OCS Study
MMS 92-0016

Fishery Databases: Description, Documentation and Narrative for the State of Oregon

Final Report

Prepared by:

Oregon Department of Fish and Wildlife
Marine Science Drive, Building #3
Newport, Oregon 97365

This Study Is Supported by:

U.S. Department of the Interior
Minerals Management Service
Pacific OCS Region
770 Paseo Camarillo
Camarillo, California 93010

under

Contract No. 14-12-0001-30459

August 1992

DISCLAIMER

PROJECT ORGANIZATION

Project Manager:
Russell G. Porter
Pacific States Marine Fisheries Commission
2501 S.W. First Avenue, Suite 200
Portland, OR 97201-4752

Project Manager:

Richard Starr
Oregon Department of Fish and Wildlife
Marine Science Dr., Bldg. #3
Newport, OR 97365

Project Technical Officer:

Frank J. Manago
U.S. Department of the Interior
Minerals Management Service
Pacific OCS Region
770 Paseo Camarillo
Camarillo, CA 93010

Report Authors:

David Fox, Project Leader
Oregon Department of Fish and Wildlife

Mark Saelens, Assistant Project Leader
Oregon Department of Fish and Wildlife

Arlene Merems, Project Biologist
Oregon Department of Fish and Wildlife

Michele Long, Experimental Biological Aide
Oregon Department of Fish and Wildlife

Barbara Bond, Experimental Biological Aide
Oregon Department of Fish and Wildlife

Other Project Personnel: (continued)

Ann Ferguson, Experimental Biological Aide
Oregon Department of Fish and Wildlife

Eric Nishibayashi, Experimental Biological Aide
Oregon Department of Fish and Wildlife

Dale Nelson, Project Biologist
Oregon Department of Fish and Wildlife

CHAPTER 1:

QUANTITATIVE FISHERY DATABASE DOCUMENTATION

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

Numerous people contributed to the successful completion of this project. The fishers who have consistently produced complete and accurate fishing logbooks over the years deserve special thanks. ODFW port biologists devoted countless hours over the past ten years collecting and examining logbooks and fishtickets. These biologists and data entry personnel are responsible for much of the raw data provided to our project.

In addition to the authors, several ODFW staff participated directly in the project. Clay Creech deserves special thanks for his work in translating computer data files for our use and for his advice in our data processing procedures. Jim Golden, Gary Hettman, Claire Wood, and Kathy Murphy from the Marine Finfish program provided needed advice in data processing and logbook data handling procedures. Phil Flanders from the Ocean Salmon Program provided the salmon troll data file. Bob Hannah, Steve Jones, and Terry Link helped with Oregon shrimp logbook interpretation. Rick Starr conceived the project and provided essential oversight toward project completion.

Washington Department of Fisheries personnel, particularly Mike Gross, Phil Coates, and Peter Sweet provided advice and guidance for development of the Washington shrimp data summaries.

ACCESS NUMBER: 30459

TECHNICAL SUMMARY

Study Title: Minerals Management Service Outer Continental Shelf Fishery Resource Database.

Report Title: Fishery Databases: Description, Documentation and Narrative for the State of Oregon.

Contract Number: MMS No. 14-12-0001-30459.

Sponsoring OCS Region: Pacific.

Applicable Planning Area: Washington-Oregon.

Fiscal Years of Project Funding: 1989, 1990, 1991.

Completion Date of Final Report: August 1992.

Costs: Oregon Department of Fish and Wildlife (ODFW) portion: FY89: $189,638; FY90: $124,049; FY91: $118,598. Cumulative Project Cost (ODFW portion): $426,285.

Project Manager: Richard Starr.

Affiliation: Oregon Department of Fish and Wildlife, Marine Region.

Address: Marine Science Dr., Bldg #3
Newport, OR 97365.

Principal Investigators:* Richard Starr, David Fox.

Key Words: Oregon, Washington, commercial fishery, outer continental shelf, groundfish, pink shrimp, weathervane scallop.

Background: In 1987, U.S. Department of the Interior's Minerals Management Service (MMS) began a new proposed 5-Year Outer Continental Shelf (OCS) Oil and Gas Leasing Program for mid-1987 through mid-1992. Proposed OCS Lease Sale 132 (off Oregon and Washington) was included in this 5-Year Program. Under the agreement, the Oregon Department of Fish and Wildlife (ODFW) developed quantitative and qualitative databases describing the major fisheries occurring off Oregon. ODFW developed databases summarizing the Oregon groundfish trawl fishery (1980 - 1989), the Oregon shrimp trawl fishery (1980 - 1989), the Oregon scallop fishery (1981 - 1985), the Washington shrimp trawl fishery (1985 - 1987), and the Oregon salmon troll fishery by port (1979 - 1988). ODFW also produced qualitative distributional maps of selected Oregon fisheries.

Objectives: To provide MMS with quantitative and qualitative databases describing major fisheries off Oregon in a format suitable for mapping.

ACCESS NUMBER: 30459

Description: Twenty-nine quantitative fishery databases were produced for MMS using existing commercial trawl logbooks and delivery records. Qualitative maps of fishery distribution were developed based on interviews with fishers and fishery biologists. The databases and maps were summarized in a report entitled Fishery Databases: **Description, Documentation and Narrative for the State of Oregon.**

Significant Conclusions: The quantitative fishery information includes groundfish, shrimp, and scallop fishery databases. These provide a detailed geographic representation of the fisheries by month, gear, and species. The data can be summarized in their present fine-resolution format or be re-combined to characterize the fishery according to aggregated data groupings. Uses of the data include identifying fisheries that are most likely to be impacted by a proposed development, identifying potential area use conflicts, and quantifying specific fishery impacts by gear, time of year, block location, and species. The qualitative fishery maps provide general locations of fishing areas for several Oregon fisheries.

Study Results: The groundfish, shrimp, and scallop fishery data files summarize catch in pounds and fishing effort in trawl hours within a 5 minute latitude by 5 minute longitude geographic grid system extending from Cape Mendocino, California to Cape Flattery, Washington. The databases provide a detailed geographic representation of the fisheries by month, gear, and species. The salmon database provides landings by port. The qualitative fishery maps summarize catch areas for the following fisheries: ocean salmon troll, dungeness crab, pot and longline groundfish, sea urchins, Pacific herring, squid, razor clam, and sport fishing charter boats.

Study Products:
29 Databases:

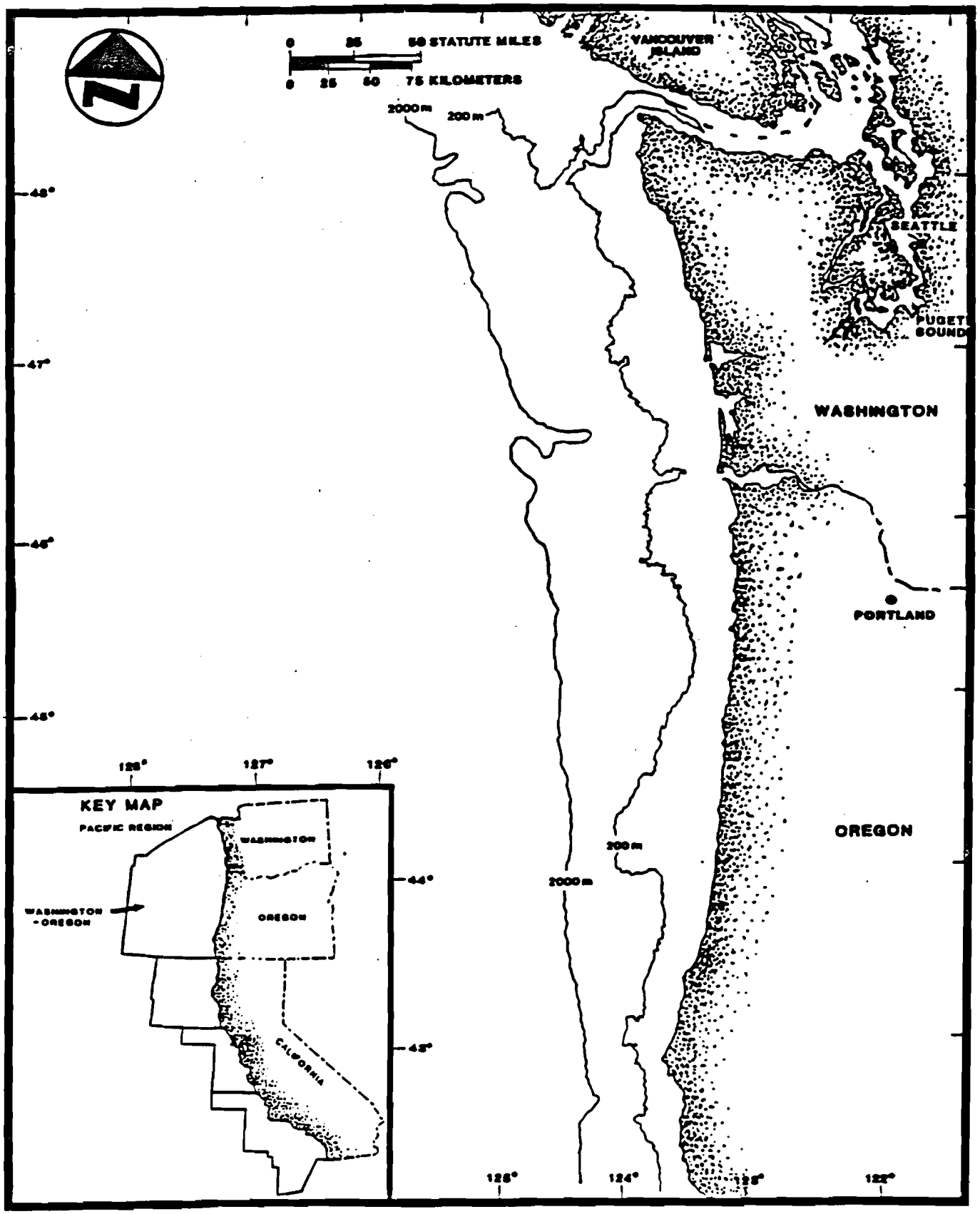
- 10 databases (1980 - 1989) describing Oregon groundfish catch and effort by month, gear, species, and block, and effort by month, gear, species, and block,
- 5 databases (1981 - 1985) describing Oregon scallop catch and effort by month, gear, species, and block,
- 3 databases (1985 - 1987) describing Washington shrimp catch and effort by month, gear, species, and block, and
- 1 database (1979 - 1988) describing Oregon salmon landings by port.

A report summarizing the quantitative fishery databases and the qualitative fishery maps:

Fox, D., M. Saelens, M. Long, B. Bond, and A. Merems. 1992. Fishery Databases: Description, Documentation and Narrative for the State of Oregon. Final report by the Oregon Department of Fish and Wildlife to the U.S. Department of the Interior, Minerals Management Service Pacific OCS Office, Camarillo, CA. OCS Study MMS 92-0016.

* P.I.'s affiliation may be different than listed for the Project Manager.

ACCESS NUMBER: 30459



Study Area Showing Washington-Oregon OCS Planning Area and Region.

I. INTRODUCTION

In 1987, U. S. Department of Interior's Minerals Management Service (MMS) began a new proposed 5-Year Outer Continental Shelf (OCS) Oil and Gas Leasing Program for mid-1987 through mid-1992. Proposed OCS Lease Sale 132 (off Oregon and Washington) was included in this 5-Year Program. The 5-Year Program requires preparation of an Environmental Impact Statement for each Lease Sale area. In 1988, the Minerals Management Service entered into a cooperative agreement with the Pacific States Marine Fisheries Commission (PSMFC) to develop fisheries information needed for the Lease Sale 132 Environmental Impact Statement. Under the cooperative agreement, Oregon Department of Fish and Wildlife (ODFW) was to develop quantitative and qualitative databases describing the major fisheries occurring off Oregon. This report documents the databases developed by ODFW.

The databases developed by the Oregon Department of Fish and Wildlife include:

1) Oregon groundfish trawl fishery summaries by block (1980 - 1989),
2) Oregon shrimp trawl fishery summaries by block (1980 - 1989),
3) Oregon scallop fishery summaries by block (1981 - 1985),
4) Washington shrimp trawl fishery summaries by block (1985 - 1987),
5) Oregon salmon troll fishery by port (1979 - 1988), and
6) qualitative distributional maps of selected Oregon fisheries.

This report documents the groundfish, shrimp, scallop, and salmon databases. The qualitative distributional information is summarized in the second section of this document. In addition to the information listed above, we provided MMS with summary information on commercial fish landings in Oregon. These data and associated documentation appear in ODFW's annual Pounds and Values reports (Brown, et al. 1981; Lukas and Carter 1982, 1983, 1984, 1985, 1986). Additional documentation of the early development of our database processing methods can be found in Starr and Saelens (1987) and Starr, et al. (1989).

II. DATABASE FORMAT AND CONTENT

Commercial groundfish, shrimp, scallop, and salmon fishery information has been presented to MMS in a series of computerized data files. The groundfish, shrimp, and scallop files summarize fishery information based on geographic fishing location, while the salmon files summarize catch based on port of landing. This section briefly describes these fisheries and summarizes the format and content of the data files. Appendix A lists the data files.

The groundfish trawl fishery is a commercial ocean fishery that targets a variety of bottomfish species, including several rockfish and flatfish species and assemblages. The fishing technique involves towing a net either along the bottom or midway through the water column. Bottomfish species are also fished commercially using pots (fish traps) and hook and line gear; however, only the trawl fishery is summarized in the data files developed for MMS. The fishery is regulated by catch quotas, minimum size limits, and net mesh size restrictions. Over much of the past decade, the groundfish trawl fishery has ranked first in total catch and second or third in total value among all Oregon fisheries.

The shrimp trawl fishery is a commercial ocean fishery that targets pink shrimp (*Pandalus jordani*). Shrimp trawlers also land a small amount of incidentally caught bottomfish. The fishing technique involves towing one or two nets along the bottom. Fishery regulations include a season (April 1 through October 31), net mesh size restrictions (when fishing in Washington or California waters), and minimum size limits expressed in shrimp count per pound. Over much of the past decade, the shrimp trawl fishery has ranked second in total catch and first or second in total value among all Oregon fisheries.

The scallop fishery off Oregon lands weathervane scallops (*Patinopecten caurinus*) using scallop dredges and trawl nets. The fishery has been sporadic over the past decade. Landings were insignificant in 1980, they rose sharply to 16.8 million pounds in 1981, and subsequently crashed by the end of 1981. Landings ranged from 800,000 to 3.3 million pounds from 1982 through 1985; no large landings have been made since 1985. There is a potential for the return of the fishery if markets improve and if the population recovers from the fishery of the early 1980's. The scallop fishery is regulated by a limited entry system and minimum mesh size restrictions.

The primary targeted species of the ocean salmon troll fishery are Chinook and coho salmon (*Oncorhynchus tshawytscha* and *O. kisutch*); a small number of chum (*O. keta*) and pink salmon (*O. gorbuscha*) are also taken commercially. The Oregon ocean fishery uses salmon troll gear (a series of lines and hooks towed through the water). Salmon fishing seasons are based on stock timing and annual quotas, and vary significantly among years and geographic management zones. The principal fishing seasons occur from May through September; some

seasons extend into October and November. Over much of the past decade, the salmon troll fishery has ranked third or lower in total catch and among the top three in total value of all Oregon fisheries.

A. Groundfish, Shrimp, and Scallop Fishery Databases

The groundfish, shrimp, and scallop fishery data files summarize catch in pounds and fishing effort in trawl hours based on Oregon and Washington official landings records and fishing vessel logbook records. The data files include a state's entire landings regardless of which state the vessels are fishing. The fishery study area includes all ocean areas from 48°50′ N. Latitude (northern boundary) to 40°30′ N. Latitude (southern boundary) and from the coastline (eastern boundary) to 126° - 126°20′ W. Longitude (western boundary) (Figure 1). The study area is intended to include all likely fishing locations of the Oregon and Washington trawl fleets. Each data file summarizes a state's catch and fishing effort within standardized geographic grid cells. This grid divides the study area into a series of 5 minute latitude by 5 minute longitude cells, referred to as 5-minute blocks.

We developed ten groundfish, ten shrimp, and five scallop fishery data files under the MMS agreement. Each data file summarizes the fishery for a given year. The record structure is identical in all data files. Each record reports catch and effort by 5-minute block, gear, year, month, and species. The records contain the following data fields:

1) 5-minute block number,
2) gear code,
3) year and month,
4) species code,
5) catch and effort.

Sections below describe the contents of each of these fields.

(1) 5-minute Block Number

The 5-minute block numbers consist of six digit numerals (four digits, a decimal point, and a two digit suffix) representing cells in our geographic grid system. We designed the reference grid system to provide a fine scale of geographic representation so that fishery data could be used effectively in ocean planning and impact analysis. The traditional areas for managing groundfish and shrimp fisheries have been State Statistical and Pacific States Marine Fisheries Commission (PSMFC) areas covering 1,000 to 2,500 square miles of ocean. We chose a 5 minute square grid to yield the finest geographic representation possible given the limits of the data. Each 5 minute grid cell covers about 24 square miles of ocean.

The reference grid was also designed to be consistent with the existing Washington/Oregon/California uniform groundfish logbook

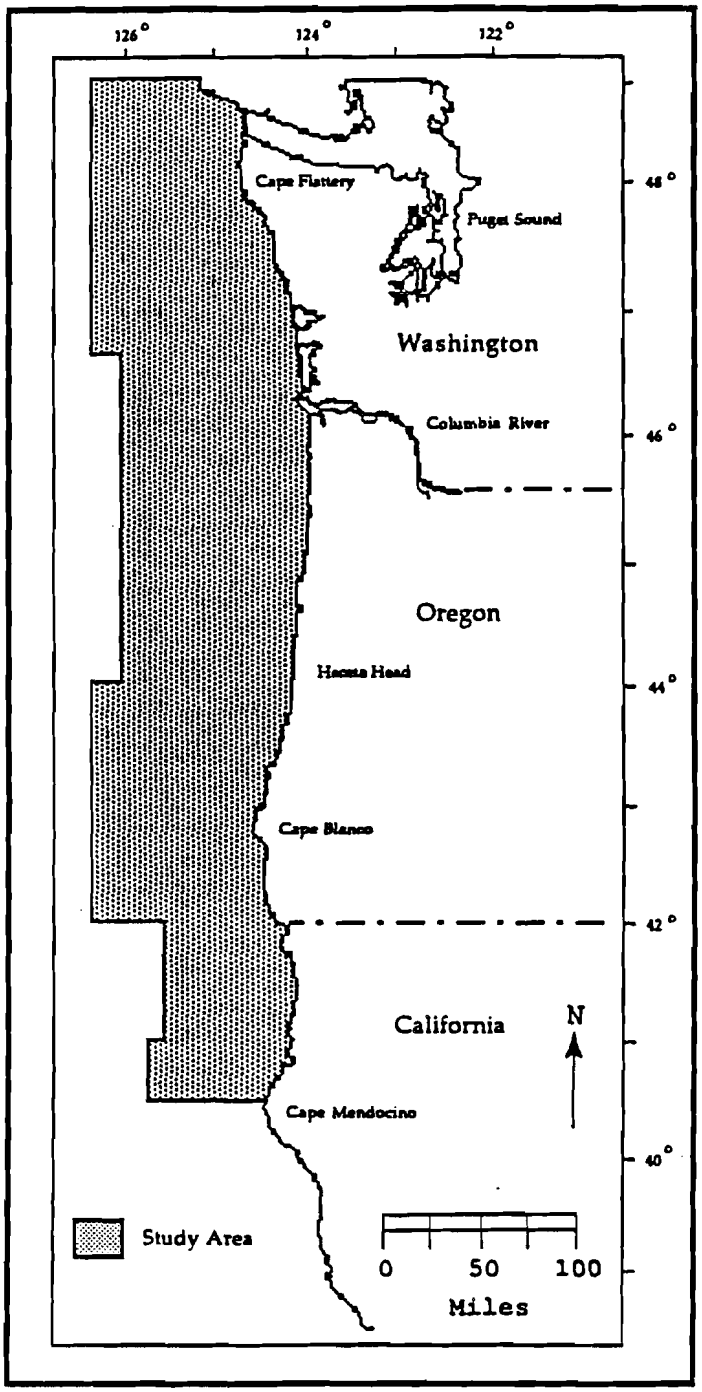


Figure 1. Fishery Database Study Area.

blocks (Figure 2). These are primarily 10 minute latitude by 10 minute longitude blocks developed in the 1940's to study sardine populations, and modified slightly to coincide with State Statistical Area boundaries established since that time. We defined our grid by quartering the uniform groundfish logbook blocks into 5 minute by 5 minute cells. The first four digits of the 5-minute block number are identical to the corresponding uniform groundfish logbook block number. The two decimal suffix sequentially numbers each 5-minute block from left to right, and top to bottom (Figure 2). Some of the original uniform groundfish logbook blocks are larger than 10 minutes square. For example there are several 40 minute square blocks located on the offshore limits of the study area. The grid divides each of these into 64 blocks. There are also a few uniform groundfish logbook blocks that are 10 minutes by 15 minutes, 20 minutes square, and other dimensions. A few 5-minute blocks are less than 5 minutes square to conform with State Statistical Area adjustments to the grid.

Trawl fishery data contain some catch information that cannot be assigned to a block within our grid system. For example, trawl logbooks report some tow locations outside of our study area, mostly resulting from erroneous recording of location data. It is not appropriate to try to assign catch from these tows to 5-minute blocks because we lack confidence in the accuracy of the reported location. Data from these tows are assigned to a series of blocks referred to as error blocks (Figure 3; Table 1). These blocks encircle the study area and cover all possible erroneous locations. Some tows located within the study area also contain locational errors. These were assigned a block number of 6000.00 or 8000.00. In addition to error blocks resulting from incorrect location data, we developed a block number to report catch that cannot be assigned to 5-minute blocks using our data expansion methodology (see **Database Development Methods**). The number for this block is 0000.00. The purpose of the error blocks and the 0000.00 block is to keep an accurate accounting of catch that cannot be legitimately assigned to a location within our 5-minute block grid system. The proportion of total catch assigned to these blocks ranges from 1% to 5% per year of data.

(2) Gear Code

The gear code is either a two digit number or a single letter representing fishing gear or net type. Gear types appearing in our databases include groundfish bottom, Danish, paired, and midwater trawl gear; shrimp double rigged equivalent gear type (see **Database Development Methods** for an explanation of double rigged equivalents); and scallop dredge or trawl. Groundfish data files for years later than 1982 further subdivide the bottom gear type into sole (bottom) and roller net types. Table 2 lists the gear codes used in our data files.

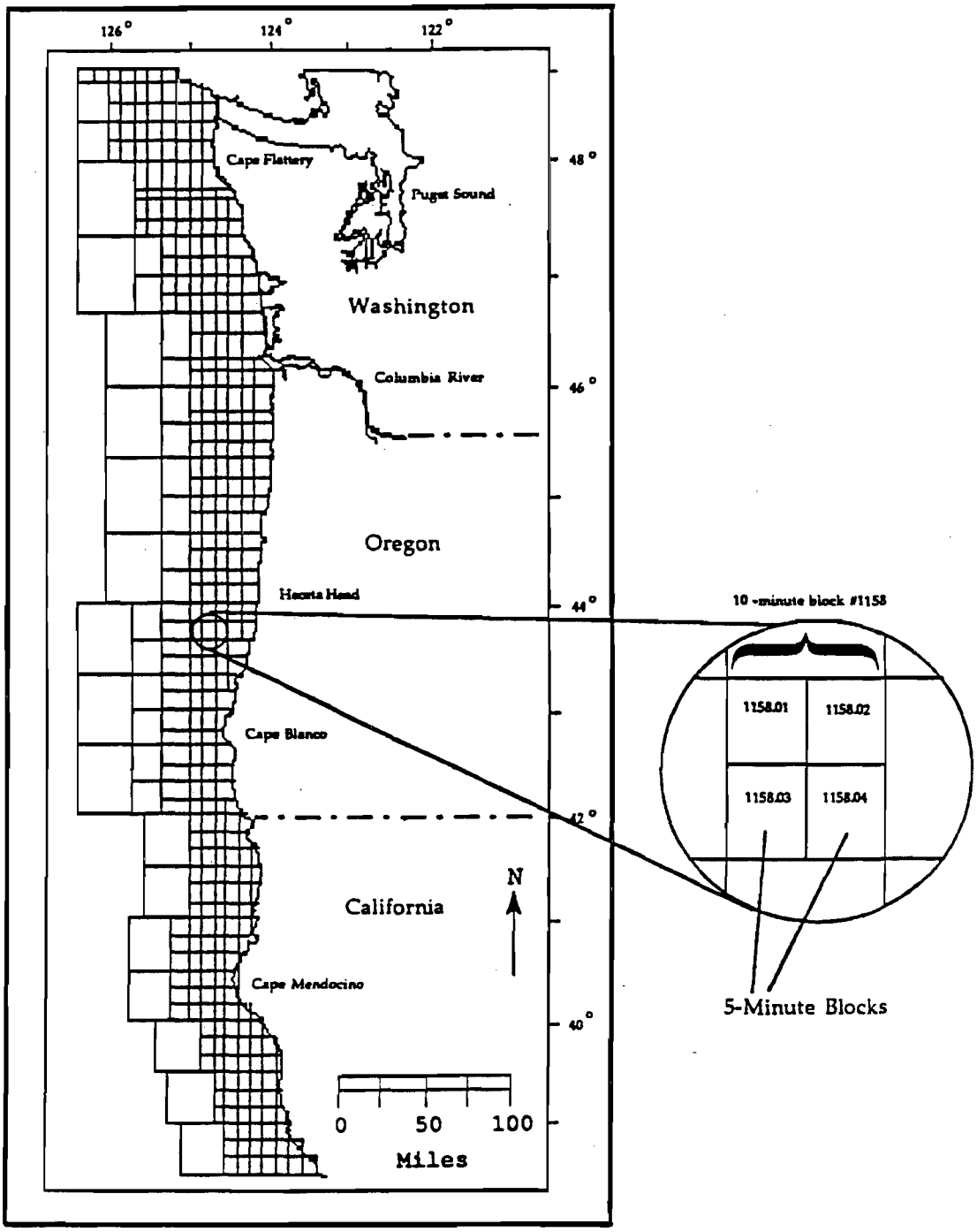


Figure 2. Washington/Oregon/California Uniform Groundfish Logbook Blocks.

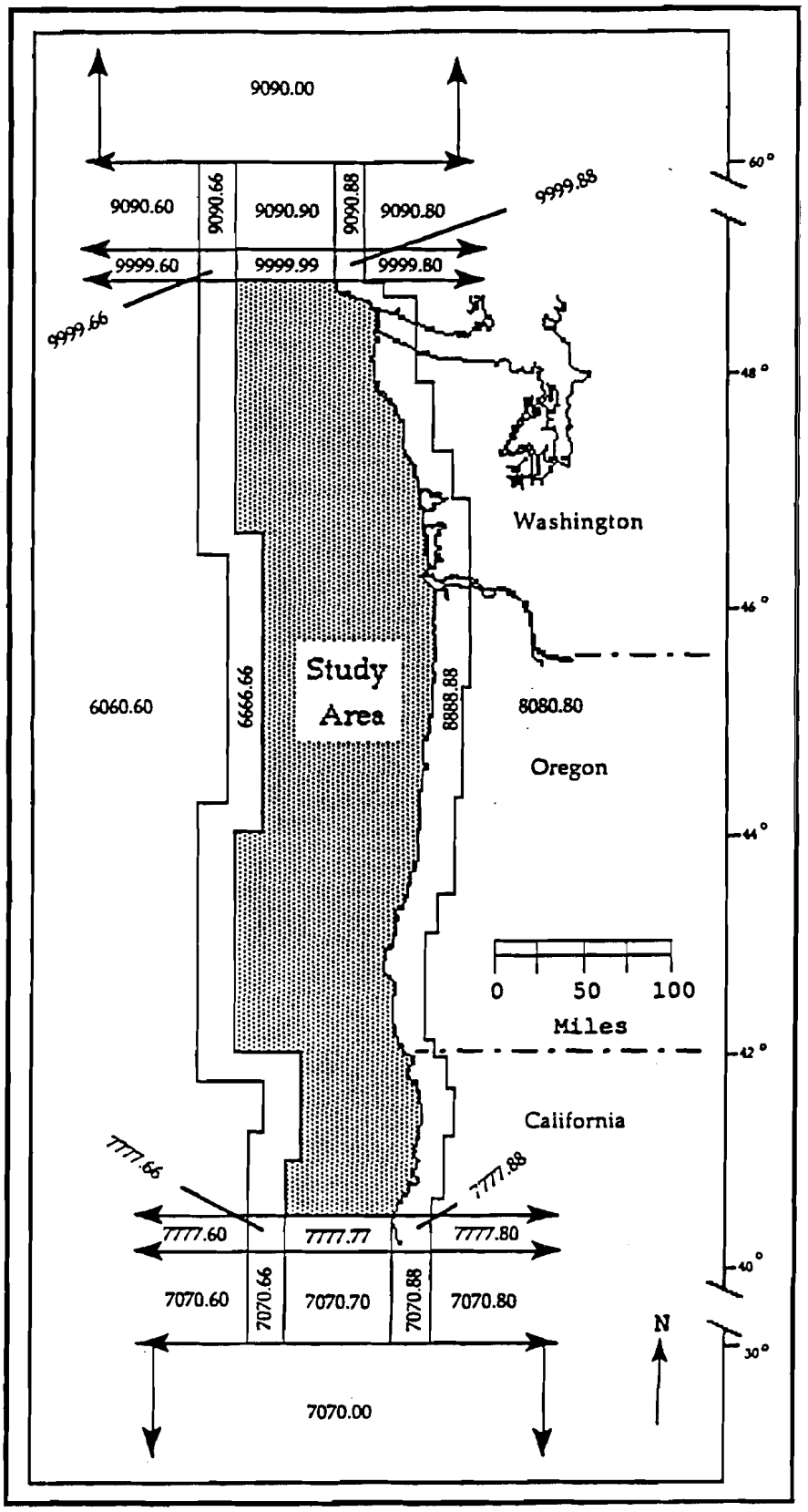


Figure 3. Schematic Map of Trawl Fishery Error Blocks (not to scale).

Table 1. Trawl Fishery Error Blocks.

Block Number	Description
6000.00	Within the study area but location is in error.
6060.60	West of study area.
6666.66	Within 5 minutes long. west of study area.
7070.00	South of study area (south of 30° N. lat.).
7070.60	South and west of study area (between 30° and 40°25′ N. lat.).
7070.66	South and within 5′ long. west of study area.
7070.70	South of study area (between 30° and 40°25′ N. lat.).
7070.88	South and within 5′ long. east of study area.
7070.80	South and east of study area (between 30° and 40°25′ N. lat.).
7777.60	West and within 5′ lat. south of study area.
7777.66	Within 5′ lat. south and 5′ long. west of study area.
7777.77	Within 5′ lat. south of study area.
7777.88	Within 5′ lat. south and 5′ long. east of study area.
7777.80	East and within 5′ lat. south of study area.
8000.00	Within the study area but location is in error.
8080.80	East of study area.
8888.88	Within 5′ long. east of study area.
9090.00	North of study area (north of 60° N. lat.).
9090.60	North and west of study area (between 48°55′ and 60°N. lat.).
9090.66	North and within 5′ long. west of study area.
9090.90	North of study area (between 48°55′ and 60°N. lat.).
9090.88	North and within 5′ long. east of study area.
9090.80	North and east of study area (between 48°55′ and 60°N. lat.).
9999.60	West and within 5′ lat. north of study area.
9999.66	Within 5′ lat. north and 5′ long. west of study area.
9999.99	Within 5′ lat. north of study area.
9999.88	Within 5′ lat. north and 5′ long. east of study area.
9999.80	East and within 5′ lat. north of study area.
0000.00	Data that cannot be assigned to a block because they are not represented in logbook records.

Table 2. Gear Codes for Groundfish, Shrimp, and Scallop Data Files.

Gear/Net Code ODFW	MMS	Gear/Net Name	Fishery and Year	Code Used on Files
D	37	shrimp double rigged equivalent	OR and WA shrimp (all years)	MMS code
C	34	combined bottom net types	OR groundfish (all years)	ODFW code
B	35	sole (bottom) net	OR groundfish (1983-89)	ODFW code
R	36	roller net	OR groundfish (1983-89)	ODFW code
D	38	Danish trawl	OR groundfish (1983-89)	ODFW code
P	39	paired trawl	OR groundfish (1983-89)	ODFW code
M	17	midwater trawl	OR groundfish (1984-89)	ODFW code
D	40	scallop dredge/ trawl	OR scallop (all years)	ODFW code

(3) Year and Month

The year data field consists of the last two digits of the year represented in the data file. The month appears in the next field, numbered consecutively with two digit numbers from 01 (January) to 12 (December).

(4) Species Code

The shrimp data files summarize catch for only one species, pink shrimp. These are reported in the data files with the MMS species code of ZBA05. The groundfish data files summarize catch for many species, each indicated using the ODFW groundfish species code (Appendix B). The scallop data files report catch for weathervane scallops only (species code 942).

(5) Catch and Effort

The data files record catch in pounds and effort (duration of tows) in trawl hours for each year, month, 5-minute block, gear, and species.

B. Salmon Troll Landings Database

ODFW summarized commercial salmon troll landings by year, month, and port for the 1979 through 1988 period. The database was developed by summarizing information from official salmon landing records. These data are not associated with catch block or other locational indicators because logbook data are not available for the commercial salmon fishery. The database covers the two principal species caught in the Oregon ocean troll fishery: Chinook and coho salmon. The records contain the following data fields:

1) year,
2) port code,
3) species code,
4) month, and
5) catch.

The year, month, and catch are expressed in the same manner as in the groundfish, shrimp, and scallop data files. Salmon port codes are as follows:

02 - Astoria
05 - Gearhart/Seaside
06 - Cannon Beach
08 - Nehalem
10 - Garibaldi
16 - Pacific City
22 - Depoe Bay
24 - Newport
26 - Waldport
30 - Florence
32 - Winchester Bay
34 - Coos Bay
36 - Bandon
38 - Port Orford
40 - Gold Beach
42 - Brookings.

Species codes, used in the salmon data files only, are as follows:

1 - Chinook salmon (*Oncorhynchus tshawytscha*)
2 - coho salmon (*O. kisutch*).

III. DATABASE DEVELOPMENT METHODS

The overall goal of the groundfish, shrimp, and scallop data development process is to convert raw fishing data recorded by commercial fishers and landing data recorded by fish processors to the most accurate representation of fishing catch, effort, and location possible. Achieving this goal involves three major steps: data gathering, data preparation and computer entry, and data processing. Data gathering involves collecting and making an initial pass at verifying and summarizing fishery information. The data preparation step includes examining, coding, entering, and verifying the data with the goal of preparing the data for processing while filtering out as many inaccuracies as possible from the information. Data processing involves assigning logbook catch to our grid system, adjusting logbooks to match landing records, assigning landing records not represented in logbooks to appropriate blocks, and running numerous error checks. The data files produced for MMS are the final output of the processing step. This section describes the data development steps for the groundfish, shrimp, and scallop fishery databases and presents a brief summary of methods for developing the salmon troll landings data file.

Oregon Groundfish

A. Data Gathering

There are two principal information sources used in preparing the Oregon groundfish fishery databases: the commercial fishing vessel logbooks and the fishing vessel delivery tickets (fishtickets). Oregon, Washington, and California require that vessels fishing commercially for groundfish, shrimp, or scallops keep logbooks of fishing activity. Logbooks are organized by individual fishing trip, the time between departing from port and returning to deliver catch. Logbook trip identification information includes vessel name, Federal document or State vessel registration number, and the departure and return dates. For each tow completed during the trip, fishers record three additional types of information on the logbook. The first, operation information, includes the date the tow was made, the type of net used, and the times the net was set to fish and hauled to stop fishing. The second information type, location, includes two LORAN-C readings and the chain used (west coast or Canadian), or a latitude and longitude position indicating where the net was set and hauled. The third information type is catch expressed as the estimated weight (hail) of each species caught during the tow. A fishticket is issued at the fish plant when the buyer purchases the catch of the fishing trip. This fishticket is the State's official landing record. Fishtickets record individual species landed, price per pound, gear used, and information on the vessel.

An Oregon Department of Fish and Wildlife port biologist summarizes logbook information each month on an analysis sheet. Each

analysis sheet represents the combined information from the logbook trip record and corresponding fishticket. The biologist may fill in missing information on logbooks through inquiry with the fisher. Available logbooks represent only 60% to 80% of fishing trips because not all fishing vessels complete logbooks and not all logbooks are collected. Fish buyers send the fishtickets to the Oregon Department of Fish and Wildlife where ticket number, vessel, name, registration, port, net-type, species, pounds hailed, and price are entered on computer. The fishticket data files represent 100% of fishing trips.

B. Data Preparation and Computer Entry

Once the logbooks are received from the port biologist they are prepared for incorporation into the database. The purpose of data preparation is to select and prepare the raw logbooks for processing. Data preparation consists of five major steps: selection, coding, entry, verification and correction.

(1) Selection: Logbooks are completed by fishers under uncontrolled sampling conditions and cannot be treated as rigorously collected scientific data. The principal concern in handling logbook data is potential error resulting from incorrectly recorded information. Although guidelines for completing the logbooks are provided at the time they are issued, fishers do not necessarily complete them consistently or accurately. Many factors contribute to potential mis-recording in logbooks, such as the desire of the skipper or deck hand to record the information accurately; the mis-reading or failure of navigation equipment; the fisher's ability or desire to identify species and estimate weight accurately; and fishers deliberately holding back information to protect the privacy of a fishing area.

Although port biologists identify some of the logbook problems, further filtering of the information is necessary to produce data accurate enough to meet the resolution requirements of our 5 minute grid system. The primary objective of the selection step is to implement this additional data filtering. Logbooks are selected based on the completeness and validity of the information. Some logbooks are complete upon receipt and can be incorporated directly into the database. Complete logbooks have the following information within each tow: tow date, time of day the net is set and retrieved; LORAN-C locations in micro-seconds and LORAN-C chain, or latitude and longitude location; depth in fathoms; gear type; and the estimated weight for each species.

Many logbooks are not entirely complete upon receipt. Information may be missing that is necessary for the logbooks to be useful in the database, or the information provided may be incorrect. Often location readings are not recorded, or the species and pounds are hailed inaccurately. The missing information can sometimes be determined with the aid of fishtickets, analysis sheets, nautical charts, and experience of ODFW employees. Changes made to the

logbooks are termed adjustments. Incomplete logbooks are evaluated to determine if the type and amount of adjustments necessary will bias the data. The objective is to use as many logbooks as possible without sacrificing the quality of the database.

Not all logbooks can be adjusted. Logbooks are rejected if there is not enough information or if the information provided is invalid, and attempting to adjust these logbooks would bias the data. For example, fishers sometimes intentionally repeat identical LORAN-C readings in every tow. These logbooks are rejected. Also, fishers will occasionally record only one LORAN-C coordinate for every tow, making it impossible for the data preparation staff to determine the tow location. Other reasons for rejecting the logbooks are: the corresponding fishticket is missing; out-of-state fishticket and delivery; missing tows within a trip; species and pounds hailed are not recorded; both LORAN-C and latitude and longitude are used interchangeably within a trip; and logbooks are illegible.

(2) Coding: Once the logbooks have been selected, they are coded with information necessary for entry into the computer. The function of the coding process is to make logbook corrections and adjustments, and transform logbook information into the numerical format of the processing step. Code numbers are assigned to the vessels (Oregon vessel code), net types, delivery ports, and species. The fishticket number is also recorded onto the logbook at this time. This allows the logbook to be matched to its fishticket during data processing.

(3) Data Entry: Logbooks are ready for data entry after all coding operations are complete. The following trip identification information is entered into the computer from the logbook: vessel name; Federal document number or Oregon state vessel code; date of delivery; port; and fishticket number. The following tow data are entered from each tow on the logbook: date; duration of the tow; the time of day; LORAN-C coordinates of tow set location, or latitude and longitude; depth; and pounds per species.

(4) Verification and Correction: When entry is complete, data printouts are verified manually against the original logbooks for entry errors. After the data have been verified, the errors are corrected on the computer and the data are ready for processing.

C. Data Processing

Following data preparation, Oregon groundfish logbook and fishticket data undergo data processing to transform individual tow location, time, gear, effort and estimated catch by species into a summary of total catch and effort by block, gear, year, month and species. The data are passed through five major processing steps, including area conversion, catch adjustment, catch expansion, summarization, and final review.

The first four processing steps are accomplished through the use of custom programs written in a form of the BASIC programming language called R/BASIC. This programming language is part of the database system called Revelation, Release G2B. We use Revelation and R/BASIC for all of our processing, with one exception; the LORAN-C to latitude and longitude conversion program runs in BASICA (a form of BASIC commonly used on IBM and compatible computers). This program was modified for our specific needs but was originally written and permission for its use granted by Leonard A. Westbo, Jr., United States Coast Guard, Retired.

(1) Area Conversion: The first step of transforming the data begins with a program that scans all logbook records entered for a given year of the fishery and checks the LORAN-C readings for each tow to determine if the values are within the range assigned for our study area. This identifies data recording or entry errors which may not have been discovered during the data preparation stage. If any tow in a given record is out of range the program temporarily skips the entire record and creates an error file which identifies the trip and specific LORAN-C error. The error records are compared against the original logbook and, if possible, corrected. The program allows corrected records and records within proper range to pass on to the next step of processing.

Next, the program converts LORAN-C position to an equivalent latitude and longitude (lat.-long.) position. In some cases the LORAN-C to lat.-long. conversion program cannot successfully compute a lat.-long. position. As with LORAN-C errors, these lat.-long. conversion errors are listed in an error file. This type of error is difficult to correct, and since they rarely occur, trips which exhibit this problem do not undergo further processing.

After we convert to lat.-long. location fixes, the tow data are placed into the proper 5-minute block. Each 5-minute block is defined by the lat.-long. coordinates of its lower right hand corner. The program compares the coordinates of the tow in question to the coordinates of the grid and obtains the block number. In some cases a tow still falls outside our study area. These are assigned an error block (see **Database Format and Content**) and listed to an error file. If possible, we correct these errors and assign a block number within the study area. The error block designation remains in the non-correctable records, and all records continue through our processing system.

(2) Catch Adjustment: The second major stage of processing converts the fishers' estimated catch to a more accurate catch by species. This process begins by matching logbook trip records to corresponding fishticket records. Fishticket records contain the total catch of each species delivered and are considered a more accurate representation of the catch because each species or species category is weighed on a certified scale. The program creates ratios from the estimated catch that reflect the percentage of each species caught for each tow. These ratios are multiplied by the total catch

for each species recorded on the fishticket, and result in new catch values by tow and species. These values are referred to as adjusted pounds.

In many cases there are discrepancies between the species recorded on the logbook as compared to the fishticket. These discrepancies are rectified as part of the catch adjustment process. In some cases the species identified by the fisher is not the same species as on the fishticket. Since the fishticket is our only source of total species catch, the species code is changed on the logbook when it does not match the code reflected on the fishticket. In other instances species recorded on the logbook do not appear on the fishticket. In these cases we assume that the catch was included with another species when purchased, taken home by the fisher, or the processing plant refused to buy it. These species are left on the logbook with estimated catch, but are not included in the summarized catch. As with location errors, catch adjustment errors are listed to an error file which allows us to review the records in question, and correct them where possible. Records which cannot be corrected are removed from further processing.

(3) Catch Expansion: The catch adjustment process produces information on trips which have had logbook location and catch information entered, verified, corrected and processed (termed known catch). The adjustment process does not account for trips for which no logbooks have been collected, or for which the logbooks are too poor to use (termed unknown catch). To increase the breadth of the data, we expand the distribution of known catch from logbook data to include the unknown catch. Total unknown catch is derived from the fishtickets that do not have a corresponding logbook record. The general catch expansion procedure is to derive the ratio of known catch occurring for each species in each 5-minute block to the total known catch for that same species. We then multiply the sum of the unknown catch for that species by the ratio. This yields a derived catch of each species for each block. We obtain the final expanded catch figure for each species in each block by adding the known catch to the derived catch. To avoid biasing the catch in any particular month or port, we use the above procedure within units of port and month.

We also expand effort values. The pounds caught per trawl hour (termed catch per unit effort or CPUE) are calculated by dividing the known catch by the known effort. We expand effort by dividing the derived catch by CPUE, and adding this additional effort to known effort. By summing known and derived data we obtain expanded catch, effort, and catch-per-hour by block for each month-port unit for a given year of the fishery.

(4) Summarization: The fourth data processing step involves summarizing the expanded logbook data to the level of resolution required by the MMS contract. To summarize the data to a monthly level all of the records for a particular port, month, gear, block and species are accumulated into one record of month, gear, block and

species. These summaries are completed for each year of groundfish data processed.

(5) Final Review: The last data processing step is a final review of the database to detect additional locational errors. This step is designed to filter the databases of tow locational errors that occur within the study area but were not detected in the area conversion process. These errors are detected by comparing each tow's depth data with an assigned depth range for the 5-minute block containing the tow in question. Tows that do not fall within the depth range are flagged and their location checked on navigation charts. If the tow's depth is substantially different from navigation chart depth soundings in the area, the tow's location is considered to be in error and is assigned a block number of 6000.00 or 8000.00 (see **Database Format and Content**). We then revise the final summarized database by assigning block numbers of 6000.00 or 8000.00 to the 5-minute blocks containing the error tows.

Oregon Shrimp

A. Data Gathering and Preparation

Oregon shrimp logbook gathering and preparation procedures are very similar to those for Oregon groundfish logbooks. The gathering process is identical, while in most aspects the preparation process is less demanding because the data report only one species. Coding the gear for shrimp logbooks, however, is more complex than for groundfish. Shrimp fishers often do not record gear type on their logbooks. The port biologists needs to determine gear for these vessels. If we are not able to obtain the gear for a particular trip from the port biologist we assign the gear as double-rigged, as it is by far the more common gear used by modern Oregon shrimp vessels.

B. Data Processing

Oregon shrimp logbook data are handled in the same manner as the Oregon groundfish logbook data with two important differences. First, the shrimp fishery targets only pink shrimp; incidental landings of other species amount to only 1% to 2% annually. Shrimp fishers typically do not record their catch of incidental species. For these reasons we summarized only pink shrimp catch data.

The second major difference in our shrimp processing is the standardization of fishing effort between the two shrimp gear types. Vessels either tow one net (single-rigged gear) or two nets (double-rigged gear). An accurate relationship of the shrimp catching ability of the two net types has previously been determined. The ratio of single-rigged fishing efficiency to double-rigged is 1.0:1.6. The standardization step uses this ratio to calculate an expression of effort called double-rigged equivalent trawl hour.

Oregon Scallop

A. Data Gathering, Preparation, and Processing

Oregon scallop data gathering, preparation, and processing are handled in the same manner as Oregon groundfish, except only one species and gear type appear on the scallop databases.

Washington Shrimp

A. Data Gathering and Preparation

Washington shrimp logbooks were obtained from Washington Department of Fisheries (WDF). WDF personnel gathered and coded these logbooks in a fashion similar to Oregon shrimp logbooks. In a few cases coding of a given data field is slightly different, but easily converted to the standard used for Oregon shrimp logbooks. Also, port of landing is not entered for Washington shrimp logbooks. Instead a port/processor code is used that reflects not only the port where the shrimp are delivered, but also the location of the processor that buys the shrimp.

B. Data Processing

Washington shrimp logbooks are processed using our standard methods for area conversion (determine block number) and catch adjustment (adjust fishers estimated catch to actual landed catch). Washington shrimp fishtickets were not available for our use in catch data expansion. Instead, we used existing Pacific Fishery Management Council (PFMC) catch summaries to allocate catch not represented in logbooks to appropriate blocks. WDF had previously generated the PFMC summaries using logbook and fishticket data. The catch expansion procedure involves generating ratios between total logbook catch for a particular month and PFMC area and the total PFMC summarized catch for that same month and area. We generate expanded catch and effort values by multiplying the logbook catch and effort in 5-minute blocks within each month/PFMC area combination by the appropriate ratios.

Oregon Troll Salmon Landings

A. Data Gathering, Preparation, and Processing

We developed the salmon troll landings database from Oregon fishticket records. ODFW summarizes fishticket data annually to produce information used by fisheries management agencies in tracking catch and setting regulations. These data include ticket number, vessel name, registration, port, net type, species, pounds delivered, and price. The salmon troll data file developed for MMS summarizes the existing 1979 through 1988 fishticket databases by year, month, port, and species.

IV. RELIABILITY AND USE OF THE DATABASES

The groundfish, shrimp, and scallop fishery databases provide a detailed geographic representation of the fisheries by month, gear, and species. The data can be summarized in their present fine-resolution format or be re-combined to characterize the fishery according to aggregated data groupings. Uses of the data include identifying fisheries that are most likely to be impacted by a proposed development, identifying potential area use conflicts, and quantifying specific fishery impacts by gear, time of year, block location, and species.

The reliability of the databases is subject to the accuracy with which the fishers record logbook information at sea and how well we handle, enter, and process the data. Our data are recorded by independent fishers outside our direct observation and control. We detected recording errors by testing data values against expected ranges and by comparing the logbook information to independently recorded fishticket information. We also developed several error checking routines and procedures to detect data errors that we might have introduced during data handling, entry, and processing. Appendix C summarizes our quality control procedures.

Our examination of the data has revealed several specific data use and interpretation issues that need to be considered when analyzing the information. The primary database use issues pertain to selecting species for analysis, comparing data types among years, determining potential data outliers, and aggregating catch and effort data. Database interpretation requires consideration of fishing behavior and how it is influenced by regulations, market forces, and other factors.

Selecting species to examine and comparing years of the groundfish databases require consideration of changes in logbook and fishticket recording conventions and of how frequently the species occurs in the fishery. Fishers and fish processors have changed their logbook and fishticket reporting conventions over the years, primarily in terms of species data. For example, the market did not distinguish widow rockfish (*Sebastes entomelas*) from other rockfish species until 1984 (Table 3). Widow rockfish catch prior to 1984 was reported within the general rockfish category. We can compare widow rockfish among 1984 through 1989 data, but cannot compare these data with 1980 through 1983 databases. About one-fourth of the approximately 45 species or groups that appear in the groundfish data files occur with a great enough frequency to allow individual detailed analysis (Table 3). These frequently caught species and groups are also the most important to the fishery because, together, they account for most of the catch. Other species or groups can be analyzed only with specific knowledge of the effects that reporting conventions and frequency of occurrence have on the data for the particular year and area considered.

Comparison of gear types among years of groundfish data requires consideration of changes in gear reporting procedures. The 1980 through 1983 groundfish fishery did not report the midwater fishery adequately in logbooks. These databases, therefore, lack information on this large fishery. The 1984 groundfish database has midwater trawl data; however, only a small percentage of logbooks were collected that year. The 1985 through 1989 groundfish databases report midwater trawl catch adequately. The 1983 through 1989 groundfish databases report catch in terms of bottom and roller net types, while the 1980 through 1982 data combine these into a single gear type (Table 2). Analysis of gear effects when comparing year groups with different reporting conventions is not possible.

Certain month, gear, species, block combinations in the groundfish, shrimp, and scallop fisheries should be considered as potential outliers due to either low sample size or potential data biasing during our expansion process. Generally, we consider blocks as potential outliers if they do not fit the overall distribution pattern for the species, and have less than 100 pounds of catch per block per year or are represented by five or fewer tows per block. The number of tows per block is included on the ODFW databases but is not in the MMS system. When using the MMS system, the number of tows can be approximated by dividing the effort values by the average length of a tow. Groundfish bottom trawl tows average 2.8 hours and midwater tows average 3.4 hours. Shrimp tows average 1.9 hours. Scallop tows averaged 0.9 hours in 1981 and 1982, and 2.0 hours from 1983 through 1985. Consideration should be given to excluding potential outliers from analyses.

Grouping catch and effort data into combined species, gears, blocks, months, or years for all trawl databases requires additional considerations. Catch data are generally additive among the different possible data groupings; however, years with different species or gear reporting conventions (see above) should not be combined. The groundfish databases report fishing effort by individual species. Effort values can be aggregated within a species by block, month, gear type, or year; however, they are not additive among species. Effort for a group of species can only be determined by applying our catch expansion and summarization computer programs on the group of species in question and re-creating the databases.

Proper interpretation of the output from the databases requires consideration of factors that influence fishing behavior. These factors include fishing regulations, market conditions, weather, gear improvements, development of new fisheries, and a host of economic factors such as fuel prices, interest rates, etc. Fishery regulation changes affect catch primarily through annual quotas and trip limits. Appendix D summarizes regulation changes that affect groundfish trawl fisheries. Economic factors influence the species and quantity that are landed. Important economic factors include costs associated with fishing, price paid for fish (Appendix E), and many factors in the processing and marketing sectors. Hanna (1989) notes the general economic factors influencing fisheries in Oregon and Washington. A

detailed analysis of the economic influences on Oregon's fisheries is not available.

Table 3. Principal Groundfish Species or Groups Appearing in the Fishery Databases.

Species or Group	ODFW Species Code	Database Years
Dover sole (*Microstomus pacificus*)	724	1980-1989
petrale sole (*Eopsetta jordani*)	708	1980-1989
English sole (*Parophrys vetulus*)	726	1980-1989
arrowtooth flounder (*Atheresthes stomias*)	706	1980-1989
starry flounder (*Platichthys stellatus*)	728	1980-1989
rex sole (*Glyptocephalus zachirus*)	710	1980-1989
Pacific true cod (*Gadus macrocephalus*)	310	1980-1989
sablefish (*Anoplopoma fimbria*)	610	1980-1989
lingcod (*Ophiodon elongatus*)	620	1980-1989
widow rockfish (*Sebastes entomelas*)	531	1984-1989
channel rockfish (*Sebastolobus alascanus* and *S. altivelis*)	568 and 569	1984-1989
yellowtail rockfish (*Sebastes flavidus*)	533	1985-1989
Pacific Ocean perch (*Sebastes alutus*)	513	1980-1989
general rockfish category	510	1980-1989

V. REFERENCES

Brown, K., R. Berry, J. Lukas, and C. Carter. 1981. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Hanna, S. 1989. Fishery economics issues related to oil and gas development. Chapter 4 in Proceedings: Conference/workshop on recommendations for studies in Washington and Oregon relative to offshore oil and gas development. May 1988. OCS Study MMS 88-0090.

Lukas, J., and C. Carter. 1982. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and Carter, C. 1983. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and Carter, C. 1984. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and Carter, C. 1985. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and Carter, C. 1986. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

PSMFC. 1991. Status of the Pacific Coast groundfish fishery through 1991 and recommended acceptable biological catches for 1992. Pacific Fishery Management Council, Portland, OR.

ODFW. 1991. Groundfish field sampling guide. Oregon Department of Fish and Wildlife, Newport, OR.

Starr, R. M. and M. R. Saelens. 1987. Identification of important marine habitat. Oregon Department of Fish and Wildlife, Newport, OR.

Starr, R. M., M. R. Saelens, and D. S. Fox. 1989. Fishery resource mapping. Final report for the National Coastal Resources Research and Development Institute. Oregon Department of Fish and Wildlife, Newport, OR.

APPENDIX A

Data Files Developed for MMS

Fishery and Year	File Name	Number of Records	Total Pounds Landed
Oregon Groundfish			
1980	ORGF80M.MMS	16,092	37,081,499
1981	ORGF81M.MMS	19,438	44,935,221
1982	ORGF82M.MMS	24,693	54,624,677
1983	ORGF83M.MMS	23,852	62,362,474
1984	ORGF84M.MMS	26,962	56,250,005
1985	ORGF85M.MMS	25,481	56,892,943
1986	ORGF86M.MMS	15,355	45,895,049
1987	ORGF87M.MMS	27,670	57,520,907
1988	ORGF88M.MMS	33,229	63,703,894
1989	ORGF89M.MMS	40,211	74,344,633
Oregon Shrimp			
1980	ORSH80M.MMS	1,310	30,132,130
1981	ORSH81M.MMS	1,303	25,922,560
1982	ORSH82M.MMS	1,066	18,468,508
1983	ORSH83M.MMS	781	6,550,921
1984	ORSH84M.MMS	323	4,844,146
1985	ORSH85M.MMS	632	14,849,059
1986	ORSH86M.MMS	1,106	33,822,127
1987	ORSH87M.MMS	1,155	44,528,461
1988	ORSH88M.MMS	1,168	41,826,260
1989	ORSH89M.MMS	1,539	49,116,839
Oregon Scallop			
1981	ORSC81M.MMS	254	16,853,731
1982	ORSC82M.MMS	37	1,487,938
1983	ORSC83M.MMS	197	2,648,959
1984	ORSC84M.MMS	421	3,329,193
1985	ORSC85M.MMS	116	819,029
Washington Shrimp			
1985	WASH85M.MMS	404	9,074,925
1986	WASH86M.MMS	640	17,405,027
1987	WASH87M.MMS	656	15,773,588
Salmon Troll Landings			
1979-1988	SALMON.MMS	1,023	

APPENDIX B

Species Codes

SPECIES CODES APPEARING ON THE GROUNDFISH, SHRIMP, AND SCALLOP DATABASES

GROUNDFISH SPECIES CODES

CODE	SPECIES	SCIENTIFIC NAME
010	Non-human Food Code	
012	Mink Food	
014	Scrap	
016	Reduction Use	
110	Lamprey	*Lampetra tridentatus*
115	Shark sp.	
120	Soupfin Shark	*Galeorhinus zyopterus*
125	Thresher Shark	*Alopias vulpinus*
130	Dogfish Shark	*Squalus acanthias*
140	Skate	*Raja binoculata, R. kincaidi, R. rhina*
150	Rays (Sting, Elec. Devil Fish)	
160	All Sturgeon	
161	Green Sturgeon	*Acipenser medirostris*
162	White Sturgeon	*Acipenser transmontanus*
210	Shad Buck (All)	
211	Shad Buck - Columbia	*Alosa sapidissima*
212	Shad Buck - Coast	
240	All Herring & Anchovy	
241	Herring	*Clupea harengus pallasi*
245	Anchovy	*Engraulis mordax*
250	Chinook Salmon (All Sizes)	*Oncorhynchus tshawytscha*
251	Chinook Salmon (Col. R. or Large size) over 10 lbs.	
252	Chinook Salmon (Medium Size) 7-10 lbs	
253	Chinook Salmon (Small Size) under 7 lbs	
254	Chinook Salmon (White)	
255	Chinook Salmon (Mixed Size)	
260	Coho Salmon (All Sizes)	*O. kisutch*
261	Coho Salmon (Col. R., Med., or Mixed sizes) over 10 lbs	
262	Coho Salmon (Large Size) 7-10 lbs	
263	Coho Salmon (Small Size) under 7 lbs	

CODE	SPECIES	SCIENTIFIC NAME
270	Chum, Pink and Red Salmon	
271	Chum Salmon	*O. keta*
272	Pink Salmon	*O. gorbuscha*
277	Sockeye Salmon	*O. nerka*
280	Steelhead	*O. gairdneri*
290	All Smelt	
291	Smelt sp.	
292	Eulachon	*Thaleichthys pacificus*
310	Pacific True Cod	*Gadus macrocephalus*
312	Pacific Hake	*Merluccius productus*
315	Pacific Tomcod	*Microgadus proximus*
340	Grenadiers	*Macrouridae*
402	Giant Wrymouth	*Delolepis gigantea*
404	Monkeyface Prickleback	*Cebidichthys violaceus*
410	Striped Bass	*Morone saxatilis*
420	Surfperches	*Embiotocidae*
430	Wolf-eel	*Anarrhichthys ocellatus*
450	All tuna and Mackerel	
451	Skipjack Tuna	*Euthynnus pelamis*
452	Mackerel	*Scomber japonicus*
453	Albacore Tuna	*Thunnus alalunga*
454	Yellowfin Tuna	*T. albacares*
455	Bluefin Tuna	*T. thynnus*
500	All Rockfish	
506	Small rockfish	
510	Rockfish sp.	
512	Rougheye	*Sebastes aleutianus*
513	Pacific ocean perch	*S. alutus*
517	Aurora	*S. aurora*
518	Redbanded	*S. babcocki*
519	Silvergray	*S. brevispinis*
521	Copper	*S. caurinus*
526	Darkblotched	*S. crameri*
528	Splitnose	*S. diploproa*
529	Greenstriped	*S. elongatus*

CODE	SPECIES	SCIENTIFIC NAME
531	Widow	*S. entomelas*
533	Yellowtail	*S. flavidus*
535	Chilipepper	*S. goodei*
536	Rosethorn	*S. helvomaculatus*
538	Shortbelly	*S. jordani*
541	Quillback	*S. maliger*
542	Black	*S. melanops*
545	Blue	*S. mystinus*
546	China	*S. nebulosus*
547	Tiger	*S. nigrocinctus*
549	Bocaccio	*S. paucispinis*
551	Canary	*S. pinniger*
553	Redstripe	*S. proriger*
555	Yellowmouth	*S. reedi*
557	Yelloweye	*S. ruberrimus*
560	Stripetail	*S. saxicola*
566	Pygmy	*S. wilsoni*
567	Sharpchin	*S. zacentrus*
568	Shortspine thornyhead (channel cat, channel rock, idiot, hardhead)	*Sebastolobus alascanus*
569	Longspine thornyhead	*Sebastolobus altivelis*
570	Snapper (troll-caught rockfish)	*Sebastes sp.*
610	Sablefish (round)	*Anoplopoma fimbria*
611	Sablefish (dressed)	
620	Lingcod (round)	*Ophiodon elongatus*
621	Lingcod (dressed)	
630	Greenlings	Hexagrammidae
641	Cabezon	*Scorpaenichthys marmoratus*
700	All Flatfish	
702	Flatfish sp.	
704	Pacific sanddab (dabs)	*Citharichthys sordidus*
706	Arrowtooth flounder (turbot [Astoria], Wolfsole)	*Atheresthes stomias*
708	Petrale sole	*Eopsetta jordani*
710	Rex sole	*Glyptocephalus zachirus*
712	Flathead sole	*Hippoglossoides elassodon*
714	Pacific Halibut	*Hippoglossus stenolepis*
716	Hybrid sole	*Inopsetta ischyra*
718	Butter sole	*Isopsetta isolepis*
720	Rocksole (true turbot, rough-backs)	*Lepidopsetta bilineata*
722	Slender sole	*Lyopsetta exilis*
724	Dover sole	*Microstomus pacificus*

CODE	SPECIES	SCIENTIFIC NAME
726	English sole	*Parophrys vetulus*
728	Starry flounder	*Platichthys stellatus*
730	C-O sole	*Pleuronichthys coenosus*
732	Curlfin sole (Lemon sole, French sole, turbot [Coos Bay])	*Pleuronichthys decurrens*
734	Sand sole	*Psettichthys melanostictus*
900	All Crustaceans and other Shellfish	
901	Ocean shrimp	*Pandalus jordani*
905	Sand shrimp	*Upogebia pugettensis* *Callianassa californiensis*
910	All Dungeness Crabs	
911	Crabs, Dungeness (Bay)	*Cancer magister*
912	Crabs, Dungeness (Ocean)	
913	Tanner Crab	*Chionocetes bairdi, C. tanneri*
914	Box Crab	*Lopholithodes foraminatus*
931	Clam sp.	
932	Razor clams	*Siliqua patula*
938	Mussel (Ocean)	*Mytilus californianus*
939	Mussel (Bay)	*Mytilus edulis*
941	Macoma sp.	*Macoma spp.*
942	Scallops (Weather vane)	*Patinopecten caurinus*
943	Rock Scallops	*Crassedoma giganteum*
960	Squid	Teuthoidea
962	Octopus	Octopoda

The following additional codes may appear in the groundfish databases. These indicate unknown fish species.

514
707
781

SHRIMP SPECIES CODE

CODE	SPECIES	SCIENTIFIC NAME
ZBA05	Pink Shrimp	*Pandalus jordani*

SCALLOP SPECIES CODE

CODE	SPECIES	SCIENTIFIC NAME
942	Scallops (Weather vane)	*Patinopecten caurinus*

APPENDIX C

Principal Quality Control Procedures

Database Development Step	Quality Control Procedure
Data Gathering	1. Logbooks are collected, reviewed, and summarized as soon as possible.
	2. Logbook review follows written procedures set forth in ODFW (1991).
Data Preparation and Entry	3. Consistent criteria are applied to logbook review.
	4. Standard data codes are used for logbook coding.
	5. Data are entered by a different staff member than performed the coding to catch missed problems.
	6. Entered data are printed out and visually verified by a different staff member than performed the entry.
	7. Data entry errors are marked in red on the data printouts, corrected on the computer entry screen, and initialed on the printout.
Data Processing	8. Computer checks loran readings and chain against specified ranges.
	9. Computer checks latitude and longitude values against specified ranges.
	10. Location errors flagged in 8 and 9, above, are manually checked and corrected.
	11. Computer matches fishticket with each log and cross checks the following fields: ticket number landing date port code gear code vessel number species code total pounds landed per species
	12. Errors flagged in 11, above, are manually checked and corrected.

Database Development Step	Quality Control Procedure
Data Processing (continued)	13. Total pounds and number of records are cross checked among the various intermediate files created during every processing step. If totals do not match, processing is halted until the problem is rectified
	14. Files are subjected to a final review procedure to detect and correct additional locational errors not detected in 8 and 9, above

APPENDIX D

Pacific Fishery Management Council (PFMC) Actions that Affect the Groundfish Fishery

The following list of regulatory actions is reproduced from Table 7 of PFMC (1991). Frequently used abbreviations:

ABC = acceptable biological catch
OY = optimum yield
mt = metric ton
FMP = fishery management plan

Effective October 13, 1982:
* Recommended 75,000 lb trip limit on widow rockfish for remainder of 1982 (coastwide OY = 26,000 mt).
* Sablefish OY exceeded: 3,000 lb trip limit imposed (coastwide OY = 13,400 mt).

Effective November 30, 1982:
* Recommended extension of widow rockfish trip limits of 75,000 pounds to January 31, 1983 (effective January 1, 1983).
* Recommended extension of sablefish trip limit of 3,000 lb for remainder of 1982.
* Sablefish OY increased 30% to 17,400 mt for 1982 and recommended this be the preliminary specification for 1983 (ABC = 13,400 mt).

Effective January 1, 1983:
* Recommended extensions of widow rockfish trip limits of 75,000 lb until superseded.
* Adopted policy to continue groundfish fishery over the entire year.
* Recommended coastwide trip limit of 30,000 lb on widow rockfish; adjust in midseason as necessary so that 10,500 mt OY is not reached prior to year end (the coastwide widow rockfish ABC and OY were 10,500 mt in 1983).
* Recommended 40,000 lb coastwide trip limit on Sebastes complex; adjust as necessary in midseason so that annual catch in the Vancouver and Columbia areas falls about halfway between the 1982 catch and 1983 aggregate ABC (about 14,000 mt). (Vancouver and Columbia areas ABC = 9,500 mt.)
* Recommended 22-inch total length size limit on sablefish in all areas north of Point Conception (excluding Monterey Bay). Permit incidental trip limit for fish smaller than 22 inches of 333 fish, 1,000 lb or 10% of weight of all sablefish on board. Adjust as necessary to stay within the 17,400 mt OY (ABC = 13,400 mt).

Effective June 28, 1983:
* Recommended increase in Vancouver and Columbia areas Sebastes complex harvest guideline for 1983 from 14,000 to 18,500 mt; retain 40,000 lb trip limit; trip frequency in Vancouver and Columbia areas set at one per week; when 18,500 mt quota is achieved, fishery closes (Vancouver and Columbia areas ABC = 9,500 mt).
* Recommended that harvest guidelines for the Vancouver and Columbia areas Sebastes complex and all flatfish managed under the FMP shall not be permitted to exceed 130% of the respective summed ABCs in 1984.
* Recommended retention of 22-inch size limit on sablefish as before, but set incidental allowance of small fish (<22 inches) at 5,000 pounds per trip.

Effective September 10, 1983:
* Recommended 1,000 lb trip limit on coastwide widow rockfish to avoid reaching OY; if 10,500 mt OY reached, fishery closes.
* Recommended 3,000 lb trip limit on Sebastes complex in Vancouver and Columbia areas; if 18,500 mt quota reached, fishery closes. One per week trip frequency limit is removed.
* Recommended continuing 40,000 lb trip limit on Sebastes complex south of 43° N; no limit on number of trips.

Effective November 10, 1983:
* Recommended closure of Columbia area to Pacific ocean perch fishing until the end of the year as 950 mt OY for this species has been reached; retain 5,000 lb trip limit or 10% of total trip weight on landings of Pacific ocean perch in the Vancouver area.

Effective January 1, 1984:
* Recommended coastwide widow rockfish trip limit of 50,000 lb; trip frequency limited to once per week; if OY of 9,300 mt is reached, fishery closes.
* Harvest guideline for Sebastes complex in the Vancouver and Columbia areas established at 10,100 mt (110% of the Summed ABCs).
* Recommended 30,000 lb trip limit on Sebastes complex from Vancouver and Columbia areas; one trip per week north of 43° N (changed to Cape Blanco, 42° 50′, on February 12, 1984).
* Recommended continuance of 40,000 lb trip limit on Sebastes complex south of 43° changed to 42° 50′ on February 12, 1984); no limit on trip frequency.
* Recommended continuance of 22-inch size limit on sablefish as in 1983; retain 5,000 lb incidental allowance of small fish (<22 inches); fishery closes when coastwide OY of 17,400 mt is reached (ABC = 13,400 mt).
* Continuation of 5,000 lb trip limit or 10% of total trip weight on Pacific ocean perch as specified in FMP. Fishery closes when area OYs are reached (see action effective November 10, 1983 above).

Effective February 12, 1984:
* Southern boundary of Vancouver and Columbia areas shifted south, from 43°. to 42° 50′ for management of Sebastes complex; application of Sebastes complex regulations clarified.

Effective May 6, 1984:
* Recommended reduction in coastwide widow rockfish trip limit from 50,000 lb once per week to 40,000 lb once per week.
* Recommended reduction in Vancouver and Columbia areas Sebastes complex from 30,000 lb once per week to 15,000 lb once per week; fishermen have option to land 30,000 lb once every two weeks with appropriate advance declaration of intent.
* Fishing for groundfish on a Sebastes complex trip may occur on only one side of Cape Blanco (42°50′) which allows southern caught fish to be landed north of Cape Blanco using the southern trip limit of 40,000 lb with appropriate declaration of intent.
* Recommended no change in Sebastes complex trip limit of 40,000 lb in the Eureka, Monterey and Conception areas.

Effective August 1, 1984:
* Recommended cessation of directed fishing for widow rockfish when 9,200 of the 9,300 mt OY is landed. Remaining 100 mt is a quota for incidental landings, to be taken in incidental landing limits of 1,000 lb per trip. The fishery for this species will close when the 9,300 mt quota is taken.
* Recommended immediate reduction in trip limit for Pacific ocean perch in the Vancouver and Columbia areas to 20% by weight of all fish on board, not to exceed 5,000 lb per vessel per trip. When OY is reached in either area, landings of Pacific ocean perch will be prohibited in that area (Oregon and Washington implemented Pacific ocean perch recommendation in mid-July).
* Recommended reduction in landings of Vancouver and Columbia areas Sebastes complex to 7,500 lb once each week or 15,000 lb once every two weeks with appropriate advance declaration of intent. When the 10,100 mt Harvest guideline is reached, a 3,000 lb trip limit will be imposed.
* Recommended allowing vessel operators on combined groundfish/Sebastes complex trips to fish on both sides of a line at 42°50'N (Cape Blanco) but landing of Sebastes complex in excess of 3,000 lb to be controlled by the trip limit/trip frequency in effect north of the line (Vancouver and Columbia areas). Appropriate advance declaration of intent is required.

Automatic Closure (Effective August 16, 1984)
* Commercial fishing for Pacific ocean perch in the Columbia area closed for remainder of the year. (See items regarding this species effective Jan 1 and Aug 1, 1984 above.)

Automatic Action (Effective September 9, 1984)
* Recommended cessation of directed fishing for widow rockfish; incidental catch trip limit reduced to 1,000 lb (based on action effective Aug 1, 1984), fishery for this species closed on Nov 28.

Effective January 10, 1985:
* Recommended coastwide widow rockfish trip limit of 30,000 lb; trip frequency limited to one per week (or 60,000 lb once every two weeks with appropriate declaration to state in which fish are landed); adjust after first trimester, as necessary (OY = 9,300 mt).
* Harvest guideline for Sebastes complex in Vancouver and Columbia areas fixed at 10,100 mt.
* For Sebastes complex north of Cape Blanco (42°50'N): recommended 30,000 lb weekly trip limit of which no more than 10,000 lb may be yellowtail rockfish (or 60,000 lb once every two weeks of which no more than 20,000 lb may be yellowtail rockfish with appropriate declaration to state in which fish are landed).
* For Sebastes complex south of Cape Blanco, recommend 40,000 lb trip limit without a trip frequency.
* Recommended that if fishermen fish on both sides of the Cape Blanco line during a trip, the northern (more restrictive) limit on Sebastes complex will apply.
* Recommended that landings of Sebastes complex and widow rockfish smaller than 3,000 lb be unrestricted.

* Recommended continuing 22-inch size limit on sablefish in all areas north of Point Conception (abolishes Monterey Bay exclusion); retain 5,000 lb incidental landing limit for sablefish less than 22 inches.
* Recommended Vancouver and Columbia areas Pacific ocean perch trip limit of 20% by weight of all fish on board (no 5,000 lb limit as specified in last half of 1984).

Effective April 28, 1985:
* Recommended retention of the coastwide widow rockfish trip limit of 30,000 lb once per week, but rescinded the option to land 60,000 lb once every two weeks.
* Recommended reduction in the coastwide widow rockfish trip limit to 10% by weight of all fish on board not to exceed 3,000 lb if 90% of the OY (about 8,400 mt) is reached before the Council's July meeting (under this incidental limit, landings of widow rockfish less than 1,000 lb will be unrestricted).
* For the Sebastes complex north of Cape Blanco (42°50'N), recommended reduction in the current trip limit to 15,000 lb once per week of which no more than 5,000 lb may be yellowtail rockfish (or 30,000 lb once every two weeks of which no more than 10,000 lb may be yellowtail rockfish). Recommended a third option to land 7,500 lb twice each week of which no more than 3,000 lb in each landing may be yellowtail rockfish; landings declaration applies.
* Recommended the Vancouver and Columbia areas Pacific ocean perch trip limit be reduced to 5,000 lb or 20% by weight of all fish on board, whichever is less. Landings of Pacific ocean perch less than 1,000 lb will be unrestricted. The fishery for this species will close when the OY in each area is reached.

Effective June 10, 1985:
* Recommended landings of Pacific ocean perch up to 1,000 lb per trip will be unrestricted regardless of the percentage of these fish on board.

Effective July 21, 1985:
* Recommended reduction of the coastwide widow rockfish trip limit to 3,000 lb per trip without a trip frequency.

Effective July 25, 1985:
* Recommended that "tickler chains", which contact the sea floor ahead of the rollers, may not be used with a roller or bobbin trawl.

Effective September 1, 1985:
* Recommended changing the management boundary line separating northern and southern trip limits for the Sebastes complex from Cape Blanco (42°50'N) northward 30 miles to the north jetty at Coos Bay (43°22'N).

Effective October 6, 1985:
* Recommended increasing the Vancouver and Columbia areas Sebastes complex trip limit to 20,000 lb once per week except that no more than 5,000 lb may be yellowtail rockfish (or one landing once every two weeks of 40,000 lb of which no more than 10,000 lb may be yellowtail

rockfish, or two landings per week of 10,000 lb each of which no more than 3,000 lb per landing may be yellowtail rockfish; landings declaration apply).

Effective November 25, 1985:
* Established that 90% of sablefish quota had been reached and recommended a trip limit of 13% sablefish in all trawl landings containing sablefish.

Effective December 6, 1985:
* Established that sablefish quota (OY) had been exceeded on Nov 22, 1985; recommended that landings of sablefish be prohibited until January 1, 1986.

Effective January 1, 1986:
* Recommended coastwide widow rockfish trip limit of 30,000 lb per week; no biweekly option (coastwide OY = 10,200 mt; ABC = 9,300 mt).
* Harvest guideline for Sebastes complex north of Coos Bay, Oregon (43°22'N) fixed at 10,100 mt.
* For Sebastes complex north of Coos Bay, recommended 25,000 lb weekly trip limit of which no more than 10,000 lb may be yellowtail rockfish (or 50,000 lb biweekly of which no more than 20,000 lb may be yellowtail rockfish, or 12,500 lb twice per week of which no more than 5,000 lb may be yellowtail rockfish; biweekly and twice weekly landings require appropriate declaration to state in which fish are landed).
* For Sebastes complex south of Coos Bay, recommended 40,000 lb trip limit; no trip frequency.
* Recommended landings of Sebastes complex and widow rockfish be unrestricted if less than 3,000 lb.
* Recommended that fishermen fishing the Sebastes complex on both sides of the Coos Bay line during a trip must conform with the northern (more restrictive) trip limit.
* Recommended continuance of 22-inch size limit on sablefish in all areas north of Point Conception; retain 5,000 lb incidental landing limit for sablefish smaller than 22 inches; coastwide OY = 13,600 mt; ABC = 10,300 mt.
* Recommended the Pacific ocean perch limit in the area north of Cape Blanco (42°50'N) should be 20% (by weight) of all fish on board or 10,000 lb whichever is less; landings of Pacific ocean perch should be unrestricted if less than 1,000 lb regardless of percentage on board; Vancouver area OY = 600 mt; Columbia area OY = 950 mt.
* Recommended an ABC an OY of 227,500 mt for Pacific whiting.
* Recommended an ABC of 3,900 mt for yellowtail rockfish.

Effective April 11, 1986:
* Recommended increasing Pacific whiting ABC and OY to 295,8000 mt, up 30% from 227,500 mt established at the beginning of 1986.
* Recommended increasing yellowtail rockfish ABC to 4,000 mt, up 100 mt from 3,900 mt established at beginning of 1986. (Yellowtail rockfish is in the multispecies Sebastes complex and does not have a numerical OY.) The 100 mt increase is assigned entirely to the Columbia area north of Coos Bay.

Automatic Action: (see September 28, 1986 below)
* Recommended in April to impose a 3,000 lb trip limit without a trip frequency to be implemented when the widow rockfish ABC is reached.

Effective August 22, 1986: (Emergency Regulation)
* Recommended allocating the estimated remaining sablefish OY between trawl and fixed gear at 55 and 45%, respectively.
* Recommended and 8,000 lb sablefish trip limit on trawl gear.
* Recommended retention of the current regulation of a 5,000 lb trip limit on sablefish smaller than 22 inches.
* Recommended prohibition of any further landings of sablefish by trawl gear after trawl quota is reached.
* Recommended prohibition of any further landings of sablefish by fixed gear after fixed gear quota is reached.
* Recommended prohibition of any further landings of sablefish after the coastwide OY is reached.

Effective August 26, 1986: (see August 22 Emergency Regulation)
* Announced amounts of sablefish quota under emergency regulations (2,915 mt trawl; 3,385 mt fixed gear).

Effective August 31, 1986:
* For Sebastes complex north of Coos Bay, Oregon, recommended the following increases in trip limits: weekly = 30,000 lb of which no more than 12,500 lb may be yellowtail rockfish; biweekly = 60,000 lb of which no more than 25,000 lb may be yellowtail rockfish; and twice weekly = 15,000 lb of which no more than 6,500 lb may be yellowtail rockfish.Effective September 28, 1986:
* Widow rockfish ABC reached; coastwide 3,000 lb trip limit without trip frequency imposed (see Automatic Action above).

Effective September 28, 1986:
* Widow rockfish AC reached; coastwide 3,000 lb trip limit without trip frequency imposed (see Automatic Action above).

Effective October 23, 1986: (see August 22 Emergency Regulation)
* Fixed gear sablefish quota reached; fixed gear fishery closed.
* Trawl gear trip limit increased to 12,000 lb for remainder of year or until trawl quota is reached.
* Sablefish quotas revised (2,800 mt trawl; 2,300 mt fixed gear).

Effective November 20, 1986: (see Aug 22 Emergency Regulation)
* Extension of sablefish emergency regulation until the end of the year.

Effective December 1, 1986:
* OY quota for Pacific ocean perch reached in the Vancouver area; fishery closed until January 1, 1987.

Effective January 1, 1987:
* Recommended a coastwide widow rockfish trip limit of 30,000 lb per week with no biweekly option. Only 1 landing per week above 3,000 lb (coastwide OY = 12,500 mt; ABC = 12,100 mt).

* Harvest guideline for Sebastes complex north of Coos Bay, Oregon (43°21'34"N) set at 10,200 mt.
* For Sebastes complex north of Coos Bay, recommended 25,000 lb weekly trip limit of which no more than 10,000 lb may be yellowtail rockfish (or 50,000 lb biweekly of which no more than 20,000 lb may be yellowtail rockfish, or 12,500 lb twice per week of which no more than 5,000 lb may be yellowtail rockfish; biweekly and twice weekly landings require appropriate declaration to state in which fish are landed); no restriction on landings less than 3,000 lb.
* For Sebastes complex south of Coos Bay, recommended 40,000 lb trip limit; no trip frequency limit.
* Recommended allocating the sablefish OY between trawl and fixed gear at 52 (6,200 mt) and 48% (5,800), respectively; if the quota for either gear type is reached, sablefish becomes a prohibited species for that gear; coastwide OY and ABC = 12,000 mt.
* Recommended 5,000 lb trawl and 100 lb fixed gear trip limits (round weights) for sablefish smaller than 22-inches total length (16-inches dorsal total length), and apply coastwide.
* Recommended the coastwide Pacific ocean perch limit should be 20% of all legal fish on board or 5,000 lb whichever is less (in round weight); landings of Pacific ocean perch unrestricted if less than 1,000 lb regardless of percentage on board; Vancouver area OY = 500 mt; Columbia area OY = 800 mt.
* Recommended an ABC and OY of 195,000 mt for Pacific whiting.
* Recommended an ABC of 4,000 mt for yellowtail rockfish.

Effective April 5, 1987:
* Recommended the size limit for processed sablefish be changed from 16.0 to 15.5 inches (dorsal total length).

Effective April 27, 1987:
* Recommended the trip limit for sablefish smaller than 22 inches (total length) caught by fixed gear be increased from 100 to 1,500 lb coastwide.

Effective May 3, 1987:
* Recommended changing the definition of fishing week from Sunday through Saturday to Wednesday through Tuesday for Sebastes complex and widow rockfish.

Effective July 22, 1987:
* Recommended the weekly trip limit for yellowtail rockfish caught north of Coos Bay be reduced to 7,500 lb (or 15,000 lb biweekly, or 3,750 lb twice weekly).

Effective August 14, 1987:
* Coastwide ABCs for widow and chilipepper rockfishes increased to 12,500 and 3,600 mt, respectively.

Effective October 2, 1987:
* Recommended the trawl trip limit for sablefish be 6,000 lb or 20% of the legal fish on board, whichever is greater, including no more than 5,000 lb of sablefish under 22 inches.

Effective October 14, 1987:
* Recommended the weekly trip limit for widow rockfish be reduced from 30,000 to 5,000 lb when 95% of the widow rockfish OY is projected to be reached (i.e., at 11,875 mt). Closure of the non-trawl (fixed gear) sablefish fishery because the non-trawl allocation of 5,800 mt was reached.

Effective October 22, 1987:
* Closure of sablefish trawl fishery because the trawl allocation of 6,200 mt was reached.

Effective November 25, 1987:
* Closure of widow rockfish fishery because 12,500 mt was reached.

Effective January 1, 1988:
* Recommended a coastwide widow rockfish trip limit of 30,000 lb per week. Only 1 landing per week above 3,000 lb. No restriction on landings less than 3,000 lb (coastwide OY/ABC = 12,100 mt).
* Harvest guideline for Sebastes complex north of Coos Bay, Oregon (43°21′34"N) fixed at 10,200.
* For Sebastes complex north of Coos Bay, recommended 25,000 lb biweekly trip limit of which no more than 10,000 lb may be yellowtail rockfish (or 50,000 lb biweekly of which no more than 20,000 lb may be yellowtail rockfish, or 12,500 lb twice per week, of which no more than 5,000 lb may be yellowtail rockfish; biweekly and twice weekly landings require appropriate declaration to state in which fish are landed). No restriction on landings less than 3,000 lb.
* For Sebastes complex south of Coos Bay, recommended 40,000 lb trip limit; no trip frequency restriction.
* Recommended allocating the sablefish OY between trawl and non-trawl (fixed gear) at 5,200 and 4,800 mt respectively; if the quota for non-trawl gear is reached, sablefish becomes a prohibited species for that gear; manage the trawl fishery to achieve the trawl allocation provided that up to an additional 800 mt may be added to the trawl allocation for unavoidable incidental catch; coastwide OY = 9,200 to 10,800 mt; ABC = 10,000 mt.
* For trawl-caught sablefish, recommended trip limit of 6,000 lb or 20% of legal fish on board, whichever is greater, with only 2 landings above 1,000 lb allowed per vessel per week; no restriction on landings less than 1,000 lb.
* Recommended continuance of 22-inch total length size limit (15.5-inch dorsal length) on sablefish in all areas; 5,000 lb trawl and 1,500 lb non-trawl incidental landing limits for sablefish smaller than the minimum size limit.
* Recommended the coastwide Pacific ocean perch trip limit should be 20% (by weight) of all fish on board or 5,000 lb, whichever is less; landings of Pacific ocean perch be unrestricted if less than 1,000 lb regardless of percentage on board; Vancouver area OY = 500 mt; Columbia area OY = 800 mt.
* Recommended an ABC and OY of 232,000 mt for Pacific Whiting.
* Recommended an ABC of 4,000 mt for yellowtail rockfish.

Effective August 3, 1988:
* Recommended the trawl sablefish allocation be increased to 6,000 mt; reduce the trawl trip limit to 1 landing per week, not to exceed 2,000 lb (including sablefish smaller than 22 inches).
* Recommended changing the non-trawl trip limit for sablefish smaller than 22 inches to 1,500 lb or 3% of all sablefish on board, whichever is greater.

Effective August 26, 1988:
* Closure of the non-trawl sablefish fishery because the non-trawl allocation of 4,800 mt was reached.

Effective September 21, 1988:
* Recommended lowering the trip limit for widow rockfish to 3,000 lb (with no restriction on the number of landings per week) on September 21, the date when just enough of the OY remains to allow continuation of this trip limit through the end of the year.

Effective October 5, 1988:
* Recommended lifting the restriction that no more than one landing of sablefish by trawlers may be made during any week; reduce the weekly trip limit for yellowtail rockfish north of Coos Bay from 10,000 to 7,500 lb (biweekly and twice weekly options to remain in effect).

Effective January 1, 1989:
* Recommended a coastwide widow rockfish trip limit of 30,000 lb per week. Only 1 landing per week above 3,000 lb. No restriction on landings less than 3,000 lb (coastwide OY/ABC = 12,400 mt).
* Harvest guideline for Sebastes complex north of Coos Bay, Oregon (43°21'34"N) set at 10,200 mt.
* For Sebastes complex north of Coos Bay, recommended 25,000 lb weekly trip limit of which no more than 7,500 lb may be yellowtail rockfish (or 50,000 lb biweekly of which no more than 15,000 lb may be yellowtail rockfish, or 12,500 lb twice per week, or which no more than 3,750 lb may be yellowtail rockfish; biweekly and twice weekly landings require appropriate declaration to state in which fish are landed). No restriction on landings less than 3,000 lb.
* For Sebastes south of Coos Bay, recommended 40,000 lb trip limit; no trip frequency restriction.
* For coastwide sablefish, management measures will be designed to achieve the low end of the OY range (10,400 to 11,000 mt). After 22 mt are set aside from the 10,400 mt harvest guideline for the Makah Indian fishery, the remaining 10,378 mt allocated 5,397 mt (52%) for trawl gear and 4,981 mt (48%) for non-trawl (fixed) gear.
* Established a coastwide trawl trip of 1,000 lb or 45% of the deepwater complex (consisting of sablefish, Dover sole, arrowtooth flounder and thornyheads), whichever is greater. Within the 45% trawl limit, no more than 5,000 lb of sablefish smaller than 22 inches (total length) may be taken per trip. If fishing under the 1,000 lb limit, all sablefish may be smaller than 22 inches. The coastwide non-trawl trip limit for sablefish smaller than 22 inches set at the greater of 1,500 lb or 3% of all sablefish on board.

* The harvest guideline may be increased by up to 600 mt to enable small fisheries to continue operating after a gear allocation is met and to allow for landings of sablefish caught incidentally while fishing for other species. If the upper end of the OY range (11,000 mt) is reached, all further landings will be prohibited (coastwide ABC = 9,000 mt; OY = 10,400 to 11,000 mt).
* Established the coastwide Pacific ocean perch trip limit at 20% (by weight) of all fish on board or 5,000 lb whichever is less; landings of Pacific ocean perch unrestricted if less than 1,000 lb regardless of percentage on board (Vancouver area OY = 500 mt; Columbia area OY = 800 mt).
* ABC and OY set at 225,000 mt for Pacific whiting.
* ABC set at 4,300 mt for yellowtail rockfish.

Effective April 26, 1989:
* Established coastwide weekly trip limit on the deepwater complex (consisting of sablefish, Dover sole, arrowtooth flounder and thornyheads) of only 1 landing above 4,000 lb per week, not to exceed 30,000 lb. No limit on the number of landings of deepwater complex less than 4,000 lb. For each landing of the deepwater complex, no more than 1,000 lb or 25% of the deepwater complex, whichever is greater, may be sablefish. If fishing under the 25% limit, no more than 5,000 lb may be sablefish under 22 inches. Biweekly and twice weekly trip limit options for trawl-caught sablefish are available but require appropriate declaration to state in which fish are landed.
* Revised the gear quotas for the remainder of the year by reducing the non-trawl quota 400 mt (to 4,581 mt) and increasing the trawl quota by 1,000 mt (400 mt from non-trawl gear plus the 600 mt reserve) so it totals 6,397 mt. If either gear quota is reached, further landings by that gear will be prohibited for the remainder of the year.
* Reduced the coastwide weekly trip limit for widow rockfish to 10,000 lb.

Effective July 17, 1989:
* Established a coastwide non-trawl sablefish trip limit of 100 lb with no frequency limit for the remainder of the year, until the non-trawl allocation is reached, or until OY is reached, whichever occurs first. Because the trip limit is smaller than the limit on fish less than 22 inches, the 22-inch minimum size provision is rescinded.

Effective July 26, 1989:
* Reduced the trip limit for yellowtail rockfish to 3,000 lb or 20% of the Sebastes complex, whichever is greater.
* Reduced the coastwide trip limit for Pacific ocean perch to 2,000 lb or 20% of all fish on board, whichever is less, with no trip frequency restriction.
* Increased the Columbia area Pacific ocean perch OY from 800 to 1,040 mt.

Effective October 4, 1989:
* Removed the overall trawl poundage and trip frequency limits for the deepwater complex, while retaining the separate trip limit for

sablefish at 25% of the deepwater complex or 1,000 lb, whichever is greater.
* Increased the non-trawl trip limit to 2,000 lb or 20% of all groundfish on board, whichever is less, when more than 100 lb of sablefish on board. Because the trip limit remains small, the entire landing may be made up of sablefish less than 22 inches.

Effective October 11, 1989:
* Reduced the trip limit for widow rockfish to 3,000 lb (with no restriction on the number of landings per week) on October 11, the date when just enough of the OY remained to allow continuation of this trip limit through the end of the year.

Effective December 13, 1989:
* Closed the Pacific ocean perch fishery in the Columbia area because 1,040 mt OY reached.

APPENDIX E

Average Annual Price Paid for Principal Groundfish, Shrimp, and Scallop Species

Average annual prices (dollars/pound) for selected fish and shellfish species. Note: prices may fluctuate significantly during each year.

SPECIES	CODE	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Dover Sole	724	0.2175	0.2152	0.2326	0.2240	0.2320	0.2510	0.2662	0.3184	0.3054	0.2782
petrale sole	708	0.4600	0.5180	0.6152	0.6970	0.7202	0.7364	0.7636	0.8258	0.8302	0.8210
English sole	726	0.2588	0.2864	0.3214	0.3228	0.3226	0.3331	0.3626	0.4096	0.3870	0.3670
arrowtooth flounder	706	0.1000	0.1136	0.1066	0.1038	0.1022	0.1006	0.1070	0.1530	0.1372	0.1034
starry flounder	728	0.2300	0.2398	0.2684	0.2718	0.2864	0.2913	0.3104	0.3780	0.3394	0.3314
rex sole	710	0.3150	0.3038	0.3374	0.3320	0.3324	0.3363	0.3582	0.3898	0.3874	0.3650
Pacific true cod	310	0.2000	0.2470	0.2367	0.3398	0.2577	0.3536	0.2864	0.3272	0.2836	0.2624
sablefish	610	0.1400	0.1794	0.2298	0.2156	0.1994	0.2798	0.3498	0.4456	0.4624	0.4336
lingcod	620	0.2350	0.2456	0.2502	0.2496	0.2516	0.2636	0.3368	0.3860	0.3670	0.3434
widow rockfish	531	0.1200	0.1352	0.1724	0.1910	0.2276	0.2514	0.2734	0.3220	0.2794	0.2576
channel rockfish	568	0.2000	no data	no data	0.2210	0.2258	0.2470	0.2824	0.3276	0.3482	0.3604
yellowtail rockfish	533	0.2000	0.1524	0.1860	0.2018	0.2320	0.2555	0.2810	0.3220	0.2788	0.2333
Pacific Ocean perch	513	0.1714	0.1526	0.1890	0.2126	0.2228	0.2495	0.2752	0.3270	0.2830	0.2646
Other Rockfish	510	no data	0.1530	0.1884	0.2080	0.2280	0.2477	0.2906	0.3516	0.2970	0.3098
Pink shrimp	901	0.4500	no data	0.5046	0.7140	0.4522	0.3526	0.5400	0.6800	0.4100	0.3670
Scallops - round	942	no data	0.2000	0.2400	0.2940	0.3057	0.4004	0.4500	0.4700	no data	no data

Sources: 1980 prices - Oregon fish tickets
1981-1989 prices - Pacfin PFMC groundfish management team reports

CHAPTER 2:

DESCRIPTION OF THE SELECTED OREGON OCEAN FISHERIES

TABLE OF CONTENTS

LIST OF FIGURES

ACKNOWLEDGMENTS

Numerous people contributed to the successful completion of this project. The fishers who participated in interviews deserve special thanks for their willingness to take time out of busy schedules and convey their extensive knowledge of fishing locations. Their combined experience made development of the maps in this report possible. Bob Jacobson, Marine Extension Agent, provided fishery locational information and helped us make contacts with fishers.

Several Oregon Department of Fish and Wildlife staff provided assistance on the project. Terry Link and Neil Richmond devoted many hours conducting interviews with fishers. The following staff biologists provided fisheries locational information for the maps: Don Bodenmiller, Jerry Butler, Darrell Demory, Dave Douglas, Mike Hosie, Steve Jones, Terry Link, Jean McCrae, and Rick Starr. The experience of these biologists added significantly to the quality of the maps. Barbara Bond and Arlene Merems spent numerous hours drafting and digitizing maps. This project would not have been possible without their help. Several individuals reviewed and provided constructive comments on the draft report, including Clay Creech, Gary Hettman, Mark Saelens, and many of the staff listed above. Rick Starr provided essential guidance toward creating the maps and editing the report.

I. INTRODUCTION

In 1987, U. S. Department of Interior's Minerals Management Service began a new proposed 5-Year Oil and Gas Leasing Program for mid-1987 through mid-1992. Outer Continental Shelf (OCS) proposed Lease Sale 132 (off of Oregon and Washington) was included in this 5-Year Program. The 5-Year Program requires preparation of an Environmental Impact Statement for each Lease Sale area. In 1988, the Minerals Management Service entered into a cooperative agreement with the Pacific States Marine Fisheries Commission, Oregon and Washington fisheries agencies, and the Northwest Indian Fisheries Commission to develop fisheries information needed for the Lease Sale 132 Environmental Impact Statement. The contract requires Oregon Department of Fish and Wildlife to develop quantitative and qualitative data bases describing the major fisheries occurring off Oregon. This report presents the qualitative fisheries information.

The goals of the qualitative portion of the fisheries data base project are:

1) To map selected commercial and recreational fishing grounds off Oregon, and

2) To describe factors influencing fisheries on the fishing grounds.

Information used to fulfill these goals was collected primarily through a series of interviews with knowledgeable fishers and biologists who mapped fishing locations and described the nature of the fisheries on each fishing ground.

This report was developed for use in offshore resource decision-making. The maps provide resource managers with a tool for identifying locations where potential resource use conflicts may occur and determining where to direct impact assessment and conflict resolution efforts. The primary users of the information will be Minerals Management Service for drafting their Environmental Impact Statement, the Oregon Ocean Resources Management Task Force in developing offshore management plans, and other state and federal agencies in reviewing offshore plans and development proposals. Use of the maps for fulfilling quantitative impact assessment requirements is limited because they were generated primarily from qualitative verbal communications. The **Map Uses and Limitations** section explains some of the maps' limitations.

This report presents qualitative fisheries map information for the following fisheries:

- commercial ocean salmon troll,
- commercial ocean Dungeness crab,
- commercial pot and longline groundfish,
- commercial sea urchin,
- commercial Pacific herring,

- commercial squid,
- commercial and recreational razor clam, and
- recreational charter.

Following the **Introduction**, the **Methods** section describes our procedures for gathering the qualitative data and developing the maps. The **Fishery Descriptions** and **Fishery Summaries and Maps** sections present and interpret the maps.

II. METHODS

We acquired information for the maps through a series of interviews with fishers and Oregon Department of Fish and Wildlife staff biologists familiar with the fisheries. The data acquisition process included identifying experienced individuals to interview, defining an interview format, and conducting the interviews. Oregon Department of Fish and Wildlife biologists, marine extension agents, and knowledgeable fishers suggested experienced individuals for our interview list. We focused on collecting information from a relatively small number of individuals with the greatest knowledge of the fisheries. We chose this strategy rather than a broad-based approach of interviewing a large sample of fishers because we felt that the fisheries could be adequately represented by the more experienced participants. During the interview process we usually observed that, after 2 or 3 interviews for a given area, additional contacts produced little or no new information on fishing locations. We interviewed individuals from the list who were available during the timeframe of the project and willing to participate. Many of the interview subjects had 20 or more years experience in the fishery. We conducted a total of 66 interviews for the fisheries included in this project.

The standard format of the interviews was to instruct the fisher as to the purpose of the project, and have them map the fishery of interest and complete a questionnaire about the fishery. In addition to, or instead of the questionnaire, the interviewer also kept notes to record information about the fishery. The map data produced by the fishers were in the form of hand-drawn polygons on photocopies of NOAA navigation charts (NOAA 1983, 1984, 1989) depicting primary fishing locations. The fishers selected primary fishing grounds by generalizing past years experience of where the fishery typically operates. We defined a fishing ground as any area where a fisher will typically attempt to fish based on a past record of catching an adequate amount of product to make fishing trips economically worthwhile.

Maps displayed in this report represent our compilation and generalization of the principal fishing grounds mapped by the fishers. Our compilation process involved hand transferring the interview map polygons for each fishery onto velum overlays registered to NOAA navigation charts. Compilation onto a single overlay for each fishery allowed comparison of different interview responses and generalization

of the interview polygons. The final fishing-ground polygons were drawn by evaluating individual interview map polygons with interview questionnaires and notes, physical factors such as depth and substrate type, and Oregon Department of Fish and Wildlife staff experience in the fisheries. We submitted copies of the final overlays to Minerals Management Service and digitized the information to prepare the maps presented in this report.

III. MAP USES AND LIMITATIONS

Maps presented in this report are useful for defining principal geographic locations of fisheries. Their uses for offshore planning and development review include identifying fisheries that are most likely to be impacted by proposed development, identifying potential space-use conflicts, and determining where to focus further research for assessing potential impacts. The maps, however, have several important limitations to their use. The following list briefly explains these limitations.

1) Interview data are subject to personal biases and limited knowledge.

Information gathered during interviews can be subject to personal biases, errors, limits on personal knowledge, and attempts to sway information for personal purposes. Individuals interviewed for this study were, in general, very knowledgeable and appeared entirely open and honest in providing fishing ground locational information. We therefore suspect little intentional biasing of the data. Abilities to generalize past fishing experience and represent the information on maps varied among the individuals interviewed. This resulted in some inconsistency in the data; the maps tend to be biased toward information gathered from individuals who were better able to represent their experience on maps.

2) Catch or effort levels cannot be associated with mapped fishing grounds.

Oregon organizes official landing records by port. Because boats often fish some distance from their home port, fishing locations cannot be easily correlated with port of landing. As a result, catch data derived from official landing records cannot be legitimately assigned to individual fishing grounds.

3) Relative importance of fishing grounds cannot be consistently determined.

The interviews made no attempt to systematically ascertain relative importance of fishing grounds. Individual perceptions of importance vary too widely to legitimately rank fishing grounds using interview data.

4) Maps do not represent the distribution of non-marketable life stages or conditions of the fishery species.

Fisheries target only marketable life stages or conditions of species. Size is generally the primary factor determining marketability. The maps, therefore, do not represent distribution of juvenile or other non-marketable life stages.

5) Maps represent principal fishing areas only.

The fishers interviewed mapped principal fishing areas only. Small or infrequently used areas were not mapped due to lack of consistent information about them. When fishers are unsuccessful in their usual fishing grounds, they search other areas and often make adequate catches in areas not shown on the maps. The maps should be viewed with the understanding that minor fishing areas may exist in addition to those mapped.

6) Maps represent current fishery only.

Generally, if fishers are successful on the currently used grounds, they will not expend significant effort exploring new grounds. When fishing success decreases or when fishing pressure increases on a ground, new grounds are opened up. Also, current gear or regulatory restrictions may influence the use of current fishing grounds. New grounds may be opened up as gear is improved or regulations change over time. The maps, therefore, represent a snapshot in time and make no attempt to anticipate future fishing grounds.

7) Maps do not provide all data needed for impact analysis.

Any assessment of impacts should not rely on the maps alone. The maps should be used as a first step toward identifying fisheries of concern for the impact assessment. Once these fisheries and areas are identified, the assessment should gather more detailed and up-to-date information about the fishery, biological information on all life stages of the species involved, and economic and fleet structure information specific to the area being examined.

IV. FISHERIES DESCRIPTIONS

A. Ocean Salmon Troll Fishery

The primary targeted species of the ocean salmon troll fishery are Chinook and coho salmon (*Oncorhynchus tshawytscha* and *O. kisutch*); a small number of chum (*O. keta*) and pink salmon (*O. gorbuscha*) are also taken commercially. Incidental species to the fishery include rockfish (*Sebastes spp.*) and lingcod (*Ophiodon elongatus*). The Oregon ocean fishery uses only salmon troll gear (a series of lines and hooks towed through the water). Salmon fishing seasons are established based on stock timing and annual quotas, and vary significantly among

years and between geographic management zones. The principal fishing seasons occur from May through September; some seasons extend into October and November. Figure 1 summarizes average monthly catch of the fishery.

The distribution of the ocean salmon troll fishery is determined primarily by fish population distribution and regulatory factors. Water column conditions and migratory timing influence offshore salmon population distribution. Salmon are a pelagic species that respond to habitat conditions within the water column and will group in areas of upwelling and other oceanic frontal conditions that tend to concentrate prey. Because these oceanic conditions are spatially and temporally variable, population concentrations show similar variability. As a result, the fishery is not tied to specific locations, and can occur in any part of the nearshore area shown on Figure 2. Migrational behavior influences the distribution of individual salmon stocks in relation to their river of origin and the timing of their upriver run. Regulations have a strong influence on the location and timing of salmon fishing. Regulations vary widely from year to year; maps of individual years' fishing would be very dissimilar. Because Figure 2 represents a composite of many years' fishing locations, it masks individual effects of regulations.

B. Ocean Dungeness Crab Fishery

Dungeness crab (*Cancer magister*) are fished commercially in Oregon ocean waters primarily with anchored strings of crab pots. Incidental species to the fishery include box crab (*Lopholithodes foraminatus*), octopus (Octopoda spp.), cabezon (*Scorpaenichthys marmorataus*), lingcod, and rockfish; incidental landings make up less than 1% of the total catch (Brown, et al. 1981; Lukas and Carter 1982, 1983, 1984, 1985, 1986). The ocean crab fishing season runs from December 1 through August 15. Figure 3 summarizes average monthly catch for the fishery.

Principal factors determining the distribution of the fishery include crab population distribution, gear limitations, weather, time of year, and gear conflicts. Adult crab populations are most prevalent shoreward of 75 fathoms. For most of the coast, however, only the winter fishery extends to 75 fathoms (Figure 4). Adult crab tend to become more concentrated inside of 45 fathoms during the spring and summer months (Demory, ODFW, personal communication 1989). Juvenile crab concentrate in shallow nearshore waters, intertidal beach areas, and estuaries. Commercial crab gear are most efficiently fished in shallow water; beyond 75 fathoms fishing becomes inefficient. Also, the gear can only be fished on sandy or muddy bottoms. Although crab occur on rocky substrates, the rock areas are not fished due to increased chance of gear movement and loss. Many of the rocky areas, however, consist of a mosaic of rocky and soft substrates. A substantial amount of successful fishing occurs in sandy areas interspersed among the rock outcroppings. Weather limits the inside extent of the fishery. During rough winter months, gear is rarely set inside of 10 fathoms in order to avoid strong surges and

surf. During summer, the gear can be set shoreward to 2 to 3 fathoms (Figure 4). The crab fishery experiences significant gear conflicts. Generally, crabbers avoid heavily trawled areas and tow boat lanes to decrease their gear loss. Increases in trawling and trolling pressure during summer contribute to the seasonal inshore shift of the crab fishery in some areas. Crabbers and towboat operators have set agreed-upon tow boat lanes to reduce gear loss problems (Appendix A).

C. Pot and Longline Groundfish Fisheries

The pot and longline fisheries are classified as fixed-gear groundfish fisheries. Both fisheries employ anchored gear; the pot fishery uses strings of fish traps or pots and the longline fishery uses strings of hooks. The pot fishery targets on sablefish (*Anoplopoma fimbria*) while the longline fishery consists of a series of smaller fisheries targeting on Pacific halibut (*Hippoglossus stenolepis*), sablefish, rockfish, or lingcod. Only the larger longline fisheries, halibut and sablefish, are represented in Figure 6. There are several other gear types used for catching groundfish, including groundfish bottom and midwater trawls, Portuguese (vertical) longline, and jig, that are not shown on the map. Timing of fixed-gear sablefish fishing is regulated by an annual quota. When the quota is reached, only incidental catch is permitted. In 1989 the quota was met in mid-July. Halibut fishing is regulated with a series of short seasons during the year based on annually established quotas. Figure 5 summarizes the monthly catch of the fixed-gear sablefish and halibut fisheries.

The principal factors affecting distribution of the fixed-gear groundfish fisheries include fish population distribution, regulations, gear limitations, and gear conflicts. The effects of these factors vary among species and gear types. Sablefish are fished primarily in deep water; the pot fishery generally utilizes areas between 200 and 800 fathoms, while the longline fishery targets on sablefish from 200 to 400 fathoms (Figure 6). Sablefish occur beyond these depths but gear limitations do not favor cost-effective fishing in deeper waters. The fisheries are generally located on hard mud or sand bottoms and at the edges of rock outcroppings, particularly in steeply sloped areas on the continental slope or in submarine canyons. Trawlers catch large amounts of sablefish in the 100 to 300 fathom range while fishing on the deepwater dover sole complex. The fixed-gear fisheries avoid these areas to reduce gear loss. Minimum size limits on sablefish and the market preference for larger fish also encourage pot and longline fishing in deeper waters where the larger sablefish occur. Halibut fishing areas are generally associated with rocky reefs or hard bottom areas. Some concentrations of halibut are also found in apparently featureless soft bottom habitat. The fixed-gear groundfish fisheries are very susceptible to gear conflicts, including activities that occupy ocean space or tow gear through the water in fishing areas.

D. Sea Urchin Fishery

The sea urchin fishery in Oregon employs divers using hand harvesting techniques. The targeted species is the red sea urchin (*Strongylocentrotus franciscanus*). Incidental species to the fishery include the purple urchin (*S. purpuratus*) and green urchin (*S. droebachiensis*). The fishing season for urchins is open all year. Figure 7 summarizes the monthly landings of the fishery in 1988.

The distribution of the urchin fishery is determined primarily by availability of suitable urchin habitat, regulations and physical restrictions on depth of harvest, weather, and market factors. Red urchins inhabit rocky substrates with concentrations of kelp and other marine algae. In Oregon, these areas are restricted to a few nearshore rocky reefs, primarily on the south coast (Figure 8). Because habitat is so limited, an impact to one area cannot be mitigated by temporarily displacing the fishery to other areas. Regulations set the minimum harvest depth at 3.08 meters below Mean Lower Low Water. The maximum harvest depth is determined by lower limits of urchin habitat and maximum depth of efficient harvest using dive equipment. Urchins are currently harvested to depths of about 21.54 meters in Oregon. The dive equipment allows effective harvest to about 27.69 meters. Market factors affect both the distribution and timing of the fishery. The Oregon urchin fishery is young and, to date, markets have been very unstable. Timing of harvest has tended to coincide with availability of markets. Market demand and, consequently, fishing activity is intense when urchin gonads are full. Although the timing of peak gonadal condition varies geographically and annually, it is generally highest in the late fall and early winter months (McCrae, ODFW, personal communication 1989). Market price is generally lower in summer; however, fishing activity remains intense because of favorable weather conditions (Figure 7). Conversely, rough winter weather often restricts harvest even if market demand is high. Market instability slows the search for new fishing areas. As markets stabilize and the fishery matures, some new harvest areas are likely to open up.

E. Pacific Herring Fishery

The Pacific herring (*Clupea harengus pallasi*) fishery is small in Oregon relative to adjacent states. Herring are fished primarily for their roe in Yaquina Bay with purse and lampara seines, and as baitfish in the Umpqua Estuary with beach seines. The herring season is open year round except in Yaquina Bay where it is closed during January. Figure 9 summarizes average monthly catch of the fishery.

Primary factors affecting the location of herring fishing areas include timing and location of schools, regulations, and market conditions. The Yaquina Bay fishery targets herring which concentrate in the bay prior to spawning. The primary fishery occurs in February. The Umpqua Estuary fishery targets on sub-adult herring which school for feeding in the estuary during spring. Market conditions and regulations currently favor only the fisheries in Yaquina Bay and the

Umpqua Estuary. Yaquina Bay is the only area in the state where the roe herring fishery is allowed. Other than this fishery, only a few small-scale isolated bait fisheries, of which the Umpqua Estuary's is the largest, offer adequate economic returns.

F. Squid Fishery

The squid fishery in Oregon experienced a period of high catch from 1982 through 1985. Gear used to catch squid includes purse seines, shrimp trawls, and lampara seines; most squid in the recent Oregon fishery were landed with purse seines. The target species of the fishery is market squid (*Loligo opalescens*). Incidental catch is very low, consisting primarily of mackerel (*Scomber japonicus*). The squid fishery is open all year; however, most fishing occurs from March through June. During the period of intense fishing, temporary closures or limits may be placed on individual schools. Figure 11 summarizes average monthly landings of the squid fishery from 1982 through 1985.

The primary factors determining location and occurrence of the squid fishery include distribution of large squid schools and market demand. Squid school in nearshore areas prior to and during spawning. In Oregon waters, this occurs primarily from March through May (Starr and McCrae 1985). Figure 12 shows school locations that were fished from 1982 through 1985. Many other spawning schools have been observed but have not been fished. Changes in market demand have controlled the occurrence of the squid fishery in Oregon. The fishery expanded in the early 1980's in response to increased demand and availability of vessels idled due to poor shrimp fishing, and declined after 1985 due to severe price reductions and an increase in the shrimp fishery.

G. Razor Clam Fisheries

Razor clams are dug both commercially and recreationally on intertidal beach areas. Offshore (subtidal) populations are not harvested. Harvest is by hand using shovels or clam guns. The targeted species is the razor clam (*Siliqua patula*) and there are no incidental species to the fishery. The commercial and recreational fishing seasons are open year round except from July 15 through August 31 in the area north of Tillamook head. The recreational harvest comprises about 90% of the total clam catch. Recreational razor clam digging occurs primarily from April through June. Figure 13 summarizes average monthly commercial landings. Monthly catch information is not available for the recreational harvest.

The distribution of the fishery is influenced primarily by the abundance and distribution of clams. About 90% of the recreational and nearly 100% of the commercial fishery occurs on beaches north of Tillamook Head (Figure 14). There is substantial year to year variation in both occurrence and distribution of clams on the beaches south of Tillamook Head. The large subtidal clam population north of Tillamook Head (Figure 14) is thought to produce enough new young to

help replenish the heavily harvested intertidal populations. Any habitat disruption or water quality impacts to the large subtidal clam population on the north coast could have significant effects on intertidal populations and the clam fishery.

H. Charter Fisheries

The charter fishing map (Figure 15) shows location of the salmon, Pacific halibut, and other bottomfish sport fisheries. Other bottomfish include primarily rockfish species, lingcod, cabezon, and flatfish species. At present, charter boats operate on a regular basis out of Columbia River ports, Garibaldi, Depoe Bay, Newport, Winchester Bay, Coos Bay, and Brookings, and, occasionally, out of Pacific City, Florence, Bandon, and Gold Beach. Fishing gear for all Oregon charter fisheries is hook and line. Recreational salmon and halibut fisheries have seasonal regulations. Seasons for both fisheries are based on annually established quotas and vary from year to year. Salmon fishing is generally most intense in late spring and summer, and halibut fishing from mid May through mid August.

The principal factors affecting location and timing of charter fishing grounds are fish population distribution, distance from port, and recreational market demand. The **Ocean Salmon Troll Fishery** section discussed factors that affect salmon distribution. The charter salmon fishery (Figure 15) utilizes much of the nearshore portion of the area used by the commercial salmon fishery (Figure 2). The outside limits of the charter salmon fishery are defined by the maximum fishing distance from port given the length of the trip. In general, salmon charters operate on 4 to 6 hour trips in Oregon. This allows for approximately a 10 mile fishing radius from port. Halibut and other bottom fishing areas are determined by the existence of rocky reefs or other hard substrate habitat. These are discussed more fully in the Pot and Longline Groundfish Fisheries section. The outer limits of halibut and other bottomfish fishing areas are defined by the maximum fishing distance for a 12 hour trip. Although current charter fishing operations in Oregon do not offer trips longer than 12 hours, overnight trips are a future possibility. Most of the demand for charter fishing occurs during the summer tourist season. Only Newport and Depoe Bay have active charter fleets during other times of the year.

V. FISHERIES SUMMARIES AND MAPS

A. Ocean Salmon Troll Fishery Map Summary Sheet

Targeted Species: Chinook salmon (*Oncorhynchus tshawytscha*); coho salmon (*Oncorhynchus kisutch*)

Incidental Species: Rockfish (*Sebastes spp.*); lingcod (*Ophiodon elongatus*)

Gear: Troll gear

Fishing Seasons: Seasons vary significantly among years and management zones. They are based both on stock timing and annually established quotas. The principal fishing seasons occur from May - September with some seasons extending to the end of November.

Monthly Landings:

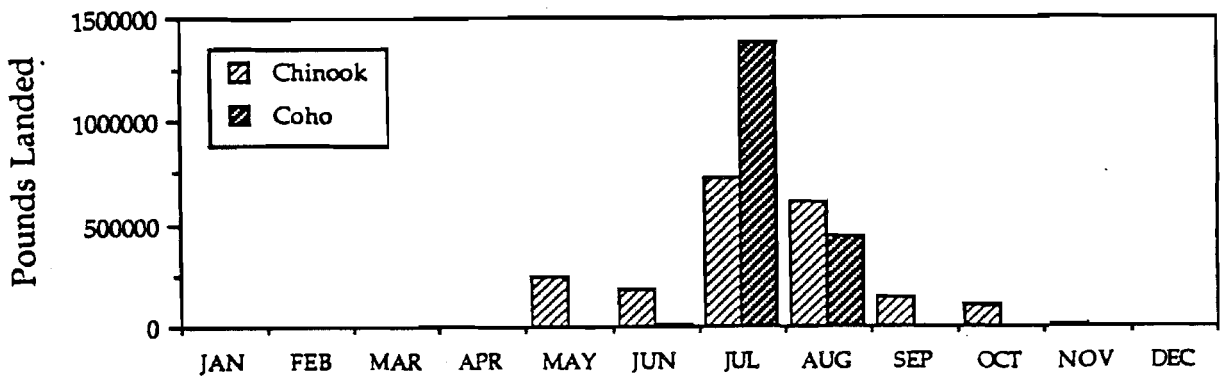


Figure 1. Average Monthly Landings (1981-1986) of Chinook and Coho Salmon (*Oncorhynchus tshawytscha* and *O. kisutch*) from the Ocean Troll Salmon Fishery for All Oregon Ports (from Brown, et al. 1981; Lukas and Carter 1982, 1983, 1984, 1985, 1986).

Map Accuracy and Resolution Considerations: Figure 2 divides the salmon troll fishery into three categories of fishing intensity. Because salmon are a pelagic species subject to extremely variable oceanic frontal and circulation conditions, the size and shape of these mapped grounds can vary considerably from year to year.

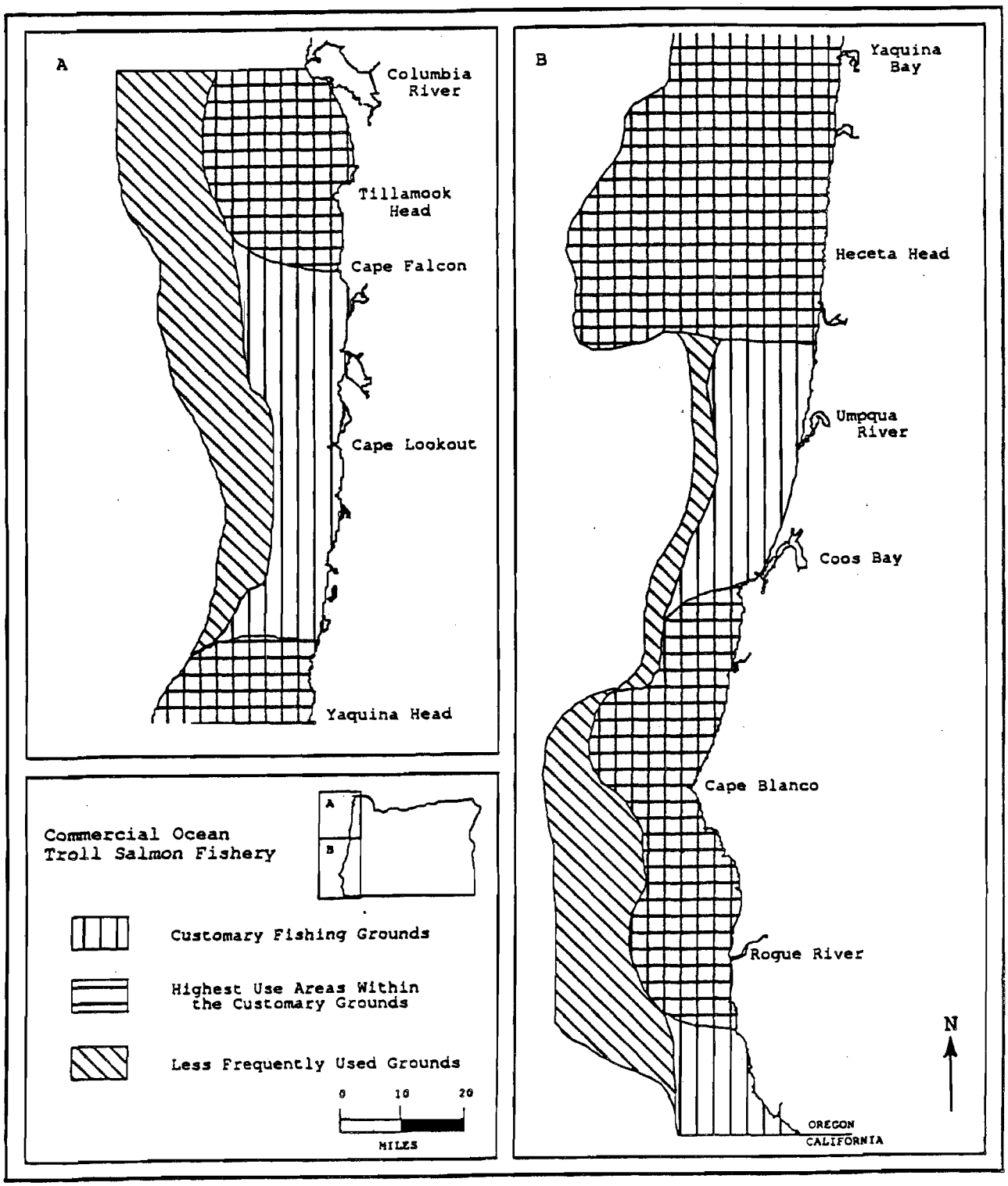


Figure 2. Principal Ocean Troll Salmon Fishing Grounds.

B. Ocean Dungeness Crab Fishery Map Summary Sheet

Targeted Species: Dungeness crab (*Cancer magister*)

Incidental Species: Box crab (*Lopholithodes foraminatus*); octopus (Octopoda spp.); cabezon (*Scorpaenichthys marmorataus*); lingcod (*Ophiodon elongatus*); rockfish (*Sebastes spp.*)

Gear: Crab pots

Fishing Season: December 1 - August 15

Monthly Landings:

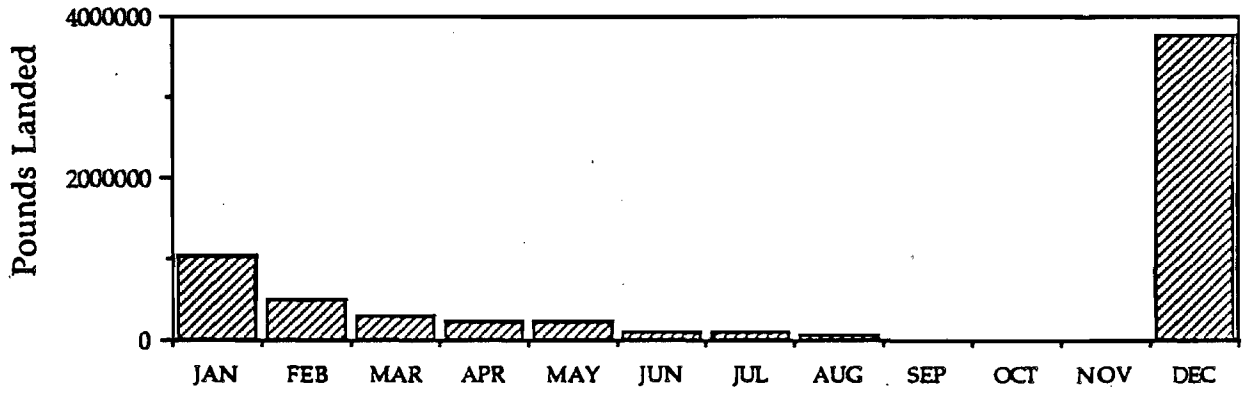


Figure 3. Average Monthly Landings (1985-1988) of Dungeness Crab (*Cancer magister*) from the Commercial Ocean Crab Fishery for All Oregon Ports (from Lukas and Carter 1985, 1986; Demory, ODFW, personal communication 1989).

Map Accuracy and Resolution Considerations: Figure 4 provides an accurate picture of the current bounds of the crab fishery. Some fishing can occur outside of the boundaries; however, gear and weather limitations keep most of the fishery within the mapped areas. Rock outcroppings occurring within the mapped areas are not fished; however, fishing occurs in sandy areas between rock structures.

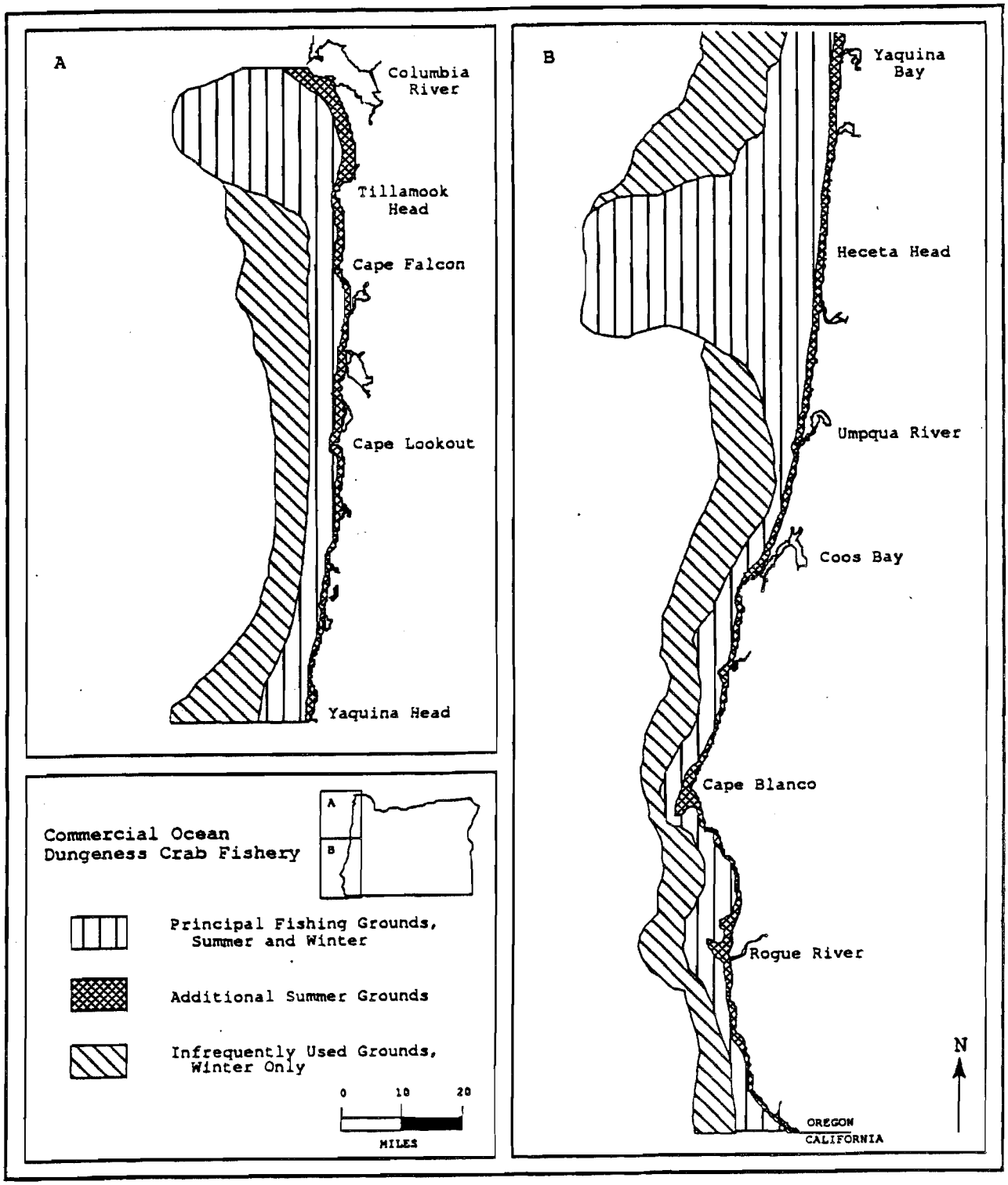


Figure 4. Principal Commercial Ocean Dungeness Crab (*Cancer magister*) Fishing Grounds.

C. Pot and Longline Groundfish Fisheries Map Summary Sheet

Targeted Species: Pot - Sablefish (*Anoplopoma fimbria*)
Longline - Pacific halibut (*Hippoglossus stenolepis*); sablefish (*Anoplopoma fimbria*)

Incidental Species: Pot - Rockfish; lingcod (*Ophiodon elongatus*)
Longline - Flatfish (Pleuronectiformes spp.); cabezon (*Scorpaenichthys marmorataus*)

Gear: Fish pot; longline

Fishing Season: Sablefish - Fisheries close to all but incidental catches when the annually established quota is met. In 1989 the quota was met in mid-July.
Halibut - Short seasons are set annually based on quotas. 1989 seasons: June 27-29; July 24-26; August 28-30 (ODFW 1989).

Monthly Landings:

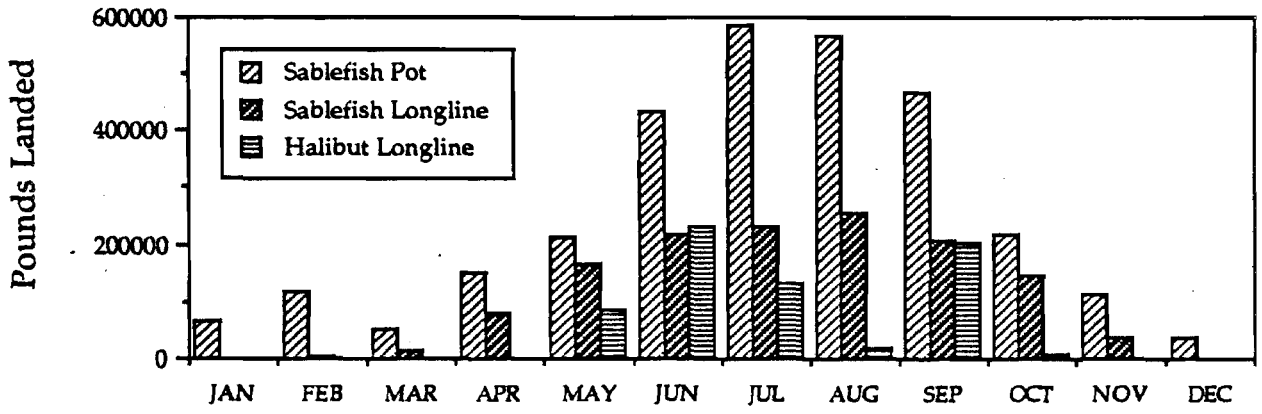


Figure 5. Average Monthly Landings (1981-1986) of Sablefish (*Anoplopoma fimbria*) from the Groundfish Pot and Longline Fisheries, and of Pacific Halibut (*Hippoglossus stenolepis*) from the Groundfish Longline Fishery for All Oregon Ports (from Brown, et al. 1981; Lukas and Carter 1982, 1983, 1984, 1985, 1986).

Map Accuracy and Resolution Considerations: Figure 6 represents the fixed-gear sablefish fisheries over large areas of the continental margin. Individual areas of intense fishing could not be mapped separately because most of the intense fishing sites vary in location from year to year and can occur anywhere within the mapped grounds. The mapped halibut fishing grounds may under-represent the fishery potential because seasons are so short that fishermen cannot afford the time to search for new areas, thus fishing only in known spots.

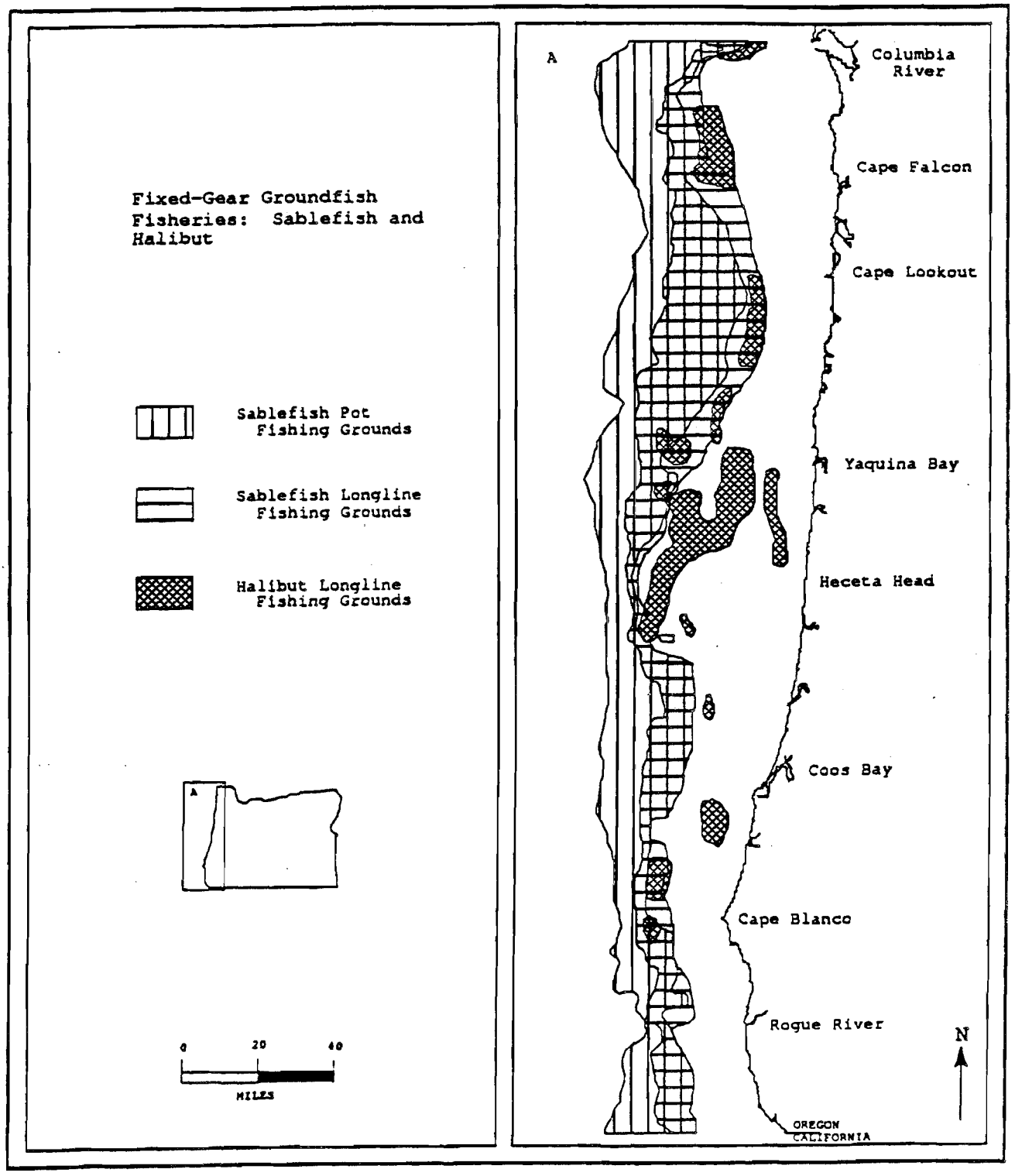


Figure 6. Principal Pot and Longline Groundfish Fishing Grounds.

D. Sea Urchin Fishery Map Summary Sheet

Targeted Species: Red sea urchin (*Strongylocentrotus ranciscanus*)

Incidental Species: Purple sea urchin (*S. purpuratus*); green sea urchin (*S. droebachiensis*)

Gear: Hand harvest with a short-handled rake

Fishing Season: Open all year

Monthly Landings:

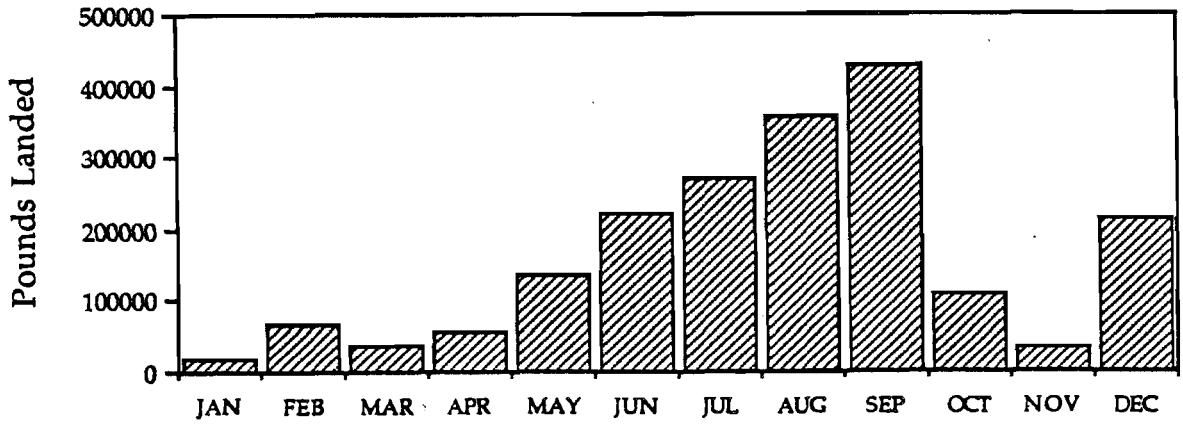


Figure 7. Monthly Landings (1988) of the Sea Urchin Fishery for All Oregon Ports (ODFW 1989).

Map Accuracy and Resolution Considerations: Map representation of urchin harvest areas is relatively precise because the urchins are confined to a few distinct rocky reefs. The urchin fishery in Oregon is young. Although the mapped areas are accurate for the 1989 fishery, additional areas will likely appear over the next few years.

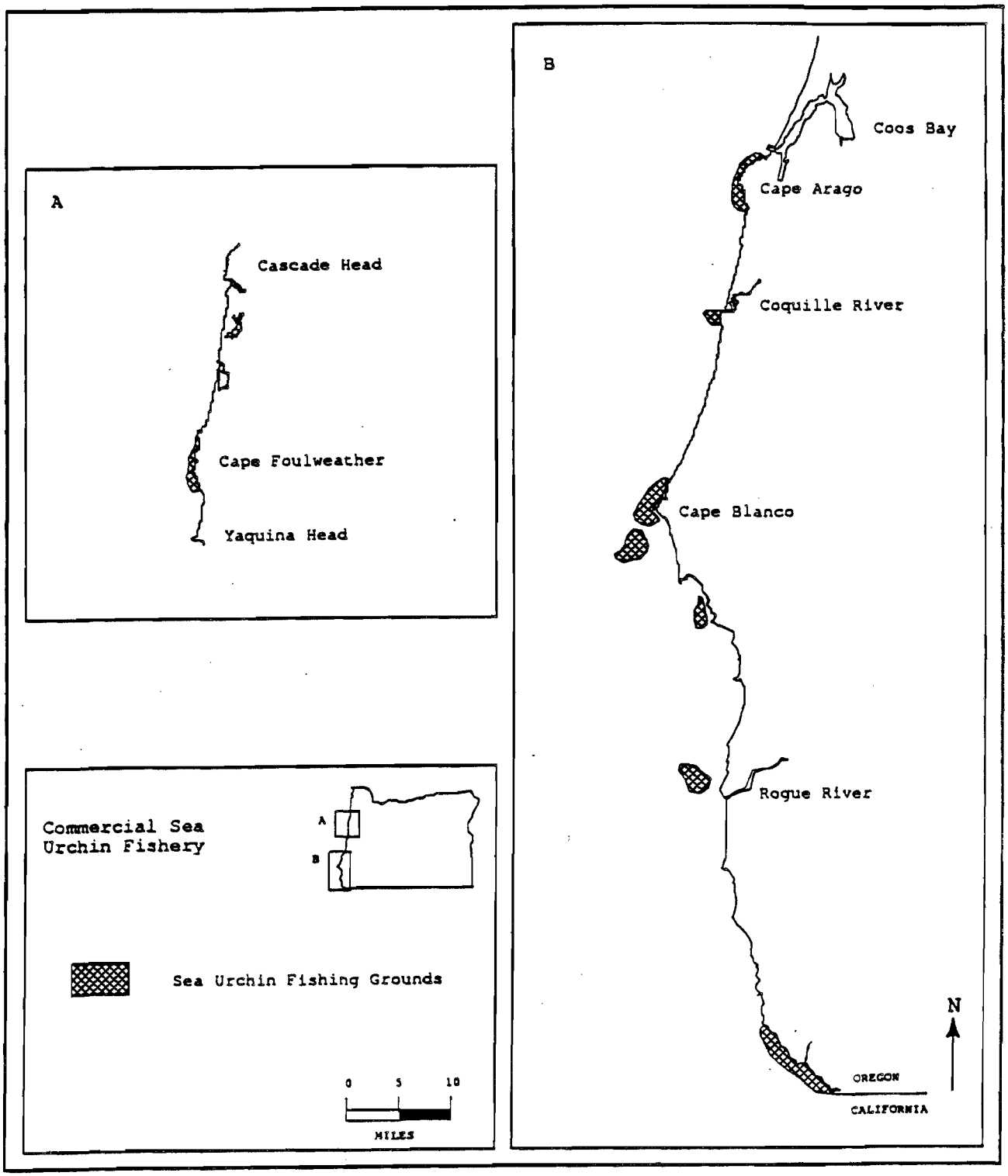


Figure 8. Principal Sea Urchin Fishing Grounds.

E. Pacific Herring Fishery Map Summary Sheet

Targeted Species: Pacific herring (*Clupea harengus pallasi*)

Incidental Species: Smelt (Osmeridae spp.)

Gear: Purse seine, lampara seine, beach seine

Fishing Season: Open all year except in Yaquina Bay where the season is closed from January 1 - 31

Monthly Landings:

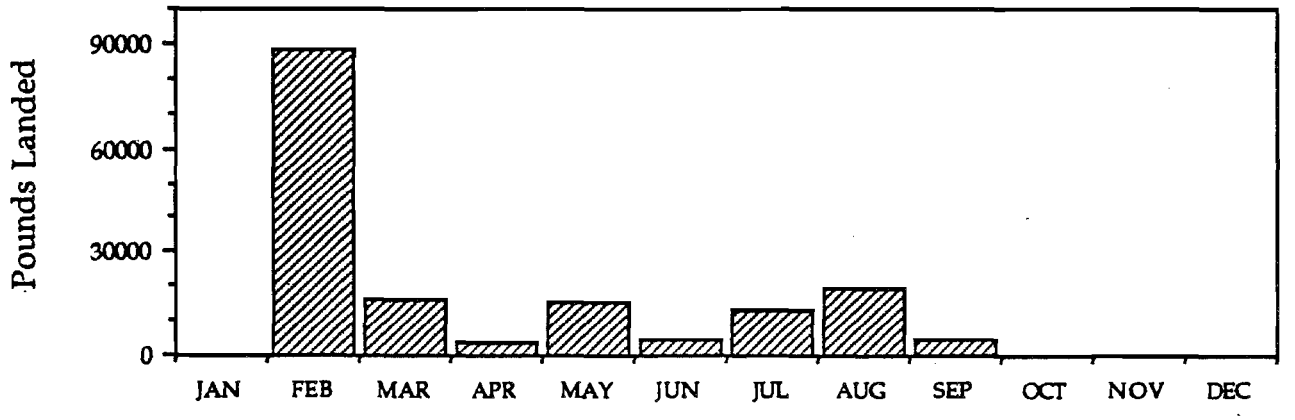


Figure 9. Average Monthly Landings (1981-1986) of the Pacific Herring (*Clupea harengus pallasi*) Fishery for All Oregon Ports (from Brown, et al. 1981; Lukas and Carter 1982, 1983, 1984, 1985, 1986).

Map Accuracy and Resolution Considerations: The present fishery takes herring primarily from only two areas: Yaquina Bay and the Umpqua Estuary (Figure 10). Herring occur in schools in other areas of the coast but are currently not fished due to low market price and restrictions on roe herring harvest.

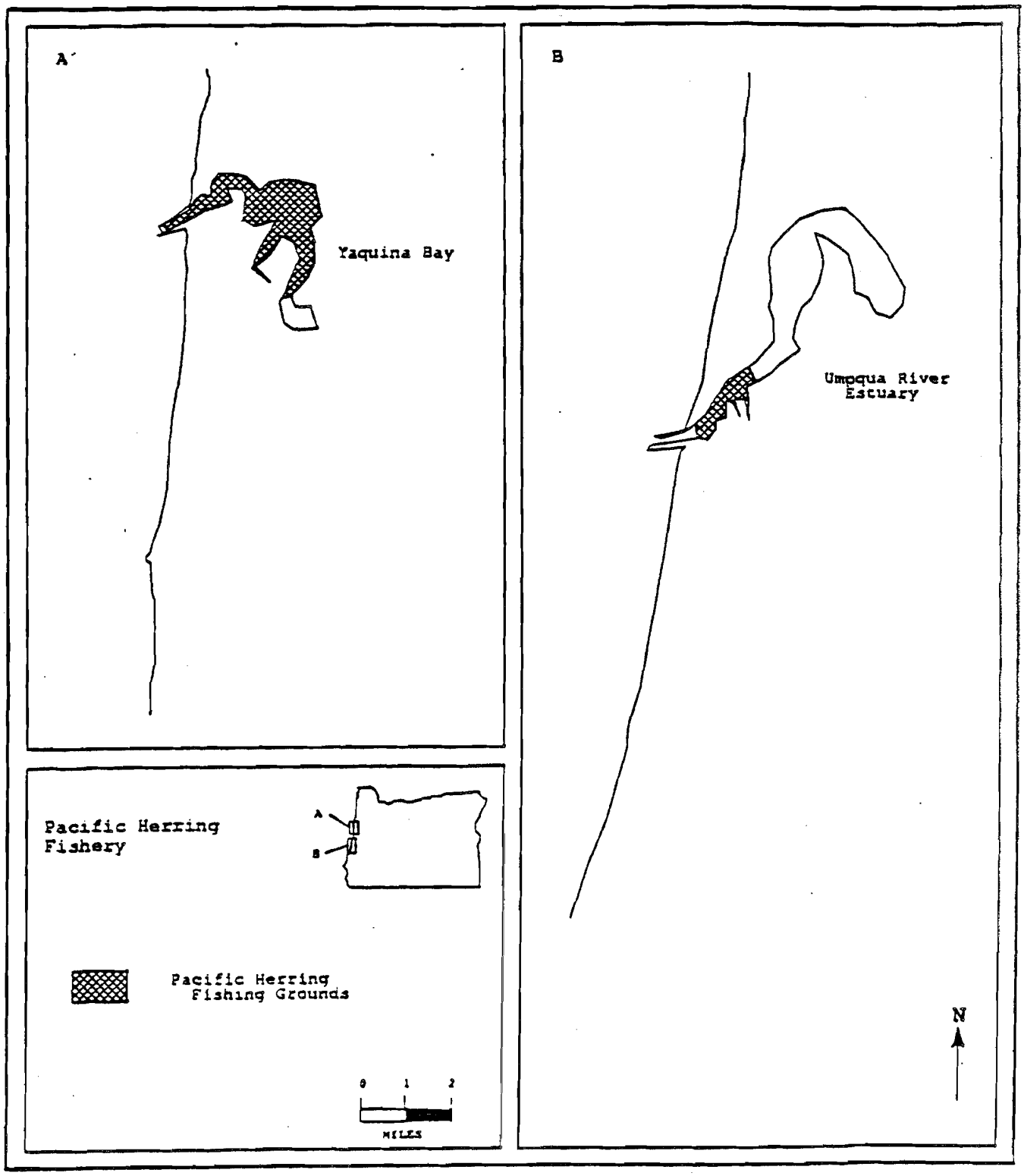


Figure 10. Principal Pacific Herring (*Clupea harengus pallasi*) Fishing Grounds.

F. Squid Fishery Map Summary Sheet

Targeted species: Market squid (*Loligo opalescens*)

Incidental Species: Mackerel (*Scomber japonicus*)

Gear: Purse seine; shrimp trawl; lampara seine

Fishing Season: Open all year

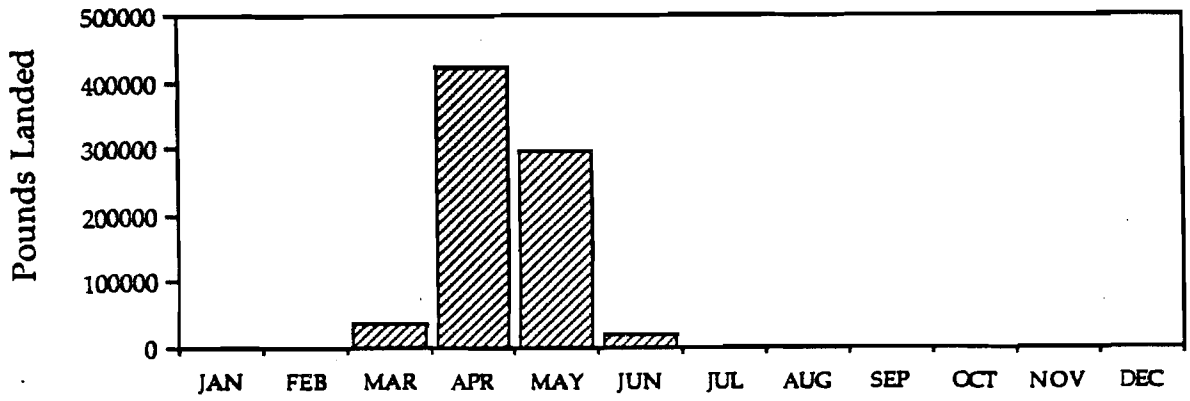


Figure 11. Average Monthly Landings (1982-1985) of the Squid (*Loligo opalescens*) Fishery for All Oregon Ports (from Brown, et al. 1981; Lukas and Carter 1982, 1983, 1984, 1985, 1986).

Map Accuracy and Resolution Considerations: Figure 12 shows areas where squid schools were fished during a period of relatively intense fishing from 1982-1985. Fishing areas may change locations in the future due to squid movements in response to oceanic conditions. Also, new fishing areas may open up if the fishery utilizes previously unexploited schools.

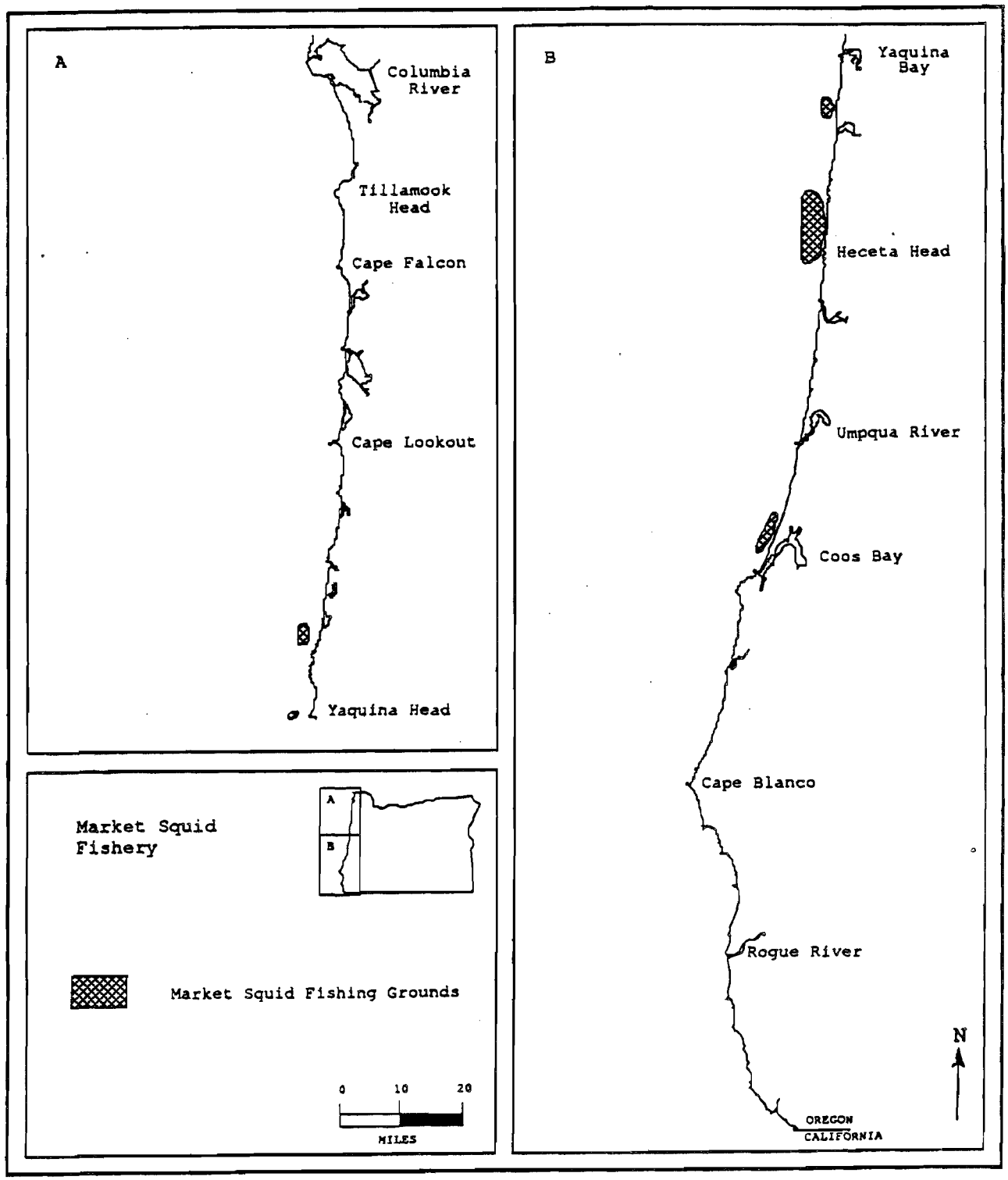


Figure 12. Principal Squid (*Loligo opalescens*) Fishing Grounds.

G. Razor Clam Map Summary Sheet

Targeted Species: Razor clam (*Siliqua patula*)

Incidental Species: None

Gear: Hand harvest with shovel or clam gun

Fishing Season: Open year round except from July 15 through August 31 north of Tillamook Head

Monthly Landings:

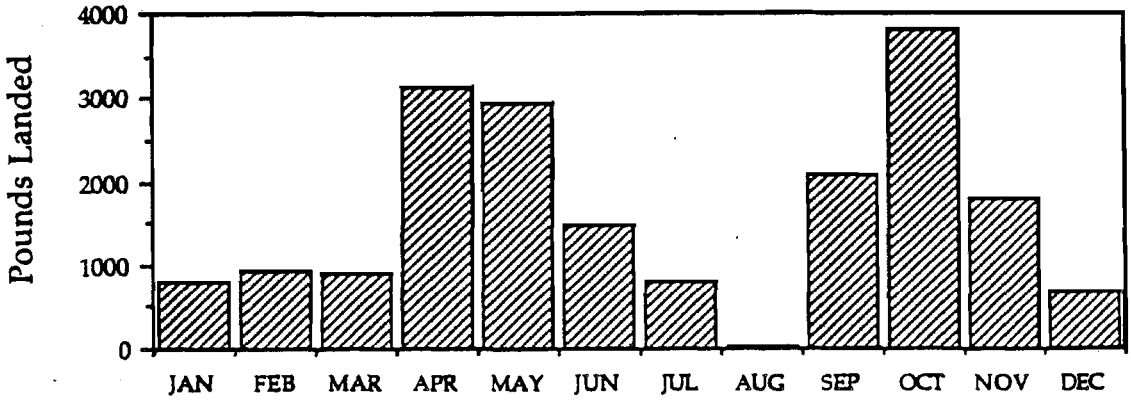


Figure 13. Average Monthly Landings (1981-1986) of the Commercial Razor Clam (*Siliqua patula*) Fishery for All Oregon Ports (from Brown, et al. 1981; Lukas and Carter 1982, 1983, 1984, 1985, 1986).

Map Accuracy and Resolution Considerations: Figure 14 shows all known razor clam digging areas and approximates the large subtidal population north of Tillamook Head. Most of the clam digging in Oregon occurs north of Tillamook Head. Clam digging pressure and location varies from year to year on beaches south of Tillamook Head.

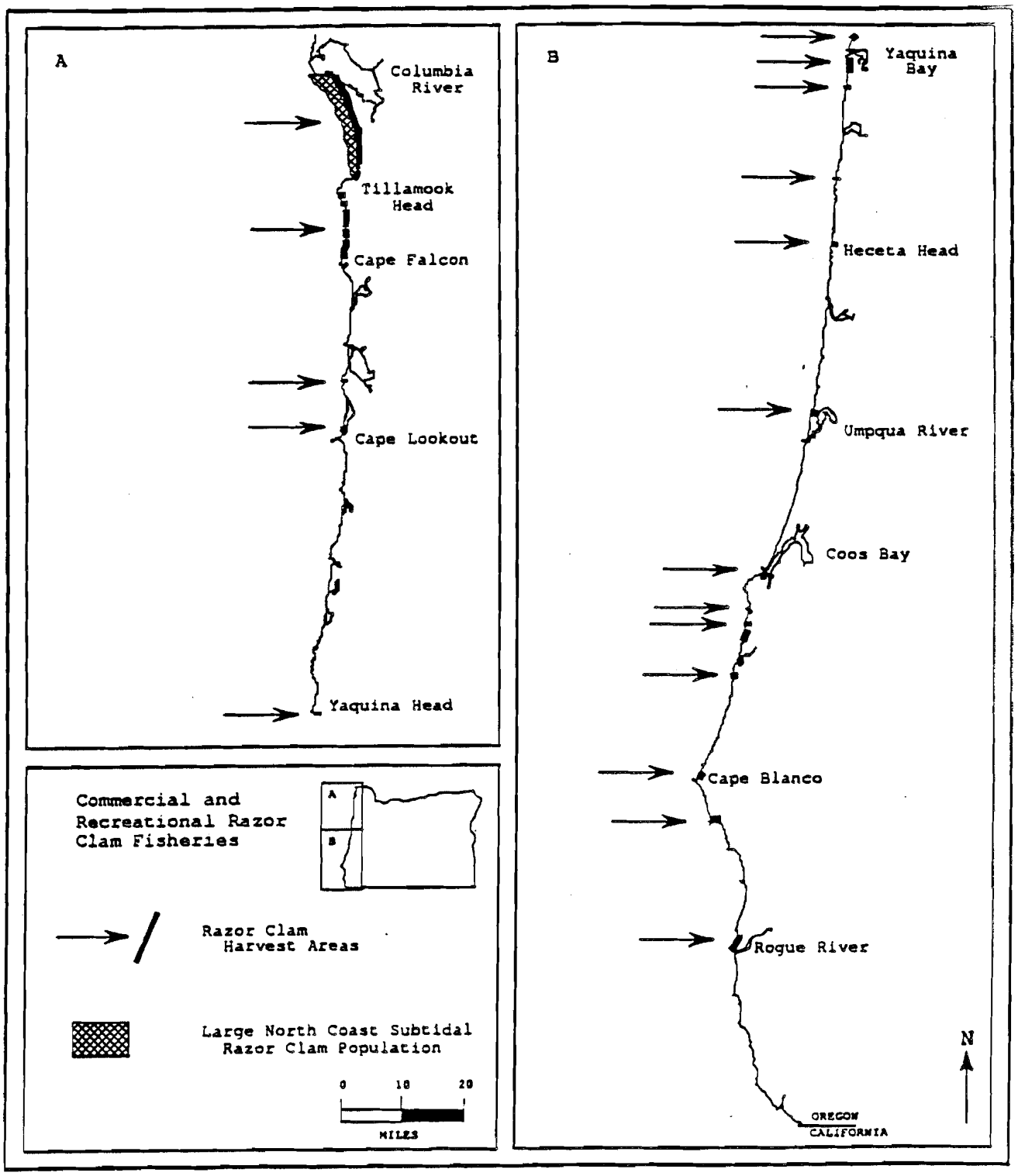


Figure 14. Principal Commercial and Recreational Razor Clam (*Siliqua patula*) Harvest Areas.

H. Charter Fisheries Map Summary Sheet

Targeted Species: Chinook and coho salmon (*Oncorhynchus tshawytscha* and *O. kisutch*); Pacific halibut (*Hippoglossus stenolepis*); rockfish (*Sebastes spp.*)

Incidental species: Rockfish (*Sebastes spp.*); flatfishes (*Pleuronectiformes spp.*); lingcod (*Ophiodon elongatus*); many others

Gear: Hook and line

Fishing Seasons: Salmon and halibut seasons are based on annually established quotas.

Map Accuracy and Resolution Considerations: Salmon - The mapped boundaries represent known fishing areas within an area limited by the maximum distance fished on 4 to 6 hour trips. If future demand favors longer trips, charter operators will fish outside the areas shown on Figure 15.
Bottomfish - Mapped bottomfish fishing grounds are based on known fishing areas, usually associated with reef or hard bottom habitat. Most of the locations on the map are generalized; several small adjacent reefs may be enclosed by one polygon. The most distant reef areas mapped are fished during 12 hour trips. Some operators may begin offering overnight trips, opening up areas beyond those mapped.

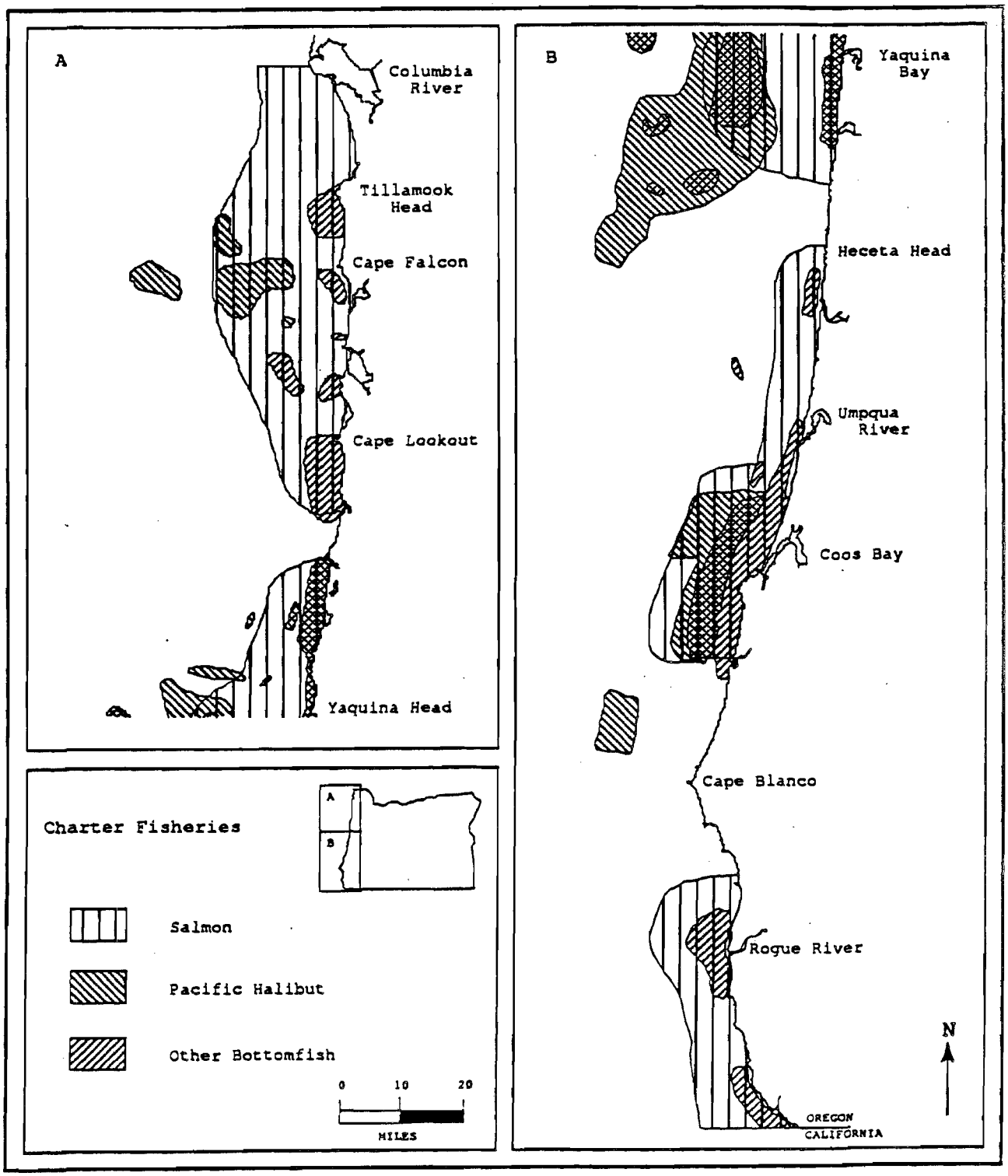


Figure 15. Principal Charter Boat Fishing Grounds.

VI. REFERENCES

Brown, K., R. Berry, J. Lukas, and C. Carter. 1981. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and C. Carter. 1982. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and Carter, C. 1983. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and Carter, C. 1984. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and Carter, C. 1985. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

Lukas, J., and Carter, C. 1986. Pounds and values of commercially caught fish and shellfish landed in Oregon. Oregon Department of Fish and Wildlife, Portland, OR.

NOAA. 1983. United States - West Coast, Oregon, Cape Blanco to Yaquina Head. Navigation chart #18580. National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce, Washington, DC.

NOAA. 1984. United States - West Coast, California - Oregon, Trinidad Head to Cape Blanco. Navigation chart #18600. National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce, Washington, DC.

NOAA. 1989. United States - West Coast, Oregon - Washington, Yaquina Head to Columbia River. Navigation chart #18520. National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce, Washington, DC.

ODFW. 1989. Oregon commercial fishing regulations, 1989 synopsis. Oregon Department of Fish and Wildlife, Portland, OR.

ODFW. 1989. Oregon Department of Fish and Wildlife unpublished sea urchin catch data.

Starr, R.M., and McCrae, J.E. 1985. Market squid (Loligo opalescens) investigations in Oregon, 1983-1985. Oregon Department of Fish and Wildlife Information Report #85-10, Newport, OR.

APPENDIX A

Towboat Lanes Mutually Established by Crab Fishermen and Towboat Operators

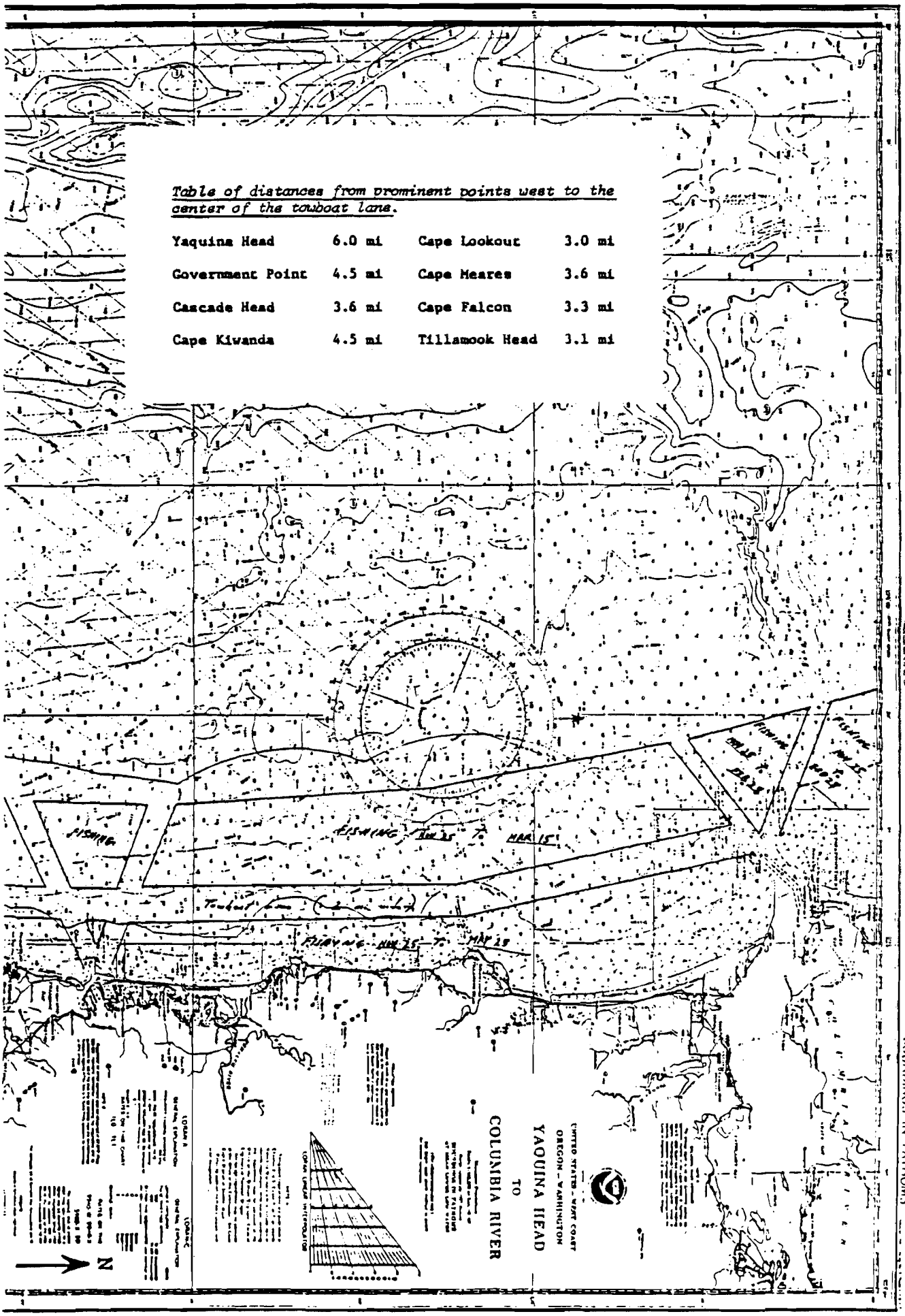
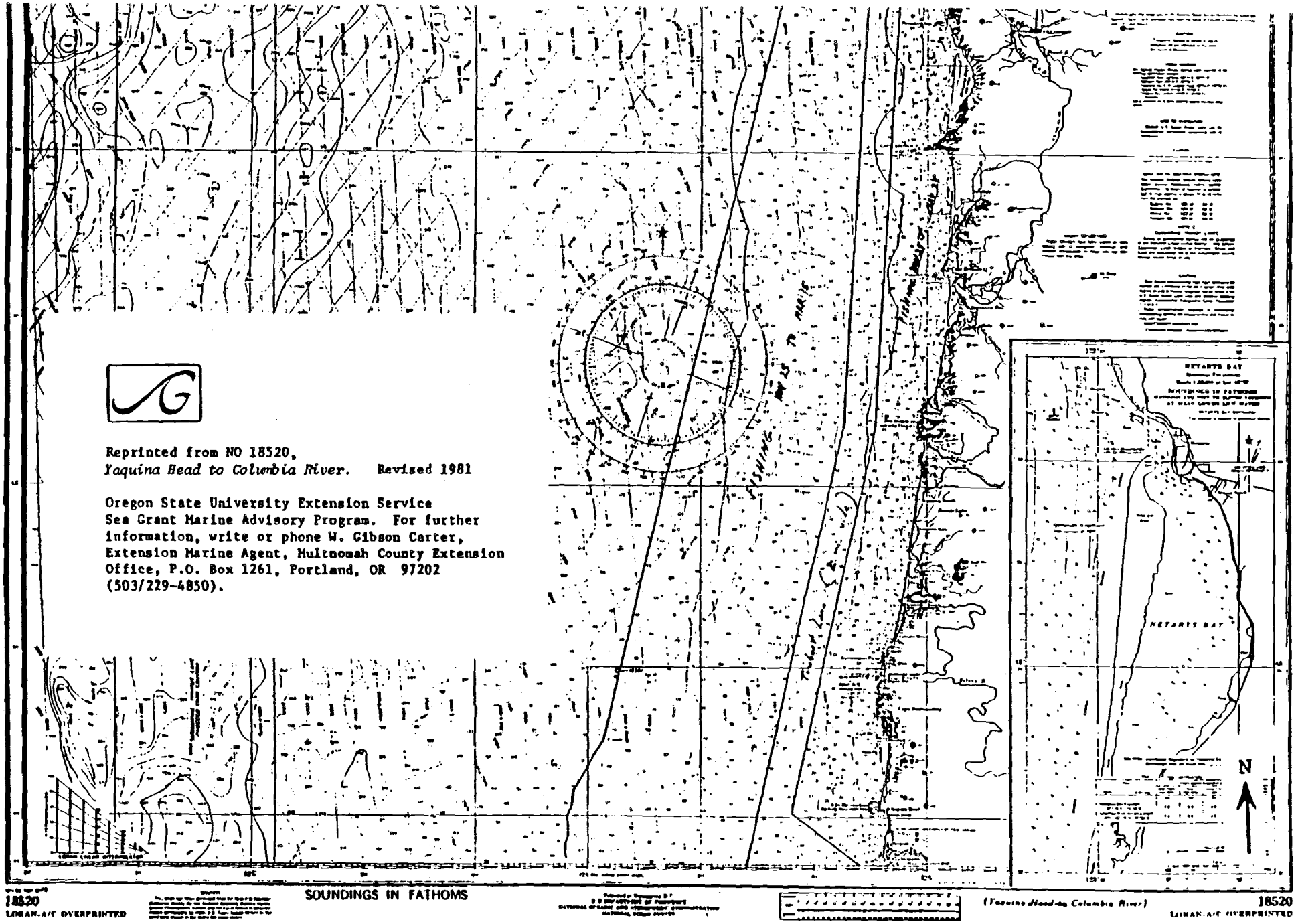
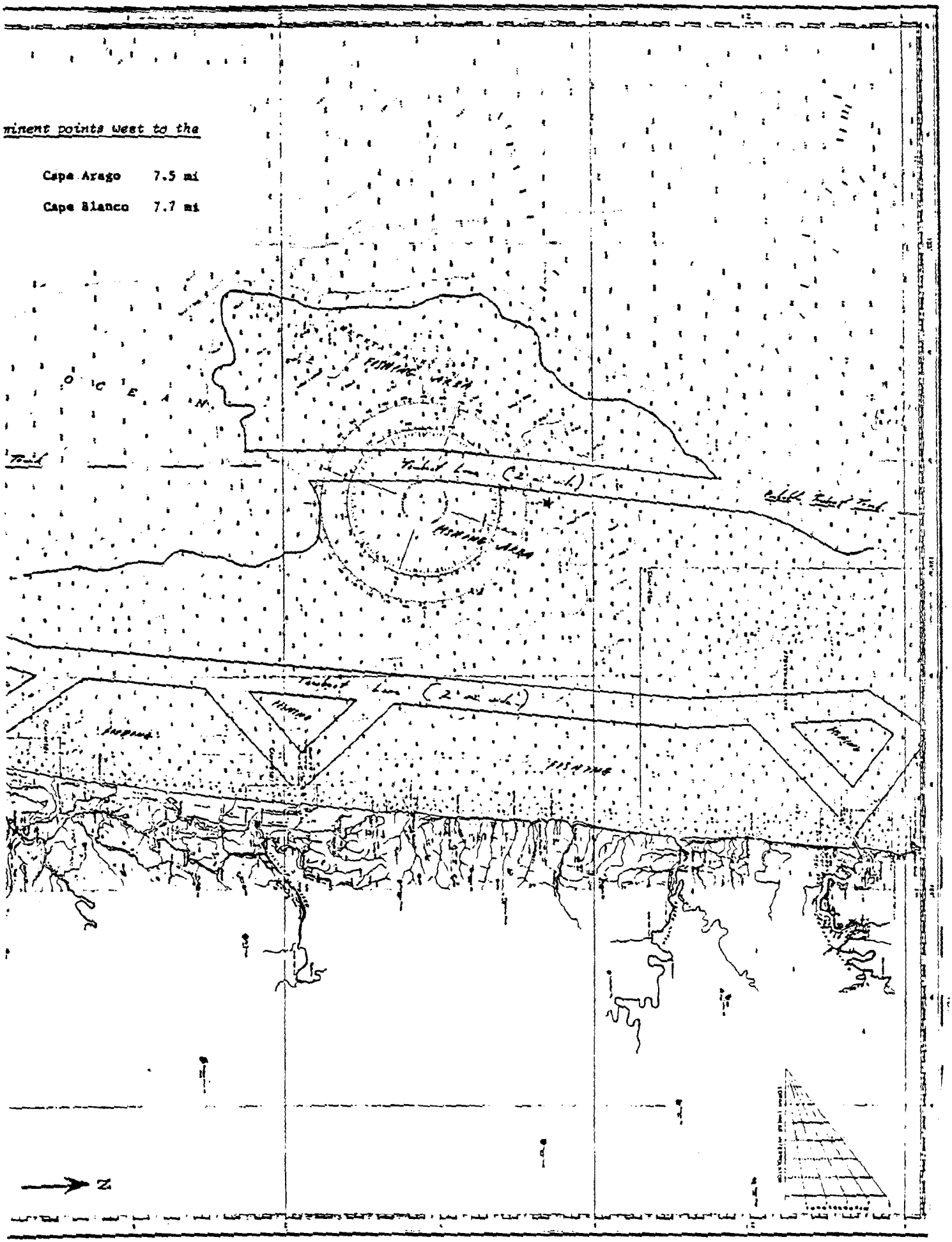
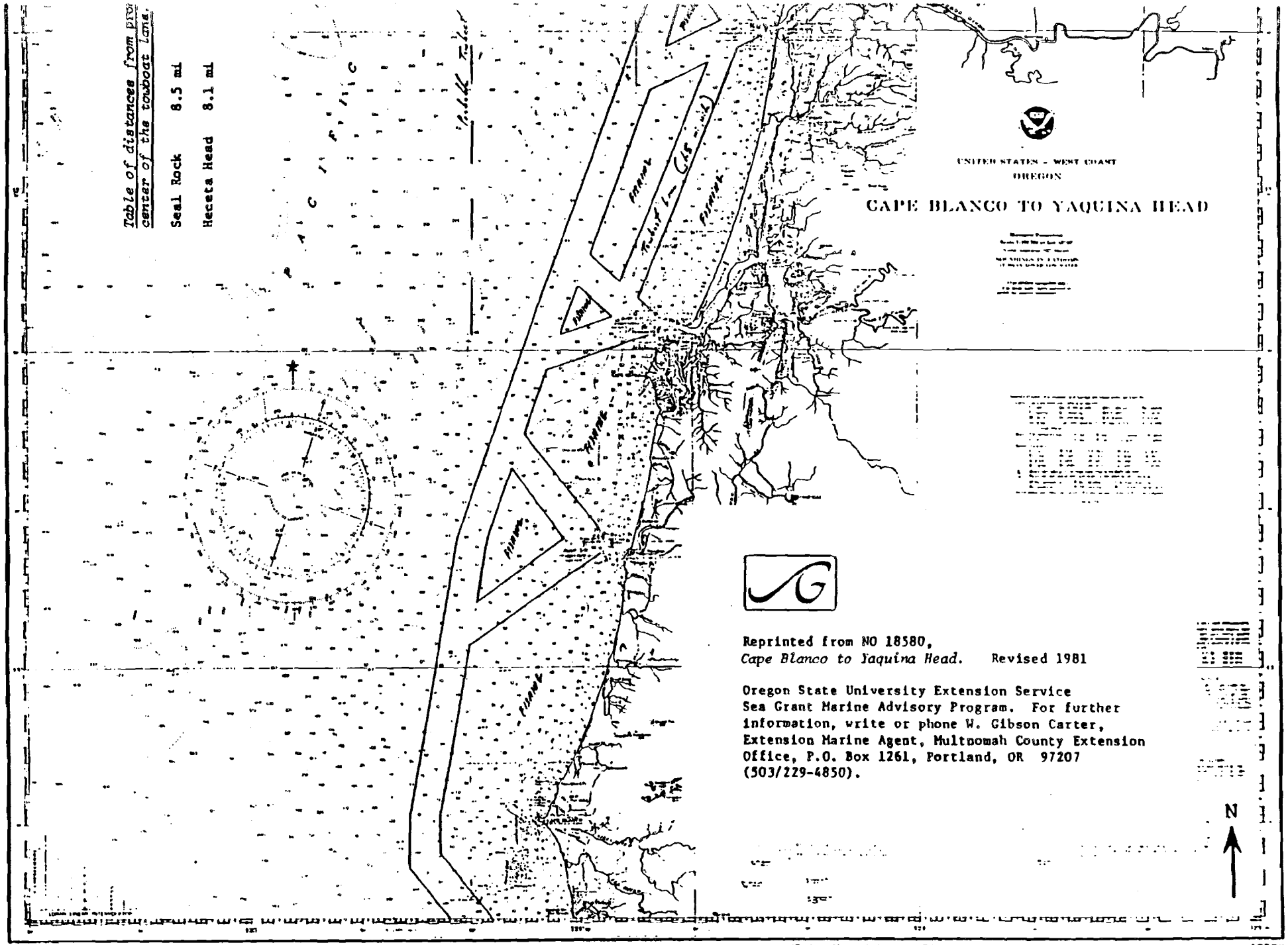


Table of distances from prominent points west to the center of the towboat lane.

Yaquina Head	6.0 mi	Cape Lookout	3.0 mi
Government Point	4.5 mi	Cape Meares	3.6 mi
Cascade Head	3.6 mi	Cape Falcon	3.3 mi
Cape Kiwanda	4.5 mi	Tillamook Head	3.1 mi


Reprinted from NO 18520,
Yaquina Head to Columbia River. Revised 1981
Oregon State University Extension Service
Sea Grant Marine Advisory Program. For further information, write or phone W. Gibson Carter, Extension Marine Agent, Multnomah County Extension Office, P.O. Box 1261, Portland, OR 97202 (503/229-4850).
NETARTS BAY
N
18520
LORAN-A/C OVERPRINTED
SOUNDINGS IN FATHOMS
(Yaquina Head to Columbia River)
18520
LORAN-A/C OVERPRINTED


minent points west to the
Cape Arago 7.5 mi
Cape Blanco 7.7 mi
O C E A N
FISHING AREA
FISHING AREA
FISHING
N



18580

(Cape Blanco to Yaquina Head)

18580

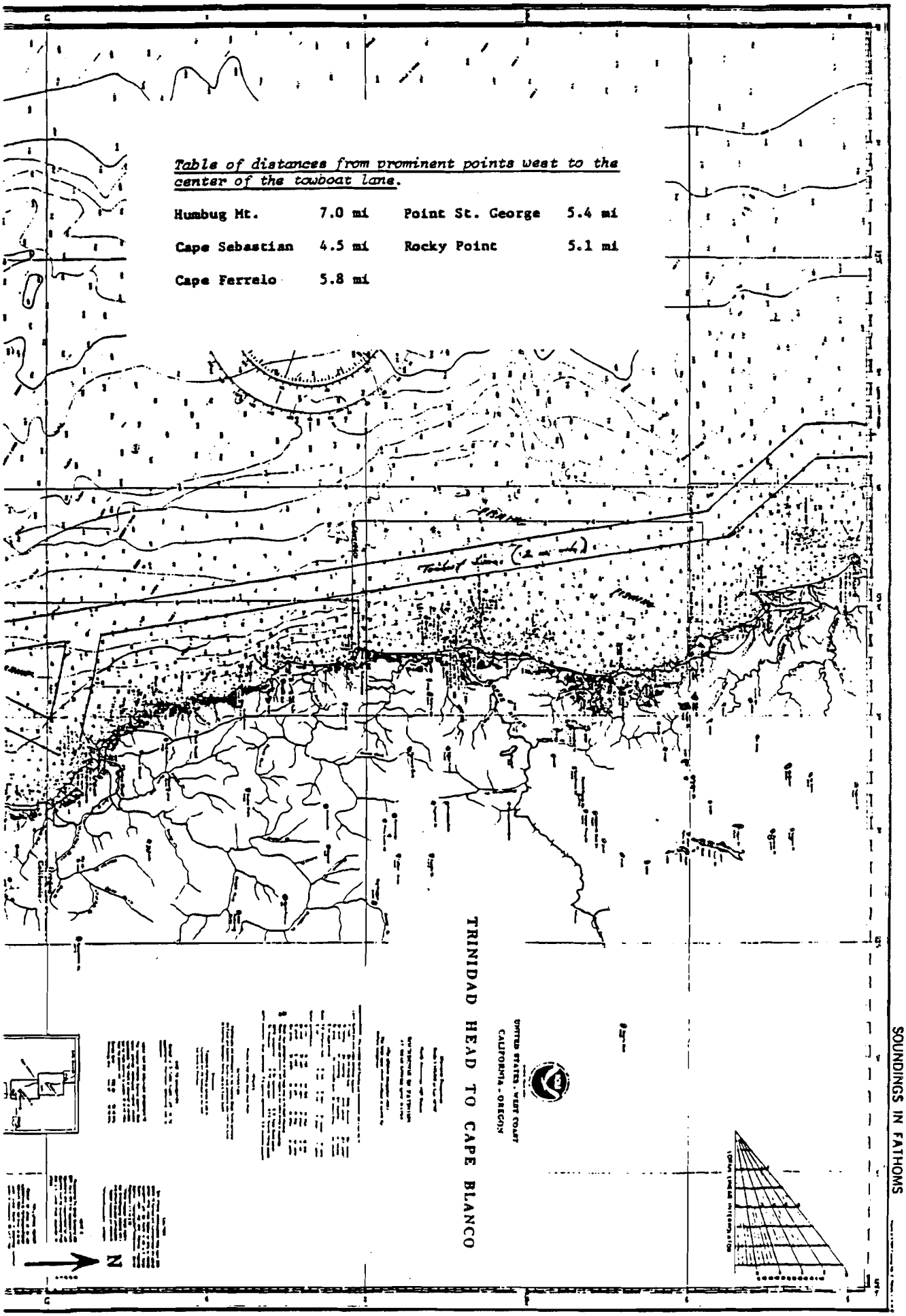


Table of distances from prominent points west to the center of the towboat lane.

Humbug Mt.	7.0 mi	Point St. George	5.4 mi
Cape Sebastian	4.5 mi	Rocky Point	5.1 mi
Cape Ferrelo	5.8 mi		