Monthly abundance varied from 8.2 percent in September 1967 to 93.7 percent in April 1967.

Ninespine sticklebacks were second in abundance in 1967 at 29.4 percent and third at 8.6 percent in 1966 (table 50). They were the most abundant species in the July and September 1967 average catches with 32.2 and 81.1 percent, respectively (Appendix table 11). Slimy sculpins ranked second in 1966 with 21.3 percent and third in 1967 with 7.7 percent (table 50). Maximum abundance was 30.4 percent in July 1966 (Appendix table 10). Other important species in the catch were round whitefish, 7.7 percent in 1966; lake trout, 5.5 percent in 1966; and bloaters, 4.4 percent in 1967 (table 50). Monthly abundances of these species fluctuated widely.

Table 50. Annual average number of fish caught and (in parentheses) annual average percentage contribution of each species to the catch per 15-minute bottom trawl tow at Station 75 in the Apostle Islands area of western Lake Superior.*

Species	1966		1967	
Lake herring	<0.1	(0.1)	0.0	(0.0)
Bloater	1.6	(3.9)	3.5	(4.4)
Lake whitefish	1.3	(2.6)	0.0	(0.0)
Shortnose cisco	0.0	(0.0)	0.2	(0.1)
Pygmy whitefish	0.5	(1.0)	0.2	(0.2)
Round whitefish	3.6	(7.7)	0.0	(0.0)
Lake trout	2.7	(5.5)	2.4	(4.5)
American smelt	20.8	(46.5)	99.4	(51.1)
Longnose sucker	0.1	(0.1)	0.0	(0.0)
Slimy sculpin	9.5	(21.3)	7.7	(7.7)
Spoonhead sculpin	0.0	(0.0)	0.4	(0.2)
Fourhorn sculpin	0.4	(0.9)	0.4	(0.1)
Ninespine stickleback	4.2	(8.6)	50.7	(29.4)
Trout-perch	1.0	(1.8)	1.4	(1.5)
Burbot	<0.1	(0.1)	1.2	(0.7)
Alewife	0.0	(0.0)	0.1	(0.1)
Number of tows	14		10	

* Values obtained from Appendix tables 10 and 11.

Miscellaneous stations. Trawl catches at 13 additional stations in the Apostle Islands during 1965-1967 were combined to facilitate analysis. Smelt were most abundant, with annual percentages ranging from 51.3 to 64.9 (table 51). Ninespine sticklebacks ranked second each year followed primarily by lake trout, trout-perch, slimy sculpins, bloaters, and round whitefish. Maximum monthly abundance of smelt was 93.1 percent in December 1966 (Appendix table 13), with a low of only 0.1 percent in July 1966. Sticklebacks were most abundant in September 1965 at 55.0 percent (Appendix table 12) and July 1966 at 96.9 percent (Appendix table 13). Maximum lake trout abundance was 23.3 percent in September 1965 (Appendix table 12). Percentage abundances of the other primary species varied from month to month.

FOOD INTERRELATIONSHIPS OF TRAWL-CAUGHT FISH

Food Organisms

In the foregoing description of food habits, items of diet were grouped into six categories: crustaceans, insects, fish, molluscs, fish eggs, and other material. Crustaceans comprised, by far, the bulk of the diet for the majority of fishes. Most important among this group were Mysidacea, Amphipoda, and Copepoda. Based on use by the greatest number of species, insects were next in order followed by fish eggs, molluscs, and fish. The sixth category, other material, consisted of miscellaneous items and particularly unidentified matter. Even though other material represented a portion of the diet of all species, it was not considered in the following discussion.

Eight classifications of food items were used in an attempt to evaluate the food interrelationships of trawl-caught fish in western Lake Superior. The classifications were crustaceans as a group; Mysidacea; Amphipoda; and Copepoda of the crustacean group; insects; fish; molluscs; and fish eggs.

Computational Procedure

The abundance of a fish species in bottom trawl catches and the food habits of the fish were utilized to obtain a numerical value that would roughly describe the proportion of a given food item used by that species. This numerical value is referred to as the percentage use.

The basic components used in the computational procedure were the monthly values for the (1) percentage contribution of the species to the average catch per 15-minute trawl tow (obtained from Appendix tables 1-14) and (2) percentage of total volume of the food item in the stomach contents of the species (obtained from tables 3-46). For species having food habits described for more than one size class, a weighted average from the different sets of data was used for the percentage of total volume for the food item. The product of values (1) and (2) was expressed as a percentage of the sum of all such products obtained from all the species included in the average trawl catch for the month and station in question. In this manner, an estimate was obtained of the percentage of the food item in question consumed by each species for the month and station. Several limitations in the original data should be considered when results are evaluated. No adjustment was made for differences in the total volume of stomachs among species. Food habits were listed for a number of species using inadequate numbers of specimens. Trawl catches are not completely reliable estimators of fish abundance since catchability obviously differs for the various species.

Table 51. Annual average number of fish caught and (in parentheses) annual average percentage contribution of each species to the catch per 15-minute bottom trawl tow at miscellaneous stations in the Apostle Islands area of western Lake Superior.*

Species	1965	1966	1967
Lake herring	0.1 (0.1)	0.1 (<0.1)	0.2 (0.1)
Bloater	4.6 (1.7)	8.1 (5.2)	4.7 (1.9)
Lake whitefish	0.2 (0.1)	0.4 (0.2)	2.2 (0.6)
Shortjaw cisco	0.1 (0.1)	0.0 (0.0)	0.0 (0.0)
Pygmy whitefish	0.0 (0.0)	<0.1 (<0.1)	0.0 (0.0)
Round whitefish	6.3 (1.6)	12.5 (0.8)	4.6 (2.8)
Lake trout	17.8 (8.1)	8.9 (5.8)	4.0 (1.2)
American smelt	435.0 (51.3)	75.8 (52.3)	152.4 (64.9)
Longnose sucker	0.0 (0.0)	<0.1 (<0.1)	<0.1 (<0.1)
White sucker	0.0 (0.0)	0.0 (0.0)	0.1 (<0.1)
Slimy sculpin	11.6 (6.7)	3.6 (1.1)	13.8 (7.8)

* Values obtained from Appendix tables 12, 13, and 14.

Table 51. (Continued)

Species	1965	1966	1967
Spoonhead sculpin	0.2 (0.2)	0.2 (0.1)	0.1 (<0.1)
Fourhorn sculpin	0.6 (0.3)	0.0 (0.0)	0.1 (<0.1)
Mottled sculpin	0.0 (0.0)	<0.1 (<0.1)	0.0 (0.0)
Ninespine stickleback	71.7 (20.7)	499.6 (32.9)	48.7 (14.0)
Trout-perch	9.7 (8.2)	2.1 (1.4)	12.6 (6.4)
Burbot	0.1 (0.1)	0.0 (0.0)	0.2 (0.1)
Alewife	0.1 (0.1)	0.0 (0.0)	0.0 (0.0)
Yellow perch	0.0 (0.0)	0.0 (0.0)	<0.1 (<0.1)
Johnny darter	0.4 (0.2)	0.0 (0.0)	0.0 (0.0)
Spottail shiner	0.3 (0.3)	0.0 (0.0)	0.0 (0.0)
Number of tows	14	24	12

* Values obtained from Appendix tables 12, 13, and 14.

Consumption of Organisms

CRUSTACEANS

In western Lake Superior, smelt consumed approximately 50 percent of the crustaceans eaten by all trawl-caught species (table 52). Slimy sculpins and ninespine sticklebacks followed with percentage uses of 17.7 and 13.8, respectively. Other species, in decreasing order of use, were bloaters, trout-perch, fourhorn sculpins, and lake trout.

Percentage use of crustaceans by smelt at Station 112 in the Duluth-Superior area varied from 72.9 in 1966 to 56.4 in 1968 (table 53). Consumption at Apostle Islands stations was similar with smelt ranking first except at Station 35, where annual values for smelt ranged from 3.4 percent in 1967 to 17.9 percent in 1968. Monthly values for smelt at the various stations during 1965-1968 showed considerable variation from 0 to 95.3 percent. (Appendix tables 15-28).

Use of crustaceans at Duluth-Superior by other species was primarily by slimy sculpins, trout-perch, bloaters, and longnose suckers (table 53). Monthly use of crustaceans by these species was subject to fluctuation (Appendix tables 15-17).

Slimy sculpins had the highest percentage use of crustaceans at Station 35 in the Apostle Islands with annual values ranging from 43.9 to 49.4 (table 53). Percentage use by this species increased after April and May each year (Appendix tables 18-20). In 1966, fourhorn sculpins were next in importance followed by ninespine sticklebacks, bloaters, and smelt. Bloaters were second in 1967 with sticklebacks third. Smelt followed slimy sculpins in 1968, while bloaters were a close third. Percentage crustacean use by these species varied greatly from month to month.

At Station 12, sticklebacks, slimy sculpins, trout-perch, bloaters, and lake trout followed far behind smelt in crustacean use (table 53). Their importance, relative to each other, changed from year to year and month to month (Appendix tables 21-23).

Sticklebacks and slimy sculpins followed smelt in importance at Station 75, with lake trout and bloaters farther behind (table 53). At miscellaneous stations in the Apostle Islands, sticklebacks ranked first after smelt each year (table 53), while percentage use for all other species was much less. An extremely high value of 97.6 percent for sticklebacks in July 1966 (Appendix table 27) was the result of several trawl tows at Station 24 where there happened to be an exceedingly high concentration of the species.

MYSIDACEA

Highest percentage use of *Mysis relicta* at combined stations in western Lake Superior was by smelt, which accounted for 62.7 percent (table 52). Ninespine sticklebacks were next at 11.1 percent, followed by bloaters (6.7 percent), fourhorn sculpins (5.1 percent), slimy sculpins (4.6 percent), trout-perch and lake trout (3.7 percent), and round whitefish (1.4 percent).

Smelt dominated the *Mysis* consumption at Station 112, with annual values ranging from 86.7 percent in 1966 to 77.6 in 1968 (table 54). Trout-perch were second in percentage use at 12.0 in 1966, 10.0 in 1967, and 12.0 in 1968. Only bloaters in 1967 and 1968 (4.8 and 4.2 percent) and slimy sculpins in 1968 (4.6 percent) constituted any additional significant use of the item. Monthly use by smelt was as high as 98.9 in June 1967 (Appendix table 30).

Table 52. Percentage use of food items by trawl-caught fish in western Lake Superior. Values are grand averages of annual means from all stations over the period, 1965-1968.

Species	Crustaceans	Mysidacea	Amphipoda	Copepoda	Insects	Fish	Molluscs	Fish eggs
Lake herring	0.2	<0.1	<0.1	0.5	<0.1	-	-	0.1
Bloater	6.8	6.7	1.2	24.1	6.5	-	19.1	14.6
Lake whitefish	0.2	0.2	0.2	0.4	1.9	-	6.0	0.9
Kiyi	0.1	0.4	-	0.3	<0.1	-	-	<0.1
Blackfin cisco	<0.1	<0.1	-	-	-	-	-	-
Shortjaw cisco	0.1	0.1	<0.1	<0.1	<0.1	-	-	<0.1
Shortnose cisco	<0.1	<0.1	-	<0.1	-	-	-	-
Pygmy whitefish	0.2	<0.1	0.6	0.2	0.6	-	0.3	3.2
Round whitefish	0.4	1.4	<0.1	0.6	5.8	-	7.0	4.0
Lake trout	2.1	3.7	1.8	0.2	3.3	44.6	5.2	3.8
American smelt	50.1	62.7	25.1	58.0	19.2	42.2	41.6	22.5
Longnose sucker	0.6	<0.1	1.5	<0.1	1.7	-	2.7	<0.1
White sucker	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1
Slimy sculpin	17.7	4.6	34.6	4.4	20.1	-	15.5	43.5
Spoonhead sculpin	0.5	<0.1	1.5	<0.1	1.2	-	-	0.3
Mottled sculpin	<0.1	-	<0.1	-	<0.1	-	-	-
Fourhorn sculpin	2.5	5.1	2.5	0.5	0.3	-	-	0.2
Ninespine stickleback	13.8	11.1	20.6	9.9	10.7	-	-	3.9
Trout-perch	4.7	3.7	10.0	0.9	28.1	-	0.2	-
Burbot	0.1	0.1	0.2	<0.1	0.1	12.8	2.5	0.3
Alewife	<0.1	<0.1	-	<0.1	-	-	-	-
Walleye	<0.1	<0.1	-	-	-	-	-	0.2
Yellow perch	<0.1	<0.1	<0.1	<0.1	-	-	-	-
Johnny darter	-	-	-	-	0.1	-	-	-
Lake chub	<0.1	<0.1	-	-	0.1	0.4	-	-
Spottail shiner	<0.1	<0.1	<0.1	-	<0.1	-	-	-
Emerald shiner	-	-	-	-	0.1	-	-	-

Table 53. Percentage use of crustaceans as food by trawl-caught fish at stations in western Lake Superior.
Values are annual averages.

Species	Station 112			Station 35			Station 12			Station 75		Misc. stations		
	1966	1967	1968	1966	1967	1968	1966	1967	1968	1966	1967	1965	1966	1967
Lake herring	0.2	1.7	0.5	0.1	-	-	0.2	-	-	0.1	-	0.1	<0.1	0.1
Bloater	3.3	9.9	4.1	9.1	25.0	17.1	7.7	3.0	0.1	3.3	3.8	1.7	5.6	1.7
Lake whitefish	-	-	-	-	-	-	-	-	-	2.5	-	0.1	0.2	0.4
Kiyi	-	-	-	1.0	0.7	-	-	-	-	-	-	-	-	-
Blackfin cisco	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-
Shortjaw cisco	-	-	-	0.8	-	-	-	-	-	-	-	0.1	-	-
Shortnose cisco	-	-	-	<0.1	-	-	-	-	-	-	0.1	-	-	-
Pygmy whitefish	-	-	<0.1	<0.1	-	0.1	1.1	0.3	0.4	1.0	0.2	-	<0.1	-
Round whitefish	-	-	-	-	-	-	-	<0.1	-	2.9	-	0.6	0.6	0.9
Lake trout	0.1	<0.1	0.2	1.1	0.1	0.9	3.9	2.6	0.1	4.4	3.1	7.3	4.2	0.9
American smelt	72.9	68.6	56.4	5.0	3.4	17.9	67.9	59.3	64.2	52.7	53.4	55.9	53.7	70.4
Longnose sucker	2.5	3.3	1.9	-	-	-	-	-	-	0.1	-	-	<0.1	<0.1
White sucker	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	<0.1
Slimy sculpin	5.5	10.7	24.2	43.9	48.9	49.4	6.9	9.5	6.9	21.1	7.2	5.6	1.1	6.3
Spoonhead sculpin	0.2	0.4	1.8	0.3	0.2	0.9	0.1	0.4	2.4	-	0.2	0.1	0.1	0.1
Mottled sculpin	-	-	0.1	-	0.2	-	-	-	-	-	-	-	<0.1	-
Fourhorn sculpin	<0.1	<0.1	-	22.5	3.1	2.3	3.0	0.4	1.6	1.0	0.2	0.3	-	<0.1
Ninespine stickleback	0.1	0.2	0.3	15.2	18.0	10.9	7.2	13.6	18.7	9.6	30.4	21.4	33.1	14.1
Trout-perch	15.0	6.4	10.5	0.8	-	0.3	1.8	10.7	5.5	1.4	1.1	6.4	1.2	5.1
Burbot	<0.1	<0.1	0.1	<0.1	0.2	0.1	0.2	0.2	<0.1	0.1	0.3	0.1	-	<0.1
Alewife	-	-	<0.1	-	-	<0.1	-	-	-	-	0.1	0.1	-	-
Walleye	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow perch	0.1	<0.1	-	-	0.1	-	-	-	-	-	-	-	-	<0.1
Lake chub	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-
Spottail shiner	<0.1	-	<0.1	-	-	-	-	-	-	-	-	0.3	-	-

Table 54. Percentage use of Mysidacea as food by trawl-caught fish at stations in western Lake Superior.
Values are annual averages.

Species	Station 112			Station 35			Station 12			Station 75		Misc. stations		
	1966	1967	1968	1966	1967	1968	1966	1967	1968	1966	1967	1965	1966	1967
Lake herring	-	0.6	-	0.1	-	-	-	-	-	-	-	<0.1	-	<0.1
Bloater	0.5	4.8	4.2	13.1	30.0	25.0	0.8	2.4	<0.1	2.1	3.3	5.3	0.5	1.9
Lake whitefish	-	-	-	-	-	-	-	-	-	2.1	-	-	0.1	0.2
Kiyi	-	-	-	3.2	3.1	-	-	-	-	-	-	-	-	-
Blackfin cisco	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Shortjaw cisco	-	-	-	1.1	-	-	-	-	-	-	-	0.1	-	-
Shortnose cisco	-	-	-	0.1	-	-	-	-	-	-	<0.1	-	-	-
Pygmy whitefish	-	-	<0.1	<0.1	-	-	<0.1	-	0.1	-	-	-	-	-
Round whitefish	-	-	-	-	-	-	-	<0.1	-	1.9	-	15.7	1.1	1.1
Lake trout	0.1	0.1	1.1	3.4	0.5	1.4	4.8	4.0	0.2	7.3	8.2	13.1	5.2	2.0
American smelt	86.7	83.3	77.6	7.8	18.9	32.5	86.0	81.9	75.5	77.3	65.1	34.7	60.3	90.2
Longnose sucker	<0.1	0.2	<0.1	-	-	-	-	-	-	-	-	-	-	-
White sucker	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Slimy sculpin	0.4	0.8	4.6	8.2	19.1	20.8	0.6	1.1	1.5	2.5	1.3	2.0	0.1	1.1
Spoonhead sculpin	<0.1	0.2	0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	-	<0.1	<0.1	-	<0.1
Fourhorn sculpin	0.1	<0.1	-	46.8	11.8	7.6	2.5	0.4	1.6	1.0	0.1	0.1	-	<0.1
Ninespine stickleback	<0.1	0.1	0.1	15.0	16.2	11.9	3.8	6.1	14.8	5.3	21.0	26.0	31.7	3.1
Trout-perch	12.0	10.0	12.0	0.9	-	0.6	1.3	3.8	6.1	0.5	0.4	2.4	0.9	0.5
Burbot	<0.1	<0.1	0.1	<0.1	0.4	0.1	<0.1	0.2	<0.1	<0.1	0.4	0.1	-	<0.1
Alewife	-	-	<0.1	-	-	0.1	-	-	-	-	0.2	0.2	-	-
Walleye	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow perch	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-
Lake chub	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-
Spottail shiner	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-

The principal species consuming *Mysis* at Station 35 in the Apostle Islands was different each year (1966-1968). Fourhorn sculpins ranked first in 1966 at 46.8 percent, bloaters were first in 1967 at 30.0 percent, and smelt were first in 1968 at 32.5 percent (table 54). In addition to these, slimy sculpins and ninespine sticklebacks were important, with yearly values ranging from 8.2 to 20.8 percent. Of considerably less importance were lake trout and kiyi. Percentage use by all species varied substantially by month (Appendix tables 32-34).

Smelt was the predominant species using the item at the other Apostle Islands stations, with annual percentage use ranging from 34.7 to 90.2 (table 54). Ninespine sticklebacks generally ranked second at these stations in *Mysis* use. At Station 12, less important species were lake trout, trout-perch, fourhorn sculpins, and slimy sculpins. Lake trout, bloaters, and slimy sculpins followed smelt and sticklebacks at Station 75. In 1965 at miscellaneous stations, round whitefish were third at 15.7 percent followed by lake trout at 13.1 percent. In 1966 and 1967, smelt and sticklebacks constituted most of the *Mysis* use at miscellaneous stations.

AMPHIPODA

Slimy sculpins ranked first at 34.6 percent in use of amphipods by trawl-caught fish (table 52). Smelt accounted for 25.1 percent, followed by ninespine sticklebacks with 20.6 percent and trout-perch with 10.0 percent. Substantially less important use was made by fourhorn sculpins, lake trout, spoonhead sculpins, longnose suckers, and bloaters at 2.5, 1.8, 1.5, 1.5, and 1.2 percent, respectively.

At Station 112 (Duluth-Superior), use by trout-perch ranked first in 1966 at 37.4 percent, with smelt close behind at 32.5 percent and slimy sculpins and longnose suckers next at 17.9 and 8.7 percent, respectively (table 55). Smelt were most important in 1967 at 43.3 percent and in 1968 at 46.1 percent, while sculpins, trout-perch, and suckers were second, third, and fourth, respectively, both years. These positions by the various species varied with the month, however, (Appendix tables 43-45).

Percentage use of amphipods was highest by slimy sculpins at Station 35 (Apostle Islands), with annual values from 60.4 to 79.4 percent (table 55). Sticklebacks ranked next at 12.2 to 28.5 percent, followed by fourhorn sculpins at 1.8 to 17.3 percent.

At Station 12, smelt were first in 1966 at 38.8 percent followed by slimy sculpins at 23.8 percent and sticklebacks at 17.8 percent (table 55). In 1967, sticklebacks ranked highest at 30.4 percent, while sculpins were close behind at 28.2 percent and smelt were third at 13.2 percent. Slimy sculpins were first in 1968 (28.0 percent), sticklebacks were second (27.3 percent), and smelt and spoonhead sculpins followed (22.3 and 11.7 percent, respectively).

Slimy sculpins ranked highest at Station 75 in 1966 followed by smelt and sticklebacks (table 55), while in 1967, sticklebacks were first followed by smelt and then sculpins. Smelt and sticklebacks alternated being most important at the miscellaneous stations from 1965 to 1967, while slimy sculpins and trout-perch followed.

Table 55. Percentage use of Amphipoda as food by trawl-caught fish at stations in western Lake Superior. Values are annual averages.

Species	Station 112			Station 35			Station 12			Station 75		Misc. stations		
	1966	1967	1968	1966	1967	1968	1966	1967	1968	1966	1967	1965	1966	1967
Lake herring	0.2	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Bloater	1.6	3.2	2.1	1.0	1.4	1.2	1.0	0.9	-	0.5	0.7	0.5	1.2	0.8
Lake whitefish	-	-	-	-	-	-	-	-	-	1.9	-	0.1	0.3	0.8
Shortjaw cisco	-	-	-	0.4	-	-	-	-	-	-	-	<0.1	-	-
Pygmy whitefish	-	-	0.1	<0.1	-	0.2	3.2	0.7	0.6	2.1	0.8	-	0.1	-
Round whitefish	-	-	-	-	-	-	-	<0.1	-	-	-	<0.1	<0.1	0.1
Lake trout	0.2	0.1	<0.1	0.7	0.1	0.8	4.8	1.8	0.3	3.7	3.1	1.3	7.3	1.3
American smelt	32.5	43.3	46.1	1.5	0.4	2.4	38.8	13.2	22.3	18.8	26.4	34.2	47.2	24.8
Longnose sucker	8.7	9.3	2.9	-	-	-	-	-	-	0.3	-	-	0.2	<0.1
White sucker	0.1	-	-	-	-	-	-	-	-	-	-	-	-	<0.1
Slimy sculpin	17.9	31.4	29.9	60.4	65.8	79.4	23.8	28.2	28.0	53.0	23.7	14.7	4.6	23.0
Spoonhead sculpin	0.7	1.1	2.2	0.4	0.4	1.6	0.4	1.0	11.7	-	0.8	0.3	0.3	0.3
Mottled sculpin	-	-	0.1	-	0.4	-	-	-	-	-	-	-	0.1	-
Fourhorn sculpin	0.1	0.2	-	17.3	2.8	1.8	5.9	0.9	3.2	1.3	0.5	0.7	-	0.1
Ninespine stickleback	0.2	0.2	0.2	17.4	28.5	12.2	17.8	30.4	27.3	16.1	39.3	34.3	35.3	28.9
Trout-perch	37.4	11.0	16.1	0.8	-	0.2	3.8	22.3	6.3	2.3	4.1	13.3	3.4	19.6
Burbot	<0.1	0.2	0.1	<0.1	0.2	0.1	0.5	0.5	0.1	0.1	0.4	<0.1	-	0.1
Yellow perch	0.3	0.1	-	-	0.1	-	-	-	-	-	-	-	-	0.1
Spottail shiner	0.1	-	<0.1	-	-	-	-	-	-	-	-	0.5	-	-

COPEPODA

Smelt were the principal users of copepods with an overall percentage use of 58.0 (table 52). Bloaters were second in importance with 24.1 percent, while ninespine sticklebacks and slimy sculpins followed at 9.9 and 4.4 percent, respectively.

At Station 112, percentage use by smelt varied annually from 77.4 to 90.2 (table 56). Monthly values for smelt (Appendix tables 57-59) were from 41.1 to 99.1 percent. Bloaters accounted for most of the remaining consumption of copepods by trawl-caught fish.

Bloaters were the most important consumers each year at Station 35 (table 56). Slimy sculpins ranked second in 1966 and 1967, while smelt assumed that position in 1968. Ninespine sticklebacks were less important at 3.3 to 7.4 percent, with fourhorn sculpins worthy of mention only in 1966 at 7.3 percent.

Smelt were most important in copepod use at the other Apostle Island stations each year (table 56). Bloaters and sticklebacks generally alternated as the second in importance. Trout-perch, round whitefish, lake whitefish, and slimy sculpins were significant users occasionally.

INSECTS

Trout-perch were the primary consumers of insects at all stations combined and accounted for 28.1 percent (table 52) of the total. Slimy sculpins were second at 20.1 percent followed closely by smelt at 19.2 percent. Ninespine sticklebacks consumed 10.7 percent; bloaters, 6.5 percent; round whitefish, 5.8 percent; and lake trout, 3.3 percent.

Trout-perch ranked first in 1966 at Station 112 with 53.3 percent, while smelt consumed 26.4 percent (table 57). Smelt assumed the prominent position in 1967 and 1968 and trout-perch were second. Longnose suckers, bloaters, and slimy sculpins were similar in their use of insects, with values from 3.2 to 9.8 percent.

Slimy sculpins were foremost in insect use at Station 35 (table 57). Trout-perch, sticklebacks, bloaters, and lake trout followed, in that order, in 1966. Bloaters ranked behind sculpins in 1967, with sticklebacks a distant third. Trout-perch, bloaters, and lake trout were grouped closely from 13.3 to 11.3 percent in 1968, with sticklebacks at 7.5 percent.

Trout-perch were first at Station 12 in 1967 and 1968 but second to smelt in 1966 (table 57). Slimy sculpins, sticklebacks, lake trout, and bloaters generally accounted for the remaining insect consumption. At Station 75, trout-perch were first in 1967, but round whitefish were the primary insect consumers in 1966 (table 57). All previously-mentioned species used insects in varying amounts each year. Round whitefish were the leading insect users in 1965 at miscellaneous stations, as were sticklebacks in 1966 and trout-perch in 1967 (table 57). Smelt, slimy sculpins, lake trout, lake whitefish, and bloaters were used in varying percentages of the total during the period.

Table 56. Percentage use of Copepoda as food by trawl-caught fish at stations in western Lake Superior. Values are annual averages.

Species	Station 112			Station 35			Station 12			Station 75		Misc. stations		
	1966	1967	1968	1966	1967	1968	1966	1967	1968	1966	1967	1965	1966	1967
Lake herring	0.9	2.4	1.0	0.4	-	-	0.9	-	-	0.7	-	0.4	0.1	0.1
Bloater	7.3	16.2	14.3	52.5	78.6	62.0	31.0	12.5	0.3	16.3	12.2	9.6	20.8	3.9
Lake whitefish	-	-	-	-	-	-	-	-	-	6.0	-	-	<0.1	0.3
Kiyi	-	-	-	2.2	1.4	-	-	-	-	-	-	-	-	-
Shortjaw cisco	-	-	-	0.1	-	-	-	-	-	-	-	0.1	-	-
Shortnose cisco	-	-	-	<0.1	-	-	-	-	-	-	0.1	-	-	-
Pygmy whitefish	-	-	<0.1	0.1	-	<0.1	0.4	0.1	1.8	0.4	-	-	<0.1	-
Round whitefish	-	-	-	-	-	-	-	<0.1	-	7.9	-	<0.1	0.3	0.1
Lake trout	0.1	<0.1	-	0.7	<0.1	0.1	0.2	0.2	<0.1	0.9	0.8	<0.1	0.2	0.2
American smelt	90.2	78.4	77.4	6.5	4.0	19.5	64.4	72.5	85.0	58.3	58.6	77.4	45.3	74.9
Longnose sucker	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	<0.1
White sucker	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	<0.1
Slimy sculpin	0.2	0.2	<0.1	22.6	13.7	14.6	0.5	1.1	0.8	3.8	1.6	1.0	<0.1	0.8
Spoonhead sculpin	<0.1	<0.1	-	0.1	-	-	-	-	-	-	-	-	<0.1	-
Fourhorn sculpin	<0.1	-	-	7.3	<0.1	<0.1	0.1	<0.1	0.1	0.1	<0.1	-	-	-
Ninespine stickleback	<0.1	2.0	6.5	7.4	3.3	3.8	2.0	6.6	11.2	5.7	26.6	10.8	33.1	19.3
Trout-perch	1.1	0.7	0.7	0.2	-	-	0.3	6.9	1.0	-	0.1	0.7	-	0.3
Burbot	-	-	-	-	-	-	<0.1	-	-	<0.1	-	-	-	-
Alewife	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	-
Yellow perch	0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-

Table 57. Percentage use of insects as food by trawl-caught fish at stations in western Lake Superior. Values are annual averages.

Species	Station 112			Station 35			Station 12			Station 75		Misc. stations		
	1966	1967	1968	1966	1967	1968	1966	1967	1968	1966	1967	1965	1966	1967
Lake herring	<0.1	0.1	-	-	-	-	0.2	-	-	0.1	-	<0.1	<0.1	-
Bloater	3.2	9.8	6.5	4.9	33.7	11.7	4.7	2.7	<0.1	3.6	3.5	1.9	2.6	1.7
Lake whitefish	-	-	-	-	-	-	-	-	-	4.6	-	0.1	18.9	2.6
Kiyi	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-
Shortjaw cisco	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-
Pygmy whitefish	-	-	0.5	0.2	-	0.1	3.6	1.1	1.1	1.9	-	-	0.1	-
Round whitefish	-	-	-	-	-	-	-	0.9	-	31.6	-	30.5	6.1	12.3
Lake trout	0.3	0.1	3.2	3.2	2.0	11.3	5.4	2.6	0.9	4.8	3.9	3.3	3.7	2.0
American smelt	26.4	47.8	33.7	1.8	3.4	2.0	46.3	26.7	18.5	16.4	2.7	3.5	21.4	18.2
Longnose sucker	6.0	9.0	8.6	-	-	-	-	-	-	<0.1	-	-	<0.1	<0.1
White sucker	0.1	-	-	-	-	-	-	-	-	-	-	-	-	<0.1
Slimy sculpin	8.7	5.6	7.9	63.0	46.7	51.3	2.6	12.9	13.3	25.5	14.9	14.2	0.4	14.5
Spoonhead sculpin	0.3	0.8	6.8	-	<0.1	2.2	-	0.3	4.7	-	2.2	<0.1	-	<0.1
Mottled sculpin	-	-	<0.1	-	<0.1	-	-	-	-	-	-	-	<0.1	-
Fourhorn sculpin	-	-	-	-	2.6	0.8	-	0.1	0.6	-	0.6	-	-	-
Ninespine stickleback	<0.1	0.2	0.3	7.3	11.2	7.5	2.6	15.2	4.2	2.5	28.1	23.3	27.2	20.7
Trout-perch	53.3	24.7	32.2	19.7	-	13.3	34.4	37.6	56.7	8.9	43.8	21.5	19.5	27.9
Burbot	<0.1	<0.1	0.2	-	0.1	-	<0.1	<0.1	-	<0.1	0.3	<0.1	-	<0.1
Johnny darter	-	-	-	-	-	-	-	-	-	-	-	1.2	-	-
Lake chub	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-
Spottail shiner	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
Emerald shiner	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-

FISH

Consumption of fish by trawl-caught fish in western Lake Superior was confined to four species. Lake trout had the highest percentage use at 44.6 followed closely by smelt at 42.2 percent (table 52). Burbot accounted for 12.8 percent, while lake chubs were insignificant at 0.4 percent.

Smelt dominated fish consumption at Station 112, where annual percentages ranged from 59.8 to 94.1 (table 58). In 1966, lake trout used 35.9 percent and burbot 4.3 percent. Lake trout consumed only 0.3 percent in 1967, while use by burbot and lake chubs was 12.8 and 5.7 percent, respectively. Lake trout and burbot in 1968 used only 4.0 and 1.9 percent, respectively.

Percentage use of fish at Station 35 was greatest by lake trout in 1966 and 1968 (table 58). In 1967, fish use was essentially equal by burbot, smelt, and lake trout. At Station 12, smelt ranked first in 1967 and 1968, and lake trout ranked first in 1966 (table 58). Consumption by lake trout and burbot was similar in 1967 and 1968. Lake trout were first in fish use at Station 75 in 1966, with smelt second (table 58). Burbot were most important in 1967, with lake trout a close second and smelt a distant third. Smelt were the principal fish user at the miscellaneous stations in 1965 and 1967 (table 58), and lake trout were leading users in 1966. Trout ranked second and burbot third in 1965 and 1967.

MOLLUSCS

The consumption of molluscs was greatest by smelt at 41.6 percent (table 52). Bloaters followed with 19.1 percent, and slimy sculpins were third with 15.5 percent. Use by other species included round whitefish (7.0 percent), lake whitefish (6.0 percent), lake trout (5.2 percent), longnose suckers (2.7 percent), and burbot (2.5 percent).

Smelt were the most important consumers of molluscs at Station 12 each year followed by bloaters in 1966 and 1967 and longnose suckers in 1968 (table 59).

Mollusc use at Station 35 was dominated by three species. Bloaters, slimy sculpins, and lake trout, in that order, accounted for all mollusc consumption in 1966 (table 59). Sculpins (62.0 percent) and bloaters (29.9 percent) were the primary users in 1967. Bloaters (50.0 percent) and sculpins (49.6 percent) constituted almost all the use in 1968.

Smelt, with 81.8 and 93.4 percent in 1967 and 1968, respectively, were the chief mollusc consumers at Station 12, with slimy sculpins far behind with uses of 6.2 and 6.6 percent (table 59). Bloaters were most important in 1966 and smelt were second. Smelt were most important in both 1966 and 1967 at Station 75 (table 59). Sculpins, lake whitefish, and lake trout were also significant consumers in 1966. Burbot and sculpins followed closely behind smelt in 1967.

Table 58. Percentage use of fish as food by trawl-caught fish at stations in western Lake Superior.
Values are annual averages.

Species	Station 112			Station 35			Station 12			Station 75		Misc. stations		
	1966	1967	1968	1966	1967	1968	1966	1967	1968	1966	1967	1965	1966	1967
Lake trout	35.9	0.3	4.0	88.0	31.2	56.9	81.8	28.8	30.0	73.2	39.5	40.7	92.6	21.0
American smelt	59.8	81.1	94.1	-	32.1	33.3	18.2	41.7	45.8	26.8	16.0	57.2	7.4	77.1
Burbot	4.3	12.8	1.9	12.0	36.6	9.8	-	29.5	24.1	-	44.5	2.1	-	1.9
Lake chub	-	5.7	-	-	-	-	-	-	-	-	-	-	-	-

Table 59. Percentage use of molluscs as food by trawl-caught fish at stations in western Lake Superior.
Values are annual averages.

Species	Station 112			Station 35			Station 12			Station 75		Misc. stations		
	1966	1967	1968	1966	1967	1968	1966	1967	1968	1966	1967	1965	1966	1967
Bloater	37.2	20.8	0.5	45.2	29.9	50.0	59.2	6.0	-	2.4	5.3	3.3	5.5	1.5
Lake whitefish	-	-	-	-	-	-	-	-	-	15.6	-	3.7	53.4	11.6
Pygmy whitefish	-	-	-	-	-	0.2	1.4	0.2	-	2.0	-	-	<0.1	-
Round whitefish	-	-	-	-	-	-	-	-	-	-	-	64.6	-	33.5
Lake trout	-	-	-	21.4	0.8	-	6.4	5.8	-	10.2	1.8	15.9	9.9	0.2
American smelt	54.8	75.2	65.1	-	7.3	0.2	32.8	81.8	93.4	53.8	34.6	8.4	24.5	49.8
Longnose sucker	2.6	1.9	33.3	-	-	-	-	-	-	-	-	-	-	0.1
White sucker	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
Slimy sculpin	4.1	0.7	0.8	33.3	62.0	49.6	-	6.2	6.6	15.8	24.9	3.5	6.7	3.3
Trout-perch	1.1	1.4	-	-	-	-	-	-	-	-	-	-	-	-
Burbot	<0.1	<0.1	0.3	-	-	-	0.2	-	-	0.2	33.3	0.6	-	-

At the miscellaneous stations in the Apostle Islands, round whitefish (64.6 percent), lake whitefish (53.4 percent), and smelt (49.8 percent) were foremost in mollusc use in 1965, 1966, and 1967, respectively (table 59). Trout and smelt in 1965, smelt, trout, sculpins, and bloaters in 1966, and round whitefish and lake whitefish in 1967 were also significant users of molluscs.

FISH EGGS

Slimy sculpins outranked all other species in the percentage use of fish eggs with 43.5 percent (table 52). Smelt were second in importance with 22.5 percent and bloaters third with 14.6 percent. Round whitefish, ninespine sticklebacks, lake trout, and pygmy whitefish together consumed 3.2 to 4.0 percent of fish eggs taken. Smelt at Station 112 were foremost in egg consumption each year (table 60). However, following smelt closely were bloaters and slimy sculpins in 1966 and 1967 and pygmy whitefish and sculpins in 1968.

Egg use by slimy sculpins at Station 35 varied from 57.6 to 85.0 percent (table 60). Species taking most of the remaining eggs were sticklebacks, bloaters, and smelt.

Slimy sculpins ranked first in egg consumption at Station 12 (table 60), with smelt second in 1966 and 1967 and sticklebacks second in 1968. Bloaters, lake trout, and pygmy whitefish also were important users. Sculpins were also first at Station 75 in 1966 and 1967 (table 60), with trout, bloaters, and smelt following. Smelt in 1965 and 1967 and sculpins in 1966 were predominant at miscellaneous stations, with round whitefish, bloaters, trout, and lake whitefish additional important egg consumers.

CONCLUSIONS

The description of food habits has indicated the preferences of the various species and revealed similarities in diet for many. Findings are incomplete for a number of fishes, but data are, in many cases, sufficient to establish a foundation for additional work.

Data indicate that crustaceans constitute the main part of the diet for most species, at least during some phase of their life history. It was found that various species depend primarily on specific types of crustaceans, such as *Mysis*, amphipods, and copepods. Certain species also tend to rely heavily on insects, fish, molluscs, and fish eggs.

Although precise food interrelationships are not defined easily, the predominance of various species in certain localities is obvious. Some of the changes in fish stocks in Lake Superior undoubtedly can be correlated with food interrelationships. The introduction and subsequent increase in abundance of smelt no doubt has had definite effects on the endemic species, as evidenced by the predominant percentage use of most food organisms by smelt. Anderson and Smith (1970) suggested that the increase in smelt abundance strongly influenced the decline of lake herring in western Lake Superior through food competition.

It is believed that the results of this study will serve as an important background for further studies on poorly understood fish species not only in Lake Superior but also in other areas of the Great Lakes basin.

Table 60. Percentage use of fish eggs as food by trawl-caught fish at stations in western Lake Superior. Values are annual averages.

Species	Station 112			Station 35			Station 12			Station 75		Misc. stations		
	1966	1967	1968	1966	1967	1968	1966	1967	1968	1966	1967	1965	1966	1967
Lake herring	-	-	-	-	-	-	-	-	-	-	-	1.7	-	-
Bloater	35.1	25.4	2.4	9.6	15.5	6.7	21.6	6.4	-	10.2	26.5	-	16.6	28.3
Lake whitefish	-	-	-	-	-	-	-	-	-	-	-	-	12.5	-
Kiyi	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-
Shortjaw cisco	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-
Pygmy whitefish	-	-	28.6	0.2	-	-	1.0	11.6	3.7	-	-	-	-	-
Round whitefish	-	-	-	-	-	-	-	-	-	-	-	25.3	-	30.1
Lake trout	-	-	-	0.6	0.4	0.5	14.4	6.3	0.1	11.7	4.7	0.4	14.2	0.1
American smelt	46.9	43.5	39.4	1.4	25.0	0.6	27.2	25.0	4.8	9.5	25.0	33.3	-	33.3
Longnose sucker	0.4	0.1	-	-	-	-	-	-	-	-	-	-	-	-
White sucker	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Slimy sculpin	17.2	30.7	26.2	75.1	57.6	85.0	27.4	49.8	64.1	63.1	41.7	5.8	56.8	8.2
Spoonhead sculpin	0.4	0.2	0.2	0.2	-	0.2	-	-	3.2	-	0.4	-	-	-
Fourhorn sculpin	-	-	-	-	1.2	0.1	-	0.1	0.8	-	0.2	-	-	-
Ninespine stickleback	-	-	-	12.6	-	6.5	7.4	-	23.0	5.3	-	-	-	-
Burbot	<0.1	<0.1	0.2	<0.1	0.3	0.3	0.6	0.8	0.3	0.2	1.6	0.1	-	-
Walleye	-	-	3.0	-	-	-	-	-	-	-	-	-	-	-

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Appendix Table 1. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April		June		November		Average*	
Lake herring	0.9	(0.6)	0.2	(0.1)	0.0	(0.0)	0.4	(0.2)
Bloater	1.9	(1.4)	14.3	(8.6)	2.0	(0.2)	6.1	(3.4)
Lake trout	0.1	(0.1)	0.5	(0.3)	0.5	(0.1)	0.4	(0.2)
American smelt	81.2	(58.5)	115.6	(69.8)	650.0	(81.9)	282.3	(70.1)
Longnose sucker	3.6	(2.6)	11.6	(7.0)	3.0	(0.4)	6.1	(3.3)
White sucker	0.3	(0.2)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Slimy sculpin	11.7	(8.4)	17.2	(10.4)	6.0	(0.8)	11.6	(6.5)
Spoonhead sculpin	0.3	(0.2)	0.6	(0.4)	1.0	(0.1)	0.6	(0.2)
Fourhorn sculpin	0.0	(0.0)	0.1	(0.1)	0.0	(0.0)	<0.1	(<0.1)
Ninespine stickleback	0.1	(0.1)	0.2	(0.1)	0.0	(0.0)	0.1	(0.1)
Brook stickleback	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)	<0.1	(<0.1)
Trout-perch	37.2	(26.8)	4.9	(3.0)	125.0	(15.8)	55.7	(15.2)
Burbot	0.2	(0.1)	0.2	(0.1)	0.0	(0.0)	0.1	(0.1)
Walleye	0.0	(0.0)	0.0	(0.0)	0.5	(0.1)	0.2	(<0.1)
Yellow perch	0.3	(0.2)	0.1	(0.1)	0.0	(0.0)	0.1	(0.1)
Spottail shiner	0.6	(0.4)	0.0	(0.0)	0.0	(0.0)	0.2	(0.1)
Emerald shiner	0.3	(0.2)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Number of tows	18		19		2		39	

* Unweighted average.

Appendix Table 2. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April		May		June		July		September		November		Average*	
Lake herring	0.4	(0.1)	0.0	(0.0)	2.3	(1.0)	1.4	(3.4)	0.4	(0.2)	5.5	(7.7)	1.7	(2.1)
Bloater	2.0	(0.5)	0.0	(0.0)	7.7	(3.3)	12.8	(31.5)	15.4	(6.6)	23.8	(33.2)	10.3	(12.5)
Lake trout	0.2	(0.1)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.5	(0.2)	0.0	(0.0)	0.1	(<0.1)
American smelt	353.6	(90.2)	67.0	(44.9)	182.0	(77.4)	10.2	(25.1)	194.8	(83.8)	40.6	(56.7)	141.4	(63.0)
Longnose sucker	4.2	(1.1)	30.0	(20.1)	9.3	(4.0)	0.0	(0.0)	10.1	(4.3)	0.0	(0.0)	8.9	(4.9)
Slimy sculpin	13.4	(3.4)	10.0	(6.7)	14.3	(6.1)	14.0	(34.5)	6.6	(2.8)	1.5	(2.1)	10.0	(9.3)
Spoonhead sculpin	0.0	(0.0)	0.0	(0.0)	2.0	(0.8)	0.4	(1.0)	1.1	(0.5)	0.0	(0.0)	0.6	(0.4)
Fourhorn sculpin	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.1	(<0.1)	0.0	(0.0)	<0.1	(<0.1)
Ninespine stickleback	0.0	(0.0)	0.0	(0.0)	0.3	(0.1)	0.4	(1.0)	0.0	(0.0)	0.0	(0.0)	0.1	(0.2)
Trout-perch	17.0	(4.3)	41.0	(27.5)	15.0	(6.4)	1.2	(3.0)	2.9	(1.2)	0.2	(0.3)	12.9	(7.1)
Burbot	0.4	(0.1)	1.0	(0.7)	1.0	(0.4)	0.0	(0.0)	0.5	(0.2)	0.0	(0.0)	0.5	(0.2)
Walleye	0.0	(0.0)	0.0	(0.0)	1.0	(0.4)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Yellow perch	0.2	(0.1)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	<0.1	(<0.1)
Lake chub	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.2	(0.5)	0.0	(0.0)	0.0	(0.0)	<0.1	(0.1)
Number of tows	5		1		3		5		14		4		32	

* Unweighted average.

Appendix Table 3. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April		May		July		Average*	
Lake herring	0.3	(0.1)	4.0	(1.3)	0.1	(0.2)	1.5	(0.5)
Bloater	3.9	(1.0)	21.4	(7.2)	6.4	(10.4)	10.6	(6.2)
Pygmy whitefish	0.0	(0.0)	0.2	(0.1)	0.0	(0.0)	0.1	(<0.1)
Lake trout	0.0	(0.0)	1.8	(0.6)	0.5	(0.8)	0.8	(0.5)
American smelt	245.5	(66.0)	265.3	(88.9)	7.2	(11.7)	172.7	(55.5)
Longnose sucker	4.1	(1.1)	0.2	(0.1)	4.0	(6.5)	2.8	(2.6)
Slimy sculpin	6.1	(1.6)	0.2	(0.1)	39.1	(63.8)	15.1	(21.8)
Spoonhead sculpin	0.3	(0.1)	0.0	(0.0)	3.5	(5.7)	1.3	(1.9)
Mottled sculpin	0.0	(0.0)	0.0	(0.0)	0.1	(0.2)	<0.1	(0.1)
Ninespine stickleback	0.1	(<0.1)	0.0	(0.0)	0.4	(0.7)	0.2	(0.2)
Trout-perch	108.4	(29.2)	5.2	(1.7)	0.0	(0.0)	37.9	(10.3)
Burbot	2.4	(0.6)	0.0	(0.0)	0.0	(0.0)	0.8	(0.2)
Alewife	0.1	(<0.1)	0.2	(0.1)	0.0	(0.0)	0.1	(<0.1)
Walleye	0.4	(0.1)	0.0	(0.0)	0.0	(0.0)	0.1	(<0.1)
Spottail shiner	0.1	(<0.1)	0.0	(0.0)	0.0	(0.0)	<0.1	(<0.1)
Number of tows	7		4		8		19	

* Unweighted average.

Appendix Table 4. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May		June		July		Average*	
Lake herring	0.4	(0.3)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Bloater	16.8	(12.4)	0.5	(0.5)	8.0	(17.4)	8.4	(10.1)
Kiyi	2.2	(1.6)	1.5	(1.4)	0.0	(0.0)	1.2	(1.0)
Blackfin cisco	0.2	(0.1)	0.0	(0.0)	0.0	(0.0)	0.1	(<0.1)
Shortjaw cisco	2.1	(1.5)	1.0	(0.9)	0.0	(0.0)	1.0	(0.8)
Shortnose cisco	0.2	(0.1)	0.0	(0.0)	0.0	(0.0)	0.1	(<0.1)
Pygmy whitefish	0.2	(0.1)	0.0	(0.0)	0.0	(0.0)	0.1	(<0.1)
Lake trout	1.4	(1.0)	1.0	(0.9)	1.0	(2.2)	1.1	(1.4)
American smelt	18.4	(13.6)	0.0	(0.0)	0.0	(0.0)	6.1	(4.5)
Slimy sculpin	28.9	(21.3)	63.5	(60.2)	25.0	(54.3)	39.1	(45.3)
Spoonhead sculpin	0.7	(0.5)	0.5	(0.5)	0.0	(0.0)	0.4	(0.3)
Fourhorn sculpin	2.9	(2.1)	35.5	(33.6)	12.0	(26.1)	16.8	(20.6)
Ninespine stickleback	55.9	(41.2)	2.0	(1.9)	0.0	(0.0)	19.3	(14.4)
Trout-perch	5.0	(3.7)	0.0	(0.0)	0.0	(0.0)	1.7	(1.2)
Burbot	0.3	(0.2)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Number of tows	10		2		1		13	

* Unweighted average.

Appendix Table 5. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April		June		July		September		Average*	
Bloater	65.3	(37.2)	15.5	(16.1)	22.5	(30.8)	15.5	(11.5)	29.7	(23.9)
Kiyi	0.0	(0.0)	0.0	(0.0)	2.0	(2.7)	0.5	(0.4)	0.6	(0.8)
Lake trout	0.3	(0.2)	0.5	(0.5)	0.0	(0.0)	0.0	(0.0)	0.2	(0.2)
American smelt	12.4	(7.1)	4.0	(4.2)	0.5	(0.7)	0.5	(0.4)	4.4	(3.1)
Slimy sculpin	17.7	(10.1)	38.0	(39.6)	45.0	(61.6)	109.0	(80.7)	52.4	(48.0)
Spoonhead sculpin	0.0	(0.0)	0.0	(0.0)	0.5	(0.7)	0.0	(0.0)	0.1	(0.2)
Mottled sculpin	0.0	(0.0)	0.0	(0.0)	0.5	(0.7)	0.0	(0.0)	0.1	(0.2)
Fourhorn sculpin	8.0	(4.6)	1.5	(1.6)	2.0	(2.7)	1.0	(0.7)	3.1	(2.4)
Ninespine stickleback	71.3	(40.7)	36.0	(37.5)	0.0	(0.0)	7.0	(5.2)	28.6	(20.8)
Burbot	0.3	(0.2)	0.0	(0.0)	0.0	(0.0)	1.5	(1.1)	0.4	(0.3)
Yellow perch	0.0	(0.0)	0.5	(0.5)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Number of tows	3		2		2		2		9	

* Unweighted average.

Appendix Table 6. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April		May		July		Average*	
Bloater	35.0	(15.7)	18.5	(22.8)	21.5	(13.6)	25.0	(17.4)
Pygmy whitefish	0.0	(0.0)	0.0	(0.0)	0.5	(0.3)	0.2	(0.1)
Lake trout	2.0	(0.9)	2.5	(3.1)	0.0	(0.0)	1.5	(1.3)
American smelt	100.5	(45.0)	6.0	(7.4)	0.5	(0.3)	35.7	(17.6)
Slimy sculpin	72.0	(32.2)	31.5	(38.9)	125.0	(79.1)	76.2	(50.1)
Spoonhead sculpin	1.5	(0.7)	0.0	(0.0)	2.5	(1.6)	1.3	(0.8)
Fourhorn sculpin	3.0	(1.3)	0.0	(0.0)	7.0	(4.4)	3.3	(1.9)
Ninespine stickleback	6.0	(2.7)	22.5	(27.8)	1.0	(0.6)	9.8	(10.4)
Trout-perch	2.0	(0.9)	0.0	(0.0)	0.0	(0.0)	0.7	(0.3)
Burbot	1.0	(0.4)	0.0	(0.0)	0.0	(0.0)	0.3	(0.1)
Alewife	0.5	(0.2)	0.0	(0.0)	0.0	(0.0)	0.2	(0.1)
Number of tows	2		2		2		6	

* Unweighted average.

Appendix Table 7. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May		June		Average*	
Lake herring	0.0	(0.0)	0.2	(0.4)	0.1	(0.2)
Bloater	0.7	(0.4)	7.2	(14.4)	4.0	(7.4)
Pygmy whitefish	0.3	(0.2)	1.1	(2.2)	0.7	(1.2)
Lake trout	0.0	(0.0)	5.0	(10.0)	2.5	(5.0)
American smelt	126.0	(81.0)	25.5	(51.2)	75.8	(66.1)
Slimy sculpin	8.3	(5.3)	4.4	(8.8)	6.4	(7.0)
Spoonhead sculpin	0.0	(0.0)	0.1	(0.2)	<0.1	(0.1)
Fourhorn sculpin	0.7	(0.4)	2.6	(5.2)	1.6	(2.8)
Ninespine stickleback	11.3	(7.3)	3.4	(6.8)	7.4	(7.0)
Trout-perch	8.3	(5.3)	0.1	(0.2)	4.2	(2.8)
Burbot	0.0	(0.0)	0.2	(0.4)	0.1	(0.2)
Number of tows	3		14		17	

* Unweighted average.

Appendix Table 8. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April		June		July		September		Average*	
Bloater	0.0	(0.0)	0.5	(3.4)	1.6	(1.2)	16.5	(7.7)	4.6	(3.1)
Pygmy whitefish	0.5	(0.8)	0.0	(0.0)	0.4	(0.3)	1.5	(0.7)	0.6	(0.4)
Round whitefish	0.0	(0.0)	0.0	(0.0)	0.3	(0.2)	0.0	(0.0)	0.1	(<0.1)
Lake trout	0.0	(0.0)	1.0	(6.9)	2.2	(1.6)	8.5	(4.0)	2.9	(3.1)
American smelt	45.0	(73.2)	7.5	(51.7)	78.0	(56.4)	100.0	(46.6)	57.6	(57.0)
Slimy sculpin	5.0	(8.1)	2.5	(17.2)	10.9	(7.9)	8.5	(4.0)	6.7	(9.3)
Spoonhead sculpin	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)	2.5	(1.2)	0.6	(0.3)
Fourhorn sculpin	0.5	(0.8)	0.0	(0.0)	0.8	(0.6)	0.5	(0.2)	0.4	(0.4)
Ninespine stickleback	4.0	(6.5)	1.0	(6.9)	10.3	(7.4)	75.5	(35.2)	22.7	(14.0)
Trout-perch	6.0	(9.8)	2.0	(13.8)	33.7	(24.4)	0.0	(0.0)	10.4	(12.0)
Burbot	0.5	(0.8)	0.0	(0.0)	0.0	(0.0)	1.0	(0.5)	0.4	(0.3)
Number of tows	2		2		9		2		15	

* Unweighted average.

Appendix Table 9. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April		May		July		Average*	
Bloater	0.3	(0.2)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Pygmy whitefish	0.0	(0.0)	1.0	(1.5)	0.0	(0.0)	0.3	(0.5)
Lake trout	0.3	(0.2)	0.0	(0.0)	0.5	(0.4)	0.3	(0.2)
American smelt	91.4	(69.8)	21.0	(31.3)	107.0	(88.1)	73.1	(63.1)
Slimy sculpin	18.0	(13.7)	1.0	(1.5)	7.5	(6.2)	8.8	(7.1)
Spoonhead sculpin	6.0	(4.6)	0.0	(0.0)	2.5	(2.1)	2.8	(2.2)
Fourhorn sculpin	4.3	(3.3)	0.0	(0.0)	1.0	(0.8)	1.8	(1.4)
Ninespine stickleback	1.7	(1.3)	33.5	(50.0)	3.0	(2.5)	12.7	(17.9)
Trout-perch	8.7	(6.6)	10.5	(15.7)	0.0	(0.0)	6.4	(7.4)
Burbot	0.3	(0.2)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Number of tows	3		2		2		7	

* Unweighted average.

Appendix Table 10. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May		June		July		Average*	
Lake herring	0.0	(0.0)	0.1	(0.2)	0.0	(0.0)	<0.1	(0.1)
Bloater	0.0	(0.0)	1.6	(3.1)	3.3	(8.6)	1.6	(3.9)
Lake whitefish	0.5	(1.1)	3.1	(5.9)	0.3	(0.8)	1.3	(2.6)
Pygmy whitefish	0.0	(0.0)	1.1	(2.1)	0.3	(0.8)	0.5	(1.0)
Round whitefish	10.5	(22.8)	0.2	(0.4)	0.0	(0.0)	3.6	(7.7)
Lake trout	0.0	(0.0)	6.8	(13.0)	1.3	(3.4)	2.7	(5.5)
American smelt	24.5	(53.3)	17.5	(33.4)	20.3	(52.7)	20.8	(46.5)
Longnose sucker	0.0	(0.0)	0.2	(0.4)	0.0	(0.0)	0.1	(0.1)
Slimy sculpin	6.0	(13.0)	10.8	(20.6)	11.7	(30.4)	9.5	(21.3)
Fourhorn sculpin	0.0	(0.0)	1.0	(1.9)	0.3	(0.8)	0.4	(0.9)
Ninespine stickleback	4.5	(9.8)	7.0	(13.4)	1.0	(2.6)	4.2	(8.6)
Trout-perch	0.0	(0.0)	2.9	(5.5)	0.0	(0.0)	1.0	(1.8)
Burbot	0.0	(0.0)	0.1	(0.2)	0.0	(0.0)	<0.1	(0.1)
Number of tows	2		9		3		14	

* Unweighted average.

Appendix Table 11. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April		July		September		November		Average*	
Bloater	1.0	(0.3)	3.0	(9.6)	6.0	(2.6)	4.0	(5.3)	3.5	(4.4)
Shortnose cisco	0.0	(0.0)	0.0	(0.0)	1.0	(0.4)	0.0	(0.0)	0.2	(0.1)
Pygmy whitefish	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.7	(0.9)	0.2	(0.2)
Lake trout	0.0	(0.0)	3.7	(11.9)	2.0	(0.9)	4.0	(5.3)	2.4	(4.5)
American smelt	312.0	(93.7)	7.7	(24.8)	19.0	(8.2)	59.0	(77.6)	99.4	(51.1)
Slimy sculpin	13.0	(3.9)	6.7	(21.5)	10.5	(4.6)	0.7	(0.9)	7.7	(7.7)
Spoonhead sculpin	0.5	(0.2)	0.0	(0.0)	1.0	(0.4)	0.0	(0.0)	0.4	(0.2)
Fourhorn sculpin	1.0	(0.3)	0.0	(0.0)	0.5	(0.2)	0.0	(0.0)	0.4	(0.1)
Ninespine stickleback	3.5	(1.1)	10.0	(32.2)	187.0	(81.1)	2.3	(3.0)	50.7	(29.4)
Trout-perch	1.5	(0.4)	0.0	(0.0)	0.0	(0.0)	4.3	(5.7)	1.4	(1.5)
Burbot	0.5	(0.2)	0.0	(0.0)	3.5	(1.5)	0.7	(0.9)	1.2	(0.7)
Alewife	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.3	(0.4)	0.1	(0.1)
Number of tows	2		3		2		3		10	

* Unweighted average.

Appendix Table 12. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September		October		November		Average*	
Lake herring	0.2	(0.1)	0.0	(0.0)	0.2	(0.2)	0.1	(0.1)
Bloater	11.0	(4.9)	2.7	(0.2)	0.0	(0.0)	4.6	(1.7)
Lake whitefish	0.6	(0.3)	0.0	(0.0)	0.0	(0.0)	0.2	(0.1)
Shortjaw cisco	0.4	(0.2)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)
Round whitefish	0.0	(0.0)	14.3	(1.1)	4.5	(3.8)	6.3	(1.6)
Lake trout	52.0	(23.3)	0.0	(0.0)	1.3	(1.1)	17.8	(8.1)
American smelt	27.6	(12.4)	1,218.0	(91.1)	59.4	(50.5)	435.0	(51.3)
Slimy sculpin	6.6	(3.0)	8.7	(0.6)	19.5	(16.6)	11.6	(6.7)
Spoonhead sculpin	0.2	(0.1)	0.0	(0.0)	0.5	(0.4)	0.2	(0.2)
Fourhorn sculpin	1.2	(0.5)	0.0	(0.0)	0.5	(0.4)	0.6	(0.3)
Ninespine stickleback	122.8	(55.0)	92.3	(6.9)	0.1	(0.1)	71.7	(20.7)
Trout-perch	0.2	(0.1)	0.0	(0.0)	28.8	(24.5)	9.7	(8.2)
Burbot	0.0	(0.0)	0.0	(0.0)	0.4	(0.3)	0.1	(0.1)
Alewife	0.0	(0.0)	0.0	(0.0)	0.4	(0.3)	0.1	(0.1)
Johnny darter	0.0	(0.0)	0.3	(<0.1)	0.8	(0.7)	0.4	(0.2)
Spottail shiner	0.0	(0.0)	0.0	(0.0)	1.0	(0.8)	0.3	(0.3)
Number of tows	5		3		6		14	

* Unweighted average.

Appendix Table 13. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June		July		December		Average*	
Lake herring	0.2	(0.1)	0.0	(0.0)	0.0	(0.0)	0.1	(<0.1)
Bloater	23.7	(15.3)	0.0	(0.0)	0.5	(0.4)	8.1	(5.2)
Lake whitefish	0.5	(0.3)	0.1	(<0.1)	0.5	(0.4)	0.4	(0.2)
Pygmy whitefish	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)	<0.1	(<0.1)
Round whitefish	0.2	(0.1)	37.3	(2.4)	0.0	(0.0)	12.5	(0.8)
Lake trout	20.3	(13.1)	0.3	(<0.1)	6.0	(4.4)	8.9	(5.8)
American smelt	98.5	(63.7)	1.4	(0.1)	127.5	(93.1)	75.8	(52.3)
Longnose sucker	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)	<0.1	(<0.1)
Slimy sculpin	3.7	(2.4)	6.7	(0.4)	0.5	(0.4)	3.6	(1.1)
Spoonhead sculpin	0.0	(0.0)	0.0	(0.0)	0.5	(0.4)	0.2	(0.1)
Mottled sculpin	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)	<0.1	(<0.1)
Ninespine stickleback	2.6	(1.7)	1,496.1	(96.9)	0.0	(0.0)	499.6	(32.9)
Trout-perch	4.7	(3.0)	0.0	(0.0)	1.5	(1.1)	2.1	(1.4)
Number of tows	15		7		2		24	

* Unweighted average.

Appendix Table 14. Average number of fish caught and (in parentheses) percentage contribution of each species to the average catch per 15-minute bottom trawl tow at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July		September		November		Average*	
Lake herring	0.0	(0.0)	0.7	(0.3)	0.0	(0.0)	0.2	(0.1)
Bloater	5.8	(1.6)	7.8	(3.8)	0.5	(0.3)	4.7	(1.9)
Lake whitefish	6.5	(1.8)	0.1	(<0.1)	0.0	(0.0)	2.2	(0.6)
Round whitefish	0.5	(0.1)	0.3	(0.1)	13.0	(8.3)	4.6	(2.8)
Lake trout	10.8	(2.9)	0.8	(0.4)	0.5	(0.3)	4.0	(1.2)
American smelt	204.0	(55.5)	143.2	(69.3)	110.0	(69.8)	152.4	(64.9)
Longnose sucker	0.0	(0.0)	0.1	(<0.1)	0.0	(0.0)	<0.1	(<0.1)
White sucker	0.0	(0.0)	0.3	(0.1)	0.0	(0.0)	0.1	(<0.1)
Slimy sculpin	1.2	(0.3)	16.3	(7.9)	24.0	(15.2)	13.8	(7.8)
Spoonhead sculpin	0.2	(0.1)	0.1	(<0.1)	0.0	(0.0)	0.1	(<0.1)
Fourhorn sculpin	0.0	(0.0)	0.3	(0.1)	0.0	(0.0)	0.1	(<0.1)
Ninespine stickleback	135.8	(37.0)	10.2	(4.9)	0.0	(0.0)	48.7	(14.0)
Trout-perch	2.5	(0.7)	25.9	(12.5)	9.5	(6.0)	12.6	(6.4)
Burbot	0.0	(0.0)	0.5	(0.2)	0.0	(0.0)	0.2	(0.1)
Yellow perch	0.0	(0.0)	0.1	(<0.1)	0.0	(0.0)	<0.1	(<0.1)
Number of tows	4		6		2		12	

* Weighted average.

Appendix Table 15. Percentage use of crustaceans as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April	June	November	Average
Lake herring	0.6	0.1	-	0.2
Bloater	1.1	8.5	0.2	3.3
Lake trout	0.1	0.2	-	0.1
American smelt	60.5	74.7	83.5	72.9
Longnose sucker	1.9	5.4	0.1	2.5
White sucker	0.1	-	-	<0.1
Slimy sculpin	6.6	9.2	0.8	5.5
Spoonhead sculpin	0.2	0.3	0.1	0.2
Fourhorn sculpin	-	0.1	-	<0.1
Ninespine stickleback	0.1	0.1	-	0.1
Trout-perch	28.4	1.3	15.2	15.0
Burbot	0.1	<0.1	-	<0.1
Walleye	-	-	0.1	<0.1
Yellow perch	0.2	-	-	0.1
Spottail shiner	0.1	-	-	<0.1

Appendix Table 16. Percentage use of crustaceans as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April	May	June	July	September	November	Average
Lake herring	0.1	-	1.1	0.1	0.2	8.8	1.7
Bloater	0.4	-	3.3	14.9	4.9	35.9	9.9
Lake trout	0.1	-	-	-	0.2	-	<0.1
American smelt	91.4	51.0	83.4	33.6	91.3	60.7	68.6
Longnose sucker	0.8	15.8	3.1	-	0.1	-	3.3
Slimy sculpin	2.6	6.7	5.4	45.8	1.4	2.2	10.7
Spoonhead sculpin	-	-	0.7	1.1	0.5	-	0.4
Fourhorn sculpin	-	-	-	-	0.1	-	<0.1
Ninespine stickleback	-	-	0.1	1.2	-	-	0.2
Trout-perch	4.5	26.4	2.7	3.2	1.2	0.3	6.4
Burbot	0.1	-	<0.1	-	0.1	-	<0.1
Yellow perch	0.1	-	-	-	-	-	<0.1
Lake chub	-	-	-	<0.1	-	-	<0.1

Appendix Table 17. Percentage use of crustaceans as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April	May	July	Average
Lake herring	0.1	1.4	<0.1	0.5
Bloater	0.8	7.4	4.1	4.1
Pygmy whitefish	-	0.1	-	<0.1
Lake trout	-	-	0.5	0.2
American smelt	66.4	89.5	13.2	56.4
Longnose sucker	0.8	0.1	4.7	1.9
Slimy sculpin	1.2	0.1	71.2	24.2
Spoonhead sculpin	0.1	-	5.3	1.8
Mottled sculpin	-	-	0.2	0.1
Ninespine stickleback	0.1	-	0.7	0.3
Trout-perch	30.1	1.4	-	10.5
Burbot	0.3	-	-	0.1
Alewife	0.1	-	-	<0.1
Spottail shiner	<0.1	-	-	<0.1

Appendix Table 18. Percentage use of crustaceans as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Lake herring	0.2	-	-	0.1
Bloater	12.8	0.5	14.0	9.1
Kiyi	1.7	1.2	-	1.0
Blackfin cisco	0.1	-	-	<0.1
Shortjaw cisco	1.6	0.9	-	0.8
Shortnose cisco	0.1	-	-	<0.1
Pygmy whitefish	0.1	-	-	<0.1
Lake trout	0.8	0.7	1.8	1.1
American smelt	14.9	-	-	5.0
Slimy sculpin	18.6	60.1	53.1	43.9
Spoonhead sculpin	0.5	0.5	-	0.3
Fourhorn sculpin	2.1	34.2	31.1	22.5
Ninespine stickleback	43.9	1.8	-	15.2
Trout-perch	2.5	-	-	0.8
Burbot	<0.1	-	-	<0.1

Appendix Table 19. Percentage use of crustaceans as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	44.1	16.1	26.6	13.2	25.0
Kiyi	-	-	2.4	0.4	0.7
Lake trout	0.1	0.4	-	-	0.1
American smelt	8.3	4.1	0.9	0.5	3.4
Slimy sculpin	12.2	40.3	64.8	78.3	48.9
Spoonhead sculpin	-	-	0.9	-	0.2
Mottled sculpin	-	-	0.9	-	0.2
Fourhorn sculpin	6.4	1.7	3.5	0.8	3.1
Ninespine stickleback	28.7	37.0	-	6.2	18.0
Burbot	0.2	-	-	0.5	0.2
Yellow perch	-	0.4	-	-	0.1

Appendix Table 20. Percentage use of crustaceans as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	15.9	24.1	11.3	17.1
Pygmy whitefish	-	-	0.4	0.1
Lake trout	0.4	2.4	-	0.9
American smelt	45.0	8.3	0.4	17.9
Slimy sculpin	33.4	34.8	79.9	49.4
Spoonhead sculpin	0.8	-	1.9	0.9
Fourhorn sculpin	1.6	-	5.4	2.3
Ninespine stickleback	1.6	30.3	0.7	10.9
Trout-perch	0.8	-	-	0.3
Burbot	0.3	-	-	0.1
Alewife	0.1	-	-	<0.1

Appendix Table 21. Percentage use of crustaceans as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	Average
Lake herring	-	0.4	0.2
Bloater	0.4	15.0	7.7
Pygmy whitefish	0.1	2.1	1.1
Lake trout	-	7.8	3.9
American smelt	84.0	51.8	67.9
Slimy sculpin	4.4	9.4	6.9
Spoonhead sculpin	-	0.2	0.1
Fourhorn sculpin	0.4	5.7	3.0
Ninespine stickleback	7.3	7.0	7.2
Trout-perch	3.4	0.2	1.8
Burbot	-	0.3	0.2

Appendix Table 22. Percentage use of crustaceans as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	3.7	0.9	7.5	3.0
Pygmy whitefish	0.2	-	0.3	0.6	0.3
Round whitefish	-	-	0.1	-	<0.1
Lake trout	-	5.6	1.2	3.6	2.6
American smelt	76.2	53.9	59.3	47.7	59.3
Slimy sculpin	8.7	18.9	7.0	3.3	9.5
Spoonhead sculpin	-	-	0.1	1.3	0.4
Fourhorn sculpin	1.0	-	0.6	0.2	0.4
Ninespine stickleback	4.1	7.3	7.5	35.7	13.6
Trout-perch	9.2	10.7	22.9	-	10.7
Burbot	0.5	-	-	0.2	0.2

Appendix Table 23. Percentage use of crustaceans as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	0.2	-	-	0.1
Pygmy whitefish	-	1.1	-	0.4
Lake trout	0.1	-	0.3	0.1
American smelt	69.6	34.1	89.0	64.2
Slimy sculpin	14.2	1.3	5.3	6.9
Spoonhead sculpin	5.1	-	2.1	2.4
Fourhorn sculpin	3.9	-	0.8	1.6
Ninespine stickleback	0.8	52.9	2.4	18.7
Trout-perch	5.9	10.5	-	5.5
Burbot	0.1	-	-	<0.1

Appendix Table 24. Percentage use of crustaceans as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Lake herring	-	0.2	-	0.1
Bloater	-	3.3	6.5	3.3
Lake whitefish	1.4	5.6	0.5	2.5
Pygmy whitefish	-	2.0	0.9	1.0
Round whitefish	8.6	-	-	2.9
Lake trout	-	10.4	2.7	4.4
American smelt	65.6	34.7	57.8	52.7
Longnose sucker	-	0.4	-	0.1
Slimy sculpin	12.7	22.5	28.0	21.1
Fourhorn sculpin	-	2.1	0.9	1.0
Ninespine stickleback	11.7	14.2	2.8	9.6
Trout-perch	-	4.2	-	1.4
Burbot	-	0.2	-	0.1

Appendix Table 25. Percentage use of crustaceans as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	July	September	November	Average
Bloater	0.3	7.4	2.5	5.2	3.8
Shortnose cisco	-	-	0.4	-	0.1
Pygmy whitefish	-	-	-	0.8	0.2
Lake trout	-	9.6	0.8	1.9	3.1
American smelt	93.9	27.8	8.5	83.4	53.4
Slimy sculpin	4.0	20.2	3.8	0.6	7.2
Spoonhead sculpin	0.2	-	0.4	-	0.2
Fourhorn sculpin	0.4	-	0.2	-	0.2
Ninespine stickleback	0.7	34.9	82.7	3.3	30.4
Trout-perch	0.4	-	-	3.9	1.1
Burbot	0.1	-	0.6	0.4	0.3
Alewife	-	-	-	0.4	0.1

Appendix Table 26. Percentage use of crustaceans as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September	October	November	Average
Lake herring	0.1	-	0.2	0.1
Bloater	4.9	0.2	-	1.7
Lake whitefish	0.2	-	-	0.1
Shortjaw cisco	0.2	-	-	0.1
Round whitefish	-	0.5	1.2	0.6
Lake trout	21.4	-	0.5	7.3
American smelt	13.0	91.7	62.9	55.9
Slimy sculpin	2.5	0.5	13.9	5.6
Spoonhead sculpin	0.1	-	0.3	0.1
Fourhorn sculpin	0.5	-	0.5	0.3
Ninespine stickleback	57.1	6.9	0.1	21.4
Trout-perch	0.1	-	19.2	6.4
Burbot	-	-	0.2	0.1
Alewife	-	-	0.4	0.1
Spottail shiner	-	-	0.8	0.3

Appendix Table 27. Percentage use of crustaceans as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June	July	December	Average
Lake herring	0.1	-	-	<0.1
Bloater	16.3	-	0.4	5.6
Lake whitefish	0.3	0.1	0.1	0.2
Pygmy whitefish	0.1	-	-	<0.1
Round whitefish	-	1.7	-	0.6
Lake trout	10.5	0.1	2.0	4.2
American smelt	65.8	0.1	95.3	53.7
Longnose sucker	0.1	-	-	<0.1
Slimy sculpin	2.6	0.3	0.4	1.1
Spoonhead sculpin	-	-	0.4	0.1
Mottled sculpin	0.1	-	-	<0.1
Ninespine stickleback	1.8	97.6	-	33.1
Trout-perch	2.3	-	1.2	1.2

Appendix Table 28. Percentage use of crustaceans as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July	September	November	Average
Lake herring	-	0.3	-	0.1
Bloater	1.1	3.8	0.3	1.7
Lake whitefish	1.1	0.1	-	0.4
Round whitefish	0.1	0.1	2.4	0.9
Lake trout	2.2	0.4	0.1	0.9
American smelt	57.4	72.9	81.0	70.4
Longnose sucker	-	<0.1	-	<0.1
White sucker	-	<0.1	-	<0.1
Slimy sculpin	0.3	6.7	11.8	6.3
Spoonhead sculpin	0.1	0.1	-	0.1
Fourhorn sculpin	-	0.1	-	<0.1
Ninespine stickleback	37.1	5.1	-	14.1
Trout-perch	0.6	10.2	4.4	5.1
Burbot	-	0.1	-	<0.1
Yellow perch	-	0.1	-	<0.1

Appendix Table 29. Percentage use of Mysidacea as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April	June	November	Average
Bloater	0.3	1.2	-	0.5
Lake trout	-	0.3	-	0.1
American smelt	65.7	97.5	97.0	86.7
Longnose sucker	0.1	-	-	<0.1
White sucker	<0.1	-	-	<0.1
Slimy sculpin	0.6	0.5	-	0.4
Spoonhead sculpin	<0.1	-	-	<0.1
Fourhorn sculpin	-	0.2	-	0.1
Ninespine stickleback	-	0.1	-	<0.1
Trout-perch	33.2	0.1	2.8	12.0
Burbot	0.1	-	-	<0.1
Walleye	-	-	0.2	0.1
Yellow perch	<0.1	-	-	<0.1

Appendix Table 30. Percentage use of Mysidacea as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April	May	June	July	September	November	Average
Lake herring	-	-	-	-	-	3.3	0.6
Bloater	0.1	-	0.4	19.3	9.3	-	4.8
Lake trout	-	-	-	-	0.6	-	0.1
American smelt	94.6	45.1	98.9	76.2	88.2	96.6	83.3
Longnose sucker	<0.1	0.9	-	-	-	-	0.2
Slimy sculpin	0.2	-	0.3	3.7	0.6	-	0.8
Spoonhead sculpin	-	-	-	<0.1	1.2	-	0.2
Fourhorn sculpin	-	-	-	-	0.2	-	<0.1
Ninespine stickleback	-	-	0.1	0.3	-	-	0.1
Trout-perch	5.0	54.0	0.3	0.3	-	0.1	10.0
Burbot	0.1	-	-	-	<0.1	-	<0.1
Yellow perch	<0.1	-	-	-	-	-	<0.1
Lake chub	-	-	-	0.1	-	-	<0.1

Appendix Table 31. Percentage use of Mysidacea as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	0.2	-	12.5	4.2
Pygmy whitefish	-	<0.1	-	<0.1
Lake trout	-	-	3.3	1.1
American smelt	66.6	96.3	69.8	77.6
Longnose sucker	<0.1	<0.1	-	<0.1
Slimy sculpin	0.1	-	13.6	4.6
Spoonhead sculpin	<0.1	-	0.4	0.1
Ninespine stickleback	-	-	0.4	0.1
Trout-perch	32.5	3.6	-	12.0
Burbot	0.4	-	-	0.1
Alewife	0.1	-	-	<0.1

Appendix Table 32. Percentage use of Mysidacea as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Lake herring	0.2	-	-	0.1
Bloater	15.7	0.1	23.6	13.1
Kiyi	3.2	6.5	-	3.2
Blackfin cisco	0.2	-	-	0.1
Shortjaw cisco	3.3	-	-	1.1
Shortnose cisco	0.2	-	-	0.1
Pygmy whitefish	<0.1	-	-	<0.1
Lake trout	0.1	2.4	7.6	3.4
American smelt	23.3	-	-	7.8
Slimy sculpin	5.1	7.3	12.3	8.2
Spoonhead sculpin	0.3	0.1	-	0.1
Fourhorn sculpin	2.1	81.8	56.5	46.8
Ninespine stickleback	43.2	1.9	-	15.0
Trout-perch	2.8	-	-	0.9
Burbot	<0.1	-	-	<0.1

Appendix Table 33. Percentage use of Mysidacea as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	8.9	5.8	58.1	47.1	30.0
Kiyi	-	-	11.4	1.0	3.1
Lake trout	0.4	1.5	-	-	0.5
American smelt	44.2	26.3	3.0	2.1	18.9
Slimy sculpin	14.5	7.1	19.4	35.4	19.1
Spoonhead sculpin	-	-	0.1	-	<0.1
Fourhorn sculpin	31.4	5.7	8.1	1.9	11.8
Ninespine stickleback	-	53.6	-	11.4	16.2
Burbot	0.6	-	-	1.2	0.4

Appendix Table 34. Percentage use of Mysidacea as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	1.1	34.7	39.1	25.0
Lake trout	0.5	3.8	-	1.4
American smelt	80.2	15.3	2.0	32.5
Slimy sculpin	13.2	11.2	37.9	20.8
Spoonhead sculpin	<0.1	-	0.3	0.1
Fourhorn sculpin	2.5	-	20.2	7.6
Ninespine stickleback	-	35.1	0.5	11.9
Trout-perch	1.7	-	-	0.6
Burbot	0.4	-	-	0.1
Alewife	0.3	-	-	0.1

Appendix Table 35. Percentage use of Mysidacea as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	Average
Bloater	0.3	1.3	0.8
Pygmy whitefish	<0.1	-	<0.1
Lake trout	-	9.7	4.8
American smelt	90.0	81.2	86.0
Slimy sculpin	0.8	0.4	0.6
Spoonhead sculpin	-	<0.1	<0.1
Fourhorn sculpin	0.3	4.7	2.5
Ninespine stickleback	5.0	2.5	3.8
Trout-perch	2.6	<0.1	1.3
Burbot	-	<0.1	<0.1

Appendix Table 36. Percentage use of Mysidacea as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	0.3	0.9	8.4	2.4
Round whitefish	-	-	0.1	-	<0.1
Lake trout	-	7.0	3.0	6.0	4.0
American smelt	84.4	85.9	93.0	64.2	81.9
Slimy sculpin	2.2	0.8	1.0	0.5	1.1
Spoonhead sculpin	-	-	<0.1	0.2	0.1
Fourhorn sculpin	1.0	-	0.7	0.1	0.4
Ninespine stickleback	-	2.6	1.4	20.5	6.1
Trout-perch	11.9	3.3	-	-	3.8
Burbot	0.5	-	-	0.1	0.2

Appendix Table 37. Percentage use of Mysidacea as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	<0.1	-	-	<0.1
Pygmy whitefish	-	0.2	-	0.1
Lake trout	0.1	-	0.5	0.2
American smelt	83.3	45.3	97.9	75.5
Slimy sculpin	3.8	0.3	0.5	1.5
Spoonhead sculpin	0.1	-	0.1	0.1
Fourhorn sculpin	4.3	-	0.6	1.6
Ninespine stickleback	-	44.2	0.3	14.8
Trout-perch	8.3	10.1	-	6.1
Burbot	0.1	-	-	<0.1

Appendix Table 38. Percentage use of Mysidacea as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Bloater	-	0.4	6.0	2.1
Lake whitefish	-	6.0	0.2	2.1
Round whitefish	4.9	0.7	-	1.9
Lake trout	-	15.8	6.1	7.3
American smelt	82.9	66.2	82.9	77.3
Slimy sculpin	2.8	1.2	3.5	2.5
Fourhorn sculpin	-	2.2	0.9	1.0
Ninespine stickleback	9.3	6.1	0.5	5.3
Trout-perch	-	1.6	-	0.5
Burbot	-	<0.1	-	<0.1

Appendix Table 39. Percentage use of Mysidacea as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	July	September	November	Average
Bloater	<0.1	8.8	1.6	2.7	3.3
Shortnose cisco	-	-	0.2	-	<0.1
Lake trout	-	28.1	2.2	2.4	8.2
American smelt	98.1	51.8	18.2	92.2	65.1
Slimy sculpin	0.9	3.3	0.9	0.1	1.3
Spoonhead sculpin	<0.1	-	0.1	-	<0.1
Fourhorn sculpin	0.3	-	0.2	-	0.1
Ninespine stickleback	-	7.9	75.9	-	21.0
Trout-perch	0.4	-	-	1.2	0.4
Burbot	0.1	-	0.7	0.6	0.4
Alewife	-	-	-	0.6	0.2

Appendix Table 40. Percentage use of Mysidacea as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September	October	November	Average
Lake herring	<0.1	-	<0.1	<0.1
Bloater	5.9	9.9	-	5.3
Shortjaw cisco	0.4	-	-	0.1
Round whitefish	-	45.2	2.0	15.7
Lake trout	38.5	-	0.7	13.1
American smelt	18.9	-	85.3	34.7
Slimy sculpin	0.4	2.5	3.2	2.0
Spoonhead sculpin	<0.1	-	-	<0.1
Fourhorn sculpin	0.4	-	-	0.1
Ninespine stickleback	35.4	42.5	-	26.0
Trout-perch	-	-	7.3	2.4
Burbot	-	-	0.3	0.1
Alewife	-	-	0.7	0.2
Spottail shiner	-	-	0.6	0.2

Appendix Table 41. Percentage use of Mysidacea as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June	July	December	Average
Bloater	1.2	-	0.4	0.5
Lake whitefish	0.2	0.1	-	0.1
Round whitefish	0.1	3.2	-	1.1
Lake trout	11.0	0.9	3.7	5.2
American smelt	86.9	0.8	93.2	60.3
Slimy sculpin	0.1	0.2	-	0.1
Ninespine stickleback	0.5	94.6	-	31.7
Trout-perch	-	-	2.6	0.9

Appendix Table 42. Percentage use of Mysidacea as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July	September	November	Average
Lake herring	-	0.1	-	<0.1
Bloater	1.1	4.0	0.2	1.9
Lake whitefish	0.5	-	-	0.2
Round whitefish	<0.1	<0.1	3.4	1.1
Lake trout	5.1	0.6	0.2	2.0
American smelt	86.4	91.5	92.6	90.2
Slimy sculpin	<0.1	0.9	2.3	1.1
Spoonhead Sculpin	<0.1	<0.1	-	<0.1
Fourhorn sculpin	-	0.1	-	<0.1
Ninespine stickleback	6.7	2.7	-	3.1
Trout-perch	-	-	1.4	0.5
Burbot	-	0.1	-	<0.1

Appendix Table 43. Percentage use of Amphipoda as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April	June	November	Average
Lake herring	0.7	-	-	0.2
Bloater	0.1	4.6	-	1.6
Lake trout	-	0.5	-	0.2
American smelt	36.2	37.6	23.7	32.5
Longnose sucker	5.6	20.1	0.5	8.7
White sucker	0.4	-	-	0.1
Slimy sculpin	19.8	33.6	0.4	17.9
Spoonhead sculpin	0.6	0.9	0.6	0.7
Fourhorn sculpin	-	0.3	-	0.1
Ninespine stickleback	0.2	0.3	-	0.2
Trout-perch	35.3	1.9	74.9	37.4
Burbot	<0.1	<0.1	-	<0.1
Yellow perch	0.6	0.2	-	0.3
Spottail shiner	0.4	-	-	0.1

Appendix Table 44. Percentage use of Amphipoda as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April	May	June	July	September	November	Average
Lake herring	0.2	-	-	-	<0.1	-	<0.1
Bloater	<0.1	-	2.2	11.4	5.5	-	3.2
Lake trout	-	-	-	-	0.7	-	0.1
American smelt	77.1	19.5	51.5	2.4	52.1	57.0	43.3
Longnose sucker	3.3	37.4	14.2	-	0.9	-	9.3
Slimy sculpin	11.1	15.8	24.4	79.1	19.7	38.0	31.4
Spoonhead sculpin	-	-	2.3	2.0	2.3	-	1.1
Fourhorn sculpin	-	-	-	-	1.1	-	0.2
Ninespine stickleback	-	-	0.4	1.0	-	-	0.2
Trout-perch	7.8	27.3	5.0	4.1	16.9	4.9	11.0
Burbot	0.1	-	<0.1	-	0.8	-	0.2
Yellow perch	0.4	-	-	-	-	-	0.1

Appendix Table 45. Percentage use of Amphipoda as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April	May	July	Average
Lake herring	0.1	-	-	<0.1
Bloater	<0.1	4.2	2.2	2.1
Pygmy whitefish	-	0.3	-	0.1
Lake trout	-	-	<0.1	<0.1
American smelt	47.2	90.5	0.7	46.1
Longnose sucker	2.8	0.4	5.4	2.9
Slimy sculpin	4.4	0.6	84.6	29.9
Spoonhead sculpin	0.3	-	6.4	2.2
Mottled sculpin	-	-	0.3	0.1
Ninespine stickleback	0.3	-	0.4	0.2
Trout-perch	44.4	4.0	-	16.1
Burbot	0.3	-	-	0.1
Spottail shiner	0.1	-	-	<0.1

Appendix Table 46. Percentage use of Amphipoda as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Bloater	1.6	<0.1	1.4	1.0
Shortjaw cisco	<0.1	1.1	-	0.4
Pygmy whitefish	0.1	-	-	<0.1
Lake trout	0.6	0.3	1.2	0.7
American smelt	4.5	-	-	1.5
Slimy sculpin	36.9	71.1	73.1	60.4
Spoonhead sculpin	0.7	0.6	-	0.4
Fourhorn sculpin	2.5	25.1	24.3	17.3
Ninespine stickleback	50.4	1.7	-	17.4
Trout-perch	2.5	-	-	0.8
Burbot	0.1	-	-	<0.1

Appendix Table 47. Percentage use of Amphipoda as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	0.9	2.7	2.1	1.4
Lake trout	0.2	0.2	-	-	0.1
American smelt	0.7	0.8	0.1	<0.1	0.4
Slimy sculpin	24.6	55.4	91.5	91.6	65.8
Spoonhead sculpin	-	-	1.4	-	0.4
Mottled sculpin	-	-	1.5	-	0.4
Fourhorn sculpin	6.4	1.4	2.8	0.6	2.8
Ninespine stickleback	67.9	40.9	-	5.2	28.5
Burbot	0.2	-	-	0.4	0.2
Yellow perch	-	0.3	-	-	0.1

Appendix Table 48. Percentage use of Amphipoda as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	-	2.7	0.9	1.2
Pygmy whitefish	-	-	0.5	0.2
Lake trout	0.7	1.8	-	0.8
American smelt	4.8	2.3	<0.1	2.4
Slimy sculpin	84.3	62.0	92.0	79.4
Spoonhead sculpin	2.3	-	2.5	1.6
Fourhorn sculpin	2.0	-	3.5	1.8
Ninespine stickleback	4.8	31.3	0.4	12.2
Trout-perch	0.6	-	-	0.2
Burbot	0.4	-	-	0.1

Appendix Table 49. Percentage use of Amphipoda as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	Average
Bloater	0.1	2.0	1.0
Pygmy whitefish	0.4	6.0	3.2
Lake trout	-	9.7	4.8
American smelt	54.5	23.0	38.8
Slimy sculpin	18.7	28.9	23.8
Spoonhead sculpin	-	0.7	0.4
Fourhorn sculpin	1.0	10.8	5.9
Ninespine stickleback	18.1	17.4	17.8
Trout-perch	7.1	0.4	3.8
Burbot	-	1.0	0.5

Appendix Table 50. Percentage use of Amphipoda as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	0.4	0.2	2.9	0.9
Pygmy whitefish	-	-	0.9	1.9	0.7
Round whitefish	-	-	<0.1	-	<0.1
Lake trout	-	5.1	1.5	0.8	1.8
American smelt	15.8	17.6	13.2	6.3	13.2
Slimy sculpin	42.6	42.9	17.9	9.5	28.2
Spoonhead sculpin	-	-	0.3	3.7	1.0
Fourhorn sculpin	2.4	-	0.9	0.4	0.9
Ninespine stickleback	23.4	13.4	10.6	74.1	30.4
Trout-perch	14.1	20.6	54.5	-	22.3
Burbot	1.6	-	-	0.4	0.5

Appendix Table 51. Percentage use of Amphipoda as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Pygmy whitefish	-	1.9	-	0.6
Lake trout	0.2	-	0.8	0.3
American smelt	10.6	12.0	44.4	22.3
Slimy sculpin	50.7	3.0	30.4	28.0
Spoonhead sculpin	21.2	-	13.9	11.7
Fourhorn sculpin	7.0	-	2.7	3.2
Ninespine stickleback	3.3	71.0	7.7	27.3
Trout-perch	6.7	12.1	-	6.3
Burbot	0.3	-	-	0.1

Appendix Table 52. Percentage use of Amphipoda as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Bloater	-	0.3	1.2	0.5
Lake whitefish	-	5.0	0.7	1.9
Pygmy whitefish	-	3.6	2.6	2.1
Lake trout	-	7.8	3.4	3.7
American smelt	33.8	9.4	13.1	18.8
Longnose sucker	-	0.9	-	0.3
Slimy sculpin	43.2	42.2	73.6	53.0
Fourhorn sculpin	-	2.5	1.3	1.3
Ninespine stickleback	23.0	21.4	4.0	16.1
Trout-perch	-	6.8	-	2.3
Burbot	-	0.3	-	0.1

Appendix Table 53. Percentage use of Amphipoda as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	July	September	November	Average
Bloater	-	1.1	0.5	1.3	0.7
Pygmy whitefish	-	-	-	3.3	0.8
Lake trout	-	9.8	0.1	2.6	3.1
American smelt	42.3	5.1	0.6	57.6	26.4
Slimy sculpin	42.8	43.1	5.9	3.0	23.7
Spoonhead sculpin	2.7	-	0.7	-	0.8
Fourhorn sculpin	1.9	-	0.2	-	0.5
Ninespine stickleback	8.3	40.8	91.4	16.7	39.3
Trout-perch	1.2	-	-	15.2	4.1
Burbot	0.8	-	0.7	0.3	0.4

Appendix Table 54. Percentage use of Amphipoda as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September	October	November	Average
Bloater	1.4	0.2	-	0.5
Lake whitefish	0.4	-	-	0.1
Shortjaw cisco	<0.1	-	-	<0.1
Round whitefish	-	-	0.1	<0.1
Lake trout	3.6	-	0.3	1.3
American smelt	1.3	78.6	22.8	34.2
Slimy sculpin	5.4	5.6	33.1	14.7
Spoonhead sculpin	0.2	-	0.8	0.3
Fourhorn sculpin	0.7	-	1.5	0.7
Ninespine stickleback	87.0	15.6	0.3	34.3
Trout-perch	0.2	-	39.6	13.3
Burbot	-	-	0.1	<0.1
Spottail shiner	-	-	1.4	0.5

Appendix Table 55. Percentage use of Amphipoda as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June	July	December	Average
Bloater	3.4	-	0.1	1.2
Lake whitefish	0.6	0.1	0.2	0.3
Pygmy whitefish	0.4	-	-	0.1
Round whitefish	-	0.1	-	<0.1
Lake trout	20.2	0.1	1.5	7.3
American smelt	45.6	<0.1	96.0	47.2
Longnose sucker	0.5	-	-	0.2
Slimy sculpin	12.6	0.6	0.6	4.6
Spoonhead sculpin	-	-	0.6	0.3
Mottled sculpin	0.3	-	-	0.1
Ninespine stickleback	6.9	99.1	-	35.3
Trout-perch	9.4	-	0.9	3.4

Appendix Table 56. Percentage use of Amphipoda as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July	September	November	Average
Bloater	0.3	2.0	0.1	0.8
Lake whitefish	2.1	0.2	-	0.8
Round whitefish	<0.1	<0.1	0.4	0.1
Lake trout	3.7	0.1	0.1	1.3
American smelt	17.7	13.0	43.8	24.8
Longnose sucker	-	<0.1	-	<0.1
White sucker	-	<0.1	-	<0.1
Slimy sculpin	0.9	25.9	42.1	23.0
Spoonhead sculpin	0.4	0.4	-	0.3
Fourhorn sculpin	-	0.2	-	0.1
Ninespine stickleback	72.6	14.2	-	28.9
Trout-perch	2.1	43.3	13.5	19.6
Burbot	-	0.2	-	0.1
Yellow perch	-	0.2	-	0.1

Appendix Table 57. Percentage use of Copepoda as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April	June	November	Average
Lake herring	2.5	0.2	-	0.9
Bloater	6.0	15.3	0.5	7.3
Lake trout	0.4	-	-	0.1
American smelt	88.2	83.4	99.1	90.2
Longnose sucker	0.2	-	-	0.1
White sucker	<0.1	-	-	<0.1
Slimy sculpin	0.6	-	-	0.2
Spoonhead sculpin	-	0.1	-	<0.1
Fourhorn sculpin	-	<0.1	-	<0.1
Ninespine stickleback	-	<0.1	-	<0.1
Trout-perch	1.9	0.9	0.4	1.1
Yellow perch	0.2	-	-	0.1

Appendix Table 58. Percentage use of Copepoda as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April	May	June	July	September	November	Average
Lake herring	0.3	-	2.4	2.6	0.2	9.1	2.4
Bloater	1.5	-	5.7	36.2	4.4	49.7	16.2
Lake trout	0.3	-	-	-	-	-	<0.1
American smelt	97.4	98.9	89.9	48.1	94.7	41.1	78.4
Longnose sucker	0.1	-	-	-	-	-	<0.1
Slimy sculpin	0.2	1.1	-	-	-	-	0.2
Spoonhead sculpin	-	-	0.2	-	<0.1	-	<0.1
Ninespine stickleback	-	-	<0.1	11.9	-	-	2.0
Trout-perch	0.2	-	1.9	1.2	0.7	<0.1	0.7
Yellow perch	0.1	-	-	-	-	-	<0.1

Appendix Table 59. Percentage use of Copepoda as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April	May	July	Average
Lake herring	0.4	2.3	0.4	1.0
Bloater	4.0	11.0	27.9	14.3
Pygmy whitefish	-	<0.1	-	<0.1
American smelt	93.4	86.6	52.3	77.4
Longnose sucker	0.1	-	-	<0.1
Slimy sculpin	0.1	<0.1	-	<0.1
Ninespine stickleback	-	-	19.4	6.5
Trout-perch	2.0	-	-	0.7

Appendix Table 60. Percentage use of Copepoda as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Lake herring	1.3	-	-	0.4
Bloater	56.5	28.4	72.5	52.5
Kiyi	2.1	4.5	-	2.2
Shortjaw cisco	0.4	-	-	0.1
Shortnose cisco	<0.1	-	-	<0.1
Pygmy whitefish	0.2	-	-	0.1
Lake trout	0.1	0.6	1.4	0.7
American smelt	19.5	-	-	6.5
Slimy sculpin	2.8	38.8	26.1	22.6
Spoonhead sculpin	0.2	-	-	0.1
Fourhorn sculpin	0.3	21.6	-	7.3
Ninespine stickleback	16.1	6.1	-	7.4
Trout-perch	0.5	-	-	0.2

Appendix Table 61. Percentage use of Copepoda as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	93.3	83.1	80.4	57.5	78.6
Kiyi	-	-	-	5.5	1.4
Lake trout	-	<0.1	-	-	<0.1
American smelt	6.3	3.4	1.0	1.2	4.0
Slimy sculpin	0.3	2.3	18.6	33.6	13.7
Fourhorn sculpin	0.1	0.1	-	-	<0.1
Ninespine stickleback	-	11.0	-	2.2	3.3

Appendix Table 62. Percentage use of Copepoda as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	49.0	79.4	57.6	62.0
Pygmy whitefish	-	-	<0.1	<0.1
Lake trout	-	0.3	-	0.1
American smelt	49.7	8.1	0.7	19.5
Slimy sculpin	1.2	3.9	38.6	14.6
Fourhorn sculpin	<0.1	-	-	<0.1
Ninespine stickleback	-	8.3	3.0	3.8

Appendix Table 63. Percentage use of Copepoda as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	Average
Lake herring	-	1.8	0.9
Bloater	1.5	60.6	31.0
Pygmy whitefish	0.4	0.5	0.4
Lake trout	-	0.5	0.2
American smelt	94.6	34.3	64.4
Slimy sculpin	0.6	0.4	0.5
Fourhorn sculpin	<0.1	0.2	0.1
Ninespine stickleback	2.3	1.6	2.0
Trout-perch	0.6	-	0.3
Burbot	-	<0.1	<0.1

Appendix Table 64. Percentage use of Copepoda as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	27.7	2.1	20.2	12.5
Pygmy whitefish	0.5	-	<0.1	-	0.1
Round whitefish	-	-	0.2	-	<0.1
Lake trout	-	0.6	0.4	-	0.2
American smelt	99.0	66.9	52.7	71.3	72.5
Slimy sculpin	0.4	1.6	1.6	0.9	1.1
Fourhorn sculpin	0.1	-	-	-	<0.1
Ninespine stickleback	-	3.2	15.3	7.7	6.6
Trout-perch	-	-	27.7	-	6.9

Appendix Table 65. Percentage use of Copepoda as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	0.8	-	-	0.3
Pygmy whitefish	-	5.3	-	1.8
Lake trout	-	-	0.1	<0.1
American smelt	98.4	63.8	92.7	85.0
Slimy sculpin	0.7	0.3	1.4	0.8
Fourhorn sculpin	0.2	-	-	0.1
Ninespine stickleback	-	27.8	5.8	11.2
Trout-perch	-	2.9	-	1.0

Appendix Table 66. Percentage use of Copepoda as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Lake herring	-	2.1	-	0.7
Bloater	-	29.5	19.3	16.3
Lake whitefish	11.4	5.7	0.8	6.0
Pygmy whitefish	-	1.1	0.1	0.4
Round whitefish	23.6	-	-	7.9
Lake trout	-	1.4	1.2	0.9
American smelt	60.6	50.5	63.8	58.3
Slimy sculpin	1.3	2.2	7.9	3.8
Fourhorn sculpin	-	0.2	-	0.1
Ninespine stickleback	3.0	7.2	7.0	5.7
Burbot	-	<0.1	-	<0.1

Appendix Table 67. Percentage use of Copepoda as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	July	September	November	Average
Bloater	0.9	14.6	17.8	15.5	12.2
Shortnose cisco	-	-	0.5	-	0.1
Lake trout	-	2.8	-	0.3	0.8
American smelt	98.9	20.3	32.8	82.3	58.6
Slimy sculpin	0.1	3.8	2.6	<0.1	1.6
Fourhorn sculpin	<0.1	-	-	-	<0.1
Ninespine stickleback	-	58.5	46.3	1.5	26.6
Trout-perch	-	-	-	0.3	0.1
Alewife	-	-	-	<0.1	<0.1

Appendix Table 68. Percentage use of Copepoda as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September	October	November	Average
Lake herring	0.1	-	1.0	0.4
Bloater	28.8	0.1	-	9.6
Shortjaw cisco	0.2	-	-	0.1
Round whitefish	-	0.1	-	<0.1
Lake trout	-	-	0.1	<0.1
American smelt	42.5	94.5	95.1	77.4
Slimy sculpin	1.5	-	1.5	1.0
Ninespine stickleback	26.9	5.3	0.1	10.8
Trout-perch	-	-	2.2	0.7
Alewife	-	-	<0.1	<0.1

Appendix Table 69. Percentage use of Copepoda as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June	July	December	Average
Lake herring	0.4	-	-	0.1
Bloater	59.2	-	3.2	20.8
Lake whitefish	0.1	<0.1	-	<0.1
Pygmy whitefish	<0.1	-	-	<0.1
Round whitefish	-	1.0	-	0.3
Lake trout	0.6	<0.1	-	0.2
American smelt	39.2	<0.1	96.7	45.3
Slimy sculpin	0.1	<0.1	-	<0.1
Spoonhead sculpin	-	-	0.1	<0.1
Ninespine stickleback	0.4	98.8	-	33.1

Appendix Table 70. Percentage use of Copepoda as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July	September	November	Average
Lake herring	-	0.2	-	0.1
Bloater	2.1	8.4	1.2	3.9
Lake whitefish	1.0	-	-	0.3
Round whitefish	0.1	0.3	-	0.1
Lake trout	0.6	-	<0.1	0.2
American smelt	38.6	88.8	97.4	74.9
Longnose sucker	-	<0.1	-	<0.1
White sucker	-	<0.1	-	<0.1
Slimy sculpin	<0.1	1.4	1.0	0.8
Ninespine stickleback	57.0	0.9	-	19.3
Trout-perch	0.6	-	0.4	0.3

Appendix Table 71. Percentage use of insects as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April	June	November	Average
Lake herring	-	<0.1	-	<0.1
Bloater	1.4	8.1	-	3.2
Lake trout	-	0.8	-	0.3
American smelt	14.2	33.0	32.0	26.4
Longnose sucker	3.2	14.9	-	6.0
White sucker	0.2	-	-	0.1
Slimy sculpin	4.1	22.1	-	8.7
Spoonhead sculpin	0.2	0.7	-	0.3
Ninespine stickleback	-	<0.1	-	<0.1
Trout-perch	71.7	20.2	68.0	53.3
Burbot	0.1	-	-	<0.1
Emerald shiner	4.9	-	-	1.6

Appendix Table 72. Percentage use of insects as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April	May	June	July	September	November	Average
Lake herring	-	-	0.4	-	0.3	-	0.1
Bloater	1.3	-	2.9	47.9	6.5	-	9.8
Lake trout	-	-	-	-	0.4	-	0.1
American smelt	59.3	7.6	34.4	7.6	83.1	94.5	47.8
Longnose sucker	3.6	41.0	8.0	-	1.4	-	9.0
Slimy sculpin	4.5	-	12.2	10.5	6.5	-	5.6
Spoonhead sculpin	-	-	1.3	3.1	0.4	-	0.8
Ninespine stickleback	-	-	<0.1	1.2	-	-	0.2
Trout-perch	31.1	51.4	40.6	18.3	1.4	5.5	24.7
Burbot	0.3	-	-	-	<0.1	-	<0.1
Lake chub	-	-	-	11.4	-	-	1.9

Appendix Table 73. Percentage use of insects as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	1.0	-	18.6	6.5
Pygmy whitefish	-	1.4	-	0.5
Lake trout	-	-	9.5	3.2
American smelt	16.4	80.5	4.2	33.7
Longnose sucker	1.4	1.1	23.3	8.6
Slimy sculpin	0.8	-	22.9	7.9
Spoonhead sculpin	0.1	-	20.4	6.8
Mottled sculpin	-	-	0.1	<0.1
Ninespine stickleback	-	-	1.0	0.3
Trout-perch	79.8	16.9	-	32.2
Burbot	0.6	-	-	0.2

Appendix Table 74. Percentage use of insects as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Bloater	-	2.1	12.5	4.9
Pygmy whitefish	0.6	-	-	0.2
Lake trout	1.6	6.4	1.6	3.2
American smelt	5.4	-	-	1.8
Slimy sculpin	17.0	86.0	85.9	63.0
Ninespine stickleback	16.4	5.4	-	7.3
Trout-perch	59.0	-	-	19.7

Appendix Table 75. Percentage use of insects as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	83.0	25.3	18.4	8.1	33.7
Kiyi	-	-	-	1.0	0.2
Lake trout	6.7	1.3	-	-	2.0
American smelt	-	13.2	0.1	0.3	3.4
Slimy sculpin	-	20.8	81.1	84.8	46.7
Spoonhead sculpin	-	-	0.2	-	<0.1
Mottled sculpin	-	-	0.2	-	<0.1
Fourhorn sculpin	10.3	-	-	-	2.6
Ninespine stickleback	-	39.3	-	5.5	11.2
Burbot	-	-	-	0.4	0.1

Appendix Table 76. Percentage use of insects as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	27.8	-	7.2	11.7
Pygmy whitefish	-	-	0.2	0.1
Lake trout	23.9	9.9	-	11.3
American smelt	-	5.9	<0.1	2.0
Slimy sculpin	-	62.0	92.0	51.3
Spoonhead sculpin	6.2	-	0.3	2.2
Fourhorn sculpin	2.3	-	-	0.8
Ninespine stickleback	-	22.2	0.3	7.5
Trout-perch	39.8	-	-	13.3

Appendix Table 77. Percentage use of insects as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	Average
Lake herring	-	0.4	0.2
Bloater	-	9.4	4.7
Pygmy whitefish	1.0	6.2	3.6
Lake trout	-	10.9	5.4
American smelt	25.8	66.8	46.3
Slimy sculpin	3.4	1.9	2.6
Ninespine stickleback	2.3	3.0	2.6
Trout-perch	67.5	1.3	34.4
Burbot	-	0.1	<0.1

Appendix Table 78. Percentage use of insects as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	1.3	3.1	6.4	2.7
Pygmy whitefish	-	-	1.1	3.2	1.1
Round whitefish	-	-	3.6	-	0.9
Lake trout	-	4.4	4.1	1.7	2.6
American smelt	-	39.5	28.7	38.7	26.7
Slimy sculpin	-	2.2	44.3	5.0	12.9
Spoonhead sculpin	-	-	0.1	1.0	0.3
Fourhorn sculpin	0.3	-	-	-	0.1
Ninespine stickleback	-	1.8	15.1	43.9	15.2
Trout-perch	99.7	50.9	-	-	37.6
Burbot	-	-	-	0.2	<0.1

Appendix Table 79. Percentage use of insects as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	0.1	-	-	<0.1
Pygmy whitefish	-	3.3	-	1.1
Lake trout	1.5	-	1.2	0.9
American smelt	-	4.3	51.1	18.5
Slimy sculpin	-	0.4	39.5	13.3
Spoonhead sculpin	11.8	-	2.4	4.7
Fourhorn sculpin	1.7	-	-	0.6
Ninespine stickleback	-	6.8	5.8	4.2
Trout-perch	84.8	85.3	-	56.7

Appendix Table 80. Percentage use of insects as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Lake herring	-	0.2	-	0.1
Bloater	-	1.6	9.1	3.6
Lake whitefish	-	11.9	1.9	4.6
Pygmy whitefish	-	4.6	1.2	1.9
Round whitefish	92.6	2.2	-	31.6
Lake trout	-	10.9	3.6	4.8
American smelt	4.4	33.7	11.1	16.4
Longnose sucker	-	0.1	-	<0.1
Slimy sculpin	2.2	3.5	70.9	25.5
Ninespine stickleback	0.8	4.5	2.2	2.5
Trout-perch	-	26.8	-	8.9
Burbot	-	<0.1	-	<0.1

Appendix Table 81. Percentage use of insects as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	July	September	November	Average
Bloater	2.6	9.6	1.8	-	3.5
Lake trout	-	12.0	0.3	3.3	3.9
American smelt	-	5.0	5.8	-	2.7
Slimy sculpin	-	47.5	4.9	7.3	14.9
Spoonhead sculpin	8.6	-	0.3	-	2.2
Fourhorn sculpin	2.6	-	-	-	0.6
Ninespine stickleback	-	25.9	86.3	-	28.1
Trout-perch	86.2	-	-	88.8	43.8
Burbot	-	-	0.5	0.6	0.3

Appendix Table 82. Percentage use of insects as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September	October	November	Average
Lake herring	-	-	<0.1	<0.1
Bloater	4.2	1.4	-	1.9
Lake whitefish	0.4	-	-	0.1
Shortjaw cisco	0.4	-	-	0.1
Round whitefish	-	82.3	9.1	30.5
Lake trout	9.9	-	0.1	3.3
American smelt	10.5	-	-	3.5
Slimy sculpin	3.8	16.3	22.5	14.2
Spoonhead sculpin	0.1	-	-	<0.1
Ninespine stickleback	69.9	-	-	23.3
Trout-perch	0.8	-	63.8	21.5
Burbot	-	-	<0.1	<0.1
Johnny darter	-	-	3.6	1.2
Spottail shiner	-	-	0.8	0.3

Appendix Table 83. Percentage use of insects as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June	July	December	Average
Lake herring	0.1	-	-	<0.1
Bloater	7.7	-	-	2.6
Lake whitefish	0.6	0.2	56.0	18.9
Pygmy whitefish	0.2	-	-	0.1
Round whitefish	0.6	17.6	-	6.1
Lake trout	11.0	0.1	-	3.7
American smelt	64.1	<0.1	-	21.4
Longnose sucker	<0.1	-	-	<0.1
Slimy sculpin	0.4	0.9	-	0.4
Mottled sculpin	0.1	-	-	<0.1
Ninespine stickleback	0.6	81.1	-	27.2
Trout-perch	14.6	-	44.0	19.5

Appendix Table 84. Percentage use of insects as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July	September	November	Average
Bloater	3.2	1.8	-	1.7
Lake whitefish	7.8	0.1	-	2.6
Round whitefish	1.4	0.2	35.4	12.3
Lake trout	5.7	0.1	0.1	2.0
American smelt	22.0	32.6	-	18.2
Longnose sucker	-	0.1	-	<0.1
White sucker	-	0.1	-	<0.1
Slimy sculpin	1.3	5.6	36.7	14.5
Spoonhead sculpin	0.1	<0.1	-	<0.1
Ninespine stickleback	58.5	3.5	-	20.7
Trout-perch	-	55.9	27.8	27.9
Burbot	-	<0.1	-	<0.1

Appendix Table 85. Percentage use of fish as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April	June	November	Average
Lake trout	1.7	6.0	100.0	35.9
American smelt	97.2	82.2	-	59.8
Burbot	1.1	11.8	-	4.3

Appendix Table 86. Percentage use of fish as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April	May	June	July	September	November	Average
Lake trout	1.1	-	-	-	0.5	-	0.3
American smelt	98.2	76.2	65.9	71.5	93.9	-	81.1
Burbot	0.7	23.8	34.1	-	5.6	-	12.8
Lake chub	-	-	-	28.5	-	-	5.7

Appendix Table 87. Percentage use of fish as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April	May	July	Average
Lake trout	-	11.9	-	4.0
American smelt	94.2	88.1	100.0	94.1
Burbot	5.8	-	-	1.9

Appendix Table 88. Percentage use of fish as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Lake trout	63.9	100.0	100.0	88.0
Burbot	36.1	-	-	12.0

Appendix Table 89. Percentage use of fish as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Lake trout	51.8	73.2	-	-	31.2
American smelt	-	26.8	100.0	1.7	32.1
Burbot	48.2	-	-	98.3	36.6

Appendix Table 90. Percentage use of fish as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Lake trout	70.7	100.0	-	56.9
American smelt	-	-	100.0	33.3
Burbot	29.3	-	-	9.8

Appendix Table 91. Percentage use of fish as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	Average
Lake trout	-	81.8	81.8
American smelt	-	18.2	18.2

Appendix Table 92. Percentage use of fish as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Lake trout	-	75.4	36.2	3.7	28.8
American smelt	-	24.6	63.8	78.3	41.7
Burbot	100.0	-	-	18.0	29.5

Appendix Table 93. Percentage use of fish as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Lake trout	51.8	-	8.3	30.0
American smelt	-	-	91.7	45.8
Burbot	48.2	-	-	24.1

Appendix Table 94. Percentage use of fish as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Lake trout	-	90.0	56.3	73.2
American smelt	-	10.0	43.7	26.8

Appendix Table 95. Percentage use of fish as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	July	September	November	Average
Lake trout	-	90.6	10.9	56.5	39.5
American smelt	-	9.4	18.1	36.5	16.0
Burbot	100.0	-	71.0	7.0	44.5

Appendix Table 96. Percentage use of fish as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September	October	November	Average
Lake trout	91.2	-	31.0	40.7
American smelt	8.8	100.0	62.8	57.2
Burbot	-	-	6.2	2.1

Appendix Table 97. Percentage use of fish as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June	July	December	Average
Lake trout	82.5	95.2	100.0	92.6
American smelt	17.5	4.8	-	7.4

Appendix Table 98. Percentage use of fish as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July	September	November	Average
Lake trout	51.1	2.9	8.9	21.0
American smelt	48.9	91.4	91.1	77.1
Burbot	-	5.7	-	1.9

Appendix Table 99. Percentage use of molluscs as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April	June	November	Average
Bloater	2.0	9.7	100.0	37.2
American smelt	85.5	79.0	-	54.8
Longnose sucker	-	7.9	-	2.6
Slimy sculpin	12.3	-	-	4.1
Trout-perch	-	3.4	-	1.1
Burbot	0.1	-	-	<0.1

Appendix Table 100. Percentage use of molluscs as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April	May	June	July	September	November	Average
Bloater	0.5	-	3.6	-	-	100.0	20.8
American smelt	95.8	100.0	85.0	-	95.1	-	75.2
Longnose sucker	-	-	4.4	-	4.9	-	1.9
Slimy sculpin	3.6	-	-	-	-	-	0.7
Trout-perch	-	-	7.0	-	-	-	1.4
Burbot	0.1	-	-	-	-	-	<0.1

Appendix Table 101. Percentage use of molluscs as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	1.4	-	-	0.5
American smelt	95.4	100.0	-	65.1
Longnose sucker	-	-	100.0	33.3
Slimy sculpin	2.3	-	-	0.8
Burbot	0.9	-	-	0.3

Appendix Table 102. Percentage use of molluscs as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Bloater	100.0	35.7	-	45.2
Lake trout	-	64.3	-	21.4
Slimy sculpin	-	-	100.0	33.3

Appendix Table 103. Percentage use of molluscs as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	77.4	-	12.4	29.9
Lake trout	-	2.4	-	-	0.8
American smelt	-	20.2	1.1	0.5	7.3
Slimy sculpin	-	-	98.9	87.1	62.0

Appendix Table 104. Percentage use of molluscs as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	-	100.0	-	50.0
Pygmy whitefish	-	-	0.4	0.2
American smelt	-	-	0.4	0.2
Slimy sculpin	-	-	99.2	49.6

Appendix Table 105. Percentage use of molluscs as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	Average
Bloater	100.0	18.4	59.2
Pygmy whitefish	-	2.8	1.4
Lake trout	-	12.8	6.4
American smelt	-	65.5	32.8
Burbot	-	0.5	0.2

Appendix Table 106. Percentage use of molluscs as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	5.5	-	12.4	6.0
Pygmy whitefish	-	-	0.5	-	0.2
Lake trout	-	11.1	-	6.4	5.8
American smelt	-	83.4	87.3	74.8	81.8
Slimy sculpin	-	-	12.2	6.4	6.2

Appendix Table 107. Percentage use of molluscs as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
American smelt	-	-	93.4	93.4
Slimy sculpin	-	-	6.6	6.6

Appendix Table 108. Percentage use of molluscs as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Bloater	-	4.9	-	2.4
Lake whitefish	-	18.6	12.5	15.6
Pygmy whitefish	-	3.3	0.8	2.0
Lake trout	-	20.4	-	10.2
American smelt	-	52.5	55.0	53.8
Slimy sculpin	-	-	31.7	15.8
Burbot	-	0.3	-	0.2

Appendix Table 109. Percentage use of molluscs as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	July	September	November	Average
Bloater	-	-	16.0	-	5.3
Lake trout	-	-	5.5	-	1.8
American smelt	-	53.6	50.3	-	34.6
Slimy sculpin	-	46.4	28.2	-	24.9
Burbot	-	-	-	100.0	33.3

Appendix Table 110. Percentage use of molluscs as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September	October	November	Average
Bloater	10.0	-	-	3.3
Lake whitefish	11.0	-	-	3.7
Round whitefish	-	95.7	98.1	64.6
Lake trout	47.6	-	-	15.9
American smelt	25.3	-	-	8.4
Slimy sculpin	6.1	4.3	-	3.5
Burbot	-	-	1.9	0.6

Appendix Table 111. Percentage use of molluscs as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June	July	December	Average
Bloater	16.5	-	-	5.5
Lake whitefish	0.6	75.0	84.5	53.4
Pygmy whitefish	0.1	-	-	<0.1
Lake trout	14.1	-	15.5	9.9
American smelt	68.6	5.0	-	24.5
Slimy sculpin	-	20.0	-	6.7

Appendix Table 112. Percentage use of molluscs as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July	September	November	Average
Bloater	-	4.5	-	1.5
Lake whitefish	32.6	2.1	-	11.6
Round whitefish	-	0.5	100.0	33.5
Lake trout	-	0.5	-	0.2
American smelt	67.0	82.3	-	49.8
Longnose sucker	-	0.4	-	0.1
White sucker	-	0.4	-	0.1
Slimy sculpin	0.4	9.4	-	3.3

Appendix Table 113. Percentage use of fish eggs as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1966.

Species	April	June	November	Average
Bloater	5.2	-	100.0	35.1
American smelt	54.1	86.6	-	46.9
Longnose sucker	1.2	-	-	0.4
White sucker	0.1	-	-	<0.1
Slimy sculpin	38.8	12.9	-	17.2
Spoonhead sculpin	0.6	0.5	-	0.4
Burbot	<0.1	-	-	<0.1

Appendix Table 114. Percentage use of fish eggs as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1967.

Species	April	May	June	July	September	November	Average
Bloater	1.8	-	-	-	-	100.0	25.4
American smelt	82.1	-	91.8	-	-	-	43.5
Longnose sucker	0.5	-	-	-	-	-	0.1
Slimy sculpin	15.5	100.0	7.2	-	-	-	30.7
Spoonhead sculpin	-	-	0.9	-	-	-	0.2
Burbot	<0.1	-	-	-	-	-	<0.1

Appendix Table 115. Percentage use of fish eggs as food by trawl-caught fish at Station 112 in the Duluth-Superior area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	4.8	-	-	2.4
Pygmy whitefish	-	57.1	-	28.6
American smelt	78.9	-	-	39.4
Slimy sculpin	9.6	42.9	-	26.2
Spoonhead sculpin	0.4	-	-	0.2
Burbot	0.4	-	-	0.2
Walleye	6.0	-	-	3.0

Appendix Table 116. Percentage use of fish eggs as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Bloater	3.8	0.8	24.3	9.6
Kiyi	0.5	-	-	0.2
Shortjaw cisco	0.5	-	-	0.2
Pygmy whitefish	0.5	-	-	0.2
Lake trout	0.3	1.5	-	0.6
American smelt	4.2	-	-	1.4
Slimy sculpin	52.0	97.7	75.7	75.1
Spoonhead sculpin	0.5	-	-	0.2
Ninespine stickleback	37.7	-	-	12.6
Burbot	0.1	-	-	<0.1

Appendix Table 117. Percentage use of fish eggs as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	28.6	33.3	-	15.5
Lake trout	0.6	0.9	-	-	0.4
American smelt	-	-	-	100.0	25.0
Slimy sculpin	93.4	70.5	66.7	-	57.6
Fourhorn sculpin	4.7	-	-	-	1.2
Burbot	1.2	-	-	-	0.3

Appendix Table 118. Percentage use of fish eggs as food by trawl-caught fish at Station 35 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Bloater	-	5.3	14.7	6.7
Lake trout	0.9	0.7	-	0.5
American smelt	-	1.7	-	0.6
Slimy sculpin	97.1	72.7	85.3	85.0
Spoonhead sculpin	0.7	-	-	0.2
Fourhorn sculpin	0.4	-	-	0.1
Ninespine stickleback	-	19.5	-	6.5
Burbot	0.8	-	-	0.3

Appendix Table 119. Percentage use of fish eggs as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	Average
Bloater	0.3	42.9	21.6
Pygmy whitefish	2.1	-	1.0
Lake trout	-	28.9	14.4
American smelt	54.4	-	27.2
Slimy sculpin	28.5	26.2	27.4
Ninespine stickleback	14.7	-	7.4
Burbot	-	1.2	0.6

Appendix Table 120. Percentage use of fish eggs as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	June	July	September	Average
Bloater	-	12.4	13.2	-	6.4
Pygmy whitefish	46.4	-	-	-	11.6
Lake trout	-	25.1	-	-	6.3
American smelt	-	-	-	100.0	25.0
Slimy sculpin	49.8	62.5	86.8	-	49.8
Fourhorn sculpin	0.5	-	-	-	0.1
Burbot	3.3	-	-	-	0.8

Appendix Table 121. Percentage use of fish eggs as food by trawl-caught fish at Station 12 in the Apostle Islands area of western Lake Superior in 1968.

Species	April	May	July	Average
Pygmy whitefish	-	11.0	-	3.7
Lake trout	0.4	-	-	0.1
American smelt	-	14.4	-	4.8
Slimy sculpin	86.7	5.5	100.0	64.1
Spoonhead sculpin	9.7	-	-	3.2
Fourhorn sculpin	2.3	-	-	0.8
Ninespine stickleback	-	69.0	-	23.0
Burbot	0.8	-	-	0.3

Appendix Table 122. Percentage use of fish eggs as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1966.

Species	May	June	July	Average
Bloater	-	8.4	22.1	10.2
Lake trout	-	35.2	-	11.7
American smelt	28.5	-	-	9.5
Slimy sculpin	55.7	55.8	77.9	63.1
Ninespine stickleback	15.8	-	-	5.3
Burbot	-	0.5	-	0.2

Appendix Table 123. Percentage use of fish eggs as food by trawl-caught fish at Station 75 in the Apostle Islands area of western Lake Superior in 1967.

Species	April	July	September	November	Average
Bloater	-	30.9	-	75.2	26.5
Lake trout	-	-	-	18.8	4.7
American smelt	-	-	100.0	-	25.0
Slimy sculpin	94.4	69.1	-	3.2	41.7
Spoonhead sculpin	1.6	-	-	-	0.4
Fourhorn sculpin	0.8	-	-	-	0.2
Burbot	3.2	-	-	3.2	1.6

Appendix Table 124. Percentage use of fish eggs as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1965.

Species	September	October	November	Average
Lake herring	-	-	5.1	1.7
Round whitefish	-	-	76.0	25.3
Lake trout	-	-	1.2	0.4
American smelt	100.0	-	-	33.3
Slimy sculpin	-	-	17.5	5.8
Burbot	-	-	0.3	0.1

Appendix Table 125. Percentage use of fish eggs as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1966.

Species	June	July	December	Average
Bloater	49.7	-	-	16.6
Lake whitefish	-	-	37.5	12.5
Lake trout	42.5	-	-	14.2
Slimy sculpin	7.8	100.0	62.5	56.8

Appendix Table 126. Percentage use of fish eggs as food by trawl-caught fish at miscellaneous stations in the Apostle Islands area of western Lake Superior in 1967.

Species	July	September	November	Average
Bloater	84.2	-	0.7	28.3
Round whitefish	-	-	90.4	30.1
Lake trout	-	-	0.2	0.1
American smelt	-	100.0	-	33.3
Slimy sculpin	15.8	-	8.7	8.2