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Prince William Sound Walleye Pollock: Current Assessment and 1999 Management Recommendations

By
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ABSTRACT

Prior to 1995, less than 4 metric tons (mt) of walleye pollock *Theragra chalcogramma* were annually harvested, mainly by jig and bottom trawl gears, from Prince William Sound (PWS), Alaska. An annual fishery using mid-water trawls first developed in 1995. This fishery occurs within internal waters of PWS and is managed by the Alaska Department of Fish and Game (ADF&G). Walleye pollock occurring in PWS during the summer have not been included in Gulf of Alaska assessments conducted by the National Marine Fisheries Service (NMFS). The harvest guideline for the PWS pollock fishery has been based on estimates of the pollock resource that reside in PWS in the summer and is not assessed by NMFS surveys in adjacent federal waters. Comprehensive summer surveys were not conducted during 1995-1997. Therefore, the PWS harvest guideline for 1996 and 1997 was calculated as (1) PWS pollock population estimates from the last non-winter survey in 1994, (2) scaled by the same relative change that NMFS assessment scientists recommended for the allowable biological catch for pollock in adjacent federal waters. This approach assumed that ecosystem processes affecting PWS pollock were similar in magnitude and direction to ecosystem processes affecting adjacent pollock stocks in adjacent federal waters. In 1997, ADF&G conducted summer trawl and longline surveys in PWS and in 1997 and 1998 coordinated winter acoustic surveys of pre-spawning pollock. Based on the 1997 summer trawl survey, a guideline harvest level of 2,100 mt (4.6 million lb) was recommended for PWS pollock in 1998. In addition to sampling pollock for length, weight, sex, maturity, and age from survey and commercial fishery catches in PWS, ADF&G collected genetic samples and the Prince William Science Center collected tissue isotope samples from pollock caught in PWS and adjacent federal waters. Preliminary genetic analysis indicated differentiation between the pollock in PWS and Shelikof Strait and those pollock near Bogoslof Island. The relationship between pollock in PWS and adjacent federal waters remains poorly understood and additional analysis is underway. Because the summer biomass was not effectively assessed in 1998, it is recommended that the 1999 fishery again be managed for a 2,100 mt harvest guideline. In addition to sampling during the fishery, ADF&G anticipates conducting another PWS summer trawl survey in 1999.

KEY WORDS: commercial fishery, groundfish management, Prince William Sound, *Theragra chalcogramma,* walleye pollock

INTRODUCTION

Prior to 1995, less than 4 mt of walleye pollock *Theragra chalcogramma* were commercially harvested annually, mainly by jig and bottom trawl gear, within Prince William Sound, Alaska (Bechtol 1995, 1998*a*). In 1995 the annual harvest from this area increased dramatically with the landing of 2,900 mt of walleye pollock, mainly by mid-water trawl gear. The objectives of this report are: (1) to present updated information on the walleye pollock resource of Prince William Sound; (2) to provide a description and summary of commercial harvests of this species for this area; and (3) to make recommendations for the future management and research needs for this species in Prince William Sound.

GENERAL BIOLOGY

Walleye pollock have been reported along the west coast of North American from Carmel, central California, through the Bering Sea to St. Lawrence Island, and on the Asia coast to Kamchatka, the Okhotsk Sea, and the southern Sea of Japan (Hart 1973; Bakkala et al. 1986). Walleye pollock are generally considered to be semidemersal, inhabiting continental shelf and slope waters to depths of 650 m, but they may also be pelagic in some areas. Genetic differences between walleye pollock of the eastern and western Pacific, as well as regional differences in age, growth, morphometric, and meristic characteristics, suggests that multiple stocks exist (Okada 1986).

Walleye pollock typically spawn in the first half of the calendar year, but may spawn later in the year at higher latitudes. The pelagic eggs are 1.35 to 1.45 mm in diameter. Age-0 walleye pollock in the Bering Sea typically occupy the upper 40 m of the water column until fall months when they begin a semidemersal existence (Traynor and Nelson 1983). Age-1 and -2 walleye pollock occupy discrete schools between 30 m and the bottom in the eastern Bering Sea. Age-1, -2, and -3 fish generally occur higher in the water column and are typically captured in pelagic trawls, while most fish age-4 and older are located closer to the bottom and are commonly captured in demersal trawls. In the Gulf of Alaska, age-1 and -2 walleye pollock are approximately 13 cm and 25 cm in length, respectively (Janusz 1986). Size at first maturity appears to be about 35 cm, which is usually attained at age-3.

The size, number, and variety of prey increase with walleye pollock size. Walleye pollock yolk-sac larvae, 3-6 mm in length, feed primarily on copepod nauplii (Nishiyama et al. 1986). Euphausiids and shrimp are important prey items for both juveniles and adults, particularly in the spring (Dwyer et al. 1986; Yang 1993). In summer, calanoid copepods and amphipods become an important component of the diet of small walleye pollock, while fishes are a major prey of large walleye pollock. In the Bering Sea during

summer, age-0 walleye pollock were major prey items of larger walleye pollock (Livingston et al. 1993). By autumn cannibalism represented a major diet component of both large and small fish. In the Gulf of Alaska, a variety of fishes are consumed by walleye pollock during the summer, with the most important prey item often being capelin *Mallotus villosus*. In winter, fish again composed the greatest portion of the diet of walleye pollock, but only the larger individuals commonly preyed upon other walleye pollock.

Walleye pollock are harvested in several fisheries and are also preyed upon by a variety of organisms. Population models for pollock resources occurring in federal waters incorporate a variety of data sources including recent efforts to model predation upon pollock (Hollowed et al. 1997).

MANAGEMENT AREA

Prince William Sound, Alaska, (PWS) is a complex fjord-type system located along the northern Gulf of Alaska (Muensch and Schmidt 1974). The commercial pollock fishery described in this report occurs within the Inside District of the PWS Management Area. The Inside District includes all waters enclosed by lines drawn from Point Whitshed to Point Bentinck, Cape Hinchinbrook to Zaikof Point, and Cape Cleare to Cape Puget (Figure 1). PWS is recognized as being internal waters of the State of Alaska, so the Alaska Department of Fish and Game (ADF&G) manages groundfish harvests within PWS.

CATCH HISTORY

Prior to 1995, annual commercial harvests of walleye pollock from PWS were less than 4 mt (Table 1; Bechtol 1995*a*, 1998*a*). These harvests were primarily taken incidentally by trawl or longline gear, although some directed effort with jig gear occurred in 1994. Little information on at-sea discards is available for PWS, but walleye pollock discards probably occur at low levels on longline gear (Bechtol and Vansant 1998).

In January 1995, mid-water trawl vessels transiting the southwest portion of PWS observed sonar echoes from what appeared to be walleye pollock aggregations. A harvest guideline had not previously been established for pollock in (Bechtol 1995*b*) although historical assessment surveys indicated that walleye pollock reside year-round within PWS (Parks and Zenger 1979; Haynes and Urban 1991; C. Wilson, NMFS, unpublished data). The most recent survey, a series of bottom trawl tows made during the summer of 1989 following the *T/V Exxon Valdez* oil spill, indicated that 9,500 mt of walleye pollock were in PWS at the time of the survey (Haynes and Urban 1991). Therefore, ADF&G set

a guideline harvest range of 950-2,000 mt for the 1995 directed fishery of walleye pollock based on an exploitation rate of 10-20% of the 1989 biomass estimate. The 1995 trawl fishery lasted from 31 January until 16 February 1995 with a total of nine midwater trawl vessels delivering 2,857 mt (6.2 million lb). Following the trawl closure, walleye pollock fishing was not closed to other gear types because non-trawl catches were expected to be small. The total PWS walleye pollock harvest in 1995 was 2,960 mt (6.5 million lb), which included about 4 mt landed by longline and jig gears and 98 mt landed by a combination test fishery and acoustic survey conducted by ADF&G in late February and early March (Trowbridge 1996).

The 1996 midwater trawl fishery from 20-25 January yielded a harvest of 1,480 mt (3.3 million lb) by 11 vessels (Trowbridge 1996). The total harvest of pollock in 1996 was 1,672 mt (3.7 million lb), including 191 mt landed by an ADF&G test fishery and <1 mt landed as bycatch in other pot, longline, and trawl fisheries.

The 1997 midwater trawl fishery from 20-28 January yielded a harvest of 1,779 mt (3.9 million lb) by 10 vessels (Charles Trowbridge, ADF&G, Homer, AK, personal communication). The total 1997 pollock harvest from PWS was 2,027 mt (4.5 million lb), including 244 mt landed by an ADF&G test fishery and 3.3 mt landed as bycatch in other pot, longline, and trawl fisheries.

The 1998 midwater trawl fishery from 20-26 January yielded a harvest of 2,022 mt (4.5 million lb) by 10 vessels. The total 1998 pollock harvest through 26 October was 2,310 mt (4.6 million lb), including 287 mt landed by an ADF&G test fishery and 1 mt landed as bycatch in other pot and longline fisheries.

The directed pollock fishery typically involved midwater trawl vessels targeting dense aggregations of pre-spawning pollock in the southwest portion of the Inside District (Figure 1). Vessels delivered to shore-based processing plants once every 2-3 days or to tender vessels on the grounds up to twice daily. Individual deliveries usually consisted of 70-140 mt of walleye pollock, captured in one or two tows, depending upon vessel size and capacity and fish aggregations. Most of the directed fishery catch has been processed into fillets with some marketing of the roe.

FISHERY MANAGEMENT CONSIDERATIONS

The mid-water trawl fishery for walleye pollock in PWS is a relatively new fishery within state managed waters; management strategies are still being developed. Although previous surveys indicated that walleye pollock resided year-round within PWS (Parks and Zenger 1979; Haynes and Urban 1991), the relationship between walleye pollock inside PWS and pollock in adjacent Gulf of Alaska waters remains unclear. Even if walleye pollock occurring in PWS intermingle with the Gulf of Alaska stock, the PWS component is not assessed by the National Marine Fisheries Service (NMFS) triennial

trawl survey conducted during summer months in the Gulf of Alaska (Chris Wilson, NMFS, Seattle, WA, personal communication). Groundfish resources off the coast of Alaska are co-managed by ADF&G and NMFS (Trowbridge 1996). In the absence of area and gear specific regulations established by the Alaska Board of Fisheries or management measures developed by ADF&G through internal and public review, fisheries in state waters typically coincide with seasons in the adjacent federal waters. However, prosecuting the PWS pollock fishery as part of the total allowable catch (TAC) established for the adjacent federal waters of the Gulf of Alaska fails to accommodate resource levels in PWS and could lead to over- or under-utilization of the resource in PWS. In contrast, sustainability for the walleye pollock fishery in PWS may be established if: (1) estimates of walleye pollock biomass inside PWS are available, (2) a conservative harvest level is set, (3) fishery management measures ensure harvests can be controlled, and (4) further research is conducted to explore the relationship between pollock in PWS and those in the adjacent waters of the Gulf of Alaska.

Available Assessment Data

1989 Trawl Surveys

Following the *M/V Exxon Valdez* oil spill, ADF&G and NMFS conducted two multi-species bottom trawl surveys of PWS in the summer of 1989 using a 400 mesh Eastern otter trawl (Haynes and Urban 1991). The first survey, designed to emulate a previous survey conducted in April 1978 (Parks and Zenger 1979), included 61 hauls during 17 May through 23 June 1989. The second survey, based on a random stratified sampling design, included 63 hauls during 7 August through 13 September 1989. The survey estimated a walleye pollock biomass of 9,500 mt. Actual pollock biomass was probably greater because the semi-pelagic habits of this species likely made some of the population unavailable to the bottom trawl survey gear. Furthermore, the 400-mesh Eastern gear has a lower rise opening than bottom trawls currently used in the NMFS triennial surveys (Anne Hollowed, NMFS, Seattle, WA, personal communication), so abundance data collected in PWS were not directly comparable to data collected in the Gulf of Alaska.

Acoustic Surveys

1994 Spring Acoustic

During early and late May 1994, an acoustic survey was conducted in PWS as part of the *Exxon Valdez* Trustee Council Sound Ecosystem Assessment (SEA) project. Expansion of survey data resulted in a walleye pollock biomass estimate of 24,328 mt within the 40-125 m depth range of PWS (Table 2; Jay Kirsch, Prince William Sound Science Center, Cordova, AK, personal communication). However, several factors make it difficult to assess the accuracy of this estimate. First, although sampling conducted during the

acoustic survey indicated that walleye pollock were widely distributed at depths greater than 20 m, pollock density (kg/surface area) above 40 m could not be estimated due to echo scattering by a plankton layer. Second, while the acoustic survey did not assess pollock biomass below 125 m, ADF&G bottom trawl surveys have shown walleye pollock to occur deeper than 125 m in PWS (personal observation). These two factors likely resulted in an underestimate of walleye pollock biomass in 1994. Furthermore, the acoustic survey only covered western PWS and errors introduced into the biomass estimate by extrapolating acoustic density estimates from western to eastern PWS are unknown.

Winter Acoustic Surveys

In cooperative projects, ADF&G worked with the Prince William Sound Science Center and the fishing industry to obtain more information on the prespawning biomass and distribution of walleye pollock in PWS. Commercial vessels, using biologists and acoustic equipment provided by the Prince William Sound Science Center and ADF&G, conducted acoustic surveys of pollock in PWS after the winter fisheries in 1995, 1997, and 1998 (Thomas and Stables 1995; Kirsch 1997; Kirsch and Thomas 1998). These surveys focused on prespawning walleye pollock aggregation in southwestern PWS, particularly Port Bainbridge, Knight Island Passage, and Montague Strait.

The 1995 survey involved two survey legs: the first leg, conducted from 24 to 25 February, yielded a walleye pollock biomass estimate of 19,756 mt; the second leg, from 28 February to 1 March, provided an estimate of 37,953 mt (Thomas and Stables 1996). During the second leg, approximately 27,000 mt were observed in Port Bainbridge and 11,000 mt in Lower Knight Island Pass. The mean estimate of both legs was 28,855 mt. Despite a cursory examination of other areas of PWS, no other significant walleye pollock aggregations were found. This wide range in survey estimates over a relative short temporal scale may have indicated short-term spawning movements.

The 1997 PWS acoustic survey, conducted during 23-27 February, yielded a pollock biomass estimate of 37,894 mt (Kirsch 1997). The relative distribution of pollock biomass was a virtual reversal of the distribution in the 1995 survey. In 1997, pollock biomass was distributed approximately 27,000 mt in Lower Knight Island Pass and 11,000 mt in Port Bainbridge. Smaller aggregations were assessed in Orca Bay and east of Green Island but totaled less than 1,000 mt and were excluded from the above 1997 total biomass estimate.

1998 Winter Acoustic Survey

The 1998 acoustic survey, conducted during 8-13 March, yielded a maximum PWS pollock biomass estimate of 114,344 mt (Kirsch and Thomas 1998). This biomass was approximately distributed as follows: 9,800 mt in Port Bainbridge, 63,100 mt in the Lower Knight Island Pass, 39,400 mt extending from Hinchinbrook Entrance across the mouth of Orca Bay, and 2,100 mt in Montague Strait. The Lower Knight Island Pass estimate was a replicate assessment conducted 11 March; the pollock biomass estimate

from the first assessment on 9 March was 42,500 mt. With the exception of Port Bainbridge which yielded a biomass estimate lower than previous years, other areas contained substantially more pollock biomass than was observed in either the 1995 or 1997 acoustic surveys. In particular, the 39,400 mt aggregation extending from Hinchinbrook Entrance across Orca Bay had not been previously observed.

1997 Trawl and Longline Surveys

A 1997 trawl survey with the research vessel *Pandalus* used a 400 mesh Eastern bottom trawl to conduct 53 tows in PWS (Bechtol *in preparation*). After dividing PWS into quadrants delineated at 147°00' W. longitude and 60°30' N. latitude, survey effort included 26 stations in the southwest quadrant, 25 stations in the northeast, and 2 in the southeast. Each survey station measured 6.25 square nautical miles and was sampled by a 1.0 nautical mile long tow. Average catches of pollock per nautical mile towed were 98.6 kg (217.4 lb) in the southwest, 74.3 kg (163.8 lb) in the northeast, and 1.8 kg (4.0 lb) in the southeast. No tows were made in the northeast area.

Another approach with the trawl data involved post-stratification of PWS surface area according to 91.6 m (50 fathom) bottom depth contours. In this case, mean catch from trawl stations within a stratum was expanded by the stratum surface area. Four of the nine depth strata represented on a NOAA nautical chart were sampled by the 1997 trawl survey. After excluding unsampled strata, this approach yielded a 27% and 16% coverage of the available survey stations in the two largest depth strata; 11% of all potential survey stations were sampled in 1997. The pollock biomass estimate for the four sampled strata was 21,000 mt ± 9,491 mt (95% confidence interval; Table 2). This estimate incorporated some habitat from all PWS quadrants but was seen as conservative because the surveyed strata represented only 74% of the available PWS surface area.

A 1997 longline survey for sablefish *Anoplopoma fimbria* with the research vessel *Montague* sampled 24 stations in the northwest area and 14 stations in the southwest area (Bechtol (1998*b*). Gear configuration was similar to sablefish surveys conducted in federal waters by the National Marine Fisheries Service (Mike Sigler, NMFS, Juneau, personal communication). One objective of these surveys was to evaluate the relative abundance and distribution of all species caught on longline gear. Although only an index, the northwest area of PWS yielded an average catch of 4.7 pollock per set, compared to 3.1 pollock per set in the southwest area, or an average catch rate of 49.5% more pollock in the northwest area. The application of relative pollock catch rates from the longline survey to extrapolate trawl catch rates from the southwest to the northwest area was considered but rejected at this time due to uncertainties about this approach. This technique may be further explored as future longline and trawl surveys are completed.

Trawl Catchability

In October 1997, NMFS and ADF&G conducted a project off the southern end of Kodiak to compare bottom trawl catchabilities among the NMFS and ADF&G bottom trawl survey gears (Eric Brown, National Marine Fisheries Service, Seattle, WA, personal communication). NMFS used a four-seam, high-opening polyethylene Nor'eastern trawl equipped with roller gear and towed by a NMFS-chartered vessel, the *Peggy Jo*. ADF&G used standard 400 mesh Eastern nets towed by the ADF&G research vessels the *Resolution* and the *Pandalus*. Instrumentation attached to the nets indicated mean net widths were virtually identical at 13.8 m among all nets, while the vertical openings were substantially different at 6.9 m for the Nor'eastern trawl and 1.9 m for the Eastern trawls. Preliminary results indicated that standardized catch rates for walleye pollock were 3.1 times greater with the NMFS Nor'eastern trawl than with ADF&G's Eastern trawl.

Age, Weight, and Length Data

Length and sex composition data were collected from commercial landings of walleye pollock in PWS during 1995-1998. In addition, sagittal otoliths were removed for aging of pollock in 1997 and 1998. To date, only otoliths from 1997 have been aged.

In the 1995 PWS commercial fishery, males comprised 46% of all samples. The length distribution ranged from 44-65 cm (Figure 2). The most abundant male pollock measured 51 cm whereas the most abundant female pollock measured 56 cm.

Males comprised 56% of all samples in the 1996 PWS commercial fishery. The length distribution ranged from 38-64 cm, with the most abundant male pollock being 52-cm fish and the most abundant female pollock being 56-cm fish (Figure 3). Length frequency data from the commercial pollock fisheries indicated PWS pollock were substantially larger than pollock caught in other GOA areas in 1996.

In 1997, males comprised 51% of pollock in commercial fishery samples but only 45% of pollock in acoustic survey samples. For both male and female pollock, the 56-cm fish were the dominant size mode in the PWS commercial fishery (Figure 4). Acoustic survey samples were dominated by 54-cm fish for both male and female pollock. A mode of smaller fish, centered at 32-34 cm for male and female pollock, was also observed in the acoustic surveys. Age data for commercial catch samples indicated age-7 pollock were the most abundant age class (Figure 5). Age-7 males and age-7 females contributed 17% and 16%, respectively, of all commercial samples.

In 1998 samples, males pollock comprised 53% of all commercial samples, increasing to 68% of the acoustic survey samples. Dominant size modes in commercial fishery samples were 55 cm for male fish and 57 cm for female pollock (Figure 6). In the March 1998 acoustic survey, 57-cm fish were the most abundant male pollock and 60-cm fish were the most abundant females. A smaller-sized cohort, centered at 38 cm for males and 42 cm for females, was also observed in the 1998 acoustic survey. This smaller cohort is

likely the 1994 age class that is becoming more prevalent in Gulf of Alaska fisheries (Hollowed et al. 1997).

Length distributions of pollock sampled from the PWS commercial fisheries were similar during the directed fisheries of 1995 to 1998, although a shift toward slightly larger fish was evident during most of the time series (Figure 7). The exception was commercial catch composition in 1997 when slightly smaller fish were observed. Although only available for one year, length frequency data from the commercial pollock fisheries also indicated PWS pollock were substantially larger than pollock caught in other GOA areas in 1996 (Figure 8).

Biological Markers

Biological markers may yield data on the mixing or the lack of mixing between pollock in PWS and adjacent federal waters. Previous genetic studies of pollock indicated that heterogeneity exists across large areas, such as between the Eastern Bering Sea and the Sea of Japan. ADF&G biologists assessed three different types of genetic markers to evaluate differentiation among pollock stocks collected from PWS, the Western Gulf of Alaska, and the Eastern Bering Sea (Eric Kretschmer, ADF&G, Anchorage, AK, personal communication). Walleye pollock collected from PWS, Shelikof Strait, and near Bogoslof Island in the Bering Sea were assayed for genetic variation at microsatellite, mtDNA and allozyme loci. Of seven microsatellite loci developed in Atlantic cod *Gadus morhua*, four amplified in walleye pollock. Mendelian inheritance of the microsatellite loci was confirmed using three single-pair matings. The four microsatellite loci had a frequency for the most common allele ≤ 0.95. Five regions of walleye pollock mtDNA were amplified and digested with 33 restriction enzymes; ten enzymes produced polymorphisms. Finally, 31 allozyme loci were screened, and seven allozyme loci had a frequency for the most common allele ≤ 0.95. The mtDNA analysis showed significant differences between Gulf of Alaska samples, treated as collections pooled from PWS and Shelikof, and Bering Sea samples collected near Bogoslof Island. The results indicate that these three types of genetic markers may be useful for future studies of walleye pollock populations.

In addition, Prince William Sound Science Center staff observed differences in the carbon isotope ratios of *Neocalanus* spp. from inside and outside PWS, and used these ratios to identify feeding habits of young-of-the-year (YOY) pollock (T. Kline, Prince William Sound Science Center, Cordova, AK, personal communication). YOY pollock were subsequently classified by carbon isotope ratios into the following geographic groups: (1) Gulf of Alaska and South Montague; (2) Eastern PWS; and (3) Western PWS. Although adult pollock showed similar C_{13} signatures, greater work is needed to understand uptake/response times.

Relative Change in the Eastern Gulf of Alaska Regulatory Area

Previous estimates of surplus production in the PWS pollock population relied on an assumption that large-scale processes that simultaneously affect many areas across the northern Gulf of Alaska direct changes in ecosystem productivity. Thus, ecosystem functions that cause a change in the pollock population of the Eastern Gulf of Alaska Regulatory Area will cause a similar relative change in the PWS pollock population. As a result, the relative scale of changes in the allowable biological catch (ABC) for pollock in the in adjacent federal waters of the Eastern Gulf of Alaska Regulatory Area (Hollowed et al. 1995, 1996; Bechtol 1998) was used to scale changes in the PWS pollock guideline. The recommended ABC for the eastern Gulf of Alaska increased by 62% from 1997 to 1998 (Hollowed et al. 1997). Under this relative change, the PWS pollock biomass would have potentially increased by 62% from the 1997 level of 1,800 mt to 2912 mt in 1998. Although the ABC recommendation is not yet available for the 1999 Gulf of Alaska population, preliminary analysis indicates spawner biomass will peak in 1999 following estimated increases in recent years (Anne Hollowed, National Marine Fisheries Service, Seattle, WA, personal communication).

GUIDELINE HARVEST RECOMMENDATIONS

The 1995, 1997, and 1998 winter acoustic surveys of prespawning pollock aggregations in PWS yielded biomass estimates that were substantially greater than recent or historical summer population estimates. In particular, the 1998 survey observed a previously undetected aggregation in eastern PWS in the mouth of Orca Bay. Among all PWS survey sites, the 1998 biomass estimate was three times greater than the 1977 biomass estimate (Kirsch and Thomas 1998). However, the relationship between these prespawning aggregations and the summer population unassessed by the NMFS surveys is unknown. Further research is needed to explore the utility of winter acoustic data in determining exploitable biomass for the Gulf of Alaska and the PWS pollock resources.

The harvest guideline for the PWS pollock fishery has been based on estimates of the pollock resource not assessed by NMFS surveys in adjacent federal waters. Although a substantial summer pollock population was observed in PWS by numerous assessment studies that followed the *EXXON Valdez* Oil Spill (EVOS Trustee Council 1993), most of these studies focused on juvenile pollock interactions with rearing Pacific herring (*Clupea pallasi*) and salmonids (*Ocorhynchus* spp.). The wide variety of habitats, an extensive plankton bloom that inhibits acoustic assessments, and depths that exceed 700 m have hampered acoustic assessments of the adult summer population in PWS. An alternative of extrapolating a previous PWS guideline by the relative change of the

allowable biological catch in the adjacent federal waters fails to incorporate data on PWS pollock generated by 1997 summer surveys.

Based on a delineation of PWS into a sample station grid of squares, 2.5 nautical miles on a side, the 1997 trawl survey sampled 17% of the available stations in the northeast and southeast portions of PWS and 17% of the stations available in the southwest area. No trawl survey estimates were available for the northwest area. Use of the longline survey data to expand trawl catch rates from the southwest area to the northwest area was seen as problematic without additional analysis. Instead, the delineation of PWS surface area into 91.6 m depth strata allowed extrapolation of trawl data into all four quadrants of PWS. Area-swept estimates yielded a pollock biomass estimate of 21,220 mt ± 9,491 mt (95% CI). This is a conservative estimate for several reasons. First, only four of the nine available depth strata, or 74% of the PWS total surface area, was represented because non-sampled strata were excluded from the analysis. Full expansion to the entire surface area would yield an estimated pollock biomass of 28,676 mt but would incorporate unsurveyed depth strata. Second, the NMFS survey uses a high-rise trawl that is three times more effective in capturing pollock than the 400 mesh Eastern used by ADF&G (Eric Brown, National Marine Fisheries Service, Seattle). As a result, the ADF&G survey likely underestimated summer pollock biomass in PWS when compared to what the NMFS trawl might have estimated. Because little new biomass data are available, it is recommended that the walleye pollock harvest guideline for Prince William Sound in 1999 be set at 2,100 mt, the same guideline that was recommended for 1997 (Bechtol 1998).

Ongoing PWS Pollock Research

Genetic assessment to differentiate pollock from PWS, the Gulf of Alaska, and the Bering Sea is still in progress (J. Seeb, ADF&G, Anchorage, AK). In addition, staff from the Prince William Science Center continue to examine pollock from inside and outside of PWS for isotope signatures. In September 1998, ADF&G conducted a third longline survey, this time focusing on the northwest and eastern quadrants of PWS. Finally, ADF&G is scheduled to conduct another bottom trawl survey of PWS during 1999. The 1999 trawl survey would occur at approximately the same time of year as the triennial trawl survey conducted by NMFS in the adjacent federal waters.

Fishery Management Measures

The fishing power of the mid-water trawl vessels makes it possible to harvest and even exceed the relatively small guideline harvest level within a short time frame. To meet stock conservation needs and allow for an orderly harvest, the Alaska Board of Fisheries adopted a registration deadline of 13 January for any vessel participating in the PWS

pollock fishery. The board also adopted a regulation to allow trawl fishing for pollock only under the terms of a permit issued by the commissioner of ADF&G. This permit may specify requirements for logbooks, observers, harvest reporting procedures, and other requirements. The following measures will likely be implemented for the 1999 fishery:

Fishing Season - The fishery will open at 12:00 noon on 20 January 1999, and will remain open until the harvest guideline is taken. This opening will coincide with openings in the adjacent federal waters. Time and area closures may be used to reduce the bycatch of non-target species.

Check-In/Check-Out procedures - Vessel operators are required to check-in and check-out with the Cordova ADF&G office prior to fishing.

Observer Coverage - All vessels must carry an ADF&G observer if requested.

Logbook Reporting - All vessels will be required to maintain logbooks while participating in this fishery.

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Table 1. Annual commercial walleye pollock harvest from Prince William Sound, Alaska during 1987-1998.

Year[a]	Round Weight (metric tons)			
	Longline	Trawl	Other	Total
1987	0.4			0.4
1988	0.7			0.7
1989	0.2	0.4	<0.1	0.7
1990	0.3	3.0		3.3
1991				0.0
1992	<0.1	2.7		2.7
1993	0.1	2.5		2.6
1994	<0.1		2.5	2.5
1995	1.6	2,954.5	2.7	2,958.8
1996	0.3	1,671.4	0.6	1,672.3
1997	3.2	2,023.6	0.1	2,026.9
1998	1.2	2,107.1	0.0	2,108.3

[a] Preliminary data through 26 October 1998.

Table 2. Walleye pollock biomass survey estimates available for Prince William Sound, 1989-1998.

A. Prince William Sound pollock biomass estimated during 1989-1998 surveys.

Estimation Source	Survey Estimated Biomass (mt)		Comments
1989 Bottom Trawl Survey	9,500	Summer	Summer survey.
1994 Hydroacoustic Survey	24,328	Summer	Target discrimination problems >140 m and <20 m.
1995 Hydroacoustic Survey	28,855	Winter	Prespawning Aggregation.
1997 Hydroacoustic Survey	37,894	Winter	Prespawning Aggregation.
1998 Hydroacoustic Survey	114,344	Winter	Prespawning Aggregation.
1997 Trawl Survey	21,220	Summer	Few stations in SE and no stations in NW
1997 Longline Survey	NA	Summer	Relative abundance between SW and NW
1998 Longline Survey	NA	Summer	Relative abundance between east and NW

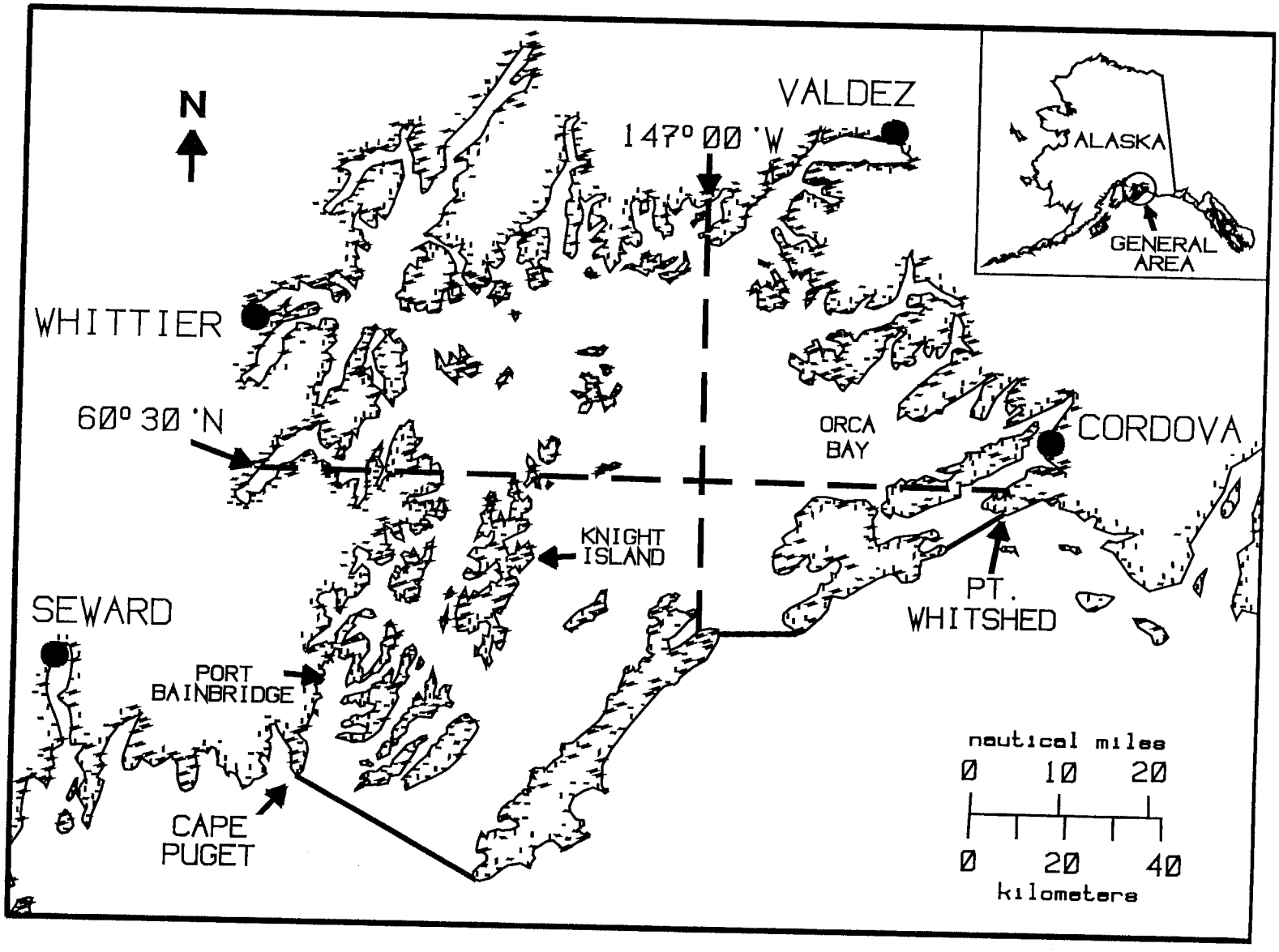

Figure 1. Prince William Sound management area.

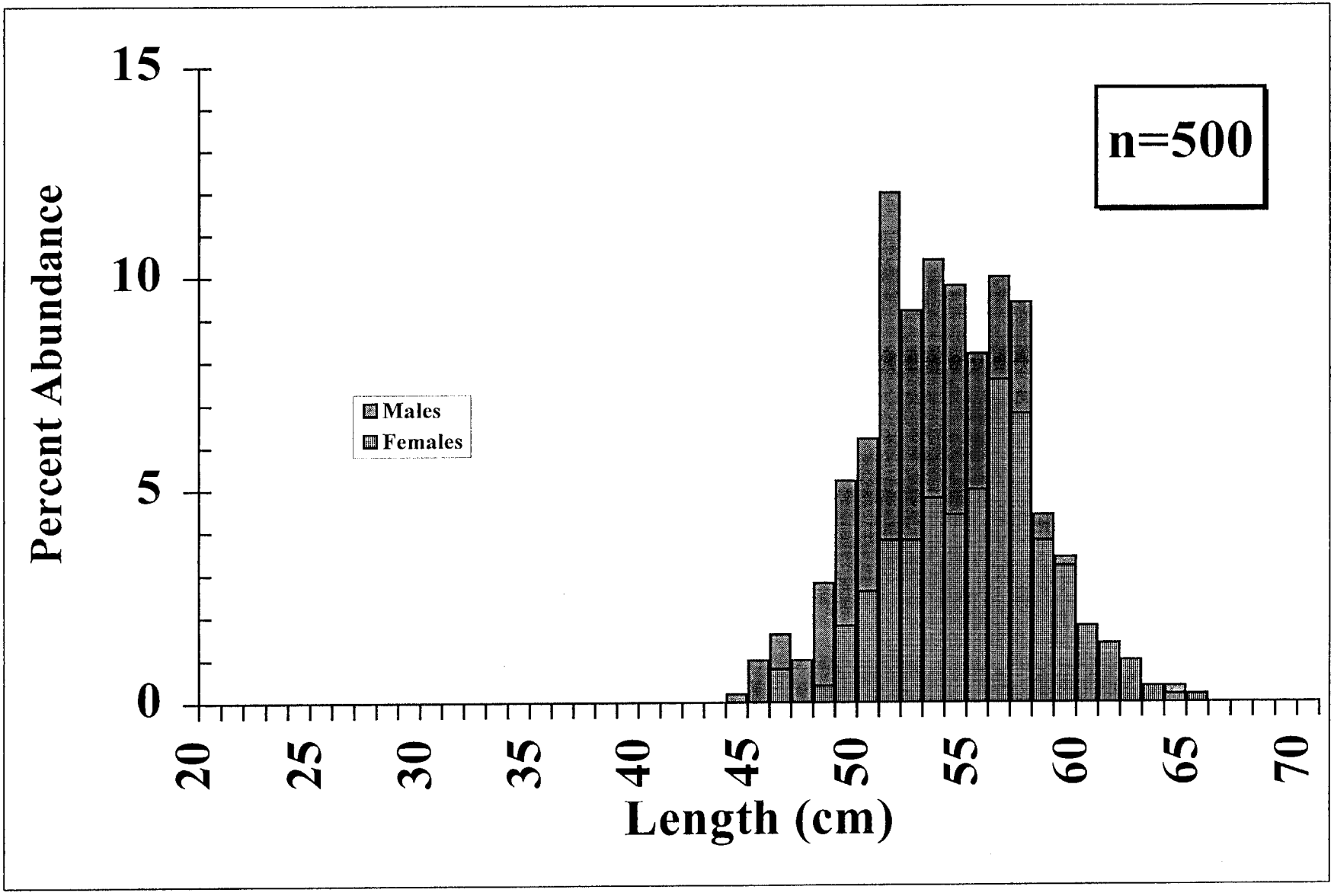

Figure 2. Length composition of pollock sampled from the commercial trawl fishery of Prince William Sound, 1995.

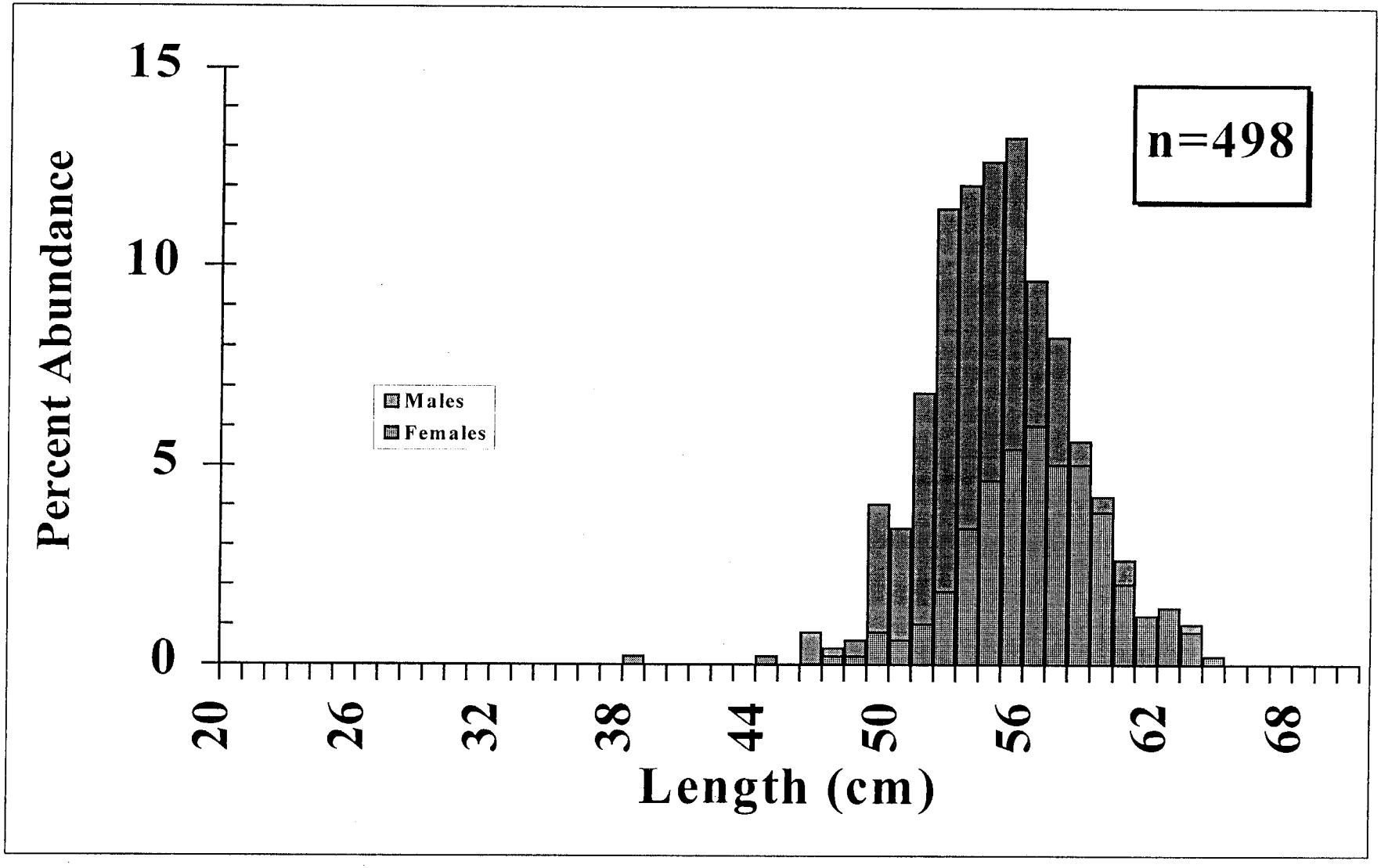

Figure 3. Length composition of pollock sampled from the commercial trawl fishery of Prince William Sound, 1996.

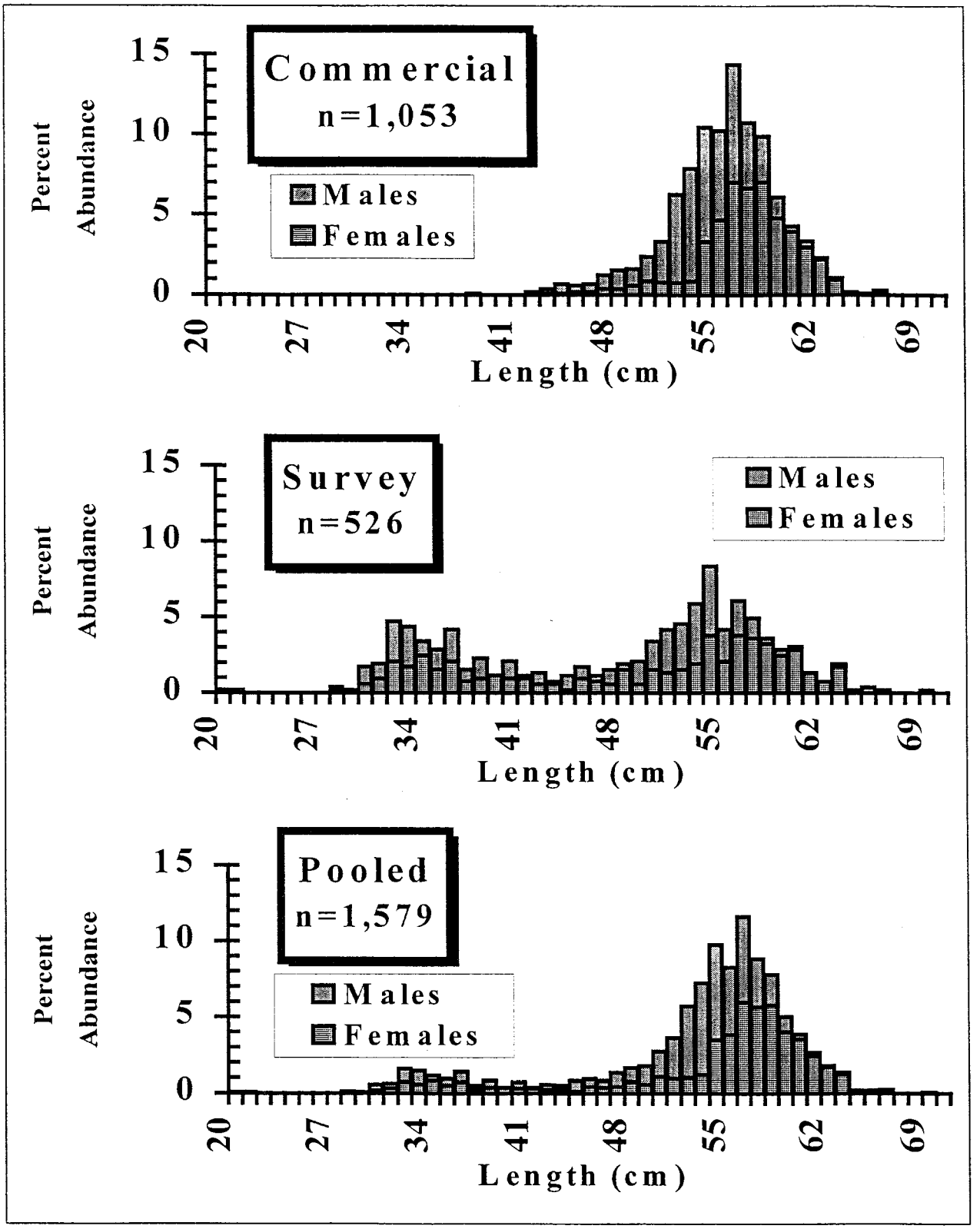

Figure 4. Length composition of pollock in commercial fishery and acoustic survey catches from Prince William Sound, 1997.

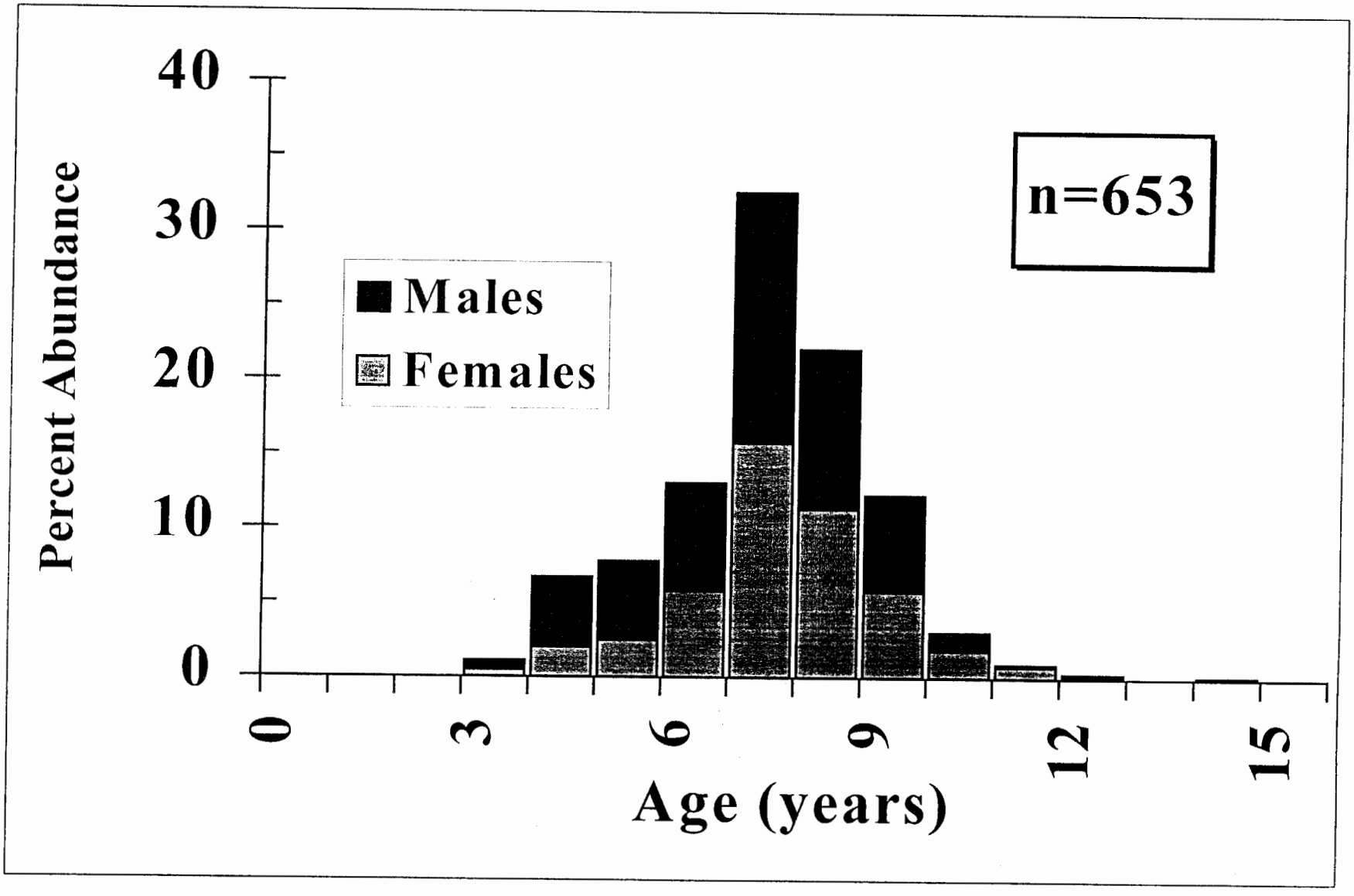

Figure 5. Age composition of male and female pollock in commercial fishery catches from Prince William Sound, 1997.

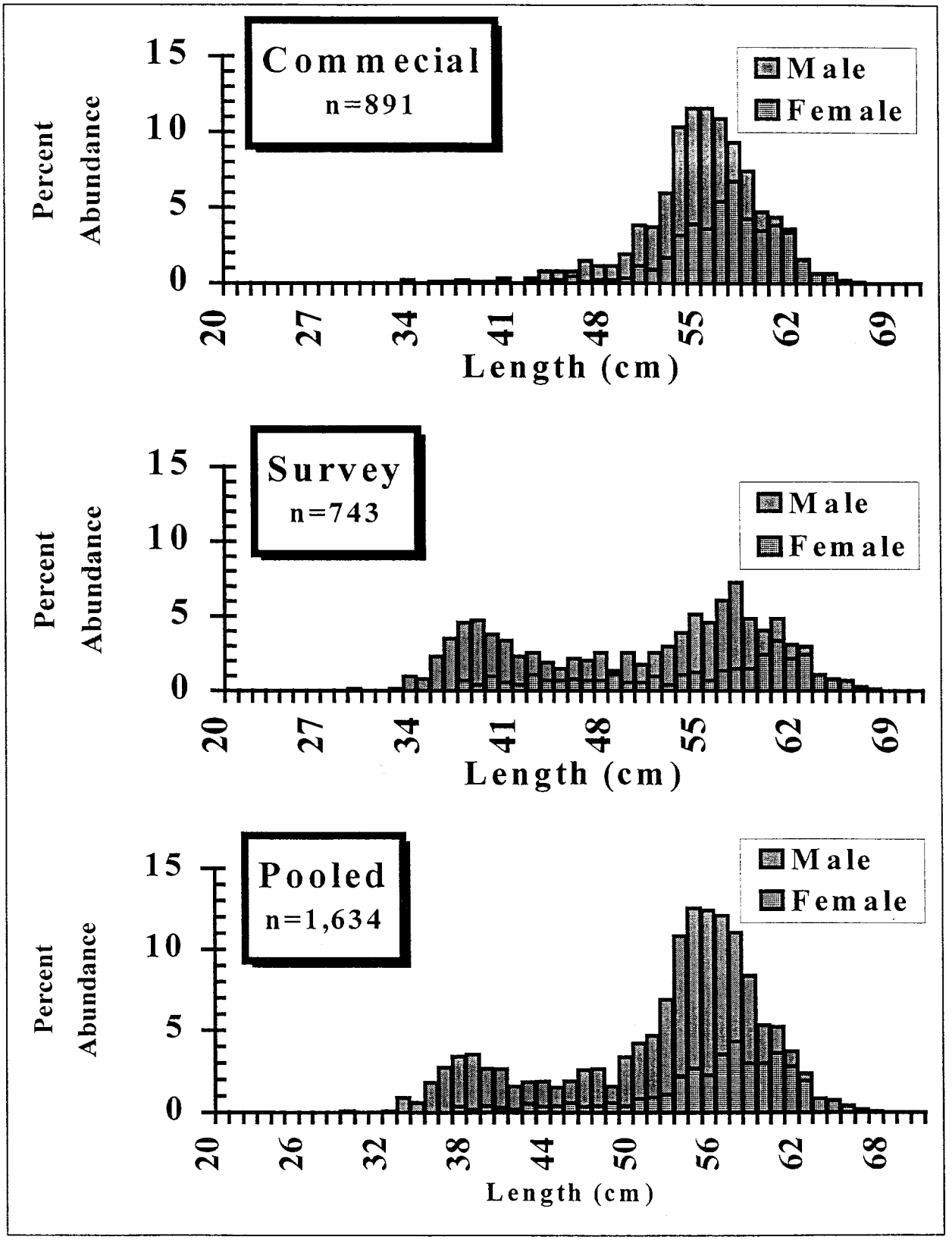

Figure 6. Length composition of pollock in commercial fishery and acoustic survey catches from Prince William Sound, 1998.

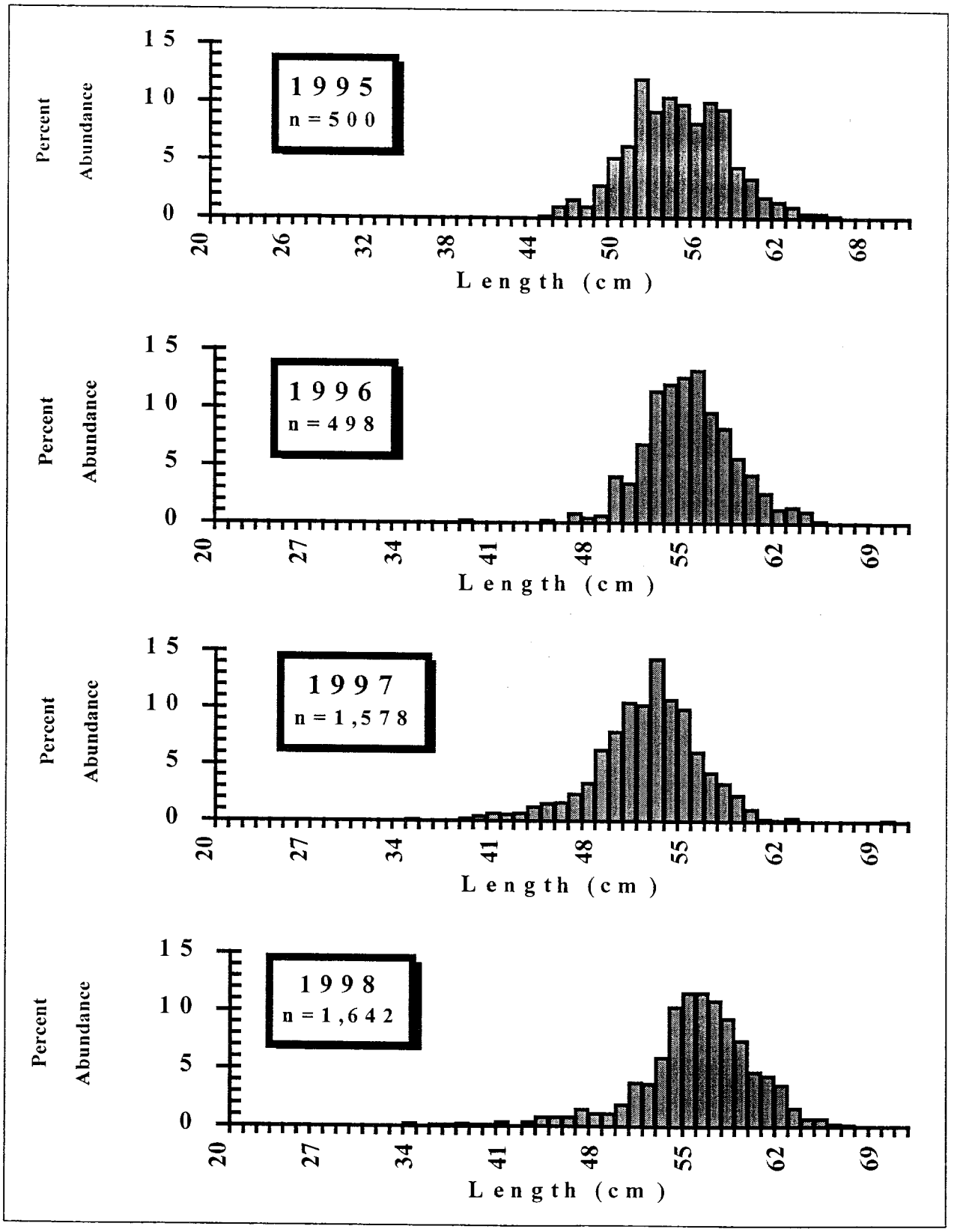

Figure 7. Length composition of pollock caught commercially from Prince William Sound, 1995-1998.

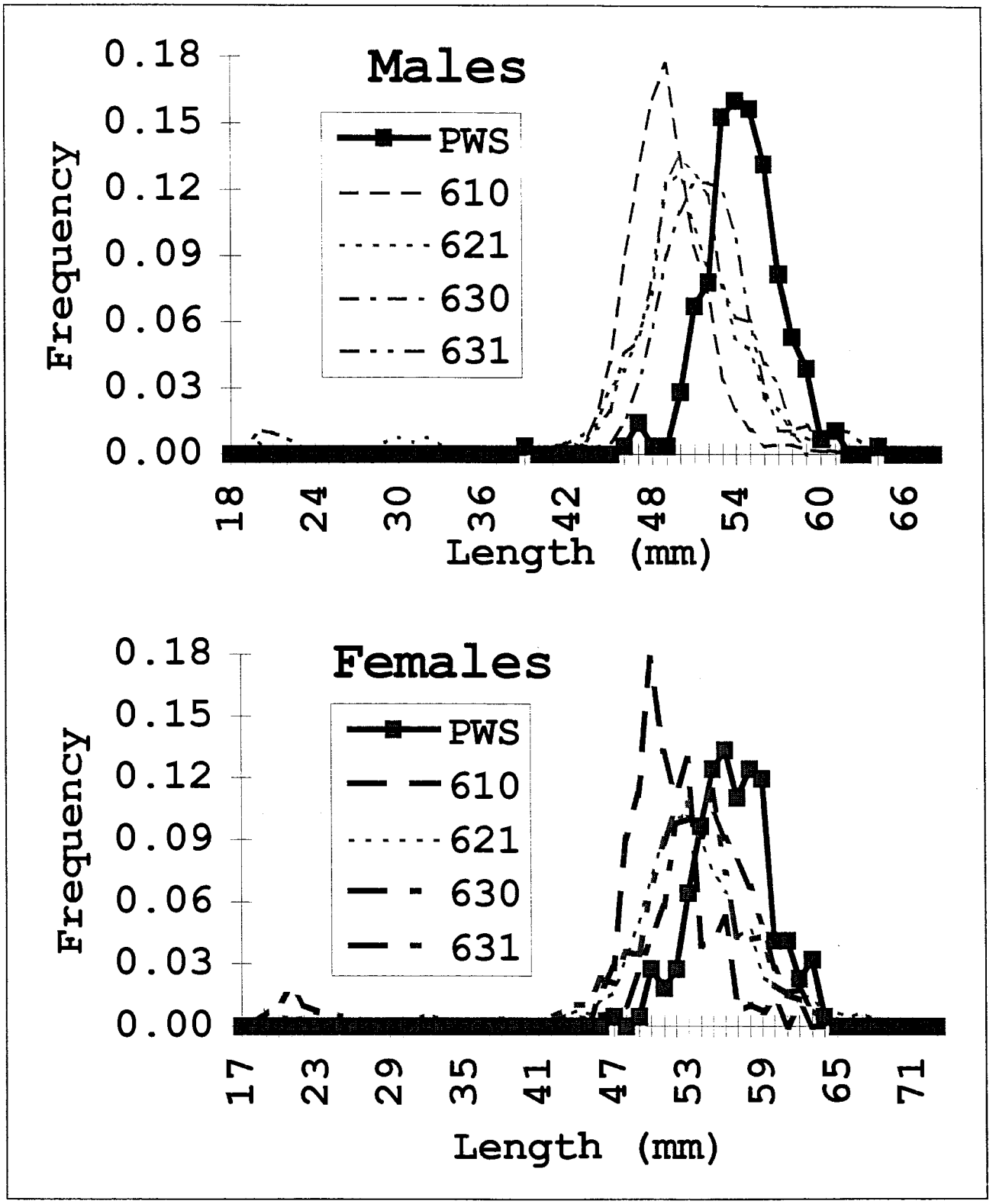

Figure 8. Length-frequency distributions of pollock caught in commercial trawl fisheries in Prince William Sound and federal regulatory areas 610, 620, 630, and 631 of the Gulf of Alaska, 1996.

Appendix A. Length composition of walleye pollock by size, sex, and sample type from Prince William Sound, Alaska, 1995-1998.

	Pollock Abundance											
	1995		1996		1997				1998			
Size	Commercial		Commercial		Commercial		Survey		Commercial		Survey	
(cm)	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
20								1				
21								1				
22												
23												
24												
25												
26												
27												
28							1	1				
29							1				1	
30							6	3				
31							5	5				
32							14	11			1	
33							14	9	2		7	
34							5	13			6	
35							7	8	1		17	
36							11	11	1		26	
37							4	4	1	1	29	5
38			1			1	7	5	1		32	3
39								6	1		21	7
40							6	5	2	1	21	4
41							1	5			14	3
42					1	1	4	3	2	1	11	8
43					3	1	1	3	6	1	9	5
44	1		1		6	1	5	1	5	2	6	5
45	5				4	2	4	5	3	4	10	6
46	4	4	4		5	2	2	4	12	1	10	5
47	5		1	1	9	4	5	3	8	2	14	5
48	12	2	2	1	12	4	2	8	8	2	2	8
49	17	9	16	4	11	6	8	3	14	3	15	4
50	18	13	14	3	16	9	10	8	24	10	9	4
51	41	19	29	5	27	8	15	7	25	8	12	7
52	27	19	48	9	58	8	16	8	38	15	19	3
53	28	24	43	17	74	9	21	10	64	28	21	8
54	27	22	40	23	75	35	24	20	68	35	29	9
55	16	25	39	27	59	49	11	11	71	32	29	5
56	12	38	18	30	77	74	12	20	49	48	35	10
57	13	34	16	25	43	70	7	19	23	60	43	11
58	3	19	3	25	30	74	2	17	28	38	25	11
59	1	16	2	19	14	50	2	13	11	31	12	18
60		9	3	10	4	41	1	15	5	34	11	25
61		7		6	4	31		7	2	30	7	16
62		5		7	1	23		4		14	4	18
63		2	1	4	1	10	1	9		6		8
64	1	1		1		2		1		6		6
65		1				1		2		2		5
66					1	2		1		1		2
67												1
68												
69								1				
70												

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