

**Species Composition of Deep-water Ciscoes
(Chubs) in Commercial Catches
From Michigan Waters of Lake Superior**

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Fisheries Research Report No. 1849
October 18, 1977

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION

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SPECIES COMPOSITION OF DEEP-WATER CISCOES (CHUBS)
IN COMMERCIAL CATCHES FROM MICHIGAN WATERS
OF LAKE SUPERIOR¹ ↓

By James W. Peck

ABSTRACT

I determined the species composition of deep-water ciscoes (chubs) in commercial catches from fishing grounds west, north and east, of the Keweenaw Peninsula in Statistical District MS-3 during April-May, August-September, and November-January of 1974-76; and near Marquette in Statistical District MS-4 during June, August, and December 1974-76.

Bloaters were the most abundant chub in the total samples from each of the fishing grounds, ranging from 51% at Marquette to 87% at east Keweenaw. Kiyi made up 38-40% of the chubs sampled from west Keweenaw, north Keweenaw, and Marquette, but only 7% of the chubs from the east Keweenaw grounds. Shortjaw ciscoes comprised 6% of the chubs from the fishing grounds around the Keweenaw Peninsula and 11% of the chubs sampled at Marquette. No shortnose or blackfin ciscoes were found in any of the samples. I could not establish any definite differences in the species composition between the three seasonal sampling periods on each fishing ground. There was no observed change in bloater or kiyi composition between years but shortjaw ciscoes were more abundant in 1974 than in either 1975 or 1976 on all fishing grounds and for most seasons. I could not establish species composition by depth interval because the depth range of individual net sets on each ground overlapped. However, bloaters made up a much greater percentage of the catch on the shallower east Keweenaw grounds than they did on the deeper west Keweenaw, north Keweenaw, and Marquette grounds.

¹ ↓ Contribution from Dingell-Johnson Project F-35-R, Michigan.

Introduction

The deep-water ciscoes (Coregonus spp.) collectively referred to as "chubs" by fishermen and many biologists, have recently become one of the most important commercial fish in Lake Superior. More pounds of chubs than any other fish are now landed from Michigan waters of Lake Superior. The decline of chub stocks in the other Great Lakes and closure of the commercial fishery for lake trout (Salvelinus naymacush) and lake herring (Coregonus artedii) in Michigan waters of Lake Superior has created a good demand and an intensive fishery for chubs from Lake Superior. Michigan fishermen have landed about one million pounds annually since 1969.

Deep-water ciscoes in commercial catches from Lake Superior have never been reported by species but simply as "chubs" due to a lack of readily apparent distinguishing characteristics and, to a lesser extent, because of the former unimportance of chubs in the commercial fishery.

Fisheries biologists responsible for Michigan waters of Lake Superior could develop a more sophisticated approach toward managing the chub fishery if chubs were identified as species. Although chub identification requires a degree of subjective analysis, biologists should be cognizant of chub species composition in the commercial catch and how that composition changes with depth and time of year. Age composition, catch-per-unit-effort and other stock parameters should be measured on a species basis unless the population is composed of mainly one species. Although bloaters (Coregonus hoyi) predominated in the Wisconsin commercial chub fishery of the 1960's which operated in 30-50 fathoms (Dryer and Beil 1968), bloaters may not predominate in the current chub fishery in Michigan waters which has been restricted to waters 60 fathoms and deeper since 1974. Dryer (1966) reported that bloaters were most abundant at 40-49 fathoms, then declined with increasing depth. The deeper-dwelling kiyi (C. kiyi) may now be the most abundant cisco in the Michigan chub fishery. Determination of the species composition of chubs in adjacent waters less than 60 fathoms deep, which are closed to

commercial fishing, would provide additional information on how species composition changes with depth, would perhaps determine the extent of movement between the fished and unfished areas during the year and provide an opportunity to evaluate response of chub species composition to the closure.

The species of ciscoes from the Great Lakes have never been easy to identify, but in recent years identification has been even more difficult. Parsons and Todd (1974) attributed this to recent changes in abundance, habits and habitats of the ciscoes, and the known plasticity of the phenotypes. Koelz (1929) thoroughly described nine species of ciscoes from the Great Lakes of which five were deep-water ciscoes identified from Lake Superior (bloater, C. hoyi; kiyi, C. kiyi; shortjaw cisco, C. zenithicus; shortnose cisco, C. reighardi; and blackfin cisco, C. nigripinnis). Although this classification and these descriptions were accepted as standard for Great Lakes ciscoes, some of these species are now rare or extinct and some recent specimens do not fit any of the Koelz descriptions. Parsons and Todd (1974) reported that the shortnose and blackfin ciscoes have not been found in recent collections from Lake Superior. They also found that specimens of bloater and kiyi exhibited an intergradation of taxonomic characteristics which suggested that these two forms may be of a single species. Consequently, Mr. Thomas Todd of the U.S. Fish and Wildlife Service has been reexamining cisco speciation in the Great Lakes at the Great Lakes Fisheries Laboratory in Ann Arbor, Michigan.

The objectives of my study were to: (1) determine the species composition of chubs at various depths and times of year in commercial catches on important chub fishing grounds, and on adjacent grounds shallower than 60 fathoms which have been closed to commercial chub fishing since 1973, (2) work toward mutual agreement on chub identification with other biologists responsible for chub research and management to provide comparable data on species composition.

Methods

One or two boxes of net-run (ungraded) chubs from the fishing grounds east, west and north of the Keweenaw Peninsula (MS-3) and at Marquette (MS-4) were collected during April-June, August-September, and November-January from either the Lake Superior Fisheries in Hancock or Thill Fisheries in Marquette. A box contained approximately 100 chubs. Chubs from adjacent waters less than 60 fathoms deep were to have been captured by Department of Natural Resources fisheries personnel during the same time periods but none were collected due to commitments to other assignments.

I identified most of the chubs at the fisherman's dock or wholesale house. A few specimens could not immediately be identified and were retained for a more intensive examination either at the Marquette Fisheries Research Station or the Great Lakes Fisheries Laboratory. These fish were either frozen or preserved in 10% formalin. Mr. Richard Schorfhaar or Mr. Richard Jansen of the Marquette Great Lakes Station assisted me with the identification. I based my identification of ciscoes on characteristics described by Koelz (1929) and by Parsons and Todd (1974) as interpreted by Mr. Thomas Todd at the Great Lakes Fisheries Laboratory. Mr. Todd participated in the examination of ciscoes during the May and December 1974 sampling periods and demonstrated what he considered to be distinguishing characteristics for cisco species in Lake Superior.

Bloater, kiyi, and blackfin cisco are distinguished from shortnose cisco and shortjaw cisco by longer and more numerous gill rakers and a prognathous lower jaw (mandible). Shortnose and shortjaw ciscoes typically have fewer and very short gill rakers and a lower jaw which is shorter or nearly equal in length to the upper jaw.

Blackfin ciscoes were distinguished from bloater and kiyi by more numerous gill rakers and heavily pigmented paired fins. The distinction between bloater and kiyi was not clear. According to Koelz (1929), bloaters have fewer gill rakers, shorter fins, smaller eyes and are not as darkly pigmented as kiyi. However, bloaters and kiyi in recent

collections exhibited such intergradation of these characteristics that Parsons and Todd (1974) believed they may be two forms of the same species. Management biologists and I have separated bloaters and kiyi in the samples we examined based on the following, rather subjective, characteristics. We labeled as kiyi, those chubs with a prognathous lower jaw, gill rakers of medium length, pelvic fins that were long enough to touch the anus or the unscaled area around the anus, and a relatively large eye. Bloaters were identified as those prognathous-jawed chubs with medium to long gill rakers, short fins and small-to-medium sized eye.

There appears to be no good external characteristic for separating shortnose and shortjaw ciscoes. Parsons and Todd (1974) indicated that relatively shorter, paired fins and dark pigment on the tip of the snout of the shortnose cisco are the major characteristics distinguishing it from the shortjaw cisco which has relatively longer fins and a lightly pigmented snout tip.

Results

I found only bloater, kiyi and shortjaw cisco in the commercial chub catches sampled during 1974-76. There were no blackfin ciscoes or shortnose ciscoes in the samples. A few heavily pigmented chubs were encountered but these were identified as kiyi rather than blackfin ciscoes. Mr. Todd identified a few shortnose ciscoes in some samples examined in early 1974 based on gonad condition. Those that would spawn in the spring were believed to be shortnose ciscoes whereas shortjaw ciscoes are typically fall spawners. However, Todd (personal communication) subsequently concluded that these spring spawners were just a form of shortjaw. A few kiyi with a short lower jaw were collected and sent to Mr. Todd who confirmed they were kiyi. A few lake herring were in the chub samples, but fishermen generally recognize herring and sort them from the catch.

I found that bloaters were the most abundant chub in all the samples from each of the fishing grounds (Tables 1 and 2), ranging from 51% at Marquette to 87% at east Keweenaw. Kiyi made up 38-40% of the chubs

sampled from west Keweenaw, north Keweenaw and Marquette and even predominated in the September 1975 sample from west Keweenaw and the December 1974 sample from Marquette. Only 7% of the chubs from east Keweenaw were kiyi. Shortjaw ciscoes comprised 6% of the chubs sampled west, north and east of the Keweenaw Peninsula and 11% of those sampled at Marquette.

I could not definitely establish any difference in species composition between seasons on any of the fishing grounds. Bloater abundance was lower during August-September on the east Keweenaw and Marquette grounds but was highest during this period on the west Keweenaw and north Keweenaw grounds. I suspect that my sampling was inadequate to detect any but the most obvious seasonal changes in species composition.

I did not observe any change in bloater or kiyi composition between years but shortjaw ciscoes were more abundant in 1974 than in either 1975 or 1976 on all fishing grounds and for most seasons. It is possible that some kiyi with the short lower jaw were mistakenly called shortjaw ciscoes during that first year of sampling. It is also possible the decline of shortjaw ciscoes is fictitious, resulting from the small sample size, sampling different depths and sampling different grids on the same fishing ground.

Bloaters made up practically all of the catch on the shallowest ground (east Keweenaw) and kiyi were almost as abundant as bloaters on the deeper west Keweenaw, north Keweenaw, and Marquette fishing grounds. I could not establish species composition by depth interval on the same ground because the depth range of an individual net set was generally extensive and overlapped other nets.

Discussion

Chubs on the east Keweenaw grounds were almost all bloaters and these grounds can be managed as a single-species fishery. Management on the other grounds where bloaters and kiyi are nearly equal in abundance will require that changes in abundance of each species be considered in setting commercial catch quotas for the chub fishery. Bloaters and kiyi may eventually be managed as a single species if either a current U.S. Fish

and Wildlife study on taxonomy reveals that they are one species, or an ongoing Michigan Department of Natural Resources study (Dingell-Johnson F-35-R, Group 5, Study XII) concludes that the age composition and mortality rates for bloaters and kiyi are similar.

Acknowledgments

I am especially grateful to Thomas N. Todd of the U.S. Fish and Wildlife Service (Great Lakes Fisheries Laboratory) in Ann Arbor, Michigan, who instructed Marquette Great Lakes Station personnel and myself in chub species identification and identified those specimens which baffled us. Richard G. Schorfhaar and Richard Jansen of the Marquette Great Lakes Station assisted in the identification of the chub samples. I appreciate the editorial suggestions offered by William C. Latta and Mercer H. Patriarche. Doris S. Greenleaf and Margaret S. McClure typed the manuscript.

Table 1.--Species composition (percent) of deep-water ciscoes (chubs) in commercial catches from fishing grounds west, north and east of the Keweenaw Peninsula (MS-3) during April-May, August-September, and November-January, 1974-76.

Fishing ground and date	Grids	Depth range (feet)	Number examined	Species composition		
				Bloater	Kiyi	Shortjaw
<u>West Keweenaw</u>						
May 1974	1119	384-504	129	50	27	23
Apr 1975	920, 1021	456-660	430	49	48	3
Apr 1976	1020	480-624	352	62	34	4
Apr-May Total			911	54	40	6
Aug 1974	1118	474-528	109	64	28	8
Sep 1975	1119	444-480	189	46	50	4
Sep 1976	920	510-600	110	58	39	3
Aug-Sep Total			408	54	41	5
Fishing Ground Total			1319	54	40	6
<u>North Keweenaw</u>						
May 1974	927, 1029	420-540	247	45	41	14
Apr 1975	1029	480-570	474	47	46	7
Apr 1976	930	540-660	219	49	48	3
Apr-May Total			940	47	45	8
Aug 1974	927, 1028	420-540	337	74	22	4
Sep 1975	1028, 1029	390-552	417	47	47	6
Sep 1976	928	510-570	112	77	23	0
Aug-Sep Total			866	61	34	5
Dec 1974	928	420-540	69	52	48	0
Fishing Ground Total			1875	54	40	6
<u>East Keweenaw</u>						
May 1974	127, 1128	300-360	316	96	2	2
Apr 1975	1126	360-450	513	84	8	8
Apr 1976	1127, 1226	360-480	384	86	9	5
Apr-May Total			1213	88	7	5
Sep 1974	1126	360-510	245	78	12	10
Sep 1975	1127	360-492	469	83	8	9
Sep 1976	1226	360-504	128	79	12	9
Sep Total			842	81	10	9
Dec 1974	1128, 1225	360-480	280	90	3	7
Jan 1976	1126	390-420	230	95	4	1
Nov 1976	1127	360-390	144	96	1	3
Nov-Jan Total			654	93	3	4
Fishing Ground Total			2709	87	7	6

Table 2. --Species composition (percent) of deep-water ciscoes (chubs) in commercial catches from the Marquette fishing ground (MS-4) during June, August and September 1974-76.

Date	Grids	Depth range (feet)	Number examined	Species composition		
				Bloater	Kiyi	Shortjaw
June 1975	1431	420	134	55	31	14
June 1976	1331	468-504	122	53	47	0
June Total			256	54	39	7
Aug 1974	1430	378-420	216	36	33	31
Aug 1975	1329	480	113	57	41	2
August Total			329	43	36	21
Dec 1974	1430	384	153	37	56	7
Dec 1975	1429	420-450	104	75	18	7
Dec 1976	1430	420-498	91	70	29	1
December Total			348	57	38	5
Fishing Ground Total			933	51	38	11

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Report approved by W. C. Latta

Typed by M. S. McClure