

Fisheries Investigations in Western Camden Bay, Arctic National Wildlife Refuge, Alaska, 1987

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Abstract

Fishes inhabiting the nearshore coastal waters of Camden Bay, Alaska were sampled from July 11 to September 7, 1987 to determine distribution, relative abundance, and biological characteristics. Fyke net stations were located in the areas of Konganevik Point and Simpson Cove. Sixteen species of fish were captured which included six diadromous and ten marine species. Arctic cod *Boreogadus saida* were the most numerous fish caught, and they were followed in abundance by capelin *Mallotus villosus*, young of the year Arctic cisco *Coregonus autumnalis*, fourhorn sculpin *Myoxocephalus quadricornis*, Dolly Varden *Salvelinus malma*, Arctic flounder *Pleuronectes glacialis*, and juvenile and adult size Arctic cisco. Arctic cod catch rates ranged from 0 to over 50,000 fish/d with the highest catch rates occurring after July 30. Most (~ 75%) of the Arctic cod were less than 120 mm total length. Young of the year Arctic cisco were captured throughout the sampling period. Catch rates ranged from 0 to over 6,600 fish/d. The higher catch rates occurred from mid to late August. Dolly Varden catch rates ranged from 0 to 114 fish/d with most (~ 90%) catch rates less than 10 fish/d. Higher catch rates of Dolly Varden occurred in July and all stations showed a general decline in the catch rate beginning in early August. Dolly Varden ranged from 83 to 692 mm fork length. Average daily air temperatures during the study ranged from 1° to 12°C. Average wind velocity for each month was ~ 12 to 14 mph. Water temperature ranged from 2° to 10.5°C in Camden Bay from mid-July to early September. Warmer temperatures (> 8°C) occurred in July and during the third week of August. Salinity measurements ranged from 10.5 to 28.5 ppt and were higher (> 20 ppt) after late July.

Introduction

Diadromous and marine fish utilize lagoons and other nearshore Beaufort sea coastal habitats for feeding during summer (Figure 1; Craig 1984). Lagoons are important because they are relatively warmer than offshore Beaufort Sea waters and have high concentrations of prey organisms. These conditions facilitate accumulations of fat reserves in fish for overwintering and sexual maturation. Nearshore waters also serve as a migration corridor for diadromous fish.

The major fish species utilizing coastal lagoons along the Arctic Refuge include: Arctic cisco, Dolly Varden, Arctic cod, fourhorn sculpin, Arctic flounder, and capelin (Table 1) (Roguski and Komarek 1971; Griffiths et al. 1977; Griffiths 1983; West and Wiswar 1985; Wiswar and West 1987; Wiswar et al. 1995). Dolly Varden and Arctic cisco are an important subsistence resource of the residents of Kaktovik which is located on Barter Island (Jacobson and Wentworth 1982; Pedersen and Linn 2005).

Dolly Varden migrate long distances along the Beaufort Sea coast during the open water season (McCart 1980). Within the refuge, Dolly Varden are found in the Sagavanirktok, Canning (Craig 1977; Yoshihara 1972, 1973), Hulahula, Aichilik, Egaksrak, Kongakut rivers, (Ward and Craig 1974; Furniss 1975; Smith and Glesne 1983; Daum et al. 1984; West and Wiswar 1985) and upper reaches of the Firth River (Glova and McCart 1974; Kristofferson et al. 1991).

Arctic cisco have international significance as they originate in the Mackenzie River, Northwest Territories, Canada (Fechhelm and Fissel 1988). Young-of-the-year Arctic cisco (age 0) migrate from the Mackenzie River westward to the Colville River. Their migration to the Colville River is aided by the wind-driven, easterly longshore current that flows along the Arctic coast (Fechhelm and Fissel 1988). Arctic cisco spend the next seven to eight years feeding in the nearshore waters of the Beaufort Sea and overwintering in the Colville and Sagavanirktok rivers before returning to the Mackenzie River to spawn (Gallaway et al. 1989). The Mackenzie River, by roughly following the shoreline to its western channels, is about 220-250 km east of the Alaska/Yukon border.

The Alaska National Interest Lands Conservation Act of 1980 provided in Section 1002(c) for biological baseline studies to assess fish and wildlife populations on the coastal plain of the Arctic National Wildlife Refuge (Arctic Refuge). Fisheries investigations were conducted in Camden Bay, Alaska to determine use by diadromous and marine fish species. Specific objectives were to: 1) determine relative abundance, distribution, and movements of diadromous and marine fishes; 2) determine length frequency, age structure for Arctic cisco and Dolly Varden and a weight-length relationship for Dolly Varden; and 3) describe biological characteristics of other species captured.

Exploratory drilling for oil and gas has already occurred in several areas adjacent to the Arctic Refuge. Industrial activities that could affect fish resources include oil spills, drilling discharges, marine seismic activity, and construction of port facilities, causeways, and pipelines (Clough et al. 1987). These activities and structures may hinder or prevent fish migration and degrade physical habitat and hydrologic conditions. It was the intent of this study to provide baseline information prior to the potential advent of activities in the Arctic Refuge.

Study Area

Camden Bay (70° 09' N, 144° 45' W) is bordered by the Arctic coastal plain to the south, the Canning River delta on the west, and Barter Island to the east (Orth 1967). Major rivers flowing into the bay are the Canning, Katakaturuk, Sadlerochit, Hulahula, and Okpilak rivers. The study area within the bay extends from Konganevik Point on the west to Simpson Cove on the east (Figure 2).

The open water season generally runs from early July until mid September or early October (Truett 1981). In June, snow melt runoff enters the bay from the rivers and accelerates the break-up of ice. Ice in Camden Bay in 1987 did not completely dissipate until July 17. The nearshore waters are influenced by a northwesterly, longshore current and wind patterns associated with storms (OCSEAP 1978; Truett 1981). In the study area extending from Konganevik Point to Simpson Cove depths reach to 15 feet (Mean Lower Low Water, Navigational Chart #16042, National Oceanic and Atmospheric Administration).

Methods

Weather and Hydrologic Measurements

Climatological data were obtained from meteorological observations recorded at Barter Island, Alaska (NOAA 1987). Simpson Cove is situated about 55 km west of Barter Island. Surface water temperature and salinity were measured at each station daily except during periods of severe wind and wave conditions. Water temperature was measured with a standard centigrade thermometer and we estimated to the nearest 0.5°C. Salinity was measured with a salinity-conductivity-temperature meter.

Fyke Net Stations

Dual trap, directional fyke nets, with leads extending up to 61 m and 15 m wings, were deployed from shore. Actual length of the leads from shore varied according to depth where the trap was set. Traps measured 1.5 m wide by 1.2 m high at the mouth. Mesh size for the traps measured 12.5 mm stretch mesh with 25 mm for the wings and lead. Sampling was conducted from July 13 to September 7, 1987 at eight locations. Due to ice conditions and storms, all stations were not established on the same day nor were they sampled continuously. Each station's fishing schedule is presented in Table 2.

Fish Sampling

Nets were checked once daily, generally between 1200 and 1800 hrs, except during extremely poor weather conditions that precluded safe boat operation. All fish were enumerated by species. Large catches (> 200 fish) consisting of one species and size class were estimated by counting the number of fish in three dip net sub-samples, averaging the results, and multiplying that number by the total number of dip net samples of equal volume.

Fish were measured to the nearest mm for fork length (FL) or total length (TL) for fish species with rounded or truncated caudal fins. Weights of Arctic cisco and Dolly Varden were estimated to the nearest 5 g using spring scales with ranges of 0-500 g and 0-2,000 g.

Numbered Floy FD-67 anchor tags were implanted in Dolly Varden, Arctic and least cisco, saffron cod and Arctic flounder to aid in determining fish movements. Fish selected for tagging were greater than 250 mm FL. After biological data were recorded, all fish were transported about 100 m further offshore from the trap and released.

Data Analysis

Catch rate— Daily catch rate (fish/trap/d) by species at each station was calculated by adjusting for 24 hours from the catch-per-unit-effort (CPUE). Catch rate in the text is rounded to the nearest fish. Data in the appendices are presented in tenths. Data were not included in the catch rate analysis when severe weather conditions and wave action compromised the fishing efficiency of the trap or when trap was not checked within ~ 48 hours. There were two exceptions to this. One was for capelin which were vulnerable to being gilled in the trap lead and wings. The number of these fish was estimated and included in the daily catch. The other exception was on July 22 at SC 1 and SC 2 where the nets were checked twice on that day; once in the early morning and the second time in late afternoon or early evening. The catches from the two time periods were combined at each station and the later time was used to calculate the catch rate for the day.

The migration pattern of young of the year Arctic cisco differs from that of adults and juveniles (Gallaway et al. 1983; Fechhelm and Fissel 1988); therefore, Arctic cisco were separated into three groups for the purpose of catch rate analysis. The separation between young of the year and juvenile (age 1) was set at the 90 mm FL interval and is based on length at age information from studies in the Beaufort Sea by Craig and Haldorson (1981), Bond and Erickson (1987), Glass and Parker (1991), Moulton (1989), and Wiswar et al. (1995). Young of the year Arctic cisco were considered as ≤ 90 mm FL. Juvenile fish representing 1 and 2 year old Arctic cisco were grouped > 90 -199 mm FL. Larger, adult size fish ≥ 200 mm FL were the third group where the length interval for separation is similar to analyses used in other studies (Reub et al. 1991; Underwood et al. 1995).

Biological characteristics— For fish species with the highest catches, all measured fish were used to construct length-frequency histograms. These data were divided into four periods to evaluate seasonal change. Total number of fish used in the histograms may exceed the number reported for total catch from fyke net stations as the histograms include days not calculated for catch rate (see *Catch rate* above). For Arctic cisco and Dolly Varden, the parameters of nonlinear weight-length models (Ricker 1975) were estimated by regressing \log_e weight on \log_e length.

Ages of Arctic cisco and Dolly Varden were estimated from otoliths (sagittae). Larger sagittae were broken at the nucleus and burned in an alcohol flame before viewing under reflected light (Barber and McFarlane 1987). When sagittae were too small to be broken, ages were estimated by surface reading.

Results and Discussion

Weather and Hydrologic Measurements

Weather— Average ambient air temperature at Barter Island for July, August, and early September was 7°C, 6°C, and 3°C, respectively (NOAA 1987). Average daily temperatures during the study ranged from 1°C to 12°C. Wind direction was variable. In July, during the period of this study, winds were from the east/southeast on 11 days and from the northwest/west on 10 days. Overall, average daily wind velocity was 12.5 mph. There were 11 days when a sustained (\geq min) wind velocity of over 20 mph was recorded. In August, winds were from the west/northwest on 18 days and from the east on 13 days. Average daily wind velocity was 14.2 mph and there was a period in 19 days during the month when wind velocity exceeded 20 mph. From September 1-7, winds were from the east on 5 days and from the west on 2 days. Average daily wind velocity was 13.9 mph. Periods of strong winds during this study increased wave action which affected fyke net trap efficiency. Examples of affects include conditions when: 1) traps were moved out of alignment which twisted the throat of the traps and prevented fish from entering, and 2) vertical supports for the leads and wings were knocked down. Winds from the northwest and west caused a noticeable increase in the water mass in the study area. These wind-induced tides have been described along the Beaufort Sea coast by Dygas et al. (1972).

Water Temperature and Salinity— Water temperature ranged from 2° to 10.5°C in Camden Bay from mid-July to early September (Appendices 1 and 2). Warmer temperatures ($> 8^\circ\text{C}$) occurred in July and again during the third week of August. Salinity measurements ranged from 10.5 to 28.5 ppt. Salinity was higher (> 20 ppt) from late July to the third week of August when it decreased to < 17 ppt in the Simpson Cove area. Equipment failure was responsible for an

incomplete record from the stations near Konganevik Point.

Catch Results and Biological Characteristics of Diadromous Fish

Sixteen species of fish were caught in Camden Bay (Table 3); six species were diadromous and ten were marine species. Arctic cod were the most numerous fish caught, and they were followed in abundance by capelin, young of the year Arctic cisco, fourhorn sculpin, Dolly Varden, Arctic flounder, and Arctic cisco ≥ 200 mm FL.

Arctic cisco— Arctic cisco ≥ 200 mm FL were captured throughout the sampling period but not on every day (Appendix 3). A total of 742 larger size Arctic cisco were captured from all fyke net stations. Catch rates from all stations ranged from 0 to 134 fish/d. Higher catch rates occurred at stations SC 4 and SC 2. There was a general decline in Arctic cisco captured at all the stations after late August.

Juvenile Arctic cisco (> 90 and < 200 mm FL) were captured fairly consistently after mid-July but not at all stations (Appendix 4). Catch rates from all stations ranged from 0 to 192 fish/d. The higher catch rates occurred at SC 4 and KP 3 between mid and late August.

Young of the year (yoy) Arctic cisco were captured throughout the sampling period (Appendix 5). Catch rates from all stations ranged from 0 to over 6,600 fish/d. The higher catch rates occurred from mid to late August at KP 3, KP 2, and SC 4. Daily catch rates increased and declined very rapidly during this period. In another study further towards the west off the Sagavanirktok River delta, the first large increase in the catch rate of yoy Arctic cisco was on August 17 (Reub et al. 1991). This would indicate that it took about 11 days for the first pulse of fish to travel the 160 km. At the different stations in this area the daily catch rates were highly variable and catch rates of ~ 200 fish/d were recorded into the second week of September. In 1986 in Oruktalik Lagoon, the timing of the yoy Arctic cisco was similar to this study where they were abundant in fyke net catches from mid to late August (Wiswar et al. 1995).

Arctic cisco ranged in length from 38 to 463 mm FL and exhibited a bi-modal length distribution in all sampling periods (Figure 3). These distributions were characterized by young of the year and adult size Arctic cisco over 330 mm FL. Juvenile fish in the size range between 150 and 300 mm FL were poorly represented or absent. The length mode for Arctic cisco ≥ 200 mm FL was 350 mm and ranged from 213 to 463 mm FL among the fyke net stations. For young of the year fish the mode was 80 mm FL. Juvenile fish (1 and 2 year old) fork lengths ranged from 91 to 195 mm with a mode of 92 mm. There is probably an overlap between larger size young of the year and smaller juvenile Arctic cisco in the 90 to 120 mm size range.

Sixteen adults were examined for age, sex, and length (Table 4). Their ages ranged from 7 to 10 years old and lengths ranged from 326 to 384 mm FL. Females in these age groups ranged from 0 to 67%. Arctic cisco become mature at 6 years of age (Nikolskii 1961 as cited in Morrow 1980, Roguski and Komarek 1971). From previous age and length studies the smallest size for this age group is about 290 mm FL (Wiswar and West 1985); therefore, we concluded that the fish in our sample were all mature.

A total of 631 Arctic cisco were tagged. Nine fish from this study were recaptured (Table 5). Four fish were harvested in the subsistence fishery about 85 km east at Griffin Point near Oruktalik Lagoon. There were two recaptures within the bay and both were within two days of

their initial capture. This suggests that they utilize the bay for only a short period of time and then continue their coastal movements to overwintering locations in the Mackenzie and Colville rivers. Six fish tagged in the Prudhoe Bay area from other studies were recaptured in Camden Bay. Three other fish were recaptured in different years and locations.

Arctic cisco utilize lagoon habitat shortly after break-up occurs. They appear to be one of the earliest arriving fish species found in this habitat off the Arctic Refuge coast (Roguski and Komarek 1971; Griffiths et al. 1977; West and Wiswar 1985; Wiswar and West 1986). They were captured as early as June 24, 1984 in Beaufort Lagoon when most of the lagoon was still covered by ice (West and Wiswar 1985).

Dolly Varden— Dolly Varden were captured throughout the sampling period but their occurrence was infrequent. A total of 1,314 Dolly Varden were captured from all stations. Catch rates ranged from 0 to 114 fish/d with most (~ 90%) catch rates less than 10 fish/d. The higher catch rates occurred in July. All stations showed a general decline in the catch rate beginning in early August (Appendix 6).

Dolly Varden ranged from 83 to 692 mm FL (Figure 4). Several of the smaller size char had parr marks. Dolly Varden less than 300 mm FL were predominant throughout the sampling periods. This is somewhat in contrast to what has been observed in other studies where the distribution was more bi-modal in character or with a stronger representation of larger (> 300 mm FL) fish (West and Wiswar 1985; Wiswar and West 1986; Bond and Erickson 1989; Reub et al. 1991; Wiswar et al. 1995).

Age estimated for 73 Dolly Varden ranged between 2 and 9 years (Table 6). Sex ratios of females for the age groups ranged from 0 to 67%. Most Dolly Varden reach maturation by the time they are 7 years old (Yoshihara 1973).

The weight – length relationship for Dolly Varden is described by the equation:

$$\ln(\text{weight}) = -12.65 + 3.18 \ln(\text{fork length}),$$

where $r = 0.96$, $N = 72$, lengths and weights ranged between 146 and 433 mm FL and 30 to 845 g, respectively.

A total of 460 Dolly Varden were tagged with numbered Floy FD-67 anchor tags and eight were recaptured in the study area (Table 7). The time between initial capture and recapture ranged from 1 to 37 days. Dolly Varden tagged in Camden Bay were also recaptured in the Kongakut and Canning rivers. The recapture the char from this study either from or in different river drainages supports the conclusion from genetic analysis of Everett et al. (1997) that multiple populations occur in the same areas across the Beaufort Sea coast. Seven fish were recaptured that were tagged in other studies. Five char were tagged in the Hulahula River at Fish Hole 2 in 1983 and two were fish tagged in the Prudhoe Bay area.

Least cisco— Least cisco were captured in Camden Bay between July 24 and September 2 ($N = 264$). About 50% of those fish were captured between August 9 and 18 at SC 2. Least cisco ranged in length from 107 to 366 mm FL and most (~ 78%) were between 270 and 310 mm FL (Figure 5). Seventeen least cisco were collected to estimate their ages. These fish were 268 – 329 mm FL and 7-16 years old (Table 8). A total of 157 least cisco were tagged (Table 9). Three fish from Simpson Cove were recaptured within ten days in the same area. Two fish were recaptured in the Camden Bay that were initially tagged in another study in the Prudhoe Bay area.

and one fish from this study was recaptured in the Colville River. Least cisco are not abundant off the Arctic Refuge coast (Roguski and Komarek 1971; Griffiths et al. 1977; Griffiths 1983; Wiswar and West 1986) and are not known to occur in any of the rivers in the refuge flowing into the Beaufort Sea with the exception of the Sagavanirktok River (McCart et al. 1972). The recapture information provides some evidence that they may be originating from the Colville River.

Broad whitefish— Five broad whitefish were captured between August 14 and 20 in Simpson Cove. Four were juveniles measured between 121 and 135 mm, and one was an adult at 358 mm FL. Broad whitefish occur in the Colville (Alt and Kogl 1973), Sagavanirktok (Yoshihara 1972), Blow (Bryan 1973), and Mackenzie rivers (Percy 1975) and have also been found near the Canning River delta (Ward and Craig 1974). They were described as moderately abundant in fyke net catches off the Sagavanirktok River delta in 1985 (Cannon et al. 1987). No rivers in the Arctic Refuge flowing into the Beaufort Sea are known to support a broad whitefish population.

Rainbow smelt— Rainbow smelt were captured in low numbers (N = 59) between July 12 and September 4. They ranged in length from 75 to 245 mm (N = 54, \bar{x} = 123.3, SE = 6.4). Most (about 65%) were less than 120 mm. The fish in this length range correspond to fish under 3 years old following length at age comparisons of Haldorson and Craig (1984) in Simpson Lagoon. The larger smelt in Camden Bay may be as old as 10 years.

Rainbow smelt appear to comprise only a small portion of the fish using the nearshore waters during summer. In Simpson Lagoon, located west of Prudhoe Bay, they accounted for less than 1% of the anadromous fish captured in 1977 and 1978 (Haldorson and Craig 1984). In contrast, under-ice surveys conducted off the Colville River delta during the winter found that they were the most common species.

Ninespine stickleback— Ninespine stickleback were captured (N = 36) between August 11 and September 3. About 70% were captured at SC 4. Stickleback ranged from 52 to 75 mm FL (N = 32, \bar{x} = 63.8, SE = 1.0). Ninespine stickleback are present in many aquatic habitats and have been captured in nearshore coastal waters and in many rivers, streams and lakes in the Arctic Refuge (West and Frugé 1989).

Catch Results and Biological Characteristics of Marine Species

Arctic cod— Arctic cod were the most abundant marine species captured in Camden Bay (N = 529,606). Catch rates ranged from 0 to over 50,000 fish/d (Appendix 7). The highest Arctic cod catch rates occurred after July 30. About 40% of the fish were captured at KP 3. Arctic cod lengths ranged from 54-301 mm TL (N = 3,552, \bar{x} = 102.6, SE = 0.5; Figure 6). Most (~ 75%) of the Arctic cod were less than 120 mm TL and these fish would correspond to 1 and 2 year old fish (Craig et al. 1982).

Arctic cod are widespread and abundant in the nearshore and marine waters of the Beaufort Sea (Craig 1984). Their year to year relative abundance in fyke net catches can be highly variable. In Simpson Lagoon, located west of Prudhoe Bay, during two years of study, their relative abundance ranged from 8% to 78% of the total number of fish caught (Craig et al. 1982).

Capelin— Capelin were the second most numerous marine species captured (N = 50,114). Their catch rates ranged from 0 to over 33,000 fish/d and were most abundant from July 20 to August

10 but with no sustained peak period of abundance during that time (Appendix 8). Fork lengths of capelin ranged from 74 to 162 mm ($N = 542$, $\bar{x} = 131.6$, $SE = 0.5$; Figure 7). Females were gravid and spawning males were identified by the raised midlateral ridge. Along the shoreline west of KP 1 during the peak period of abundance when wave action was slight, we often observed schools of capelin moving in an easterly direction within a couple of meters of the beach.

Fourhorn sculpin— Fourhorn sculpin were the third most numerous marine species captured in Camden Bay. Their daily catch rates ranged from 0 to over 2,200 fish/d but most days (~ 80%) were less than 50 fish/d (Appendix 9). The highest catch rates occurred at SC 1 in July.

Fourhorn sculpins ranged in length from 38–350 mm ($N = 2,321$, $\bar{x} = 110.9$, $SE = 0.8$; Figure 8). There was an increase in the mean size fish in August when compared to fourhorn sculpin in July.

Fourhorn sculpin are an abundant and widespread species along the Beaufort Sea coastal area. They have been the numerically dominant marine species captured in fyke nets in lagoons along the Arctic Refuge coast (Griffiths 1983; West and Wiswar 1985; Wiswar and West 1986).

Arctic flounder— Arctic flounder were captured throughout the sampling period, but not at all stations. Catch rates ranged from 0 to 67 fish/d and were highest at SC 1 and at fyke net stations located in small embayments, KP 2 and SC 4, that were protected from wave action. Arctic flounder ranged in length from 68 to 300 mm ($N = 847$, $\bar{x} = 187.7$, $SE = 1.3$; Figure 9). The mode ranged from 190 to 205 over the four sampling periods. Two Arctic flounder tagged near Konganevik Point area were recaptured in the same area 15 and 28 days later.

Saffron cod— Saffron cod were captured at all stations throughout the sampling period but in low numbers ($N = 225$). About 46% of those captured were from the SC2. There was a wide range in their length from 32 to 333 mm TL (Figure 10). Saffron cod between 90 and 180 mm TL comprised 82% of those measured. These fish correspond to one year old fish following the length at age relationship of saffron cod from Simpson Cove (Craig and Haldorson 1981). Five saffron cod measuring between 261 and 333 mm TL were tagged and none were recaptured.

Kelp snailfish— Sixty-eight kelp snailfish were captured between July 20 and September 7. Most (45%) were captured at station KP 3 between August 16 and September 5. The higher catch at KP 3 may be due to this fyke net station's proximity to an undersea boulder area identified north of Konganevik Point on NOAA Navigation Chart #16044 that may support a kelp community. Those fish measured ranged in length from 61-135 mm ($N = 63$, $\bar{x} = 99.6$, $SE = 1.9$).

Bering wolffish— Four Bering wolffish were captured between July 19 and August 18. These fish measured between 171-182 mm and were probably yearlings (Barsukov 1959). This capture of Bering wolffish is the first reported in the Beaufort Sea (Frugé and Wiswar 1991).

Prickleback spp.— Pricklebacks are a circumboreal bottomfish often found in intertidal waters (Hart 1973). Four species have been identified from the Beaufort Sea (Craig 1984). Forty-four pricklebacks were captured between July 23 and August 26. Most (55%) were captured at Station SC 2. Pricklebacks ranged in length from 107 to 200 mm ($N = 34$, $\bar{x} = 140.4$, $SE = 4.0$).

Pacific herring— Pacific herring were captured in low numbers (N = 23) in Camden Bay from July 15 to August 26. Most (83%) were captured in the traps in Simpson Cove. Pacific herring ranged in length from 76 to 236 mm (N = 22, \bar{x} = 157.9, SE = 10.6)

Pacific herring are spring spawners. They have comprised only a small percent of the catch in summer studies along the Beaufort Sea coast (Kendel et al. 1975; Craig and Haldorson 1981; Bond and Erickson 1987; Cannon et al. 1987; Reub et al. 1991; Wiswar et al. 1995).

Pacific sandlance— One sandlance was captured on August 6 at SC 2. The lone specimen measured 158 mm FL.

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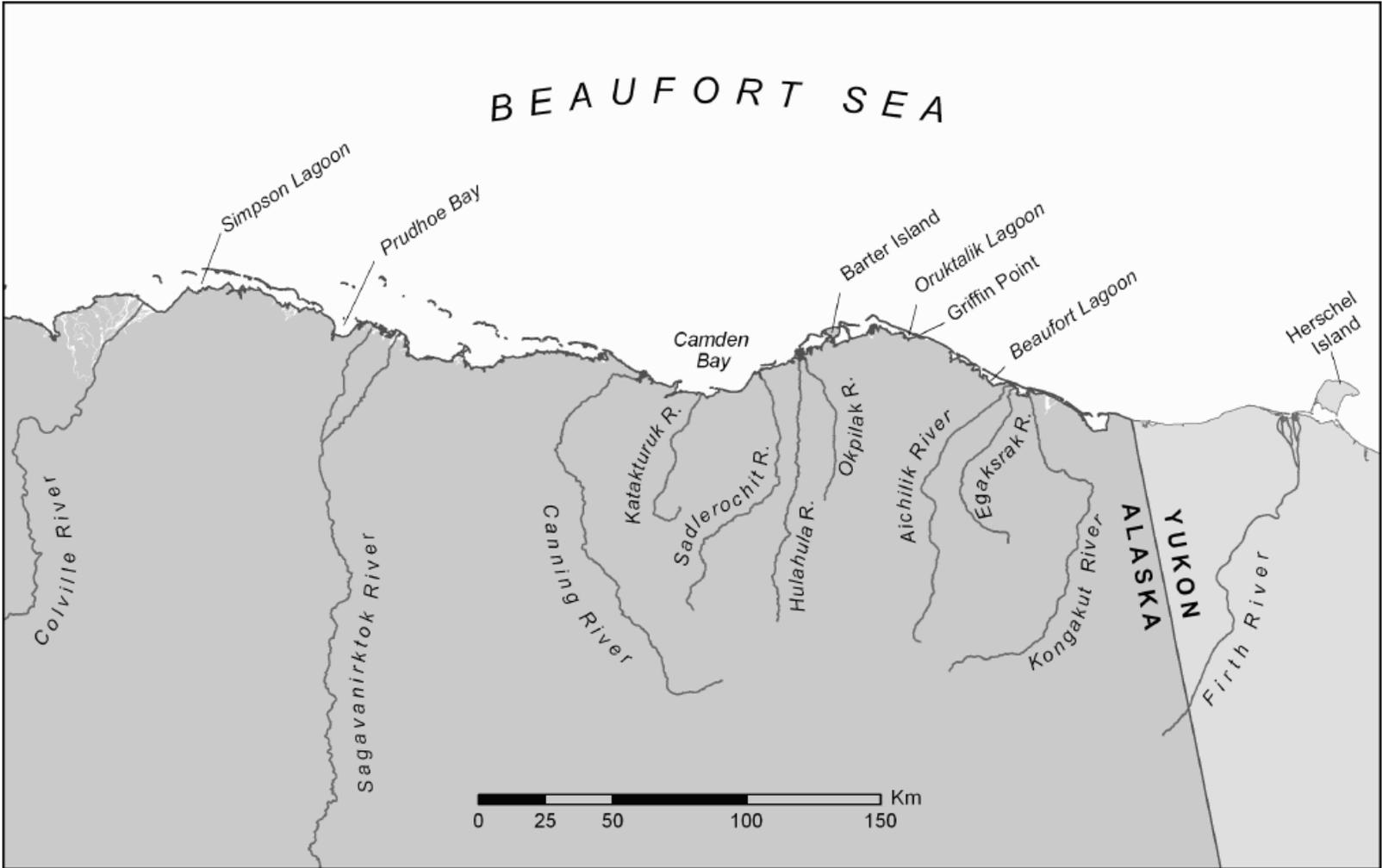


Figure 1. North Slope rivers and coastal areas referenced in this report.

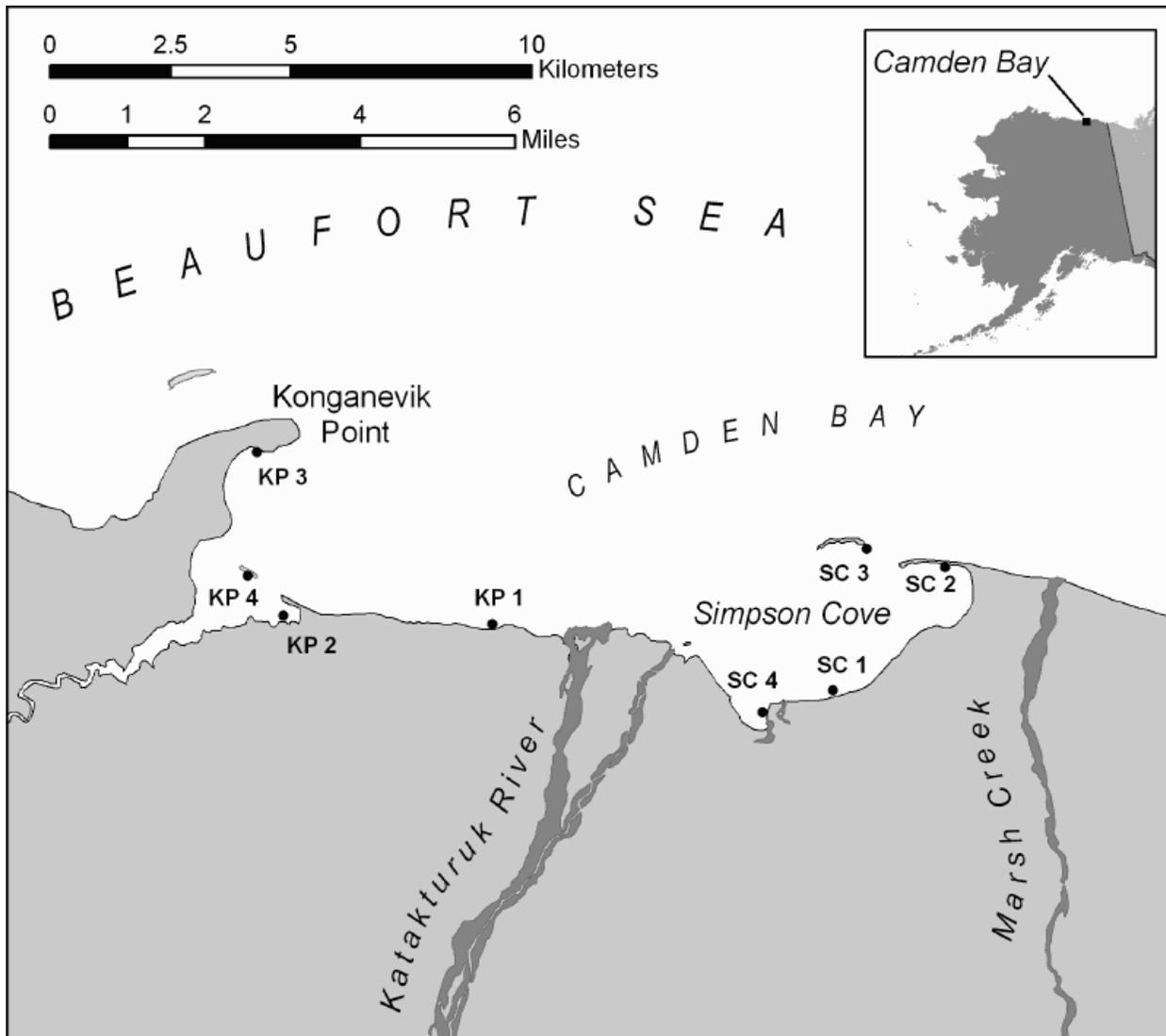


Figure 2. Fyke net stations in Camden Bay, Alaska, July – September 1987.

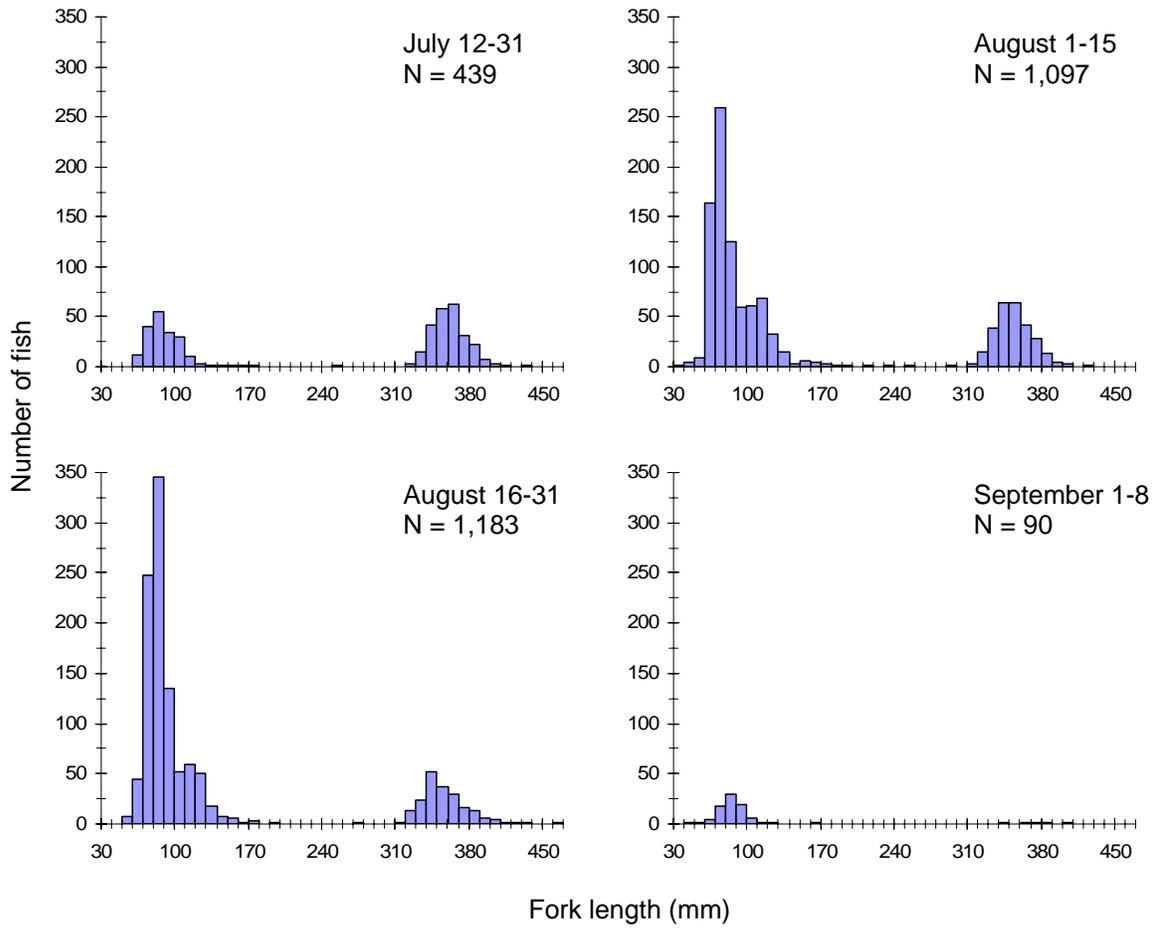


Figure 3. Length frequencies of Arctic cisco captured in Camden Bay, Alaska, July – September 1987.

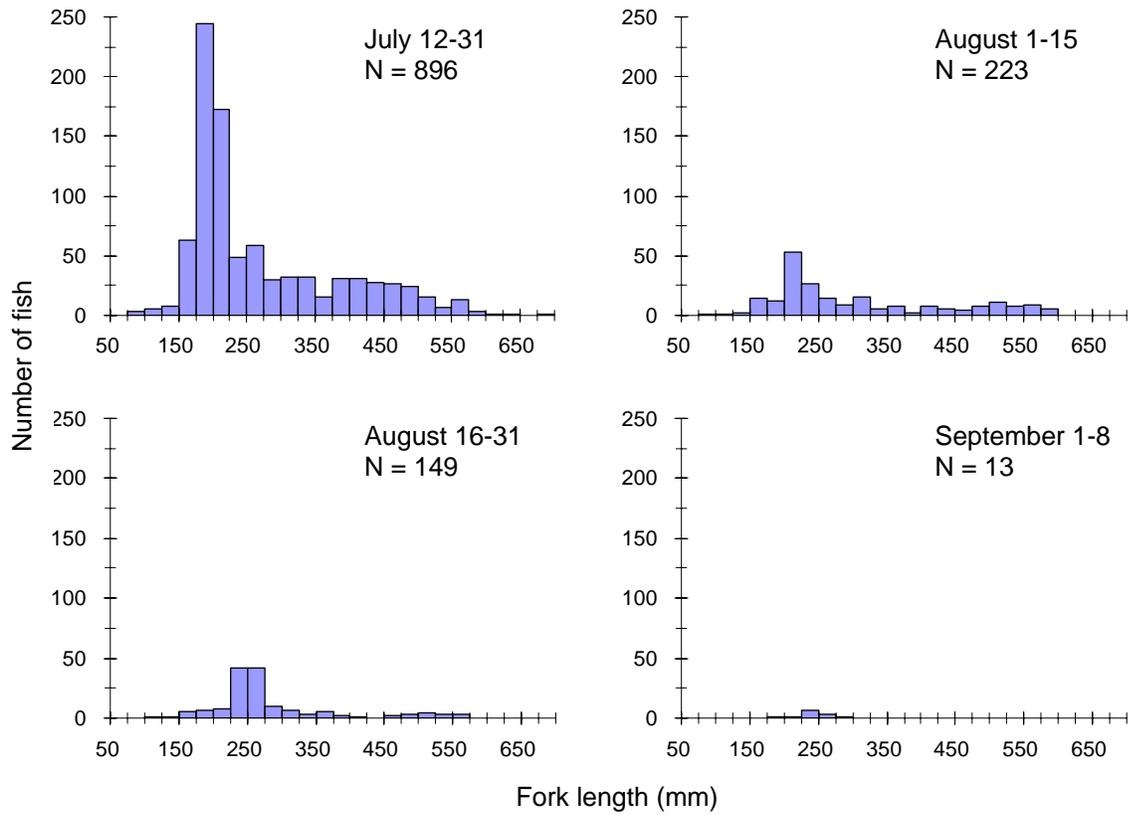


Figure 4. Length frequencies of Dolly Varden captured in Camden Bay, Alaska, July - September 1987.

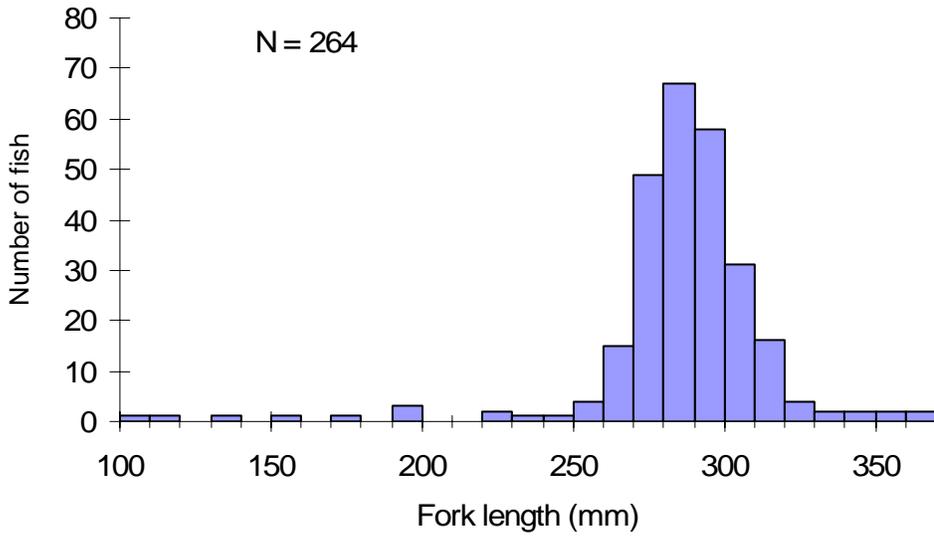


Figure 5. Length frequencies of least cisco captured in Camden Bay, Alaska, July – September 1987.

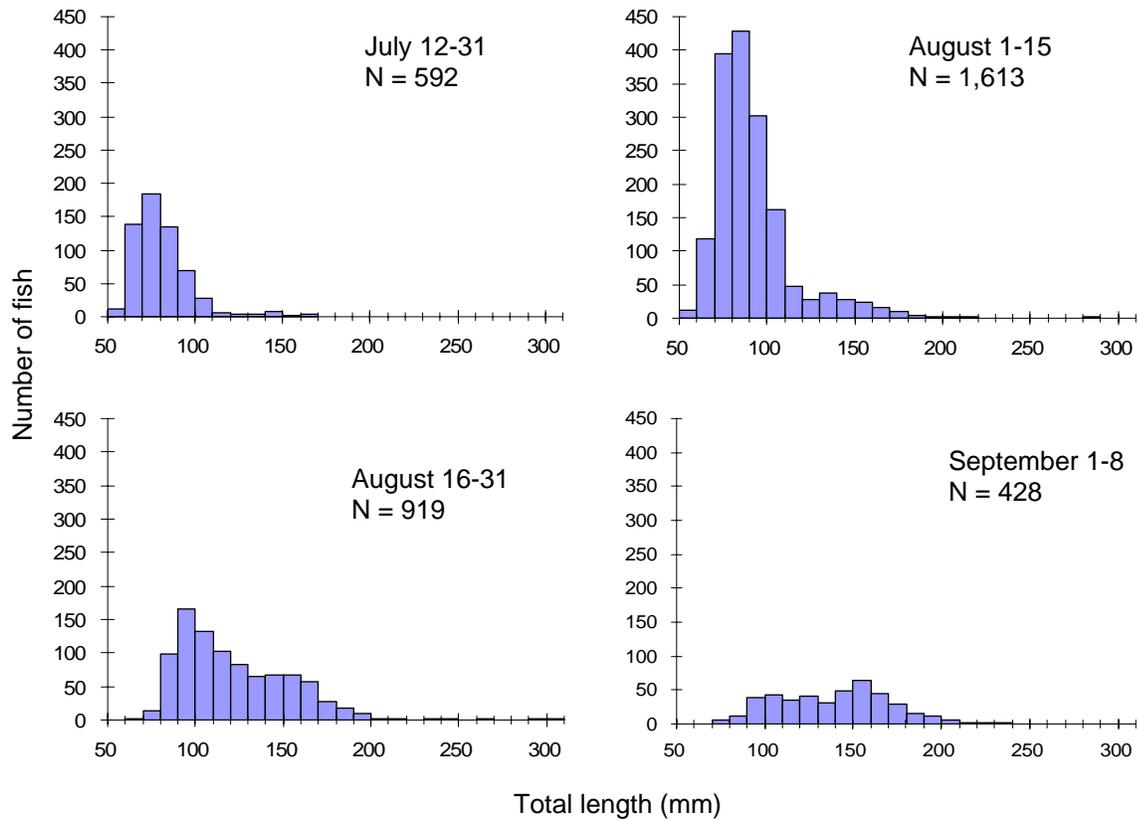


Figure 6. Length frequencies of Arctic cod captured in Camden Bay, Alaska, July - September 1987.

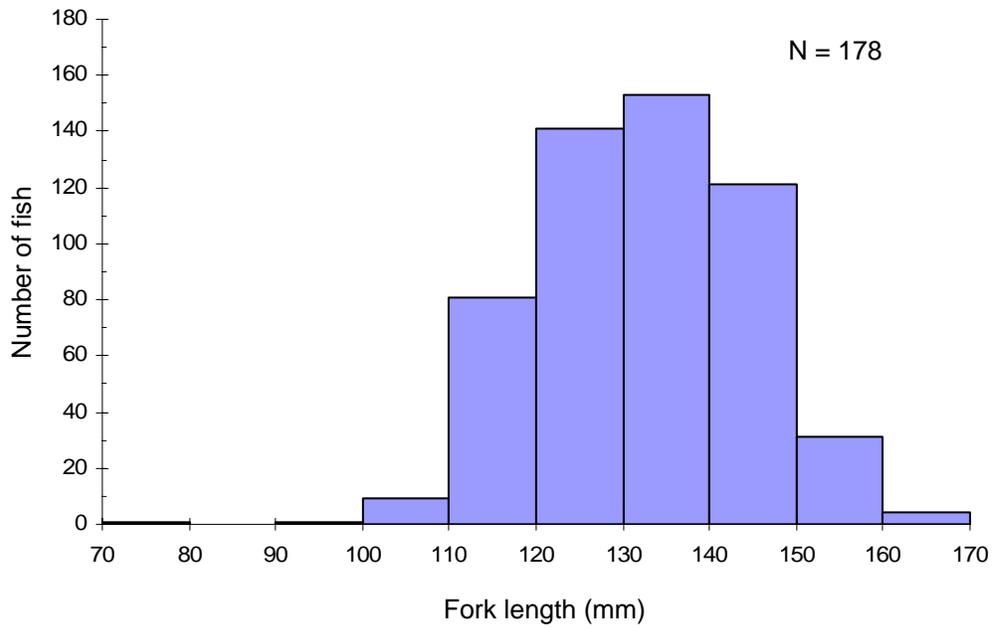


Figure 7. Length frequencies of capelin captured in Camden Bay, Alaska, July – September 1987.

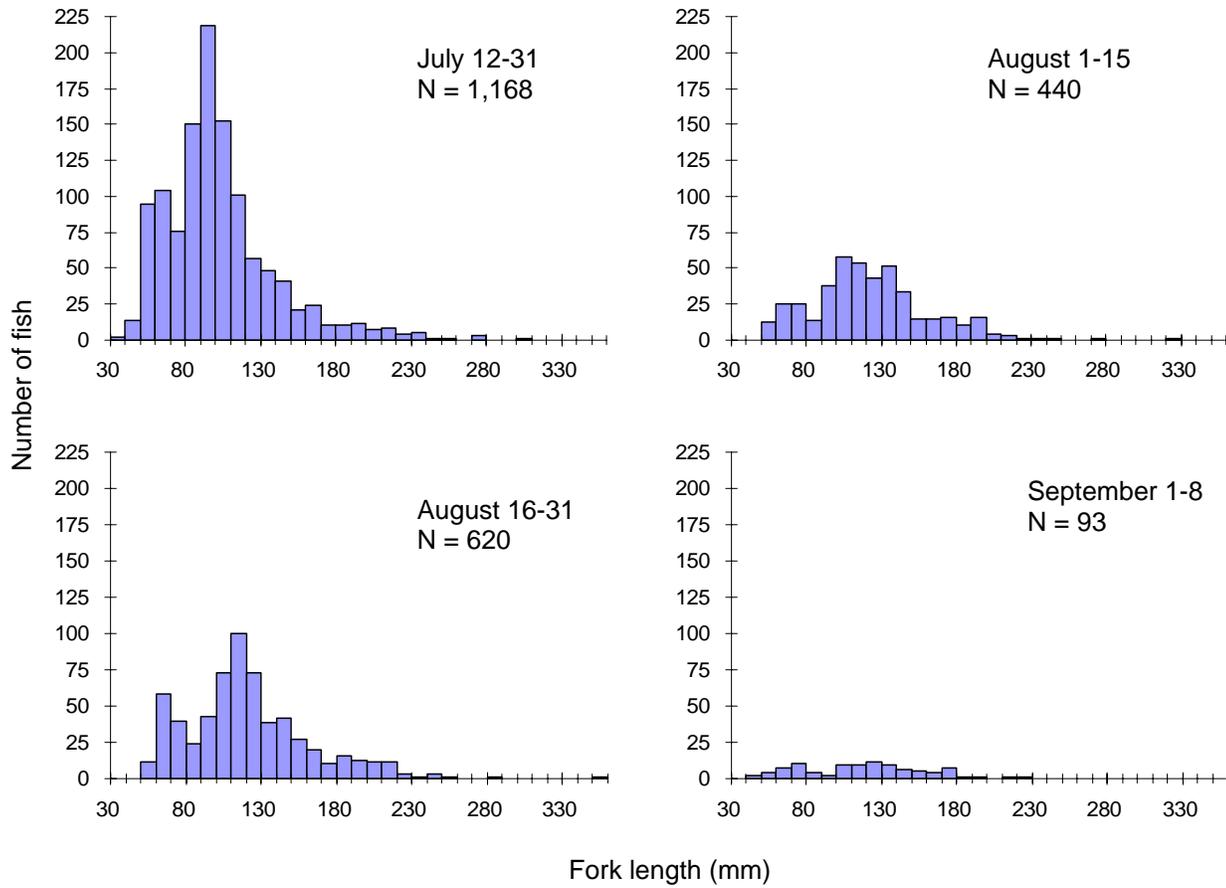


Figure 8. Length frequencies of fourhorn sculpin captured in Camden Bay, Alaska, July – September 1987.

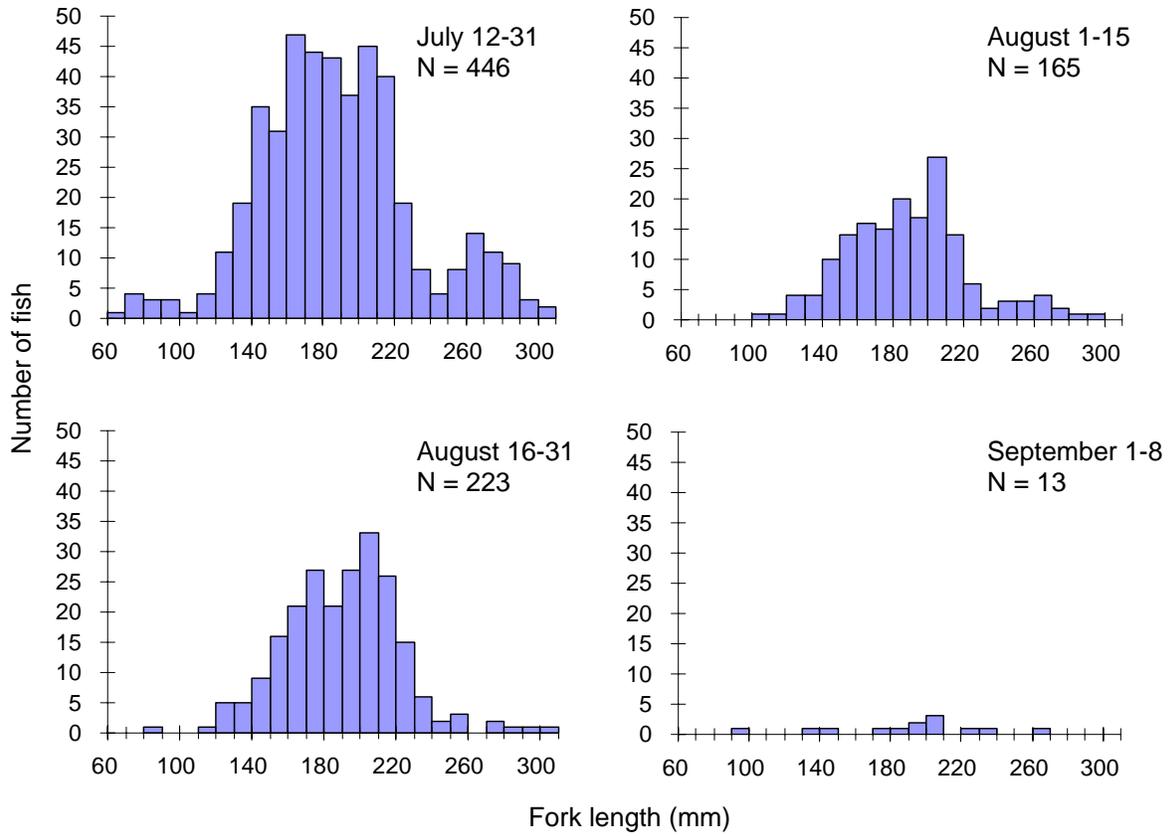


Figure 9. Length frequencies of Arctic flounder captured in Camden Bay, Alaska, July – September 1987.

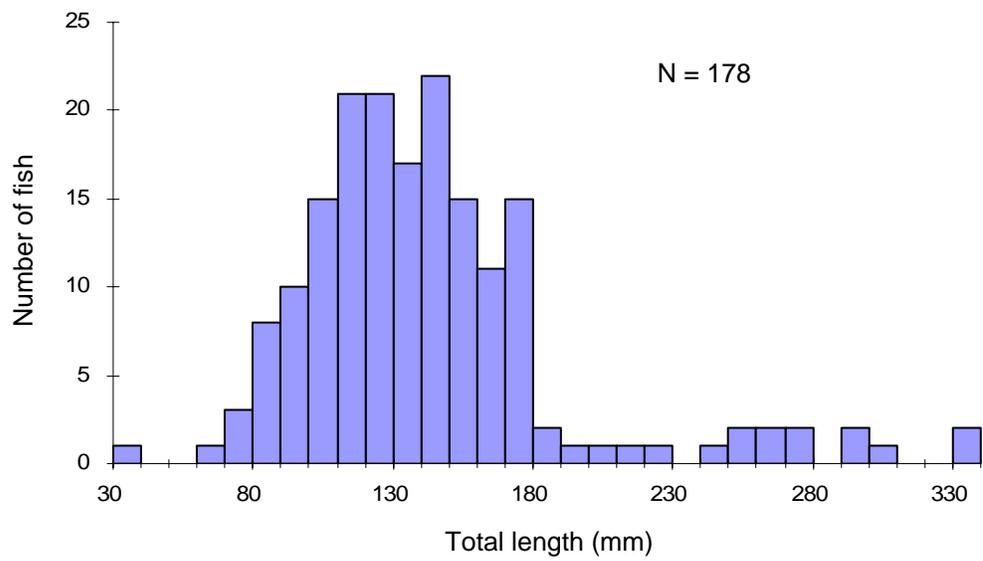


Figure 10. Length frequency of saffron cod captures in Camden Bay, Alaska, July – September 1987.

Table 1. Common and scientific names of fish (AFS 2004) captured in Camden Bay, Alaska, July – September 1987.

Family	Common name	Scientific name
Diadromous species		
Salmonidae	Arctic cisco	<i>Coregonus autumnalis</i>
	Broad whitefish	<i>C. nasus</i>
	Least cisco	<i>C. sardinella</i>
Osmeridae	Dolly Varden	<i>Salvelinus malma</i>
	Rainbow smelt	<i>Osmerus mordax</i>
Gasterosteidae	Ninespine stickleback	<i>Pungitius pungitius</i>
Marine species		
Clupeidae	Pacific herring	<i>Clupea harengus</i>
Osmeridae	Capelin	<i>Mallotus villosus</i>
Gadidae	Arctic cod	<i>Boreogadus saida</i>
	Saffron cod	<i>Eleginus gracilis</i>
Stichaeidae	Prickleback spp.	
Anarhichadidae	Bering wolffish	<i>Anarhichas orientalis</i>
Ammodytidae	Pacific sand lance	<i>Ammodytes hexapterus</i>
Cottidae	Fourhorn sculpin	<i>Myoxocephalus quadricornis</i>
Cyclopteridae	Kelp snailfish	<i>Liparis tunicatus</i>
Pleuronectidae	Arctic flounder	<i>Pleuronectes glacialis</i>

Table 2. Fyke net stations in Camden Bay, Alaska, July – September 1987.

Station	Latitude		Station description	Comments
	Longitude	Dates fished		
Konganevik Point				
KP1	145° 05.1' W 69° 59.2' N	July 13 – August 17	KP1 was along a section of exposed gravel shoreline west of the Katakaturuk River.	During northwest and west winds this station received much wave action and was knocked down repeatedly.
KP2	145° 12.0' W 69° 59.5' N	July 14 – September 7	KP2 was on the south side of a small embayment protected by a spit and island across its entrance. The embayment is surrounded low lying tundra bluffs 1-3 m high. The bottom composition consisted of mud and detritus.	
KP3	145° 12.0' W 70° 01.5' N	July 15 – September 7	KP3 was southwest of Konganevik Point in a small embayment protected by a narrow spit. Bottom composition consisted of mud and detritus.	
KP4	145° 12.5' W 70° 00.0' N	August 25 – September 7	KP4 was across from KP2 on the inside of the island protecting the embayment.	
Simpson Cove				
SC1	144° 53.7' W 69° 54.6' N	July 11 – August 25	SC1 was along an exposed shoreline in Simpson Cove at the base of a 6-8 m high bluff. The bottom composition along this area consisted of sand and detritus.	During northwest and west winds and high water much erosion occurred at the base of the bluff.
SC2	144° 50.8' W 69° 59.1' N	July 11 – September 3	SC2 was on the inside of the spit in Simpson Cove.	
SC3	144° 53.2' W 69° 58.9' N	July 13 – August 28	SC3 was on the inside of the island west of Collinson Point which is the point of land between Simpson Cove and Camden Bay.	During a storm in late August wave action cut a channel through the island near the station and destroyed the trap.
SC4	144° 58.8' W 69° 57.7' N	August 7 – September 3	SC4 was in a small shallow cove along the southeast shoreline of Simpson Cove. The adjacent land is low tundra and a marsh.	

Table 3. Number of fish captured by species at the fyke net stations in Camden Bay, July - September 1987. Fish numbers are not adjusted for catch-per-unit-effort.

Fish species	Fyke net stations								Total
	Konganevik Point				Simpson Cove				
	KP 1	KP 2	KP 3	KP 4	SC 1	SC 2	SC 3	SC 4	
Diadromous species									
Arctic cisco									
adult (≥ 200 mm FL)	53	54	20	0	38	344	16	217	742
juvenile (> 90 FL < 200 mm)	4	149	673	27	21	310	11	696	1,891
young of the year (≤ 90 mm FL)	302	5,764	19,738	84	85	329	48	3,064	29,414
Dolly Varden	86	136	549	4	298	143	20	78	1,314
Least cisco	16	10	8	0	0	190	8	32	264
Broad whitefish	0	0	0	0	0	4	0	1	5
Rainbow smelt	1	16	3	0	12	13	3	11	59
Ninespine stickleback	0	2	7	1	0	1	0	25	36
Marine species									
Arctic cod	3,912	69,588	209,817	13,154	630	142,618	29,374	60,513	529,606
Saffron cod	1	38	11	9	34	103	3	26	225
Capelin	42,937	10	3	0	4,024	3,023	106	11	50,114
Fourhorn sculpin	518	1,448	813	289	5,563	2,340	165	1,838	12,974
Arctic flounder	5	431	11	10	203	172	1	287	1,120
Pacific herring	0	2	2	0	1	9	1	8	23
Kelp snailfish	2	8	30	0	0	11	10	7	68
Prickleback	0	6	4	1	0	23	9	1	44
Bering wolffish	1	0	0	0	0	2	0	0	3
Pacific sand lance	0	0	0	0	0	1	0	0	1

Table 4. Age-specific length and sex ratio for Arctic cisco from Camden Bay, Alaska, July and August 1987. Age determined from otoliths. Sexes combined.

Age	N	Fork length (mm)			N	Sex ratio
		Mean	S.E.	Range		% females
7	3	345.0	8.7	330-360	3	67
8	9	348.9	5.7	326-378	8	63
9	3	365.3	10.0	350-384	2	50
10	1	355			1	0
Total	16				14	

Table 5. Information on tagged Arctic cisco associated with this study. FL measurements in mm. sf = subsistence fishery. YT = Yukon Territory.

Tagging information				Recapture			
Location	Date	Tag #	FL	Location	Date	FL	Days at large
SC 1	Jul 12	10002	383	SC 2	Jul 14	382	2d
SC 1	Jul 17	10267	365	Colville River	Oct 17, 1989		2y 2mo
SC 2	Jul 12	10024	366	Simpson Cove	Aug 24, 1989	396	2y 1mo 12d
SC 2	Jul 14	10064	372	SC 1	Jul 16	373	2d
SC 2	Jul 14	10119	348	Griffin Pt., sf	Jul 23		9d
SC 2	Jul 14	10152	378	Griffin Pt., sf	Jul 23		9d
SC 2	Jul 14	10167	377	Griffin Pt., sf	Jul 23		9d
SC 2	Aug 5	10367	386	Griffin Pt., sf	August		< 25d
SC 4	Aug 11	10461	353	Herschel Is., YT	unknown		unknown
Prudhoe Bay	unknown	Enviro 15727		SC 2	Jul 14	338	unknown
Prudhoe Bay	unknown	Enviro 22660		SC 2	Jul 14	366	unknown
Prudhoe Bay	unknown	Enviro 21787		SC 2	Jul 14	337	unknown
Prudhoe Bay	unknown	ARCO #85 (Colville R #00069)		SC 2	Jul 14	355	unknown
Prudhoe Bay	unknown	WCC 84 1030642		SC 4	Aug 11	390	unknown

Table 6. Age-specific length and sex ratio for Dolly Varden from Camden Bay, July and August 1987. Age determined from otoliths. Sexes combined.

Age	N	Fork length (mm)			N	Sex ratio % females
		Mean	S.E.	Range		
2	3	167.3	11.9	146-187	2	0
3	24	191.4	4.2	156-255	15	53
4	16	202.6	5.7	180-266	15	67
5	8	263.4	17.5	195-317	7	29
6	10	336.7	10.9	299-398	9	56
7	5	353.2	35.0	236-421	5	40
8	5	399.6	20.9	320-423	5	60
9	2	413.0	20.0	393-433	2	50
Total	73				60	

Table 7. Information on tagged Dolly Varden associated with this study. FL measurements in mm. Kong Pt. = Konganevik Point. sf = subsistence fishery. YT = Yukon Territory.

Initial capture				Recapture			
Location	Date	Tag #	FL	Location	Date	FL	Days at large
KP 3	Jul 19	08248	271	SC 2	Aug 25	323	37d
KP 3	Jul 19	08256	274	KP 3	Jul 20	273	1d
KP 3	Jul 19	08269	440	SC 4	Aug 17	460	29d
KP 3	Jul 20	08287	420	Shublik Spring, Canning R.	Sep 12, 1990		3y 1mo 23d
KP 3	Jul 20	08291	353	KP 1	Jul 27	333	7d
KP 3	Jul 22	08331	380	KP 3	Jul 25	385	3d
KP 3	Jul 29	08422	512	Cross Is., NNE of Prudhoe Bay	Jul 20, 1991		3y 11 mo 21d
KP 3	Aug 4	08467	356	KP 2	Aug 10	360	6d
KP 3	Jul 26	08393	550	Shingle Pt., YT	Aug 16, 1988		1y 21d
KP 3	Aug 4	08475	440	Barter Island,sf	Aug 1988		~ 1 y
SC 1	Jul 13	10035	274	KP 3	Aug 13	329	31d
SC 1	Jul 17	10279	273	Griffin Pt., sf	summer 1987		< 60d
SC 2	Jul 12	10027	327	Kong Pt., sf	Aug 2		21d
SC 2	Jul 13	10032	260	SC 1	Jul 15	262	2d
SC 4	Aug 15	10610	597	Kongakut R.	Aug 15, 1988		1y
SC 4	Aug 18	10663	493	Kongakut R.	Aug 30, 1990		3y 12d
Hulahula River	Aug 10, 1983	05889	321	KP 1	Jul 27	417	3y 11mo 7d
Hulahula River	Aug 10, 1983	05906	279	SC 2	Jul 15	393	3y 11mo 5d
Hulahula River	Aug 10, 1983	05991	457	KP 1	Aug 10	540	4y
Hulahula River	Aug 30, 1983	05160	357	KP 3	Aug 4	505	3y 11mo 5d
Hulahula River	Sep 2, 1983	05305	310	KP 3	Jul 24	473	3y 10mo 22d
Prudhoe Bay	unknown	WCC 84 1029441		KP 3	Jul 19	548	unknown
Prudhoe Bay	unknown	Enviro 33943		KP 3	Jul 30	550	unknown

Table 8. Age-specific length and sex ratio for least cisco from Camden Bay, Alaska, July and August 1987. Age determined from otoliths. Sexes combined.

Age	N	Fork length (mm)			N	Sex ratio % females
		Mean	S.E.	Range		
7	4	272.0	2.4	268-279	4	25
8	7	285.4	3.6	271-302	7	29
9	4	289.5	1.7	285-293	4	75
10	1	294			1	100
16	1	329			1	100
Total	17				17	

Table 9. Information on tagged least cisco associated with this study. FL measurements in mm. sf = subsistence fishery.

Initial capture				Recapture			
Location	Date	Tag #	FL	Location	Date	FL	Days at large
KP 3	Aug 4	08465	366	Griffin Pt., sf	August		< 27d
SC 2	Jul 30	10321	291	SC 2	Aug 9	287	10d
SC 2	Aug 5	10364	284	SC 2	Aug 10	288	5d
SC 2	Aug 12	10526	281	SC 4	Aug 19	282	7d
SC 2	Aug 18	10683	308	Colville R.	Oct 22		2m 4d
Prudhoe Bay	unknown	WCC 82 07001		SC 2	Aug 9	299	unknown
Prudhoe Bay	unknown	WCC 82 05327		SC 4	Aug 19	345	unknown

Appendix 1. Temperature and salinity measured at the fyke net stations in the Konganevik Point area of Camden Bay, Alaska July – September 1987. Temp = °C. Salinity =

	KP 1		KP 2		KP 3		KP 4	
	Temp.	Salinity	Temp.	Salinity	Temp.	Salinity	Temp.	Salinity
Jul 12								
Jul 13								
Jul 14	8.5	11						
Jul 15			9.5	12				
Jul 16			10.5	12.5	9	14		
Jul 17			10	13	8.5	14.5		
Jul 18								
Jul 19					7.5	20		
Jul 20			10	14	8	22		
Jul 21					5	19.5		
Jul 22	9.5	21.5	8	21	6.5	26		
Jul 23	5	21						
Jul 24	8	24.5	10.5	23.5	6.5	27		
Jul 25	8.5	20	11	28	9	24.5		
Jul 26			11.5	28	10	24.5		
Jul 27								
Jul 28								
Jul 29			6	25.5	6	22		
Jul 30	5	21	6	26.5	5.5	31.5		
Jul 31								
Aug 1			7.5	27				
Aug 2			9	19				
Aug 3								
Aug 4					7.5	21		
Aug 5								
Aug 6			6.5	18	6	23		
Aug 7	7	25	6	19.5	6	23		
Aug 8								
Aug 9			7.5	22	5	24		
Aug 10			8	22.5				
Aug 11			7	25				
Aug 12								
Aug 13								
Aug 14								
Aug 15								
Aug 16								
Aug 17								
Aug 18								
Aug 19								
Aug 20								
Aug 21								
Aug 22								
Aug 23			9		9			
Aug 24			10		10			
Aug 25								
Aug 26					8		10	
Aug 27					8			
Aug 28			7		6		7	
Aug 29								
Aug 30			3		2		3	

Appendix 1. Continued.

	KP 1		KP 2		KP 3		KP 4	
	Temp.	Salinity	Temp.	Salinity	Temp.	Salinity	Temp.	Salinity
Aug 31			4.5		4		4.5	
Sep 1								
Sep 2			3		2		2	
Sep 3			3				3	
Sep 4					3			
Sep 5			2		1			
Sep 6			2		2		2	
Sep 7			2		1		3	

Appendix 2. Temperature and salinity measured at the fyke net stations in Simpson Cove area of Camden Bay, Alaska July – September 1987.

	SC 1		SC 2		SC-3		SC-4	
	Temp.	Salinity	Temp.	Salinity	Temp.	Salinity	Temp.	Salinity
Jul 12	7	12	5					
Jul 13	8	12	5.5					
Jul 14	8	12	8	13	8.5	28.5		
Jul 15	10.5	12	9	14.5	7	14		
Jul 16	9	16.5	7	20.5	5.5	18.5		
Jul 17	8.5	16	7	19	7	17.5		
Jul 18	7	23.5	6.5					
Jul 19			4	24.5	2	25		
Jul 20	7	26	4	25	3	25		
Jul 21								
Jul 22			7	26	5.5	25		
Jul 23	7.5	26.5	7	25.5	5	24.5		
Jul 24	9	22.5	10	21	9	22		
Jul 25	6.5	26	6	27	6	28		
Jul 26								
Jul 27								
Jul 28								
Jul 29			4	22	3	21.5		
Jul 30			4	22.5	4	20.5		
Jul 31			4.5	21.5	3.5	20		
Aug 1			5.5	23	5	24		
Aug 2			6	24	3	25		
Aug 3			4.5	26	3	26		
Aug 4			4	26	3.5	26.5		
Aug 5			5	25.5	2.5	27		
Aug 6			3	27	2	27		
Aug 7			4	27	2	27	9.5	25
Aug 8					4.5	26		
Aug 9			6	23.5				
Aug 10			6	26	5	26		
Aug 11			6.5	26	5.5	26	10	12
Aug 12			6.5	26	5	26	9	19.5
Aug 13			6	25.5	7.5	23	10.5	24
Aug 14								
Aug 15								
Aug 16			7	26	8	25		
Aug 17			8	23	7	25	9	21
Aug 18			7	24	8	24	9.5	23
Aug 19							9	21
Aug 20			8	21	7	23.5	9	21
Aug 21			9.5	21.5	8	23	10	21.5
Aug 22			10.5	21.5	9	23	10.5	22.5
Aug 23			10	20.5	9	22.5	10	22.5
Aug 24			10.5	20.5	9.5	21.5	11.5	20
Aug 25			10	21	9.5	21	10	21.5
Aug 26			10	16.5	8	21.8	10	14
Aug 27								
Aug 28			6	15	7	16	6.5	13.3
Aug 29								
Aug 30			3	10.5			2.8	13
Aug 31			4.8	12.8			4.5	10.5
Sep 1			5	14.5			4.8	13
Sep 2			4.5	15.8			4	14
Sep 3							4	12

Appendix 3. Catch per unit effort of Arctic cisco (≥ 200 mm FL) in Camden Bay, July - September 1987.
Gaps indicate no data available from days when stations were not checked due to weather or when trap efficiency was compromised.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP 4	SC 1	SC 2	SC 3	SC 4
Jul 11					Trap set	Trap set		
Jul 12					3.5	5.5		
Jul 13	Trap set				0.9	0.0	Trap set	
Jul 14	0.0	Trap set			0.0	134.2	0.0	
Jul 15		0.0	Trap set			24.1	0.0	
Jul 16		0.0	0.0		1.2	0.0	0.0	
Jul 17		0.0	0.0		21.0	0.0	0.0	
Jul 18						0.0		
Jul 19		0.0	1.3			0.0	0.0	
Jul 20		2.3	0.0		0.0	0.0	0.0	
Jul 21		0.0	4.1					
Jul 22		0.0	2.7			5.1	0.0	
Jul 23	3.9	0.0	0.0		0.9	0.0	0.0	
Jul 24	0.0	0.0	2.5		1.0	0.0	0.0	
Jul 25	1.1	0.0	1.0		2.0	1.1	0.0	
Jul 26		0.0	0.0					
Jul 27								
Jul 28								
Jul 29		0.0	0.0					
Jul 30		0.0	1.2			1.1	0.0	
Jul 31						0.0	0.0	
Aug 1		0.5				0.9	1.8	
Aug 2		0.0				0.0	3.4	
Aug 3	0.0					3.3	1.0	
Aug 4			0.2			12.6	0.0	
Aug 5						2.1	0.0	
Aug 6		3.8	0.0			9.3	0.0	
Aug 7		3.7	3.4			2.2	0.0	Trap set
Aug 8							0.0	
Aug 9		1.3	0.0			18.3		
Aug 10	25.5	0.0				0.0		
Aug 11		20.1				0.0	0.0	23.5
Aug 12		0.8	1.1			17.0	1.0	32.0
Aug 13		1.4	0.0				0.0	5.6
Aug 14		2.5	0.0			3.9		0.0
Aug 15		2.3	0.0			0.8		30.2
Aug 16		0.9	0.0			0.0	0.0	14.1
Aug 17	0.0	2.4	0.0			1.2	0.0	0.0
Aug 18		1.2				4.5	9.4	11.6
Aug 19								11.1
Aug 20		0.4	0.0					0.0
Aug 21		1.1	0.0			3.4		2.6
Aug 22		0.0	0.0			4.2	0.0	10.7
Aug 23		0.0	0.0			0.0		11.9
Aug 24		0.8	0.0					29.5

Appendix 3. Continued.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Aug 25		1.5	0.0	Trap set		1.5	0.0	16.7
Aug 26		1.9	0.0	0.0		20.9	0.0	12.5
Aug 27			0.0					
Aug 28		0.0	0.0	0.0				
Aug 29								
Aug 30		0.0	0.0	0.0		0.6		
Aug 31		0.0	0.0	0.0				0.0
Sep 1						0.0		5.3
Sep 2		0.0	0.0	0.0		0.0		0.0
Sep 3		0.0		0.0		0.0		0.0
Sep 4			0.0					
Sep 5		0.0	0.0					
Sep 6		0.0	0.0	0.0				
Sep 7		0.0	0.0	0.0				

Appendix 4. Catch per unit effort of Arctic cisco (> 90 mm FL < 200 mm) in Camden Bay, July - September 1987. Gaps indicate no data available from days when stations were not checked due to weather or when trap efficiency was compromised.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Jul 11					Trap set	Trap set		
Jul 12					0.0	0.0		
Jul 13	Trap set				0.0	0.0	Trap set	
Jul 14	0.0	Trap set			0.0	1.0	0.0	
Jul 15		0.0	Trap set			2.9	0.0	
Jul 16		0.0	0.0		2.4	0.0	0.0	
Jul 17		0.0	0.0		4.2	0.0	0.0	
Jul 18		0.0				0.0		
Jul 19		0.0	0.0			0.0	0.0	
Jul 20		0.0			1.8	0.0	0.0	
Jul 21		0.0	0.0					
Jul 22		0.0	0.0			0.0	0.0	
Jul 23	0.0	0.0	0.0		0.0	0.0	0.0	
Jul 24	0.0	1.2	0.0		6.1	0.0	0.0	
Jul 25	0.0	1.1	0.0		1.0	0.0	0.0	
Jul 26		0.0	0.0					
Jul 27								
Jul 28								
Jul 29		0.3	0.0					
Jul 30		12.9	0.0			4.5	0.0	
Jul 31		0.0				8.3	0.0	
Aug 1		0.0				0.0	0.0	
Aug 2		1.0				1.7	0.0	
Aug 3	0.0					0.0	0.0	
Aug 4			0.0			0.0	0.0	
Aug 5						0.0	0.0	
Aug 6		5.3	0.0			2.6	0.0	
Aug 7		4.9	0.0			2.2	0.0	Trap set
Aug 8		0.0					0.0	
Aug 9		2.6	0.0			5.8		
Aug 10	1.5	0.0				0.0		
Aug 11		17.0				9.6	0.0	42.1
Aug 12		21.6	32.7			54.0	0.0	41.0
Aug 13		2.7	0.0				5.9	24.2
Aug 14		0.8	0.0			29.4		0.0
Aug 15		11.6	20.9			50.6		59.0
Aug 16		0.0	0.0			3.7	1.7	9.8
Aug 17	0.0	5.9	0.0			3.5	0.0	7.5
Aug 18		1.2				31.3	0.0	25.8
Aug 19								16.3
Aug 20		2.5	14.0					3.1
Aug 21		3.4	17.4			0.0		13.7
Aug 22		0.0	1.3			0.0	0.0	20.1
Aug 23		7.9	77.7			0.0		4.7
Aug 24		3.2	120.0					6.7

Appendix 4. Continued.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Aug 25		4.6	12.6	Trap set		3.0	1.4	25.0
Aug 26		2.8	3.9	8.1		15.2	0.0	145.5
Aug 27			85.0					
Aug 28		2.3	42.0	4.2				
Aug 29								
Aug 30		0.0	59.2	2.3		6.9		
Aug 31		4.7	28.0	3.1				192.0
Sep 1						2.0		3.5
Sep 2		0.0	2.4	0.6		0.0		0.0
Sep 3		4.8		1.6		0.0		8.5
Sep 4			0.5					
Sep 5		2.7	1.0					
Sep 6		0.0	0.0	0.0				
Sep 7		0.0	0.0	0.0				

Appendix 5. Catch per unit effort of Arctic cisco (≤ 90 mm FL) in Camden Bay, July - September 1987.
Gaps indicate no data available from days when stations were not checked due to weather or when trap efficiency was compromised.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Jul 11					Trap set	Trap set		
Jul 12					0.0	0.0		
Jul 13	Trap set				3.6	0.0	Trap set	
Jul 14	0.0	Trap set			10.4	0.0	0.0	
Jul 15		0.0	Trap set			2.9	0.0	
Jul 16		0.0	0.0		0.0	0.0	0.0	
Jul 17		0.0	0.0		9.4	0.0	0.0	
Jul 18		0.0				0.0		
Jul 19		0.0	0.0			1.3	0.0	
Jul 20		0.0			0.0	0.0	0.0	
Jul 21		0.0	0.0					
Jul 22		0.0	0.0			2.3	0.0	
Jul 23	0.0	0.0	1.1		4.5	0.0	0.0	
Jul 24	0.0	1.2	0.0		35.4	0.0	0.0	
Jul 25	0.0	3.4	0.0		6.1	1.1	0.0	
Jul 26		0.0	10.7					
Jul 27								
Jul 28								
Jul 29		0.9	0.9					
Jul 30		33.0	11.7			0.0	0.0	
Jul 31		0.0				1.0	0.0	
Aug 1		0.0				0.0	0.0	
Aug 2		3.1				3.3	0.0	
Aug 3	0.0					0.0	0.0	
Aug 4			1.8			0.0	0.0	
Aug 5						0.0	1.1	
Aug 6		5.1	6.1			0.0	0.0	
Aug 7		14.8	18.3			0.0	0.0	Trap set
Aug 8		0.0					0.0	
Aug 9		0.4	0.0			1.3		
Aug 10	0.8	0.0				2.0		
Aug 11		475.4				6.7	5.1	395.8
Aug 12		538.4	808.3			63.0	6.8	1,529.6
Aug 13		4,418.7	1,769.6				7.1	127.7
Aug 14		226.9	6,646.2			19.4		7.7
Aug 15		115.7	198.9			139.8		176.9
Aug 16		716.4	499.0			0.0	0.0	16.3
Aug 17	290.9	58.8	3,483.0			0.0	0.0	0.0
Aug 18		81.2				4.5	1.0	476.7
Aug 19								21.5
Aug 20		27.0	142.9					12.6
Aug 21		30.4	156.9			0.0		24.7
Aug 22		0.0	966.4			0.0	1.4	63.1
Aug 23		12.4	1,174.9			0.0		4.7
Aug 24		3.2	888.0					10.1

Appendix 5. Continued.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Aug 25		7.7	31.5	Trap set		0.0	0.0	133.6
Aug 26		12.1	3.9	44.2		1.0	0.0	216.1
Aug 27			500.0					
Aug 28		1.9	155.5	6.5				
Aug 29								
Aug 30		0.0	324.2	12.4		0.6		
Aug 31		4.7	142.4	3.1				176.5
Sep 1						0.0		3.5
Sep 2		0.0	1.2	0.0		0.0		0.0
Sep 3		11.2		4.8		0.0		34.1
Sep 4			0.5					
Sep 5		4.8	0.0					
Sep 6		0.0	0.0	0.0				
Sep 7		0.0	0.0	0.0				

Appendix 6. Catch per unit effort of Dolly Varden in Camden Bay, July - September 1987. Gaps indicate no data available from days when stations were not checked due to weather or when trap efficiency was compromised.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP 4	SC 1	SC 2	SC 3	SC 4
Jul 11					Trap set	Trap set		
Jul 12						5.5		
Jul 13	Trap set				60.1	6.1	Trap set	
Jul 14	13.0	Trap set			10.4	11.4	1.6	
Jul 15		14.5	Trap set			6.8	1.0	
Jul 16		8.0	0.0		39.4	16.0	0.0	
Jul 17		6.8	2.5		114.4	1.8	0.9	
Jul 18						0.9		
Jul 19			89.5			2.6	0.0	
Jul 20		18.5	34.7		3.6	3.3	0.0	
Jul 21		7.0	21.7					
Jul 22		7.1	9.3			7.5	0.0	
Jul 23	7.8	0.0	3.3		0.0	0.0	0.0	
Jul 24	4.6	3.6	7.4		3.0	1.0	1.9	
Jul 25	5.3	4.6	18.8		3.0	4.3	1.1	
Jul 26		2.3	20.0					
Jul 27								
Jul 28								
Jul 29		0.0	8.9					
Jul 30		4.3	58.5			7.9	0.0	
Jul 31						2.1	0.0	
Aug 1		7.3				0.9	1.8	
Aug 2		6.1				0.0	0.0	
Aug 3	0.0					0.0	0.0	
Aug 4			15.9			0.0	1.2	
Aug 5						4.2	0.0	
Aug 6		0.8	1.8			0.0	0.0	
Aug 7		1.2	0.0			4.4	0.0	Trap set
Aug 8							0.0	
Aug 9		0.9	0.4			8.0		
Aug 10	4.6	3.3				0.0		
Aug 11		3.1				2.9	3.4	13.7
Aug 12		2.4	3.0			3.0	3.9	7.7
Aug 13		4.1	3.5				1.2	3.7
Aug 14		0.0	0.0			0.0		0.0
Aug 15		0.0	6.3			0.0		4.1
Aug 16		0.0	0.0			0.0	0.0	6.5
Aug 17	1.0	1.2	1.1			0.0	0.0	1.1
Aug 18		1.2				4.5	0.0	3.9
Aug 19								7.4
Aug 20		0.8	0.3					2.1
Aug 21		1.1	0.0			0.9		1.7
Aug 22		3.9	1.3			5.6	0.0	2.7
Aug 23		3.4	2.3			1.0		7.1
Aug 24		2.4	1.6					4.2

Appendix 6. Continued.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP 4	SC 1	SC 2	SC 3	SC 4
Aug 25		0.0	6.3	Trap set		3.0	0.0	2.8
Aug 26		0.9	0.0	0.0		3.8	0.0	3.3
Aug 27			11.0					
Aug 28			7.8	0.9				
Aug 29								
Aug 30		0.6	4.4	0.6		0.6		
Aug 31		0.8	12.0	0.0				1.9
Sep 1						0.0		0.9
Sep 2		0.0	0.0	0.0		0.0		1.0
Sep 3		1.6		0.8		0.0		3.2
Sep 4			1.0					
Sep 5		0.0	1.0					
Sep 6		1.0	0.0	0.0				
Sep 7		0.0	1.0	0.0				

Appendix 7. Catch per unit effort of Arctic cod in Camden Bay, July - September 1987. Gaps indicate no data available from days when stations were not checked due to weather or when trap efficiency was compromised.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Jul 11					Trap set	Trap set		
Jul 12						27.3		
Jul 13	Trap set				9.0	17.4	Trap set	
Jul 14	5.9	Trap set			11.6	11.4	1.6	
Jul 15		2.9	Trap set			1.0	1.9	
Jul 16		1.0	0.0		152.6	1.3	2.9	
Jul 17		2.7	5.1		38.8	14.8	0.9	
Jul 18						4.4		
Jul 19		0.9	5.2			1,069.9	13.7	
Jul 20					43.5	58.9	31.6	
Jul 21		91.8	5,264.5					
Jul 22		131.4	334.7			6.1	11.7	
Jul 23	210.2	14.5	98.2		48.0	11.3	59.9	
Jul 24	11.6	19.2	1,385.8		41.4	145.0	36.5	
Jul 25	0.0	21.7	315.1		143.2	1,445.3	87.7	
Jul 26		0.0	108.0					
Jul 27								
Jul 28								
Jul 29		0.0	0.0					
Jul 30		207.8	24.6			18,638.6	109.2	
Jul 31						32.3	8,375.4	
Aug 1		2.4				3,393.2	256.3	
Aug 2		6.1				18.2	1,931.8	
Aug 3	0.0					204.1	1,334.2	
Aug 4			3,292.6			59.4	8,645.9	
Aug 5						21.9	1,741.9	
Aug 6		16.9	3,894.7			210.5	1,287.4	
Aug 7		68.9	50,285.7			31.6	464.6	Trap set
Aug 8							42.9	
Aug 9		2,264.8	28,195.8			395.2		
Aug 10	2,132.9	22,493.0				9,732.0		
Aug 11		1,951.0				2,578.6	47.2	820.9
Aug 12		32.0	3,211.9			678.0	745.6	1,154.6
Aug 13		763.9	13,763.9				464.3	9,122.8
Aug 14		31.6	313.8			2,709.7		13,071.4
Aug 15		5,783.1	15,912.8			9,665.9		7,573.0
Aug 16		300.0	5,214.1			13,405.8	1,085.1	2,194.4
Aug 17	921.2	29.4	1,981.0			1,053.7	2,383.4	11,155.3
Aug 18		2.3				31.3	991.3	702.2
Aug 19								346.2
Aug 20		71.8	478.4					208.8
Aug 21		484.5	220.8			690.0		409.6
Aug 22		677.3	116.0			19,104.0	342.8	115.5
Aug 23		480.0	269.7			2,219.4		138.7
Aug 24		310.2	96.0					154.1

Appendix 7. Continued.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Aug 25		150.2	56.7	Trap set		9,858.0	98.5	571.8
Aug 26		150.1	13.6	27.9		138.8	250.1	617.6
Aug 27			78.0					
Aug 28		85.8	890.0	77.0				
Aug 29								
Aug 30		523.7	93.5	248.9		722.1		
Aug 31		167.9	36.8	542.8				385.0
Sep 1						934.0		42.3
Sep 2		1,006.5	257.2	231.5		11,986.1		58.3
Sep 3		233.6		399.3		23,676.3		1,738.7
Sep 4			1,133.6					
Sep 5		1,917.3	4,820.2					
Sep 6		16,545.3	6,787.1	3,235.7				
Sep 7		11,373.6	7,611.0	1,322.1				

Appendix 8. Catch per unit effort of capelin in Camden Bay, July - September 1987. Gaps indicate no data available from days when stations were not checked due to weather or when trap efficiency was compromised.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP 4	SC 1	SC 2	SC 3	SC 4
Jul 11					Trap set	Trap set		
Jul 12						0.0		
Jul 13	Trap set				0.0	0.0	Trap set	
Jul 14	0.0	Trap set			0.0	0.0	0.0	
Jul 15		0.0	Trap set			0.0	0.0	
Jul 16		0.0	0.0		0.0	0.0	0.0	
Jul 17		0.0	0.0		2.1	0.0	0.0	
Jul 18						0.0		
Jul 19		0.0	0.0			2.6	0.5	
Jul 20					1,246.2	4.4	1.1	
Jul 21		7.0	0.0					
Jul 22		0.0	1.3			285.2	0.0	
Jul 23	33,387.2	0.0	0.0		53.4	2.3	14.7	
Jul 24	156.1	0.0	0.0		0.0	21.1	0.0	
Jul 25	0.0	0.0	0.0		0.0	0.0	8.0	
Jul 26		0.0	0.0					
Jul 27								
Jul 28								
Jul 29		0.0	0.0					
Jul 30		0.0	0.0			336.8	0.0	
Jul 31						264.0	20.9	
Aug 1		0.0				3.6	1.8	
Aug 2		0.0				1.7	3.4	
Aug 3	0.0					70.2	0.0	
Aug 4			0.0			21.7	8.3	
Aug 5						4.2	5.3	
Aug 6		0.0	0.0			37.1	0.0	
Aug 7		0.0	1.1			9.8	1.3	Trap set
Aug 8							0.0	
Aug 9		0.9	0.4			55.8		
Aug 10	5,465.8	1.1				0.0		
Aug 11		0.0				29.8	0.0	0.0
Aug 12		0.0	0.0			93.0	23.3	0.0
Aug 13		0.0	0.0				10.6	0.0
Aug 14		0.0	0.0			0.8		1.7
Aug 15		0.0	0.0			10.4		1.4
Aug 16		0.0	0.0			1.8	0.0	1.1
Aug 17	0.0	0.0	0.0			0.0	0.0	0.0
Aug 18		0.0				1.1	1.0	0.0
Aug 19								1.5
Aug 20		0.4	0.0					0.0
Aug 21		0.0	0.0			0.0		0.0
Aug 22		0.0	0.0			0.0	8.5	0.0
Aug 23		0.0	0.0			0.0		0.0
Aug 24		0.0	0.0					0.0

Appendix 8. Continued.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP 4	SC 1	SC 2	SC 3	SC 4
Aug 25		0.0	0.0	Trap set		0.0	0.0	1.4
Aug 26		0.0	0.0	0.0		0.0	0.9	0.0
Aug 27			0.0					
Aug 28		0.0	0.0	0.0				
Aug 29								
Aug 30		0.0	0.0	0.0		0.0		
Aug 31		0.0	0.0	0.0				0.0
Sep 1						0.0		0.0
Sep 2		0.0	0.0	0.0		0.0		0.0
Sep 3		0.0				0.0		0.0
Sep 4			0.0					
Sep 5		0.0	0.0					
Sep 6		0.0	0.0	0.0				
Sep 7		0.0	0.0	0.0				

Appendix 9. Catch per unit effort of fourhorn sculpin in Camden Bay, July - September 1987. Gaps indicate no data available from days when stations were not checked due to weather or when trap efficiency was compromised.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Jul 11					Trap set	Trap set		
Jul 12						41.5		
Jul 13	Trap set				418.1	12.3	Trap set	
Jul 14	93.6	Trap set			74.0	9.3	4.0	
Jul 15		11.6	Trap set			28.0	2.9	
Jul 16		5.0	3.7		2,279.0	5.3	5.8	
Jul 17		33.8	37.9		728.1	14.8	1.8	
Jul 18						15.9		
Jul 19		6.9	15.2			22.5	0.0	
Jul 20					425.7	5.5	10.9	
Jul 21		15.3	16.5					
Jul 22		30.3	32.0			21.4	1.9	
Jul 23	19.5	11.6	6.5		1,017.1	10.1	10.2	
Jul 24	47.4	52.8	29.5		31.3	18.2	1.9	
Jul 25	2.1	70.9	9.4		135.1	11.7	9.1	
Jul 26		0.0	1.3					
Jul 27								
Jul 28								
Jul 29		30.8	35.2					
Jul 30		67.3	3.5			123.5	2.2	
Jul 31						8.3	0.0	
Aug 1		29.1				3.6	8.3	
Aug 2		15.3				13.2	21.9	
Aug 3	0.0					1.1	0.0	
Aug 4			9.9			2.3	2.4	
Aug 5						7.3	1.1	
Aug 6		13.9	3.6			7.9	0.9	
Aug 7		57.8	2.3			6.5	3.8	Trap set
Aug 8							3.7	
Aug 9		13.2	0.0			281.7		
Aug 10	273.3	16.7				60.0		
Aug 11		6.2				38.4	5.9	431.0
Aug 12		8.0	3.8			15.0	1.9	93.4
Aug 13		36.5	0.0				5.9	47.5
Aug 14		29.1	0.0			19.4		174.0
Aug 15		13.9	2.1			44.2		93.3
Aug 16		15.2	0.0			6.5	4.2	31.5
Aug 17		24.7	2.2			11.7	9.3	29.0
Aug 18		22.0				20.1	3.1	34.8
Aug 19								167.5
Aug 20		21.1	7.1					125.9
Aug 21		36.1	12.8			89.1		81.1
Aug 22		19.7	25.8			264.0	5.7	65.8
Aug 23		50.8	28.6			92.9		83.0
Aug 24		43.6	28.0					89.3

Appendix 9. Continued.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Aug 25		69.7	102.3	Net set		34.5	4.3	45.9
Aug 26		52.2	32.0	18.6		9.5	0.9	24.1
Aug 27			40.0					
Aug 28		29.2	7.0	19.9				
Aug 29								
Aug 30		48.9	41.1	31.5		23.5		
Aug 31		24.9	44.8	60.9				18.4
Sep 1						5.0		1.8
Sep 2		44.7	10.7	16.4		0.0		7.6
Sep 3		36.8		10.4		0.0		0.0
Sep 4			11.6					
Sep 5		32.4	1.0					
Sep 6		15.7	3.1	15.5				
Sep 7		7.6	1.0	8.4				

Appendix 10. Catch per unit effort of Arctic flounder in Camden Bay, July - September 1987. Gaps indicate no data available from days when stations were not checked due to weather or when trap efficiency was compromised.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP 4	SC 1	SC 2	SC 3	SC 4
Jul 11					Trap set	Trap set		
Jul 12						2.2		
Jul 13	Trap set				67.3	2.0	Trap set	
Jul 14	2.4	Trap set			3.5	2.1	0.0	
Jul 15		1.0	Trap set			6.8	0.0	
Jul 16		3.0	0.9		44.1	0.0	0.0	
Jul 17		8.1	3.8		19.9	1.8	0.0	
Jul 18						0.0		
Jul 19		0.9	0.4			5.3	0.0	
Jul 20					36.2	0.0	0.0	
Jul 21		26.4	0.0					
Jul 22		41.4	0.0			2.3	0.0	
Jul 23	0.0	2.9	0.0		5.4	0.0	0.0	
Jul 24	0.0	30.0	1.2		0.0	0.0	0.0	
Jul 25	0.0	5.7	0.0		0.0	0.0	0.0	
Jul 26		3.5	0.0					
Jul 27								
Jul 28								
Jul 29		8.7	0.0					
Jul 30		30.1	0.0			10.1	0.0	
Jul 31						2.1	0.0	
Aug 1		6.3				0.0	0.0	
Aug 2		6.1				0.0	0.0	
Aug 3	0.0					0.0	0.0	
Aug 4			0.2			0.0	0.0	
Aug 5						0.0	0.0	
Aug 6		4.0	0.6			0.0	0.0	
Aug 7		38.2	0.0			0.0	0.0	Trap set
Aug 8							0.0	
Aug 9		3.1	0.0			4.5		
Aug 10	2.3	8.9				2.0		
Aug 11		12.4				5.8	0.0	6.9
Aug 12		2.4	0.0			6.0	0.0	19.2
Aug 13		2.7	0.0				0.0	12.1
Aug 14		7.5	0.0			0.0		45.4
Aug 15		0.0	0.0			6.4		11.0
Aug 16		4.5	0.0			0.9	0.0	3.3
Aug 17	0.0	1.2	0.0			0.0	0.0	0.0
Aug 18		2.3				4.5	0.0	1.3
Aug 19								36.3
Aug 20		6.3	0.0					16.8
Aug 21		7.9	0.0			5.1		11.1
Aug 22		18.4	0.0			24.0	0.0	8.1
Aug 23		13.6	0.0			12.4		26.1
Aug 24		9.5	0.8					21.9

Appendix 10. Continued.

Date	Fyke net stations							
	Konganevik Point				Simpson Cove			
	KP 1	KP 2	KP 3	KP4	SC 1	SC 2	SC 3	SC 4
Aug 25		12.4	0.0	Trap set		12.0	0.0	9.7
Aug 26		9.3	0.0	1.2		2.9	0.9	15.0
Aug 27			1.0					
Aug 28		7.0	0.8	0.9				
Aug 29								
Aug 30		10.2	0.0	2.3		6.9		
Aug 31		1.6	0.0	0.0				2.9
Sep 1						0.0		0.9
Sep 2		1.8	0.0	0.6		0.0		1.9
Sep 3		1.6		0.0		0.0		1.1
Sep 4			0.0					
Sep 5		0.5	0.0					
Sep 6		0.0	0.0	0.7				
Sep 7		0.0	0.0	0.0				