HARVEST ESTIMATE AND ASSOCIATED INFORMATION FOR THE 2004 COLVILLE RIVER FALL FISHERY

April 2005

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EXECUTIVE SUMMARY

Moulton, L.L and B.T. Seavey. Harvest estimate and associated information for the 2004 Colville River fall fishery.

The objectives of the 2004 study were to continue obtaining estimates of the total effort and catch for the fall gill net fishery in the Colville River delta, which targets qaaqtaq (Arctic cisco), including harvests of both the village of Nuiqsut and the commercial fishery. Similar to previous years, a daily count was made of the nets fishing from mid October to late November.

The fishery began around October 9, which is considered a normal start date. The 2004 fishery was characterized by high catch rates of qaaqtaq (Arctic cisco) through the season, ending up with the fourth highest catch rate recorded in the 20 years of monitoring. The catch of iqalussaq (least cisco), the primary by-catch species, was the highest yet recorded in the Nigliq Channel.

The catch rate of qaaktaq (Arctic cisco) in 2005 is likely to decease from that seen in 2004, but should still be adequate to meet subsistence needs. This prediction is based on the abundance of fish from the 1998 and 1999 as recorded in the Prudhoe Bay region during summer 2004. The 2004 harvest was supported by the 1998 year class and larger fish of the 1997 year class. Catches in fyke nets from summer studies in Prudhoe Bay indicate there continues to be a moderate number of fish from the 1998 and 1999 year classes that will be available for harvest by fall 2005. Fish caught in 2005 should be of similar size to those in 2004 because of growth in the 1998 and 1999 year classes that will comprise the catch.

Catch rates of qaaktaq (Arctic cisco) in 2006 will likely decline to a low level as the 1998 and 1999 year classes mature and leave the area.

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Lawrence L. Moulton

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INTRODUCTION

For nearly 30 years, there were concerns that causeways built in the coastal region of the Alaskan Beaufort Sea to support coastal developments were causing changes in the summer feeding habitat of anadromous fishes in the region (Furniss 1975; USACE 1980, 1984). A variety of studies have been conducted in the coastal region since the mid-1970's to gain basic biological, distribution and habitat utilization information needed to address these concerns (Furniss 1975; Bendock 1979; Craig and Haldorson 1981; Griffiths and Gallaway 1982; Critchlow 1983; Griffiths et al. 1983; Woodward-Clyde Consultants 1983; Moulton and Fawcett 1984; Envirosphere 1987, LGL 1990, 1992, 1993, 1995; Fechhelm et al. 2005).

The anadromous fishes that are the subject of these studies provide an important food resource for the Inupiat communities of the Alaskan Arctic Coastal Plain and have been fished for many generations. The qaaqtaq (Arctic cisco, *Coregonus autumnalis*), in particular, is a highly prized food resource. This species is harvested near Kaktovik in late summer and in the Colville River delta after ice forms during fall. In addition to subsistence harvests, there is a commercial fishery that has operated in the Colville River delta since the early 1950's. Prior to 1985, there was little information on the subsistence harvests of anadromous fishes, although detailed information existed on the commercial fishery (Craig and Haldorson 1981; Gallaway et al. 1983; Moulton et al. 1986a; Craig 1987).

Concerns expressed over possible effects of causeways to the anadromous fishes of the region, especially Arctic cisco, raised concerns among local people that their traditional fishery resource would, in turn, be affected. This study was initiated in 1985 when the local government for Alaska's

Arctic Coastal Plain region, the North Slope Borough, requested that information be collected to assess fisheries in the Colville River that were considered to be most at risk. The initial year of investigation included a study of fish use of the Colville River delta region and evaluation of both summer and fall fisheries (Fawcett et al. 1986; Moulton et al. 1986b). Following years (1986 to 2004) focused on the fall fishery for Arctic cisco.

Arctic cisco targeted by the fall fishery are derived from spawning stocks in the Mackenzie River, with young-of-the year fish recruiting into the Colville region during August or September, as described by Gallaway et al. (1983). Recruitment of age 0 Arctic cisco into the Colville River region is aided by westerly currents generated by predominantly easterly winds in the Beaufort Sea region. Strength of recruitment has been correlated to percentage of easterly winds from June to September (Fechhelm and Fissel 1988). Arctic cisco return to the Mackenzie River at maturity to spawn, thus are only available to the fishery for two or three years prior to maturity. Anadromous least cisco being harvested spawn and winter entirely in the Colville Delta and lower river.

This study of the 2004 fishery represents the nineteen year since 1985 that the fishery in the delta was subjected to a harvest estimate; the survey was not conducted in 1999. Results from 1985 to 2003 are reported in Moulton and Field (1988), previous editions of the Endicott Monitoring Program Annual Report Series, Moulton (2001, 2003) and Moulton and Seavey (2004). Additional information on the fall gill net fishery in the Colville River was developed by George and Nageak (1986) and George and Kovalsky (1986).

In previous years, information on the commercial fishery was provided by the fisherman operating that fishery. In 2003 and 2004, however, he decided not to participate in the fishery assessment, thus the assessment for the most recent years is only on the Nuiqsut fishery conducted in the Nigliq Channel. The objectives of the 2004 survey were to 1) continue to obtain estimates of effort and catch for the fall fishery in the Nigliq channel of the Colville River, which targets Arctic cisco, 2) evaluate the harvest predictions made prior to the fishing season, and 3) evaluate methods to predict catches in future years.

METHODS

The study area includes the Colville River from the Itkillik River downstream to Harrison Bay (Figure 1). The 2004 study was restricted to three areas of concentrated fishing effort in the Nigliq Channel: 1) the Upper Nigliq Channel near Nuiqsut, 2) the Nanuk area of the Nigliq Channel, and 3) the Nigliq Delta (Figure 2).

The assessment and monitoring of the fall under-ice fishery based in Nuiqsut began on 10 October and continued through the third week in November. Fishing began on October 9, which was a normal start date for this fishery (Table 1).

Salinity measurements were taken every other day with a YSI 30 salinity/conductivity/temperature meter at standard locations in three monitoring areas on the Nigliq Channel (Figure 2). Salinity was measured from a vertical profile of the water column at 0.5 m increments.

During the main fishing season, village catches were sampled daily for species composition, number of fish caught, and fork length to the nearest mm. Fish were examined for tags, fin clips, and dye marks applied by other fish studies in the region. Whenever catch data were collected, set duration, net length, net depth (e.g. the width of the net) and mesh size data were also recorded so that catch-per-unit-effort (CPUE) could be calculated for the net set. Effort was calculated in net-days by using the start and end dates for each net. Effort data were adjusted for the various net lengths and set durations by standardizing net length to 18 m and set duration to 24 h.

The nets in the village fishery are of variable length with 18 and 24-m nets being the most common. In 2004, net depth was measured on nets used in the Nigliq Channel. Seventy-one of the 73 nets were 1.8 m deep, with the remainder being 1.2 m. In 1993 and 1994, estimates of the total catch were made both with and without a correction for net depth. The 1993 estimate containing the correction for net depth was 4.4% greater than the estimate based solely on net length and set duration, while in 1994 the correction resulted in an error 3% less than the uncorrected estimate. A correction for net depth was not made in 2004 because virtually all the nets were 1.8 m deep.

Within the main sampling areas, catch rates (CPUE) were estimated by obtaining catch and effort data by mesh size in each fishing area during the season. For each mesh size in each fishing area, the total observed catch was divided by the total observed effort to provide the CPUE estimate. The catch rates for each mesh size by area were then multiplied by the total effort estimated for each mesh size/area combination, and the estimated catches were summed to provide the estimates of total catch.

In the village fishery, 76-mm (3 inch) mesh nets were the preferred gear. Catch rate indices used for comparisons among areas and years and evaluation of changes in length distributions were based on 76-mm (3 inch) mesh.

In previous years, otoliths were obtained from Arctic cisco and least cisco caught in 76-mm (3 inch) mesh in the commercial fishery to estimate the age distribution of the harvest. Otoliths were obtained from Arctic cisco caught in the Nigliq Channel during 2004. Otoliths were read using the break-and-burn technique. The otolith is broken across the transverse axis, held over a flame until the edge begins to discolor, and placed in isopropyl alcohol to be viewed with a dissecting microscope at 30 power. Annuli appear as narrow dark rings between the wider, lighter annual growth bands.

Information obtained from annual measurements of length frequency, length/weight relationships and estimated catches by mesh size was used to estimate the annual harvested biomass for Arctic cisco and least cisco from 1985 to 2004. Length/weight relationships and length frequency data were used to estimate the mean weight of a harvested fish by mesh size for each year, then the total estimated harvest for that mesh size was multiplied by the mean weight. A composite length frequency was generated for mesh sizes in which length frequencies were not determined on an annual basis.

Information from the commercial fishery was not obtained in 2004, but records of the previous data are included in the report for comparative purposes. Records of catch and effort have been

maintained for the Colville Delta commercial fishery since 1967 (summarized in Gallaway et al. 1983, 1989). Effort data are recorded as the beginning and end date of each net set. Catch data are recorded as the catch by species for each net whenever the nets are checked. Usually the nets are checked daily or every other day, although longer sets are sometimes made. From 1967 to 1986, the fishery records were maintained by Mr. Jim Helmericks. In 1987, a second fishery operation was initiated by Mr. Harmon (Bud) Helmericks. Data from 1987 to 1991 contain estimates of the effort and catch for both operations. Since 1992, the fishery has reverted to a single operation. The data are converted to catch rates (CPUE) by dividing the total season harvest by the total effort expended.

Prior to 1981, the total effort expended by the commercial fisheries averaged 908 net-days (standard deviation = 295) and was never less than 500 net-days. Between 1982 and 1990, the effort averaged 475 net-days (standard deviation = 186). There is a significant inverse correlation between catch rate and effort ($r = -0.545$, 45 df, $a=0.01$). The relationship is statistically identical for Arctic cisco and least cisco catch rates. Because of this correlation between effort and catch rate, the data were adjusted to remove the linearity from the relationship. Use of the unadjusted data would provide inflated estimates of catch rates in years when effort is low. The adjustment consisted of calculating a correction factor for each observed effort based on the correlations through 1990. The correction factor was calculated as follows:

$$CF_i = CPUE_{Ei} - CPUE_m$$

where CF_i = correction factor for effort estimate i

$CPUE_{Ei}$ = linear estimate of catch rate associated with effort i

$CPUE_m$ = estimated catch rate associated with the mean of the observed effort

The correction factor was then subtracted from the observed catch rates to provide an adjusted catch rate (Table 2). The adjusted catch rates were used for all subsequent analyses. The trend of the revised CPUE estimates is similar to that of the observed CPUE. The primary effects of the adjustment are a slight increase in CPUE in the early years of the data set and a decrease in the post-1980 period for years in which effort was low, which was the desired effect of the adjustment.

RESULTS

Distribution of Fishing Effort

Village Fishery. Total estimated effort by Nuiqsut villagers in the Nigliq Channel fall fishery was 1,844 net-days, slightly above the average for the 1994-2003 period (Figure 4). From 1985 to 2004 the number of Nuiqsut fishing groups (a family or group of families fishing cooperatively) participating in the under-ice fishery ranged between 21 and 35, using 29 to 83 separate nets. In 2004, 29 fishing groups using 77 nets were identified. The trend in the number of nets being used is not statistically significant, however effort measured in net-days has been increasing significantly over the period of record (Figure 4). Effort in 2004 was highest in the Nigliq Delta area, followed by the Upper Nigliq area (Figure 5).

Effort has gradually shifted downstream in the Nigliq Channel during the twenty year monitoring period (Figure 5). From 1985 to 1989, between 65 to 74% of the effort within the channel was expended in the Upper Nigliq area. In 1993, effort in the Nanuk area exceeded that of the Upper Nigliq area for the first time, and in 2004 over 76% of the Nigliq Channel effort was in the Nigliq Delta area. Since 1998, the Nigliq Delta has had the highest effort of the three Nigliq Channel areas.

Salinity is monitored in conjunction with the fishery because Arctic cisco are commonly associated with salinities in the range of 15 to 25‰ (parts per thousand). During east winds, water level in the river drops, and the channels become fresh. When the wind reverses to the west, water levels rise and saline water moves into the delta, which brings in Arctic cisco, and displaces least cisco, piquktuuq (humpback whitefish, *Coregonus pidschian*) and aanaakliq (broad whitefish, *C. nasus*). From 1985 to 1993, with the exception of 1988, salinity in the Nigliq Channel near the village reached 10 to 15‰ by the beginning of November (Figure 6). In contrast, during 1997 and 1998 the salinity exceeded 20‰ in both the Nanuk and Nigliq Delta areas through the fishing season. In 2004, salinity in the Nigliq Channel was high compared to previous years, with the Upper Nigliq increasing to 10‰ by the end of the season (Figure 7). In the Nanuk region, salinity rose from 13‰ at the onset of fishing to 28‰ by late November. Salinity in the Nigliq Delta was 18‰ at the onset

of fishing, and increased to over 28‰ by the end of monitoring. This salinity distribution is considered ideal for Arctic cisco fishing.

Commercial Fishery. The commercial fishery has operated at a low level of effort since 1993 (Figure 4). There has been a declining trend in effort, and effort in 2003, the last year for which information is available, was reported to be low (J. Helmericks, personal communication, 2003).

Catch Composition

Arctic cisco, the target species, comprised over 74% of the total observed catch in the Nigliq Channel in 2004 (Table 2). Least cisco also accounted for 24% of the observed catch, with humpback whitefish third most abundant at less than 1%. In 2004, tiipuq (Bering cisco, *C. laurettae*) abundance remained low. In 1990, the species was more numerous than in the past and an effort was made to quantify their contribution to the 1990 harvest. Since 1991, their occurrence in the harvest has remained low. Siquilaraaq (round whitefish, *Prosopium cylindraceum*) occur in high abundance within the lower Colville River and delta (Fawcett et al. 1986), but rarely appear in the harvest. Their small size and narrow body allow them to pass through the meshes used in the fishery. Only 8 uugaq (saffron cod, *Eleginus gracilis*) were caught in 2004, which seems low considering the high salinity in the main fishing areas during the fishing season.

Comparative Catch Rates

Village Catch Rates. Overall, the Arctic cisco catch rates in the Nigliq Channel were well above average for the period 1985-2003, being the fourth highest observed since monitoring began in 1985 (Table 3, Figure 8). While there is considerable variation on a daily basis, catches tend to remain high through the season when Arctic cisco are abundant, and remain low when they are scarce (Figure 9). Least cisco mean catch rates in Nigliq Channel areas were among the highest yet observed (Table 4).

Commercial Catch Rates. Catch rates for Arctic cisco in the commercial fishery were not

estimated in either 2003 or 2004 but the historical rates are included for comparison to recent village harvest rates (Table 5). The mean annual catch rate for Arctic cisco and least cisco has been recorded for one of the commercial fisheries since 1967. Values are reported in fish/day/46 m net to maintain continuity with previous reports on this fishery.

Estimated Total Catch

The total estimated catch of Arctic cisco in the Nigliq Channel (40,065 fish, 15,325 kg) was the third highest for the Nigliq Channel (Figure 10, Appendix Table 2). The least cisco total catch was the highest yet observed for the Nigliq Channel, about 67% above the previous high recorded in 1990, and about 2.7 times the recent 10-year average (Figure 10, Appendix Table 3). Humpback whitefish contributed less than in recent years, with only 454 harvested in 2004 compared to the recent 10-year average of 3,374 fish (Table 6). Broad whitefish harvest remained at low levels.

Size and Age of Harvested Fish

A comparison of length frequencies of Arctic cisco captured in 76-mm (3 inch) mesh gill nets to those captured in fyke nets has been used in past reports to evaluate the effect of strong and weak year-classes on the fishery, for both catch rate and size of harvested fish (Figure 11). Movement of dominant year classes through the fishery has a profound effect on the size of fish harvested, even when mesh size was held constant. For example, the length frequency of Arctic cisco from fyke nets in the coastal region during the late summer of 1995 (after 14 August) indicated that there was a group of fish, primarily from the 1990 recruitment (LGL Alaska 1992), that was just becoming large enough to be caught by 76-mm (3 inch) mesh gill nets in 1995 (Figure 11). In 1996 and 1997, virtually all members of this group were of sufficient size to be harvested. Length frequencies for 2004 indicate that there was a large group of fish slightly too small to be caught by the 76 mm mesh gill nets. This group will grow to harvestable size by fall, 2004 and will likely comprise most of the harvest at that time.

The mean length of least cisco caught in the 76-mm (3 inch) mesh nets in 2004 was similar to that

observed in recent years (Table 8, Figure 12). Least cisco have shown a decreasing trend in mean size during the period of study.

Information from fyke nets fished in Prudhoe Bay during the summer is used to obtain information on the relative strength of Arctic cisco year classes when they recruit into the region as young-of-the-year (YOY) (Figure 13). Abundant year classes in the mid-1980's produced high catches in the early 1990's, while the abundant 1990 and 1992 year classes produced high catches in 1997-1998 (Figure 10). The absence of a dominant year class from 1993 to 1996 resulted in the recent period of low catches. Based on the YOY, and subsequent year indices, the 1997 recruitment appears to be strong and is providing some relief from the recent years (2000-2002) of low catch.

Ages of Arctic cisco taken in the fishery were estimated from 1984 to 2002 (Figure 14). The age data were used to partition the catch rate in the commercial fishery by year class to evaluate the relative year class strength (Figure 15). The cumulative catch rate for a year class can be used as an index to year class productivity. The analysis demonstrates why 1986 had such a high catch rate; i.e., two abundant year classes (1979 and 1980) had reached a harvestable size in the same year. In subsequent years, the abundance of these year classes decreased and they were replaced by later year classes. The 1987 year class, which dominated the fishery from 1992 to 1994, was essential gone by 1996. The cumulative harvest of this year class has surpassed any other single year class in abundance. The 1990 year class contributed the second highest cumulative harvest, and was responsible for the high catch rates in 1996 and 1997. Subsequent year classes have been much less abundant, which is responsible for the low catch rates in recent years.

Least cisco are only sampled every other year for age structure because of their slow growth rate and the relative stability of the population. The distribution of ages in least cisco has not shown a change in year class dominance, which is consistent with the hypothesis that the least cisco captured in the fishery were from a relatively stable Colville River population. There was, however, a continuing upward shift in the mean age of the harvested fish since 1978. In 1978, the mean age was 9.6 years; while in 1995, the mean age was 12.5 years. In subsequent years, the mean age has remained over 11 years. This upward shift in age, combined with smaller size (see above), may reflect reduced

mortality in the population. As previously presented, there has been a substantial reduction in the commercial fishing effort since 1980. This reduction in effort may account for much of the reduced mortality that has allowed the mean age of harvested fish to increase.

Information from Returned Tagged Fish

Tag returns continue to dwindle, since tags have not been released in great numbers since 1993. No tags were reported during 2004.

Predictability in Arctic cisco Harvest Rates

In previous years, the fyke net catch rate of 260-300 mm Arctic cisco during the summer prior to entering the fishery was regressed against the catch in 76-mm (3 inch) mesh gill nets used in the commercial fishery in the following year to provide a pre-season estimate of catch rates. The theory was that after an additional summer of growth, this group would grow into the 300-340 mm size range that is highly vulnerable to 76-mm (3 inch) mesh gill nets. The correlation between fyke net catches of 260-300 mm Arctic cisco and the next year's catch of 300-340 mm fish is statistically significant (p=0.02) (Table 9, Figure 17).

The harvest rate for 300-340 mm Arctic cisco was predicted for 1994 through 2002 using the relationship between commercial gill net catches and fyke net catches the prior year. The comparison of the predictions to actual harvest rates is as follows:

Year	Predicted	Actual	Percent Error
1994	15.3	15.0	-2%
1995	35.6	32.2	-30%
1996	59.1	130.0	+98%
1997	55.4	50.1	-10%
1998	66.6	20.1	-68%

1999	56.1	26.7	-52%
2002	52.5	12.7	-76%

As can be seen, there is substantial error surrounding the prediction, which can be attributed to a number of factors, including the accuracy of the fyke catch rate, accuracy of the gill net catch rate, and changes in fish distribution during the fishing season because of annual variability in the salinity distribution within the delta. The correlation between fyke net CPUE and Nigliq Channel gill net CPUE has considerably more error than that already noted. Thus, with the weak correlations, the pre-season estimate is being abandoned. Instead, the best prediction that can be made is to examine the summer fyke net CPUE in the prior year and make a judgment as to whether the gill net CPUE is likely to increase, decrease or remain similar to the previous year.

DISCUSSION

The 2004 fishery was characterized by high abundance of Arctic cisco caused by recruitment of the 1998 year class into the fishery and continuing strong representation by the 1997 year class. Early catch rates in the Nigliq Delta area were high when periodic west winds brought high salinity water into the area, inducing fish to move upstream. Catches then decreased slowly through the season. Studies from previous years have established that Arctic cisco move into the Colville River channels as salinity increases after ice formation (Moulton and Field 1988; Moulton 1994). For years in which salinity does not increase, such as 1988 and 1999, catches of Arctic cisco are lower than expected. In 2004, salinity in the Nigliq Delta and Nanuk areas was the highest yet seen through the season, and increased rapidly early in the fishing season in the Upper Nigliq area, thus the main group of Arctic cisco moved into the Nigliq Channel early in the season and was available for harvest throughout the channel. Bering cisco, which had been unusually abundant and a dominant portion of the catch in 1990, remained essentially absent in 2004. Catch of least cisco was the highest yet recorded in the Nigliq Channel, however, the humpback whitefish catch decreased from recent high levels.

In the past, knowledge of Arctic cisco juvenile recruitment into the region as a whole and

information on growth rates prior to recruitment into the fishery has allowed some prediction of impending increases or decreases in the Arctic cisco catch rate. Unpredictable variables, such as the distribution of saline water in the delta, and possible variations in natural mortality, growth and maturation rates, make accurate predictions of catch rates unlikely. In 2004, the fishery responded as expected, with the 1997 year class fully recruited into the fishery and larger members of the 1998 year class entering the fishery.

PREDICTIONS FOR 2005

The 1997 year class should leave the region as the fish mature and return to the Mackenzie River to spawn. Catches in fyke nets from summer studies in Prudhoe Bay indicate there continues to be a moderate number of fish from the 1998 and 1999 year classes that will be available for harvest by fall 2005. Fish caught in 2005 should be similar in size to those caught in 2004 because of growth in the 1998 and 1999 year classes that will comprise the catch. Catches should decrease substantially in 2005, as compared to 2004, being supported primarily by the remaining portion of the 1998 year class. Subsequent year classes appear to be weak or non-existent, thus harvests are expected to decrease even farther in 2006 and beyond.

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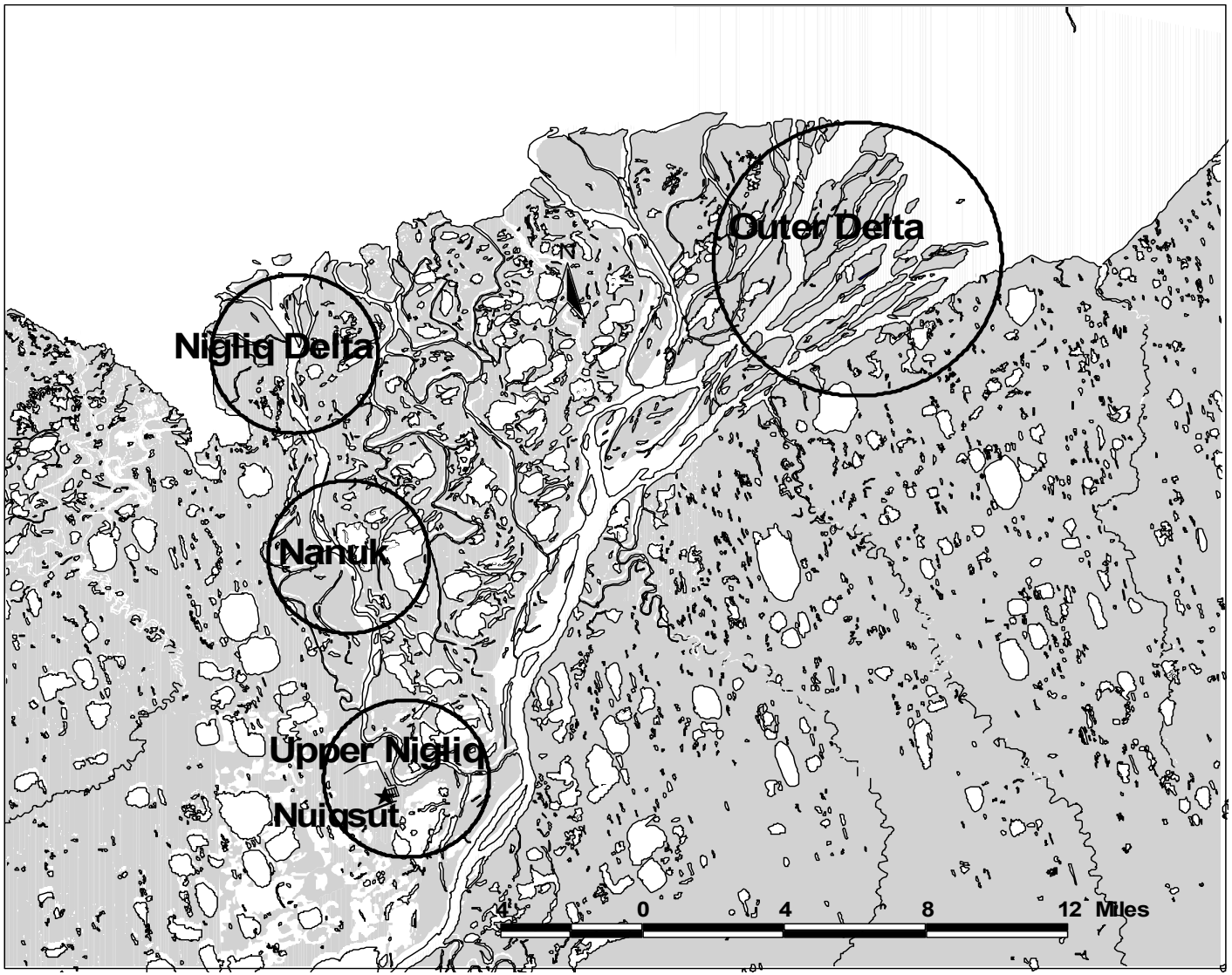


Figure 1. Colville Delta region showing locations of major fishing areas.

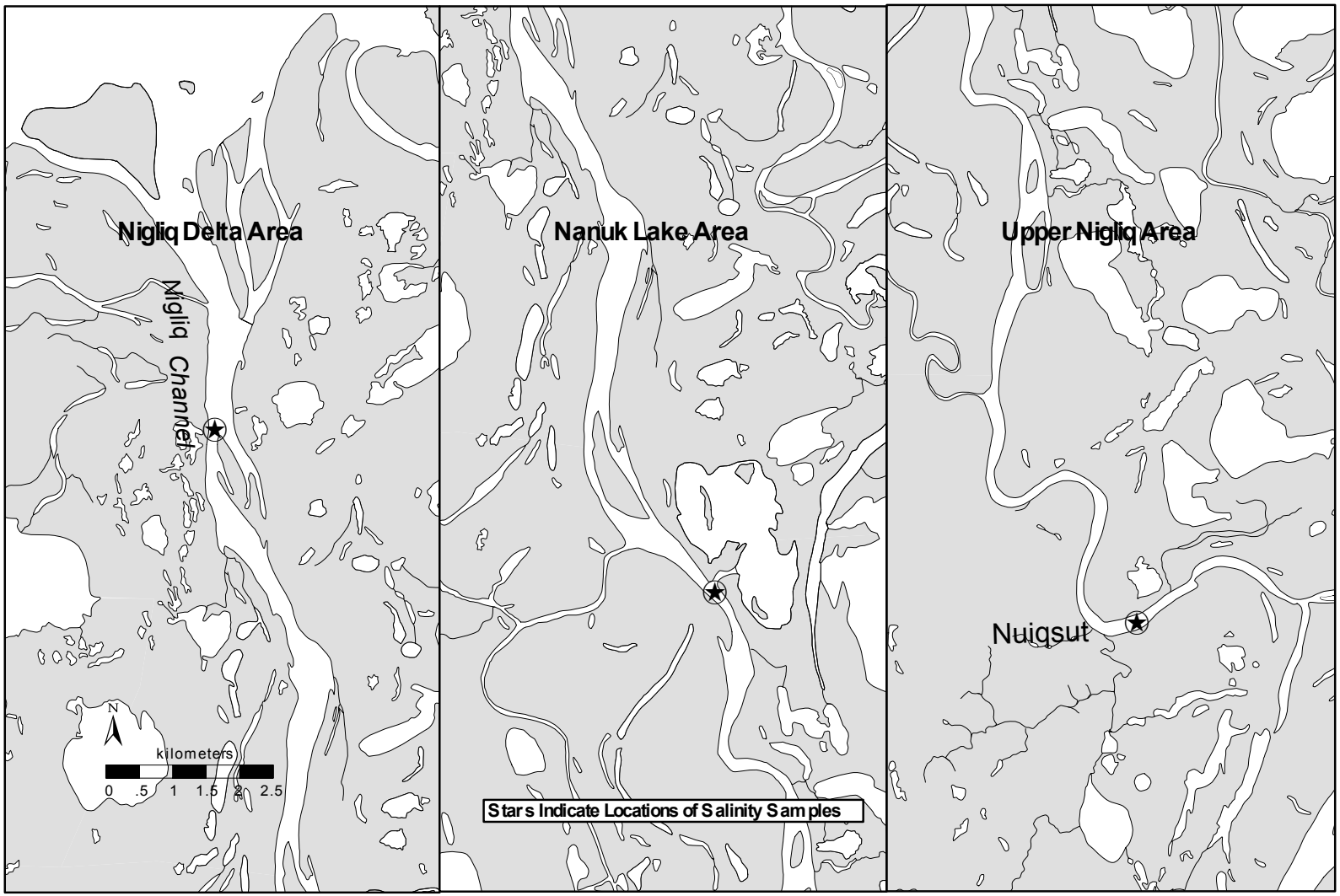


Figure 2. Major fishing areas on the Nigliq Channel with location of salinity monitoring stations.

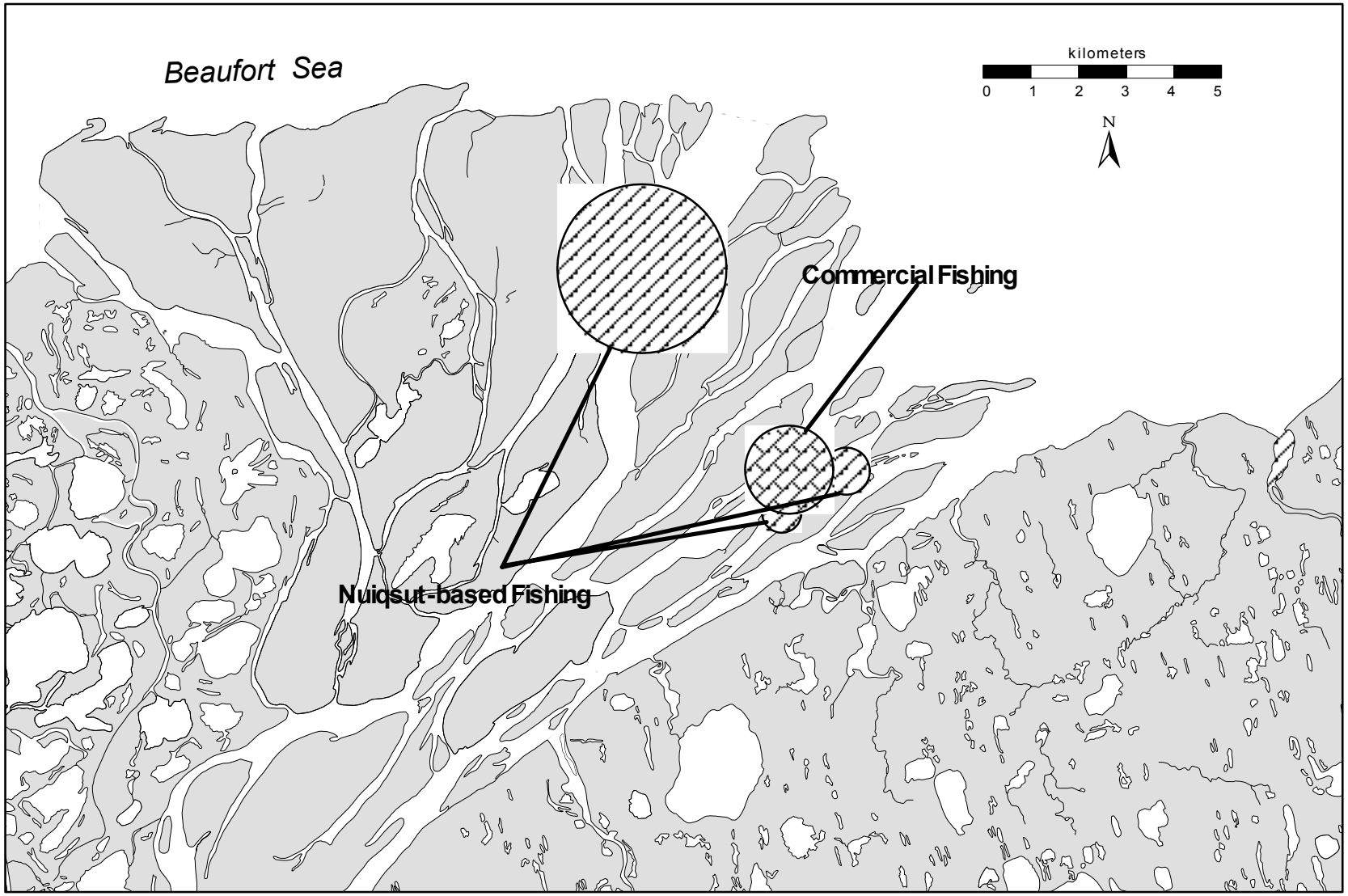
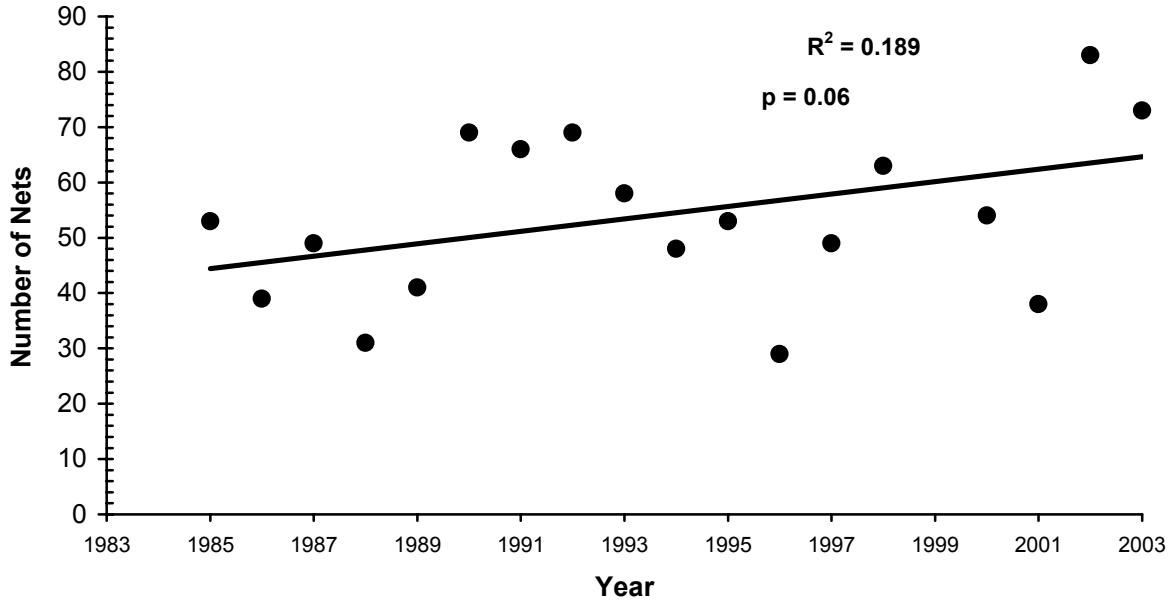
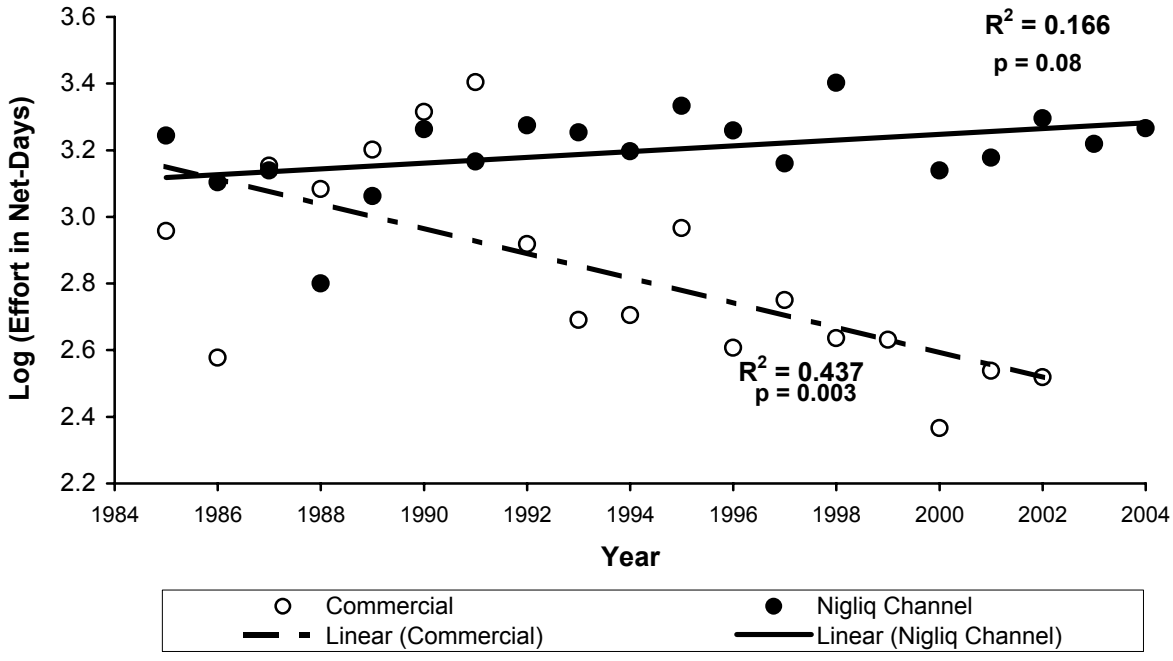


Figure 3. Fishing areas on the lower Colville River and Outer Delta region.



a. Number of Nets



b. Estimated Fishing Effort

Figure 4. Trends in fishing effort in the Colville Delta fall Fishery, 1985-2004 by number of nets and effort in net-days (1 net-day = 24 hrs fishing per 18 m of net, all meshes combined).

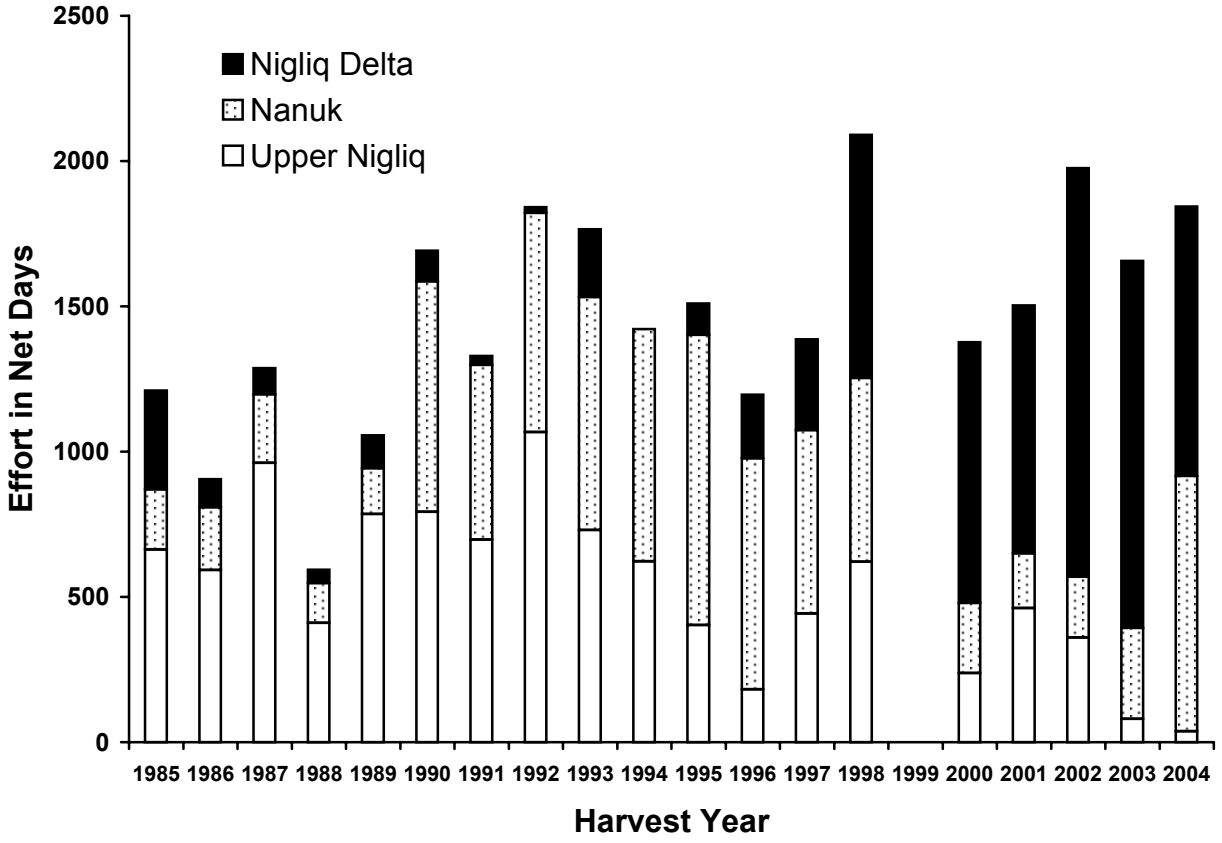


Figure 5. Distribution of fishing effort in the Nigliq Channel by fishing area, all meshes combined, 1986 to 2004.

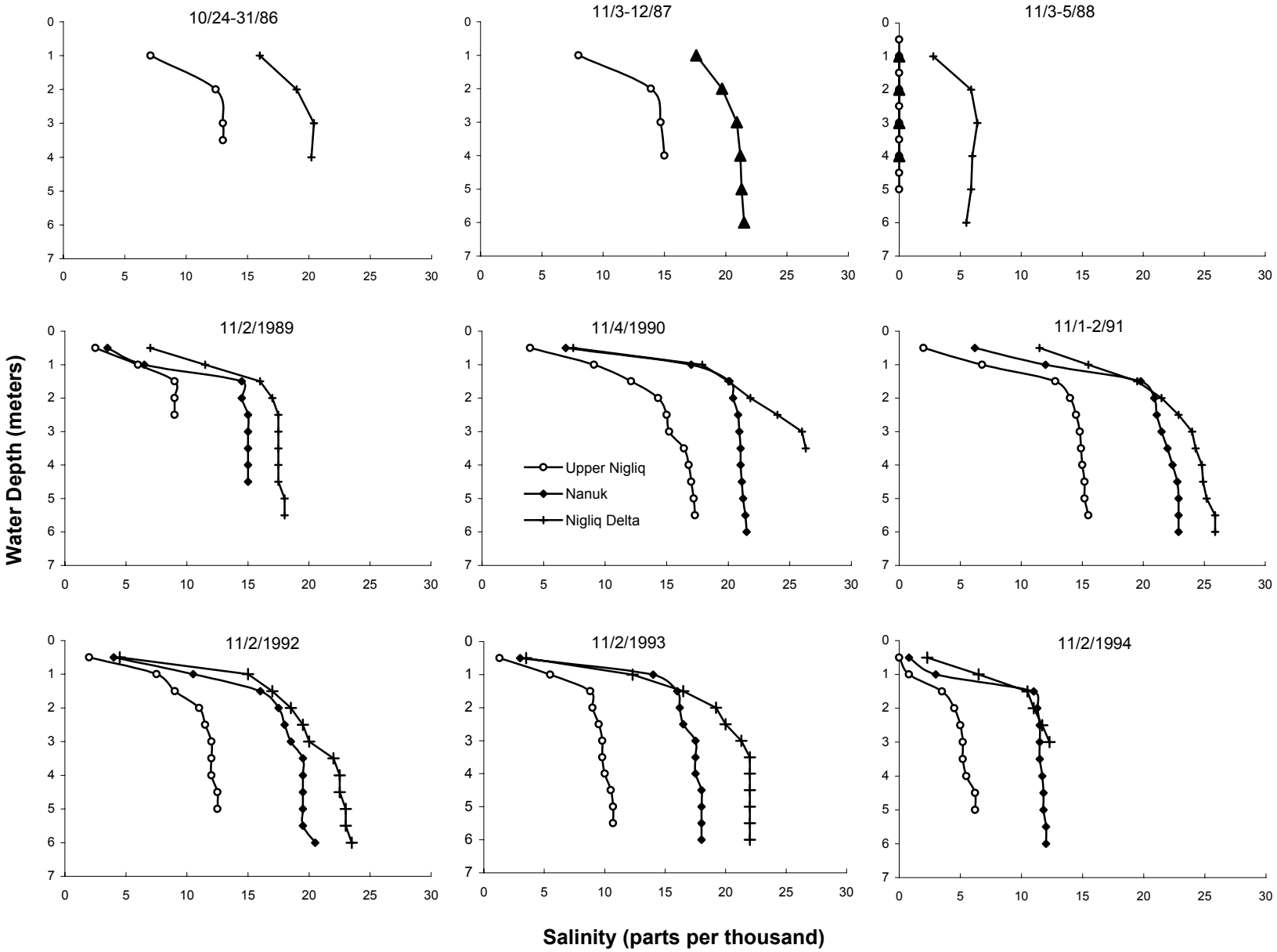
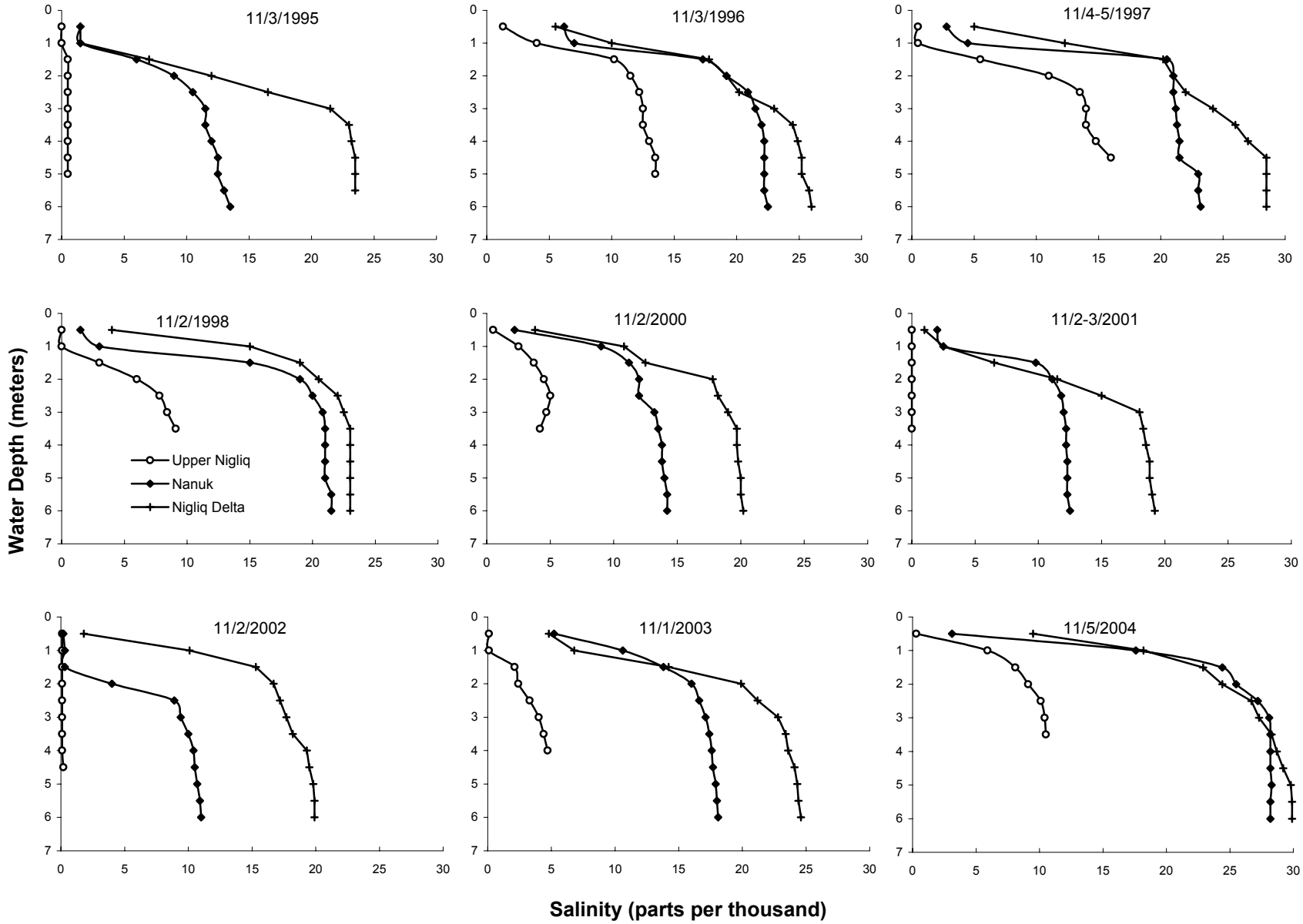


Figure 6. Salinity distribution in the Nigliq Channel, Colville Delta, during the fall gill net fishery, 1986-2004.



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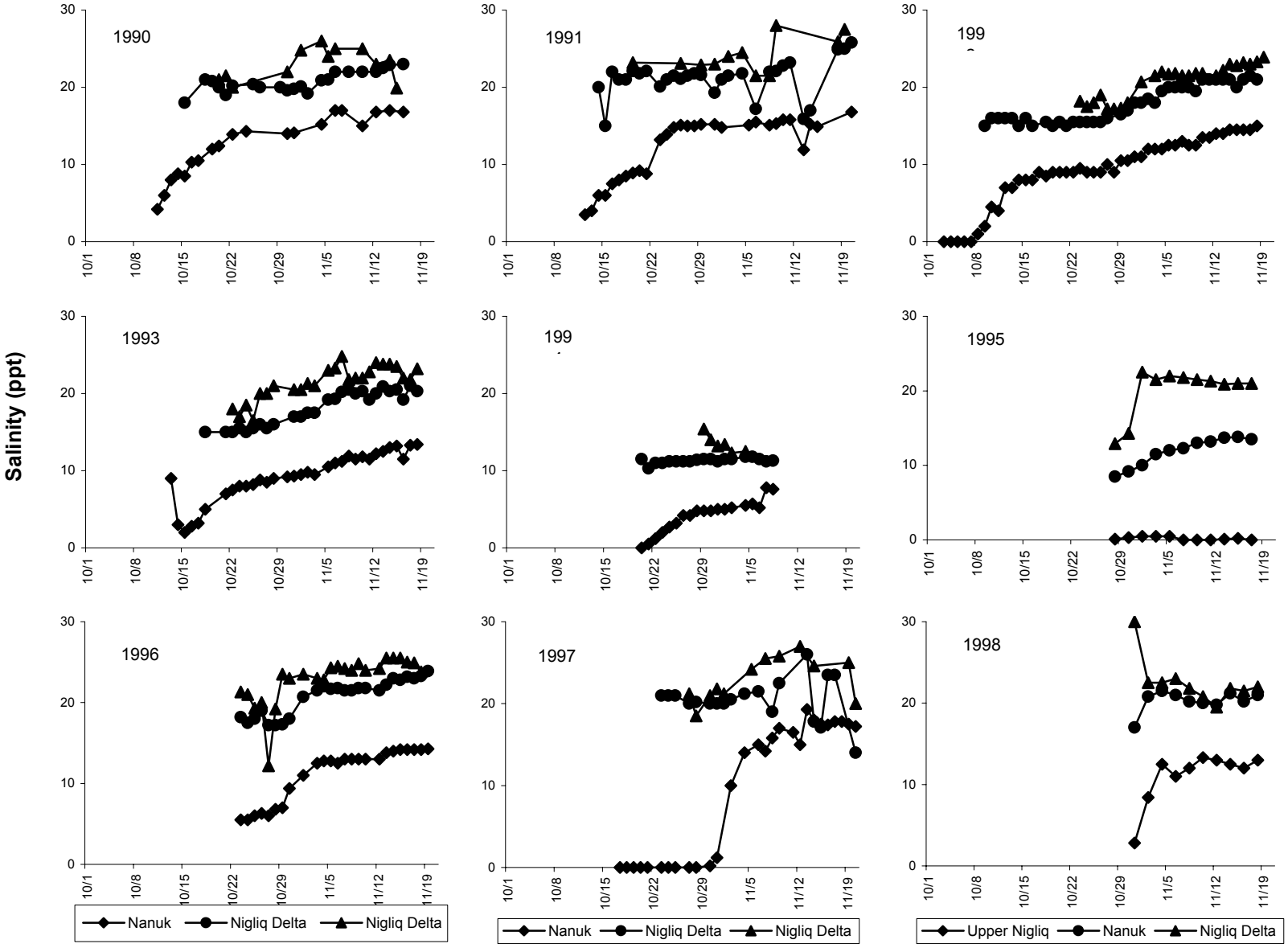
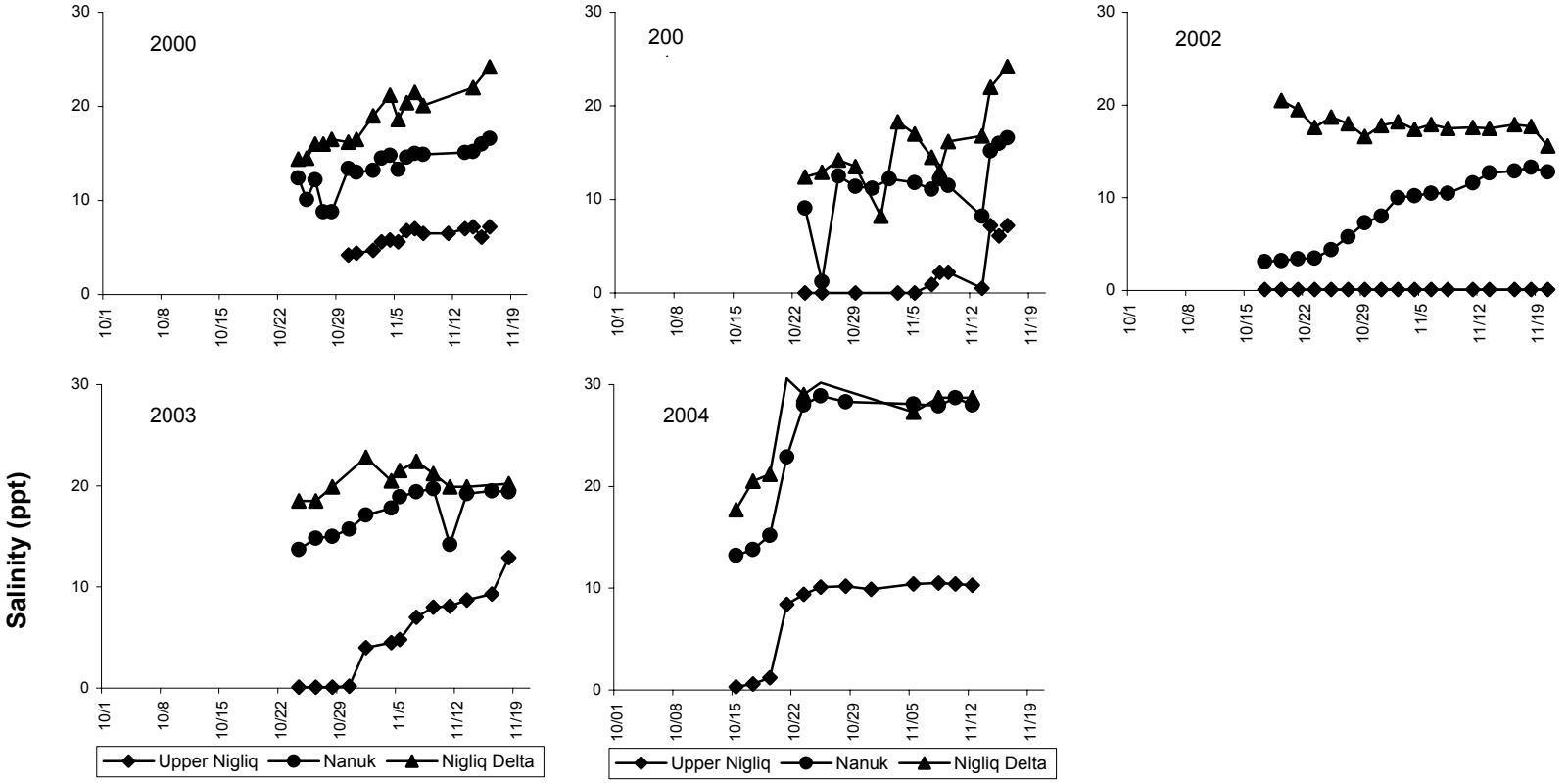


Figure 7. Salinities (in parts per thousand) measured at 3 m below the ice surface at Nigliq Channel fishing areas, 1990-2004.



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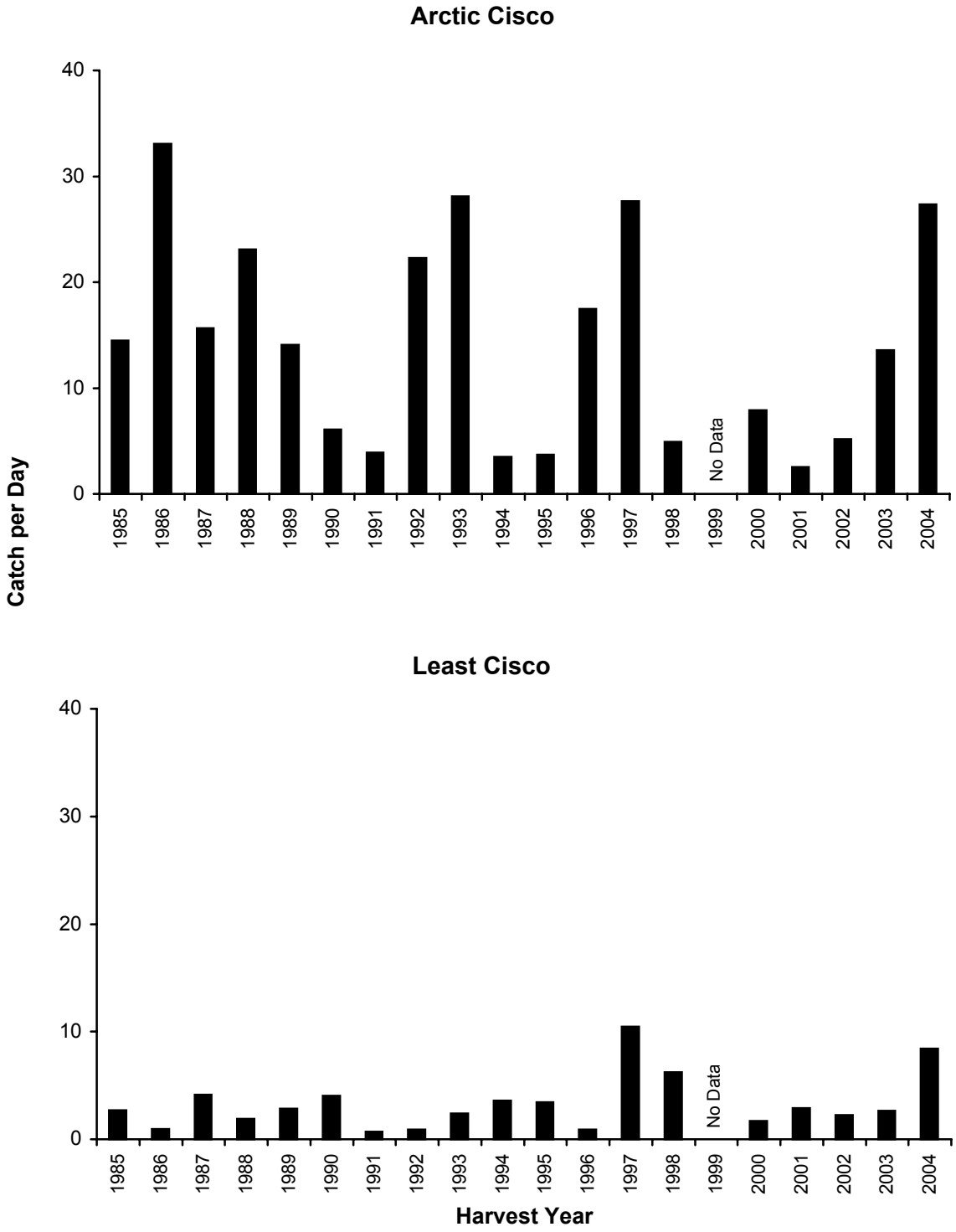


Figure 8. Catch rates of arctic cisco and least cisco in the Nuiqsut Channel fishery, 1985-2004.

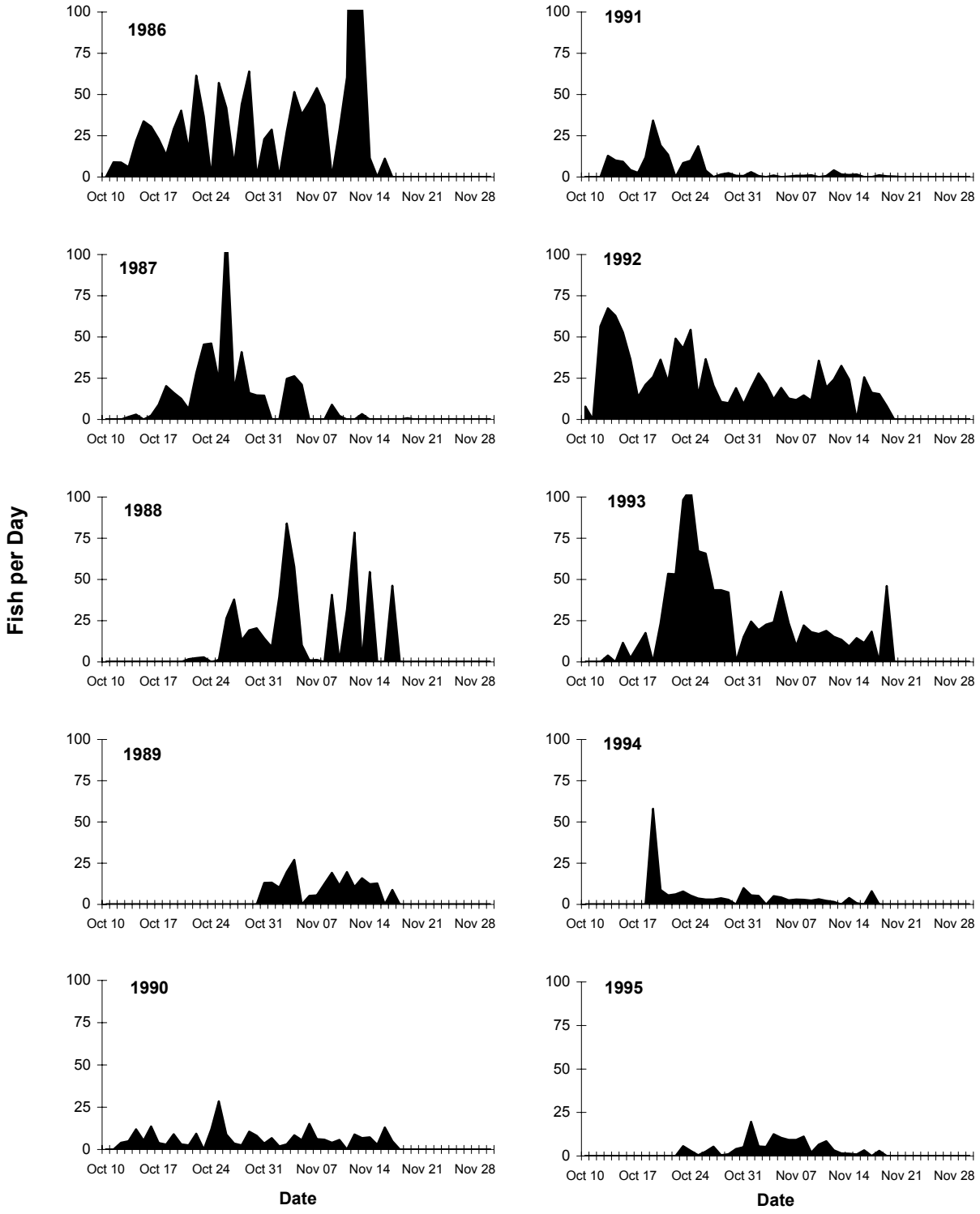
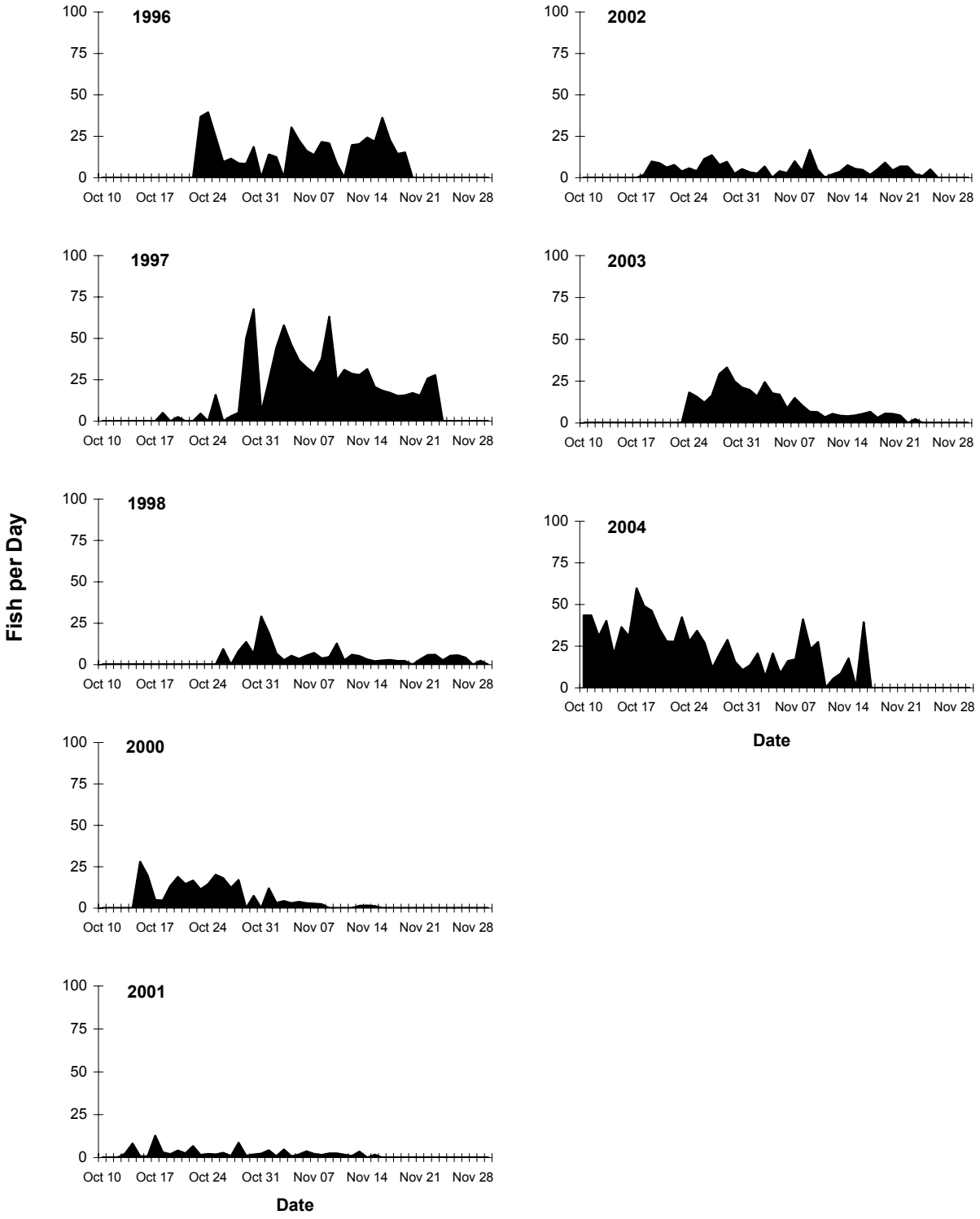


Figure 9. Mean daily catch rate of Arctic cisco in 76-mm (3 inch) mesh in the Nigliq Channel, 1986-2004.



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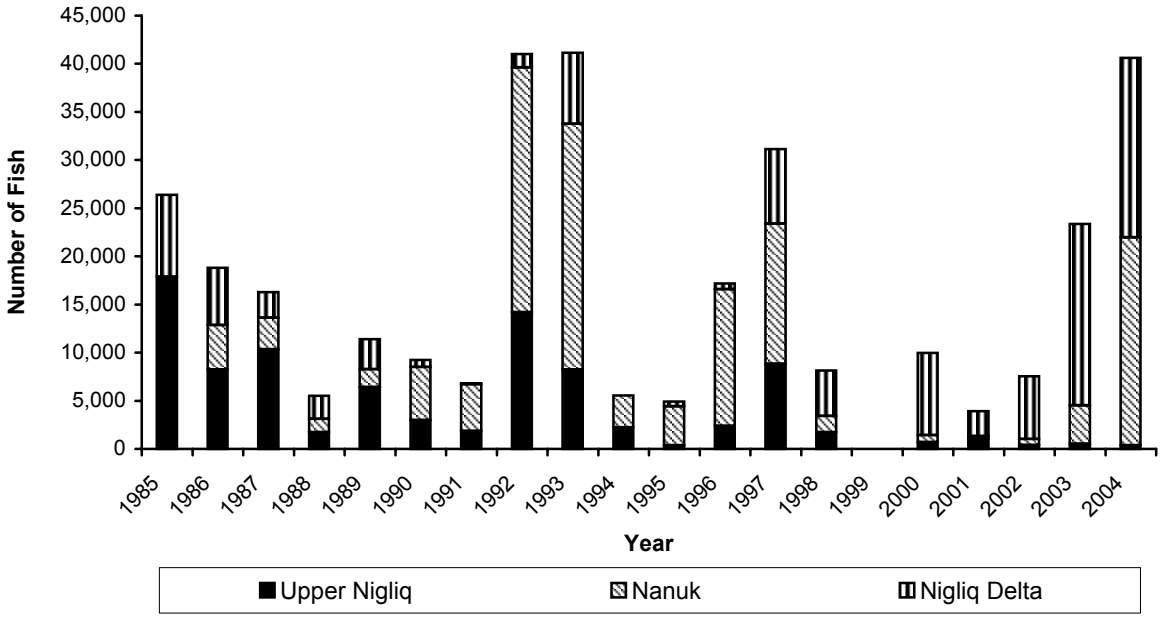
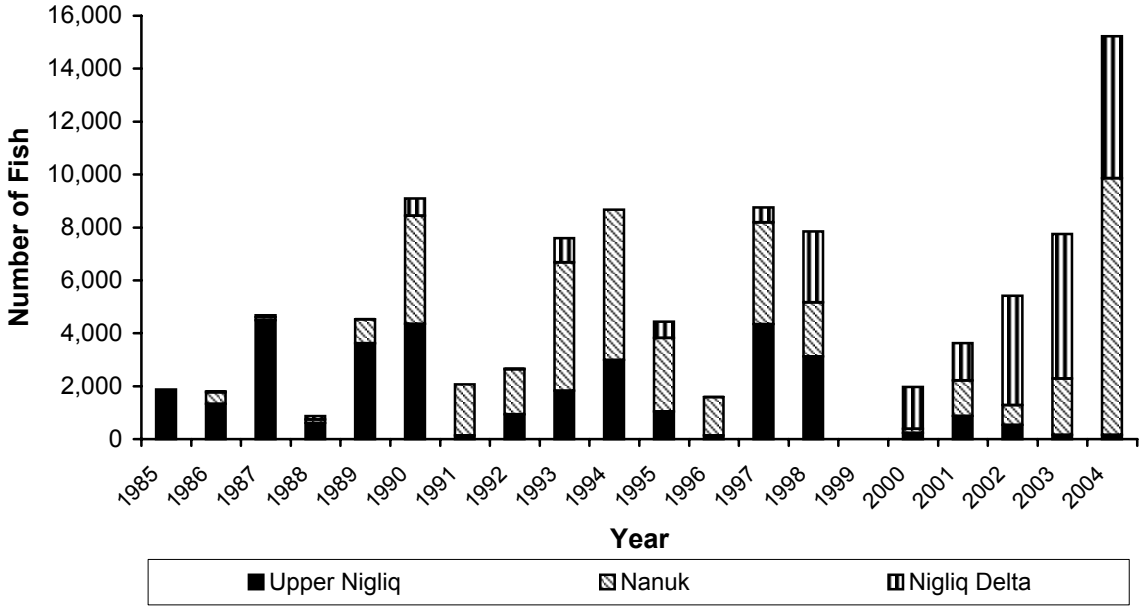


a. Arctic Cisco



b. Least Cisco

Figure 10. Catch of arctic cisco and least cisco by harvest area in the Nigliq Channel, 1985 to 2004.

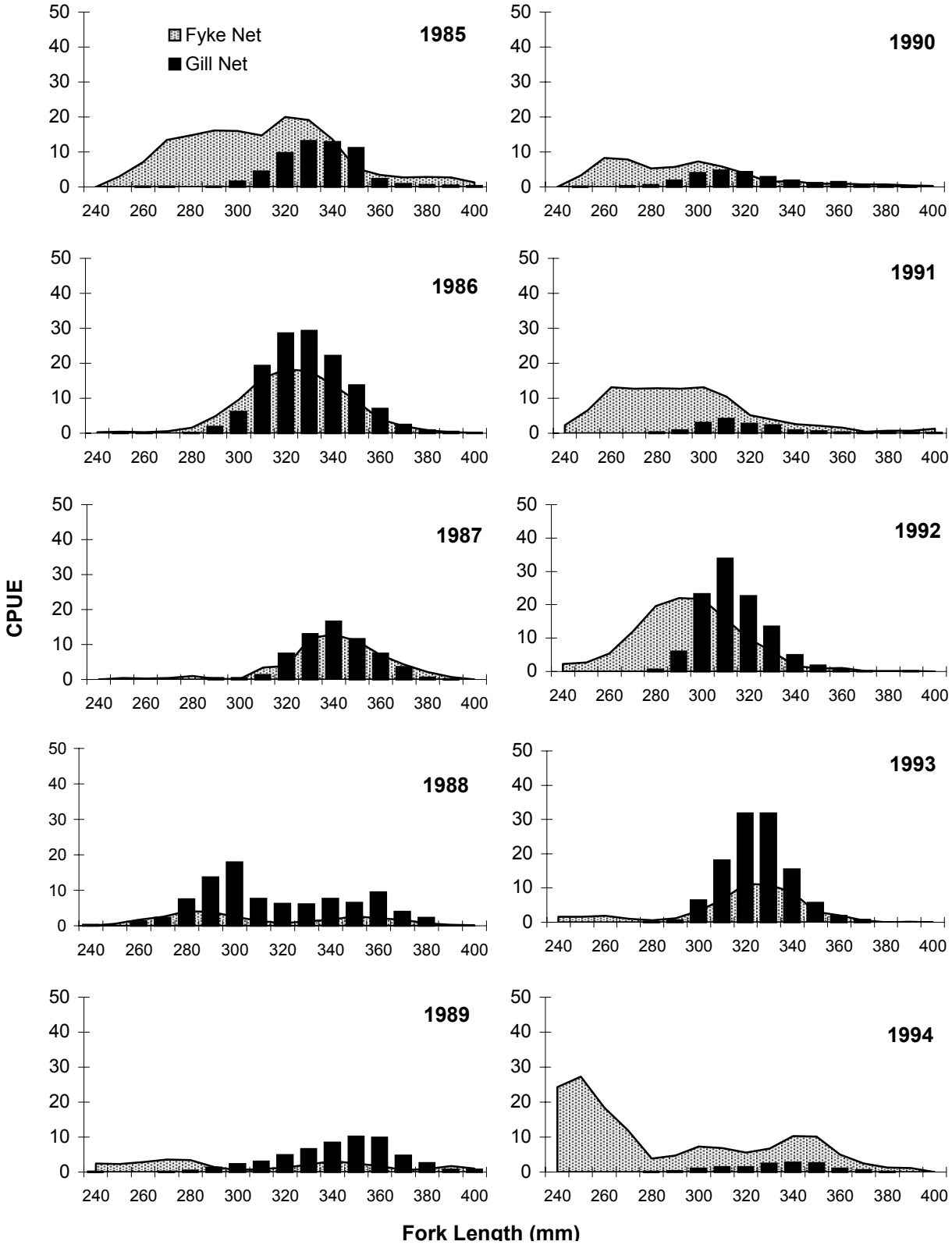
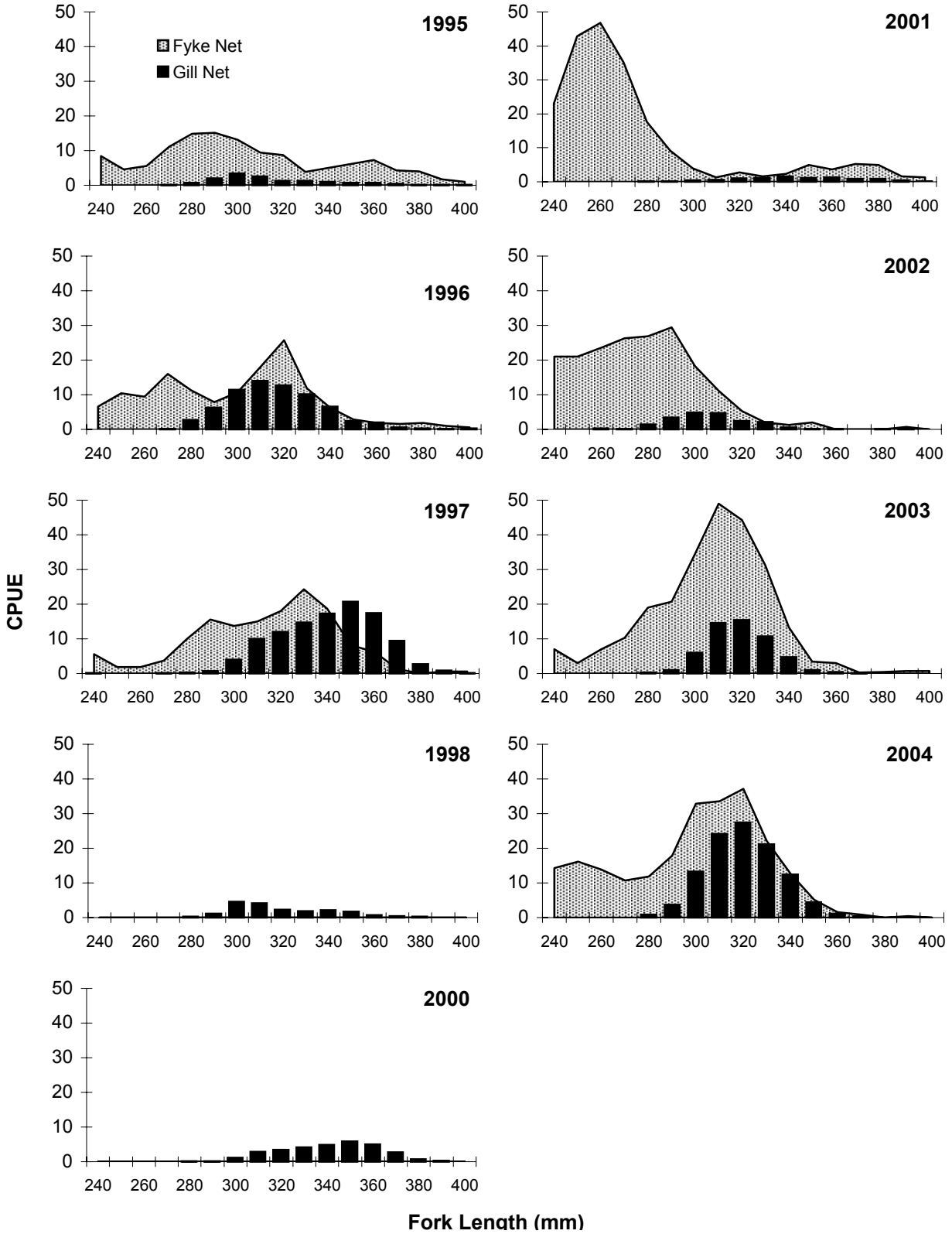


Figure 11. Length frequencies of Arctic cisco caught in Prudhoe Bay fyke nets compared to those caught by 76-mm (3 inch) Nigliq Channel gill nets, 1985-2004 (fyke net length frequencie for fish caught after August 14, i.e. after summer growth period).

Prudhoe Bay fyke nets not fished from 1998-2000



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Prudhoe Bay fyke nets not fished from 1998-2000

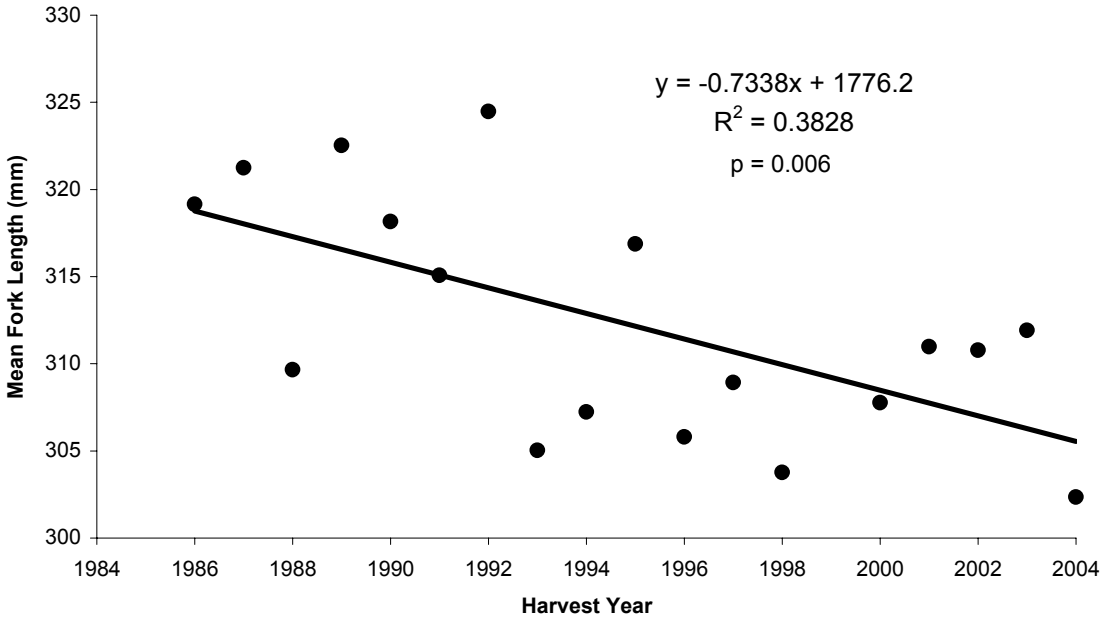

Figure 12. Trend in mean length for least cisco caught in 76-mm (3 inch) mesh in the Nuiqsut fall fishery, 1986-2003.

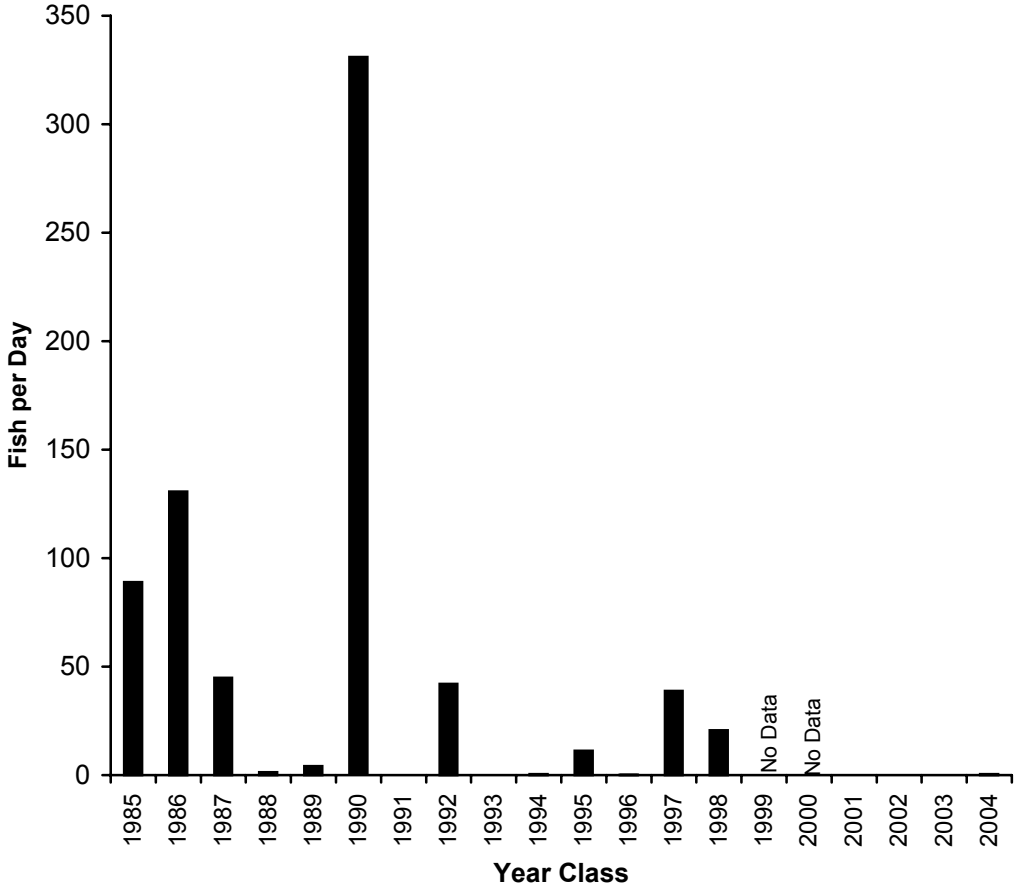

Figure 13. Catch rates of young-of-the-year (YOY) arctic cisco by year class ir Prudhoe Bay fyke nets, 1985-2004.

(source: LGL Alaska Research Associates 2000, B. Fechhelm, pers. comm. 2003, 2005).

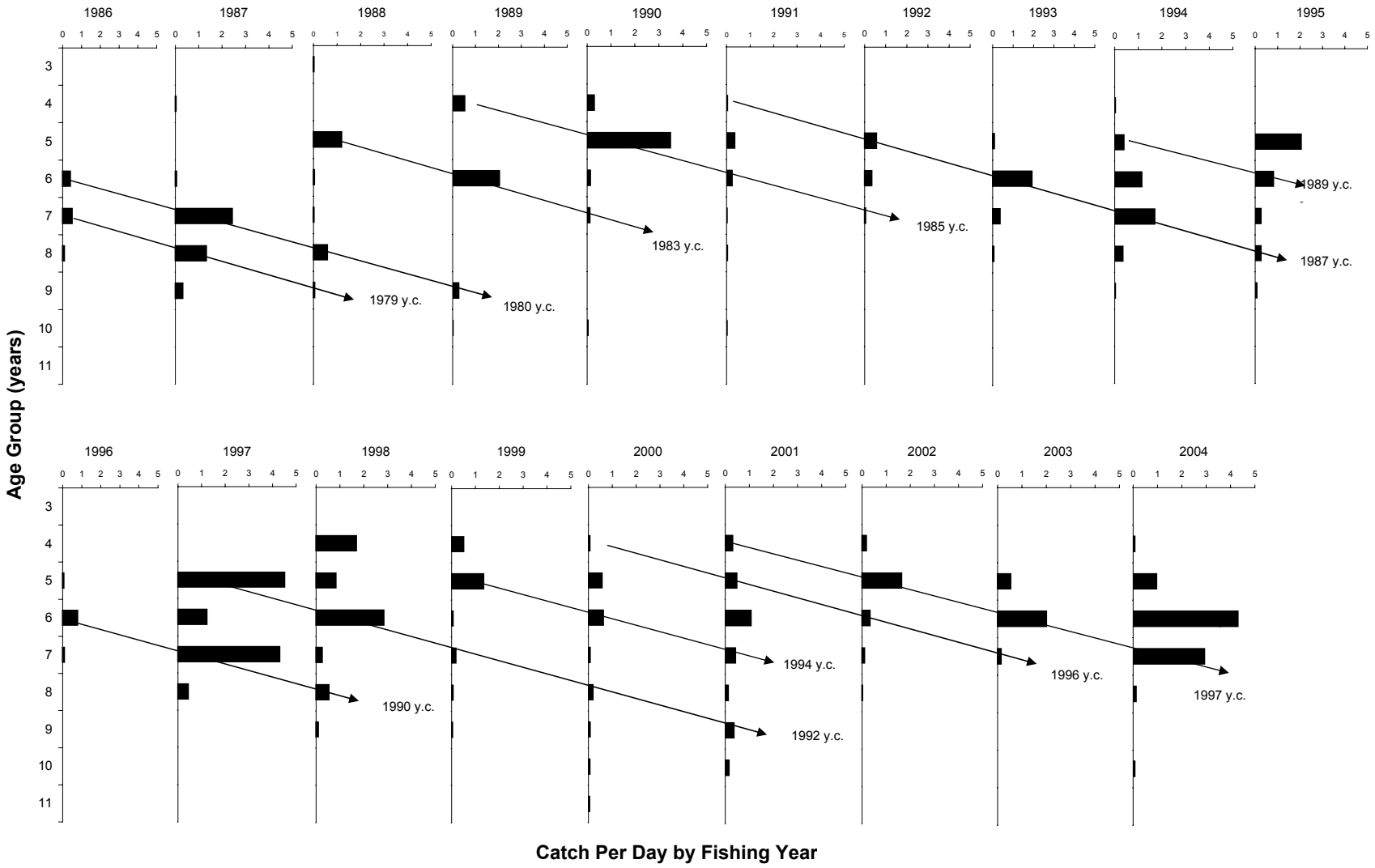

Figure 14. Age distribution of arctic cisco caught in the Colville River commercial fishery, 1984 - 2004, scaled to CPUE (from fish caught in 76-mm mesh nets, arrows indicate progression of year classes through the fishery).

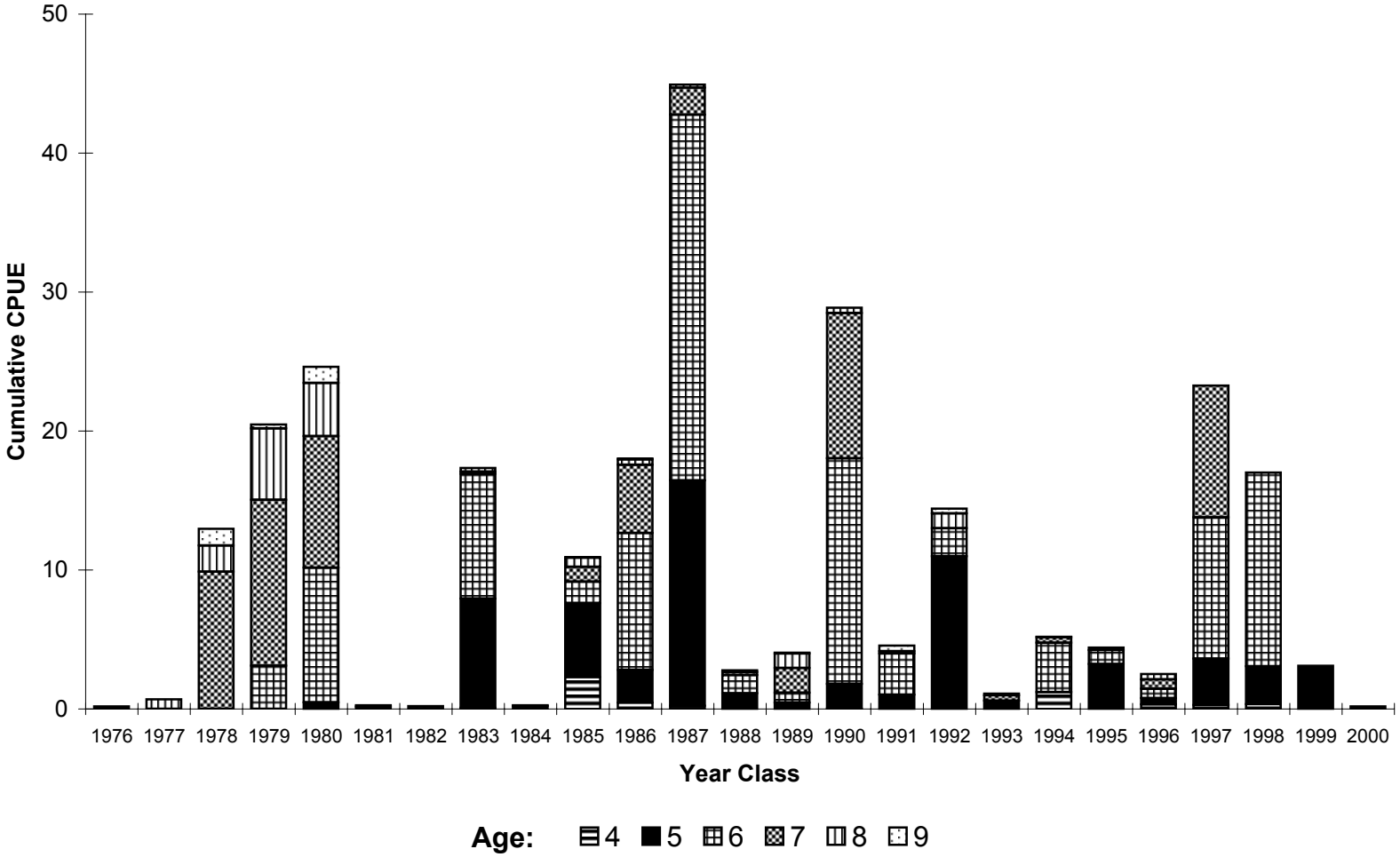

Figure 15. Cumulative harvest for each year class of arctic cisco, expressed as cumulative catch rate in the Nuiqsut fishery for harvest years 1984 to 2004.

Table 1. Estimated onset of fishing effort in the Nuiqsut fall fishery, 1985-2004.

Year	Onset of Fishing
1985	Oct 2
1986	Oct 3
1987	Oct 8
1988	Oct 14
1989	Oct 22
1990	Oct 6
1991	Oct 12
1992	Sep 26
1993	Oct 3
1994	Oct 3
1995	Oct 16
1996	Sep 28
1997	Oct 13
1998	Sep 28
1999	--
2000	Oct 3
2001	Oct 6
2002	Oct 14
2003	Oct 16
2004	Oct 9

Average start date for 1985-2004 = October 7.

Table 2. Catch contribution by species as observed during fisherman interviews in the Nigliq Channel, by percent of sampled catch, 1985-2004 (does not include commercial fishery).

Species	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	200
Arctic cisco	69.5	95.9	71.8	90.6	66.2	39.6	62.8	89.2	85.4	39.6	34.7	81.9	74.8	39.6	79.4	35.6	49.8
Bering Cisco	(a)	(a)	(a)	(a)	(a)	21.8	1.2	0.1	0.02	0.1	0.2	0.0	0.0	0.0	0.1	0.1	0.1
Least cisco	14.8	3.8	18.7	8.3	23.7	30.2	30.0	6.0	11.1	44.6	35.0	4.8	22.9	50.8	14.0	29.6	30.(
Broad whitefish	15.1	0.3	5.5	0.6	7.0	5.3	1.0	0.2	0.3	2.2	7.6	0.1	1.3	0.4	0.2	5.5	1.(
Humpback whitefish	0.5	0.03	3.8	0.5	3.1	2.9	3.8	0.1	0.4	13.2	22.3	0.4	0.9	8.9	6.0	27.8	17.5
Arctic grayling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.(
Rainbow smelt	0.2	0.03	0.01	0.0	0.03	0.2	1.0	0.0	0.04	0.3	0.2	0.1	0.0	0.0	0.3	0.1	0.2
Round whitefish	0.0	0.01	0.0	0.0	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.(
Dolly Varden char	0.0	0.0	0.03	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.(
Northern Pike	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.(
Saffron cod	0.0	0.0	0.03	0.0	0.03	0.03	0.04	0.0	0.01	0.0	0.0	0.02	0.0	0.0	0.03	0.0	0.1
Burbot	0.0	0.0	0.06	0.1	0.03	0.01	0.09	0.0	0.0	0.0	0.1	0.02	0.0	0.0	0.0	1.3	0.2
Arctic flounder	0.0	0.0	0.00	0.0	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.(
Fourhorn sculpin	(b)	(b)	(b)	(b)	(b)	(b)	(b)	4.4	2.7	(b)	(b)	12.5	(b)	(b)	(b)	(b)	(b
Total Observed:	2,705	8,952	6,826	2,948	2,946	7,911	7,576	24,305	17,155	3,792	7,155	5,730	19,758	6,481	3,871	3,515	8,44

(a) = included with Arctic cisco prior to 1990
(b) = always present but not counted

Table 3. Mean catch rate of arctic cisco in 76-mm (3 inch) mesh gill nets in the Nuiqsut fall fishery, 1985-2004 (in fish per day per 18 m of net).

(see Appendix Table A-12 for supporting data on the Nigliq Channel)

Year	Upper Nigliq	Nanuk	Nigliq Delta	Nigliq Channel Average	Outer Colville Delta Main Channel	Outer Colville Delta East Channel
1985	--	--	--	14.5	76.1	--
1986	19.2	29.9	65.8	33.0	62.0	--
1987	11.0	29.1	21.1	15.6	47.6	--
1988	6.4	8.1	55.7	23.1	19.3	--
1989	10.9	18.0	24.7	14.1	--	--
1990	4.4	7.5	7.3	6.1	--	--
1991	3.7	4.1	2.0	3.9	--	--
1992	15.3	17.8	51.5	22.3	54.1	--
1993	16.1	36.5	27.2	28.1	207.1	--
1994	3.7	3.4	--	3.5	35.5	--
1995	1.1	3.2	22.3	3.7	21.4	7.6
1996	11.5	18.6	--	17.5	28.6	45.8
1997	21.3	27.8	41.4	27.7	--	--
1998	2.0	2.6	7.8	4.9	--	--
1999	--	--	--	--	--	--
2000	1.0	3.5	9.6	7.9	--	--
2001	1.5	1.6	2.9	2.5	--	--
2002	0.9	3.7	6.3	5.2	--	--
2003	5.3	14.4	13.6	13.6	--	--
2004	15.4	29.9	25.1	27.3		
1994-2003						
Mean	5.4	8.8	14.8	9.6	28.5	26.7
Standard Deviation	6.9	9.3	13.2	8.4	7.0	27.0

-- = not available

Table 4. Mean catch rate of least cisco in 76-mm (3 inch) mesh gill nets in the Nuiqsut fall fishery, 1985-2004 (in fish per day per 18 m of net).

(see Appendix Table A-13 for supporting data on the Nigliq Channel)

Year	Upper Nigliq	Nanuk	Nigliq Delta	Nigliq Channel Average	Outer Colville Delta Main Channel
1985	--	--	--	2.7	47.4
1986	1.3	0.6	0.5	1.0	18.3
1987	5.5	1.9	0.4	4.1	15.4
1988	1.6	0.7	2.8	1.9	57.9
1989	3.7	1.1	0.5	2.8	--
1990	4.8	2.8	6.5	4.0	--
1991	0.3	0.8	0.0	0.7	--
1992	0.8	0.7	1.6	0.9	8.1
1993	1.7	3.1	1.7	2.4	--
1994	3.3	3.7	--	3.6	--
1995	4.7	2.8	7.8	3.4	--
1996	0.4	1.0	--	0.9	--
1997	11.5	12.2	3.8	10.5	--
1998	5.9	6.9	6.0	6.2	--
1999	--	--	--	--	--
2000	1.4	1.6	1.7	1.7	--
2001	2.1	9.8	2.4	2.9	--
2002	1.5	4.5	2.2	2.2	--
2003	2.1	4.4	2.3	2.7	--
2004	7.6	9.2	7.4	8.4	--
1994-2003					
Mean	3.7	5.2	3.8	3.8	
Standard Deviation	3.4	3.8	2.3	2.9	

-- = not available

Table 5. Observed and effort-adjusted CPUE values for the Colville Delta commercial fishery, 1967 - 2002 (CPUE = fish/day/46 m net).

		Arctic Cisco			Least Cisco		
Year	Total Effort	Total Harvest	Actual CPUE	Adjusted CPUE[a]	Total Harvest	Actual CPUE	Adjusted CPUE[a]
1967	774	21,904	28.3	30.8	15,982	20.6	24.0
1968	1,427	41,948	29.4	50.0	19,086	13.4	40.7
1969	699	19,593	28.0	28.5	35,001	50.1	50.6
1970	562	22,685	40.4	37.0	30,650	54.5	50.0
1971	1,422	41,312	29.1	49.5	23,887	16.8	44.0
1972	646	37,101	57.4	56.4	12,183	18.9	17.5
1973	993	71,575	72.1	80.7	25,191	25.4	36.7
1974	947	44,937	47.5	54.8	14,122	14.9	24.6
1975	759	30,953	40.8	42.9	22,476	29.6	32.4
1976	996	31,659	31.8	40.5	37,046	37.2	48.7
1977	576	31,796	55.2	52.2	14,961	26.0	22.0
1978	1,077	18,058	16.8	27.7	25,761	23.9	38.4
1979	620	9,268	14.9	13.2	25,097	40.5	38.1
1980	1,209	14,753	12.2	26.8	30,982	25.6	45.0
1981	501	38,176	76.2	71.2	15,504	30.9	24.2
1982	328	15,975	48.7	38.9	27,085	82.6	69.5
1983	520	18,162	34.9	30.4	37,909	72.9	66.9
1984	371	27,686	74.6	66.0	13,076	35.2	23.7
1985	363	23,678	65.2	56.4	17,383	47.9	36.1
1986	151	29,595	196.0	181.3	9,444	62.5	42.9
1987	570	27,948	48.3	45.9	11,930	20.9	16.7
1988	485	10,470	21.6	16.0	23,196	47.8	40.5
1989	636	24,802	39.0	37.6	19,595	30.8	29.0
1990	825	21,772	25.6	30.3	17,064	20.7	25.9
1991	1,015	23,731	23.4	32.5	7,743	7.6	19.8
1992	331	22,754	68.7	59.0	7,284	22.0	9.0
1993	196	31,310	159.7	146.3	6,037	30.8	12.8
1994	203	8,958	44.1	30.8	10,176	50.1	32.4
1995	368	14,311	38.9	30.1	8,633	23.5	11.8
1996	162	21,817	134.7	120.2	7,796	48.1	28.9
1997	225	16,990	75.5	62.8	10,754	47.8	30.9
1998	173	8,752	50.6	36.4	11,822	68.3	49.5
1999	171	8,872	51.9	37.6	7,430	43.5	24.5
2000	93	2,619	28.2	11.7	5,758	61.9	40.1
2001	138	1,924	13.9	1.0	2,976	21.6	1.4
2002	132	3,935	29.8	14.5	5,503	41.7	21.3
1992-2001 Mean:	206	13,831	66.6	53.6	7,867	41.8	24.1

[a] The relationship used to adjust the CPUE for effort is based on the correlation between CPUE and effort during the period 1967-1990.

Table 6. Estimated harvest during the Colville Delta fall fisheries by species, in number of fish, 1967-2004.

	Arctic Cisco		Least Cisco		Humpback Whitefish		Broad Whitefish	
Year	Commercial Harvest[a]	Village Harvest[b]	Commercial Harvest	Village Harvest	Commercial Harvest	Village Harvest	Commercial Harvest	Village Harvest
1967	21,904		15,982		356			
1968	41,948		19,086		172			
1969	19,593		35,001		3,136			
1970	22,685		30,650		345			
1971	41,312		23,887		183			
1972	37,101		12,183		1,481			
1973	71,575		25,191		5,733			
1974	44,937		14,122		4,802			
1975	30,953		22,476		1,946			
1976	31,659		37,046		1,793			
1977	31,796		14,961		1,366			
1978	18,058		25,761		2,758			
1979	9,268		25,097		1,102			
1980	14,753		30,982		4,232			
1981	38,176		15,504		469			
1982	15,975		27,085					
1983	18,162		37,909					
1984	27,686		13,076					
1985	23,678	46,681	17,383	15,814				1,148
1986	29,595	33,523	9,444	6,805		79		229
1987	27,948	20,847	11,930	6,114	1,880	957		1,239
1988	10,470	6,098	23,196	2,320	6,945	70		58
1989	24,802	12,892	19,595	6,035	5,804	421	69	1,306
1990	21,772	11,224	17,064	9,100	4,581	200	2	416
1991	23,731	8,269	7,743	3,193	1,658	634	11	206
1992	22,754	45,401	7,284	2,659	5,209	30	208	130
1993	31,310	46,944	6,037	7,599	5,339	1,057	19	534
1994	8,958	10,956	10,176	8,669	8,827	2,736	8	936
1995	14,311	8,573	8,633	8,573	10,860	6,395	186	1,514
1996	21,817	41,205	7,796	15,854	6,425	6,105	258	326
1997	16,990	33,274	10,754	10,002	1,721	365	13	486
1998	8,752	13,559	11,822	19,323	5,279	4,681	13	91
1999	8,872	--	7,430	--	6,875	--	436	--
2000	2,619	9,956	5,758	1,973	3,706	1,062	4	3
2001	1,924	3,935	2,976	3,630	6,184	2,576	--	979
2002	3,935	7,533	5,503	5,422	4,185	2,765	--	268
2003	--	23,369	--	7,748	--	3,685	--	176
2004	--	40,605	--	15,228	--	454	--	9

[a]Commercial harvest numbers provided by J. Helmericks, 1996-2002

[b] 2000-2004 village harvest represents only the Nigliq Channel harves

Table 7. Mean fork length of least cisco caught in 76-mm (3 inch) mesh gill nets during the Nuiqsut fall fishery, 1986-2003.

Year	Mean Length (mm)	Standard Deviation	Number of Fish
1986	319.1	18.6	148
1987	321.3	18.7	52
1988	309.7	22.4	137
1989	322.5	25.5	238
1990	318.2	21.7	267
1991	315.1	25.2	294
1992	324.5	25.4	145
1993	305.0	15.2	157
1994	307.2	17.3	218
1995	316.9	22.2	236
1996	305.8	15.0	123
1997	308.9	23.9	173
1998	303.8	19.0	513
1999	--	--	--
2000	307.8	20.6	129
2001	311.0	19.4	515
2002	310.8	21.2	688
2003	311.9	19.1	588
2004	302.4	16.2	629

Table 8. Estimated numbers and biomass of harvested Arctic cisco and least cisco by year for village and commercial fisheries in the Colville Delta, 1985-2004 (Bering cisco included for 1990).

	Village Harvest						Commercial Harvest					
	Arctic Cisco		Least Cisco		Bering Cisco		Arctic Cisco		Least Cisco			Harvested
	Catch	Biomass	Catch	Biomass	Catch	Biomass	Catch	Biomass	Catch	Biomass	Total	Biomass
Year	(in fish)	(kg)	(in fish)	(kg)	(in fish)	(kg)	(in fish)	(kg)	(in fish)	(kg)	Catch	(kg)
1985	46,681	19,478	15,814	5,298	trace		23,678	10,146	17,596	6,021	103,769	40,942
1986	33,522	14,414	6,804	2,176	trace		29,456	12,640	9,000	2,959	78,782	32,189
1987	20,926	9,800	6,178	2,020	trace		27,494	12,945	11,939	4,117	66,537	28,882
1988	6,098	2,951	2,321	793	trace		10,480	5,264	23,040	8,121	41,939	17,129
1989	12,892	6,497	6,036	1,844	trace		24,802	12,697	19,640	7,006	63,370	28,043
1990	11,224	4,407	9,100	2,584	8,652	5,474	21,105	8,634	17,049	5,513	67,130	26,613
1991	8,269	2,852	3,193	754	trace		23,698	8,695	7,744	1,838	42,904	14,139
1992	45,402	15,700	2,658	777	trace		22,754	8,391	7,284	2,513	78,098	27,380
1993	46,944	18,615	7,599	2,093	trace		31,310	12,725	6,037	1,795	91,890	35,229
1994	10,956	4,502	8,669	2,455	trace		8,958	4,037	10,176	3,153	38,758	14,147
1995	8,574	3,463	8,573	2,487	trace		14,311	5,353	8,633	2,658	40,091	13,961
1996	41,205	15,387	15,854	4,645	trace		21,817	8,124	7,796	2,375	86,672	30,531
1997	33,274	14,487	10,002	2,979	trace		16,990	7,186	10,754	3,228	71,020	27,880
1998	13,559	5,435	19,323	5,487	trace		8,752	3,501	11,822	3,443	53,455	17,866
2000	9,956	4,851	1,973	641	trace		2,619	1,218	5,758	1,873	20,306	8,583
2001	3,935	1,886	3,630	1,089	trace		1,924	913	2,976	925	12,465	4,813
2002	7,533	2,669	5,422	1,555	trace		3,935	1,424	5,503	1,710	22,393	7,358
2003	23,369	9,986	7,748	2,327	trace		--	--	--	--	--	--
2004	40,605	15,325	15,228	5,556	trace		--	--	--	--	--	--

2000-2004 village harvest represents only the Nigliq Channel harvest

DATA APPENDIX

LIST OF APPENDIX TABLES

Appendix Table 1. Total estimated fishing effort by in the Colville River fall fishery, 1985-2004 (in net-days per 18-m of gill net).

	Village Effort							
Year	Upper Nigliq	Nanuk	Nigliq Delta	Outer Delta	Main River	**Total Village**	**Commercial**	**Total**
1985	663	207	340	543		1,753	908	2,661
1986	592	216	97	365		1,270	378	1,648
1987	961	236	90	89		1,376	1,424	2,800
1988	411	136	47	37		631	1,213	1,844
1989	786	157	114	98		1,155	1,590	2,745
1990	793	793	106	142		1,834	2,063	3,897
1991	697	601	31	28	108	1,465	2,538	4,003
1992	1,067	755	19	39		1,880	828	2,707
1993	730	802	233	28		1,793	490	2,283
1994	622	800	0	152		1,574	508	2,082
1995	403	1,000	108	443	198	2,151	925	3,076
1996	182	795	219	622		1,818	405	2,223
1997	443	631	313	59		1,446	563	2,008
1998	621	632	836	435		2,525	433	2,958
1999	--	--	--	--		--	428	428
2000	238	240	898	--		1,377	233	1,609
2001	461	189	854	--		1,503	345	1,848
2002	360	209	1,407	--		1,976	330	2,306
2003	80	313	1,263	--		1,656	NR	--
2004	37	879	928	--		1,844	NR	--
1994-2003								
Mean:	379	534	655			1,781	463	2,060
StDev:	186	303	513			378	199	778

NR = not reported

Appendix Table 2. Total estimated catch of arctic cisco in the Colville Delta fall fishery, 1985-2004. (in numbers of fish).

	Nigliq Channel				Outer Colville Delta			Total	Total	
Year	Upper Nigliq	Nanuk	Nigliq Delta	Nigliq Channel Total	Main Channel	East Channel	Main River	Village Catch	Commercial Catch	Total Harves
1985	17,878	NA	8,500	26,378	12,397	7,906	--	46,681	23,678	70,3
1986	8,239	4,636	5,924	18,799	14,724	0	--	33,523	29,456	62,9
1987	10,331	3,310	2,635	16,276	4,571	0	--	20,847	27,494	48,3
1988	1,736	1,401	2,374	5,511	587	0	--	6,098	10,480	16,5
1989	6,403	1,866	3,123	11,392	1,500	0	--	12,892	24,802	37,6
1990	2,979	5,538	706	9,224	2,000	0	--	11,224	21,105	32,3
1991	1,866	4,853	91	6,810	1,025	0	434	8,269	23,731	32,0
1992	14,182	25,444	1,375	41,001	4,400	0	--	45,401	22,754	68,1
1993	8,243	25,525	7,375	41,144	5,800	0	--	46,944	31,310	78,2
1994	2,230	3,326	0	5,556	5,400	0	--	10,956	8,958	19,9
1995	379	4,037	489	4,905	1,400	1,853	415	8,573	14,311	22,8
1996	2,404	14,170	598	17,172	13,571	10,462	0	41,205	21,817	63,0
1997	8,834	14,554	7,743	31,130	2,144	0	0	33,274	16,990	50,2
1998	1,730	1,697	4,721	8,148	--	--	--	8,148	8,752	16,9
1999	--	--	--	--	--	--	--	--	8,872	
2000	688	735	8,533	9,956	--	--	--	9,956	2,619	12,5
2001	1,044	279	2,612	3,935	--	--	--	3,935	1,924	5,8
2002	384	641	6,508	7,533	--	--	--	7,533	3,935	11,4
2003	543	3,975	18,852	23,369	--	--	--	23,369	--	
2004	359	21,613	18,634	40,605	--	--	--	40,605	--	

Appendix Table 3. Total estimated catch of least cisco in the Colville Delta fall fishery, 1985-200
(in numbers of fish)

	Nigliq Channel				Outer Colville Delta			Total	Total	
Year	Upper Nigliq	Nanuk	Nigliq Delta	Nigliq Channel Total	Main Channel	East Channel	Main River	Village Catch	Commercial Catch	Total Harvest
1985	1,871	NA	0	1,871	8,698	5,245	--	15,814	33,410	49,224
1986	1,329	440	38	1,807	4,998	0	--	6,805	15,805	22,610
1987	4,483	124	74	4,681	1,433	0	--	6,114	18,053	24,167
1988	600	143	123	866	1,454	0	--	2,320	25,360	27,680
1989	3,621	898	16	4,535	1,500	0	--	6,035	25,630	31,665
1990	4,348	4,098	654	9,100	--	0	--	9,100	26,149	35,249
1991	136	1,929	0	2,065	--	0	1,128	3,193	10,931	14,124
1992	927	1,706	26	2,659	--	0	--	2,659	9,943	12,601
1993	1,832	4,839	928	7,599	--	0	--	7,599	13,636	21,234
1994	2,990	5,679	0	8,669	--	0	--	8,669	18,845	27,514
1995	1,039	2,782	615	4,436	--	3,731	406	8,573	17,206	25,779
1996	136	1,450	15	1,601	7,982	6,271	0	15,854	23,650	39,504
1997	4,344	3,845	572	8,761	1,241	0	0	10,002	10,754	20,756
1998	3,120	2,042	2,691	7,853	--	--	--	7,853	11,822	19,675
1999	--	--	--	--	--	--	--	--	7,430	--
2000	225	168	1,580	1,973	--	--	--	1,973	5,758	7,731
2001	871	1,337	1,421	3,630	--	--	--	3,630	2,976	6,606
2002	538	741	4,143	5,422	--	--	--	5,422	5,503	10,925
2003	152	2,134	5,462	7,748	--	--	--	7,748	--	--
2004	159	9,695	5,374	15,228	--	--	--	15,228	--	--

Appendix Table 4. Fishing effort in the Nigliq Channel by fisher, 2004.

Fisher Code	Net	Fishing Area	Net Length (m)	Net Depth (m)	Mesh (mm)	Start Date	End Date
1	A	650	24	1.8	76	10/10/2004	11/1/2004
7	A	650	18	1.8	76	10/10/2004	10/28/2004
7	B	650	24	1.8	76	10/15/2004	11/19/2004
24	A	650	18	1.8	76	10/10/2004	11/19/2004
24	B	650	18	1.8	76	10/17/2004	11/19/2004
24	C	650	24	1.8	76	10/10/2004	11/19/2004
24	D	650	24	1.8	76	10/18/2004	11/19/2004
25	D	650	30	1.8	76	10/22/2004	10/29/2004
25	E	650	18	1.8	89	10/26/2004	10/29/2004
25	A	670	30	1.8	76	10/10/2004	10/24/2004
25	C	670	30	1.8	76	10/20/2004	10/24/2004
25	B	670	18	1.8	89	10/10/2004	10/20/2004
27	A	650	18	1.8	76	10/22/2004	11/19/2004
30	D	610	24	1.8	89	11/7/2004	11/19/2004
30	C	670	24	1.8	76	10/18/2004	10/21/2004
30	A	670	24	1.8	89	10/16/2004	10/21/2004
30	B	670	24	1.8	89	10/17/2004	10/21/2004
31	A	650	18	1.8	76	10/10/2004	11/6/2004
31	B	650	24	1.8	76	10/10/2004	11/6/2004
31	C	650	18	1.8	76	10/17/2004	11/6/2004
32	A	670	24	1.8	89	10/10/2004	10/31/2004
32	B	670	24	1.2	89	10/10/2004	10/31/2004
33	E	650	24	1.8	64	10/21/2004	11/19/2004
33	D	650	24	1.8	76	10/16/2004	10/19/2004
33	C	650	24	1.8	76	10/19/2004	10/21/2004
33	A	670	24	1.8	76	10/10/2004	10/16/2004
33	B	670	24	1.8	76	10/10/2004	10/16/2004
37	A	670	30	1.8	76	10/10/2004	10/22/2004
37	B	670	18	2.4	76	10/17/2004	10/22/2004
41	A	670	24	1.8	76	10/11/2004	11/19/2004
41	B	670	24	1.8	76	10/11/2004	11/19/2004
42	A	670	24	1.8	76	10/10/2004	10/26/2004
43	A	650	30	1.8	76	10/15/2004	10/27/2004
49	B	670	24	1.8	76	10/10/2004	10/27/2004
49	A	670	24	1.8	89	10/10/2004	10/27/2004
52	A	650	30	1.8	76	10/19/2004	11/19/2004
54	C	650	24	1.8	76	10/26/2004	11/12/2004
54	A	670	24	1.8	76	10/10/2004	10/20/2004
54	B	670	24	1.8	76	10/22/2004	11/3/2004
54	B	670	24	1.2	89	10/10/2004	11/3/2004
57	A	670	24	1.8	76	10/10/2004	10/24/2004
57	B	670	24	1.8	76	10/11/2004	10/24/2004
57	C	670	24	1.8	76	10/15/2004	10/24/2004

Appendix Table 4. Fishing effort in the Nigliq Channel by fisher, 2004.

Fisher Code	Net	Fishing Area	Net Length (m)	Net Depth (m)	Mesh (mm)	Start Date	End Date
63	A	670	24	1.8	76	10/10/2004	10/24/2004
63	B	670	24	1.8	76	10/10/2004	10/24/2004
64	B	650	18	1.8	76	11/12/2004	11/19/2004
64	A	670	18	1.8	76	10/22/2004	10/24/2004
65	B	650	18	1.8	76	10/19/2004	11/19/2004
65	C	650	18	1.8	76	10/20/2004	11/19/2004
65	A	670	18	1.8	76	10/10/2004	10/19/2004
66	B	650	18	1.8	64	10/10/2004	10/22/2004
66	A	650	24	1.8	89	10/10/2004	10/22/2004
69	A	650	24	1.8	76	10/21/2004	11/19/2004
69	B	650	24	1.8	76	10/21/2004	11/19/2004
70	A	670	24	1.8	76	10/10/2004	10/24/2004
70	B	670	24	1.8	76	10/10/2004	11/19/2004
72	A	650	18	1.8	64	10/10/2004	10/28/2004
72	H	650	24	1.8	76	10/19/2004	11/19/2004
72	J	650	24	1.8	76	10/19/2004	11/19/2004
72	K	650	24	1.8	76	10/19/2004	11/19/2004
72	E	670	18	1.8	76	10/10/2004	11/19/2004
72	F	670	18	1.8	76	10/10/2004	11/19/2004
72	D	670	18	1.8	76	10/10/2004	10/18/2004
72	C	670	24	1.8	76	10/10/2004	10/18/2004
72	G	670	18	1.8	76	10/10/2004	10/18/2004
72	B	670	18	1.8	89	10/10/2004	11/19/2004
73	A	650	24	1.8	76	10/11/2004	10/12/2004
75	E	650	30	1.8	64	10/20/2004	11/19/2004
75	A	670	18	1.8	89	10/10/2004	11/2/2004
75	B	670	24	1.8	89	10/10/2004	11/2/2004
75	C	670	30	1.8	89	10/10/2004	11/19/2004
75	D	670	18	1.8	89	10/18/2004	11/19/2004
76	A	670	30	1.8	89	10/18/2004	10/22/2004
79	A	670	24	1.8	76	10/9/2004	10/22/2004
79	B	670	24	1.8	76	10/10/2004	10/22/2004
82	B	670	24	1.8	76	11/3/2004	11/19/2004
82	A	670	24	1.8	76	10/10/2004	10/23/2004

Fisher Code: numerical code used to identify individual fishers, used constantly across year
Area: 610 = Upper Nigliq; 650 = Nanuk; 670 = Nigliq Delta; 100 = Outer Delta
Start = Date net was set at a location
End = Date net was removed from a location

Appendix Table 5. Estimated effort by Nigliq Channel fishermen by mesh size and fishing area, 2004.

Estimated Effort in Net-Days by 10-day Interval

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29	Mesh Total	Area Total
Upper Nigliq										
	64		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	76		0.0	0.0	8.0	10.0	3.0	0.0	21.0	
	89		0.0	0.0	0.0	2.7	13.3	0.0	16.0	37.0
Nanuk										
	64		0.0	20.0	38.7	30.0	30.0	0.0	118.7	
	70		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	76		0.0	91.0	253.3	212.7	184.3	0.0	741.3	
	89		0.0	13.3	5.7	0.0	0.0	0.0	19.0	879.0
Nigliq Delta										
	51		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	64		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	70		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	76		1.3	300.0	148.7	73.3	73.3	0.0	596.7	
	89		0.0	128.0	115.3	51.7	36.7	0.0	331.7	928.3

Estimated Nigliq Total: 1,844.3

Appendix Table 6. Estimated catch of arctic cisco in the Nigliq Channel, 2004.

Estimated Arctic Cisco CPUE by 10-day Interval (numbers in bold are estimates)

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29
Upper Nigliq								
	64							
	76				26.3	10.2	5.3	
	89					**2.0**	2.0	
Nanuk								
	64			72.9	28.9	12.4	14.3	
	70							
	76			52.6	32.3	15.3	9.9	
	89			8.0	15.2			
Nigliq Delta								
	51							
	64							
	70							
	76			37.2	6.4	34.3	33.2	
	89			10.7	0.1	2.7	1.0	

Estimated Arctic Cisco Harvest by 10-day Interval

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29	Mesh Total	Area Total
Upper Nigliq										
	64	0	0	0	0	0	0	0	0	
	76	0	0	0	210	102	16	0	328	
	89	0	0	0	0	**5**	26	0	31	359
Nanuk										
	64	0	0	1,457	1,117	371	428	0	3,373	
	70	0	0	0	0	0	0	0	0	
	76	0	0	4,791	8,176	3,259	1,821	0	18,047	
	89	0	0	107	86	0	0	0	193	21,613
Nigliq Delta										
	51	0	0	0	0	0	0	0	0	
	64	0	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	
	76	0	0	11,174	957	2,512	2,434	0	17,077	
	89	0	0	1,368	10	141	38	0	1,557	18,634

Estimated Nigliq Channel Harvest: 40,605

Appendix Table 7. Estimated catch of least cisco in the Nigliq Channel fishery, 2004.

Estimated Least Cisco CPUE by 10-day Interval (numbers in bold are estimates)

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29
Upper Nigliq								
	64							
	76				8.0	8.3	4.0	
	89					**0.0**	0.0	
Nanuk								
	64			41.7	38.2	9.3	10.4	
	70							
	76			9.6	10.1	6.9	10.2	
	89			0.0	0.5	0.0		
Nigliq Delta								
	51							
	64							
	70							
	76			11.9	0.4	14.5	8.3	
	89			0.5	0.0	0.0	0.0	

Estimated Least Cisco Harvest by 10-day Interval

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29	Mesh Total	Area Total
Upper Nigliq										
	64	0	0	0	0	0	0	0	0	
	76	0	0	0	64	83	12	0	159	
	89	0	0	0	0	**0**	0	0	0	159
Nanuk										
	64	0	0	834	1,477	280	312	0	2,904	
	70	0	0	0	0	0	0	0	0	
	76	0	0	869	2,567	1,467	1,885	0	6,789	
	89	0	0	0	3	0	0	0	3	9,695
Nigliq Delta										
	51	0	0	0	0	0	0	0	0	
	64	0	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	
	76	0	0	3,579	63	1,063	605	0	5,311	
	89	0	0	61	0	2	0	0	63	5,374

Estimated Nigliq Channel Harvest: 15,228

Appendix Table 8. Estimated catch of broad whitefish in the Nigliq Channel fishery, 2004.

Estimated Broad Whitefish CPUE by 10-day Interval (numbers in bold are estimates)

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29
Upper Nigliq								
	64							
	76				0.3	0.2	0.3	
	89					**0.0**	0.0	
Nanuk								
	64			0.0	0.0	0.0	0.0	
	70							
	76			0.0	0.0	0.0	0.0	
	89			0.0	0.0	0.0		
Nigliq Delta								
	51							
	64							
	70							
	76			0.0	0.0	0.0	0.0	
	89			0.0	0.0	0.0	0.0	

Estimated Broad Whitefish Harvest by 10-day Interval

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29	Mesh Total	Area Total
Upper Nigliq										
	64	0	0	0	0	0	0	0	0	
	76	0	0	0	2	2	1	0	5	
	89	0	0	0	0	**0**	0	0	0	5
Nanuk										
	64	0	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	
	76	0	0	4	0	0	0	0	4	
	89	0	0	0	0	0	0	0	0	4
Nigliq Delta										
	51	0	0	0	0	0	0	0	0	
	64	0	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	
	76	0	0	0	0	0	0	0	0	
	89	0	0	0	0	0	0	0	0	0

Estimated Nigliq Channel Harvest: 9

Appendix Table 9. Estimated catch of humpback whitefish in the Nigliq Channel fishery, 2004.

Estimated Humpback Whitefish CPUE by 10-day Interval (numbers in bold are estimates)

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29
Upper Nigliq								
	64							
	76				1.1	1.3	1.0	
	89						0.2	
Nanuk								
	64			0.1	0.0	0.0	1.1	
	70							
	76			0.3	0.3	0.4	0.5	
	89			0.0	1.2	0.0		
Nigliq Delta								
	51							
	64							
	70							
	76			0.2	0.0	0.0	0.0	
	89			0.3	0.0	0.0	0.0	

Estimated Humpback Whitefish Harvest by 10-day Interval

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29	Mesh Total	Area Total
Upper Nigliq										
	64	0	0	0	0	0	0	0	0	
	76	0	0	0	9	13	3	0	25	
	89	0	0	0	0	**0**	2	0	2	27
Nanuk										
	64	0	0	3	0	0	34	0	37	
	70	0	0	0	0	0	0	0	0	
	76	0	0	24	78	82	101	0	286	
	89	0	0	0	7	0	0	0	7	330
Nigliq Delta										
	51	0	0	0	0	0	0	0	0	
	64	0	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	
	76	0	0	56	2	0	0	0	58	
	89	0	0	40	0	0	0	0	40	98

Estimated Nigliq Channel Harvest: 454

Appendix Table 10. Estimated catch of Bering cisco in the Nigliq Channel fishery, 2004.

Estimated Bering Cisco CPUE by 10-day Interval (numbers in bold are estimates)

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29
Upper Nigliq								
	64							
	76				0.5	0.0	0.0	
	89						0.0	
Nanuk								
	64			0.0	0.0	0.0	0.0	
	70							
	76			0.0	0.0	0.0	0.0	
	89			0.0	0.0	0.0		
Nigliq Delta								
	51							
	64							
	70							
	76			0.0	0.0	0.0	0.0	
	89			0.1	0.0	0.0	0.0	

Estimated Bering Cisco Harvest by 10-day Interval

Area	Mesh (mm)	Sep 21-30	Oct 1-10	Oct 11-20	Oct 21-30	Oct 31-Nov 9	Nov 10-19	Nov 20-29	Mesh Total	Area Total
Upper Nigliq										
	64	0	0	0	0	0	0	0	0	
	76	0	0	0	4	0	0	0	4	
	89	0	0	0	0	**0**	0	0	0	4
Nanuk										
	64	0	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	
	76	0	0	2	4	0	0	0	6	
	89	0	0	0	0	0	0	0	0	6
Nigliq Delta										
	51	0	0	0	0	0	0	0	0	
	64	0	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	
	76	0	0	5	0	0	0	0	5	
	89	0	0	8	0	0	0	0	8	13

Estimated Nigliq Channel Harvest: 23

Appendix Table 11. Length frequency by mesh size for arctic cisco and least cisco, 2004 Colville Delta fall fishery.

ARCTIC CISCO

Fork Length (mm)	Mesh (mm)		
	64	76	89
200			
210			
220			
230			
240	2	2	
250	4		
260	16		
270	31	2	1
280	45	26	
290	38	106	
300	52	385	3
310	48	697	12
320	45	792	31
330	28	611	65
340	15	357	102
350	4	128	57
360	1	33	34
370	1	14	6
380			2
390		1	
400		1	
410			
420			
430			
440			
450			
Total:	330	3,155	313

LEAST CISCO

Fork Length (mm)	Mesh (mm)		
	64	76	89
200		1	
210			
220			
230		1	
240			
250	5		
260	7	7	
270	22	22	2
280	14	86	
290	20	140	2
300	16	185	5
310	4	99	
320	3	58	6
330		18	
340		8	
350		2	
360		1	
370		1	1
380			
390			
400			
410			
420			
430			
440			
450			
Total:	91	629	16

Appendix Table A-12. Calculation of Arctic cisco catch rate in 76-mm mesh in the Nigliq Channel, 1986-2003.

	Upper Nigliq			Nanuk			Nigliq Delta			Nigliq Channel Total		
Harvest Year	Observed Catch (no. of Fish)	Observed Effort (net-days)	CPUE (fish per net Day)	Observed Catch (No. of Fish)	Observed Effort (Net-days)	CPUE (Fish per Net Day)	Observed Catch (No. of Fish)	Observed Effort (Net-days)	CPUE (Fish per Net Day)	Observed Catch (No. of Fish)	Observed Effort (Net-days)	CPUE (Fish per Net Day)
1986	2,218	115.7	19.2	752	25.1	29.9	3,379	51.3	65.8	6,349	192.2	33.0
1987	1,451	131.7	11.0	948	32.6	29.1	661	31.3	21.1	3,060	195.7	15.6
1988	366	56.9	6.4	146	18.0	8.1	2,078	37.3	55.7	2,590	112.3	23.1
1989	993	90.8	10.9	258	14.3	18.0	535	21.7	24.7	1,786	126.8	14.1
1990	650	147.1	4.4	1,114	148.5	7.5	202	27.6	7.3	1,966	323.1	6.1
1991	522	143.0	3.7	1,327	326.9	4.1	16	8.0	2.0	1,865	477.9	3.9
1992	4,825	316.2	15.3	2,322	130.4	17.8	4,956	96.2	51.5	12,103	542.8	22.3
1993	1,709	106.2	16.1	5,783	158.3	36.5	1,568	57.7	27.2	9,060	322.2	28.1
1994	366	99.0	3.7	642	190.2	3.4	0	0.0	--	1,008	289.2	3.5
1995	56	50.3	1.1	568	178.3	3.2	267	12.0	22.3	891	240.7	3.7
1996	413	36.0	11.5	3,591	193.3	18.6	0	0.0	--	4,004	229.3	17.5
1997	2,539	119.0	21.3	3,586	128.8	27.8	2,207	53.3	41.4	8,332	301.2	27.7
1998	189	92.3	2.0	218	83.7	2.6	1,214	155.3	7.8	1,621	331.3	4.9
1999	0	0.0	--	0	0.0	--	0	0.0	--	0	0.0	--
2000	8	8.0	1.0	217	62.0	3.5	1,826	190.4	9.6	2,051	260.4	7.9
2001	92	62.0	1.5	36	22.7	1.6	611	208.8	2.9	739	293.4	2.5
2002	103	115.7	0.9	137	36.7	3.7	2,925	460.9	6.3	3,165	613.2	5.2
2003	62	11.7	5.3	1,495	104.0	14.4	6,187	455.7	13.6	7,744	571.3	13.6
2004	338	22.0	15.4	8,102	270.9	29.9	5,021	199.7	25.1	13,461	492.6	27.3

Appendix Table A-13. Calculation of least cisco catch rate in 76-mm mesh in the Nigliq Channel, 1986-2004.

Harvest Year	Upper Nigliq			Nanuk			Nigliq Delta			Nigliq Channel Total		
	Observed Catch (No. of Fish)	Observed Effort (Net-days	CPUE (Fish per Net Day)	Observed Catch (No. of Fish)	Observed Effort (Net-days	CPUE (Fish per Net Day)	Observed Catch (No. of Fish)	Observed Effort (Net-days	CPUE (Fish per Net Day)	Observed Catch (No. of Fish)	Observed Effort (Net-days	CPUE (Fish per Net Day)
1986	146	115.7	1.3	16	25.1	0.6	24	51.3	0.5	186	192.2	1.0
1987	730	131.7	5.5	63	32.6	1.9	12	31.3	0.4	805	195.7	4.1
1988	93	56.9	1.6	12	18.0	0.7	105	37.3	2.8	210	112.3	1.9
1989	332	90.8	3.7	16	14.3	1.1	10	21.7	0.5	358	126.8	2.8
1990	711	147.1	4.8	416	148.5	2.8	179	27.6	6.5	1,306	323.1	4.0
1991	50	143.0	0.3	272	326.9	0.8	0	8.0	0.0	322	477.9	0.7
1992	261	316.2	0.8	88	130.4	0.7	151	96.2	1.6	500	542.8	0.9
1993	181	106.2	1.7	498	158.3	3.1	96	57.7	1.7	775	322.2	2.4
1994	330	99.0	3.3	711	190.2	3.7	0	0.0	--	1,041	289.2	3.6
1995	238	50.3	4.7	494	178.3	2.8	94	12.0	7.8	826	240.7	3.4
1996	14	36.0	0.4	195	193.3	1.0	0	0.0	--	209	229.3	0.9
1997	1,370	119.0	11.5	1,575	128.8	12.2	203	53.3	3.8	3,148	301.2	10.5
1998	544	92.3	5.9	577	83.7	6.9	935	155.3	6.0	2,056	331.3	6.2
1999	0	0.0	--	0	0.0	--	0	0.0	--	0	0.0	--
2000	11	8.0	1.4	97	62.0	1.6	330	190.4	1.7	438	260.4	1.7
2001	129	62.0	2.1	222	22.7	9.8	491	208.8	2.4	842	293.4	2.9
2002	176	115.7	1.5	165	36.7	4.5	1,033	460.9	2.2	1,374	613.2	2.2
2003	25	11.7	2.1	459	104.0	4.4	1,038	455.7	2.3	1,522	571.3	2.7
2004	167	22.0	7.6	2,493	270.9	9.2	1,483	199.7	7.4	4,143	492.6	8.4

Appendix Table 14. Age frequencies of arctic cisco caught in 76 mm mesh, 1976-2004.

	Percent																							
Age (Years)	1976	1977	1978	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
3	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.5	10.7	0.0	0.0	0.0	0.5	0.0	18.3	7.3	4.9	0.0	0.0	0.7	0.0	0.0	0.0	28.7	24.5	3.5	10.3	7.6	0.0	0.7
5	3.2	57.7	10.2	10.2	3.3	0.0	0.0	63.5	0.0	86.0	51.0	59.7	3.4	10.8	59.5	5.3	43.2	14.0	65.0	33.6	16.5	72.9	20.0	11.3
6	54.8	15.4	74.0	77.2	21.5	41.2	1.0	1.6	72.0	3.3	33.6	36.4	79.7	31.7	23.6	84.7	11.6	48.3	2.8	37.1	37.1	14.6	75.0	51.1
7	6.4	23.6	0.9	9.1	68.2	50.8	59.0	0.8	0.0	2.7	1.4	3.9	14.9	46.8	7.4	9.3	41.1	4.2	8.4	4.2	14.4	4.2	5.0	34.8
8	29.0	1.6	2.8	0.0	4.8	8.0	32.0	31.0	0.0	0.0	5.6	0.0	2.0	9.4	7.4	0.7	4.1	9.1	2.8	11.2	4.1	0.7	0.0	1.4
9	6.4	0.5	0.0	0.0	1.3	0.0	7.6	2.4	9.3	0.0	0.0	0.0	0.0	0.7	2.0	0.0	0.0	1.4	1.4	4.2	12.4	0.0	0.0	0.0
10	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	5.2	0.0	0.0	0.7
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0
N =	31	182	215	est.	est.	199	196	126	est.	150	143	154	148	139	148	150	146	151	150	143	97	144	est.	141

1984, 1985, 1989 and 2003 age distributions estimated by comparing length frequencies o
Arctic cisco caught in gill nets to fish caught in fyke net

Appendix Table 15. Age frequencies of least cisco caught in 76 mm mesh, 1976-2002.

Age (Years)	Percent																				
	1976	1977	1978	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
5			0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.7		0.7	
6			7.4				0.0		2.3		0.7		0.0		0.0		0.0		4.1		1.3	
7			14.8				2.5		0.0		2.7		0.7		2.7		2.7		2.7		2.0	
8			28.4				12.6		4.5		8.0		4.7		3.3		6.1		6.8		2.7	
9			8.6				19.6		11.4		8.7		7.4		10.0		9.5		13.0		4.7	
10			7.4				18.1		20.5		15.3		16.8		8.0		14.9		18.5		14.0	
11			7.4				16.1		13.6		20.0		24.2		17.3		14.2		13.0		20.0	
12			11.1				14.1		9.1		16.0		13.4		15.3		15.5		8.9		19.3	
13			4.9				5.5		13.6		11.3		12.8		11.3		10.8		9.6		10.7	
14			4.9				4.5		11.4		8.0		8.1		9.3		10.1		7.5		8.0	
15			0.0				4.0		6.8		2.7		6.7		6.7		6.1		4.8		5.3	
16			2.5				1.0		2.3		0.7		2.7		6.7		4.7		4.1		4.0	
17			1.2				1.0		4.5		2.0		0.7		3.3		3.4		2.7		3.3	
18			1.2				0.0		0.0		2.0		0.0		2.7		2.0		1.4		1.3	
19			0.0				0.0		0.0		1.3		0.7		0.0		0.0		1.4		1.3	
20			0.0				0.5		0.0		0.7		0.0		0.7		0.0		0.7		1.3	
21			0.0				0.0		0.0		0.0		0.7		0.7		0.0		0.0		0.0	
22			0.0				0.5		0.0		0.0		0.0		0.7		0.0		0.0		0.0	
N =			81				199		44		150		149		150		148		146		150	

Appendix Table 16. Calculation of harvested biomass for arctic cisco in the Colville Delta fall fishery, 1985-2004

Arctic Cisco

Estimated Mean Weight by Mesh Size

Mesh	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994	
(mm)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)
51	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230
64	381	0.284	381	0.306	381	0.297	381	0.313	381	0.289	381	0.287	381	0.279	525	0.253	979	0.298	125	0.219
70	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354
76	629	0.425	1,428	0.429	830	0.471	773	0.484	1,601	0.518	470	0.393	1,327	0.365	1,596	0.369	1,965	0.403	520	0.444
83	883	0.465	883	0.475	883	0.472	883	0.515	883	0.514	883	0.475	883	0.431	233	0.454	920	0.469	2,036	0.477
89	1,162	0.516	346	0.462	122	0.539	63	0.653	212	0.539	223	0.555	211	0.556	325	0.477	870	0.469	166	0.547

Estimated Nigliq Catch

Mesh	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
51		0		0		0		0		0	36	8	178	41	0	0	0	0	0	0
64	5,465	1,553	1,058	323	581	172	61	19	839	243	2,143	616	2,912	812	11,050	2,794	6,861	2,044	1,665	364
70		0		0	801	284	263	93		0		0		0	1,921	680	1,877	665	258	91
76	14,940	6,353	14,990	6,424	10,502	4,941	5,066	2,453	6,092	3,157	5,542	2,176	3,401	1,242	25,440	9,381	24,612	9,913	3,242	1,438
83	1,812	843	1,928	916	2,448	1,156	43	22	3,349	1,721	145	69	283	122	582	265	1,080	507	15	7
89	4,161	2,147	822	380	1,945	1,048	57	37	1,112	599	1,358	753	470	261	1,948	929	5,844	2,743	375	205
95															61	29	869	408		0
102							5	3												
114							16	10												
Total:	26,378	10,897	18,798	8,044	16,277	7,601	5,511	2,639	11,392	5,720	9,224	3,622	7,244	2,478	41,002	14,077	41,144	16,279	5,556	2,106

Estimated Outer Delta Catch

Mesh	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
64	682	194		0		0		0		0		0		0		0		0		0
70		0		0		0		0		0		0		0		0		0		0
76	19,148	8,143	13,102	5,615	4,487	2,111	420	203	1,500	777	2,000	785	1,025	374	4,400	1,623	5,800	2,336	5,400	2,396
83		0	390	185		0		0		0		0		0		0		0		0
89	473	244	1,232	569	162	87	167	109		0		0		0		0		0		0
Total:	20,303	8,581	14,724	6,370	4,649	2,199	587	312	1,500	777	2,000	785	1,025	374	4,400	1,623	5,800	2,336	5,400	2,396

Estimated Commercial Catch

Mesh	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
76	22,831	9,709	28,988	12,423	22,527	10,600	5,056	2,449	18,825	9,754	16,884	6,629	23,046	8,414	22,754	8,391	29,589	11,917	7,054	3,129
83		0		0	4,967	2,345	5,277	2,719	5,977	3,071	4,221	2,004	652	281	0	0	1,721	807	1,904	908
89	847	437	468	216		0	147	96		0		0		0	0	0	0	0	0	0
Total:	23,678	10,146	29,456	12,640	27,494	12,945	10,480	5,264	24,802	12,826	21,105	8,634	23,698	8,695	22,754	8,391	31,310	12,725	8,958	4,037

Appendix Table 16. continued.

Arctic Cisco

Estimated Mean Weight by Mesh Size

Mesh	1995		1996		1997		1998		2000		2001		2002		2003		2004	
(mm)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)
51	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230	116	0.230		
64	1,185	0.295	1,273	0.307	1,273	0.296	1,310	0.296	1,310	0.296	1,629	0.296	264	0.258	460	0.310	330	0.318
70	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354	786	0.354		
76	824	0.374	1,539	0.371	788	0.420	423	0.380	1,041	0.464	412	0.477	1,836	0.362	2,033	0.375	3,155	0.380
83	389	0.491	83	0.400	259	0.460	2,767	0.460	142	0.521	2,978	0.463	2,978	0.463	2,978	0.463		
89	289	0.513	296	0.451	875	0.468	299	0.501	278	0.541	278	0.541	306	0.448	216	0.411	313	0.448

Estimated Nigliq Catch

Mesh	1995		1996		1997		1998		2000		2001		2002		2003		2004	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
51	0	0		0		0		0		0		0		0	293	67		0
64	307	91	1,770	544	435	129	146	43	12	4	375	111	1,332	343	4,320	1,341	3,373	1,072
70	134	47		0		0		0		0		0		0	533	189		0
76	2,257	844	13,376	4,961	18,381	7,717	5,531	2,103	6,756	3,137	2,087	996	5,263	1,904		0	35,452	13,456
83	850	417	512	205	2,211	1,017	151	69	737	384	223	103	66	31	17,284	8,003		0
89	1,357	696	1,514	683	10,103	4,724	2,320	1,163	2,451	1,327	1,250	677	872	390	939	386	1,780	797
95		0		0		0		0		0		0		0		0		0
102																		
114																		
Total:	4,905	2,096	17,172	6,393	31,130	13,587	8,148	3,378	9,956	4,851	3,935	1,886	7,533	2,669	23,369	9,986	40,605	15,325

Estimated Outer Delta Catch

Mesh	1995		1996		1997		1998		2000		2001		2002		2003		2004	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
64	90	27	2,267	697		0		0		0		0		0		0		0
70	232	82		0		0		0		0		0		0		0		0
76	3,287	1,230	18,963	7,033	2,144	900	5,411	2,057		0		0		0		0		0
83	55	27		0		0		0		0		0		0		0		0
89	4	2	2,803	1,265		0		0		0		0		0		0		0
Total:	3,669	1,368	24,033	8,994	2,144	900	5,411	2,057	0	0	0	0	0	0	0	0	0	0

Estimated Commercial Catch

Mesh	1995		1996		1997		1998		2000		2001		2002		2003		2004	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
76	14,311	5,353	20,740	7,692	15,686	6,586	6,579	2,501	2,591	1,203	1,566	747	3,935	1,424		0		0
83	0	0	1,077	431	1,304	600	2,173	1,000	28	15	358	166		0		0		0
89	0	0		0		0		0		0		0		0		0		0
Total:	14,311	5,353	21,817	8,124	16,990	7,186	8,752	3,501	2,619	1,218	1,924	913	3,935	1,424	0	0	0	0

Appendix Table 17. Calculation of harvested biomass for least cisco in the Colville Delta fall fishery, 1985-2004

Least Cisco

Estimated mean weight by mesh size

Mesh	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994	
(mm)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)
51	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200
64	572	0.251	572	0.263	572	0.248	572	0.263	572	0.255	572	0.250	572	0.237	697	0.247	778	0.246	778	0.253
70	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290
76	449	0.342	370	0.329	400	0.344	285	0.346	388	0.355	267	0.317	292	0.236	124	0.345	311	0.297	218	0.306
83	36	0.397	36	0.382	36	0.393	36	0.412	36	0.406	36	0.366	36	0.385	39	0.386	62	0.345	62	0.371
89	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329

Estimated Nigliq Catch

Mesh	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
51		0		0		0		0		0	545	109	172	34	0	0	0	0		0
64	492	123	951	250	1,090	270	46	12	3,086	786	3,633	909	2,261	536	1,381	341	3,739	921	3,714	939
70		0		0	355	103	33	10		0		0		0	65	19	274	80	442	128
76	1,271	434	746	245	2,695	926	715	247	1,247	443	4,696	1,491	726	171	1,078	372	2,745	814	4,200	1,284
83	27	11	59	23	456	179	48	20	190	77	15	6	24	9	4	2	82	28	12	4
89	81	27	50	16	149	49	8	3	13	4	211	70	11	4	127	42	754	248	301	99
95															3	1	4	1		0
102							1													
114							16													
Total:	1,871	595	1,806	535	4,745	1,527	867	291	4,536	1,310	9,100	2,584	3,193	754	2,658	777	7,599	2,093	8,669	2,455

Estimated Outer Delta Catch

Mesh	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
64	692	173	32	8		0		0		0		0		0		0		0		0
76	13,175	4,504	4,924	1,619	1,417	487	1,392	481	1,500	533		0		0		0		0		0
83		0	12	5		0		0		0		0		0		0		0		0
89	76	25	31	10	16	5	62	20		0		0		0		0		0		0
Total:	13,943	4,702	4,998	1,642	1,433	492	1,454	502	1,500	533	0	0	0	0	0	0	0	0	0	0

Estimated Commercial Catch

Mesh	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
76	17,495	5,981	8,988	2,955	11,636	3,998	20,678	7,148	19,126	6,798	14,944	4,744	7,666	1,808	7,284	2,513	5,939	1,761	9,549	2,920
83		0		0	303	119	1,904	784	514	209	2,105	770	78	30	0	0	98	34	627	233
89	101	40	12	5		0	458	189		0		0		0	0	0	0	0	0	0
Total:	17,596	6,021	9,000	2,959	11,939	4,117	23,040	8,121	19,640	7,006	17,049	5,513	7,744	1,838	7,284	2,513	6,037	1,795	10,176	3,153

Appendix Table 17. (continued)

Least Cisco

Estimated mean weight by mesh size

Mesh	1995		1996		1997		1998		2000		2001		2002		2003		2004	
(mm)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)	Samp. Size	Ave Wgt (kg)
51	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200	140	0.200		
64	833	0.236	886	0.235	886	0.242	310	0.234	1,221	0.239	1,634	0.243	330	0.259	330	0.259	91	0.250
70	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290	106	0.290		
76	234	0.308	123	0.302	173	0.300	514	0.288	328	0.325	515	0.310	681	0.311	587	0.310	629	0.392
83	92	0.335	92	0.367	133	0.336	133	0.336	133	0.336	147	0.345	147	0.345	147	0.345		
89	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	430	0.329	446	0.329

Estimated Nigliq Catch

Mesh	1995		1996		1997		1998		2000		2001		2002		2003		2004	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
51		0		0		0		0		0		0		0	222	44		0
64	1,476	348	600	141	971	235	1,956	457	16	4	670	163	2,619	679	3,476	900	2,904	727
70	380	110		0		0		0		0		0		0	166	48		0
76	2,196	676	890	269	6,623	1,985	5,229	1,506	1,690	550	2,689	833	2,549	792		0	12258.1	4,808
83	102	34	15	6	335	112	124	42	51	17	235	81	20	7	3,448	1,190		0
89	283	93	96	32	833	274	545	179	215	71	36	12	234	77	436	144	66	22
95		0		0		0		0		0		0		0		0		0
102																		
114																		
Total:	4,437	1,262	1,601	447	8,761	2,607	7,853	2,184	1,973	641	3,630	1,089	5,422	1,555	7,748	2,327	15,228	5,556

Estimated Outer Delta Catch

Mesh	1995		1996		1997		1998		2000		2001		2002		2003		2004	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
64	708	167	1,552	365		0		0		0		0		0		0		0
76	3,333	1,026	12,700	3,833	1,241	372	11,470	3,303		0		0		0		0		0
83	95	32		0		0		0		0		0		0		0		0
89	1	0		0		0		0		0		0		0		0		0
Total:	4,137	1,225	14,253	4,198	1,241	372	11,470	3,303	0	0	0	0	0	0	0	0	0	0

Estimated Commercial Catch

Mesh	1995		1996		1997		1998		2000		2001		2002		2003		2004	
(mm)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)	No.	(kg)
76	8,633	2,658	7,451	2,249	10,644	2,580	11,010	3,170	5,693	1,851	2,823	875	5,503	1,710		0		0
83	0	0	345	127	110	33	812	273	65	22	153	53		0		0		0
89	0	0		0		0		0		0		0		0		0		0
Total:	8,633	2,658	7,796	2,375	10,754	2,613	11,822	3,443	5,758	1,873	2,976	927	5,503	1,710	0	0	0	0

Appendix Table 18. Catch rate of arctic cisco in the Nigliq Channel fishery by year-class, 1984-2004 (outlined boxes indicate year-class CPUE at age-5, based on CPUE corrected for effect of variable effort, 76-mm mesh).

	Fishing Year																				Year
Year Class	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Class Total
1974																					0.0
1975																					0.0
1976	0.19																				0.2
1977	0.70																				0.7
1978	9.88	2.64	1.19																		13.7
1979	3.11	16.79	5.00	0.55	0.04																25.5
1980	0.48	13.61	9.23	7.15	1.31	0.04															31.8
1981			0.16	0.18	0.00	0.00	0.08														0.4
1982				0.37	0.00	0.00	0.00														0.4
1983			0.08	14.65	10.14	0.16	0.22														25.2
1984				0.00	0.00	0.20	0.05														0.3
1985				0.18	2.58	5.23	1.31	0.87	0.57	0.03											10.8
1986						0.44	1.99	8.11	4.18	0.33	0.08										15.1
1987							0.19	13.32	22.42	1.63	0.28										37.8
1988									0.95	1.10	0.28	0.12									2.4
1989										0.38	0.88	1.63	1.14	0.06		0.22					4.3
1990										0.03	2.20	14.78	11.37	0.42		0.28					29.1
1991												0.93	3.22	0.19		0.33	0.13				4.8
1992													11.94	2.24		0.88	0.31				15.4
1993														0.65		0.33	0.10				1.1
1994														1.33		2.92	0.36	0.04		0.19	4.8
1995																2.64	0.93	0.22		0.00	3.8
1996																0.28	0.42	0.75	0.68	0.39	2.5
1997																	0.26	3.76	10.17	9.50	23.7
1998																		0.39	2.71	13.95	17.1
1999																				3.10	3.1
2000																				0.19	0.2
Total CPUE	14.5	33.0	15.6	23.1	14.1	6.1	3.9	22.3	28.1	3.5	3.7	17.5	27.7	4.9	--	7.9	2.5	5.2	13.6	27.3	

boxes indicate CPUE at age-5

Appendix Table 19. Mean weight and CPUE by mesh size in the Nigliq Channel fishery, 1986-2004.

Arctic Cisco

Mean Weight (kg) by Mesh Size

Mesh (mm)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004
51	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230
64	0.306	0.297	0.313	0.289	0.287	0.279	0.253	0.298	0.219	0.295	0.307	0.296	0.296	0.296	0.296	0.258	0.310	0.318
70	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354	0.354
76	0.429	0.471	0.484	0.518	0.393	0.365	0.369	0.403	0.444	0.374	0.371	0.420	0.380	0.464	0.477	0.362	0.375	0.380
83	0.475	0.472	0.515	0.514	0.475	0.431	0.454	0.469	0.477	0.491	0.400	0.460	0.460	0.521	0.463	0.463	0.463	0.463
89	0.462	0.539	0.653	0.539	0.555	0.556	0.477	0.469	0.547	0.513	0.451	0.468	0.501	0.541	0.541	0.448	0.411	0.448
95	0.462	0.539	0.653	0.539	0.555	0.556	0.477	0.469	0.547	0.513	0.513	0.513	0.513	0.513	0.513	0.513	0.513	0.513

Mean CPUE by Mesh Size

Mesh (mm)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004
51					5.7	44.5											18.3	
64	15.4	9.9	3.7	5.3	22.4	26.6	44.5	33.3	6.7	4.6	27.2	12.9	2.2	1.0	4.0	7.5	24.3	25.2
70		26.7	6.4				15.4	10.7	2.3	4.0							8.1	
76	23.5	16.1	12.4	12.5	11.0	4.4	24.7	33.0	4.2	3.0	17.5	25.4	4.4	9.6	2.7	4.6	14.4	27.3
83	14.7	8.4	1.5	3.0	5.6	3.7	14.9	15.6	0.6	5.3	3.1	17.5	10.2	6.7	1.6	0.8		
89	10.3	11.4	0.8	4.5	8.2	1.2	4.7	11.6	1.7	2.9	2.2	20.1	3.0	4.4	2.5	1.6	4.5	6.4
95							3.1	19.3										

Least Cisco

Mean Weight (kg) by Mesh Size

Mesh (mm)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004
51	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
64	0.263	0.248	0.263	0.255	0.250	0.237	0.247	0.246	0.253	0.236	0.235	0.242	0.234	0.239	0.243	0.259	0.259	0.250
70	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290	0.290
76	0.329	0.344	0.346	0.355	0.317	0.236	0.345	0.297	0.306	0.308	0.302	0.300	0.288	0.325	0.310	0.311	0.310	0.392
83	0.382	0.393	0.412	0.406	0.366	0.385	0.386	0.345	0.371	0.335	0.367	0.336	0.336	0.336	0.345	0.345	0.345	0.345
89	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329	0.329
95	0.382	0.393	0.412	0.406	0.366	0.385	0.386	0.345	0.371	0.335	0.335	0.335	0.335	0.336	0.336	0.336	0.336	0.336

Mean CPUE by Mesh Size

Mesh (mm)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004
51					46.6	43.0											13.9	
64	13.8	18.7	2.8	19.5	33.5	13.9	5.5	18.1	15.0	22.1	11.5	28.8	30.1	1.3	7.1	14.8	19.6	19.2
70		11.8	1.4				0.5	1.6	3.9	11.4							1.7	
76	1.2	4.1	1.7	2.8	4.7	0.7	1.1	3.7	5.4	2.9	1.1	9.2	4.2	2.4	3.5	2.2	2.9	8.4
83	0.5	1.6	1.7	0.9	0.3	0.3	0.1	1.2	0.5	0.6	0.6	2.6	8.4	0.5	1.7	0.2		
89	0.6	0.9	0.1	0.1	0.4	0.0	0.4	1.5	1.4	0.6	0.6	1.7	0.7	0.4	0.1	0.4	2.1	0.2
95							0.2	0.1										

Appendix Table 20. Salinity profiles from the Nigliq Channel, Colville Delta, 2004.

RK = River Kilometer, as measured from the mouth of Nigliq Channel
Depth in meters from upper surface of ice, salinity in ppt

Upper Nigliq (RK 29)

Depth												
(m)	Oct 15	Oct 17	Oct 19	Oct 21	Oct 23	Oct 25	Oct 28	Oct 31	Nov 5	Nov 8	Nov 10	Nov 12
0.5	0.1	0.3	0.2	0.3	1.3	0.2	0.2	4.3	0.3	0.4	0.4	0.4
1.0	0.1	0.3	0.2	0.7	3.9	0.2	0.2	4.3	5.9	6.1	5.9	5.8
1.5	0.1	0.1	0.5	6.3	5.7	6.7	6.9	6.8	8.1	8.4	7.9	8.1
2.0	0.1	0.2	0.7	6.8	6.7	8.8	8.4	8.4	9.1	9.6	8.9	9.1
2.5	0.2	0.5	0.8	7.9	8.7	9.7	9.5	9.6	10.1	10.3	10.2	10.1
3.0	0.3	0.6	1.2	8.4	9.4	10.1	10.2	9.9	10.4	10.5	10.4	10.3
3.5	0.3	0.6	1.4	9.4		10.3	10.2	10.2	10.5	10.6	10.6	10.6
4.0								10.3				

Nanuq Lake (RK 15)

Depth	Salinity (ppt)										
(m)	Oct 15	Oct 17	Oct 19	Oct 21	Oct 23	Oct 25	Oct 28	Nov 5	Nov 8	Nov 10	Nov 12
0.5	0.5	1.7	2.6	5.9	2.1	2.1	2.1	3.1	3.8	4.0	4.5
1.0	4.4	7.4	7.7	9.2	2.2	2.2	13.3	17.6	14.9	21.2	4.6
1.5	9.8	9.3	12.5	15.4	15.7	21.7	23.9	24.4	25.4	24.4	27.1
2.0	12.8	13.1	13.9	19.9	21.4	28.0	27.3	25.5	26.5	25.6	27.9
2.5	13.0	13.5	14.8	21.7	27.4	28.7	27.0	27.2	27.4	28.5	28.0
3.0	13.2	13.8	15.2	22.9	28.0	28.9	28.3	28.1	27.9	28.7	28.0
3.5	13.3	14.1	15.5	23.1	28.3	29.0	28.4	28.2	28.0	29.0	28.0
4.0	13.4	14.2	15.6	23.5	28.5	29.0	28.5	28.2	28.0	29.3	28.0
4.5	13.5	14.4	16.2	24.1	28.7	29.0	28.5	28.2	28.0	29.5	28.0
5.0	13.6	14.6	16.4	24.6	28.9	29.1	28.6	28.3	28.0	29.6	28.0
5.5	14.1	14.8	16.3	26.3	29.0	29.1	28.6	28.2	28.3	29.6	28.0
6.0	14.1	15.0	16.4	26.6	29.1	29.1	28.6	28.2	28.2	30.2	28.0
6.5				26.7	29.1			28.2	28.2	29.9	28.0
7.0											

Nigliq Delta (RK 6)

Depth	Salinity (ppt)								
(m)	Oct 15	Oct 17	Oct 19	Oct 21	Oct 23	Oct 25	Nov 5	Nov 8	Nov 12
0.5	1.9	0.4	2.6	8.9	6.3	4.4	9.5	10.1	6.6
1.0	7.7	10.9	10.0	17.9	14.2	13.1	18.2	19.5	18.3
1.5	11.6	12.6	14.3	27.6	23.3	25.4	22.9	23.4	22.3
2.0	13.4	18.9	18.9	29.4	27.9	28.3	24.4	26.1	24.1
2.5	16.7	20.1	20.1	30.5	28.6	29.9	26.7	28.3	26.4
3.0	17.7	20.5	21.2	30.6	29.0	30.2	27.3	28.7	28.7
3.5	18.6	20.5	22.6	30.7	29.3	30.4	28.3	29.0	29.0
4.0	18.9	21.2	22.7	30.7	29.4	30.5	28.7	29.7	29.0
4.5	20.5	21.9	23.0	30.9		30.6	29.2	29.6	29.5
5.0	20.6	22.2	23.2	31.0		30.7	29.8	29.8	29.8
5.5	21.0	22.3	23.3	31.0		30.7	29.9	29.8	29.8
6.0	21.1	22.3	23.4	31.0		30.8	29.9	29.9	29.8
6.5	21.1	22.2	24.5	31.0		30.9	29.9	30.1	29.9