

**Fishes of Offshore Waters and
Tuktoyaktuk Vicinity
Final Report of Beaufort Sea Project
Study # 7
D. F. Galbraith and J. G. Hunter
1975**

J. N. STEIN

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1. SUMMARY

In the years 1973-1975 the fish populations of the inshore waters in the vicinity of Tuktoyaktuk and the offshore waters of the southern Beaufort Sea, were investigated from shore camps, the M/V *Salvelinus* and the M/V *Theta*. Gill-nets, seines, bottom trawls, and midwater trawls were used to obtain specimens.

The most abundant fish in the Tuktoyaktuk vicinity were *Coregonus autumnalis*, *C. alpestris*, *C. nasus*, *C. sardinella*, *Stenodus leucichthys* and *Osmerus mordax*. All exhibit varying degrees of anadromy in arctic waters and all disperse widely during their stay in coastal waters. Several marine forms were found within the influence of the Mackenzie River but only *Clupea harengus pallasii* contributed notably to native fish catches.

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HEARING

In the offshore waters, juveniles of *Boreogadus saida* were found to be the most abundant species in the upper water layers down to at least 16 m.

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2. INTRODUCTION

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This report includes the results of three years of field work carried out in the Beaufort Sea. In the summer of 1973 fishing, by means of gill-nets and otter trawls, was conducted at points along the coast of the Tuktoyaktuk Peninsula, roughly between Tibjak Point and Warren Point in order to study the distribution and feeding of fishes in this area.

The study was continued in the summer of 1974 and was extended to cover the coastal waters northeastward along the Tuktoyaktuk Peninsula as far as Atkinson Point. In addition to the summer work of 1974, a gill-netting station was completed in early December to obtain information on the presence and abundance of fish under the ice in early winter.

The 1975 field work commenced in early May when three gill-netting stations were completed in the study area. In the summer of 1975 a study of the major bays along the coast of the peninsula was carried out from Kittigazuit to McKinley Bay.

Offshore midwater trawling studies were carried out in the three years of this work. In 1973, a series of 13 midwater trawls were completed in the Amundsen Gulf from the C.S.S. *Parizeau*. In 1974 and 1975 midwater trawling was carried out in the southern Beaufort Sea from the M/V *Theta* when conditions permitted.

The objectives of this study were to describe in general terms the seasonal distribution of the more important freshwater and

marine species of fish and to determine the biological and environmental factors responsible for this distribution.

3. RESUME OF CURRENT STATE OF KNOWLEDGE

At present, information on the fishery resource in the eastern Beaufort Sea is contained in manuscript reports by Bray (1975) and Hunter (1975). A preliminary account of this project was offered in Galbraith and Fraser (1974).

Several comprehensive treatments of the distribution, taxonomy and biology of the freshwater and anadromous fishes found in the study area are available, notably those of McPhail and Lindsey (1970) and Scott and Crossman (1973). An extensive bibliography of the biology and taxonomy of the marine species can be found in Andriyashev (1954) and the work of Walters (1955). STP

4. METHODS AND SOURCES OF DATA

4.1 Fishing Methods

Gill-nets were usually set in gangs consisting of five 150-foot floating gill-nets of mesh sizes 1½", 2½", 3½", 4½" and 5½" for a 24-hour period. (In 1973 a 2" mesh was substituted for 2½".) Exceptions to this are indicated in the respective tables.

Beach seining was carried out using a 20-foot single panel seine with ½" mesh.

Bottom trawls were made from a 38-foot vessel (M/V *Salvelinus*) using a 25-foot semi-balloon trawl.

Midwater trawling studies were carried out with a 6-foot Isaacs-Kidd Midwater Trawl towed from the C.S.S. *Parizeau* (in 1973) and the M/V *Theta* (in 1974 and 1975).

4.2 Hydrographic Measurements

Temperature and salinity readings were made using a Yellow Spring Instrument Co. YSI model 33 salinometer in 1973. The same meter, used in conjunction with reversing thermometers, was used at several of the stations in 1974. In 1975 temperature recordings were made with reversing thermometers and salinity was determined using a refractometer.

4.3 Fish Processing

Fish were sexed and measurements of fork length, body

weight, testis width, egg diameter and gonad weight were made. Stomachs containing food were preserved for analysis of contents (those from 1975 have not yet been examined). Otoliths for age analysis were removed from most fish caught in 1975.

5. STUDY AREA

In 1973 and 1974, fish were sampled from the water immediately offshore of the Tuktoyaktuk Peninsula near Tibjak Point, Tininerk Bay, Toker Point, Warren Point and Atkinson Point. In 1975 eight bays were studied: one near Kittigazuit, two at Peninsula Point, Tuktoyaktuk Harbour, two large bays between Toker Point and Warren Point, Hutchison Bay and McKinley Bay. Figure 1 shows the gill-netting stations and Figure 2, the bottom trawling and seining stations.

Midwater trawling studies were carried out in Amundsen Gulf (Fig. 3) and the southern Beaufort Sea as far north as 71° (Fig. 4).

6. RESULTS

6.1 The Catch

6.1.1 Tuktoyaktuk Vicinity

A list of the common and scientific names of the anadromous freshwater and marine fish collected in the vicinity of Tuktoyaktuk is presented in Table 1 and the catch at all stations for the three years of the study is given in Table 2.

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~~The most abundant anadromous species found in the area are *Coregonus autumnalis*, *C. scardinea* and *Osmerus mordax*.~~
Combined, these species comprised 68% of the total catch by all fishing methods over the three years of the study. The most abundant marine species taken was *Boreogadus saida* and most of these were juveniles taken in a single bottom trawl near Warren Point. - 10 75-019 - 2 Aug 1975

6.1.1.1 *Lampetra japonica*

A total of five specimens of *L. japonica* were collected in the three years of the study and four of these were attached to fish taken in gill-nets. The other was collected in a bottom trawl near Tibjak Point.

6.1.1.2 *Clupea harengus pallasii* *NEARINE.*

C. harengus pallasii was the most abundant marine species taken in gill-nets but comprised only 14.6% of

the catch. Although absent from all Tibjak stations in July 1973, the species had extended its distribution into Kugmallit Bay by the end of August. The largest catches of *C. harengus pallasii* occurred in Hutchison Bay in August 1975 and near Atkinson Point in late August 1974.

6.1.1.3 *Coregonus autumnalis* A. C.

C. autumnalis comprised 12.7% of the catch and was present at almost all gill-netting and seining stations, though most numerous in the large bay near Toker Point and in Hutchison Bay. Beach seining at any point along the coast usually caught several juveniles of this species. It occurred in catches of fifteen of the nineteen seining stations.

6.1.1.4 *Coregonus clupeaformis* H. B. W.

C. clupeaformis comprised 3.9% of the catch and was seldom caught in the offshore gill-netting stations. Most were taken in Tuktoyaktuk Harbour and in the western bay at Peninsula Point.

6.1.1.5 *Coregonus nasus* B. W.

C. nasus comprised only 3.9% of the catch. Almost all were taken at Kittigazuit, Peninsula Point and Tuktoyaktuk Harbour but several were taken in seines near Tibjak Point and Warren Point.

6.1.1.6 *Coregonus sardinella* L. C.

C. sardinella was the most abundant species collected and comprised 29.3% of the catch. It was collected at most gill-netting and seining stations in all years of the study. The largest catch of *C. sardinella* (692 individuals) was taken in the large outer bay at Toker Point in late July, 1975. The catch of this species generally decreased toward the eastern limits of the study area but 220 individuals were caught 2 miles offshore in the vicinity of Atkinson Point in late August 1974. *C. sardinella* was also gill-netted 2 miles offshore of Tibjak Point in early December 1974.

6.1.1.7 *Stenodus leucichthys*

S. leucichthys comprised 3.0% of the catch. Almost all were collected in the bays at Kittigazuit and Peninsula Point and in Tuktoyaktuk Harbour. This species rarely occurred in the catches at the offshore stations.

6.1.1.8 *Osmernus mordax* R. Smeets.

O. mordax was taken in large numbers in all three years of the study and comprised 16.3% of the catch. The largest catches were taken in gill-nets set offshore from Tibjak Point in 1973 and 1974.

6.1.1.9 *Esox lucius*

Only two *E. lucius* were collected: one in the gill-nets set at Kittigazuit, the other in the gill-nets at Peninsula Point.

6.1.1.10 *Catostomus catostomus*

Only five *C. catostomus* were collected: three in a gill-net at Peninsula Point and two in a seine at Tibjak Point.

6.1.1.11 ^{A. C. no. 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000} *Boreogadus saida*, *Eleginus gracilis* and *Lota lota*

B. saida comprised 20.6% of the total catch but almost all (1468) were juveniles taken in a single bottom trawl offshore from Warren Point in 1973. A total of 14 *E. gracilis* were collected, half of these in a bottom trawl in Tuktoyaktuk Harbour and the other half in a gill net in Hutchison Bay. *Lota lota* was also collected in small numbers and most were collected in bottom trawls offshore from Tibjak Point.

6.1.1.12 ^{لوتو لوتا} *Lycenchyles* sp., ^{ليجوريس} *Lycodes jugoricus* and *L. pallidus*

These three species, all members of the family Zoarcidae, were taken in small numbers. *Lycenchyles* sp. is a new record for the western Arctic and only one was collected. Only two *L. jugoricus* were represented in the catch and these were taken in Tuktoyaktuk Harbour. A total of seven *L. pallidus* were collected, all in the vicinity of Toker Point and Warren Point.

6.1.1.13 *Acantholumpenus mackayi* and *Lumpenus fabricii*

A. mackayi and *L. fabricii* were collected only in Tuktoyaktuk Harbour. A life history study of *A. mackayi* collected 106 individuals in 26 bottom trawls.

6.1.1.14 *Myoxocephalus quadricornis*

This was the most abundant species collected in bottom trawls, other than *B. saida*, and comprised 6.7% of the catch. *M. quadricornis* was invariably taken in gill-nets but was conspicuously absent at Kittigazuit and Peninsula Point.

6.1.1.15 *Liopsetta glacialis* and *Platichthys stellatus*

A total of 66 *L. glacialis* and 48 *P. stellatus* were collected, most of these in seines.

6.1.2 Offshore Waters

A list of the scientific and common names of fishes taken in the midwater trawling studies is given in Table 3.

The catches taken in the midwater trawling studies are presented in Tables 4, 5 and 6. The data collected in 1973 in the Amundsen Gulf is presented here for comparison with the southern Beaufort Sea.

A series of thirteen midwater trawls in the Amundsen Gulf between Banks Island and Parry Peninsula caught a total of 301 *B. saida*, 26 *Eleginus* sp., 6 *Triptops hybridus* and 2 *Liparis koefoedi*. These were taken at depths ranging between 6 and 180 m.

A series of thirteen midwater trawls in the southern Beaufort Sea in 1974 caught mainly freshwater species in small numbers. In 1975 twenty-two midwater trawls were made and approximately 5000 fish larvae collected. Almost all of these were *B. saida* (4027 larvae) but *Gymnocypris tricuspis* (870 larvae) and *Aspidophoroides olivaceus* (216 larvae) were also abundant. An estimated 712,800 m³ of water passed through the opening of the net in the 220 km of towing. Using this estimate, there are 6 juvenile *B. saida* per 1000 m³ of water. The depths at which the net was towed ranged between 1 and 16 m.

6.2 Length Distributions and Growth

6.2.1 *Clupea harengus pallasii*

The length frequency distribution of *C. harengus pallasii* is given in Figure 5. The length frequency distribution appears to be bimodal in 1973 and 1975 with modes at 200 and 300 mm, the latter being the largest. Almost all

individuals collected were between 250 and 330 mm though one individual was 520 mm. Almost all *C. harengus pallasii* were collected in the 1" to 2½" mesh sizes.

The oldest *C. harengus pallasii* aged was 13 years and the youngest 5 years (Fig. 6).

6.2.2 *Coregonus autumnalis*

Lengths ranged from 40 to 500 mm in 1974 and from 100 to 420 mm in 1975 (Fig. 7). Individuals shorter than 120 mm were taken in seines. In 1974 modes occurred at 60, 100, 200, 250, and 350-400 mm. This pattern was somewhat different in 1975 when modes appear only at 220 and 320-340 mm. In 1974 most *C. autumnalis* were collected in the 1½" mesh and in 1975 most were in the 2½" mesh.

The oldest *C. autumnalis* aged was 14 years, the youngest, 6 years, and most were 8 and 9 years (Fig. 8). An average length of only 190 mm was reached by age 6 years and two years later a length of 300 mm was reached. Growth appeared to almost cease after 8 years and by age 14 years a length of 320 mm was attained.

Mortality after 9 years is estimated to be about 55% for males and females combined.

6.2.3 *Coregonus sardinella*

Lengths ranged from 10 to 400 mm but only a few individuals were longer than 270 mm (Fig. 9). There is a definite mode at 200 mm in all years of the study. The mode at 150 mm in 1974 is the result of using a gill-net of mesh size 1" in the last half of the season. Individuals shorter than about 100 mm were taken in seines. Almost all *C. sardinella* were collected in the 1" and 1½" mesh sizes.

Ages ranged from 2 to 13 years with most of the population 8 and 9 years (Fig. 10). Only 6 individuals younger than 5 years were aged but growth appears to be rapid up to age 6 when a length of 200 mm is reached. By age 13 years a length of 250 mm is attained.

Mortality after 8 years is estimated to be 43% for males and females combined.

6.2.4 *Stenodus leucichthys*

Lengths ranged from 150 to 700 mm (Fig. 11). Most were collected in the 2½" and 3½" mesh gill-nets. The oldest individual aged was 20 years and most were between 6 and 12 years (Fig. 12). Ages 6, 10, and 12 dominated the population.

6.2.5 *Osmerus mordax*

Lengths ranged from 40 to 330 mm with a definite mode at 240 mm in all years of the study (Fig. 13). Most *O. mordax* were collected in the 1½" mesh size. Ages ranged from 6 to 13 years and most were 8 years. Mortality rate in the sample is very high and growth of the age groups sampled is extremely slow.

6.3 Sex Composition and Maturity

The number sexed and the percentage male of the most common species for each of the three years of this study is presented in Table 7. In all years with most species there is a slight preponderance of males. Exceptions are *C. harengus pallasii* in 1973 and 1974, *O. mordax* in 1973, *B. saida* in 1973, *E. gracilis* in 1974 and 1975, *M. quadricornis* in 1973 and 1974 and *L. glacialis* in 1975.

A maturity index for *C. harengus pallasii*, *C. autumnalis*, *C. clupeaformis*, *C. nasus*, *C. scardinella*, *S. leucichthys* and *O. mordax* was prepared based on testis widths and egg diameters. The percentages of the female populations of *C. harengus pallasii* and *O. mordax* with egg diameters <0.5, 0.5-0.8 and >0.8 mm were determined. This data is presented in Table 8. The normal spawning size of the eggs of *C. harengus pallasii* is 1.2 to 1.7 mm (Rass 1949) and of *O. mordax* is 1.0 mm (Andriyashev 1954). Most of the females of *C. harengus pallasii* had eggs <0.5 mm and almost all eggs of *O. mordax* were less than 0.5 mm in diameter. Most of the females of these species collected would probably not have spawned in the year of capture.

The percentages of the male populations of Coregonidae with testis widths <5.0, 5.0-10.0 and >10.0 and of the female populations with egg diameter <0.5, 0.5-1.0 and >1.0 mm are presented in Table 9 (cf. Craig and Mann 1974). On the basis that most eggs were less than 0.5 mm in diameter, almost all individuals were judged to be immature and would probably not have spawned in the year of capture.

6.4 Feeding

The only information available on the feeding habits of fishes in the study area was presented in Galbraith and Fraser (1974). Stomachs collected in 1975 have not yet been analyzed.

6.5 Temperature and Salinity Data

Temperature and salinity recordings of the different stations are presented in Table 10.

7. DISCUSSION

According to Hunter (1975), six species of the Coregonidae occur in the western Arctic: *Coregonus autumnalis*, *C. clupeaformis*, *C. nasus*, *C. sardinella*, *Stenodus leucichthys* and *Prosopium cylindraceum*. All but *P. cylindraceum* are migratory and may penetrate into large estuaries, such as that of the Mackenzie River, and feed during the summer months. All species, with the exception of the rarely caught *P. cylindraceum*, contribute heavily to fish catches of the western Arctic.

C. autumnalis spawns in late summer and early autumn in freshwater (McPhail and Lindsey 1970). Individuals which do not spawn in a given year apparently remain in estuarial waters for the duration of the summer and early winter. This species was gill-netted under four feet of ice near Tibjak Point in early December 1974 and one ripe female was collected under eight feet of ice at this same location in early May 1975.

C. clupeaformis is an important species in the domestic catch in Mackenzie Bay. It spawns in freshwater in October and November (Scott and Crossman 1973).

C. nasus occurs mostly in rivers, sometimes in lakes and in some cases is evidently anadromous and enters at least brackish water (McPhail and Lindsey 1970). An upstream spawning run of broad whitefish occurs in July and August in the lower Mackenzie River (Wynne-Edwards 1952) but stocks are available at Kittigazuit from ice break-up in June to at least the middle of September.

C. sardinella is very abundant in the western Northwest Territories. Spawning occurs in October. This species was also found at the Tibjak Point stations in early December and in May although in smaller numbers than in July and August.

S. leucichthys is common in the study area and probably spawns in late summer or early autumn (Scott and Crossman 1973).

The data presented by Hunter (1975, Table 5) show that at Whitefish Station East, near Kittigazuit, *Coregonus nasus* was the commonest species caught, with *C. autumnalis* and *C. sardinella* next most abundant, and *C. clupeaformis* and *Stenodus leucichthys* in moderate numbers. In 1975, in this same area, *S. leucichthys* was the most common, *C. autumnalis*, *C. clupeaformis* and *C. nasus*

were next in abundance, and *C. sardinella* was rare.

At other localities in the present study *C. autumnalis* and *C. sardinella* appeared as the dominant Coregonidae in the catches, suggesting that they may be more tolerant of the higher salinities and lower temperatures found north of Tuktoyaktuk.

The other anadromous species taken in relatively large numbers was *Osmerus mordax*. This species is common in the delta and ascends the Mackenzie as far as Arctic Red River (Hunter 1975).

Although the anadromous Coregonidae and Osmeridae comprise the main catches of fish in the coastal areas of the southeastern Beaufort Sea, some marine species are able to tolerate the wide ranges of salinity and temperature near the delta. The most important is *Clupea harengus pallasii* which occasionally occurs in large numbers at Tuktoyaktuk. In mid-July large numbers of young larvae have been found along Tuktoyaktuk Peninsula (Hunter 1975) suggesting that the inshore migration is concerned primarily with spawning.

Apart from *Myoxocephalus quadricornis*, which is common throughout the study area, the most numerous benthic species taken in the present study was *Boreogadus saida*. However, most were fry which were taken in a single bottom trawl at station 73-019 on 2 August. Although most adults were caught in the warm waters of low salinity in Kugmallit Bay, the fry were taken at comparatively low temperature and high salinity (4.1°C and 16.8‰ at 2 m).

The fishes of offshore waters collected in 1974 were mainly freshwater species. The 1975 midwater trawling studies were more successful in the collection of marine species and approximately 5000 juvenile fish were collected. Three species occurred in considerable abundance: *Boreogadus saida*, *Gymnocanthus tricuspis* and *Aspidophoroides olrikii*. *B. saida* is circumpolar (Andriashev 1954) and is of major importance in the ecosystem of the Arctic Ocean since it is probably a major element of the secondary consumer level in the trophic pyramid (Quast 1974). Andriashev (1954) cites literature records for predation on *B. saida* by a long list of species, including seals, walrus, beluga and sea gulls.

Length frequency distributions and age-length relationships for five of the species collected in the Tuktoyaktuk vicinity are presented in this report. Most of the *C. autumnalis* collected in 1974 were of three length classes 50-100, 190-250 and 350-400 mm while in 1975 only two length classes were observed, 190-230 and 300-350 mm. *C. autumnalis* collected by Craig and Mann (1974) along

the Yukon coast were 320-400 mm while fish smaller than 300 mm were poorly represented and fish less than 200 mm rare. The population of *C. autumnalis* from the Yukon coast ranged in age from 2 to 21 years with most between 7 and 11 years (Craig and Mann 1974). Hatfield *et al.* (1972) report that *C. autumnalis* from the Mackenzie River range in age from 7 to 11 years with age 8 years dominating. In the present study, ages ranged from 6 to 14 years with 8 and 9 years dominating.

Lengths of *C. sardinella* in the present study range from 10-190 mm. The length range observed by Hatfield *et al.* (1972) in the Mackenzie River was 210-380 mm. Ages of *C. sardinella* in the Mackenzie River ranged between 5 and 10 years with 8 years dominating (Hatfield *et al.* 1972) and along the Yukon coast between 1 and 13 years (Mann 1974). In the present study ages ranged between 2 and 13 years with 7, 8 and 9 years dominating. The growth of *C. sardinella* observed in the present study is considerably slower than that observed in the Mackenzie River (Hatfield *et al.* 1972) and along the Yukon coast (Mann 1974).

The length range of *Stenodus leucichthys* observed in the present study was 150-710 mm and ages ranged from 3 to 20 years with 8 to 12 dominating. Growth rate is considerably slower than that observed by Hatfield *et al.* (1972) in the Mackenzie River.

A maturity index comparable to that of Craig and Mann (1974) for *C. autumnalis* was designed for *C. harengus pallasii*, the Coregonidae and *O. mordax*. On the basis of testis width and/or egg diameter it is concluded that most *C. harengus pallasii*, *O. mordax*, *C. autumnalis*, *C. sardinella* and *S. leucichthys* examined were immature and would not have spawned in the year of capture. However, 19.6% of the *C. autumnalis* collected in bays in 1975 may have been mature while 33.9% were perhaps mature non-spawners.

8. CONCLUSIONS

Tentative conclusions concerning the fish populations in the Tuktoyaktuk area and of the Beaufort Sea are as follows:

Rainbow smelt (*Osmerus mordax*) and five species of whitefish most notably Arctic cisco (*Coregonus autumnalis*) and least cisco (*C. sardinella*), are abundant in the vicinity of Tuktoyaktuk. Almost all whitefish and smelt were judged to either immature or would not have spawned in the year of capture. Prespawning fish of the year were not present in the area.

The marine Pacific herring (*Clupea harengus pallasii*) was abundant in both inshore and offshore areas in the vicinity of Tuktoyaktuk. Few were maturing specimens in middle and late summer. Several other marine species occurring in the onshore area are Arctic cod (*Boreogadus saida*), four-horned sculpin (*Myoxocephalus quadricornis*), Arctic flounder (*Liopsetta glacialis*) and starry flounder (*Platichthys stellatus*). The young of these species frequent the shallow inshore areas and the latter three are particularly dependent upon this zone. Capelin, *Mallotus villosus*, though not caught in this investigation, occasionally spawns at about 8°C at the surf line of sandy shores in Mackenzie Bay.

In the offshore waters, *B. saida*, *Gymnocephalus triacuspis* and *Aspidophoroides olivaceus* are abundant. The population estimate for *B. saida*, though tentative, is 6 fish/1000 m³ of water. Sampling was restricted to near surface waters and the real abundance in deeper areas or of larger fish is unknown. Quast (1974) reports that the number of juvenile *B. saida* increased with depth in the eastern Chukchi Sea.

9. IMPLICATIONS AND RECOMMENDATIONS

If drilling in the Beaufort Sea is non productive, the impact of the exercise will be nil. However, should oil be found its impact on the fishes must be considered in the totality of oil exploitation. This would include possible blowouts and spills in the sea, losses from upriver pipeline, bad housekeeping practices by the oil industry and domestic and industrial pollution arising from the inevitable townsites.

If, in a blowout or spill at sea, the oil and its toxic components remain in the surface waters, little harm should come to the fish in offshore areas except for those species which feed on the plankton associated with the undersurface of sea ice. Since this zone will be affected by oil it is expected that major losses of small and larval marine fish and some of the larger anadromous fishes such as arctic charr and rainbow smelt may occur. If the oil is treated to emulsify or sink it then those fish coming in contact with it, either directly or through the food chain, would suffer. It is expected, further, that such treated oil would remain toxic for years and be a cause of fish mortality.

Oil spilled at sea eventually will land on a beach unless otherwise treated (picked up, emulsified, sunk, burned, etc.) and because its

3
degradation is slow will be harmful to fish dependent for some part of their life cycle upon the shallow inshore zone. Important resource species that might be effected are Capelin, four-horned sculpin, Arctic flounder, starry flounder and Pacific herring. Toxic elements that enter the food chain or destroy any part of it will also affect the well-being of the stocks.

Oil spilled upriver from a pipeline mishap will eventually reach the sea. In the river, oil may be adsorbed onto the muddy particulate material and hence endanger freshwater, anadromous and marine fish, both directly and through food links.

Some species of marine fishes along the Beaufort Sea coast have a precarious survival. Under natural environmental conditions they may only produce a successful brood once in several years. For example 90% of the Greenland cod (*Gadus ogac*) in the Cape Parry area were found in earlier studies to consist of a single year class. Similarly the Arctic flounder in Liverpool Bay appears to have major fluctuations in the survival of year classes while the relict species of prickleback in Tuktoyaktuk Harbour, *Acantholumpenus mackayi*, consists mostly of eight year old specimens. The additional stress of an oil catastrophe on these fish requires little amplification.

It is believed that the negative features of oil mishaps, if the oil were untreated by sinkants or emulsifiers, on fish would, in most cases, be of short duration and that the fish stocks would recover. The longevity of most arctic fishes, the many year classes composing a stock and differential distribution between spawning and non-spawning stock and size classes are important features in protecting the species and contributing to its resiliency. Recovery, once the offending oil of a spill were cleaned up, should be fairly rapid. One species might be lost permanently but on the whole most losses, though serious at the time, would not be of long duration.

Recommendations are simplistic. Do not spill or pollute and if you do be prepared to clean it up quickly. The methods of clean up will depend upon the season, faunal requirements and relative importance of the fauna involved and will require on-scene priority decisions.

10. NEEDS FOR FURTHER STUDY

Greater information is needed on the fate and distribution of oil and its lighter toxic components spilled into the waters of the Mackenzie River which is warm, turbulent and muddy during the summer and cold and clear in the winter.

The physical and chemical environment of the surface millimeter of the marine waters of the Beaufort Sea and the rates or reactions possible in this environment need study.

Effect of oil on the fish species involved needs amplification.

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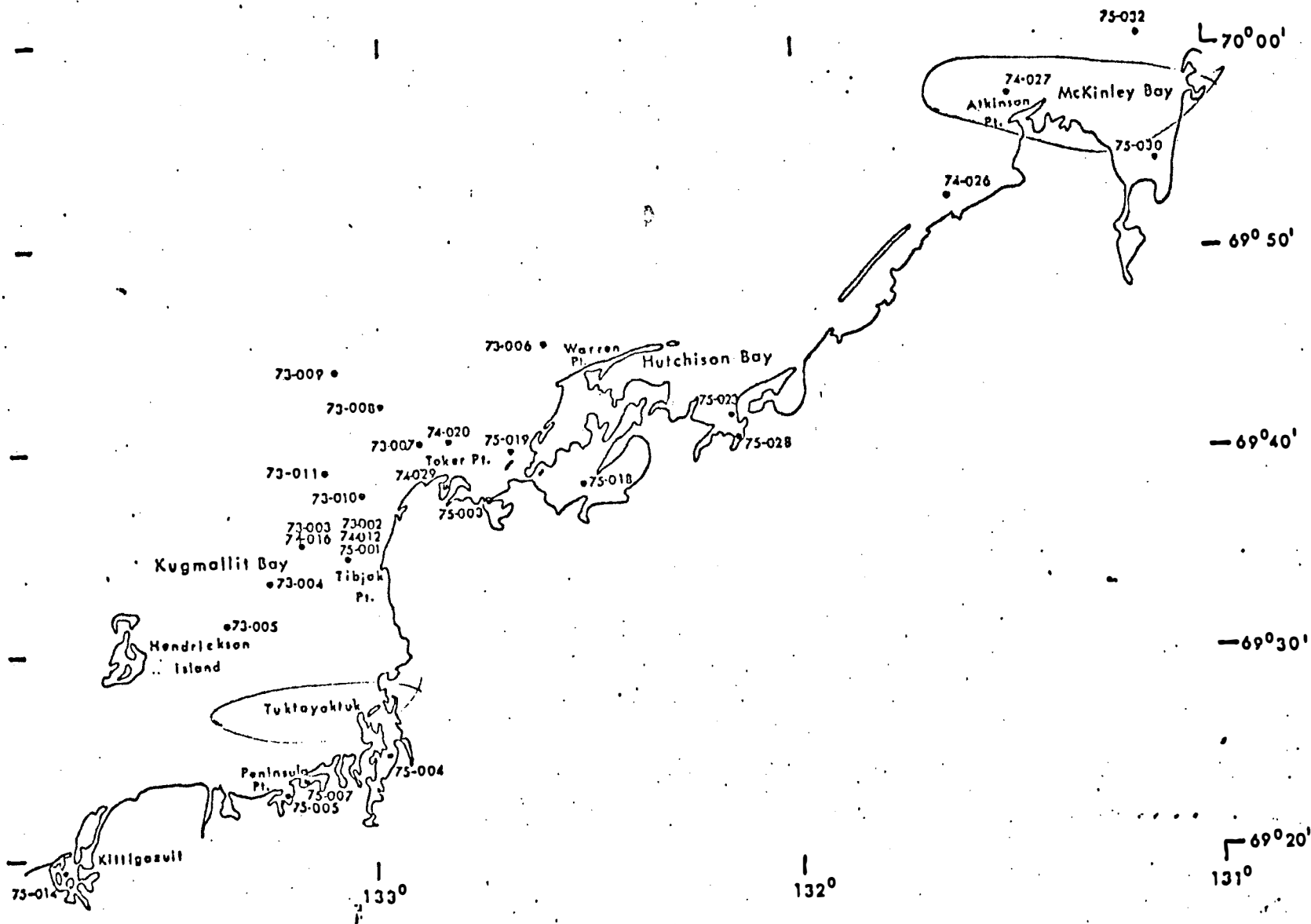


Figure 1. Gill-netting stations in vicinity of Tuktoyaktuk.

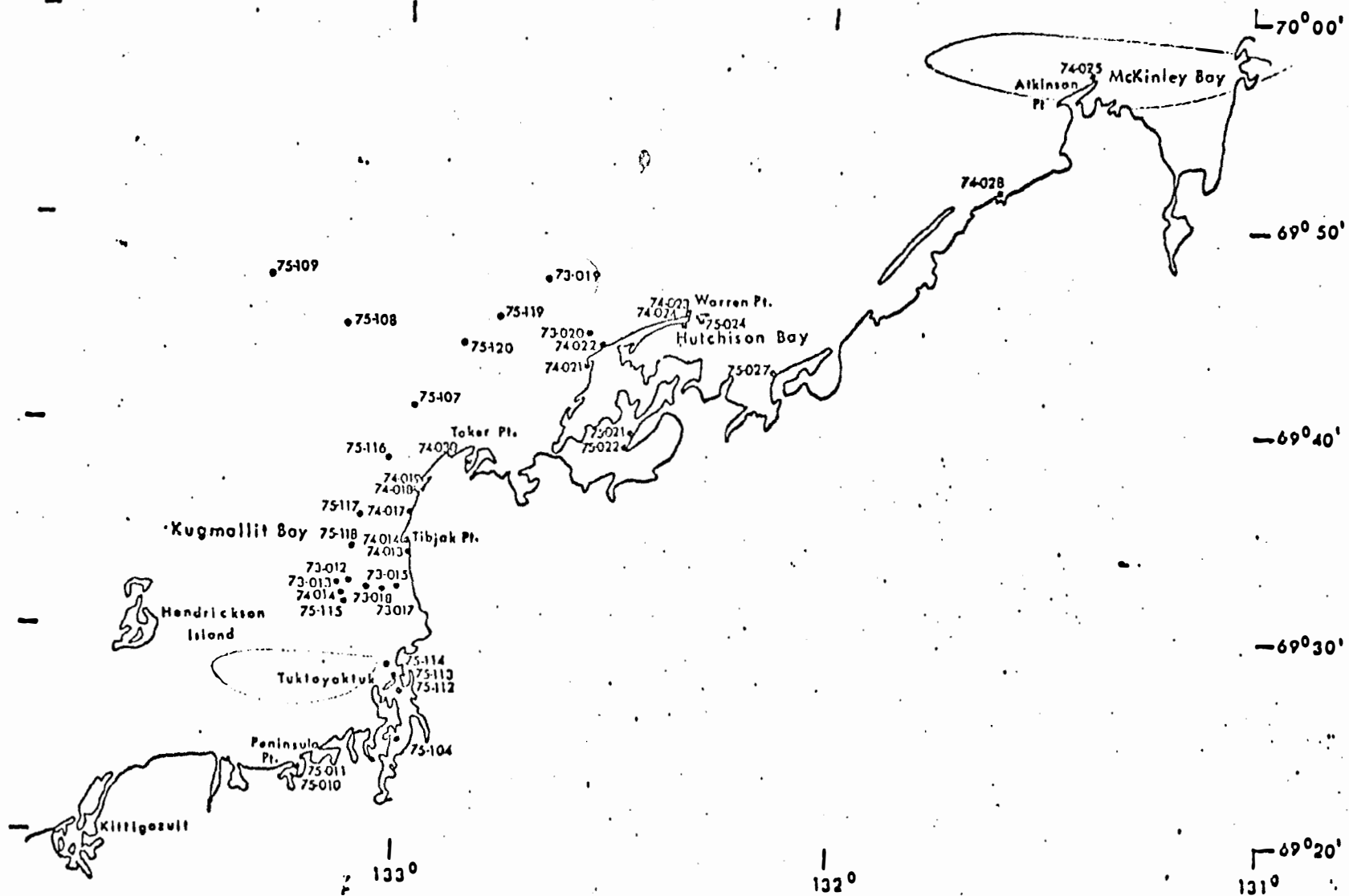


Figure 2. Bottom trawl stations and seining stations in vicinity of Tuktoyaktuk.

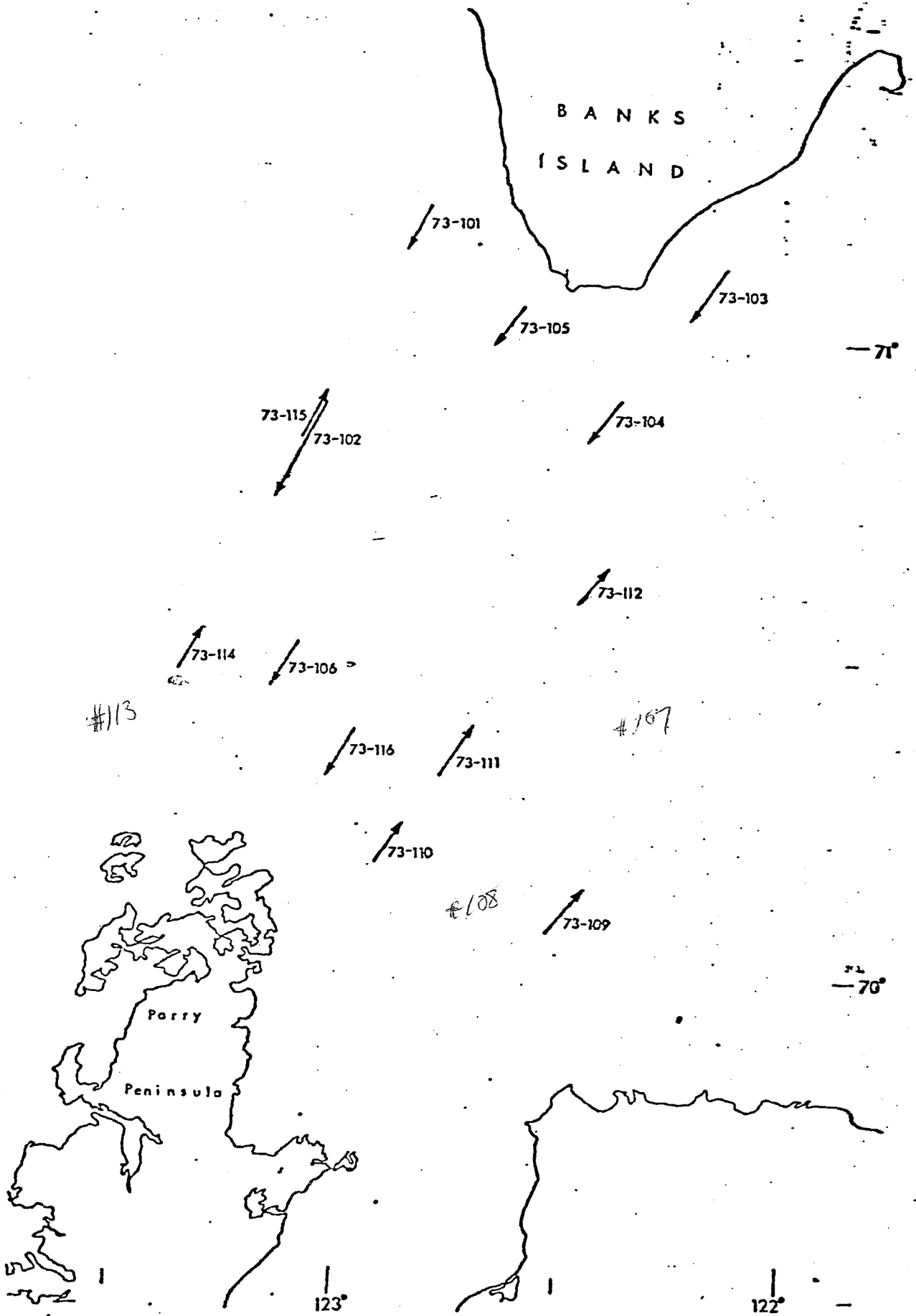


Figure 3. Midwater trawling studies in the Amundsen Gulf, 1973.

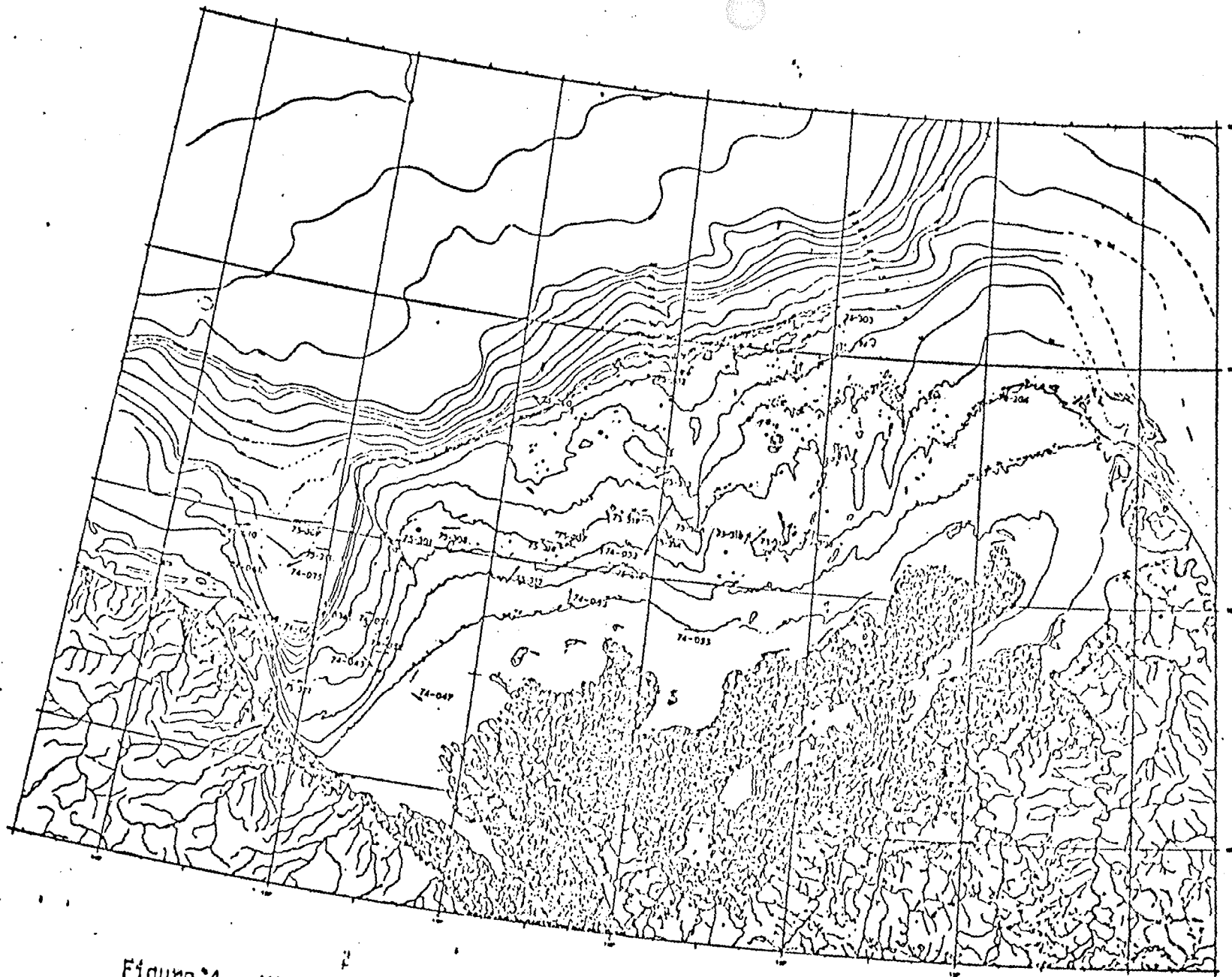


Figure 4. Midwater trawling studies in the southern Beaufort Sea, 1974 and 1976.

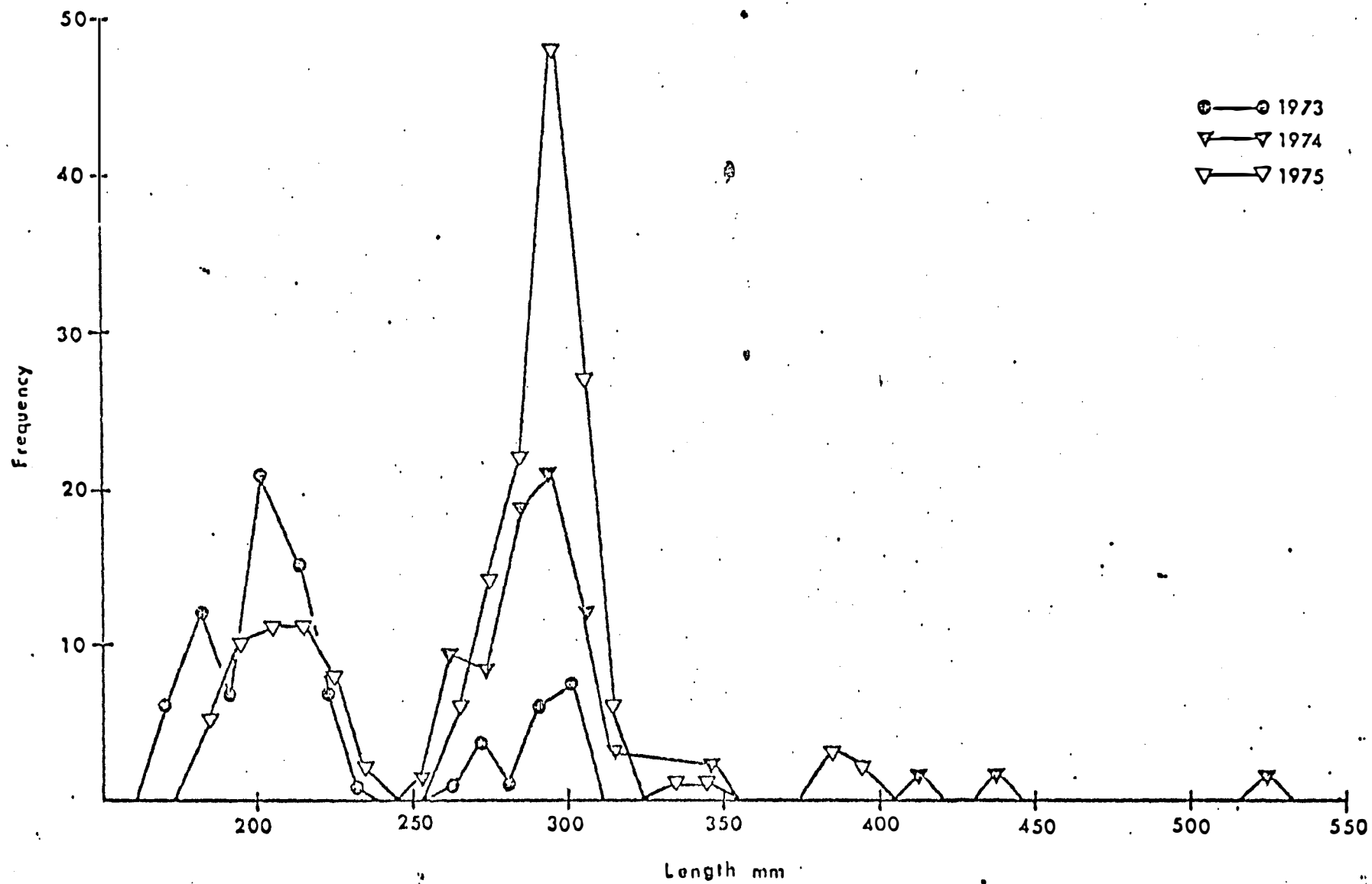


Figure 5. Length frequency distribution of Clupea harengus pallasii.

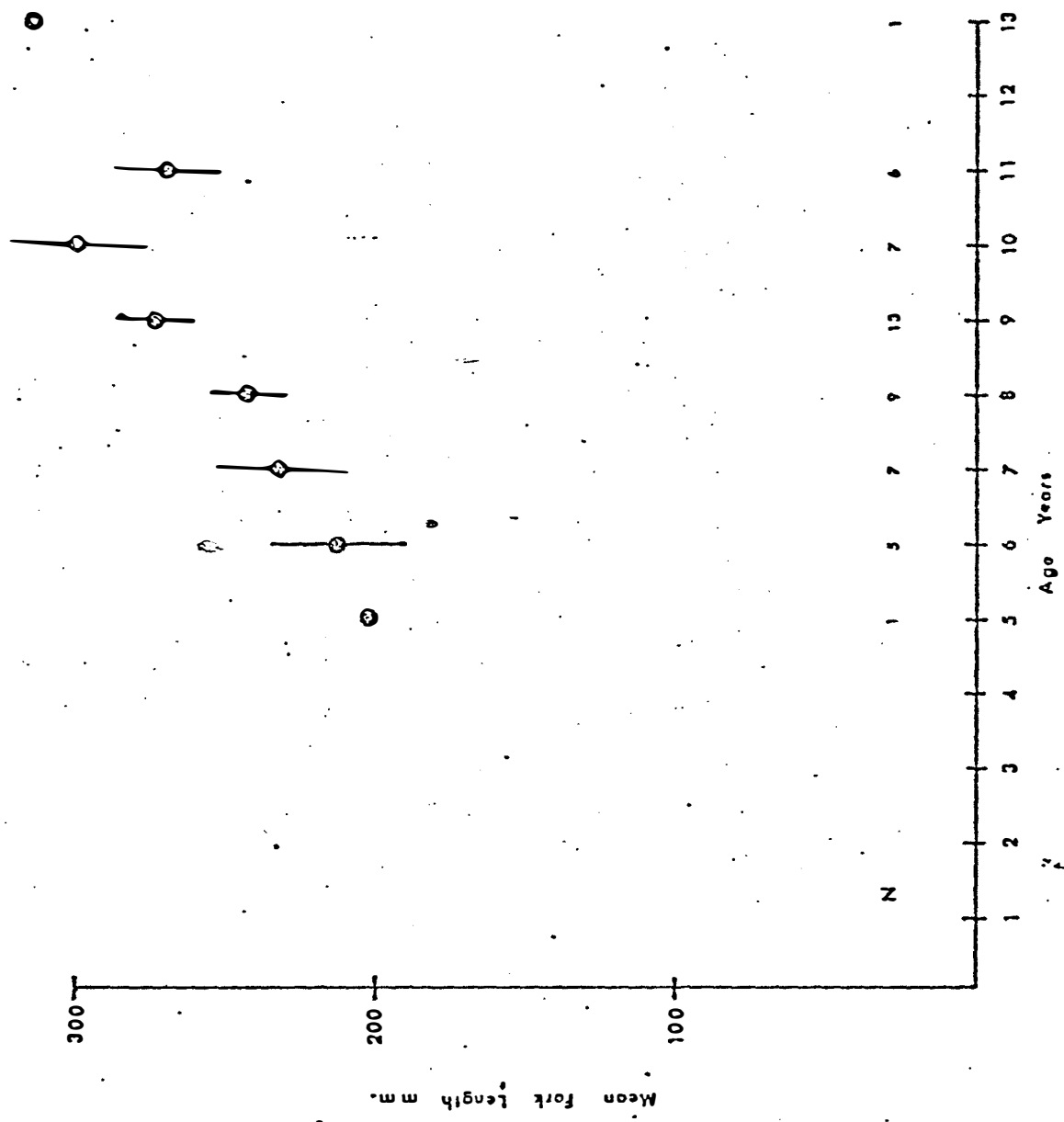


Figure 6. Age and length relationship of Clupea harengus pallasii.

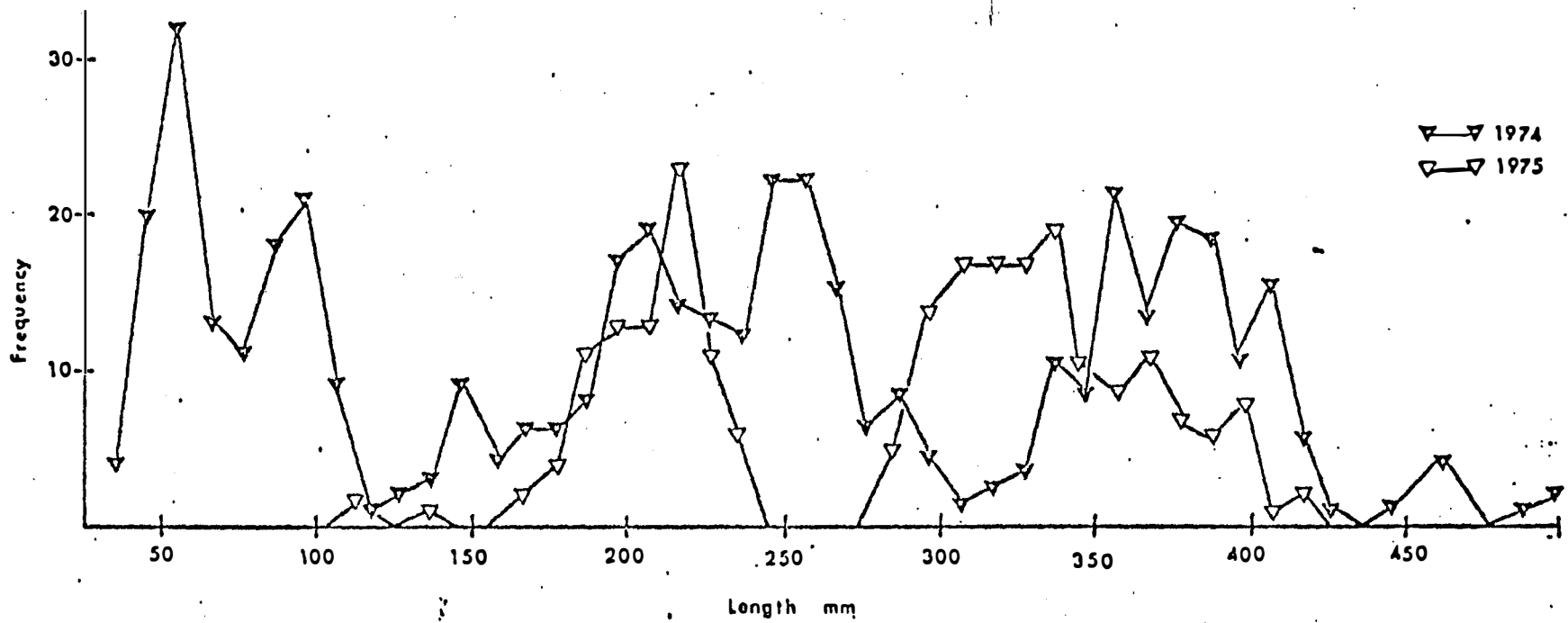


Figure 7. Length frequency distribution of *Coregonus autumnalis*.

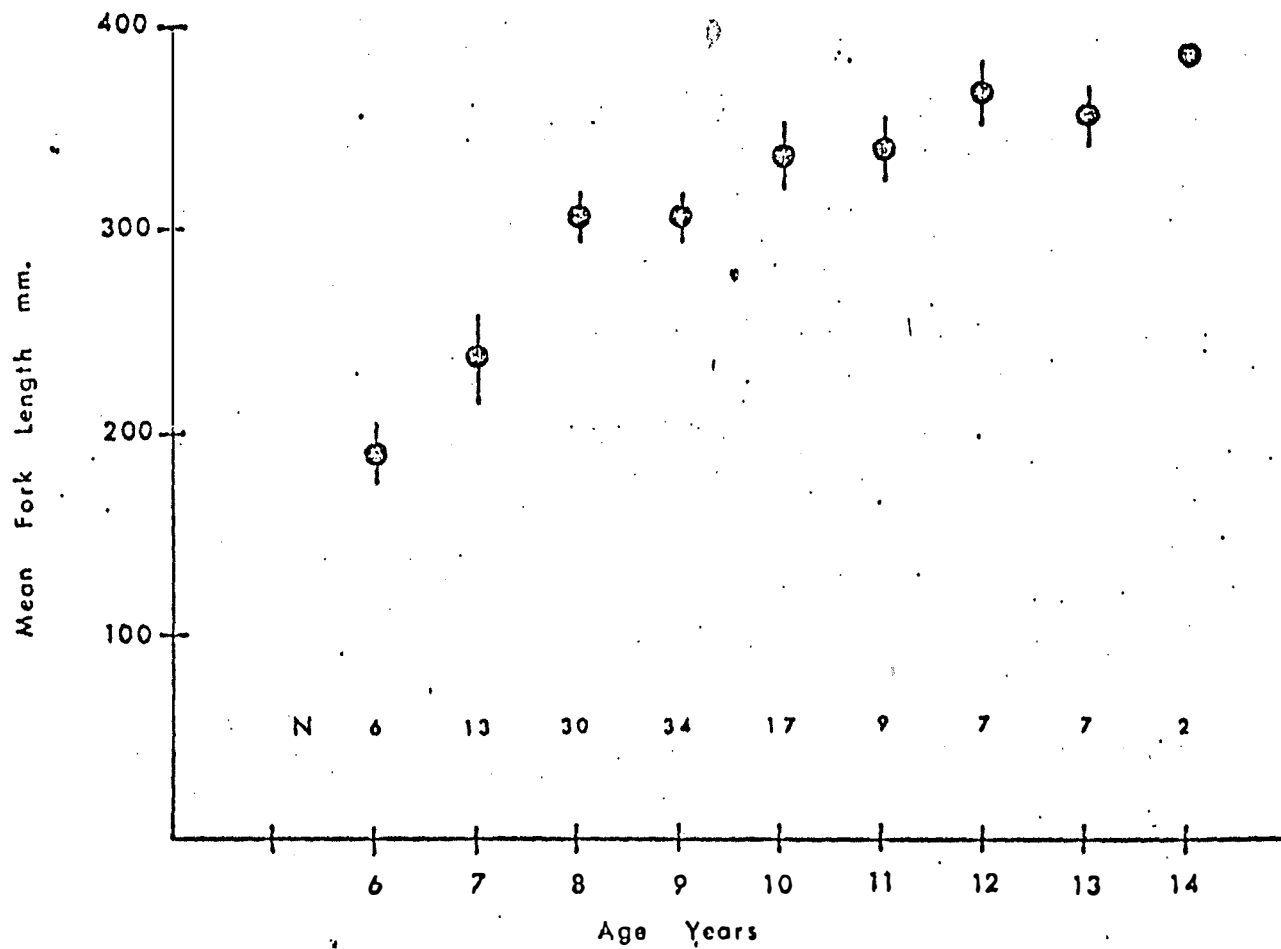


Figure 8. Age and length relationship of Coregonus autumnalis.

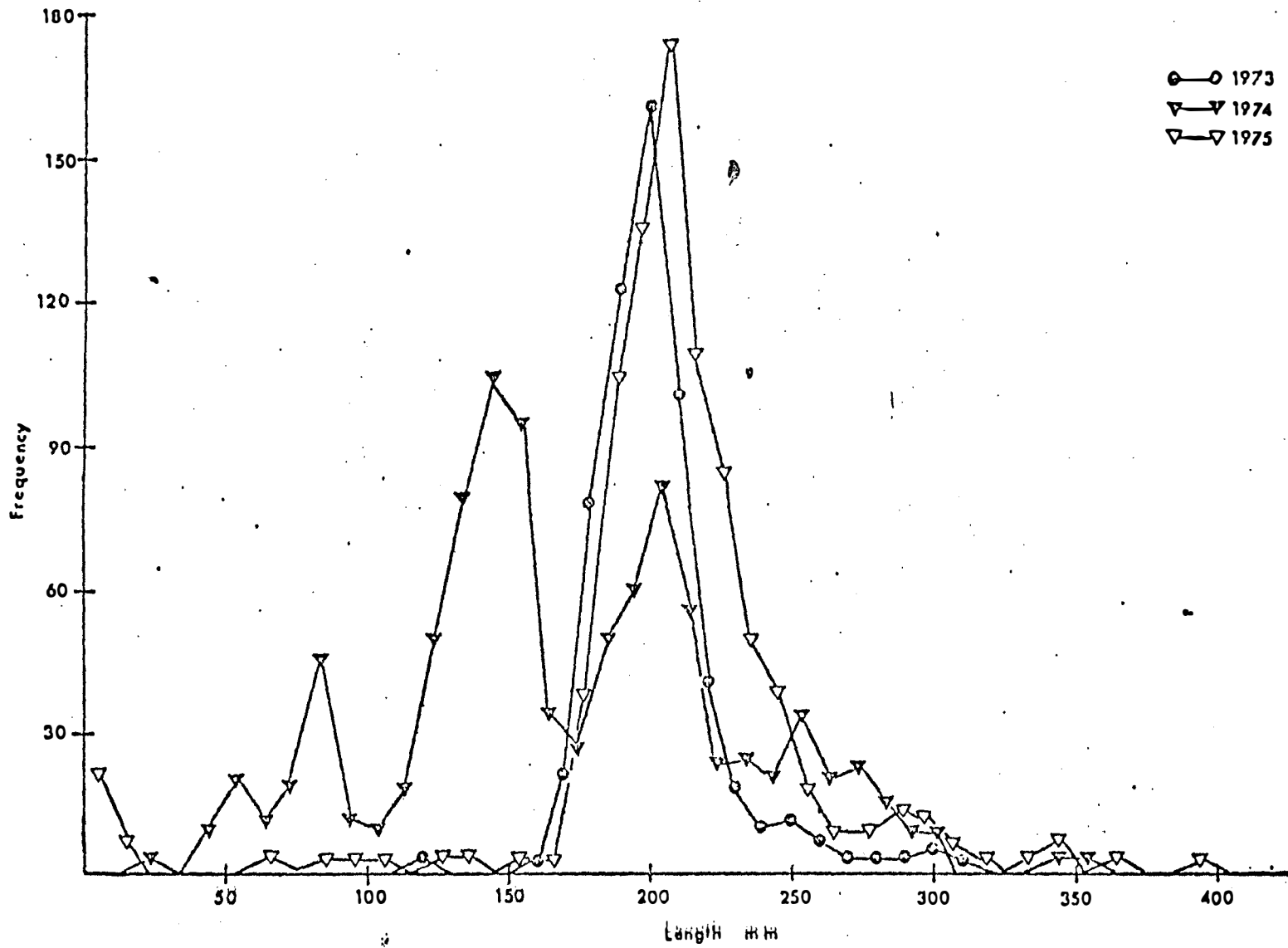


Figure 9. Length frequency distribution of Coregonus sardinella.

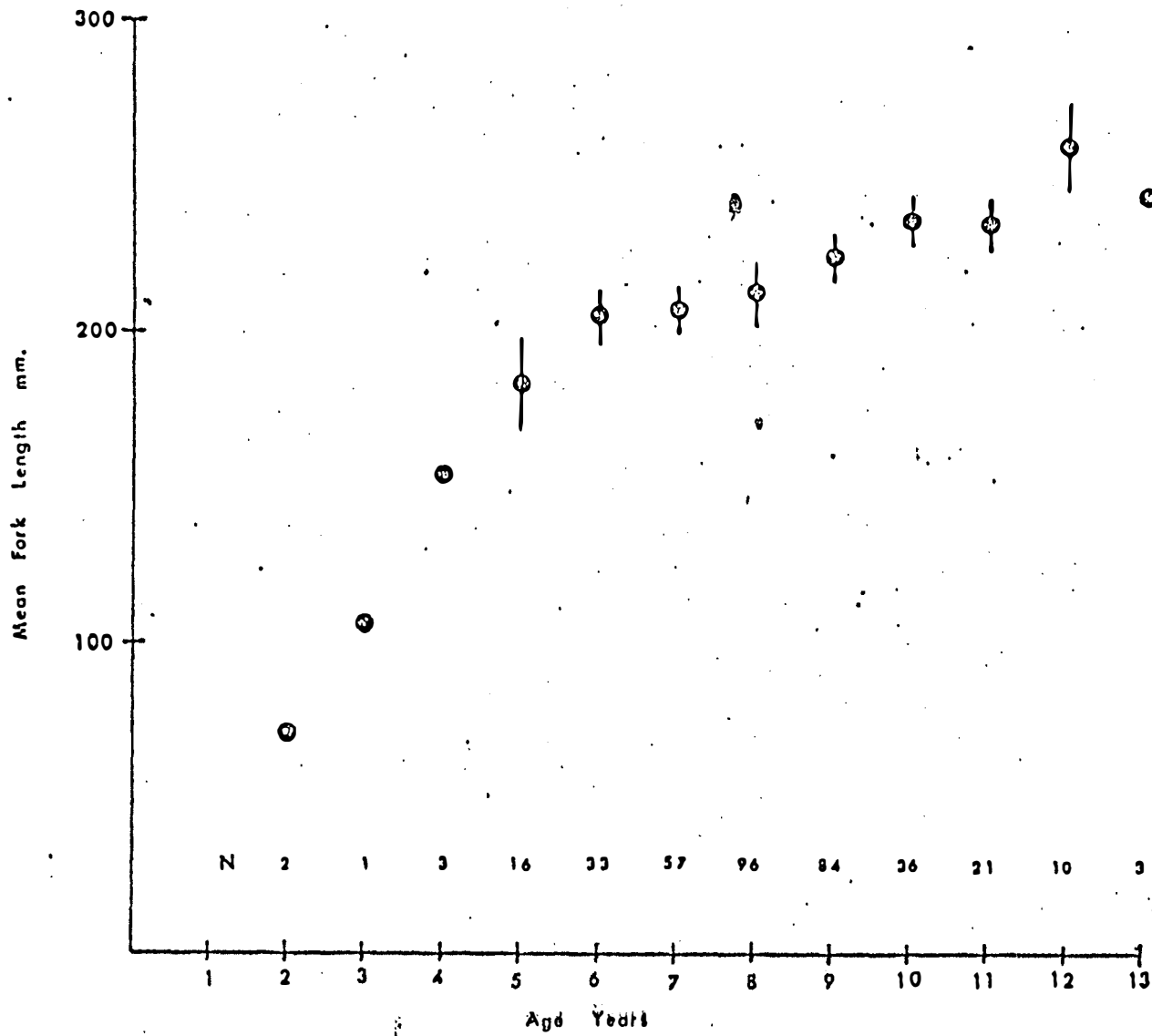


Figure 10. Age and length relationship of Coregonus sardinella.

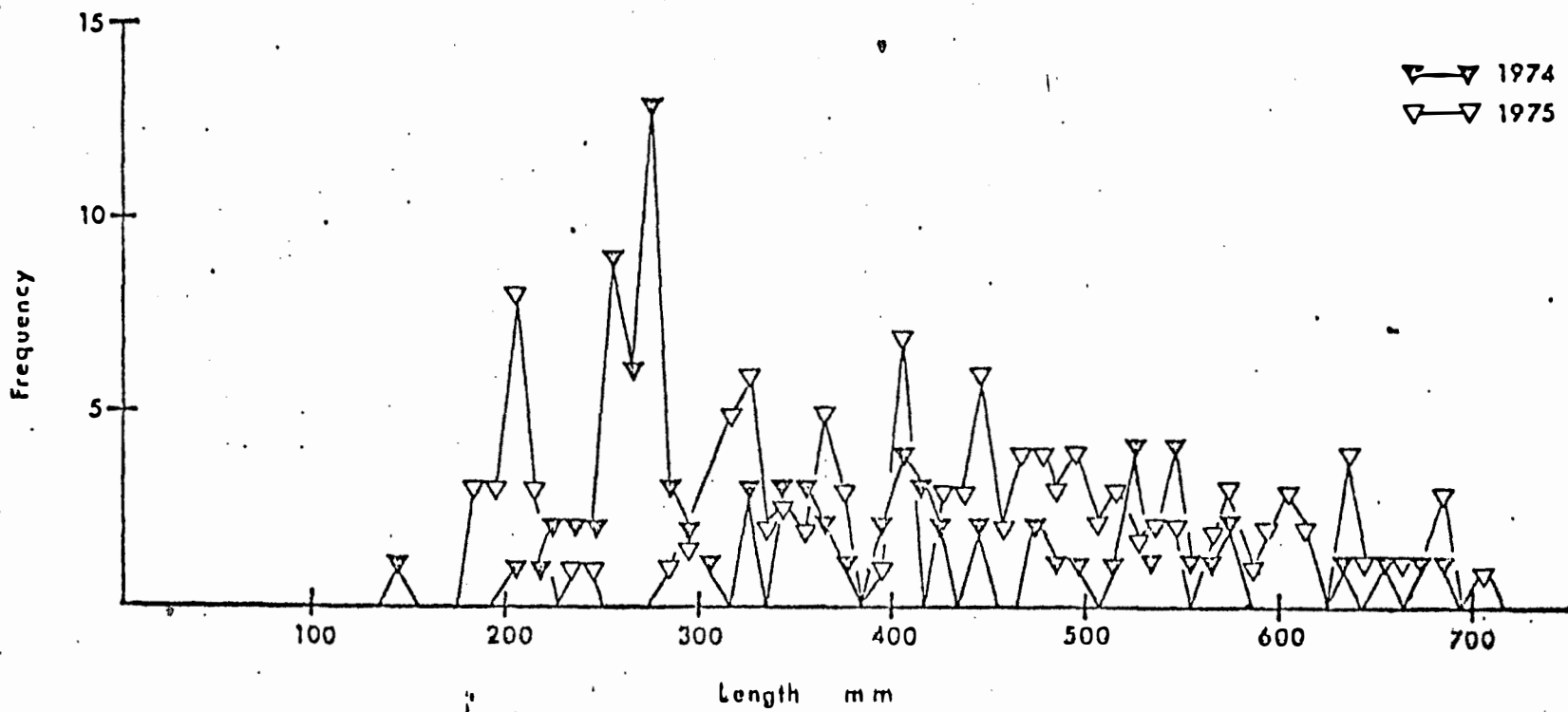


Figure 11. Length frequency distribution of Stenodus leucichthys.

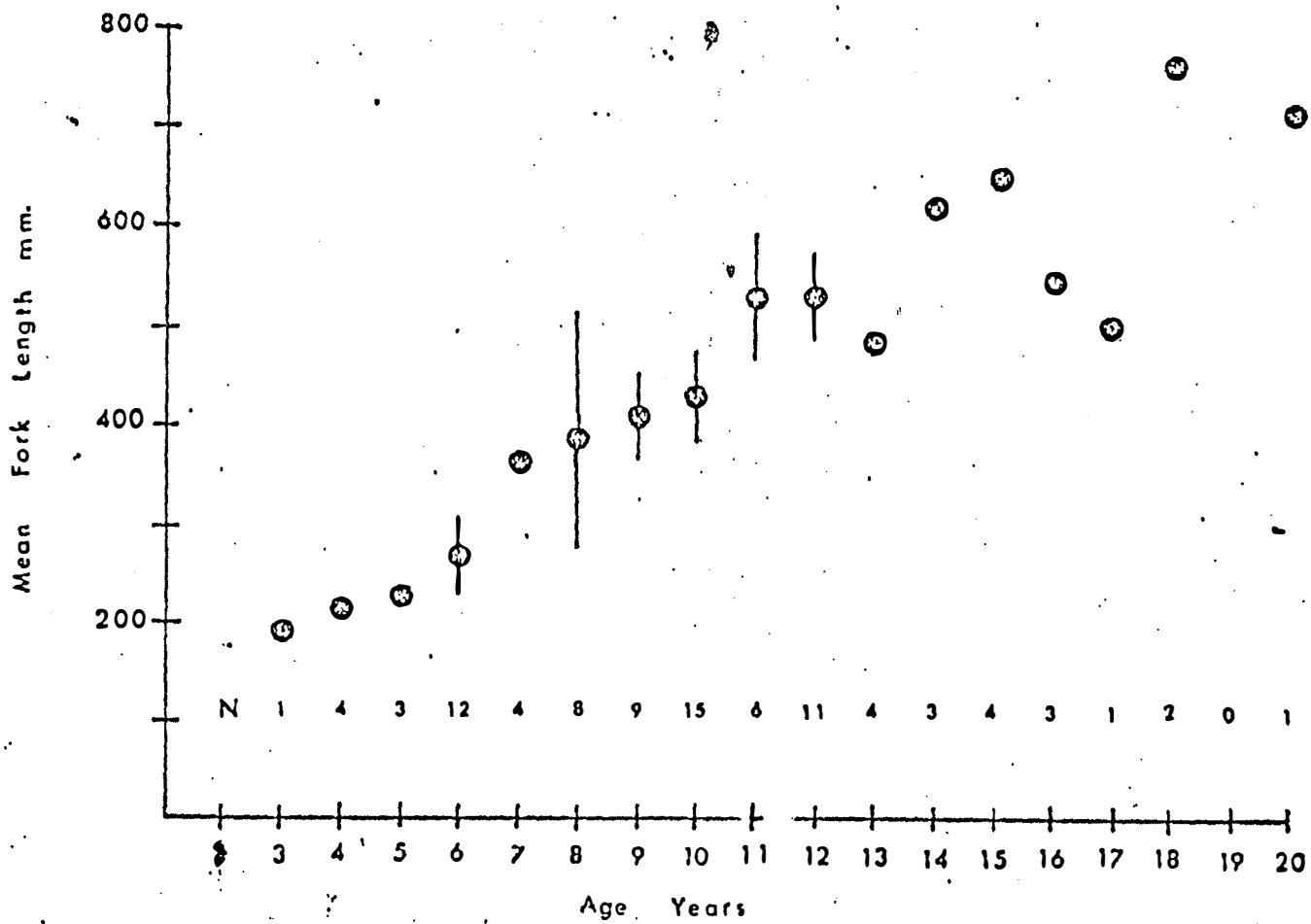


Figure 12. Age and length relationship of Stenodus leucichthys.

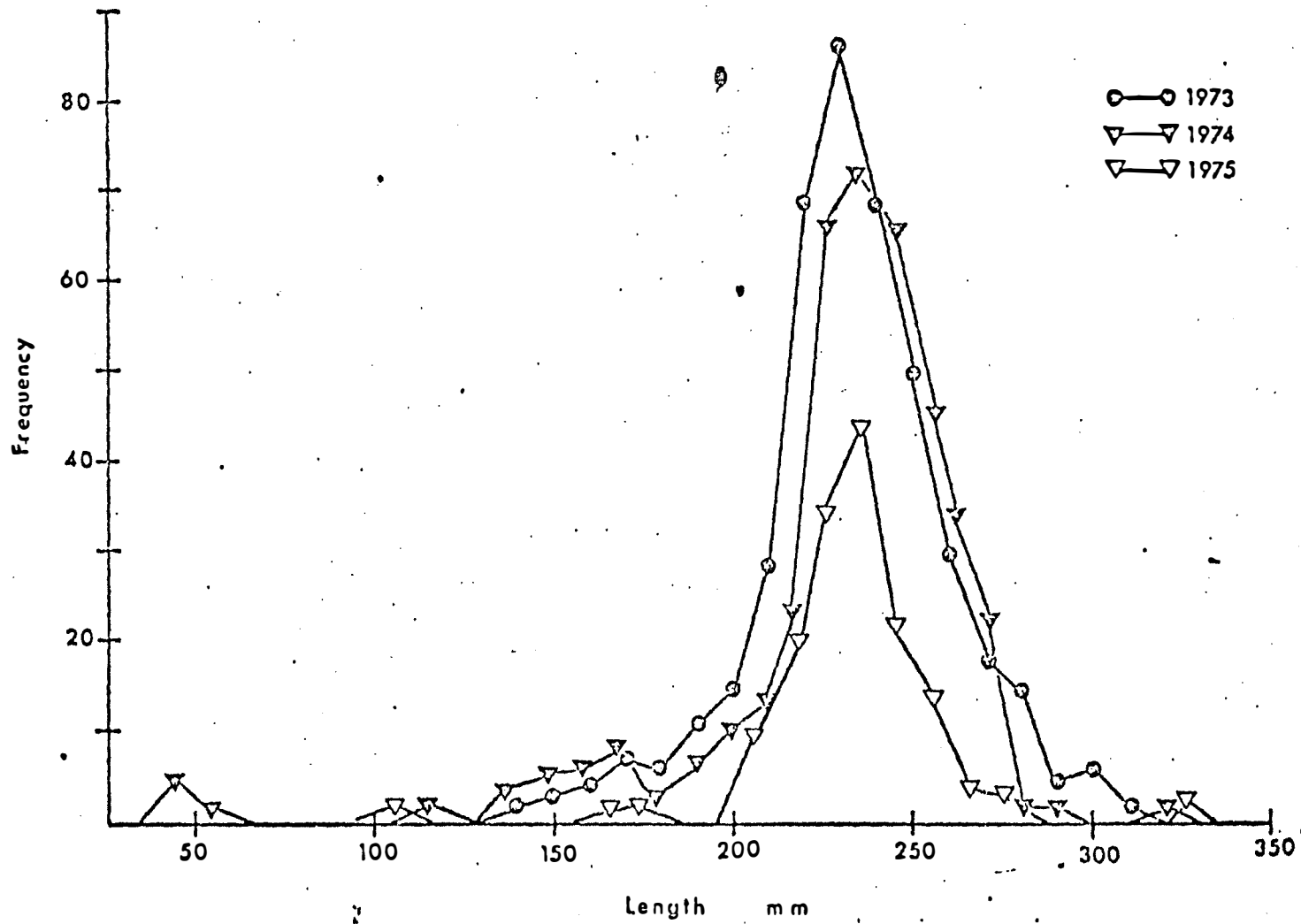


Figure 13. Length frequency distribution of *Osmerus mordax*.

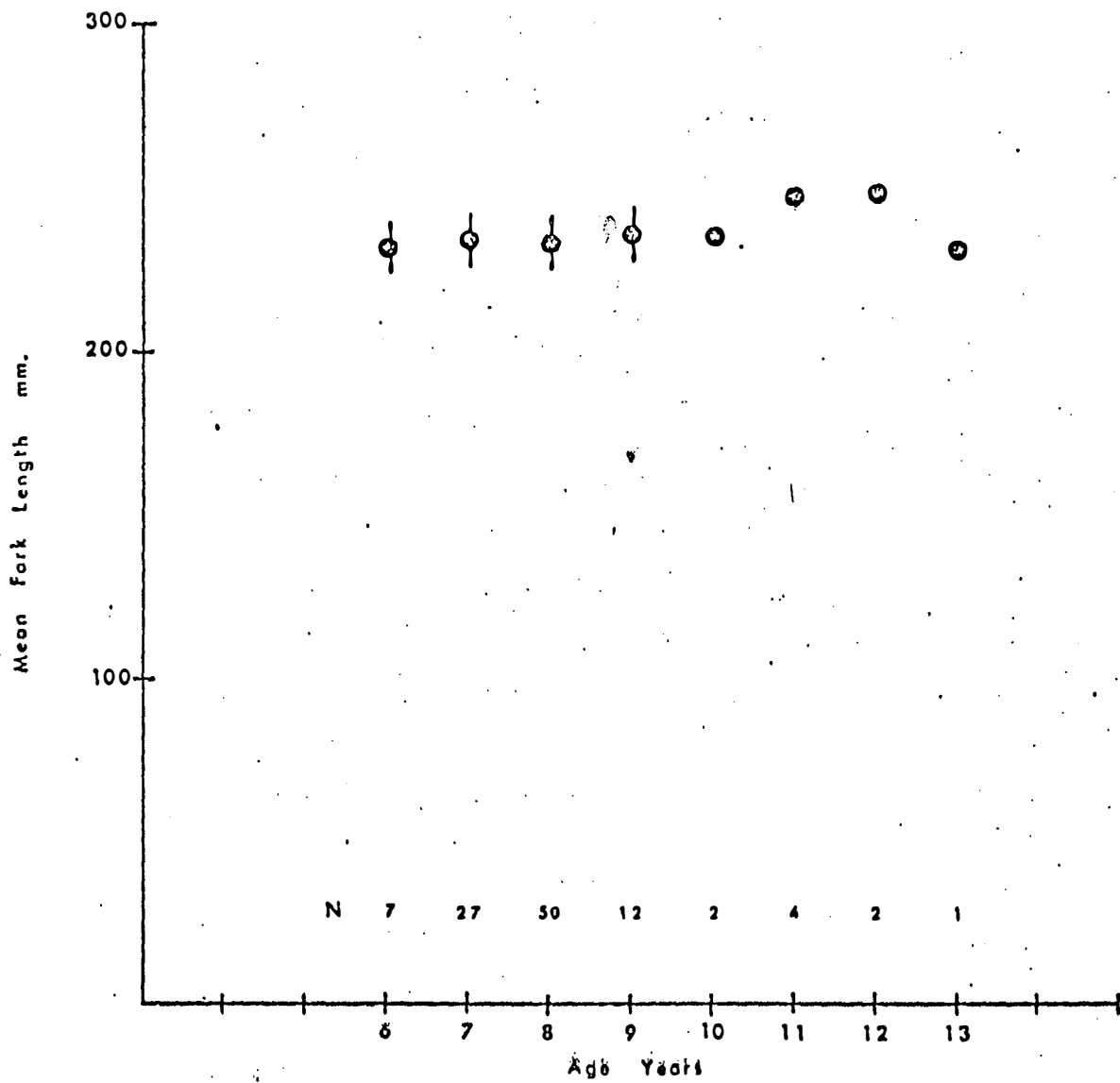


Figure 14. Age and length relationship of Osmerus mordax.

Table 1

Anadromous, freshwater and marine fish collected in the vicinity of Tuktoyaktuk.

Anadromous and freshwater species

Petromyzonidae

Lampetra japonica (Martens)

Arctic lamprey

Coregonidae

Coregonus autumnalis (Pallas)

Arctic cisco

C. clupeaformis (Mitchill)

humpback whitefish

C. nasus (Pallas)

broad whitefish

C. sardinella Valenciennes

least cisco

Stenodus leucichthys (Güldenstadt)

inconnu

Osmeridae

Osmerus mordax (Mitchill)

rainbow smelt

Esocidae

Esox lucius (Linnaeus)

northern pike

Catastomidae

Catastomus catastomus (Forster)

longnose sucker

Gadidae

Lota lota (Linnaeus)

burbot

Marine species

Clupeidae

Clupea harengus pallasii (Valenciennes)

Pacific herring

Gadidae

Boreogadus saida (Lepechin)

Arctic cod

Eleginus gracilis (Tilesius)

saffron cod

Zoarcidae

Lycencheles sp.

Lycodes jugoricus Knipowitch

shulupaołuk

L. pallidus Collett

pale eelpout

Stichaeidae

Acantholumpenus mackayi (Gilbert)

blackline prickleback

Lumpenus fabricii (Valenciennes)

slender eelblenny

Cottidae

Myoxocephalus quadricornis (Linnaeus)

fourhorn sculpin

Pleuronectidae

Liopsetta glacialis (Pallas)

Arctic flounder

Platichthys stellatus (Pallas)

starry flounder

Table 2

Fish collected in the vicinity of Tuktoyaktuk, 1973-1975 (GN = gill-nets, S = beach seine and OT = otter trawl).

	Kitti-gazuit					Tuktoyaktuk Harbour									
	75-014	75-005	75-007	75-010	75-011	74-002*	75-002+	74-010*	75-004	74-003	75-104+	75-112	75-113	75-114	
Petromyzonidae															
<u>Lampetra japonica</u>															
Clupeidae															
<u>Clupea harengus pallasii</u>												9		1	
Coregonidae															
<u>Coregonus autumnalis</u>	10	10	5			93		1	1						
<u>C. clupeaformis</u>	9	25	2	1		87		66	4						
<u>C. nasus</u>	13	2	20	22	12	36		99				1	3	1	
<u>C. sardinella</u>	2	117	141	1	5		1	9	5				1	1	
<u>Stenodus leucichthys</u>	27	77	18	1	1	82	2	11							
Osmeridae															
<u>Osmerus mordax</u>	2	7	53			8		14				2		1	
Esocidae															
<u>Esox lucius</u>	1		1												
Catostomidae															
<u>Catostomus catastomus</u>		3													
Gadidae															
<u>Boreogadus saida</u>												2	2		
<u>Eleginus gracilis</u>										5					
<u>Lota lota</u>	1	2				3	1	2							
Zoarcidae															
<u>Lycenchyles sp.</u>															
<u>Lycodes jugoricus</u>													2		
<u>L. pallidus</u>															
Stichaeidae															
<u>Acantholumpenus mackayi</u>											2	102	2		
<u>Lumpenus fabricii</u>												8			
Cottidae															
<u>Myoxocephalus quadricornis</u>						4		5		2		2			
Pleuronectidae															
<u>Liopsetta glacialis</u>						2		1		3		1			
<u>Platichthys stellatus</u>						6		27		2			5	1	
Gear used	GN	GN	GN	S	S	GN	GN	GN	GN	OT	OT	OT	OT	OT	
Water depth (m)	5	2	2						4	4	5	9	5		
Date: Day	21	08	09	11	11	07	09	31	02	17	05	18	18	18	
Month	07	07	07	07	07	07	05	08	07	07	08	08	08	08	

* total catch in 150-foot, 3½" and 4½" meshes for 4 days and 7 days respectively

+ 75-foot net consisting of 25-foot panels of 1½", 2½" and 3½" meshes

† series of 23 trawls, other fish not identified or counted

Table 2 (continued)

	Tibjak Point													
	73-001*	73-002	73-002	74-012	74-012+001	75-001+003	73-003	73-003	74-016	73-004	73-004	73-005	73-012	
<u>Petromyzonidae</u>														
<u>Lampetra japonica</u>			2					1						
<u>Clupeidae</u>														
<u>Clupea harengus pallasii</u>			9					15			14			
<u>Coregonidae</u>														
<u>Coregonus autumnalis</u>	164	1	8	14	4	1		7	9	1	9			
<u>C. clupeaformis</u>	2			1										
<u>C. nasus</u>	2													
<u>C. sardinella</u>	10	3	372	222	28	1	1	37	5	30	22	24		
<u>Stenodus leucichthys</u>				1										
<u>Osmeridae</u>														
<u>Osmerus mordax</u>	31	10	73	256				18	21	69	69	64	42	6
<u>Esocidae</u>														
<u>Esox lucius</u>														
<u>Catastomidae</u>														
<u>Catastomus catastomus</u>														
<u>Gadidae</u>														
<u>Boreogadus saida</u>	4													9
<u>Eleginus gracilis</u>														
<u>Lota lota</u>														1
<u>Zoarcidae</u>														
<u>Lycenchyles sp.</u>														
<u>Lycodes jugoricus</u>														
<u>L. pallidus</u>														
<u>Stichaeidae</u>														
<u>Acantholumpenus mackayi</u>														
<u>Lumpenus fabricii</u>														
<u>Cottidae</u>														
<u>Myoxocephalus quadricornis</u>	12	6			4				1					113
<u>Pleuronectidae</u>														
<u>Liopsetta glacialis</u>														
<u>Platichthys stellatus</u>														
<u>Gear used</u>	GN	GN	GN	GN	GN	GN	GN	GN	GN	GN	GN	GN	GN	OT
<u>Water depth (m)</u>	2	5	5	5	5	5	4	4	4	4	4	4	4	
<u>Date: Day</u>	16	21	25	17	02	05	23	02	27	25	05	26	15	
<u>Month</u>	07	07	08	07	12	05	07	09	07	07	09	07	07	

* one 150-foot 3½" mesh sampled at 5, 9, 12 and 14 hours
+ 75-foot net consisting of 25-foot panels of 1½", 2½" and 3½" meshes fishing for 48 hours and 24 hours respectively

Table 2 (continued)

	Tibjak' Point (cont'd)												
	73-014	73-015	73-016	73-017	73-018	75-115	75-117	75-118	74-013	74-013	74-014	74-015	74-017
<u>Petromyzonidae</u>													
<u>Lampetra japonica</u>													
<u>Clupeidae</u>													
<u>Clupea harengus pallasii</u>							1						
<u>Coregonidae</u>													
<u>Coregonus autumnalis</u>									75	6	16	10	4
<u>C. clupeaformis</u>									6	37	1	2	4
<u>C. nasus</u>										4	3	2	1
<u>C. sardinella</u>									33	45	27	39	34
<u>Stenodus leucichthys</u>										1			
<u>Osmeridae</u>													
<u>Osmerus mordax</u>	3	6	3	2	5	3	7	9	7				23
<u>Esocidae</u>													
<u>Esox lucius</u>													
<u>Catostomidae</u>													
<u>Catostomus catostomus</u>									2				
<u>Gadidae</u>													
<u>Boreogadus saida</u>			1	11		12							
<u>Eleginus gracilis</u>						1							
<u>Lota lota</u>	1	6	2	2	6			2					
<u>Zoarcidae</u>													
<u>Lycenchyles sp.</u>													
<u>Lycodes jugoricus</u>													
<u>L. pallidus</u>													
<u>Stichaeidae</u>													
<u>Acantholumpenus mackayi</u>													
<u>Lumpenus fabricii</u>													
<u>Cottidae</u>													
<u>Myoxocephalus quadricornis</u>	34	25	18	9	72				6	2	3		
<u>Pleuronectidae</u>													
<u>Liopsetta glacialis</u>				2							2	2	1
<u>Platichthys stellatus</u>	1							1		1			
Gear used	OT	OT	OT	OT	OT	OT	OT	OT	S	S	S	S	S
Water depth (m)						5	5	5					
Date: Day	15	25	25	25	25	20	24	24	22	05	24	24	29
Month	07	07	07	07	07	08	08	08	07	08	07	07	07

Table 2 (continued)

	<u>Tininerk Bay</u>					<u>Toker Point and vicinity</u>							
	73-010	73-011	75-116	74-018	74-019	73-007	74-020	73-008	73-009	74-029*	75-003+	75-018	75-019
<u>Petromyzonidae</u>													
<u>Lampetra japonica</u>													1
<u>Clupeidae</u>													
<u>Clupea harengus pallasii</u>	3	31				9		3	4	8		6	14
<u>Coregonidae</u>													
<u>Coregonus autumnalis</u>	16	7			2	22	3	4	1	43		12	69
<u>C. clupeaformis</u>				11	7		1			6	5		
<u>C. nasus</u>				2	1					4			
<u>C. sardinella</u>	17	2			6	54	7	9		141		3	692
<u>Stenodus leucichthys</u>												2	
<u>Osmaridae</u>													
<u>Osmerus mordax</u>	18	35	19	7	9	2	40	18	2	36			57
<u>Esocidae</u>													
<u>Esox lucius</u>													
<u>Catastomidae</u>													
<u>Catastomus catastomus</u>													
<u>Gadidae</u>													
<u>Boreogadus saida</u>				2									
<u>Eleginus gracilis</u>													1
<u>Lota lota</u>				1									
<u>Zoarcidae</u>													
<u>Lycenchyles sp.</u>													
<u>Lycodes jugoricus</u>													
<u>L. pallidus</u>													
<u>Stichaeidae</u>													
<u>Acantholumpenus mackayi</u>													
<u>Lumpenus fabricii</u>													
<u>Cottidae</u>													
<u>Myoxocephalus quadricornis</u>		6		2		3				14		4	2
<u>Pleuronectidae</u>													
<u>Liopsetta glacialis</u>				1	1			1					5
<u>Platichthys stellatus</u>												1	
Gear used	GN	GN	OT	S	S	GN	GN	GN	GN	GN	GN	GN	GN
Water depth (m)	7	6	6			5	4	6	8	2		3	2
Date: Day	17	09	24	29	29	06	31	20	01	06	10	02	30
Month	08	09	08	07	07	08	07	08	09	09	05	08	08

* five 75-foot nets of meshes 1", 2", 3", 4" and 5"

+ 75-foot net consisting of 25-foot panels of 1½", 2½" and 3½" meshes

Table 2 (continued)

	Toker Point and vicinity						Warren Point and Hutchison Bay							
	75- 107	75- 108	75- 109	74- 030	75- 021	75- 022	73- 006	75- 023*	75- 028	73- 019	73- 020	75- 119	75- 120	
Petromyzonidae														
<u>Lampetra japonica</u>													1	
Clupeidae														
<u>Clupea harengus pallasii</u>								78	57					
Coregonidae														
<u>Coregonus autumnalis</u>					1			85	31					
<u>C. clupearformis</u>														
<u>C. nasus</u>												5	B	
<u>C. sardinella</u>							30	88	28					
<u>Stenodus leucichthys</u>								1	3					
Osmeridae														
<u>Osmerus mordax</u>	5		1				46	61			8	1	23	
Esocidae														
<u>Esox lucius</u>														
Catostomidae														
<u>Catostomus catastomus</u>														
Gadidae														
<u>Boreogadus saida</u>	9	2								1468	5	5	11	
<u>Eleginus gracilis</u>									7					
<u>Lota lota</u>														
Zoarcidae														
<u>Lycenchyles sp.</u>					1									
<u>Lycodes jugoricus</u>														
<u>L. pallidus</u>					4						3			
Stichaeidae														
<u>Acantholumpenus mackayi</u>														
<u>Lumpenus fabricii</u>														
Cottidae														
<u>Moxocephalus quadricornis</u>	16			1	6			3	1	15	44	11	5	
Pleuronectidae														
<u>Liopsetta glacialis</u>					2									
<u>Platichthys stellatus</u>								1	1					
Gear used	OT	OT	OT	S	S	S	GN	GN	GN	OT	OT	OT	OT	
Water depth (m)	8	8	10				7	4	4			8	7	
Date: Day	13	13	13	07	02	02	02	05	09	02	02	25	25	
Month	08	08	08	09	08	08	08	08	08	08	08	08	08	

* standard gang fishing for 35 hours

Table 2 (continued)

	Warren Point and Hutchison Bay						Atkinson Point and McKinley Bay					
	74- 021	74- 022	74- 023	74- 024	75- 024	75- 027	74- 026*	74- 027*	75- 030	75- 032	74- 025	74- 028
<u>Petromyzonidae</u>												
<u>Lampetra japonica</u>												
<u>Clupeidae</u>												
<u>Clupea harengus pallasii</u>							55	16	17			
<u>Coregonidae</u>												
<u>Coregonus autumnalis</u>	133	4	5	4	18		27	4	2	1	2	10
<u>C. clupeaformis</u>	4	2		3				1				8
<u>C. nasus</u>						23						
<u>C. sardinella</u>	80	26	7	2	21	6	220	85	6			11
<u>Stenodus leucichthys</u>					1							
<u>Osmeridae</u>												
<u>Osmerus mordax</u>	1	1	1	2	2		4					
<u>Esocidae</u>												
<u>Esox lucius</u>												
<u>Catostomidae</u>												
<u>Catostomus catostomus</u>												
<u>Gadidae</u>												
<u>Boreogadus saida</u>												
<u>Eleginus gracilis</u>												
<u>Lota lota</u>							1					
<u>Zoarcidae</u>												
<u>Lycenchyles sp.</u>												
<u>Lycodes jugoricus</u>												
<u>L. pallidus</u>												
<u>Stichaeidae</u>												
<u>Acantholumpenus mackayi</u>												
<u>Lumpenus fabricii</u>												
<u>Cottidae</u>												
<u>Myoxocephalus quadricornis</u>		1	8	6	1	20	14		1		11	52
<u>Pleuronectidae</u>												
<u>Liopsetta glacialis</u>		2	3	1	17	6			1		2	1
<u>Platichthys stellatus</u>												
Gear used	S	S	S	S	S	S	GN	GN	GN	GN	S	S
Water depth (m)							3	7	5	7		
Date: Day	15	20	21	21	05	05	27	30	16	17	26	31
Month	08	08	08	08	08	08	08	08	08	08	08	08

* five 75-foot nets of meshes 1", 2", 3", 4" and 5"

Table 3

Fish collected in the offshore waters.

Petromyzonidae

Lampetra japonica (Martens)

Arctic lamprey

Coregonidae

Coregonus autumnalis (Pallas)

Arctic cisco

C. clupeaformis (Mitchill)

humpback whitefish

C. sardinella Valenciennes

least cisco

Osmeridae

Osmerus mordax (Mitchill)

rainbow smelt

Gadidae

Boreogadus saida (Lepechin)

Arctic cod

Eleginus gracilis (Tilesius)

saffron cod

Stichaeidae

Lumpenus fabricii (Valenciennes)

slender eelblenny

Ammodytidae

Ammodytes hexapterus Pallas

stout sand lance

Gasterosteidae

Pungitius pungitius (Linnaeus)

ninespine stickleback

Cottidae

Icelus sp.

Arctic staghorn sculpin

Gymnocanthus tricuspis (Reinhardt)

fourhorn-sculpin

Myoxocephalus quadricornis (Linnaeus)

bigeye sculpin

Triglops nybelini Jensen

ribbed sculpin

I. pingelli Reinhardt

Agonidae

Aspidophoroides olrikii Lütken

Arctic alligatorfish

Liparidae

Liparis cyclostigma Gilbert

dusky seasnail

L. herschelini Scofield

bartail seasnail

L. koefoedi Parr

gelatinous seasnail

Table 4

Midwater trawling studies, 1973

	101	102	103	104	105	106	109	110	111	112	114	115	116
Gadidae													
<u>Boreogadus saida</u>	3	6	10		7	23	23	29	96	32	25	2	45
<u>Eleginus sp.</u>									11	6	2	1	6
Cottidae													
<u>Triglops nybelini</u>						1		2	1	1			1
Liparidae													
<u>Liparis koefoedi</u>								2					
Distance net towed(km)	10	20	10	11	10	10	10	8	10	6	6	10	8
Depth net towed (m)	115	130	100	65	115	130	150	70	70	180	105	160	85
Water depth (m)	285	542	130	400	250	275	250	128	381	651	132	541	174

Table 5

Midwater trawling studies, 1974

	031	033	035	036	038	045	047	052	053	055	061	062	063
Petromyzidae													
<u>Lampetra japonica</u>			3				1		1				
Coregonidae													
<u>Coregonus autumnalis</u>	1		95	3	1		7	2	10	44			
<u>C. clupeaformis</u>						1							
<u>C. sardinella</u>			25	3					3	8			
Osmeridae													
<u>Osmerus mordax</u>										6			1
Gadidae													
<u>Eleginus gracilis</u>	1	3		1		2		3		6	3		
Gasterosteidae													
<u>Pungitius pungitius</u>						1						1	
Ammodytidae													
<u>Ammodytes hexapterus</u>										1			
Distance net towed (km)	3	3	6	6	6	6	3	6	5	6	6	5	3
Depth net towed (m)	7	6	1	10	4	8	7	8	2	2	8	4	4
Water depth (m)	48	35	30	60	10	35	10	30	11	10	70	30	120

Table 6

Midwater trawling studies, 1975

	301	302	303	304	305	306	307	308	309	310	311
Petromyzonidae											
<u>Lampetra japonica</u>											
Gadidae											
<u>Boreogadus saida</u>	1	668	120	15	314	370	280	481	146	65	18
Stichaeidae											
<u>Lumpenus sp.</u>										1	5
<u>L. fabricii</u>											
Cottidae											
<u>Icelus sp.</u>											
<u>Gymnocanthus sp.</u>										3	
<u>G. tricuspis</u>		270	152	10	182	57		9	3		
<u>Myoxocephalus quadricornis</u>		1									
<u>Triglops nybelini</u>		1?									
<u>T. pingelli</u>											8
Agonidae											
<u>Aspidophoroides olrikii</u>		25	14	1	2	3	1				
Liparidae											
<u>Liparis sp.</u>		6	2				3			7	6
<u>L. cyclostigma</u>						20					
<u>L. herschelini</u> = BTSS = KPSF											
<u>L. koefoedi</u> = GLSF											
Distance net towed (km)	6	14	13	11	13	8	10	10	14	10	6
Depth net towed (m)	1	1	1	1	1	1	1	1	1	1	6
Water depth (m)	70	79	76	42	35	40	35	35	110	55	185

Table 6 (cont'd.)

Midwater trawling studies, 1975

	312	313	314	315	316	317	318	319	320	321	322
Petromyzonidae											
<u>Lampetra japonica</u>					1						
Gadidae											
<u>Boreogadus saida</u>	153	353	109	84	19	11	113	4	27	315	361
Stichaeidae	5						86		1	13	6
<u>Lumpenus sp.</u>				1?							
<u>L. fabricii</u>								1?			
Cottidae					1	1					
<u>Icelus sp.</u>							7			3	19
<u>Gymnocanthus sp.</u>											4
<u>G. tricuspis</u>	2	99	13		1	1	59	8		4	
<u>Myoxocephalus quadricornis</u>					1						
<u>Triglops nybelini</u>											
<u>T. pingelli</u>	2									7	7
Agonidae											
<u>Aspidophoroides olrikii</u>	1	33	5	5		43	102	20			
Liparidae											
<u>Liparis sp.</u>	3						1	4			
<u>L. cyclostigma</u>		4?	2	4		2	5				3?
<u>L. herschelini</u>							29			29	64
<u>L. koefoedi</u>									4		
Distance net towed (km)	10	10	29	6	11	10	6	6	6	5	6
Depth net towed (m)	2	2	2	10	2	2	4	3	16	4	8
Water depth (m)	20	60	40	45	10	30	30	35	180	40	35

Table 7

Sex composition of each species collected in the vicinity of Tuktoyaktuk

	1973		1974		1975	
	No. sexed	% Males	No. sexed	% Males	No. sexed	% Males
<u>Clupea harengus pallasii</u>	73	39.7	72	48.6	164	56.1
<u>Coregonus autumnalis</u>	230	62.2	277	53.4	162	61.7
<u>C. clupeaformis</u>			170	56.5	30	56.7
<u>C. nasus</u>			122	59.8	26	84.6
<u>C. sardinella</u>	517	53.4	687	58.9	471	56.5
<u>Stenodus leucichthys</u>			93	67.7	102	56.8
<u>Osmerus mordax</u>	397	47.9	357	50.4	154	66.2
<u>Boreogadus saida</u>	4	25.0				
<u>Eleginus gracilis</u>			5	40.0	8	37.5
<u>Lota lota</u>			5	100.0		
<u>Myoxocephalus quadricornis</u>	25	0.1	10	20.0		
<u>Liopsetta glacialis</u>			12	66.7	5	40.4
<u>Platichthys stellatus</u>			32	78.1		

Table 8

Egg sizes of C. harenqus pallasii and O. mordax collected in the vicinity of Tuktoyaktuk in 1974 and 1975.

	Egg Diameter (mm)			
	N	%<0.5	%0.5-0.8	%>0.8
<u>C. harenqus pallasii</u>				
Coast, 1974	37	73.0	27.0	0
Bays, 1975	57	64.9	29.8	5.3
<u>O. mordax</u>				
Tuk Harbour, 1974	4	100	0	0
Coast, 1974	158	96.2	3.2	0.6
Bays, 1975	21	100	0	0

Table 9

Testis widths and egg sizes of the Coregonidae collected in the vicinity of Tuktoyaktuk in 1974 and 1975.

	N	Testis Width (mm)			Egg Diameter (mm)			
		%<5.0	%5.0-10.0	%>10.0	N	%<0.5	%0.5-1.0	%>1.0
<u>C. autumnalis</u>								
Tuk Harbour, 1974	53	100	0	0	0	0	0	0
Coast, 1974-summer	100	96.4	2.7	0.9	73	95.9	4.1	0
-winter	1	100	0	0	3	100	0	0
Bays, 1975	61	60.6	19.7	19.7	56	46.5	33.9	19.5
<u>C. clupeaformis</u>								
Tuk Harbour, 1974	23	82.6	8.7	8.7	59	47.5	33.9	18.5
Coast, 1974-summer	20	55.0	20.0	25.0	8	50.0	12.5	37.5
Bays, 1975	15	73.3	6.7	20.0	12	75.0	25.0	0
<u>C. nasus</u>								
Tuk Harbour, 1974	51	53.8	17.7	23.5		51.1	34.0	14.9
Coast, 1974-summer	1	0	0	100		0	0	0
Bays, 1975	15	33.3	13.3	53.4		66.7	33.3	0
<u>C. sardinella</u>								
Tuk Harbour, 1974	3	66.7	0	33.3		20.0	0	80.0
Coast, 1974-summer	404	97.3	2.5	0.2		95.3	4.7	0
-winter	10	90.0	10.0	0		92.3	8.3	0
Bays, 1975	197	86.3	12.2	1.5		74.8	24.5	0.7
<u>S. leucichthys</u>								
Tuk Harbour, 1974	6	83.3	16.7	0		74.1	22.1	3.7
Coast, 1974-summer	1	100	0	0		0	0	0
Bays, 1975	39	87.2	12.8	0		90.6	9.4	0

Table 10

Temperature and salinity data, 1973-1975

Station	Date	Temperature (°C)			Salinity (‰)		
		Surface	1m	2m	Surface	1m	2m
75-014	20 Jul			>12.0			0
75-005	7 Jul			>12.0			0
75-007	11 Jul			>12.0			0
73-002	21 Jul	12.0		11.8	0		0
73-002	25 Aug			9.8	3.0		3.3
74-012	17 Jul	13.4		13.0	0.2		0.2
74-012	2 Dec				<2.8		
73-003	23 Jul	12.0		12.0	0		0
73-003	2 Sep	10.3		9.6	2.2		4.1
73-004	25 Jul	13.5		13.2	0		0
73-005	26 Jul	16.0		12.5			
74-013	22 Jul		9.9			0.2	
74-013	5 Aug		11.0			0.5	
74-014	27 Jul	10.9		10.9	0.5		0.5
74-017	29 Jul		10.9			0.5	
73-010	17 Aug	6.8		6.5	14.0		15.0
73-011	9 Sep	7.3		6.3	8.1		16.8
74-018	29 Jul		12.1			0.7	
74-019	29 Jul		11.0			1.0	
73-007	6 Aug	8.5		4.5	14.5		12.2
74-020	31 Jul	12.2		12.1	0.4		0.4
73-008	20 Aug	2.5		4.2	13.3		22.5
73-009	1 Sep	5.0		3.6	21.5		24.0
74-029	6 Sep	5.2		5.0			

Table 10 (cont'd.)

Station	Date	Temperature (°C)			Salinity (‰)		
		Surface	1m	2m	Surface	1m	2m
75-003	10 May		0.1			<2.8	
75-018	26 Jul		9.2			6.0	
75-019	29 Jul		10.1			8.0	
74-030	7 Sep	5.3					
75-023	4 Aug			7.8			16.0
75-028	8 Aug			8.2			14.0
73-019	2 Aug	15.9		4.1	1.8		16.8
73-020	2 Aug	16.6		11.5	1.2		5.5
74-021	15 Aug	6.8					
74-023	21 Aug	7.3					
74-024	21 Aug	7.6					
74-026	27 Aug	8.0					
75-030	15 Aug			8.5			13.0
75-032	16 Aug			8.9			11.0
74-025	26 Aug	9.9					

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