2A00-42

Prince William Sound Walleye Pollock: Current Assessment and 2001 Management Recommendations

By
William R. Bechtol

Regional Information Report[1] No. 2A00-42

Alaska Department of Fish and Game
Division of Commercial Fisheries
333 Raspberry Road
Anchorage, Alaska 99518-1599

December 2000

Frank Rue – Commissioner
Robert D. Mecum – Director, Commercial Fisheries

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

AUTHOR

William R. Bechtol is Research Project Leader for salmon and herring in Lower Cook Inlet and groundfish and shellfish in Cook Inlet and Prince William Sound for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 3298 Douglas Place, Homer, AK, 99603.

ACKNOWLEDGMENTS

Discussions with National Marine Fisheries Service biologists Martin Dorn, Anne Hollowed, Chris Wilson, and Eric Brown helped clarify my understanding of assessment and management strategies for walleye pollock in federal waters. Anne Hollowed and Martin Dorn provided data on pollock size distributions in the Gulf of Alaska commercial fisheries. Chris Blackburn of the Alaska Groundfish Data Bank was instrumental in coordinating industry involvement in Prince William Sound pollock assessment. Jay Stinson and the crew of the fishing vessel *Alaskan* conducted the 1995, 1997, and 1998 acoustic surveys; Mr. Stinson offered substantial insights on the pollock fishery and resource distribution. The hydroacoustic, longline, and trawl surveys, and analyses of these surveys were partially funded through an ADF&G legislative program receipt authorization. William Dunne and Kris Munk aged or coordinated ageing of pollock otoliths with partial funding from the Alaska Fisheries Information Network (AKFIN) and its predecessor, PACFIN.

TABLE OF CONTENTS

Page

LIST OF TABLES iv

LIST OF FIGURES iv

ABSTRACT v

INTRODUCTION 1

GENERAL BIOLOGY 1

MANAGEMENT AREA 2

CATCH HISTORY 2

FISHERY MANAGEMENT CONSIDERATIONS 3

- Available Assessment Data 4
  - Longline Surveys 4
  - Acoustic Surveys 5
  - Bottom Trawl Surveys 6
  - Age, Weight, and Length Data 8
  - Biological Markers 10
- Relative Change in the Eastern Gulf of Alaska Regulatory Area 11
- Fixed Harvest Level 11

GUIDELINE HARVEST RECOMMENDATIONS 11

- Continuing PWS Pollock Research 12
- Fishery Management Measures 13

LITERATURE CITED 14

LIST OF TABLES

Table | Page

1. Annual commercial walleye pollock harvest from Prince William Sound, Alaska during 1987-2000. 18
2. Unweighted catch abundance and mean catch rates from the sablefish longline survey of Prince William Sound, 1996-2000. 19
3. Walleye pollock biomass estimates from a variety of Prince William Sound surveys, 1989-2000. 20

LIST OF FIGURES

Figure | Page

1. Groundfish management districts of the Prince William Sound Management Area. 21
2. Locations of interest in Prince William Sound. 22
3. Length distribution of Prince William Sound pollock, 1995. 23
4. Age composition of pollock sampled from Prince William Sound, 1995-1999. 24
5. Length distribution of Prince William Sound pollock, 1996. 25
6. Length distribution of Prince William Sound pollock, 1997. 26
8. Length distribution of Prince William Sound pollock, 1998. 27
9. Length distribution of Prince William Sound pollock, 1999. 28
10. Length distribution of Prince William Sound pollock, 2000. 29
11. Length distribution (percent abundance) of walleye pollock in commercial harvests from Prince William Sound, 1995-2000. 30

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). Abundance and biomass data for walleye pollock in PWS are available from summer bottom trawl surveys, summer longline surveys, and summer and winter acoustic surveys. In addition to sampling pollock for length, weight, sex, maturity, and age from survey and commercial fishery catches in PWS, ADF&G has collected genetic samples and the Prince William Science Center collected tissue isotope samples from pollock caught in PWS and adjacent federal waters. The relationship between pollock in PWS and adjacent federal waters remains poorly understood and additional analysis is underway. Meanwhile, walleye pollock occurring in PWS during the summer have not been assessed as a part of the Gulf of Alaska trawl surveys conducted by the National Marine Fisheries Service (NMFS). Therefore, the harvest guideline for the PWS pollock fishery has been based on estimates of the pollock resource that resides in PWS in the summer and is not assessed by NMFS surveys in adjacent federal waters. The 1999 bottom trawl survey resulted in an estimated pollock biomass of 6,304 ±2,812 mt (95% confidence interval). Based on the 1999 summer survey, a guideline harvest level of 1,420 mt (3.1 million lb) was recommended for PWS pollock in 2000. Because no bottom trawl survey was conducted in 2000, no new summer biomass data is available and the same GHL of 1,420 mt is recommended for the 2001 fishery. Relative to previous assessment documents, the following report provides updated commercial harvest information through 2000 and updated age, length, and sex data.

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 (PWS), Alaska (Bechtol 1995*a*, 1998*a*; Berceli et al. 1999). The annual harvest from this area increased dramatically in 1995 with the landing of 2,900 mt of walleye pollock, mainly by mid-water trawl gear. The objectives of this report are to: (1) provide a description and summary of commercial pollock harvests in PWS; (2) present updated assessment information on pollock resource of PWS; and (3) to make recommendations for the future management and research needs for pollock in PWS.

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). Because PWS is recognized as being internal waters of the State of Alaska, the Alaska Department of Fish and Game (ADF&G) manages harvests of groundfish, including pollock, 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 (Table 1; Trowbridge 1996).

The season for the midwater trawl fishery in subsequent years has been quite variable, opening annually on 20 January but closing as early as 25 January and as late as 31 March (Table 1; Berceli et al. 1999). Annual pollock harvest has ranged from 1,193-2,120 mt (2.6-4.7 million lb) caught by 5-11 vessels.

The 2000 midwater trawl fishery opened January 20 under a substantially different management strategy than in previous years (see below). The fishery was closed on March 31, yielding a pollock harvest of 1,193 mt (2.6 million lb) by 5 vessels, including 166 mt landed by an ADF&G test fishery. Fishery catch rates were lower than in previous years, although the fleet reported that densities of pollock aggregations increased as the season progressed. Pollock landed as byctach in pot, longline, and shrimp trawl fisheries totaled 1.8 mt (Table 1).

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). In particular, the pollock fishery has occurred in the Port Bainbridge and southern Knight Island Passage areas (Figure 2). 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 aggregation density. Most of the directed fishery catch has been processed for fillet and roe markets. Winter acoustic surveys indicate pollock also aggregate seasonally in the eastern portion of PWS from Hinchinbrook Entrance across the mouth of Orca Bay (Kirsch and Thomas 1998), although the timing of these aggregations is not well understood. However, the area of these eastern aggregations was historically closed to all groundfish fishing with trawls.

FISHERY MANAGEMENT CONSIDERATIONS

The mid-water trawl fishery for walleye pollock in PWS remains a relatively new fishery within state managed waters (Berceli et al. 1999). Management strategies continue to evolve and in December 1999, the Alaska Board of Fisheries considered new regulations designed to distribute the fishery geographically, largely in response to concerns over the decline of Steller sea lions, and to expand fishing opportunities to observed pollock distributions. These changes: (1) opened a portion of the eastern trawl exclusion area in PWS to pelagic trawl gear; and (2) divided the PWS Inside District into three harvest sections with a maximum of 40% of the annual harvest allowed out of any single section (Figure 2). These measures were implemented as emergency regulations on an interim basis for evaluation during the 2000 fishery, then formally adopted at the board's March 2000 meeting.

Although previous surveys indicated that walleye pollock occur year-round within PWS (Parks and Zenger 1979; Haynes and Urban 1991; Bechtol 1999*a*), 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, now a biennial 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; Berceli et al. 1999). 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 for resources in PWS, (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 adjacent federal waters of the Gulf of Alaska. As an interim approach in view of continuing research on the relationship between pollock in PWS and the Gulf of Alaska, the current assessment model for Gulf of Alaska has incorporated biomass estimates of PWS pollock (Dorn et al. 1999, 2000). This model was originally run using Stock Synthesis software (Methot 1990), but more recently, parameters have been fit using AD Model Builder software.

Available Assessment Data

Longline Surveys

A longline survey for sablefish *Anoplopoma fimbria* has been conducted annually since 1996 with the research vessels *Montague* and *Pandalus* (Bechtol 1998*b*; Table 2). Gear configuration was similar to sablefish surveys conducted in federal waters by the National Marine Fisheries Service (Sigler and Zenger 1989). One survey objective was to evaluate the relative abundance and distribution of all species caught on longline gear. Mean catch of pollock per longline set in the PWS survey ranged from 4.9 fish/set in 1998 to 1.3 fish/set in 2000 (Table 2). However, the longline survey is viewed as providing only an index of abundance for pollock caught in the target depths of 100 fathoms (183 m) and deeper. As additional data becomes available in the future, greater exploration of the utility of the longline data for more complex stock assessment models is anticipated.

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 3; 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) shallower than 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 in PWS with tows deeper than 125 m in have caught walleye pollock (Bechtol 1999*a*). 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, 1998, and 2000 (Thomas and Stables 1995; Kirsch 1997; Kirsch and Thomas 1998; Thorne and Thomas *under review*). These surveys focused on prespawning walleye pollock aggregation in southwestern PWS, particularly Port Bainbridge, Knight Island Passage, and Montague Strait. Surveys were conducted with the *F/V Alaskan* operated by Jay Stinson of Kodiak in all years, except the *R/V Pandalus* was used in the 2000 survey. Pollock size data were obtained from survey catches with midwater trawl nets and also from a bottom trawl net I 2000.

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 1995). 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 geographic 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.

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.

The 2000 acoustic survey, conducted during 3-10 March, yielded a maximum PWS pollock biomass estimate of 28,277 mt among all areas surveyed (Thorne and Thomas *under review*). This biomass was approximately distributed as follows: 5,057 mt in Port Bainbridge, 1,195 mt in the Lower Knight Island Passage, 9,730 mt extending from Glacier Island to Hinchinbrook Entrance, and 12,245 mt in the Montague Trench. These estimates include the means of replicate survey legs conducted in Port Bainbridge and the Montague Trench. The 2000 assessment was the first extensive acoustic survey of fish in the Montague Trench area. The midwater trawl net intended for use in the 2000 acoustic survey was found to have substantial rips that inhibited the net's ability to fish effectively. As a result, a high-rise, small-mesh bottom trawl net was used to obtain pollock samples during the latter portion of the survey.

Bottom Trawl Surveys

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 (Brown and Zenger 1999), so abundance data collected in PWS were not directly comparable to data collected in the Gulf of Alaska.

1995 Trawl Survey

A bottom trawl survey with the ADF&G research vessel *Pandalus* towing a 400 mesh Eastern bottom trawl has been conducted biennially since 1995. The 1995 survey had a limited geographic distribution that focused on crab habitat in the eastern portion of PWS and the utility of the trawl data for biomass estimation cannot be determined without additional analyses (unpublished data). However, pollock length data from the 1995 bottom trawl survey is provided in this report.

1997 Trawl Survey

For the 1997 survey, PWS was divided into potential sample stations, each measuring 6.25 square nautical miles. PWS was additionally sectioned into quadrants delineated at 147°00' W longitude and 60°30' N latitude. Historical crab survey stations in the Orca Bay, Port Fidalgo, and North Montague areas were systematically selected using historical tow paths. Additional stations were randomly selected from the southwest area. Selected station was sampled by a 1.0 nautical mile long tow. Survey effort involved 53 tows, apportioned as 26 stations in the southwest quadrant, 25 stations in the northeast, and two stations in the southeast (Bechtol 1999*a*). Due to vessel gear limitations, depth of tows was generally less than 109 m (200 fm). 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. The lack of tows in the northwest quadrant complicated calculation of biomass estimates. Exclusion of the northwest quadrant when PWS pollock biomass was considered, but would have likely to have substantially underestimated actual biomass.

Another approach with the 1997 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. Full expansion to the entire surface area would yield an estimated pollock biomass of 28,676 mt but would incorporate unsurveyed depth strata.

1999 Trawl Survey

During 28 June to 12 July 1999, the ADF&G vessel *Pandalus* made 67 successful tows within PWS with a 400 mesh eastern trawl (Bechtol 1999*b*; unpublished data). This represented 13.5% of the available survey station grids. Estimated biomass of walleye pollock was 6,304 +/-2,812 (95% CI) metric tons. Average catches of pollock per nautical mile towed were 14.7 kg (32.2 lb) in the southwest, 18.2 kg (40.2 lb) in the northeast, 2.2 kg (4.8 lb) in the southeast, and 7.2 kg (15.8 lb) in the northeast area. Mean survey catch was 29.5 lb/nm towed. Although distribution patterns of pollock appeared to be similar to the 1997 trawl survey, catch rates generally declined in all areas and substantially fewer large aggregations were observed than in previous surveys, as evidenced by a lack of large catches (e.g., >500 lb) of pollock in individual tows (Table 4). No bottom trawl survey was conducted in 2000.

Trawl Catchability Considerations
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 (Brown and Zenger 1999). 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. As a result, the ADF&G survey likely underestimated summer pollock biomass in PWS when compared to what the NMFS trawl might have estimated.

Age, Weight, and Length Data

Length and sex composition data were collected from walleye pollock sampled from PWS during 1995-2000. Sample sources included the commercial fishery that opened January 20; the test fishery occurring 1-2 weeks after the close of the commercial fishery; a semi-periodic acoustic survey in late February or early March; a biennial summer bottom trawl survey; and a fall annual longline survey. The fisheries and the acoustic survey targeted winter spawning aggregations whereas the bottom trawl and longline surveys captured fish that were generally less aggregated. Sample collections also varied geographically. The commercial fishery occurred in southern PWS; the test fishery and acoustic survey occurred in both southwestern and eastern PWS; and the surveys sampled throughout PWS. Sagittal otoliths were removed for aging of pollock during all years. To date, age data are available from the 1995 bottom trawl survey and from commercial and test fisheries in 1996-2000. For this report, age data from commercial and test fisheries were pooled within years.

Length distribution in the 1995 PWS commercial fishery ranged from 44-65 cm (Figure 3), with males comprising 46% of all samples. The most abundant male pollock measured 51 cm, whereas the most abundant female pollock measured 56 cm. Lengths in the 1995 summer trawl survey ranged from 18-74 cm, with males comprising 46% of all samples. For both male and female pollock in the 1995 summer trawl survey, the most abundant fish measured 52 cm. Age-7 pollock were the most abundant age class in the 1995 bottom trawl survey (Figure 4).

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 5). Length frequency data from the commercial pollock fisheries indicated PWS pollock were substantially larger than pollock caught in other GOA areas in 1996 (Bechtol 1998*a*). Age-8 pollock were the most abundant age class in the 1996 PWS fisheries (Figure 4). Length distribution in the longline survey ranged from 18-82 cm. Over 35% of the pollock from the longline survey were larger than 64 cm, the largest size that sampled from the commercial fishery.

Length of pollock sampled from the winter spawning aggregations ranged from 20-69 cm in 1997. Male pollock comprised 55% of commercial fishery samples but only 45% of test fishery samples and 42% of acoustic survey samples. The most abundant sizes in the PWS commercial fishery were 53-cm fish for male pollock and 56 cm for female pollock (Figure 6). In test fishery samples, the most abundant pollock measured 56 cm for males and 58 cm for females. Acoustic survey samples were dominated by 54-cm fish for males and 57-cm fish for females. A mode of smaller fish, centered at 32-36 cm for male and female pollock, was also observed in the acoustic surveys. Length distribution in the summer bottom trawl survey ranged from 10-75 cm, with male pollock comprising 45% of the samples. The most abundant fish measured 50 cm for male and 58 cm for female pollock. In the longline survey, pollock lengths ranged from 36-74 cm. The most abundant size classes in longline sample were 58-59 cm. Age-7 pollock were the most abundant age class in the 1997 commercial and test fisheries (Figure 4). Age-7 males and age-7 females contributed 17% and 15%, respectively, of the commercial fishery and 17% and 20%, respectively, of test fishery samples.

Length of pollock sampled in 1998 ranged from 29-76 cm. Male pollock comprised 53% of all commercial samples, 78% of the test fish samples, 59% of the acoustic survey samples, and 20% of the fish for which sex was determined during the longline survey. The most abundant size modes were 55 cm for males and 57 cm for females in the commercial fishery, and 55 cm for males in the test fishery (Figure 7). Females in the test fishery were bimodal with peaks in abundance at 57 and 60 cm. In the March acoustic survey, the size distribution of male pollock was strongly bimodal with peaks in abundance at 27 and 56 cm, whereas 60-cm fish were the most abundant female pollock. Age–8 pollock were the most abundant fish in data combined across the commercial and test fisheries (Figure 4).

Pollock in the 1999 commercial fishery ranged from 35-65 cm, with males pollock comprised 50% of the samples (Figure 8). Length distributions in the commercial fishery were multimodal for both sexes with peaks in abundance observed at 40-42 cm and at 52-58 cm. Age–5 pollock were the most abundant fish in the commercial fishery (Figure 4). Pollock lengths in the summer bottom trawl survey ranged from 16-74 cm, with males comprising 45% of the pollock catch. The most abundant size modes were 40 cm for males and 51 cm for females. Pollock lengths in the September longline survey ranged from 25-74 cm and 38% of the fish were male. Dominant size modes were 46 cm for males and 49 cm for females.

Pollock in the 2000 commercial fishery ranged from 26-79 cm, with males pollock comprised 54% of the samples (Figure 9). The most abundant lengths were 46 cm for male and 48 cm for female pollock. In the 2000 test fishery, pollock sample lengths ranged from 40-65 cm and 59% of the fish were male. The most abundant pollock in the test fishery measured 46 cm for males whereas female pollock were multimodal with peaks in abundance at 53 cm and 57-59 cm. Pollock lengths in the September longline survey ranged from 47-75 cm and 22% of the fish were male.

In general, bottom trawl surveys caught a greater proportion of small pollock, and longline surveys caught a greater proportion of larger pollock, when compared to commercial fishery catches (Figures 6 and 8). Length distributions of pollock sampled from the PWS commercial fisheries varied during 1995 to 2000 (Figure 10). The progression of one or more strong cohorts is evident in the annual harvests from 1995 through 1998. The development of a younger cohort can particularly be seen in the 1998 size data and this cohort appears to develop and play a greater role in the commercial harvest of 1999. Based on the abundance of age-5 fish in 1999, this younger appears to the 1994 age class (Figure 4). By the 2000 fishery, older strong cohorts have died off substantially and the overall strength of the 1994 year class is apparent.

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

For the 19996 fishery, 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 changes to the pollock population of the Eastern Gulf of Alaska Regulatory Area might be expected to effect 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 adjacent federal waters of the Eastern Gulf of Alaska Regulatory Area has been used to scale changes in the PWS pollock guideline (Hollowed et al. 1995, 1996; Bechtol 1998*a*). Another approach would be to apply the change exhibited in the exploitable biomass between years. Estimated exploitable biomass of Gulf of Alaska pollock has declined in recent years, falling an estimated 20% from 1998 to 1999, but is projected to increase by 6% from 2000 to 2001 (Dorn et al. 1999, 2000). Part of this increase is attributed to assessment model improvements and part is attributed to the 7 August 2000 federal court order closing commercial fisheries in Steller sea lion critical habitat area. Application of a relative biomass change approach to the 2000 PWS GHL would result in a 2001 GHL of 1,500 mt.

Fixed Harvest Level

A fixed annual harvest level may be applied for some fisheries to achieve sustainable yield amidst variable recruitment and fishing effort. This approach was used to set the 1999 GHL of 2,100 mt for PWS pollock (Bechtol 1998*b*). Under this approach, the 2001 GHL would again be 1,420 mt.

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 unassessed aggregation in eastern PWS in the mouth of Orca Bay. Among all PWS survey sites, the 1998 acoustic 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. Genetic analyses of PWS pollock stock structure have been inconclusive and somewhat contradictory to date (J. Seeb, ADF&G, Anchorage, AK, personal communication). In addition, size and sex data suggests a large component of this 1999 aggregation was new recruit pollock that should be allowed to further develop for optimal contribution to the fishery's target biomass. No winter assessment was conducted in 1999 and the 2000 winter assessment yielded a biomass estimate that was substantially less than that observed in the 1997 or 1998 winter surveys (Table 3). Further research is needed to explore: (1) the utility of winter acoustic data in determining exploitable biomass for the PWS pollock resources; and (2) the relationship of PWS pollock to pollock in the Gulf of Alaska.

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 (*EXXON Valdez* Oil Spill Trustee Council 1993), many of the studies encountering pollock 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 depth distributions 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 more recent summer surveys.

Following standards for establishing harvest guidelines in federal water fisheries, PWS pollock would fall under Tier 5 because an estimate of the population biomass is available. Tier 5 standards set the harvest level as 75% of the product of the biomass estimate and estimated natural mortality. In this case, the natural mortality rate is assumed to be 0.30, which is applied for pollock in federal assessment models for the Gulf of Alaska (Dorn et al. 1999). It is thought unlikely that PWS pollock biomass has changed substantially since the most recent summer biomass estimate, the 6,394 mt estimated by the 1999 summer bottom trawl survey (Bechtol 1999*b*). Thus, the recommended guideline harvest level for Prince William Sound pollock is:

$$GHL = B \times M \times 0.75 = 6{,}304 \times 0.30 \times 0.75 = 1{,}420 \text{ mt.}$$

Continuing 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 will continue to examine pollock from inside and outside of PWS for isotope signatures. ADF&G will continue to conduct annual longline surveys, with most of the survey effort focusing on the northwest quadrants of PWS and one third of the effort rotating among other areas of PWS. ADF&G is also scheduled to conduct another bottom trawl survey of PWS during 2001. The 2001 trawl survey would again occur at approximately the same time of year as the biennial trawl survey conducted by NMFS in the adjacent federal waters. In a cooperative effort between ADF&G and the Prince William Science Center, another acoustic survey of spawning aggregations of pollock is scheduled in the winter of 2001. This winter acoustic survey is tentatively planned to involve two survey legs, the first in late February and the second in late March. Finally, additional funding for pollock research throughout the Gulf of Alaska, including PWS, is being pursued by both federal and state biologists. Some specific potential research components include a summer acoustic survey and further trawl comparison studies to develop fishing power corrections for ADF&G bottom trawl nets relative to NMFS bottom trawl nets.

Fishery Management Measures

The fishing power of 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 to 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 include requirements for logbooks, observers, harvest reporting procedures, and other specifications. The following measures will likely be implemented for the 2000 fishery:

<u>Fishing Season</u> - The fishery will open at 12:00 noon on 20 January 2000, and will remain open until the guideline harvest level (GHL) is taken. This opening will coincide with the opening of trawl fishing for pollock in adjacent federal waters. Time and area closures may be used to reduce the bycatch of non-target species.

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

<u>Observer Coverage</u> - All vessels must carry an ADF&G observer if requested.

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

Pollock are a prey item of endangered Steller sea lions. To provide against localized pollock depletion in an effort to address declining Steller sea lion stocks, the Board further adopted regulations to geographically distribute pollock harvests in the PWS pollock fishery.

<u>Harvest Distribution Among Areas</u> – No more than 40% of the total PWS GHL will be taken from any one of the following sections:

1. Bainbridge Section - Inside District waters west of 148° W. long.
2. Knight Island Section - Inside District waters between 148° W. long. and 147° 20' W. long.
3. Hinchinbrook Section - - Inside District waters east of 147° 20' W. long.

LITERATURE CITED

Bakkala, R., T. Maeda, and G. McFarlane. 1986. Distribution and biology of pollock (*Theragra chalcogramma*) in the North Pacific Ocean. In: Symposium on Biology, Stock Assessment, and Management of Pollock, Pacific Cod, and Hake in the North Pacific Region. International North Pacific Fisheries Commission, Bulletin 45: 3-20

Bechtol, W.R. 1995*a*. Commercial groundfish fisheries in the Central Region, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries, Management and Development, Regional Information Report 2A95-32, Anchorage.

Bechtol, W.R. 1995*b*. Assessment and management of Prince William Sound walleye pollock for 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report 2A95-45, Anchorage.

Bechtol, W.R. 1998*a*. Current assessment and 1998 management recommendations for walleye pollock in Prince William Sound. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report 2A97-36, Anchorage.

Bechtol, W.R. 1998*b*. Prince William Sound walleye pollock: current assessment and 1999 management recommendations. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A98-41, Anchorage.

Bechtol, W.R. 1999*a*. A bottom trawl survey for crabs and groundfish in the Prince William Sound Management Area, 16-26 August 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A99-24, Anchorage.

Bechtol, W.R. 1999*b*. Prince William Sound walleye pollock: current assessment and 2000 management recommendations. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A99-33, Anchorage.

Bechtol, W.R., and J. Vansant, III. 1998. Relative abundance of sablefish and other groundfish caught on longline gear in Prince William Sound, Alaska, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report 2A98-27, Anchorage.

Berceli, R., C. Trowbridge, M. Lambdin, and W.R. Bechtol. 1999. Review of the groundfish fisheries in the Prince William Sound Management Area: Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A99-30, Anchorage.

Brown, E., and H. Zenger. 1999. National Marine Fisheries Service/Alaska Department of Fish and Game trawl comparison study. pp: 3-6 in Alaska Fisheries Science Center Quarterly Report, Jan-March 1998, Alaska Fisheries Science Center, NMFS, Seattle.

Dorn, M.W., A.B. Hollowed, E. Brown, B. Megrey, C. Wilson, and J. Blackburn. 1999. Walleye pollock. In: Stock Assessment and Fishery Evaluation Report for groundfish resources of the Gulf of Alaska . Prepared by the Gulf of Alaska Groundfish Plan Team, North Pacific Fishery Management Council, Anchorage, Alaska.

Dorn, M.W., A.B. Hollowed, E. Brown, B. Megrey, C. Wilson, and J. Blackburn. 2000. Walleye pollock. In: Stock Assessment and Fishery Evaluation Report for groundfish resources of the Gulf of Alaska . Prepared by the Gulf of Alaska Groundfish Plan Team, North Pacific Fishery Management Council, Anchorage, Alaska.

Dwyer, D.A., K. Bailey, P. Livingston, and M. Yang. 1986. Some preliminary observations on the feeding of walleye pollock (*Theragra chalcogramma)* in the Eastern Bering Sea, based on field and laboratory studies. In: Symposium on Biology, Stock Assessment, and Management of Pollock, Pacific Cod, and Hake in the North Pacific Region. International North Pacific Fisheries Commission, Bulletin. 45: 228-246.

Exxon Valdez Oil Spill Trustee Council. 1993. *Exxon Valdez* Oil Spill symposium: Abstract book. *Exxon Valdez* Oil Spill Trustee Council. Oil spill public information center, Anchorage. 356 p.

Hart, J.L. 1973. Pacific fishes of Canada. Fisheries Research Board of Canada, Bulletin 180.

Haynes, E. and D. Urban. 1991. Prince William Sound trawl assessment. State/Federal Natural Resource Damage Assessment, Fish/Shellfish Study Number 18. Final Report, 66 p.

Hollowed, A.B., E. Brown, P. Livingston, B.A. Megrey, and C. Wilson. 1995. Walleye pollock. In: Stock Assessment and Fishery Evaluation Report for the Gulf of Alaska as projected for 1996. Prepared by the Gulf of Alaska Groundfish Plan Team, North Pacific Fishery Management Council, Anchorage, Alaska.

Hollowed, A.B., E. Brown, B.A. Megrey, and C. Wilson. 1996. Walleye pollock. In: Stock Assessment and Fishery Evaluation Report for groundfish resources of the Gulf of Alaska . Prepared by the Gulf of Alaska Groundfish Plan Team, North Pacific Fishery Management Council, Anchorage, Alaska.

Hollowed, A.B., E. Brown, J, Ianelli, P. Livingston, B. Megrey, and C. Wilson. 1997. Walleye pollock. In: Stock Assessment and Fishery Evaluation Report for groundfish resources of the Gulf of Alaska . Prepared by the Gulf of Alaska Groundfish Plan Team, North Pacific Fishery Management Council, Anchorage, Alaska.

Janusz, J. 1986. Biology of walleye pollock (*Theragra chalcogramma)* from the Gulf of Alaska. In: Symposium on Biology, Stock Assessment, and Management of Pollock, Pacific Cod, and Hake in the North Pacific Region. International North Pacific Fisheries Commission, Bulletin. 45: 247-261.

Kirsch, J. 1997. Acoustic biomass estimate of adult walleye pollock in Prince William Sound, Alaska, in winter 1997. Prince William Sound Science Center, Cordova, Alaska.

Kirsch, J., and G. Thomas. 1998. Acoustic biomass estimate of adult walleye pollock in Prince William Sound, Alaska, in winter 1998: final report. Prince William Sound Science Center, Cordova, Alaska.

Livingston, P.A., A. Ward, G.M. Lang, and M.-S. Yang. 1993. Groundfish food habits and predation on commercially important prey species in the Eastern Bering Sea from 1987 to 1989. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-AFSC-11, 192 p.

Methot, R.D. 1990. Synthesis model: an adaptable framework for analysis of diverse stock assessment data. INPFC Bulletin. 50: 259-277.

Muensch, R.D., and C.M. Schmidt. 1974. Variations in the hydrographic structure of Prince William Sound. IMS Report R75-1, Institute of Marine Science, University of Alaska, Fairbanks, 35 p.

Nishiyama, T., K. Hirano, and T. Haryu. 1986. The early life history and feeding habits of larval walleye pollock, *Theragra chalcogramma* (Pallas), in the southeast Bering Sea. In: Symposium on Biology, Stock Assessment, and Management of Pollock, Pacific Cod, and Hake in the North Pacific Region. International North Pacific Fisheries Commission, Bulletin. 45: 177-227.

Okada, K. 1986. Biological characteristics and abundance of pelagic pollock in the Aleutian Basin. In: Symposium on Biology, Stock Assessment, and Management of Pollock, Pacific Cod, and Hake in the North Pacific Region. International North Pacific Fisheries Commission, Bulletin. 45: 150-176.

Parks, N.B., and H. Zenger. 1979. Trawl survey of demersal fish and shellfish resources in Prince William Sound, Alaska: spring 1978. NWAFC Processed Report 79-2, 49 p.

Sigler, M.F., and H.H. Zenger, Jr. 1989. Relative abundance of Gulf of Alaska sablefish and other groundfish based on the domestic longline survey, 1989. NOAA Technical Memorandum NMFS-AFC-40, 79 p.

Thomas, G.L., and T.B. Stables. 1995. Winter 1995 estimate of the prespawning biomass of walleye pollock in Prince William Sound, Alaska. Prince William Sound Science Center, Cordova, Alaska.

Thorne, R.E., and G.L. Thomas. *Under review.* Echo integration/midwater trawling survey of adult walleye pollock abundance in Prince William Sound, Alaska, in winter 2000.

Traynor, J.J., and M.O. Nelson. 1983. Results of the U.S. hydroacoustic survey of pollock on the continental shelf and slope. pp: 305-320 *In*: R.G. Bakkala and K. Wakabayashi [eds.], Results of cooperative U.S.-Japan groundfish investigations in the Bering Sea during May-August 1979. Unpublished manuscript., NWAFC, NMFS, Seattle.

Trowbridge, Charles. 1996. Central Region groundfish report to the Alaska Board of Fisheries, 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, Management and Development, Regional Information Report 2A96-37, Anchorage.

Yang, M.-S. 1993. Food habits of the commercially important groundfishes in the Gulf of Alaska in 1990. U.S. Dept. of Commerce, NOAA Technical Memo. NMFS-AFSC-22, 150 p.

Table 1. Annual commercial walleye pollock harvest from Prince William Sound, Alaska during 1987-2000.

Year	Round Weight (metric tons)[a]			
	Longline	Trawl	Other	Total
1987	0.4	0.0	0.0	0.4
1988	0.7	0.0	0.0	0.7
1989	0.2	0.4	<0.1	0.7
1990	0.3	3.0	0.0	3.3
1991	0.0	0.0	0.0	0.0
1992	<0.1	2.7	0.0	2.7
1993	0.1	2.5	0.0	2.6
1994	<0.1	0.0	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
1999	5.4	2,342.3	0.0	2,347.7
2000	1.8	1,191.6	0.0	1,193.4

[a] Preliminary data through 5 December 2000.

Table 2. Unweighted catch abundance and mean catch rates from the sablefish longline survey of Prince William Sound, 1996-2000.

	Sablefish	Pacific Cod	Pollock	Halibut	Arrowtooth Flounder	Demersal Rockfish	Slope Rockfish	Skates	Salmon Shark	Spiny Dogfish	Sleeper Shark	Other	Hooks Without Fish Baited	Hooks Without Fish Ineffective	Hooks Without Fish Unbaited	Total Hooks
1996 - Northwest PWS (n = 31 stations)																
Abundance	1,652	239	129	841	70	4	109	451	1	27	35	9	15,674	369	1,360	20,970
% of Hooks	7.9%	1.1%	0.6%	4.0%	0.3%	<0.1%	0.5%	2.2%	<0.1%	0.1%	0.2%	<0.1%	74.7%	1.8%	6.5%	100.0%
Fish/Hook	0.46	0.07	0.04	0.24	0.02	<0.01	0.03	0.13	<0.01	0.01	0.01	<0.01				
Fish/Set	53.3	7.7	4.2	27.1	2.3	3.5	0.1	14.5	0.0	0.9	1.1	0.3				
1997 - Northwest and Southwest PWS (n = 34 stations)																
Abundance	1,559	260	138	945	104	3	92	339	0	91	59	32	17,275	536	1,517	22,950
% of Hooks	6.8%	1.1%	0.6%	4.1%	0.5%	<0.1%	0.4%	1.5%	0.0%	0.4%	0.3%	0.1%	75.3%	2.3%	6.6%	100.0%
Catch/Hook	0.43	0.07	0.04	0.26	0.03	<0.01	0.03	0.09	0.00	0.03	0.02	0.01				
Fish/Set	45.9	7.6	4.1	27.8	3.1	2.7	0.1	10.0	0.0	2.7	1.7	0.9				
1998 - Northwest and Eastern PWS (n = 38 stations)																
Abundance	2,698	476	187	975	111	2	99	622	1	1,948	103	11	16,147	1,322	948	25,650
% of Hooks	10.5%	1.9%	0.7%	3.8%	0.4%	<0.1%	0.4%	2.4%	<0.1%	7.6%	0.4%	<0.1%	63.0%	5.2%	3.7%	100.0%
Catch/Hook	0.37	0.07	0.03	0.13	0.02	<0.01	0.01	0.09	<0.01	0.27	0.01	<0.01				
Fish/Set	71.0	12.5	4.9	25.7	2.9	2.6	0.1	16.4	0.0	51.3	2.7	0.3				
1999 - Northwest and Southwest PWS (n = 30 stations)																
Abundance	1,833	169	107	668	83	0	64	179	0	51	128	7	14,735	1,092	1,134	20,250
% of Hooks	9.1%	0.8%	0.5%	3.3%	0.4%	0.0%	0.3%	0.9%	0.0%	0.3%	0.6%	<0.1%	72.8%	5.4%	5.6%	100.0%
Catch/Hook	0.56	0.05	0.03	0.20	0.03	0.00	0.02	0.05	0.00	0.02	0.04	<0.01				
Fish/Set	61.1	5.6	3.6	22.3	2.8	2.1	0.0	6.0	0.0	1.7	4.3	0.2				
2000 - Northwest and Eastern PWS (n = 36 stations)																
Abundance	3,101	146	47	513	50	0	80	432	0	47	92	4	17,666	1,543	579	24,300
% of Hooks	12.8%	0.6%	0.2%	2.1%	0.2%	0.0%	0.3%	1.8%	0.0%	0.2%	0.4%	0.0%	72.7%	6.3%	2.4%	100.0%
Catch/Hook	68.7%	3.2%	1.0%	11.4%	1.1%	0.0%	1.8%	9.6%	0.0%	1.0%	2.0%	0.1%				
Fish/Set	86.1	4.1	1.3	14.3	1.4	0.0	2.2	12.0	0.0	1.3	2.6	0.1				
Means Among Years																
% of Hooks	9.5%	1.1%	0.5%	3.5%	0.4%	0.0%	0.4%	1.8%	0.0%	1.9%	0.4%	0.1%	71.4%	4.3%	4.9%	100.0%
Catch/Hook	48.8%	5.8%	2.7%	17.7%	1.9%	0.0%	2.0%	9.1%	0.0%	9.7%	1.9%	0.3%				
Fish/Set	64.2	7.6	3.6	23.3	2.5	0.1	2.6	12.0	0.0	12.8	2.5	0.4				

Table 3. Walleye pollock biomass estimates from a variety of Prince William Sound surveys, 1989-2000.

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.
1997 Trawl Survey	21,220	Summer	Few stations in SE and no stations in NW
1998 Hydroacoustic Survey	114,344	Winter	Prespawning Aggregation.
1999 Trawl Survey	6,304	Summer	Few stations in SE and no stations in NW
2000 Hydroacoustic Survey	28,227	Winter	Prespawning Aggregation.
1996-2000 Longline Surveys	NA	Fall	Relative abundance, distribution, and size data

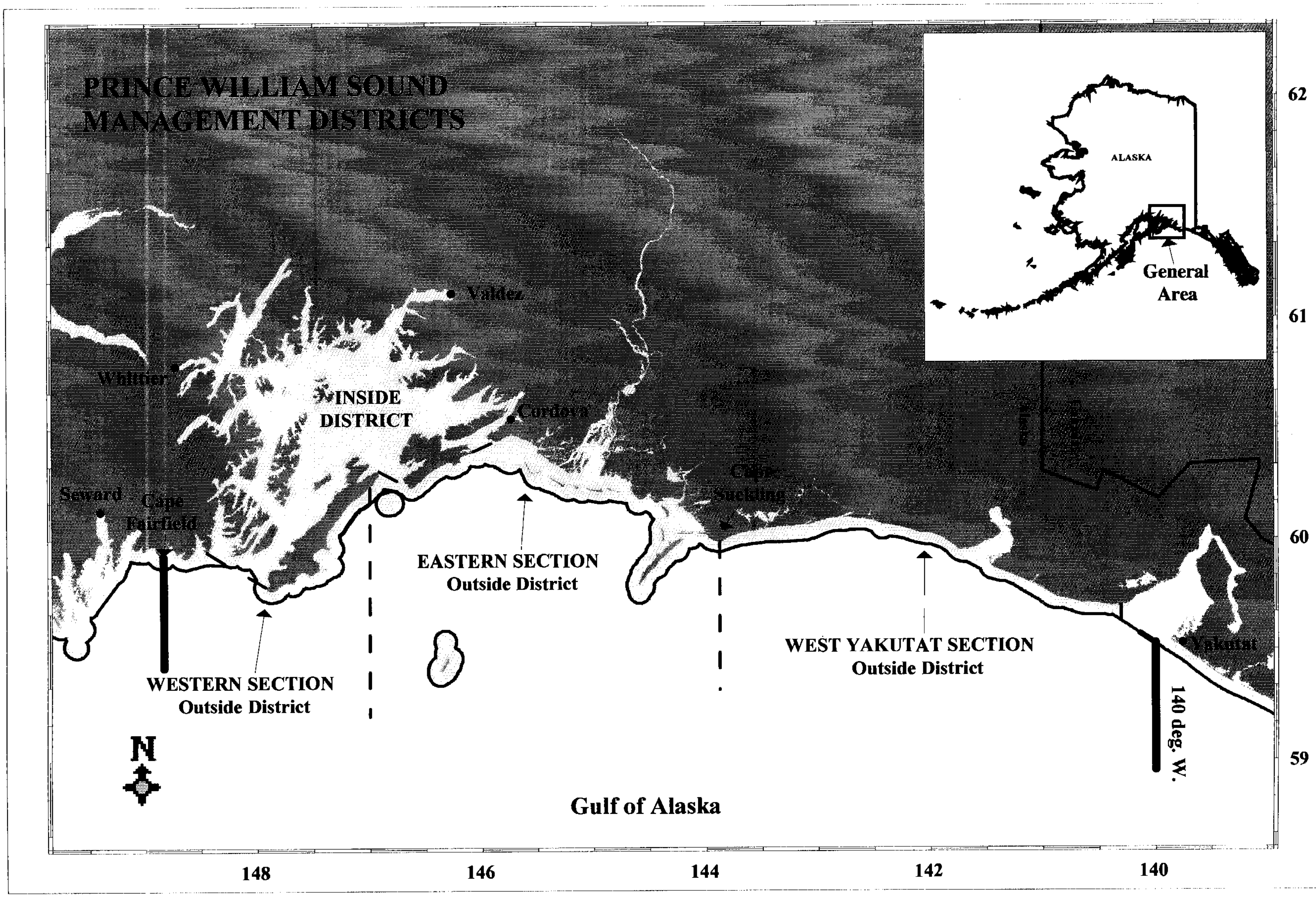

Figure 1. Groundfish management districts of the Prince William Sound Management Area.

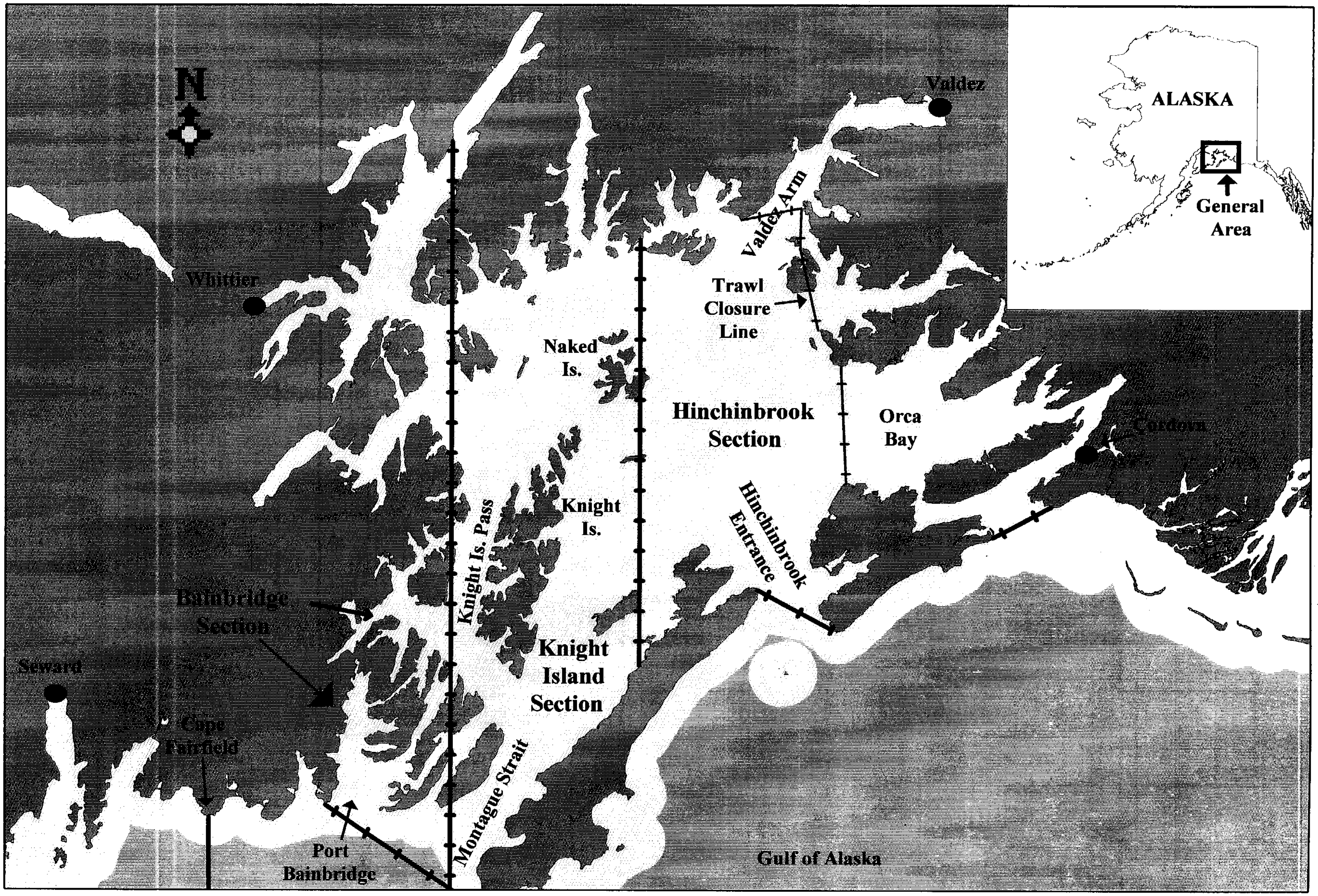

Figure 2. Locations of interest in Prince William Sound.

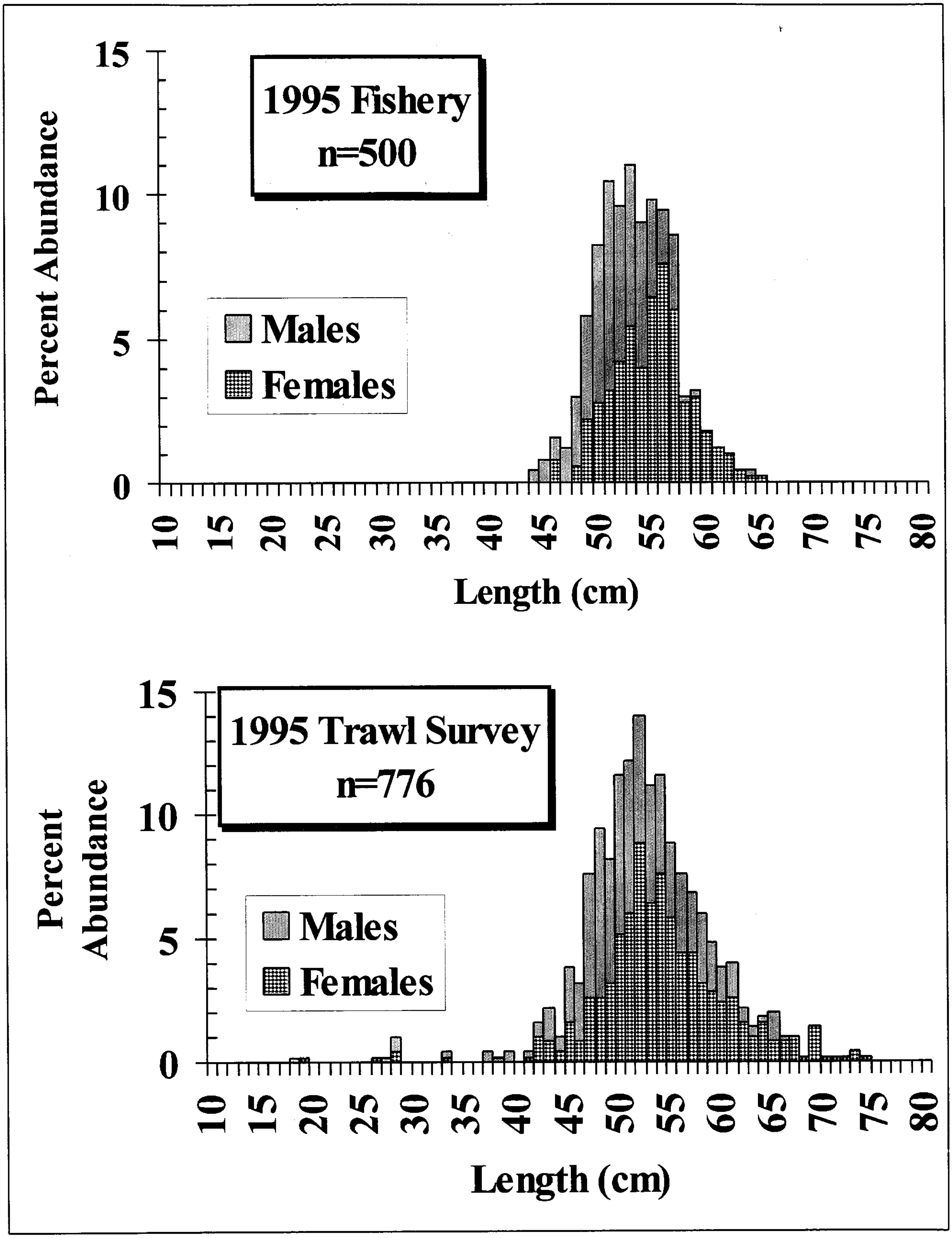

Figure 3. Length distribution of Prince William Sound pollock, 1995.

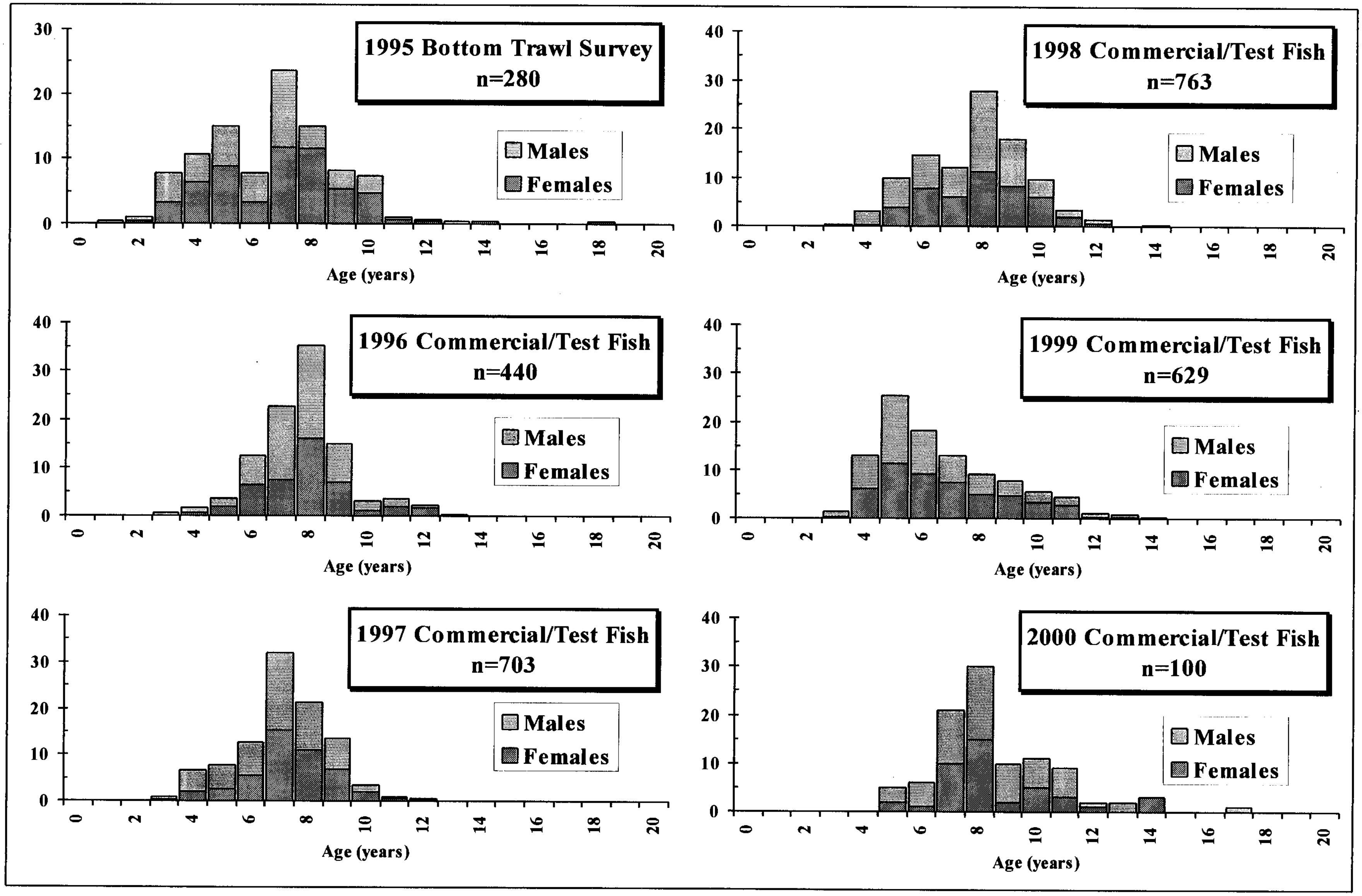

Figure 4. Age composition of pollock sampled from Prince William Sound, 1995-1999.

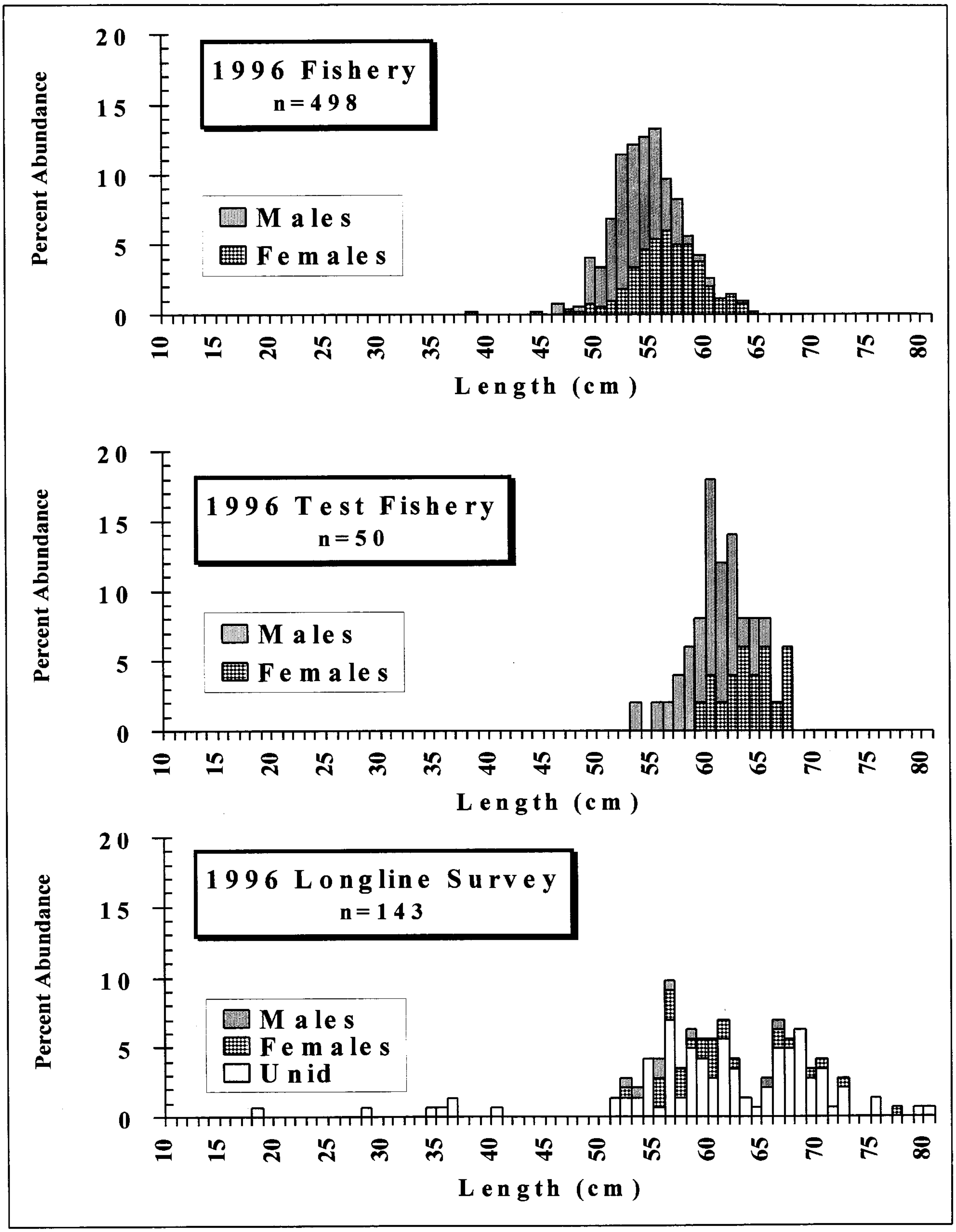

Figure 5. Length distribution of Prince William Sound pollock, 1996.

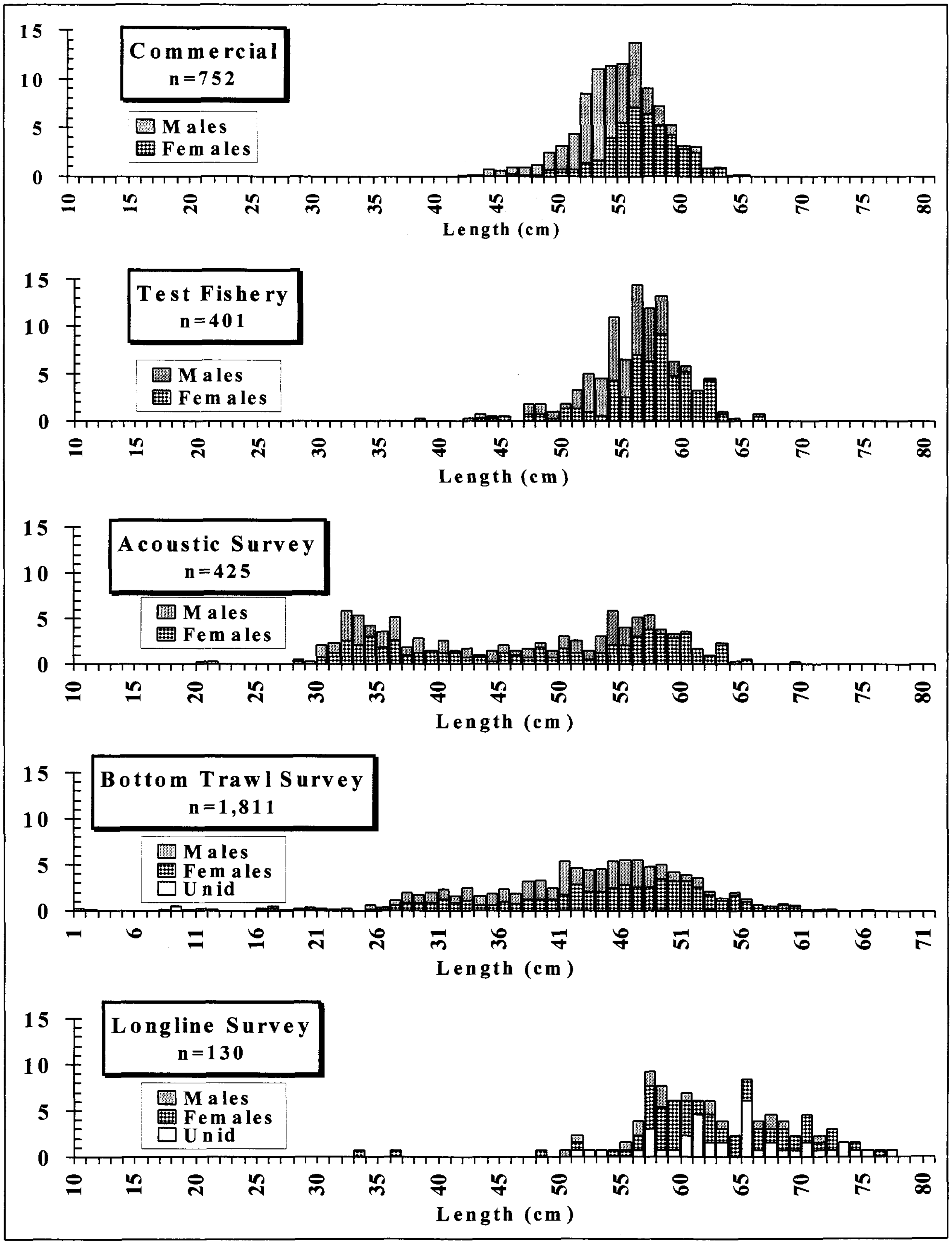

Figure 6. Length distribution of Prince William Sound pollock, 1997.

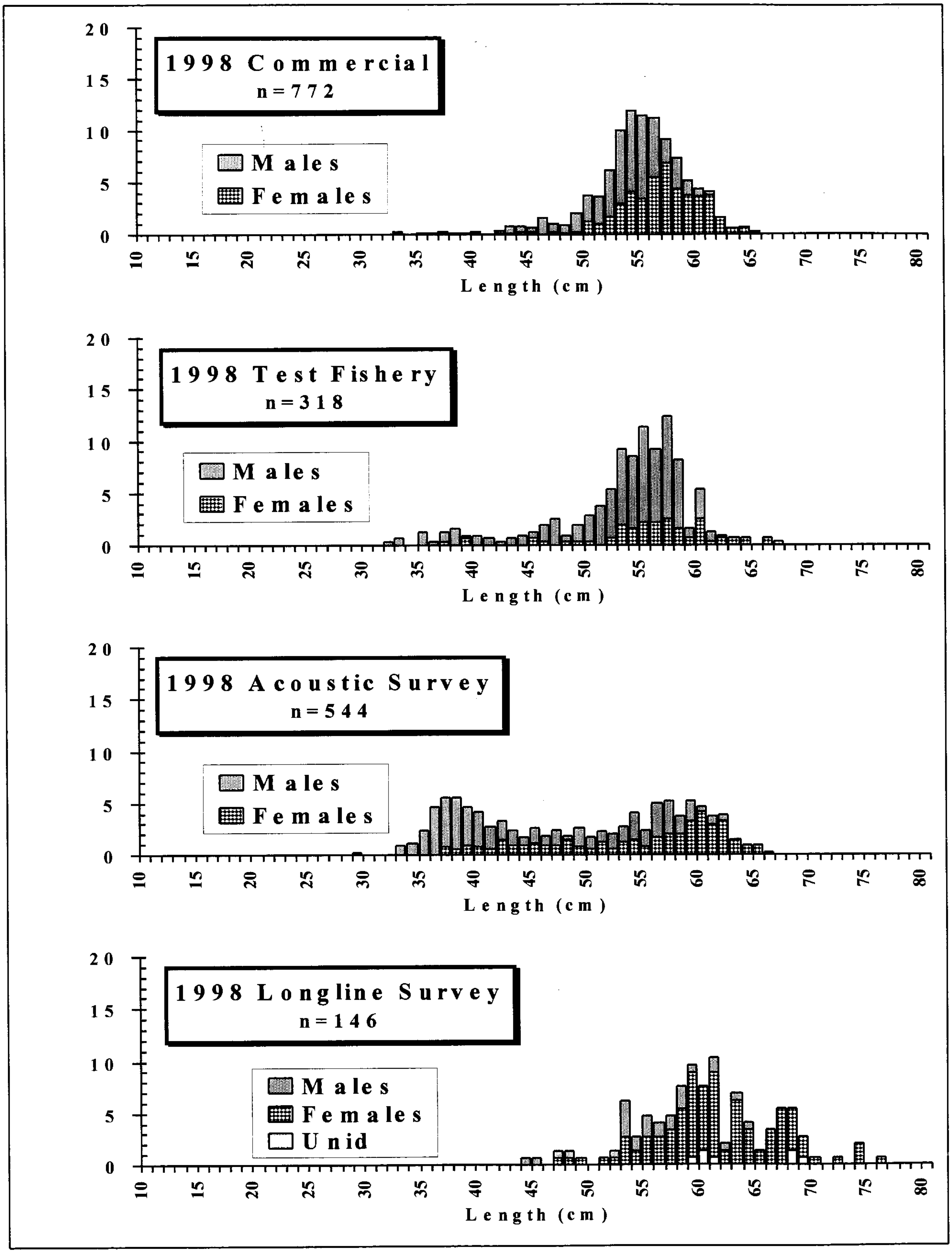

Figure 7. Length distribution of Prince William Sound pollock, 1998.

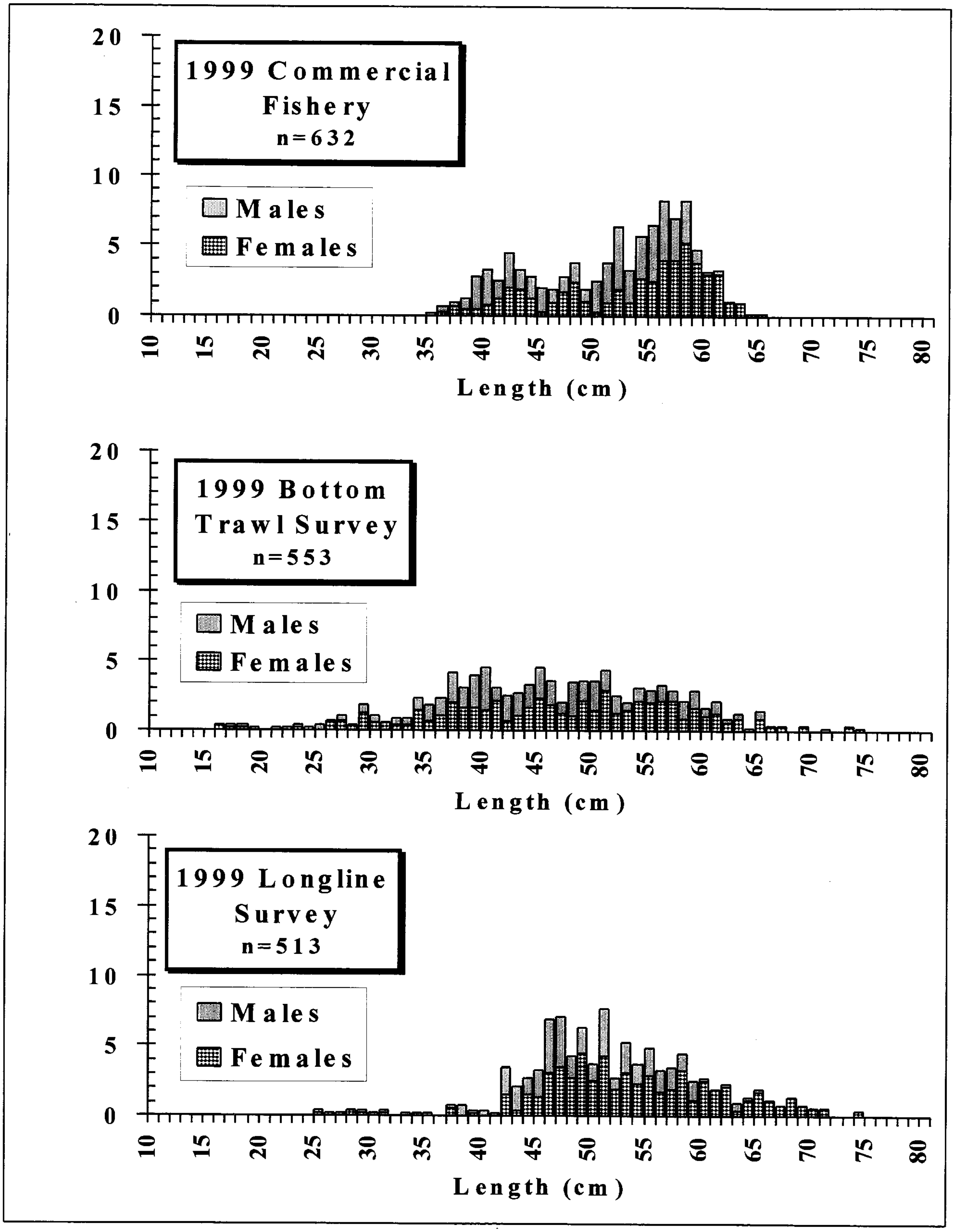

Figure 8. Length distribution of Prince William Sound pollock, 1999.

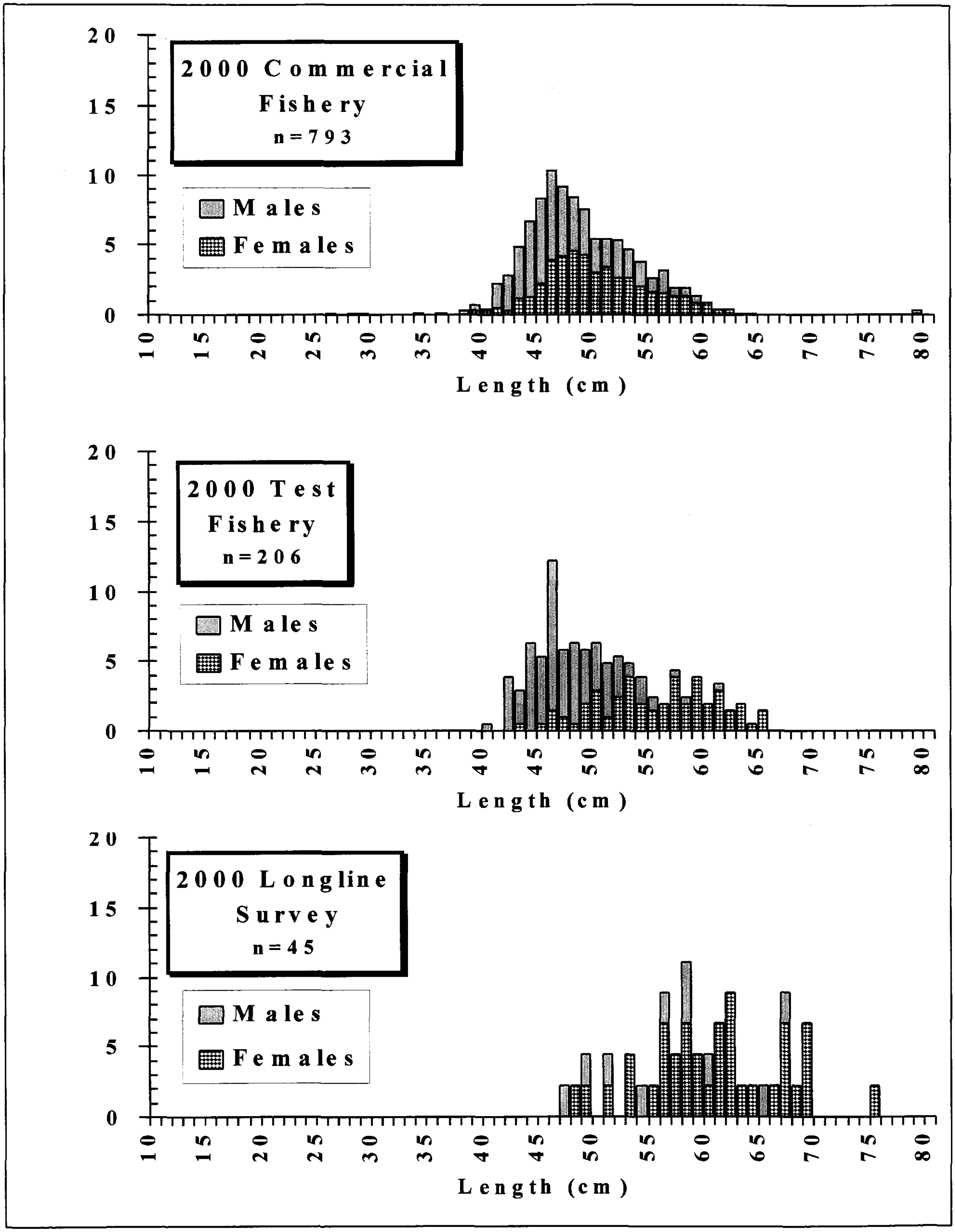

Figure 9. Length distribution of Prince William Sound pollock, 2000.

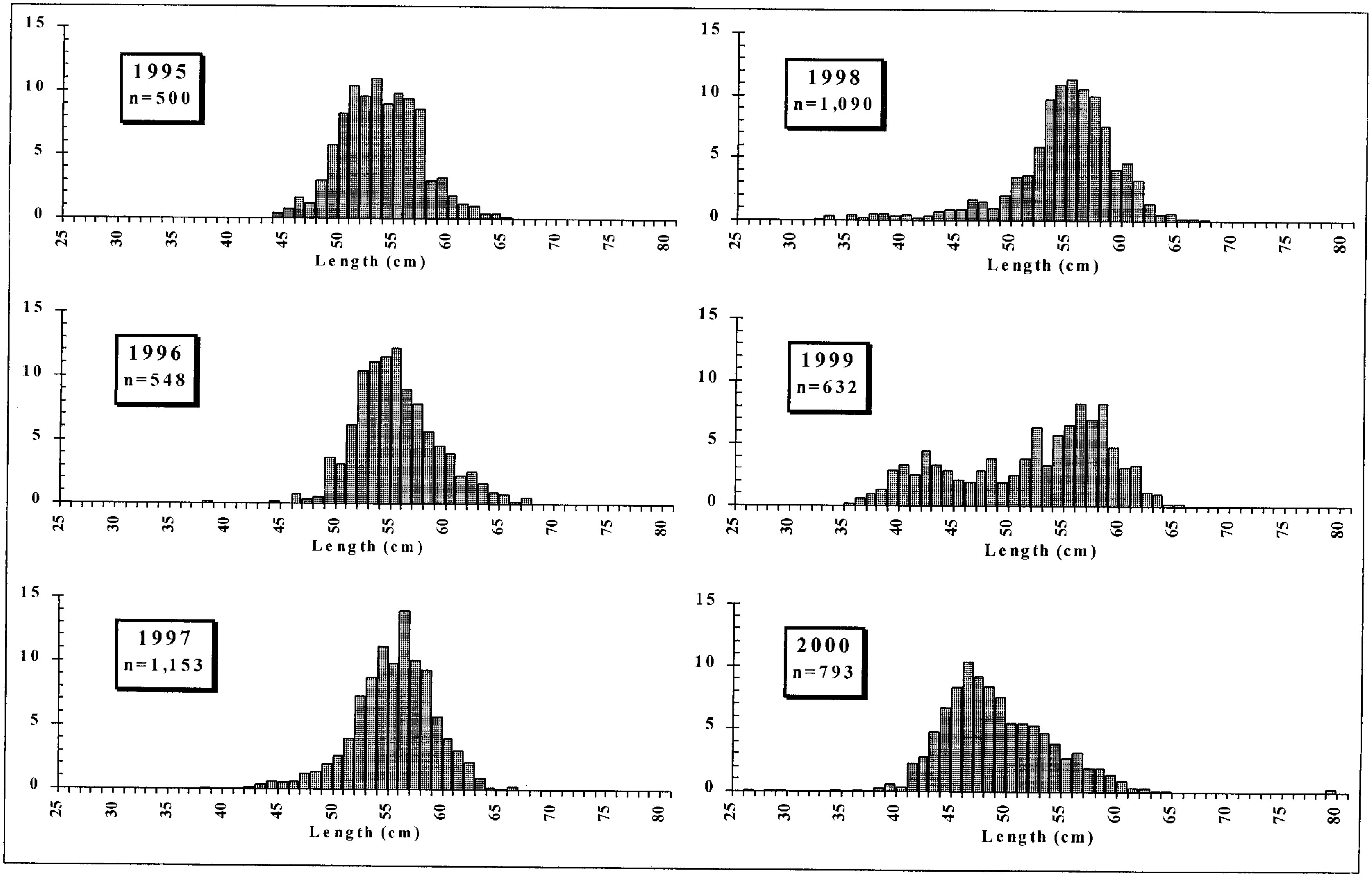

Figure 10. Length distribution (percent abundance) of walleye pollock in commercial harvests from Prince William Sound, 1995-2000.