

Fishery Data Series No. 07-36

**Abundance, Age, Sex, and Size Statistics for Pacific
Herring in the Togiak District of Bristol Bay, 2005**

by

Chuck Brazil

June 2007

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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June 2007

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ABSTRACT

The Pacific herring (*Clupea pallasii*) total run in the Togiak District of Bristol Bay was monitored for abundance/biomass and sampled for age, size, and sex composition in 2005. Abundance was estimated from aerial surveys with chartered aircraft. Commercial harvest was determined from fish tickets. Samples were collected from commercial purse seine and gillnet harvests. During closed fishing periods, herring samples were obtained from test fish purse seine catches made by volunteers from the commercial fleet. The estimated 2005 total run biomass was 156,727 short tons. Total commercial harvest was 20,912 tons; 15,071 tons was harvested by the purse seine fishery and 5,841 tons by the gillnet fishery. Total exploitation rate was estimated to be 14.1%. A total of 5,152 herring were sampled for age, sex, length, weight and sexual maturity information from 28 April–6 May. Herring ages varied from 4 to 18 years with both purse seine and gillnet samples predominately age-8 and -9. Mean length and weight from the purse seine fishery samples were 297 mm and 362 grams, while fish sampled from the gillnet fishery averaged 302 mm and 397 grams.

Key words: Pacific herring, *Clupea pallasii*, sac roe, abundance, spawning biomass, commercial herring fishery, Bristol Bay, Togiak District, age, length, weight, sex.

INTRODUCTION

Pacific herring (*Clupea pallasii*) are harvested in several spawning locations along the eastern Bering Sea coast from Norton Sound south to Port Moller (Figure 1). The Togiak District of Bristol Bay supports the largest discrete spawning biomass of Pacific herring in Alaskan waters. Biomass estimates based on aerial surveys have been conducted since 1978 and have ranged from 68,686 tons¹ (62,312 tonnes²) in 1980 to 239,022 tons (216,839 tonnes) in 1979 (Table 1). From 1995 through 2004, the total run biomass has averaged 134,319 tons (121,776 tonnes).

Herring spawn within the Togiak District from late April through May. After spawning, herring leave the fishing district and migrate south in a clockwise direction along the Alaska Peninsula to feeding areas near Unalaska Island. In August and September, these fish move to over-wintering grounds near the Pribilof Islands (Funk 1990; Rummyantsev and Darda 1970; Shaboneev 1965; Wespestad and Barton 1981; Figure 1).

The largest commercial fishery for herring that spawn in the Togiak District occurs during their inshore spawning period. The most valuable product from this harvest is the ripened ovaries, or egg skeins, referred to as sac roe. This product is primarily marketed in Japan. Commercial harvest of herring for sac roe was first documented in the Togiak District in 1968. Passage of the Fisheries Conservation and Management Act in 1976 and the resulting inability of Japanese fishers to harvest sac roe from U.S. waters prompted increased interest in the Togiak fishery by U.S. fishers. The 20-year mean sac roe harvest is presently 20,186 tons (18,313 tonnes). The greatest harvest of 30,315 tons (27,502 tonnes) occurred during the 1994 season (Table 1).

Herring spawn, deposited on brown algae (rockweed) *Fucus spp* is also harvested within the Togiak District. This wild spawn-on-kelp product is harvested either by hand or by rake. The harvest, documented since 1967, has been intermittent in recent years because of low demand

¹ The Alaska Board of Fisheries requires that inseason catch and aerial survey biomass estimates be calculated and reported in short tons. The English short ton = 2,000 lb or 907.2 kg.

² The metric tonne = 1,000 kg or 2,205 lbs: The conversion is tonnes (t) = tons/1.1023

with no fishery occurring during the 1997, 1998, 2000, 2001, 2004, and 2005 seasons. The 20-year mean spawn-on-kelp harvest has averaged 184 tons (167 tonnes; Table 1).

During their post spawning migration, herring that spawn in Togiak District are susceptible to other fisheries. A directed food/bait fishery occurs during the mid-to-late summer months in the Unalaska Island area. Harvests were first documented on these feeding herring in 1929. Harvests reached a maximum of 3,006 tons (2,727 tonnes) in 1932. The fishery declined and ended completely by 1938 because of poor market demand, but was renewed in 1981. The annual food and bait harvest since 1985 has averaged 2,149 tons (1,950 tonnes; Table 1).

Incidental harvest of Togiak herring occurs as bycatch in fisheries targeting groundfish in the southeastern Bering Sea. Foreign vessels first exploited these groundfish fisheries but domestic fishers have recently dominated. These fisheries often occur along the migratory route of feeding herring (Funk 1990; Rowell et al. 1991). The additional harvest upon a fully exploited herring population has been a concern brought before the North Pacific Fishery Management Council and the Alaska Board of Fisheries by western Alaskan fishermen.

Togiak herring have been managed as a single spawning population distinct from other populations in the Bering Sea. A maximum regulatory exploitation rate of 20% of the spawning biomass has been established in the Bristol Bay Herring Management Plan, 5 AAC 27.865. This plan provides an allocation of 1,500 tons (1,361 tonnes) to the wild spawn-on-kelp fishery and 7% of the remaining harvest for the Dutch Harbor food/bait fishery. The remainder of the harvestable surplus is reserved for the sac roe fishery with 30% allocated to the gillnet fishery and 70% to the purse seine fishery.

Stock assessment studies of the Togiak herring population began in 1976 and have continued annually since 1978 (Fried et al. 1982a, 1982b, 1983a, 1983b, and 1984; Lebida 1987; Lebida and Sandone 1988; Lebida et al. 1985a, 1985b; McBride and Whitmore 1981; McBride et al. 1981; Rowell 1995, 2002a, 2002b; Rowell et al. 1991; Sandone and Brannian 1988; Schwanke 2003; West 2002; West et al. 2003).

OBJECTIVES

Specific objectives for the Togiak herring run assessment project were to:

- 1) Estimate total run biomass and spawning escapement of herring in the Togiak District based on aerial surveys.
- 2) Determine the commercial harvest.
- 3) Estimate age, size (weight and length), and sex composition of herring harvested in the commercial harvest.
- 4) Estimate age class contribution to the total run biomass and commercial harvest.
- 5) Estimate the inseason and postseason exploitation rate of herring in the Togiak District.

METHODS

STUDY AREA

The Togiak District consists of all state waters between the longitude of the tip of Cape Constantine and the longitude of the tip of Cape Newenham, a linear distance of approximately 193 km (Figure 2). Because of its large size, the Togiak Fishing District is divided into six management sections: Kulukak, Nunavachak, Togiak, Hagemeister, Pyrite Point and Cape Newenham.

A wide intertidal zone and several shallow bays characterize the shoreline. Diurnal tidal range may reach 4.6 m (Selkregg 1976). The primary marine vegetation in the Togiak District consists of ribbon kelp *Laminaria spp.*, rockweed *Fucus*, and eelgrass *Zostera spp.* Herring have spawned throughout the fishing district, particularly in areas where eelgrass and rockweed have been present. Rockweed is the most visible species of aquatic vegetation because it grows on cobble substrate in intertidal areas and upon rocky outcroppings.

AGE, SIZE, AND SEX DATA

Data Collection

Pacific herring were collected from management sections within the fishing district during fishery openings and closures. Herring were sampled for each gear type and fishing section at the close of each commercial fishing period from tenders or individual fishing vessels. Attempts were made to collect samples from several vessels to ensure samples were collected from multiple schools of herring. During closed fishing periods, volunteer commercial fishers made test purse seine sets to capture herring for sampling roe content. Samples were also collected for age, sex, and size information from these sets. Purse seine gear whether commercial or test fish was considered non-selective gear.

A scale, for age determination, was removed from the left side of each fish approximately 2.5 cm behind the operculum and 2.5 cm below the lateral line. If scales were absent from this preferred area, a scale was removed from the right side of the fish in the same location, or anywhere a readable scale was present. Removed scales were dipped in 10% mucilage solution, mounted sculptured side up on glass slides, and read by annuli interpretation using a microfiche reader. Scales were aged by counting the annuli formed at the end of winter prior to spawning (Shaboneev 1965). This timing was coincidental to the collection of samples in the spawning migration; thus, the outer edge of the scale was counted as an annulus.

Standard length from the tip of the snout to the hypural plate at the base of the tail was measured to the nearest millimeter. Each herring was weighed to the nearest gram. Sex and maturity were determined for each herring by visual examination of the gonads, or sex products. Maturity of both male and female herring was rated by the 8-scale guideline outlined in Barton and Steinhoff (1980). These categories were combined and summarized as green (not ready to spawn), ripe (ready to spawn) or spent (already spawned).

Sample Sizes

The desired sample size of a multinomial population would result in an estimate whereby each category would simultaneously fall within 5% ($\alpha = 0.05$) of the true population age proportions 90% of the time (Thompson 1987). A sample size of 400 herring provides this level of precision and accuracy. Sample sizes required to represent the biomass from test purse seines were 400

fish per 3-day strata, or 134 fish per day based on the time required to collect and process the herring. The sample size for each time strata for the commercial purse seine harvest was 400 herring per section. The sample size for each time strata for the commercial gillnet harvest was 150 herring per section per day.

Age, Weight, and Length Data

Age composition of the commercial harvest was estimated from herring collected from the commercial and test fisheries throughout the Togiak District. The percent age composition by number, for each age class P_a , was estimated for each gear-time-area by:

$$P_a = \frac{n_a}{n}, \quad (1)$$

where:

n_a = the number of herring in the sample that were age a and

n = the total number of herring in the sample.

The mean weight-at-age, \bar{W}_a for herring was estimated for each gear-time-area stratum by:

$$\bar{W}_a = \frac{\sum_{i=1}^{n_a} W_{ai}}{n_a}, \quad (2)$$

where:

W_{ai} = the individual weight of herring in sample n that were age a .

The mean length-at-age was calculated by substituting the individual length L_{ai} of herring for the individual weight W_{ai} .

COMMERCIAL HARVEST

Fish tickets (sales receipts) were completed by processing companies and buyers for each commercial delivery of herring. Estimates of waste or discarded herring were obtained from aerial survey estimates of discarded herring or processor reports. Estimated waste was included in the fish ticket database and used in the calculation of exploitation rates.

BIOMASS ESTIMATION

Herring biomass for the Togiak District was estimated using aerial survey assessment procedures outlined by Lebida and Whitmore (1985). When weather permitted, aerial surveys were flown daily at low tide to estimate herring abundance. Each management section was divided into index areas to facilitate survey documentation. Aerial survey estimates for each index area were summed to provide biomass estimates for each management section by day. Biomass estimates of these management sections were then summed to provide the observed district-wide biomass for each day.

Age information from the herring samples collected by nonselective gear were pooled across management sections to determine any temporal trends in age composition, which would indicate immigration of new herring or emigration of herring from the fishing district after spawning.

Age composition, by weight, of the commercial harvest and of the appropriate daily biomass data for each age class was estimated by:

$$B_a = \left[\frac{n_a \bar{W}_a}{\sum_{a=1}^{\max_a} (n_a \bar{W}_a)} \right] B, \quad (3)$$

where:

B_a = the biomass for age a ,

n_a = the number of herring in the sample that were age a ,

\bar{W}_a = the mean weight for herring of age a , and

B = the total estimated harvest expressed as biomass or daily biomass estimate.

Age composition of the waste, or deadloss, (i.e., herring that were caught but not sold) was represented by the age composition for the same gear type in the commercial fishery.

The number of fish for each age class, N_a , was calculated by

$$N_a = \frac{B_a}{W_a}. \quad (4)$$

The run biomass, B_{tot} , was calculated by summing the biomass by each age class and management section from the selected daily aerial surveys.

$$B_{tot} = \sum_{i=1}^n B_i \quad (5)$$

where 1, 2, and 3 are aerial survey biomass estimates.

The inshore escapement biomass E_{tot} is the summation of the difference between the run biomass B_a for each age and the combined purse seine and gillnet harvest for each age C_a :

$$E_{tot} = \sum_{a=1}^{maz} (B_a - C_a) \quad (6)$$

RESULTS

BIOMASS ESTIMATION

Herring surveys were flown in the Togiak Fishing District from 15 April–26 May (Table 2). Herring were first observed on 28 April when 11,814 tons (10,718 tonnes) were observed in the Togiak District. The peak and first substantial daily biomass estimate of 108,585 tons (98,508 tonnes) was documented on 1 May with the bulk of the herring observed in the Hagemeister Section. On 16 and 26 May, the last two surveys flown, approximately 45,709 tons (41,467 tonnes) and 2,433 tons (2,207 tonnes) were observed (Table 2). The total biomass estimate of

156,727 tons (143,089 tonnes) was calculated by combining the peak inseason biomass estimate of 108,585 tons (98,508 tonnes) observed on 1 May and aerial survey estimates from 16 (45,709 tons) and 26 May (2,433 tons).

Spawn was first documented on 29 April when 3.8 linear miles were observed (Table 2). The amount of visible spawn peaked on 1 May at 12.5 linear miles. A total of 27.6 linear miles of spawn was documented throughout the 2005 survey period.

COMMERCIAL HARVEST

A commercial harvest of 20,912 tons (18,971 tonnes) occurred within the Togiak District for sac roe product (Table 1). Commercial openings were from 30 April – 8 May, and test purse seine fisheries occurred on 28 – 29 April and 6 May (Table 3; Appendix B9). Average roe percentages of all harvested herring was 10.0% (Table 3). Biological information was collected from 5,152 herring caught by purse seine and gillnet gear in the Togiak Fishing District from 28 April – 6 May 2005 (Table 4). Regenerated or illegible scales composed 8.0% of all scale samples. The percentage of unreadable scales from commercial gillnet samples was 11.8%, followed by test purse seine, 8.0%, and commercial purse seine at 7.3%. Age composition of the harvest by weight was predominately age-8 (41.6%), age-9 (19.3%), and age-7 (14.9%; Table 5; Figure 3).

Purse Seine

There were seven (7) commercial purse seine openings in the Togiak District from 30 April – 6 May totaling 83.0 hours (Table 3). A total of 15,071 tons (13,672 tonnes) of herring were harvested, including 784.1 tons (711 tonnes) of deadloss estimated from aerial surveys and reported loss from commercial fishing vessels. Catches from Nunavachak Section accounted for 44% of the total purse seine harvest, followed in magnitude by Hagemeister (38%), Pyrite Point (16%) and Cape Newenham (2%) Sections (Table 3; Figure 4). Roe percentages averaged 9.5% from the purse seine harvested herring.

Sample sizes collected from the commercial purse seine fishery were adequate and representative of the population (Appendix B1 – B.4). Herring sampled from the purse seine fishery ranged from age-4 to age-18 (Table 5). Age groups 7, 8 and 9 were the major age classes comprising 14.9%, 41.6% and 19.3%, of the commercial purse seine harvest by weight and 14.3%, 46.2%, and 19.7%, by number (Table 5; Figure 5; Appendix A1). Age composition of herring samples collected with non-selective gear by sampling period, east Togiak District and west Togiak District is presented in Figure 6. Mean weight of herring sampled from the harvest was 362 g and mean length was 297 mm (Table 6). Mean weights by age class of herring sampled from the purse seine fishery are presented in Appendix B1–B4. Based on samples from the purse seine harvest, there was no substantial temporal change in age class structure of the biomass.

Sex composition varied over time, but overall sex composition of all aged samples from the commercial purse seine fishery was 51.1% male and 48.9% female.

Gillnet

Nine commercial gillnet openings totaling 149.0 hours occurred from 30 April – 8 May harvesting a total of 5,841 tons (5,299 tonnes). Catches from Kulukak Section accounted for 99.7% of the total gillnet harvest and Nunuvachak Section accounting for the remaining 0.03% (Table 3; Appendix B5). The fishery peaked on 30 April, the first day of fishing, with a harvest of 1,461 tons (1,325 tonnes). Row percentage from commercial gillnet fishery averaged 11.2%.

Herring sampled from the gillnet fishery ranged from age-6 to age-16 (Table 5). Sample size was adequate and representative of the commercial gillnet harvest. Age-8 herring was the most abundant age class in the harvest comprising 35.4% of the harvest by weight and 37.9% by number of fish (Table 5; Figure 5; Appendix A2). Herring age-9 and older composed 57.8% of the gillnet harvest by weight and 54.2% by number. Contribution of herring age-6 and younger was minimal, representing only 0.2% by weight and 0.3% by number. Mean weight of herring sampled from the commercial gillnet harvest was 397 g and mean length was 302 mm (Table 6). Mean weight, by age class, of herring sampled from the gillnet fishery are in Appendix B5.

Sex composition varied over time, but overall sex composition of all aged samples from the gillnet fishery was 59.9% female and 40.1% male (Appendix B5).

Spawn on Kelp

No companies registered to buy herring spawn-on-kelp in 2005, therefore there were no openings and no commercial harvest (Table 1).

Exploitation Rate

An estimated 136,023 tons (123,399 tonnes) representing 335 million herring escaped harvest in the Togiak Fishery (Table 4). The inseason exploitation rate was estimated to be 19.9%; the commercial sac roe harvest of 20,912 tons (18,971 tonnes) was divided by the peak inseason biomass of 108,585 tons (98,508 tonnes). The final postseason exploitation rate was estimated to be 14.1%; the commercial sac roe harvest was divided by the total biomass estimate of 157,727 tons (143,089 tonnes).

DISCUSSION

The 2005 fishery started on 30 April, which was the fourth earliest starting date in the last 20 years (Table 7). The duration of the both the purse seine and gillnet fisheries, were the second longest in the last 20 years. The number of processing companies was the third lowest in recent history, and daily processing capacity was 2,330 tons per day (Table 7). The number of fishing vessels, based on peak aerial counts, was the second lowest in the last 20 years. All of these factors contributed to the prolonged duration of the 2005 herring harvest.

The preseason forecast allowed for a harvest of 16,467 tons (14,939 tonnes; Appendix C). Based on biomass surveys and age composition information, the biomass estimate for the 2005 Togiak herring stock was increased 9,000 tons (8,165 tonnes) from 96,029 (87,117 tonnes) to 105,029 (95,282 tonnes) in season. This increase as well as the 50% spawn-on-kelp reallocation increased the Togiak sac roe purse seine quota by 1,697 tons (1,540 tonnes) from 11,527 tons (10,457 tonnes) to 13,224 tons (11,997 tonnes) and Togiak sac roe gillnet quota by 727 tons (660 tonnes) from 4,940 tons (4,482 tonnes) to 5,667 tons (5,141 tonnes). The harvest of 20,912 tons (18,971 tonnes) was 6% above the revised inseason biomass estimate for the 2005 Togiak herring stock.

Based on the purse seine harvest, it appears that the offspring (recruits) of the 1998 (age-7), 1997 (age-8) and 1996 (age-9) brood years will continue to dominate the population and fishery biomass in the near future (Figure 7). These three age classes comprised 80% of the purse seine harvest by number of fish and 76% by weight.

Several factors potentially affect estimating the total run biomass of Togiak herring using aerial survey data. The migration of herring between management sections within the Togiak District is not well understood. Residence time of herring within the district and rate of turnover for the biomass on the grounds is unknown.

Since total run biomass was estimated in 2005, age composition of the total run was compared to the preseason forecast (Table 6; Appendix C). A few disparities exist between the 2005 total run forecast and the 2005 total run. The most notable disparity was the mean weight of the fish. The overall mean weight of individual fish was forecasted to be 334 g; however, the actual mean weight of fish from the total run was 372 grams. Additionally, actual mean weights, by age class, were either slightly higher or lower than the forecasted weights for age classes except for age 8 fish which came in at the forecasted weight of 345 grams (Table 6; Appendix C). The differences, by individual age classes were minimal and ranged from 6% heavier to 7% less than forecast weight.

The fishers and processors formed co-ops in 2001 and started working together to ensure quality in the harvest. This practice allows the purse seine fishermen to inspect their catches more closely, and harvest only the most valuable fish. Larger fish tend to have a higher gonad somatic index (gonad weight/fish weight), and are more valuable. This “high grading” is one likely reason why the average weight of herring harvested in the purse seine fishery was 10% higher than forecasted.

No temporal change in age composition from older to younger herring was observed in the fishery and age-7, -8, and -9 herring predominated throughout the fishery. Age composition of the purse seine harvest was similar to what was forecast to comprise the total run. Only a few disparities existed; fewer than expected age-4 and -5 fish were found in the fishery, which may suggest weak returns of these age classes in the future, or it could simply be an artifact of run timing, fishery timing or “high grading”. Also, a larger than expected return of age-7 fish were observed in the fishery, which may suggest a strong age class in the future. Additionally, the lack of postseason age composition sampling limits the ability to assess the age contribution to the biomass based on surveys conducted on 11, 16, and 26 May. The younger recruit age classes, age-4 and-5 herring, generally spawn later than older fish and therefore are typically under represented when postseason sampling is not conducted.

Observations of herring spawn were down in 2005 with only 27.6 linear miles as compared to the recent 10-year average of 54.6 linear miles. In addition, the peak inseason biomass estimate of herring was relatively high 108,585 tons (98,508 tonnes) in 2005. These observations of higher than expected biomass and lower than expected herring spawn may have occurred from one or more of the following: (1) aerial survey conditions were better in 2005; (2) the herring forecast was too low; or (3) herring spawned less, spawned deeper, or spawn was mixed in turbid water making observations difficult.

An age structured analysis (ASA) model was used to forecast the 2005 total run. Historical total run biomass estimates are included to weight the model with the most recent estimate having the most influence. The last biomass estimate included in the model was from 2001 because inadequate aerial survey information has prevented the estimation of total run biomass estimates for 2002, 2003 and 2004. Given that the 2001 estimate was determined to be high and adequate total run survey information has been limiting since 1999, a conservative approach was taken in predicting the 2005 run.

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TABLES AND FIGURES

Table 1.—Historical total run biomass and commercial harvest (tons) of Pacific herring returning to the Togiak District, Bristol Bay, 1968–2005.

Year	Togiak		Spawn-on-Kelp			Dutch Harbor	Exploitation Rate ^f
	Total Run Biomass (tons) ^{a,b}	Sac Roe Harvest (tons) ^c	Harvest (lbs) ^c	Harvest (tons) ^c	Herring Equivalent (tons) ^d	Food and Bait Harvest (tons) ^e	
1968		80					
1969		47	10,125	5			
1970		28	38,855	19			
1971		^g	51,795	26			
1972		80	64,165	32			
1973		51	11,596	6			
1974		123	125,646	63			
1975		56	111,087	56			
1976		^g	295,780	148			
1977		2,795	275,774	138			
1978	190,292	7,734	329,858	165			
1979	239,022	11,558	414,727	207			
1980	68,686	24,516	189,662	95			
1981	158,650	12,489	378,207	189		704	
1982	97,902	21,821	234,924	117		3,565	
1983	233,700	26,786	274,866	137		3,567	
1984	114,880	19,419	406,587	203	1,552	3,578	
1985	131,400	25,812	^g	^g	^g	3,480	
1986	94,770	16,276	374,142	187	1,446	2,394	
1987	88,398	15,530	307,307	154	1,309	2,503	
1988	134,718	14,168	489,400	245	1,782	2,004	
1989	98,965	12,259	559,754	280	2,499	3,081	
1990	88,105	12,230	413,844	207	1,617	820	
1991	83,229	14,970	348,357	174	1,310	1,325	
1992	156,957	25,808	363,600	182	1,482	1,949	
1993	193,847	17,956	383,000	192	1,481	2,790	11.5%
1994	185,412	30,315	308,400	154	1,134	3,349	18.8%

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Table 1.–Page 2 of 2

Year	Togiak		Spawn-on-Kelp			Dutch Harbor	Exploitation Rate ^f
	Total Run Biomass (tons) ^{a,b}	Sac Roe Harvest (tons) ^c	Harvest (lbs) ^c	Harvest (tons) ^c	Herring Equivalent (tons) ^d	Food and Bait Harvest (tons) ^e	
1995	149,093 ^h	26,732	281,600	141	996	1,748	^k
1996	135,585 ^h	24,871	455,800	228	1,899	2,239	^k
1997	144,887	23,813	^g	^g	^g	1,950	17.8%
1998	121,000 ^h	22,776	^g	^g	^g	1,994	^k
1999	157,028	19,878	419,563	210	1,605	2,398	15.2%
2000	130,904 ^h	20,421	^g	^g	^g	2,014	^k
2001	115,155 ⁱ	22,330	^g	^g	^g	1,439	20.6%
2002	120,196 ^h	17,049	67,793	34	260	2,751	^k
2003	126,213 ^h	21,663	^j	^j	^j	1,487	^k
2004	143,124 ^h	18,868	^g	^g	^g	1,258	^k
2005	156,727	20,912	^g	^g	^g	1,154	14.1%
1985–2004 Mean ^l	129,949	20,186	367,120	184	1,448	2,149	16.3%
1995–2004 Mean ^m	134,319	21,840	306,189	180	1,402	2,110	16.0%

^a Data not available prior to 1978.

^b Source: Salomone et al. 2007

^c Source : Harvest data for years 1968–1979 provided by ADF&G (Unpublished); years 1980–1987 by Sandone and Brannian (1988); and years 1988–2002 by fish ticket receipts.

^d Management plan adopted by Board of Fisheries in 1984 setting a 350,000 lb. harvest guideline, specifying 2 to 3 year rotation, and including spawn-on-kelp herring equivalent in exploitation rate. Herring equivalent calculation reported in ADF&G (1997).

^e Source: fish tickets; catches documented since 1929. Fishery did not occur between 1946 and 1980.

^f Exploitation rate calculated from reliable total run biomass postseason estimates beginning in 1993.

^g No fishery conducted.

^h Aerial surveys to determine abundance were hampered by poor weather conditions preventing calculation of a final season's biomass estimate. Inseason management used preseason forecast.

ⁱ The 2001 total run biomass estimate was determined to be high and was reduced from 146,000 tons to 115,155 tons.

^j Data confidential under Alaska Statute 16.05.815.

^k Exploitation rate not calculated as no total run biomass was estimated.

^l The 1983-2002 calculated mean for spawn-on-kelp fishery does not include years 1985, 1997,1998, 2000 and 2001 and the calculated mean harvest for the Dutch Harbor food and bait fishery does not include 1979 and 1980.

^m The 1993-2002 calculated mean for the spawn-on-kelp fishery does not include years 1997,1998, 2000 and 2001.

Table 2.—Aerial survey estimates (tons) of herring by index area, Togiak District, 2005.

Date	Start Time	Survey Rating ^a	Miles of Spawn	Estimated Biomass by Index Area ^b													Daily Total	
				NUS	KUK	MET	NVK	UGL	TOG	TNG	MTG	OSK	PYR	CPN	HAG	WAL		
4/15	09:45	1.2																
4/18	09:45	2.1																
4/20	10:05	3.9																
4/22	13:25	4.0																
4/24	09:40	3.3																
4/25	11:30	3.1																
4/26	08:05	3.2																
4/28	13:40	3.5		1,874	3,080		640	2,365	3,028		360				49	418	11,814	
4/29	08:00	3.9	3.8			950	570	950	1,888								4,358	
5/01	13:45	3.3	4.5	12,008	1,015	418	1,996	1,892	3,604	1,041	888	30	261		1,347		24,500	
5/01	19:00	2.0	8.0		12,588	8,720	7,699	3,850	14,301	3,490	17,335	4,071	12,357	560	17,773	5,841	108,585	
5/02	17:15	2.8	5.1	27	3,928	1,023	233	853	56,393	529	1,859	575	2,112			1,217	68,749	
5/03 ^c	17:45		3.3														0	
5/04 ^c	11:00		2.0														0	
5/11	13:15	2.2	0.7	2,285	546	1,528	2,057	155	4,217	748	1,706	954			2,934		17,130	
5/16	13:50	3.4	0.2	633	1,196	2,024	1,354	334	39,386	148	169	216			249		45,709	
5/26	14:00	4.6				1,974	429	30									2,433	
Total		3.1	27.6														Peak Biomass	108,585

^a 1 = Excellent, 2 = Good, 3 = Fair, 4 = Poor, 5 = Unsatisfactory.

^b Index areas: NUS - Nushagak Peninsula; KUK - Kulukak; MET - Metervik; NUK - Nunavachak; UGL - Ungalikthluk/Togiak; TOG - Togiak; TNG - Tongue Pt; MTG - Matogak; HAG - Hagemeister; OSK - Osvisak; PYT - Pyrite Point; CPN - Cape Newenham.

^c Vessel count and spawn survey only.

Table 3.—Commercial herring harvest (tons) by fishing section and gear type, Togiak District, Bristol Bay, 2005.

Date	Duration (hrs.)	Period	Kulukak		Nunavachak		Togiak		Hagemeister		Pyrite Point		Cape Newenham		Total	
			Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %
Purse Seine																
29-Apr					202.6	9.3 ^a									202.6	9.3
30-Apr	12:00	1			4,023.6	9.3	0.0	0.0	1,322.6	9.0	0.0	0.0	0.0	0.0	5,346.2	9.2
1-May	12:00	2			469.6	9.8	0.0	0.0	123.1	9.4	0.0	0.0	0.0	0.0	592.7	9.7
2-May	16:00	3			728.1	9.1	0.0	0.0	789.6	12.9 ^c	923.8	9.5	112.3	9.2	2,553.8	9.8
3-May	16:00	4			390.0	10.4 ^b	0.0	0.0	440.6	9.9	932.1	9.0	176.8	8.3	1,939.5	9.3
4-May	12:00	5			856.6	10.6	0.0	0.0	1,403.2	9.5	459.9	10.0	0.0	0.0	2,719.7	9.9
5-May	13:00	6			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-May	2:00	7					0.0	0.0	1,618.0	9.3 ^a	98.3	11.0 ^a	0.0	0.0	1,716.3	9.4
Subtotal	83:00:00				6,670.5	9.5 ^{a,b}	0.0	0.0	5,697.1	9.5 ^{a,c}	2,414.1	9.5 ^a	289.1	8.6	15,070.8	9.5
Gillnet																
30-Apr	13:00	1	1,460.9	11.3											1,460.9	11.3
1-May	23:00	2	1,181.6	11.0											1,181.6	11.0
2-May	18:00	3	900.6	10.8	0.0	0.0									900.6	10.8
3-May	13:00	4	750.1	10.8											750.1	10.8
4-May	20:00	5	632.9	10.8	0.0	0.0									632.9	10.8
5-May	20:00	6	53.2	11.0	0.0	0.0									53.2	11.0
6-May	18:00	7	32.3	13.0	0.0	0.0									32.3	13.0
7-May	16:00	8	605.8	12.2	13.6	12.0									619.4	12.2
8-May	8:00	9	210.0	11.5	0.0	0.0									210.0	11.5
Subtotal	149:00:00		5,827.4	11.2	13.6	12.0									5,841.0	11.2

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Table 3.–Page 2 of 2.

Date	Duration	Periods	Kulukak		Nunavachak		Togiak		Hagemeister		Pyrite Point		Cape Newenham		Total	
			Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %
Combined																
29-Apr					202.6	9.3 ^a									202.6	9.3
30-Apr			1,460.9	11.3	4,023.6	9.3	0.0	0.0	1,322.6	9.0	0.0	0.0	0.0	0.0	6,807.1	9.7
1-May			1,181.6	11.0	469.6	9.8	0.0	0.0	123.1	9.4	0.0	0.0	0.0	0.0	1,774.3	10.6
2-May			900.6	10.8	728.1	9.1	0.0	0.0	789.6	12.9 ^c	923.8	9.5	112.3	9.2	3,454.4	10.1
3-May			750.1	10.8	390.0	10.4 ^b	0.0	0.0	440.6	9.9	932.1	9.0	176.8	8.3	2,689.6	9.7
4-May			632.9	10.8	856.6	10.6	0.0	0.0	1,403.2	9.5	459.9	10.0	0.0	0.0	3,352.6	10.1
5-May			53.2	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.2	11.0
6-May			32.3	13.0	0.0	0.0	0.0	0.0	1,618.0	9.3 ^a	98.3	11.0 ^a	0.0	0.0	1,748.6	9.5
7-May			605.8	12.2	13.6	12.0									619.4	12.2
8-May			210.0	11.5	0.0	0.0									210.0	11.5
Total			5,827.4	11.2	6,684.1	9.5 ^{a,b}	0.0	0.0	5,697.1	9.5 ^{a,c}	2,414.1	9.5 ^a	289.1	8.6	20,911.8	10.0

^a Includes test fish harvest which is conducted during closed commercial periods.

^b Includes 250 tons documented waste.

^c Includes 534.1 tons documented waste.

Table 4.—Number of samples collected by gear type during the 2005 Togiak herring season.

Gear Type	Number of Readable Scale Samples	Number of Unreadable Scale Samples	Total	% Unreadable Scale Samples
Commercial Purse Seine	3,670	287	3,957	7.3
Commercial Gillnet	626	84	710	11.8
Test Purse Seine	446	39	485	8.0
Total	4,742	410	5,152	8.0

Table 5.—Harvest by age and gear type from the herring sac roe fishery, Togiak District, 2005.

Purse Seine					Gillnet					Escapement					Total Run				
Age	Biomass Percent		Number Percent		Age	Biomass Percent		Number Percent		Age	Biomass Percent		Number Percent		Age	Biomass Percent		Number Percent	
	ST	by Wt (x 1,000)	by No.	ST		by Wt (x 1,000)	by No.	ST	by Wt (x 1,000)		by No.	ST	by Wt (x 1,000)	by No.		ST	by Wt (x 1,000)	by No.	
1	0	0.0	0	0.0	1	0	0.0	0	0.0	1	0	0.0	0	0.0	1	0	0.0	0	0.0
2	0	0.0	0	0.0	2	0	0.0	0	0.0	2	0	0.0	0	0.0	2	0	0.0	0	0.0
3	0	0.0	0	0.0	3	0	0.0	0	0.0	3	0	0.0	0	0.0	3	0	0.0	0	0.0
4	13	0.1	73	0.1	4	0	0.0	0	0.0	4	128	0.1	763	0.2	4	141	0.1	835	0.2
5	42	0.3	172	0.4	5	0	0.0	0	0.0	5	495	0.4	2,022	0.6	5	538	0.3	2,194	0.5
6	165	1.5	355	1.0	6	11	0.2	37	0.3	6	1,111	0.8	3,626	1.1	6	1,286	0.8	4,018	1.0
7	1,980	14.9	5,303	14.3	7	366	6.5	976	7.7	7	15,172	11.2	45,714	13.6	7	17,518	11.2	51,993	13.2
8	5,932	41.6	16,214	46.2	8	2,052	35.4	4,980	37.9	8	54,547	40.1	143,708	42.9	8	62,532	39.9	164,902	44.3
9	2,894	19.3	7,143	19.7	9	1,905	31.7	4,312	31.5	9	28,092	20.7	66,823	19.9	9	32,891	21.0	78,279	20.3
10	1,002	6.3	2,176	5.5	10	518	9.5	1,080	8.8	10	9,583	7.0	20,291	6.1	10	11,104	7.1	23,547	5.8
11	958	5.6	1,955	4.6	11	432	7.3	843	6.2	11	9,599	7.1	19,386	5.8	11	10,989	7.0	22,184	5.4
12	912	5.1	1,787	4.1	12	265	4.6	510	3.8	12	7,922	5.8	15,279	4.6	12	9,099	5.8	17,576	4.5
13	351	1.8	671	1.3	13	141	2.4	260	1.9	13	2,678	2.0	5,236	1.6	13	3,171	2.0	6,168	1.6
14	249	1.4	474	1.1	14	64	1.2	118	1.0	14	2,429	1.8	4,448	1.3	14	2,742	1.7	5,040	1.3
15	211	1.3	389	1.0	15	72	1.0	133	0.8	15	2,419	1.8	4,447	1.3	15	2,703	1.7	4,970	1.1
16	119	0.7	217	0.5	16	15	0.2	28	0.2	16	1,580	1.2	2,888	0.9	16	1,714	1.1	3,134	0.6
17	34	0.2	56	0.1	17	0	0.0	0	0.0	17	265	0.2	485	0.1	17	299	0.2	541	0.2
18	5	0.1	9	0.1	18	0	0.0	0	0.0	18	0	0.0	0	0.0	18	0	0.0	0	0.0
19	0	0.0	0	0.0	19	0	0.0	0	0.0	19	0	0.0	0	0.0	19	0	0.0	0	0.0
20	0	0.0	0	0.0	20	0	0.0	0	0.0	20	0	0.0	0	0.0	20	0	0.0	0	0.0
Total	14,868	100.0	36,995	100.0	Total	5,841	100.0	13,278	100.0	Total	136,023	100.0	335,117	100.0	Total	156,727	100.0	385,381	100.0

Table 6.—Mean length (mm), weight (g), and standard deviation by age for herring of the commercial harvest by gear type, Togiak District, 2005.

Age	Total Run Biomass ^a					Commercial Purse Seine					Commercial Gillnet						
	Number of Samples	Mean Length (mm)	SD	Mean Weight (g)	SD	Age	Number of Samples	Mean Length (mm)	SD	Mean Weight (g)	SD	Age	Number of Samples	Mean Length (mm)	SD	Mean Weight (g)	SD
4	4	239	8.5	168	32.3	4	5	243	11.2	177	34.5	4					
5	11	259	7.7	221	18.0	5	15	259	7.3	225	24.9	5					
6	19	273	7.6	288	35.4	6	37	274	7.6	285	33.9	6	2	272	4.9	269	35.4
7	272	281	5.9	308	31.5	7	526	281	6.1	304	31.2	7	48	283	6.3	339	31.0
8	929	292	7.3	345	35.7	8	1,695	292	7.3	340	36.8	8	237	294	7.5	372	34.7
9	408	302	7.8	385	42.2	9	722	302	8.0	378	43.1	9	197	303	7.0	400	34.6
10	128	312	7.0	430	41.3	10	203	312	7.0	421	42.5	10	55	312	6.4	432	37.6
11	118	319	7.1	451	39.7	11	169	319	7.4	452	44.2	11	39	317	6.7	465	43.1
12	99	323	7.0	473	45.8	12	149	324	7.6	472	49.7	12	24	323	5.9	473	43.2
13	37	325	7.5	467	41.4	13	49	325	7.2	467	40.2	13	12	329	7.3	491	31.0
14	31	329	7.2	496	48.0	14	41	329	7.7	491	48.6	14	6	332	6.1	492	33.2
15	24	334	6.8	499	44.0	15	35	334	6.7	497	45.3	15	5	332	14.9	489	60.7
16	16	334	9.8	496	42.2	16	17	335	10.0	503	49.9	16	1	341		494	
17	4	340	4.2	556	39.4	17	5	340	3.7	542	45.0	17					
						18	2	342	8.5	459	26.2	18					
All Samples Combined	2,100	298	15.9	372	66.1		3,670	297	15.2	362	64.6		626	302	13.1	397	52.7

^a Collected from non-selective gear, commercial purse seine.

Table 7.—Sac roe herring industry participation, fishing effort and harvest, Togiak District 1985–2005.

Year	Daily		Gillnet						Purse Seine						Total Harvest ^c
	Companies	Processing Capacity ^a	Fishery Dates	Effort ^b	Duration (hrs.)	Harvest ^c	C.P.U.E.	Roe%	Effort ^b	Duration (hrs.)	Harvest ^c	C.P.U.E.	Roe%		
1985	23		5/23-5/25	302	11.0	4,482	1.3	7.4	155	3.0	21,330	45.9	10.0	25,812	
1986	23		5/14-5/15	209	10.0	3,448	1.6	8.8	209	1.0	12,828	61.4	9.9	16,276	
1987	18		4/27-5/6	148	36.0	2,685	0.5	8.6	111	5.5	12,845	21.0	8.9	15,530	
1988	22		5/17	300	4.0	3,695	3.1	8.3	239	0.5	10,472	87.6	10.9	14,167	
1989	19		5/9-5/14	320	5.0	2,844	1.8	7.8	310	3.0	9,415	10.1	8.5	12,259	
1990	16	3,100	5/8-5/20	277	66.0	3,072	0.2	9.0	221	3.0	9,158	13.8	9.7	12,230	
1991	16	3,350	5/10-5/17	170	14.0	3,182	1.3	8.5	200	3.0	11,788	19.6	10.0	14,970	
1992	18	3,700	5/20-5/27	274	25.5	5,030	0.7	8.8	301	0.3	20,778	230.1	9.2	25,808	
1993	12	2,500	4/27-5/9	75	144.5	3,564	0.3	10.1	140	33.8	14,392	3.0	9.6	17,956	
1994	16	3,300	5/11-5/20	146	76.0	7,462	0.7	12.0	240	4.6	22,853	20.7	9.4	30,315	
1995	22	4,350	5/7-5/15	250	33.5	6,995	0.8	12.0	254	12.2	19,737	6.4	10.1	26,732	
1996	19	4,850	5/3-5/8	461	18.0	6,863	0.8	11.1	268	2.4	18,008	27.8	9.0	24,871	
1997	18	4,200	5/2-5/6	336	24.0	5,164	0.6	11.8	231	6.4	18,649	12.6	9.4	23,813	
1998	15	2,475	4/29-5/10	152	46.0	5,952	0.9	12.5	123	16.5	16,824	8.3	9.6	22,776	
1999	12	2,400	5/18-5/26	171	28.0	4,858	1.0	11.5	96	4.7	15,020	33.3	9.2	19,878	
2000	12	2,100	5/6-5/14	227	67.0	5,464	0.4	10.6	90	15.8	14,957	10.6	10.1	20,421	
2001	11	2,255	5/6-5/13	96	84.0	6,481	0.8	10.6	64	26.0	15,849	9.5	9.2	22,330	
2002	8	1,920	5/3-5/13	82	102.0	5,216	0.6	10.9	37	57.5	11,833	5.6	9.3 ^d	17,049	
2003	7	1,920	4/25-5/7	75	142.0	6,505	0.6	10.9	35	110.2	15,158	3.9	8.9 ^d	21,663	
2004	6	2,150	4/29-5/9	54	162.0	4,980	0.6	10.4	31	78.0	13,888	5.7	9.5	18,868	
2005	8	2,330	4/30-5/8	56	149.0	5,841	0.7	11.2	33	83.0	13,869	5.1	9.6	19,711	
1985-04 Ave.	16	2,971		206	54.9	4,897	0.9	10.1	168	19.4	15,289	31.8	9.5	20,186	
1995-04 Ave.	13	2,862		190	70.7	5,848	0.7	11.2	123	33.0	15,992	12.4	9.4	21,840	

^a Number of tons per day based on companies registered.

^b Peak aerial survey count.

^c Harvest total does include deadloss and test fish harvest.

^d Values are lower than inseason assessment due to more stringent post-season market scrutiny compared with previous years.

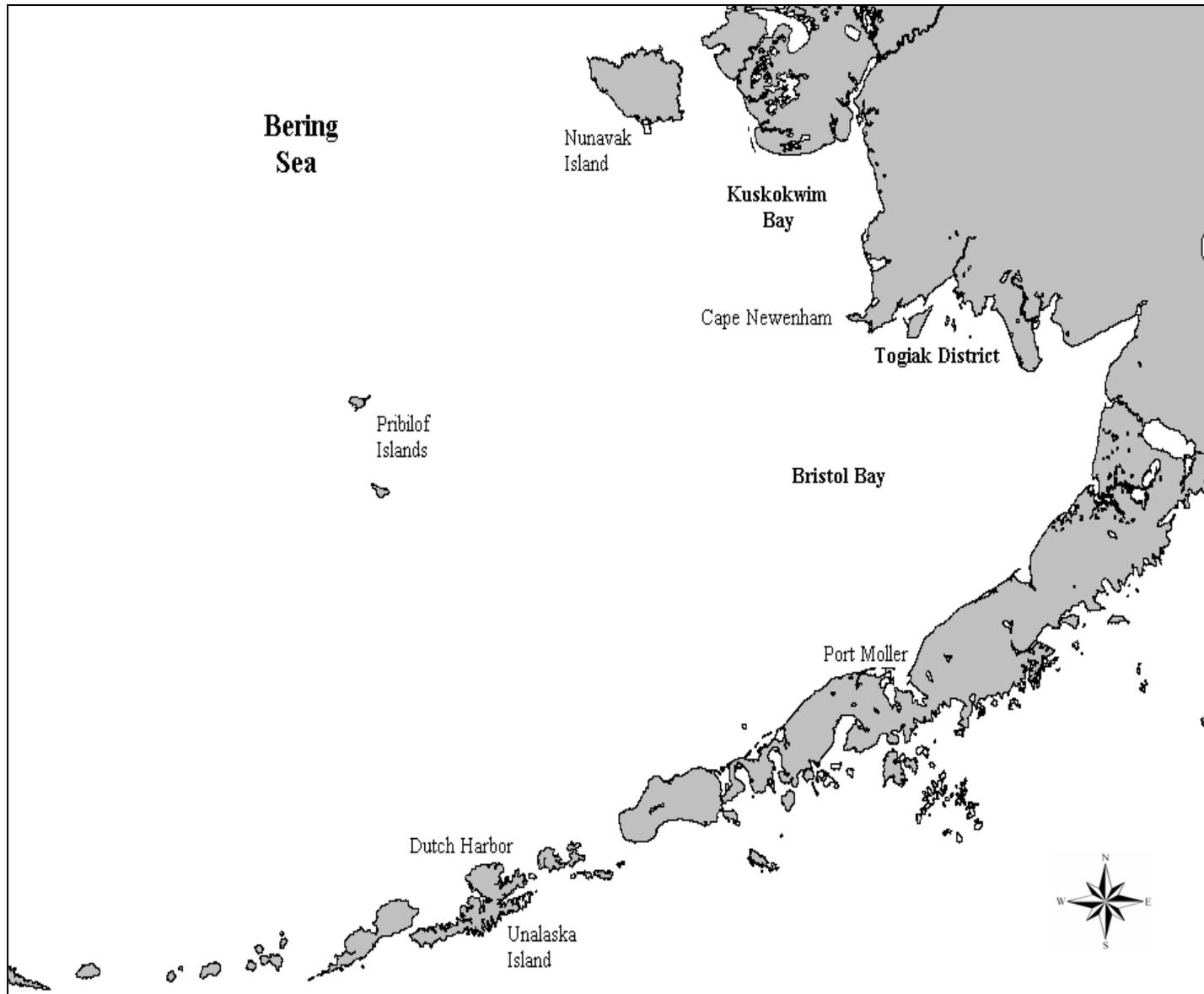


Figure 1.—Southeastern Bering Sea.

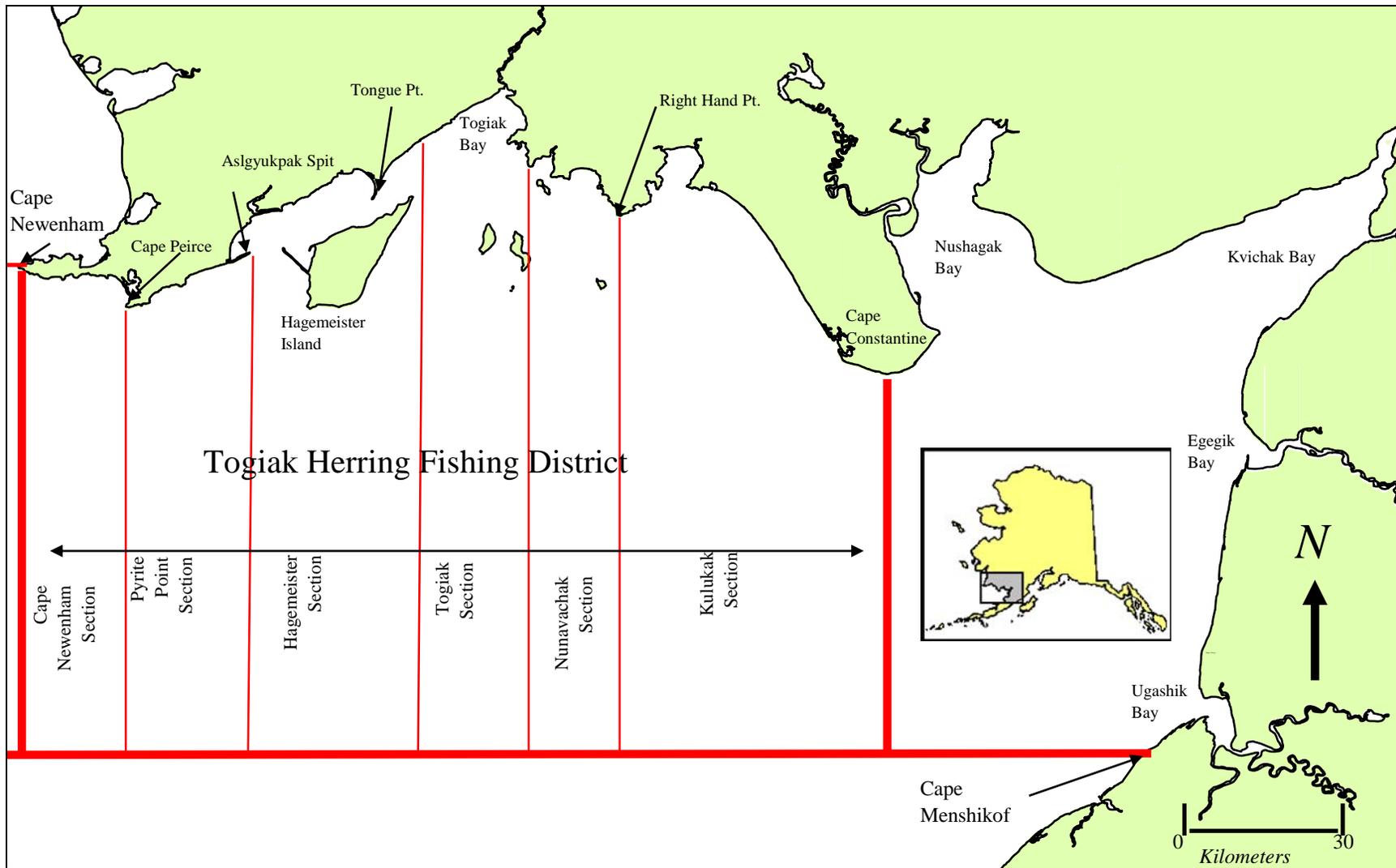


Figure 2.—Togiak Herring District, Bristol Bay.

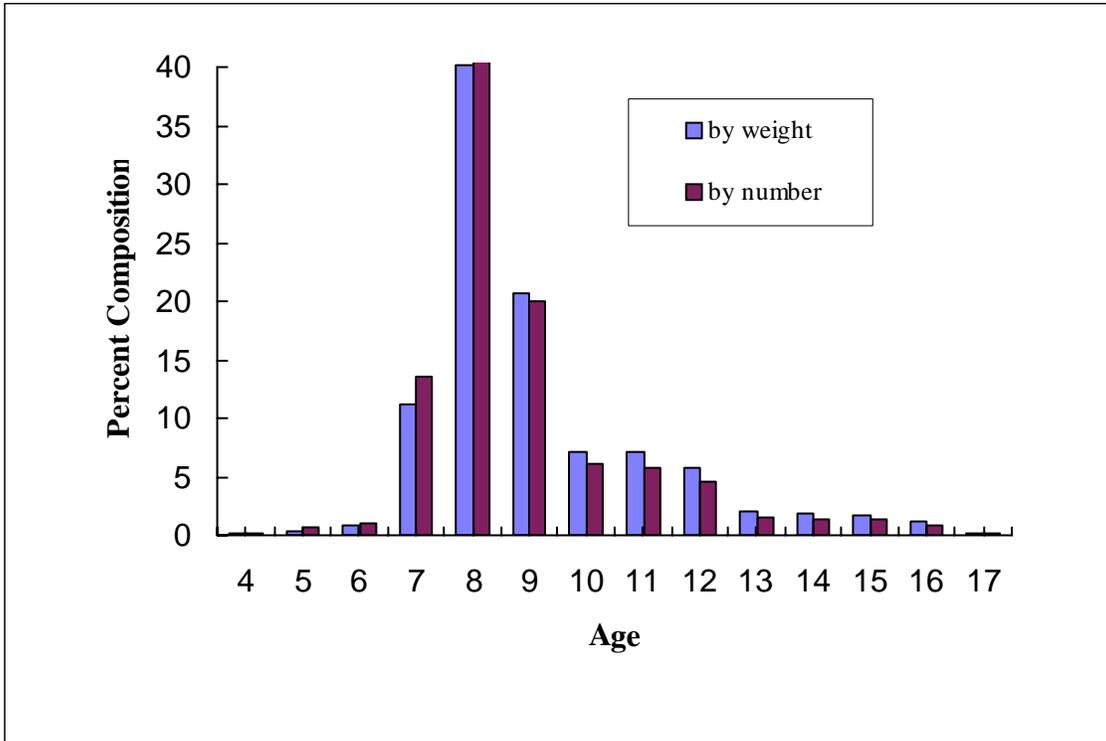


Figure 3.—Age composition of the total herring harvest, Togiak District, 2005.

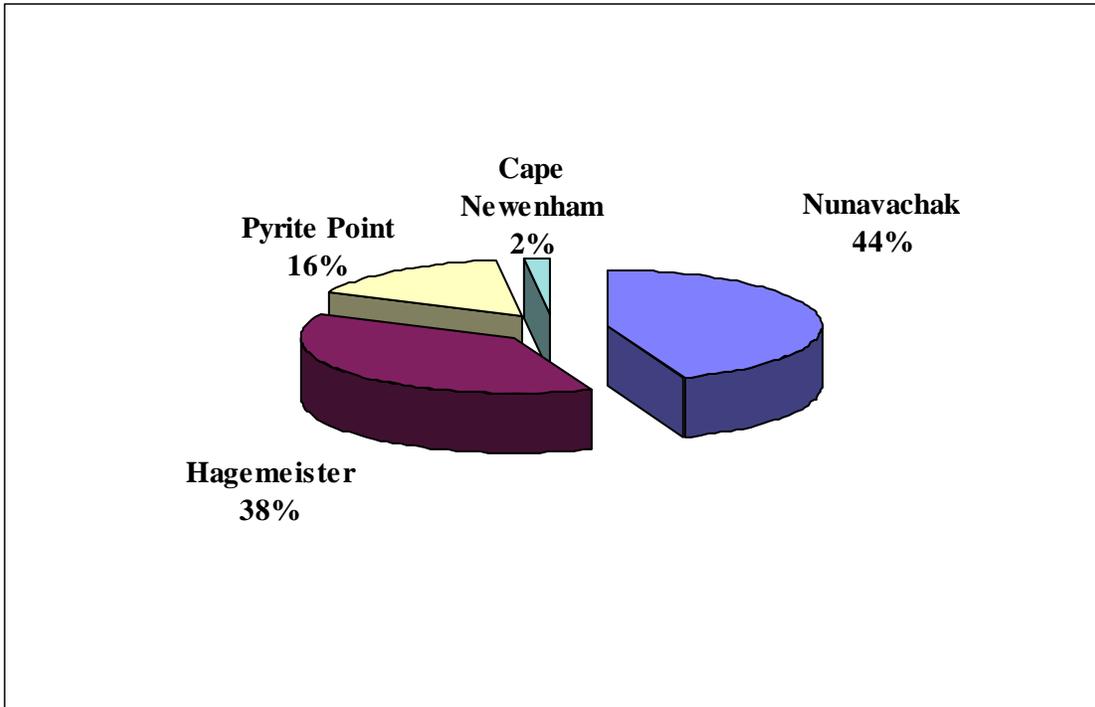


Figure 4.—Commercial purse seine harvest distribution by fishing section, Togiak District, 2005.

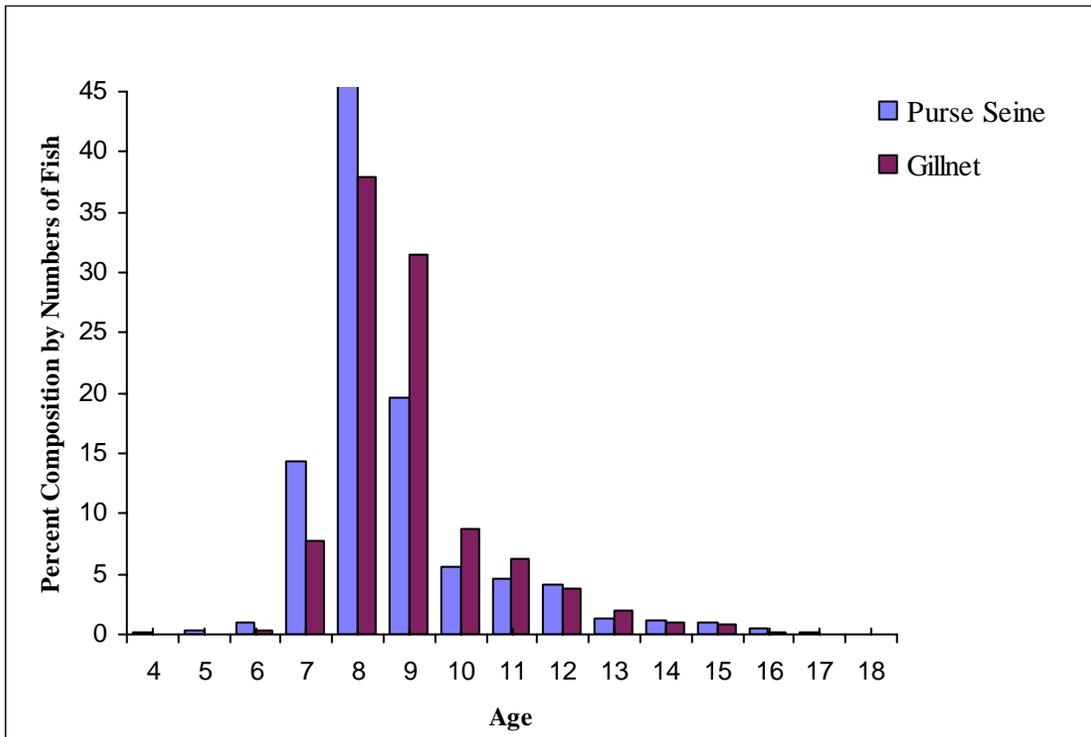
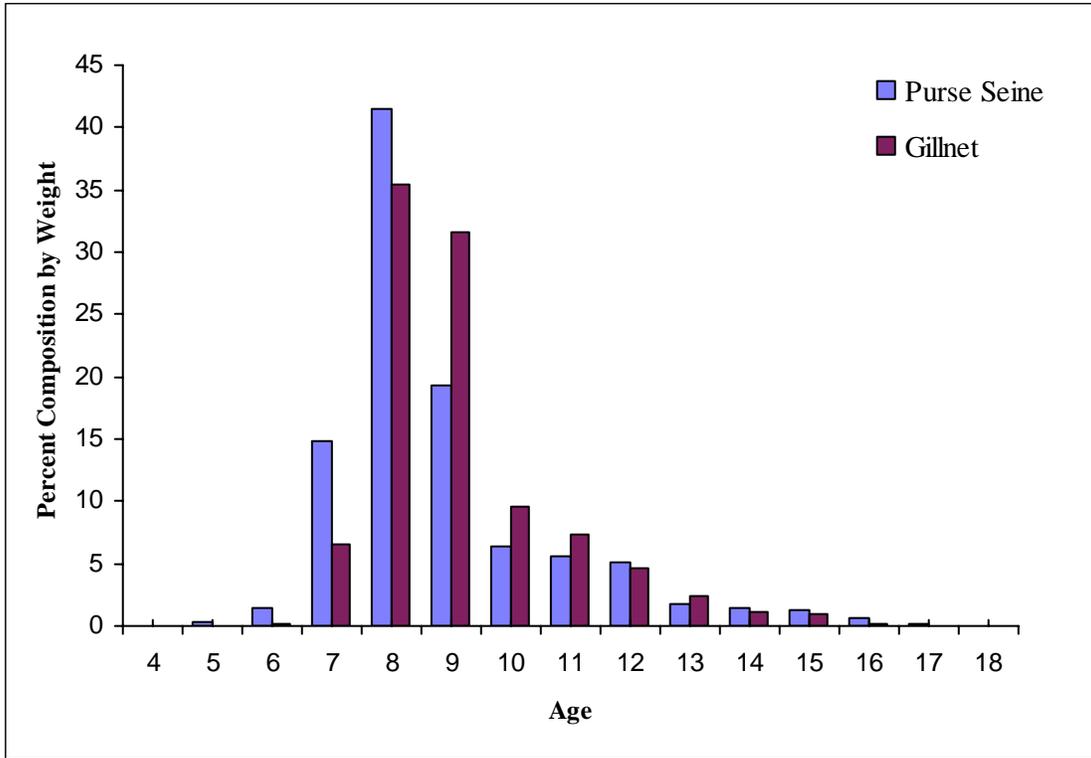


Figure 5.—Percent age composition of the commercial harvest by gear type for weight (top) and for numbers of fish (bottom), Togiak District, 2005.

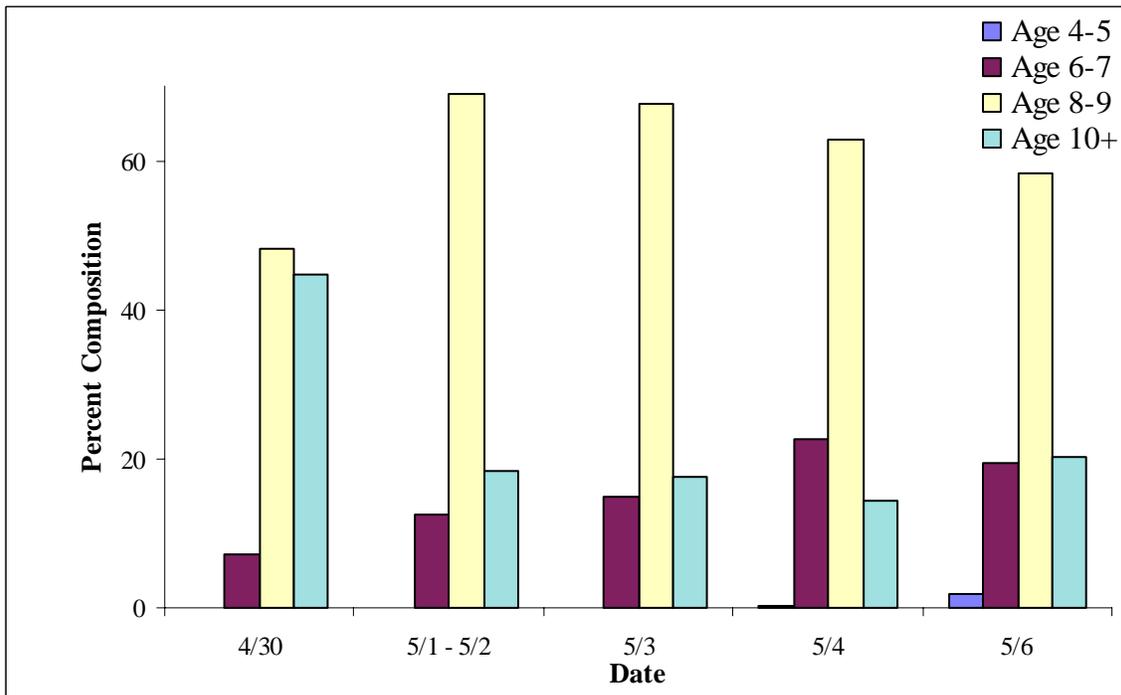
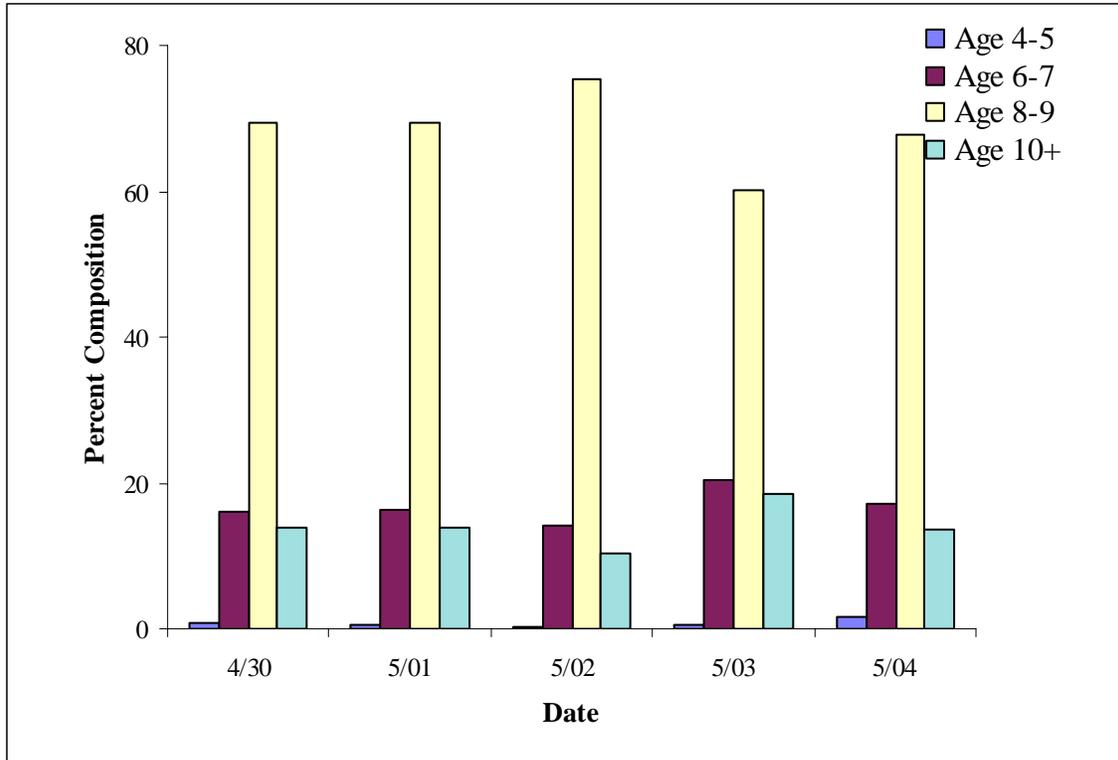
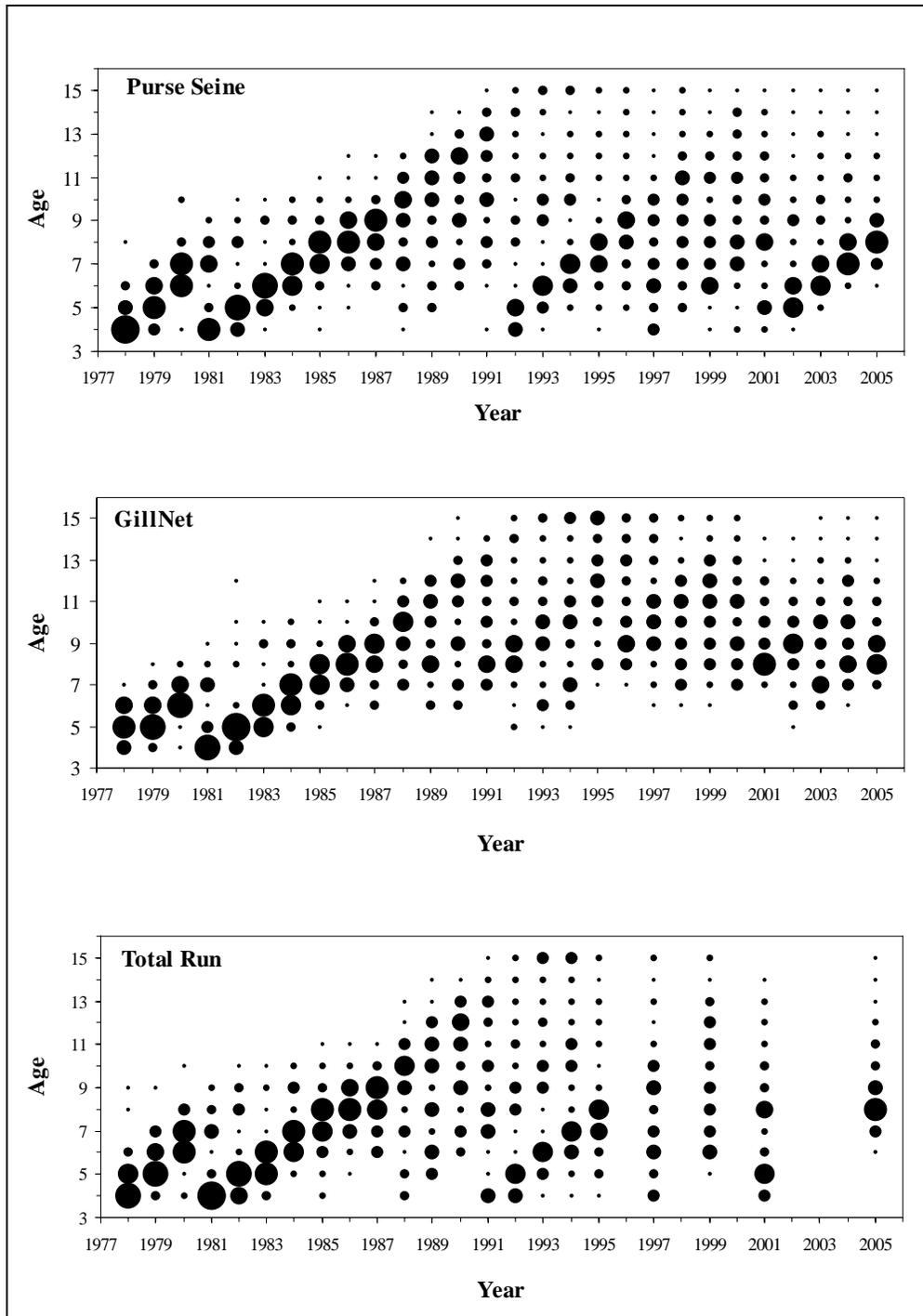


Figure 6.—Age composition of herring samples collected with non-selective gear by sampling period, east Togiak District (Nunavachak and Togiak Sections (top)) and west Togiak District (Cape Newenham, Hagemeister, and Pyrite Point Sections (bottom)), 2005.



Note: Diameter of the circles represents percent age composition, determined by number of fish.

Figure 7.—Historic age composition of the purse seine harvest, gillnet harvest, and total run, Togiak District, Bristol Bay, 1977–2005.

APPENDIX A

Appendix A1.—Estimated age composition of the commercial purse seine harvest, by date and fishing section, Togiak District, 2005.

Sample Date(s): 4/30 Section(s): Hag, Nun Harvest biomass: 5,346.2 (tons)				Sample Date(s): 5/1 Section(s): Hag, Nun Harvest biomass: 592.7 (tons)				Sample Date(s): 5/2 Section(s): Cpn, Hag, Nun, Pyp Harvest biomass: 2,553.8 (tons)				Sample Date(s): 5/3 Section(s): Cpn, Hag, Nun, Pyp Harvest biomass: 1,939.5 (tons)			
Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)
1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0
2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0
3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0
4	1	0.1%	18	4	0	0.0%	0	4	1	0.1%	5	4	0	0.0%	0
5	2	0.3%	36	5	2	0.5%	8	5	1	0.1%	5	5	1	0.3%	16
6	7	1.0%	126	6	5	1.4%	21	6	15	1.2%	76	6	3	1.0%	49
7	73	10.4%	1,315	7	55	14.9%	229	7	156	12.0%	795	7	51	16.7%	831
8	265	37.7%	4,772	8	164	44.4%	683	8	666	51.4%	3,393	8	143	46.9%	2,331
9	145	20.7%	2,611	9	92	24.9%	383	9	261	20.1%	1,330	9	52	17.0%	848
10	45	6.4%	810	10	14	3.8%	58	10	70	5.4%	357	10	22	7.2%	359
11	49	7.0%	882	11	16	4.3%	67	11	42	3.2%	214	11	12	3.9%	196
12	56	8.0%	1,008	12	12	3.3%	50	12	40	3.1%	204	12	12	3.9%	196
13	26	3.7%	468	13	3	0.8%	13	13	9	0.7%	46	13	4	1.3%	65
14	14	2.0%	252	14	2	0.5%	8	14	14	1.1%	71	14	4	1.3%	65
15	11	1.6%	198	15	3	0.8%	13	15	12	0.9%	61	15	1	0.3%	16
16	6	0.9%	108	16	0	0.0%	0	16	6	0.5%	31	16	0	0.0%	0
17	2	0.3%	36	17	0	0.0%	0	17	2	0.2%	10	17	0	0.0%	0
18	0	0.0%	0	18	1	0.3%	4	18	1	0.1%	5	18	0	0.0%	0
Total	702	100.0%	12,642	Total	369	100.0%	1,538	Total	1,296	100.0%	6,603	Total	305	100.0%	4,973
Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)
1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0
2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0
3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0
4	178	0.1%	4	4	0	0.0%	0	4	213	0.0%	1	4	0	0.0%	0
5	472	0.2%	9	5	506	0.4%	2	5	217	0.0%	1	5	221	0.2%	4
6	2,051	0.8%	41	6	1,425	1.1%	7	6	13,633	3.0%	77	6	828	0.8%	15
7	22,847	8.5%	454	7	16,500	12.8%	76	7	83,912	18.5%	471	7	15,307	14.2%	275
8	91,358	33.9%	1,814	8	55,104	42.7%	253	8	198,730	43.7%	1,116	8	47,593	44.1%	855
9	56,598	21.0%	1,123	9	33,672	26.1%	155	9	78,602	17.3%	441	9	19,110	17.7%	343
10	19,404	7.2%	385	10	5,628	4.4%	26	10	27,355	6.0%	154	10	8,866	8.2%	159
11	21,896	8.1%	435	11	6,960	5.4%	32	11	15,046	3.3%	85	11	5,627	5.2%	101
12	26,087	9.7%	518	12	5,160	4.0%	24	12	15,477	3.4%	87	12	6,016	5.6%	108
13	12,113	4.5%	240	13	1,353	1.0%	6	13	5,207	1.1%	29	13	1,898	1.8%	34
14	6,906	2.6%	137	14	894	0.7%	4	14	5,476	1.2%	31	14	1,977	1.8%	36
15	5,403	2.0%	107	15	1,383	1.1%	6	15	6,212	1.4%	35	15	478	0.4%	9
16	2,900	1.1%	58	16	0	0.0%	0	16	3,080	0.7%	17	16	0	0.0%	0
17	1,110	0.4%	22	17	0	0.0%	0	17	1,078	0.2%	6	17	0	0.0%	0
18	0	0.0%	0	18	440	0.3%	2	18	477	0.1%	3	18	0	0.0%	0
Total	269,323	100.0%	5,346	Total	129,025	100.0%	593	Total	454,715	100.0%	2,554	Total	107,921	100.0%	1,940

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Appendix A1.–Page 2 of 2.

Sample Date(s): 5/4 Section(s): Hag, Nun, Pyp Harvest biomass: 2,719.7 (tons)				Sample Date(s): 5/6 Section(s): Hag, Pyp Harvest biomass: 1,716.3 (tons)				Sample Date(s): 4/30 - 5/6 Section(s): Cpn, Hag, Nun, Pyp Harvest biomass: 14,862.2 (tons)			
Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)
1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0
2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0
3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0
4	1	0.1%	10	4	2	0.6%	39	4	5	0.1%	73
5	5	0.7%	50	5	4	1.3%	56	5	15	0.4%	172
6	2	0.3%	20	6	5	1.6%	62	6	37	1.0%	355
7	136	19.8%	1,367	7	55	17.7%	765	7	526	14.3%	5,303
8	336	48.8%	3,378	8	121	39.0%	1,655	8	1,695	46.2%	16,214
9	112	16.3%	1,126	9	60	19.4%	845	9	722	19.7%	7,143
10	32	4.7%	322	10	20	6.5%	270	10	203	5.5%	2,176
11	29	4.2%	292	11	21	6.8%	305	11	169	4.6%	1,955
12	20	2.9%	201	12	9	2.9%	128	12	149	4.1%	1,787
13	5	0.7%	50	13	2	0.6%	29	13	49	1.3%	671
14	5	0.7%	50	14	2	0.6%	27	14	41	1.1%	474
15	3	0.4%	30	15	5	1.6%	71	15	35	1.0%	389
16	1	0.1%	10	16	4	1.3%	69	16	17	0.5%	217
17	1	0.1%	10	17	0	0.0%	0	17	5	0.1%	56
18	0	0.0%	0	18	0	0.0%	0	18	2	0.1%	9
Total	688	100.0%	6,918	Total	310	100.0%	4,322	Total	3,670	100.0%	36,995
Age	Percent by Weight	Percent by Weight	Biomass (tons)	Age	Percent by Weight	Percent by Weight	Biomass (tons)	Age	Percent by Weight	Percent by Weight	Biomass (tons)
1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0
2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0
3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0
4	207	0.1%	2	4	414	0.4%	6	4	1,012	0.1%	13
5	1,099	0.4%	12	5	879	0.8%	13	5	3,394	0.3%	42
6	534	0.2%	6	6	1,335	1.2%	20	6	19,806	1.5%	165
7	40,959	16.7%	454	7	16,564	14.6%	251	7	196,089	14.9%	1,980
8	114,564	46.7%	1,270	8	41,257	36.4%	624	8	548,606	41.6%	5,932
9	43,332	17.7%	480	9	23,214	20.5%	351	9	254,528	19.3%	2,894
10	13,532	5.5%	150	10	8,458	7.5%	128	10	83,243	6.3%	1,002
11	13,861	5.6%	154	11	10,037	8.8%	152	11	73,427	5.6%	958
12	9,818	4.0%	109	12	4,418	3.9%	67	12	66,976	5.1%	912
13	2,409	1.0%	27	13	964	0.8%	15	13	23,944	1.8%	351
14	2,432	1.0%	27	14	973	0.9%	15	14	18,658	1.4%	249
15	1,497	0.6%	17	15	2,495	2.2%	38	15	17,468	1.3%	211
16	614	0.3%	7	16	2,456	2.2%	37	16	9,050	0.7%	119
17	525	0.2%	6	17	0	0.0%	0	17	2,713	0.2%	34
18	0	0.0%	0	18	0	0.0%	0	18	917	0.1%	5
Total	245,383	100.0%	2,720	Total	113,463	100.0%	1,716	Total	1,319,830	100.0%	14,868

Appendix A2.—Estimated age composition of the commercial gillnet harvest, by date and fishing section, Togiak District, 2005.

Sample Date(s): 4/30 Section(s): Kulukak Harvest biomass: 1,460.9 (tons)				Sample Dates: 5/01 Section(s): Kulukak Harvest biomass: 1,181.6 (tons)				Sample Dates: 5/2- 5/3 Section(s): Kulukak Harvest biomass: 1,650.7 (tons)				Sample Dates: 5/4 - 5/8 Section(s): Kulukak, Nunavachak Harvest biomass: 1,547.8 (tons)			
Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)
1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0
2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0
3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0
4	0	0.0%	0	4	0	0.0%	0	4	0	0.0%	0	4	0	0.0%	0
5	0	0.0%	0	5	0	0.0%	0	5	0	0.0%	0	5	0	0.0%	0
6	0	0.0%	0	6	1	0.9%	22	6	1	0.4%	15	6	0	0.0%	0
7	12	9.2%	309	7	10	8.5%	221	7	22	8.6%	332	7	4	3.3%	0
8	51	38.9%	1,312	8	37	31.6%	818	8	104	40.5%	1,570	8	45	37.2%	1,279
9	47	35.9%	1,209	9	34	29.1%	752	9	71	27.6%	1,072	9	45	37.2%	1,279
10	8	6.1%	206	10	12	10.3%	265	10	29	11.3%	438	10	6	5.0%	170
11	6	4.6%	154	11	12	10.3%	265	11	13	5.1%	196	11	8	6.6%	227
12	5	3.8%	129	12	4	3.4%	88	12	10	3.9%	151	12	5	4.1%	142
13	1	0.8%	26	13	4	3.4%	88	13	4	1.6%	60	13	3	2.5%	85
14	0	0.0%	0	14	2	1.7%	44	14	3	1.2%	45	14	1	0.8%	28
15	1	0.8%	26	15	1	0.9%	22	15	0	0.0%	0	15	3	2.5%	85
16	0	0.0%	0	16	0	0.0%	0	16	0	0.0%	0	16	1	0.8%	28
17	0	0.0%	0	17	0	0.0%	0	17	0	0.0%	0	17	0	0.0%	0
18	0	0.0%	0	18	0	0.0%	0	18	0	0.0%	1	18	0	0.0%	0
Total	131	100.0%	3,371	Total	117	100.0%	2,588	Total	257	100.0%	3,881	Total	121	100.0%	3,324
Age	Percent by Weight	Percent by Weight	Biomass (tons)	Age	Percent by Weight	Percent by Weight	Biomass (tons)	Age	Percent by Weight	Percent by Weight	Biomass (tons)	Age	Percent by Weight	Percent by Weight	Biomass (tons)
1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0	1	0	0.0%	0
2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0	2	0	0.0%	0
3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0	3	0	0.0%	0
4	0	0.0%	0	4	0	0.0%	0	4	0	0.0%	0	4	0	0.0%	0
5	0	0.0%	0	5	0	0.0%	0	5	0	0.0%	0	5	0	0.0%	0
6	0	0.0%	0	6	244	0.5%	6	6	294	0.3%	5	6	0	0.0%	0
7	3,984	7.7%	113	7	3,650	7.5%	89	7	7,236	7.3%	120	7	1,388	2.8%	0
8	19,125	37.1%	542	8	14,208	29.3%	346	8	37,474	37.8%	624	8	17,235	34.9%	540
9	18,894	36.7%	536	9	14,246	29.4%	347	9	27,668	27.9%	461	9	17,910	36.2%	561
10	3,576	6.9%	101	10	5,064	10.5%	123	10	12,222	12.3%	203	10	2,874	5.8%	90
11	2,682	5.2%	76	11	5,652	11.7%	138	11	6,045	6.1%	101	11	3,744	7.6%	117
12	2,260	4.4%	64	12	1,936	4.0%	47	12	4,849	4.9%	81	12	2,315	4.7%	73
13	518	1.0%	15	13	1,996	4.1%	49	13	1,902	1.9%	32	13	1,470	3.0%	46
14	0	0.0%	0	14	1,024	2.1%	25	14	1,478	1.5%	25	14	452	0.9%	14
15	469	0.9%	13	15	437	0.9%	11	15	0	0.0%	0	15	1,539	3.1%	48
16	0	0.0%	0	16	0	0.0%	0	16	0	0.0%	0	16	494	1.0%	15
17	0	0.0%	0	17	0	0.0%	0	17	0	0.0%	0	17	0	0.0%	0
18	0	0.0%	0	18	0	0.0%	0	18	0	0.0%	0	18	0	0.0%	0
Total	51,508	100.0%	1,461	Total	48,457	100.0%	1,182	Total	99,168	100.0%	1,651	Total	49,421	100.0%	1,504

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Appendix A2.–Page 2 of 2.

Sample Date(s): 4/30 - 5/8			
Section(s): Kulukak, Nunavachak			
Harvest biomass: 5,841.0 (tons)			
Age	No. of Samples	Percent by No.	No. of fish (x1,000)
1	0	0.0%	0
2	0	0.0%	0
3	0	0.0%	0
4	0	0.0%	0
5	0	0.0%	0
6	2	0.3%	37
7	48	7.7%	862
8	237	37.9%	4,980
9	197	31.5%	4,312
10	55	8.8%	1,080
11	39	6.2%	843
12	24	3.8%	510
13	12	1.9%	260
14	6	1.0%	118
15	5	0.8%	133
16	1	0.2%	28
17	0	0.0%	0
18	0	0.0%	0
Total	626	100.0%	13,164
Age	Weight	Percent by Weight	Biomass (tons)
1	0	0.0%	0
2	0	0.0%	0
3	0	0.0%	0
4	0	0.0%	0
5	0	0.0%	0
6	538	0.2%	11
7	16,258	6.5%	322
8	88,042	35.4%	2,052
9	78,718	31.7%	1,905
10	23,736	9.5%	518
11	18,123	7.3%	432
12	11,360	4.6%	265
13	5,886	2.4%	141
14	2,954	1.2%	64
15	2,445	1.0%	72
16	494	0.2%	15
17	0	0.0%	0
18	0	0.0%	0
Total	248,554	100.0%	5,798

APPENDIX B

Appendix B1.—Age, sex, and size composition of Pacific herring caught by commercial purse seine, Hagemeister Section, 30 April–6 May, 2005.

Sample Dates	Age	Sex (number)				% of Total	Weight				Length		
		Male	Female	Unk.	Total		SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD Measured	
30-Apr	4												
	5												
	6	0	1	0	1	0.3	0.3	341		1	282		1
	7	13	12	0	25	6.9	1.3	311	21.2	25	281	5.5	25
	8	44	55	0	99	27.3	2.3	346	34.9	99	293	7.4	99
	9	42	34	0	76	20.9	2.1	387	39.3	76	304	6.5	76
	10	20	13	0	33	9.1	1.5	432	23.9	33	315	5.6	33
	11	22	13	0	35	9.6	1.5	446	40.6	35	319	7.5	35
	12	20	23	0	43	11.8	1.7	467	39.9	43	324	7.0	43
	13	12	11	0	23	6.3	1.3	466	42.0	23	325	6.6	23
	14	7	5	0	12	3.3	0.9	488	41.0	12	330	5.7	12
15	5	5	0	10	2.8	0.9	491	50.8	10	334	7.6	10	
16	2	2	0	4	1.1	0.5	495	49.5	4	332	7.9	4	
Sample Total		188	175	0	363	100.0		403	67.1	363	308	16.4	363
2-May	4												
	5	1	0	0	1	0.2	0.2	217		1	256		1
	6	1	0	0	1	0.2	0.2	325		1	282		1
	7	37	16	0	53	12.2	1.6	319	28.4	53	282	5.3	53
	8	105	117	0	222	51.2	2.4	354	35.4	222	292	7.7	222
	9	38	40	0	78	18.0	1.8	396	42.6	78	302	8.4	78
	10	9	17	0	26	6.0	1.1	440	41.9	26	310	6.8	26
	11	11	4	0	15	3.5	0.9	454	35.4	15	317	6.8	15
	12	6	12	0	18	4.1	1.0	479	37.7	18	322	7.3	18
	13	1	2	0	3	0.7	0.4	473	14.7	3	323	6.4	3
	14	3	3	0	6	1.4	0.6	518	75.0	6	331	10.4	6
15	1	5	0	6	1.4	0.6	524	48.1	6	335	9.7	6	
16	1	3	0	4	0.9	0.5	526	23.9	4	339	15.4	4	
17	0	1	0	1	0.2	0.2	588		1	338		1	
Sample Total		214	220	0	434	100.0		378	63.1	434	297	14.8	434
3-May	4												
	5												
	6	1	0	0	1	0.6	0.6	228		1	257		1
	7	14	8	0	22	14.3	2.8	299	30.3	22	282	5.8	22
	8	30	48	0	78	50.6	4.0	331	30.8	78	292	6.7	78
	9	9	17	0	26	16.9	3.0	363	33.6	26	301	7.4	26
	10	6	5	0	11	7.1	2.1	393	32.6	11	309	4.7	11
	11	2	3	0	5	3.2	1.4	459	48.8	5	325	7.5	5
	12	3	2	0	5	3.2	1.4	534	61.2	5	333	8.8	5
	13	0	2	0	2	1.3	0.9	470	20.5	2	321	4.9	2
	14	1	2	0	3	1.9	1.1	493	83.0	3	337	11.5	3
15	0	1	0	1	0.6	0.6	478		1	328		1	
16													
17													
Sample Total		66	88	0	154	100.0		352	64.1	154	297	15.0	154

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Appendix B1.–Page 2 of 2.

Sample Dates	Age	Sex (number)				% of Total	Weight				Length		
		Male	Female	Unk.	Total		SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
4-May	4												
	5	1	0	0	1	0.3	0.3	211		1	258		1
	6												
	7	48	35	0	83	22.5	2.2	300	27.6	82	280	6.1	83
	8	85	85	0	170	46.1	2.6	338	35.6	170	291	6.5	170
	9	33	29	0	62	16.8	1.9	386	42.8	62	304	7.1	62
	10	9	9	0	18	4.9	1.1	415	42.3	18	310	6.1	18
	11	7	7	0	14	3.8	1.0	494	39.4	14	322	7.0	14
	12	6	8	0	14	3.8	1.0	493	34.1	14	328	4.2	14
	13	0	2	0	2	0.5	0.4	522	16.3	2	329	12.7	2
	14	1	0	0	1	0.3	0.3	440		1	332		1
	15	2	1	0	3	0.8	0.5	499	88.7	3	334	9.1	3
	16	0	1	0	1	0.3	0.3	614		1	347		1
17													
Sample Total		192	177	0	369	100.0		356	67.0	368	295	15.0	369
6-May	4	2	0	0	2	0.6	0.4	144	17.7	2	235	1.4	2
	5	3	1	0	4	1.3	0.6	215	11.2	4	256	4.3	4
	6	1	4	0	5	1.6	0.7	294	46.8	5	276	8.1	5
	7	35	20	0	55	17.7	2.2	297	32.8	55	281	6.5	55
	8	63	58	0	121	39.0	2.8	342	35.0	121	292	7.0	121
	9	30	30	0	60	19.4	2.2	377	35.4	60	302	6.8	60
	10	12	8	0	20	6.5	1.4	430	36.6	20	313	5.0	20
	11	10	11	0	21	6.8	1.4	452	41.8	21	321	6.9	21
	12	5	4	0	9	2.9	1.0	473	25.8	9	325	7.6	9
	13	2	0	0	2	0.6	0.4	450	31.1	2	317	4.9	2
	14	1	1	0	2	0.6	0.4	503	2.1	2	333	3.5	2
	15	2	3	0	5	1.6	0.7	481	28.4	5	333	3.1	5
	16	2	2	0	4	1.3	0.6	491	41.6	4	330	6.6	4
17													
Sample Total		168	142	0	310	100.0		360	68.0	310	297	16.7	310
30 April- 6 May	4	2	0	0	2	0.1	0.1	144	17.7	2	235	1.4	2
	5	5	1	0	6	0.4	0.2	215	8.9	6	256	3.4	6
	6	3	5	0	8	0.5	0.2	296	48.2	8	275	9.9	8
	7	147	91	0	238	14.6	0.9	304	29.8	237	281	5.9	238
	8	327	363	0	690	42.3	1.2	344	35.6	690	292	7.2	690
	9	152	150	0	302	18.5	1.0	385	40.6	302	303	7.3	302
	10	56	52	0	108	6.6	0.6	427	37.4	108	312	6.2	108
	11	52	38	0	90	5.5	0.6	457	42.8	90	320	7.3	90
	12	40	49	0	89	5.5	0.6	478	41.4	89	325	7.3	89
	13	15	17	0	32	2.0	0.3	469	39.1	32	324	6.9	32
	14	13	11	0	24	1.5	0.3	495	54.1	24	331	7.5	24
	15	10	15	0	25	1.5	0.3	497	49.9	25	334	7.2	25
	16	5	8	0	13	0.8	0.2	512	48.7	13	334	10.8	13
17	1	2	0	3	0.2	0.1	566	41.3	3	341	4.6	3	
All Samples Combined		828	802	0	1,630	100.0		373	68.4	1,629	299	16.3	1,630
Sex Composition		50.8	49.2										
Unaged		67	57	0	124	7.6		390	74	124	303	16.2	124
Sex Composition		54	46										

Appendix B2.—Age, sex, and size composition of Pacific herring caught by commercial purse seine, Nunavachack Section, 30 April–4 May, 2005.

Sample Dates	Age	Sex (number)				% of Total	Weight			Length				
		Male	Female	Unk.	Total		SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
30-Apr	4	0	1	0	1	0.3	0.3	178		1	235		1	
	5	2	0	0	2	0.6	0.4	236	6.4	2	269	2.1	2	
	6	5	1	0	6	1.8	0.7	285	29.0	6	271	5.9	6	
	7	29	19	0	48	14.2	1.9	314	33.3	48	283	5.6	48	
	8	74	92	0	166	49.0	2.7	344	37.1	166	291	7.7	166	
	9	39	30	0	69	20.4	2.2	394	41.8	69	303	9.1	69	
	10	6	6	0	12	3.5	1.0	429	72.7	12	312	14.0	12	
	11	7	7	0	14	4.1	1.1	449	39.6	14	318	6.1	14	
	12	8	5	0	13	3.8	1.0	462	54.4	13	323	7.5	13	
	13	1	2	0	3	0.9	0.5	465	78.1	3	320	11.8	3	
	14	0	2	0	2	0.6	0.4	525	4.2	2	322	4.2	2	
	15	0	1	0	1	0.3	0.3	493		1	337		1	
	16	0	2	0	2	0.6	0.4	460	77.1	2	340	12.0	2	
	17													
	18													
	Sample Total		171	168	0	339	100.0		363	61.6	339	295	14.8	339
	1-May	4												
		5	2	0	0	2	0.5	0.4	253	59.4	2	265	9.2	2
6		2	3	0	5	1.4	0.6	285	13.2	5	277	1.6	5	
7		29	26	0	55	14.9	1.9	300	35.5	55	282	6.2	55	
8		85	79	0	164	44.4	2.6	336	39.8	164	292	8.3	164	
9		44	48	0	92	24.9	2.3	366	44.5	92	300	8.1	92	
10		9	5	0	14	3.8	1.0	402	41.8	14	310	7.5	14	
11		8	8	0	16	4.3	1.1	435	39.3	16	321	6.6	16	
12		7	5	0	12	3.3	0.9	430	47.1	12	321	10.9	12	
13		2	1	0	3	0.8	0.5	451	18.2	3	328	3.8	3	
14		2	0	0	2	0.5	0.4	447	38.2	2	322	5.7	2	
15		2	1	0	3	0.8	0.5	461	31.1	3	333	9.7	3	
16								0.0						
17								0.0						
18		1	0	0	1	0.3	0.3	440		1	336		1	
Sample Total		193	176	0	369	100.0		349	55.8	369	296	13.9	369	
2-May		4	1	0	0	1	0.2	0.2	213		1	258		1
		5						0.0						
	6	4	6	0	10	1.9	0.6	282	38.0	10	274	8.0	10	
	7	44	21	0	65	12.3	1.4	294	29.7	65	281	6.5	65	
	8	150	139	0	289	54.8	2.2	328	38.1	289	291	7.7	289	
	9	56	52	0	108	20.5	1.8	363	43.1	108	301	9.0	108	
	10	8	13	0	21	4.0	0.9	403	43.2	21	311	7.6	21	
	11	6	3	0	9	1.7	0.6	414	53.1	9	315	11.8	9	
	12	9	3	0	12	2.3	0.7	447	48.1	12	322	7.0	12	
	13	1	2	0	3	0.6	0.3	426	19.6	3	325	1.5	3	
	14	1	2	0	3	0.6	0.3	474	32.4	3	329	9.2	3	
	15	0	4	0	4	0.8	0.4	510	28.4	4	334	4.0	4	
	16							0.0						
	17	1	0	0	1	0.2	0.2	490		1	341		1	
	18	0	1	0	1	0.2	0.2	477		1	348		1	
	Sample Total		281	246	0	527	100.0		340	54.6	527	294	13.2	527

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Appendix B2.–Page 2 of 2.

Sample Dates	Age	Sex (number)				% of Total	Weight			Length			
		Male	Female	Unk.	Total		SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
3-May	4												
	5	1	0	0	1	0.7	0.7	221		1	257		1
	6	1	1	0	2	1.3	0.9	300	32.5	2	281	2.1	2
	7	17	12	0	29	19.2	3.2	301	28.2	29	282	6.9	29
	8	38	27	0	65	43.0	4.0	335	32.7	65	292	6.9	65
	9	16	10	0	26	17.2	3.1	372	31.9	26	303	7.2	26
	10	4	7	0	11	7.3	2.1	413	39.2	11	311	7.2	11
	11	4	3	0	7	4.6	1.7	476	60.1	7	318	5.9	7
	12	4	3	0	7	4.6	1.7	478	65.6	7	322	9.2	7
	13	1	1	0	2	1.3	0.9	479	44.5	2	332	7.8	2
	14	0	1	0	1	0.7	0.7	498		1	321		1
	15												
	16												
	17												
	18												
Sample Total		86	65	0	151	100.0		355	64.3	151	296	14.6	151
4-May	4	0	1	0	1	0.3	0.3	207		1	252		1
	5	4	0	0	4	1.3	0.6	222	27.3	4	258	10.0	4
	6	1	1	0	2	0.6	0.4	267	22.6	2	267	0.7	2
	7	32	21	0	53	16.6	2.1	303	30.8	53	280	6.1	53
	8	79	87	0	166	52.0	2.8	344	35.4	166	291	7.1	166
	9	16	34	0	50	15.7	2.0	388	46.2	50	301	8.4	50
	10	2	12	0	14	4.4	1.2	433	37.2	14	313	4.5	14
	11	8	7	0	15	4.7	1.2	463	29.4	15	315	6.3	15
	12	2	4	0	6	1.9	0.8	486	65.1	6	320	7.5	6
	13	1	2	0	3	0.9	0.5	455	43.0	3	328	9.2	3
	14	2	2	0	4	1.3	0.6	498	52.4	4	327	8.8	4
	15												
	16												
	17	1	0	0	1	0.3	0.3	525		1	337		1
	18												
Sample Total		148	171	0	319	100.0		357	62.8	319	294	14.1	319
30 April- 4 May	4	1	2	0	3	0.2	0.1	199	18.7	3	248	11.9	3
	5	9	0	0	9	0.5	0.2	232	30.1	9	262	8.5	9
	6	13	12	0	25	1.5	0.3	283	29.3	25	274	6.7	25
	7	151	99	0	250	14.7	0.9	302	32.3	250	282	6.2	250
	8	426	424	0	850	49.9	1.2	336	37.9	850	291	7.6	850
	9	171	174	0	345	20.2	1.0	374	44.6	345	301	8.6	345
	10	29	43	0	72	4.2	0.5	415	48.0	72	311	8.3	72
	11	33	28	0	61	3.6	0.5	447	45.0	61	317	7.5	61
	12	30	20	0	50	2.9	0.4	456	55.4	50	322	8.3	50
	13	6	8	0	14	0.8	0.2	454	42.2	14	326	7.5	14
	14	5	7	0	12	0.7	0.2	488	41.6	12	325	7.1	12
	15	2	6	0	8	0.5	0.2	489	34.9	8	334	6.0	8
	16	0	2	0	2	0.1	0.1	460	77.1	2	340	12.0	2
	17	2	0	0	2	0.1	0.1	508	24.7	2	339	2.8	2
	18	1	1	0	2	0.1	0.1	459	26.2	2	342	8.5	2
All Samples Combined		879	826	0	1,705	100.0		351	59.3	1,705	295	14.0	1,705
Sex Composition		51.6	48.4										
Unaged		61	68	0	129	7.6		365	70.6	129	298	15.7	129
Sex Composition		47.3	52.7										

Appendix B3.—Age, sex, and size composition of Pacific herring caught by commercial purse seine, Pyrite Point Section, 2 May, 2005.

Sample Dates	Age	Sex (number)				% of Total	SE	Weight			Length		
		Male	Female	Unk.	Total			Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
2-May	6	3	1	0	4	1.2	0.6	276	32.7	4	271	9.6	4
	7	23	15	0	38	11.3	1.7	309	33.2	38	280	5.9	38
	8	82	73	0	155	46.3	2.7	338	34.1	155	291	6.4	155
	9	33	42	0	75	22.4	2.3	370	42.4	75	300	7.3	75
	10	8	15	0	23	6.9	1.4	414	44.8	23	311	5.6	23
	11	9	9	0	18	5.4	1.2	451	48.5	18	319	7.4	18
	12	2	8	0	10	3.0	0.9	497	68.1	10	325	4.9	10
	13	2	1	0	3	0.9	0.5	502	17.8	3	334	3.1	3
	14	2	3	0	5	1.5	0.7	473	38.7	5	326	6.9	5
	15	2	0	0	2	0.6	0.4	514	17.7	2	333	2.1	2
	16	1	1	0	2	0.6	0.4	488	11.3	2	332	0.7	2
All Samples Combined		167	168	0	335	100.0		362	62.5	335	297	14.3	335
Sex Composition		49.9	50.1										
Unaged		13	21	0	34	10.1		390	77.0	34	303	17.4	34
Sex Composition		38.2	61.8										

Appendix B4.—Age, sex, and size composition of Pacific herring caught by commercial purse seine, Hagemeister, Nunavachak, and Pyrite Point Sections, 30 April–6 May, 2005.

Sample Dates	Age	Sex (number)			% of Total	% of Total	Weight			Length				
		Male	Female	Unk.			SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
30-Apr	4	0	1	0	1	0.1	0.1	178		1	235		1	
	5	2	0	0	2	0.3	0.2	236	6.4	2	269	2.1	2	
	6	5	2	0	7	1.0	0.4	293	34.0	7	272	6.9	7	
	7	42	31	0	73	10.4	1.2	313	29.6	73	282	5.6	73	
	8	118	147	0	265	37.7	1.8	345	36.3	265	292	7.7	265	
	9	81	64	0	145	20.7	1.5	390	40.5	145	303	7.8	145	
	10	26	19	0	45	6.4	0.9	431	41.7	45	314	8.6	45	
	11	29	20	0	49	7.0	1.0	446	39.9	49	319	7.1	49	
	12	28	28	0	56	8.0	1.0	466	43.2	56	324	7.0	56	
	13	13	13	0	26	3.7	0.7	466	45.2	26	325	7.2	26	
	14	7	7	0	14	2.0	0.5	493	40.0	14	329	6.0	14	
	15	5	6	0	11	1.6	0.5	491	48.2	11	334	7.3	11	
	16	2	4	0	6	0.9	0.4	483	54.6	6	334	9.1	6	
	17	1	1	0	2	0.3	0.2	555	51.6	2	342	5.7	2	
	18													
	Sample Total		359	343	0	702	100.0		384	67.5	702	302	16.9	702
	1-May	4												
		5	2	0	0	2	0.5	0.4	253	59.4	2	265	9.2	2
6		2	3	0	5	1.4	0.6	285	13.2	5	277	1.6	5	
7		29	26	0	55	14.9	1.9	300	35.5	55	282	6.2	55	
8		85	79	0	164	44.4	2.6	336	39.8	164	292	8.3	164	
9		44	48	0	92	24.9	2.3	366	44.5	92	300	8.1	92	
10		9	5	0	14	3.8	1.0	402	41.8	14	310	7.5	14	
11		8	8	0	16	4.3	1.1	435	39.3	16	321	6.6	16	
12		7	5	0	12	3.3	0.9	430	47.1	12	321	10.9	12	
13		2	1	0	3	0.8	0.5	451	18.2	3	328	3.8	3	
14		2	0	0	2	0.5	0.4	447	38.2	2	322	5.7	2	
15		2	1	0	3	0.8	0.5	461	31.1	3	333	9.7	3	
16														
17														
18		1	0	0	1	0.3	0.3	440		1	336		1	
Sample Total			193	176	0	369	100.0		349	55.8	369	296	13.9	369
2-May		4	1	0	0	1	0.1	0.1	213		1	258		1
		5	1	0	0	1	0.1	0.1	217		1	256		1
	6	8	7	0	15	1.2	0.3	283	36.0	15	274	8.2	15	
	7	104	52	0	156	12.0	0.9	306	31.9	156	281	5.9	156	
	8	337	329	0	666	51.4	1.4	339	38.0	666	291	7.4	666	
	9	127	134	0	261	20.1	1.1	375	44.9	261	301	8.4	261	
	10	25	45	0	70	5.4	0.6	420	45.5	70	311	6.6	70	
	11	26	16	0	42	3.2	0.5	444	46.9	42	318	8.3	42	
	12	17	23	0	40	3.1	0.5	474	52.1	40	323	6.7	40	
	13	4	5	0	9	0.7	0.2	467	36.2	9	327	6.4	9	
	14	6	8	0	14	1.1	0.3	493	57.6	14	328	8.6	14	
	15	3	9	0	12	0.9	0.3	517	36.6	12	334	7.0	12	
	16	2	4	0	6	0.5	0.2	513	27.3	6	337	12.5	6	
	17	1	1	0	2	0.2	0.1	539	69.3	2	340	2.1	2	
	18	0	1	0	1	0.1	0.1	477		1	348		1	
	Sample Total		662	634	0	1,296	100.0		359	61.8	1,296	296	14.1	1,296

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Sample Dates	Age	Sex (number)			% of Total	% of Total	Weight			Length				
		Male	Female	Unk.			SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
3-May	4													
	5	1	0	0	1	0.3	0.3	221		1	257		1	
	6	2	1	0	3	1.0	0.6	276	47.5	3	273	13.7	3	
	7	31	20	0	51	16.7	2.1	300	28.9	51	282	6.4	51	
	8	68	75	0	143	46.9	2.9	333	31.6	143	292	6.8	143	
	9	25	27	0	52	17.0	2.2	367	32.7	52	302	7.3	52	
	10	10	12	0	22	7.2	1.5	403	36.7	22	310	6.1	22	
	11	6	6	0	12	3.9	1.1	469	54.0	12	321	7.0	12	
	12	7	5	0	12	3.9	1.1	501	67.5	12	327	10.3	12	
	13	1	3	0	4	1.3	0.6	474	28.8	4	326	8.3	4	
	14	1	3	0	4	1.3	0.6	495	67.8	4	333	12.3	4	
	15	0	1	0	1	0.3	0.3	478		1	328		1	
	16													
	17													
18														
Sample Total		152	153	0	305	100.0		354	64.1	305	296	14.7	305	
4-May	4	0	1	0	1	0.1	0.1	207		1	252		1	
	5	5	0	0	5	0.7	0.3	220	24.2	5	258	8.7	5	
	6	1	1	0	2	0.3	0.2	267	22.6	2	267	0.7	2	
	7	80	56	0	136	19.8	1.5	301	28.8	135	280	6.1	136	
	8	164	172	0	336	48.8	1.9	341	35.6	336	291	6.8	336	
	9	49	63	0	112	16.3	1.4	387	44.2	112	303	7.8	112	
	10	11	21	0	32	4.7	0.8	423	40.6	32	311	5.6	32	
	11	15	14	0	29	4.2	0.8	478	37.5	29	318	7.5	29	
	12	8	12	0	20	2.9	0.6	491	43.9	20	326	6.4	20	
	13	1	4	0	5	0.7	0.3	482	48.1	5	328	9.1	5	
	14	3	2	0	5	0.7	0.3	486	52.2	5	328	7.9	5	
	15	2	1	0	3	0.4	0.2	499	88.7	3	334	9.1	3	
	16	0	1	0	1	0.1	0.1	614		1	347		1	
	17	1	0	0	1	0.1	0.1	525		1	337		1	
18														
Sample Total		340	348	0	688	100.0		357	65.0	687	295	14.6	688	
6-May	4	2	0	0	2	0.6	0.4	144	17.7	2	235	1.4	2	
	5	3	1	0	4	1.3	0.6	215	11.2	4	256	4.3	4	
	6	1	4	0	5	1.6	0.7	294	46.8	5	276	8.1	5	
	7	35	20	0	55	17.7	2.2	297	32.8	55	281	6.5	55	
	8	63	58	0	121	39.0	2.8	342	35.0	121	292	7.0	121	
	9	30	30	0	60	19.4	2.2	377	35.4	60	302	6.8	60	
	10	12	8	0	20	6.5	1.4	430	36.6	20	313	5.0	20	
	11	10	11	0	21	6.8	1.4	452	41.8	21	321	6.9	21	
	12	5	4	0	9	2.9	1.0	473	25.8	9	325	7.6	9	
	13	2	0	0	2	0.6	0.4	450	31.1	2	317	4.9	2	
	14	1	1	0	2	0.6	0.4	503	2.1	2	333	3.5	2	
	15	2	3	0	5	1.6	0.7	481	28.4	5	333	3.1	5	
	16	2	2	0	4	1.3	0.6	491	41.6	4	330	6.6	4	
	17													
18														
Sample Total		168	142	0	310	100.0		360	68.0	310	297	16.7	310	

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Sample Dates	Age	Sex (number)				% of Total	Weight			Length				
		Male	Female	Unk.	Total		SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
30 April- 6 May	4	3	2	0	5	0.1	0.1	177	34.5	5	243	11.2	5	
	5	14	1	0	15	0.4	0.1	225	24.9	15	259	7.3	15	
	6	19	18	0	37	1.0	0.2	285	33.9	37	274	7.6	37	
	7	321	205	0	526	14.3	0.6	304	31.2	525	281	6.1	526	
	8	835	860	0	1,695	46.2	0.8	340	36.8	1,695	292	7.3	1,695	
	9	356	366	0	722	19.7	0.7	378	43.1	722	302	8.0	722	
	10	93	110	0	203	5.5	0.4	421	42.5	203	312	7.0	203	
	11	94	75	0	169	4.6	0.3	452	44.2	169	319	7.4	169	
	12	72	77	0	149	4.1	0.3	472	49.7	149	324	7.6	149	
	13	23	26	0	49	1.3	0.2	467	40.2	49	325	7.2	49	
	14	20	21	0	41	1.1	0.2	491	48.6	41	329	7.7	41	
	15	14	21	0	35	1.0	0.2	497	45.3	35	334	6.7	35	
	16	6	11	0	17	0.5	0.1	503	49.9	17	335	10.0	17	
	17	3	2	0	5	0.1	0.1	542	45.0	5	340	3.7	5	
	18	1	1	0	2	0.1	0.1	459	26.2	2	342	8.5	2	
	All Samples Combined		1,874	1,796	0	3,670	100.0		362	64.6	3,669	297	15.2	3,670
	Sex Composition		51.1	48.9										
	Unaged		141	146	0	287	7.8		379	73.6	287	301	16.3	287
Sex Composition		49.1	50.9											

Appendix B5.—Age, sex, and size composition of Pacific herring caught by commercial gillnet, Kulukak Section, 30 April–4 May, 2005.

Sample Dates	Age	Sex (number)				% of Total	Weight			Length				
		Male	Female	Unk.	Total		SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
30-Apr	6													
	7	5	7	0	12	9.2	2.5	332	23.2	12	285	6.6	12	
	8	18	33	0	51	38.9	4.3	375	34.2	51	297	8.0	51	
	9	19	28	0	47	35.9	4.2	402	40.3	47	304	7.4	47	
	10	3	5	0	8	6.1	2.1	447	20.4	8	313	2.9	8	
	11	2	4	0	6	4.6	1.8	447	33.9	6	316	6.3	6	
	12	4	1	0	5	3.8	1.7	452	49.8	5	324	5.0	5	
	13	0	1	0	1	0.8	0.8	518		1	327		1	
	14													
	15	1	0	0	1	0.8	0.8	469		1	331		1	
16														
Sample Total		52	79	0	131	100.0		393	48.1	131	301	11.7	131	
1-May	6	0	1	0	1	0.9	0.9	244		1	275		1	
	7	2	8	0	10	8.5	2.6	365	36.1	10	285	9.2	10	
	8	14	23	0	37	31.6	4.3	384	34.4	37	296	7.7	37	
	9	6	28	0	34	29.1	4.2	419	28.7	34	305	7.8	34	
	10	6	6	0	12	10.3	2.8	422	21.4	12	311	4.6	12	
	11	2	10	0	12	10.3	2.8	471	54.0	12	317	5.2	12	
	12	3	1	0	4	3.4	1.7	484	54.0	4	324	7.4	4	
	13	2	2	0	4	3.4	1.7	499	23.3	4	329	11.3	4	
	14	0	2	0	2	1.7	1.2	512	31.8	2	329	7.1	2	
	15	0	1	0	1	0.9	0.9	437		1	309		1	
16														
Sample Total		35	82	0	117	100.0		414	52.8	117	304	13.5	117	
2-May	6													
	7	3	7	0	10	7.6	2.3	312	30.6	10	280	4.3	10	
	8	26	28	0	54	40.9	4.3	356	34.2	54	293	7.9	54	
	9	19	18	0	37	28.0	3.9	394	33.8	37	304	5.8	37	
	10	7	9	0	16	12.1	2.8	421	28.9	16	310	4.8	16	
	11	3	5	0	8	6.1	2.1	455	29.2	8	317	6.2	8	
	12	0	3	0	3	2.3	1.3	522	25.7	3	329	3.5	3	
	13	0	3	0	3	2.3	1.3	472	56.4	3	329	8.6	3	
	14	0	1	0	1	0.8	0.8	524		1	330		1	
	15													
16														
Sample Total		58	74	0	132	100.0		385	55.0	132	301	13.0	132	

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Sample Dates	Age	Sex (number)			% of Total	% of Total	Weight			Length				
		Male	Female	Unk.			SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
3-May	6	0	1	0	1	0.8	0.8	294		1	268		1	
	7	5	7	0	12	9.6	2.6	343 17.4		12	284 3.4		12	
	8	31	19	0	50	40.0	4.4	365 33.3		50	292 5.7		50	
	9	16	18	0	34	27.2	4.0	385 33.5		34	301 6.3		34	
	10	7	6	0	13	10.4	2.7	422 44.7		13	312 9.8		13	
	11	1	4	0	5	4.0	1.8	481 54.6		5	314 9.7		5	
	12	2	5	0	7	5.6	2.1	469 36.6		7	321 6.7		7	
	13	1	0	0	1	0.8	0.8	486		1	330		1	
	14	2	0	0	2	1.6	1.1	477 25.5		2	337 7.8		2	
	15													
	16													
Sample Total		65	60	0	125	100.0		387 51.5		125	299 13.3		125	
4-May	6													
	7	1	3	0	4	3.3	1.6	347 18.4		4	281 7.7		4	
	8	15	30	0	45	37.2	4.4	383 30.1		45	295 7.0		45	
	9	13	32	0	45	37.2	4.4	398 27.8		45	303 7.0		45	
	10	1	5	0	6	5.0	2.0	479 49.2		6	316 7.4		6	
	11	4	4	0	8	6.6	2.3	468 38.3		8	319 8.2		8	
	12	3	2	0	5	4.1	1.8	463 33.4		5	320 3.9		5	
	13	1	2	0	3	2.5	1.4	490 14.0		3	328 4.6		3	
	14	1	0	0	1	0.8	0.8	452		1	328		1	
	15	2	1	0	3	2.5	1.4	513 70.5		3	341 8.1		3	
	16	0	1	0	1	0.8	0.8	494		1	341		1	
Sample Total		41	80	0	121	100.0		408 49.8		121	304 13.8		121	
30 April- 4 May	6	0	2	0	2	0.3	0.2	269 35.4		2	272 4.9		2	
	7	16	32	0	48	7.7	1.1	339 31.0		48	283 6.3		48	
	8	104	133	0	237	37.9	1.9	372 34.7		237	294 7.5		237	
	9	73	124	0	197	31.5	1.9	400 34.6		197	303 7.0		197	
	10	24	31	0	55	8.8	1.1	432 37.6		55	312 6.4		55	
	11	12	27	0	39	6.2	1.0	465 43.1		39	317 6.7		39	
	12	12	12	0	24	3.8	0.8	473 43.2		24	323 5.9		24	
	13	4	8	0	12	1.9	0.5	491 31.0		12	329 7.3		12	
	14	3	3	0	6	1.0	0.4	492 33.2		6	332 6.1		6	
	15	3	2	0	5	0.8	0.4	489 60.7		5	332 14.9		5	
	16	0	1	0	1	0.2	0.2	494		1	341		1	
All Samples Combined		251	375	0	626	100.0		397 52.7		626	302 13.1		626	
Sex Composition		40.1	59.9											
Unaged		38	46	0	84	13.4		415 48.0		84	306 11.6		84	
Sex Composition		45.2	54.8											

Appendix B7.—Age, sex, and size composition of Pacific herring caught by test commercial purse seine, Nunavachak Section, 28 April–29 April, 2005.

Sample Dates	Age	Sex (number)			% of Total	% of Total	Weight			Length			
		Male	Female	Unk.			SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
28-Apr	7	1	3	0	4	3.1	1.5	379	58.5	4	299	9.8	4
	8	29	20	0	49	38.0	4.3	338	40.6	49	291	8.2	49
	9	14	10	0	24	18.6	3.4	376	42.7	24	301	9.9	24
	10	4	3	0	7	5.4	2.0	426	53.1	7	313	10.2	7
	11	11	3	0	14	10.9	2.8	458	31.4	14	322	6.5	14
	12	5	10	0	15	11.6	2.8	468	27.6	15	321	8.2	15
	13	5	3	0	8	6.2	2.1	468	37.6	8	324	3.6	8
	14	1	3	0	4	3.1	1.5	475	26.9	4	330	11.8	4
	15	0	2	0	2	1.6	1.1	523	8.5	2	341	0.7	2
	16	0	1	0	1	0.8	0.8	574		1	337		1
17	0	1	0	1	0.8	0.8	501		1	330		1	
Sample Total		70	59	0	129	100.0		397	70.5	129	306	16.7	129
29-Apr	7	2	0	0	2	1.6	1.1	337	14.1	2	289	0.7	2
	8	29	18	0	47	38.5	4.4	343	35.5	47	292	8.5	47
	9	19	15	0	34	27.9	4.1	381	39.3	34	302	6.8	34
	10	5	2	0	7	5.7	2.1	414	52.5	7	312	12.0	7
	11	3	7	0	10	8.2	2.5	460	35.8	10	320	6.9	10
	12	7	4	0	11	9.0	2.6	505	41.5	11	328	9.0	11
	13	4	2	0	6	4.9	2.0	500	30.4	6	329	8.1	6
	14	0	2	0	2	1.6	1.1	529	12.7	2	338	6.4	2
	15	0	1	0	1	0.8	0.8	531		1	328		1
	16	0	1	0	1	0.8	0.8	565		1	343		1
17	0	1	0	1	0.8	0.8	482		1	337		1	
Sample Total		69	53	0	122	100.0		397	72.6	122	305	16.5	122
28-29 April	7	3	3	0	6	2.4	1.0	365	50.5	6	295	9.2	6
	8	58	38	0	96	38.2	3.1	340	38.1	96	292	8.3	96
	9	33	25	0	58	23.1	2.7	379	40.5	58	301	8.1	58
	10	9	5	0	14	5.6	1.5	420	51.1	14	313	10.7	14
	11	14	10	0	24	9.6	1.9	459	32.5	24	321	6.6	24
	12	12	14	0	26	10.4	1.9	484	38.3	26	324	9.0	26
	13	9	5	0	14	5.6	1.5	482	37.3	14	326	6.2	14
	14	1	5	0	6	2.4	1.0	493	35.2	6	332	10.4	6
	15	0	3	0	3	1.2	0.7	526	7.6	3	336	7.2	3
	16	0	2	0	2	0.8	0.6	570	6.4	2	340	4.2	2
17	0	2	0	2	0.8	0.6	492	13.4	2	334	4.9	2	
All Samples Combined		139	112	0	251	100.0		397	71.4	251	305	16.6	251
Sex Composition		55.4	44.6										
Unaged		12	7	0	19	7.6		418	52.8	19	309	14.9	19
Sex Composition		63.2	36.8										

Appendix B8.—Age, sex, and size composition of Pacific herring caught by test commercial purse seine, Togiak Section, 28 April–29 April, 2005.

Sample Dates	Age	Sex (number)				% of Total	Weight			Length			
		Male	Female	Unk.	Total		SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
28-Apr	5												
	6												
	7	1	0	0	1	1.6	1.6	276		1	274		1
	8	8	6	0	14	23.0	5.4	380	43.5	14	299	8.3	14
	9	13	7	0	20	32.8	6.1	403	51.0	20	305	9.3	20
	10	1	2	0	3	4.9	2.8	440	46.9	3	314	10.2	3
	11	1	3	0	4	6.6	3.2	494	55.8	4	327	8.8	4
	12	5	4	0	9	14.8	4.6	489	34.2	9	325	6.3	9
	13	0	2	0	2	3.3	2.3	547	55.2	2	333	8.5	2
	14	1	3	0	4	6.6	3.2	479	51.2	4	330	12.1	4
	15	1	1	0	2	3.3	2.3	549	40.3	2	329	2.1	2
16	1	0	0	1	1.6	1.6	494		1	326		1	
17	1	0	0	1	1.6	1.6	455		1	345		1	
Sample Total		33	28	0	61	100.0		433	70.7	61	312	15.7	61
29-Apr	5	1	0	0	1	1.2	1.2	212		1	253		1
	6												
	7	5	2	0	7	8.1	3.0	306	54.9	7	284	12.7	7
	8	23	9	0	32	37.2	5.2	314	37.6	32	285	8.3	32
	9	8	10	0	18	20.9	4.4	376	56.3	18	300	9.5	18
	10	4	2	0	6	7.0	2.8	385	79.1	6	312	17.2	6
	11	3	5	0	8	9.3	3.2	436	54.5	8	319	6.0	8
	12	3	4	0	7	8.1	3.0	468	51.3	7	322	8.4	7
	13												
	14	1	2	0	3	3.5	2.0	485	59.2	3	326	17.1	3
	15	1	1	0	2	2.3	1.6	481	18.4	2	326	0.0	2
16	0	1	0	1	1.2	1.2	528		1	354		1	
17	1	0	0	1	1.2	1.2	456		1	341		1	
Sample Total		50	36	0	86	100.0		368	80.2	86	300	19.9	86
28-29 April	5	1	0	0	1	0.7	0.7	212		1	253		1
	6												
	7	6	2	0	8	5.4	1.9	302	52.0	8	282	12.2	8
	8	31	15	0	46	31.3	3.8	334	49.8	46	290	10.3	46
	9	21	17	0	38	25.9	3.6	390	54.7	38	303	9.7	38
	10	5	4	0	9	6.1	2.0	403	72.2	9	313	14.5	9
	11	4	8	0	12	8.2	2.3	455	59.7	12	322	7.7	12
	12	8	8	0	16	10.9	2.6	480	42.3	16	324	7.1	16
	13	0	2	0	2	1.4	1.0	547	55.2	2	333	8.5	2
	14	2	5	0	7	4.8	1.8	482	49.8	7	328	13.2	7
	15	2	2	0	4	2.7	1.3	515	46.6	4	327	1.9	4
16	1	1	0	2	1.4	1.0	511	24.0	2	340	19.8	2	
17	2	0	0	2	1.4	1.0	456	0.7	2	343	2.8	2	
All Samples Combined		83	64	0	147	100.0		395	82.7	147	305	19.2	147
Sex Composition		56.5	43.5										
Unaged		7	11	0	18	12.2		418	88.9	18	310	20.9	18
Sex Composition		38.9	61.1										

Appendix B9.—Age, sex, and size composition of Pacific herring caught by test commercial purse seine, Hagemeister, Nunavachak, and Togiak Sections, 28 April–29 April, 2005.

Sample Dates	Age	Sex (number)			% of Total	% of Total	Weight			Length			
		Male	Female	Unk.			Mean SE	SD	Number Weighed	Mean (mm)	SD	Number Measured	
28-Apr	5												
	6	0	1	0	1	0.4	0.4	271		1	270		1
	7	2	4	0	6	2.5	1.0	354	61.9	6	292	13.2	6
	8	52	33	0	85	35.7	3.1	346	42.3	85	293	8.5	85
	9	34	19	0	53	22.3	2.7	386	48.7	53	302	9.7	53
	10	5	6	0	11	4.6	1.4	426	48.4	11	313	9.2	11
	11	13	12	0	25	10.5	2.0	477	41.8	25	324	6.8	25
	12	11	17	0	28	11.8	2.1	478	31.6	28	322	7.6	28
	13	5	5	0	10	4.2	1.3	484	50.4	10	326	5.7	10
	14	3	6	0	9	3.8	1.2	482	37.9	9	329	10.4	9
	15	1	4	0	5	2.1	0.9	529	28.8	5	333	6.8	5
	16	1	1	0	2	0.8	0.6	534	56.6	2	332	7.8	2
	17	2	1	0	3	1.3	0.7	489	29.5	3	336	7.8	3
Sample Total		129	109	0	238	100.0		406	74.1	238	307	16.8	238
29-Apr	5	1	0	0	1	0.5	0.5	212		1	253		1
	6												
	7	7	2	0	9	4.3	1.4	313	49.7	9	285	11.2	9
	8	52	27	0	79	38.0	3.4	331	38.9	79	289	9.0	79
	9	27	25	0	52	25.0	3.0	379	45.4	52	301	7.8	52
	10	9	4	0	13	6.3	1.7	400	64.8	13	312	14.0	13
	11	6	12	0	18	8.7	2.0	449	45.4	18	320	6.4	18
	12	10	8	0	18	8.7	2.0	491	47.8	18	326	9.0	18
	13	4	2	0	6	2.9	1.2	500	30.4	6	329	8.1	6
	14	1	4	0	5	2.4	1.1	502	48.8	5	331	14.0	5
15	1	2	0	3	1.4	0.8	498	31.7	3	327	1.2	3	
16	0	2	0	2	1.0	0.7	547	26.2	2	349	7.8	2	
17	1	1	0	2	1.0	0.7	469	18.4	2	339	2.8	2	
Sample Total		119	89	0	208	100.0		385	77.0	208	303	18.1	208
28-29 April	5	1	0	0	1	0.2	0.2	212		1	253		1
	6	0	1	0	1	0.2	0.2	271		1	270		1
	7	9	6	0	15	3.4	0.9	329	56.7	15	288	12.1	15
	8	104	60	0	164	36.8	2.3	339	41.3	164	291	8.9	164
	9	61	44	0	105	23.5	2.0	383	47.0	105	302	8.8	105
	10	14	10	0	24	5.4	1.1	412	58.2	24	313	11.8	24
	11	19	24	0	43	9.6	1.4	466	45.1	43	322	6.9	43
	12	21	25	0	46	10.3	1.4	483	38.8	46	323	8.3	46
	13	9	7	0	16	3.6	0.9	490	43.6	16	327	6.6	16
	14	4	10	0	14	3.1	0.8	489	41.5	14	330	11.3	14
	15	2	6	0	8	1.8	0.6	517	31.9	8	331	6.2	8
	16	1	3	0	4	0.9	0.4	540	36.7	4	340	11.7	4
	17	3	2	0	5	1.1	0.5	481	25.2	5	337	5.9	5
All Samples Combined		248	198	0	446	100.0		396	76.1	446	305	17.5	446
Sex Composition		55.6	44.4										
Unaged		19	20	0	39	8.7		422	72.5	39	310	17.6	39
Sex Composition		48.7	51.3										

APPENDIX C



**ALASKA DEPARTMENT OF
FISH & GAME**
COMMERCIAL FISHERIES DIVISION
MEMORANDUM

TO: Distribution

DATE: January 10, 2005

FAX NO: 267-2442

FROM: Frederick West
Fishery Biologist
Central Region

TELEPHONE NO: 267-2237
SUBJECT: 2005 Togiak Herring
Forecast and Summary

The 2005 Togiak herring forecast and harvest allocation is listed below for the Togiak District sac roe fishery and the Dutch Harbor food and bait fishery, given a maximum 20% exploitation rate of the projected run biomass:

*Harvest Allocation of the 2005 Forecasted Pacific
Herring Run Biomass, Togiak District, Bristol Bay*

	Biomass (Short Tons)	Harvest (Short Tons)
Forecasted Biomass for 2005		96,029
Exploitation @ maximum 20% for Total Allowable Harvest		19,206
Togiak Spawn-on-Kelp Fishery (Fixed Allocation)		1,500
Remaining Allowable Harvest		17,706

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Dutch Harbor Food/Bait Allocation (7.0% of the remaining allocation)	1,239
Remaining Allowable Harvest for Togiak District Sac Roe Fishery:	16,467
Purse Seine Allocation 70.0%	11,527
Gill Net Allocation 30.0%	4,940

Distribution:

Region II: Baker, Brazil, Fair, Gray, Higgins, Morstad, Regnart, Sands, and Weiland

Region III: Bergstrom, Brannian, Hilsinger, Kohler, Lingnau, Menard, Salomone, Sandone, and Whitmore

Region IV: Bowers, Burkey, Lloyd, McCullough, Murphy, Nelson, Shaul, and Witteveen

HQ: Mecum, Bruce, Clark, and Savikko

2005 TOGIAK HERRING FORECAST SUMMARY

Poor weather conditions throughout the herring fishery in 2004 prevented an accurate aerial assessment of the total run biomass. Therefore, inseason management was based on the preseason forecast of 143,124 tons. Herring were first reported in the district on April 22, when approximately 13 tons were documented on the east side of Tongue Point. The first substantial biomass was observed on April 25 with a majority of the estimated 20,000 tons concentrating in Togiak and Kulukak Bays. Poor visibility and weather conditions only allowed sporadic surveys until May 3 when the peak estimate of 34,607 tons was observed. Poor weather conditions continued to hamper aerial biomass estimates for the remainder of the season and the last survey on May 25 only observed approximately 154 tons. It is uncertain whether herring spawned less, spawned deeper, or spawn was just mixed in turbid water, but observations of herring spawn were down in 2004 with only 36 linear miles as compared to the recent 10 year average of 54 miles.

A temporal change in age composition from older to younger herring is typically observed in the fishery but age-7, -8, and -11 herring predominated throughout. This may signify that the new recruit classes of herring are weak or that these age classes did not arrive during the commercial fishery. Post-fishery sampling no longer occurs as it did in the 1980s so younger fish, which typically make up the tail end of the run are often undetected. Poor weather and visibility prevented surveys during the latter portion of the harvest and during the post-season aerial surveys. No surveys were conducted between May 7 and May 20 contributing to the difficulty of assessing the younger age classes, age-4 and -5 herring.

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Age-structured analysis (ASA) has been used since 1993 to forecast the Togiak herring population. This methodology estimates population abundance using catch and age composition data in conjunction with biomass estimates selected from the best aerial survey years.

Samples from non-selective gear (commercial purse seine and test purse seine) were used to assess the age composition of the run biomass. Commercial purse seine catch and test fish samples ranged from age-4 to age-17. Age-8 and age-7 herring were the most prevalent and represented 61% of the harvest biomass and 68% of the abundance. Age-11 herring followed with 9% of the biomass and 7% of the abundance.

Inclement weather conditions and poor visibility has plagued the herring fishery in recent years preventing an accurate aerial biomass estimate since 1999 to confirm the strength of the total run biomass. Therefore, we took a conservative approach in forecasting the 2005 biomass. The 2001 total run biomass estimate was determined to be high and was reduced from 146,000 tons to 115,000 tons in the model. Staff felt the recruit classes of herring were not abundant as expected in subsequent returns. This change lowered the historical biomass estimates, which resulted in a reduced 2005 forecast.

The forecasted herring biomass for the Togiak District in 2005 is 96,029 tons. Returns from the 1996, and 1997-year classes (ages-9, and-8, respectively) are expected to dominate with 66% of the biomass and 61% of the abundance in numbers of fish (Figure 1). Age-4 herring from year class 2001 are expected to follow in magnitude with 9% of the biomass and 17% of the abundance. A Ricker stock-recruitment model with an environmental variable of Southeast Bering Sea surface temperature was used to forecast the 2005 age-4 abundance. The forecasted return of age-4 and -5 herring are more uncertain than other ages because of the limited sample size of age-4 fish, and because new recruits are not confirmed until they return as age-5 herring. Age-12 herring from year class 1993 are also expected to abound with 7% of the biomass and 4% of the abundance. The forecasted individual average weight of the harvest biomass is 334 g. Simple linear regression models were used to forecast the weight of each age class based on their weights the previous year.

Biomass of the Togiak herring spawning population has been estimated with aerial surveys since the late 1970's, concurrent with the development of the sac-roe fishery. Peak biomass was observed during the 1986 and 1987 seasons when the large classes from brood years 1977 and 1978 fully recruited into the spawning population as age-8 herring. The 1977 and 1978 year classes dwarfed the magnitude of subsequent year classes. Modest recruitment events were evident in the 1987, 1988, 1996 and 1997 year classes.

Frederick West
Bristol Bay Research Biologist
Anchorage

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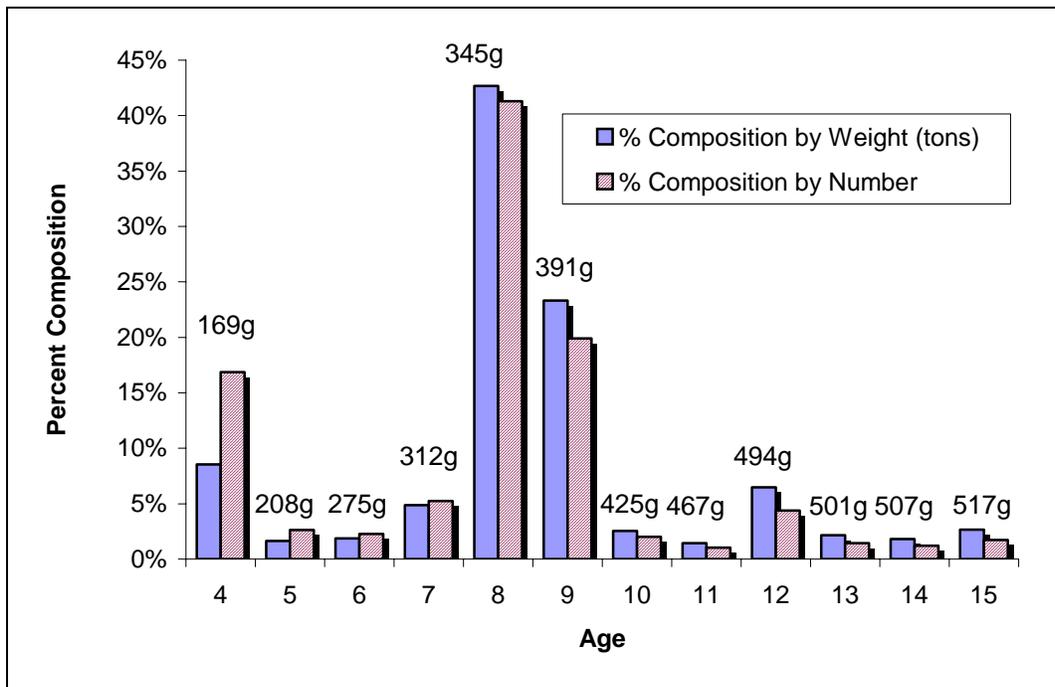


Figure 1. Forecasted age composition by weight and number for the 2005 Togiak herring return. Forecasted average weight (grams) by age is also presented.