January 18, 2001 F/AKC2:RRL

CRUISE RESULTS
NOAA Ship *Miller Freeman*, Cruise 00-12
2000 West Coast Upper Continental Slope Groundfish Bottom Trawl Survey
October 10-November 9, 1999

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) completed a four-week bottom trawl survey of the upper continental slope groundfish resources off Washington, Oregon, and California on November 9, 2000. The survey covered the upper continental slope habitat 183-1,280 m deep in the International North Pacific Fisheries Commission (INPFC) U.S. Vancouver, Columbia, Eureka, Monterey, and northern Conception statistical areas (U.S./Canada border-lat. 34?30’N). Sampling for the survey began near the U.S./Canada border in Ninitat Canyon and progressed southward toward Point Conception(Fig. 1). This report summarizes the preliminary results of the survey.

ITINERARY

The 2000 slope survey was conducted during two legs aboard the NOAA Ship *Miller Freeman* between October 10 and November 9. Scientific personnel were exchanged during a mid-cruise break in San Francisco, California, from October 30 to November 1.

OBJECTIVES

Results from annual groundfish slope surveys are used by fishery managers to assess stock conditions and establish annual harvest guidelines for sablefish (*Anoplopoma fimbria*), Dover sole (*Microstomus pacificus*), and two species of thornyhead rockfish

(*Sebastolobus alascanus* and *S. altivelis*). West Coast upper continental slope (WCUCS) surveys were conducted in 1984, from 1988 to 1993, from 1995 to 1997, and in 1999. This was the twelfth survey in an ongoing series to monitor long-term trends in the distribution and abundance of WCUCS groundfish populations.

The specific objectives for this cruise were:

1. to describe and monitor the abundance, biological characteristics, and the geographic and bathymetric distribution of major groundfish resources inhabiting the upper continental slope of the INPFC U.S. Vancouver, Columbia, Eureka, Monterey, and northern Conception statistical areas;

2. to obtain age samples and biological data including sex, length-weight relationships, and maturity for shortspine and longspine thornyhead, sablefish, Dover sole, Pacific grenadier (*Coryphaenoides acrolepis*), and arrowtooth flounder (*Atheresthes stomias*) for stock assessment purposes; and

3. to describe the slope fish community and how it varies with bathymetry.

VESSEL AND GEAR

The NOAA Ship *Miller Freeman* is a 65.5 m stern trawler equipped with a modern trawl sampling system and navigation and fishing electronics. A polyethylene high-opening Nor'eastern bottom trawl, built to RACE Division standards and equipped with mud-sweep roller gear, was used to collect all samples. Dimensions of this net are: 27.2 m headrope and 37.4 m footrope including the "flying wings." The body is constructed of 127-mm stretched-mesh polyethylene netting, 89-mm stretched-mesh web in the codend, and a 32-mm stretched-mesh codend liner. The roller gear is constructed of 203-mm solid rubber disks strung on 16-mm high tensile chain. Connecting the footrope and roller gear at each attachment point is a toggle, two shackles, and a single link of 10-mm alloy chain. Three 55-m dandylines made of 16-mm galvanized steel cable lead from each wing to a 1.8 x 2.7 m steel V-door weighing 1,000 kg. Each door has a 4-point bridle on its backside made with 13-mm long link chain having 33 links forward,

top and bottom, and 22 links aft, top and bottom. Instruments attached to the trawl gear to monitor gear performance included the SCANMAR[1] equipment for measuring net dimensions, a Furuno[1] wireless netsonde for real-time monitoring of the headrope height, and a bottom contact sensor on the footrope. A Wesmar[1] sonar was used to verify good trawl performance during the initial part of the cruise and for proper net configuration during wire marking. A Richard Brancker[1] XL-200 submersible data logger was attached to the trawl and used in conjunction with a Trimble[1] Global Positioning System (GPS) unit to record data on the time, depth, water temperature and geodetic position during each trawl. These data were integrated with fishing dimensions of the net, producing a comprehensive set of data describing gear performance in space and time.

SURVEY DESIGN AND METHODS

The original sampling design used for this survey was a cross between a systematic and random design. Sampling was conducted between 183 and 1,280 m in six strata of 183 m depth intervals (183-366, 367-549, 550-732, 733-914, 915-1,097, 1,098-1,280 m). The design included 208 stations along 32 east-west tracklines spaced 50 km apart between lat. 48^{0}05'N near Nitinat Canyon and lat. 34?30’N near Point Arguello. Most stations were the same as those trawled during 1999 WCUCS survey. Sampling at each station consisted of a controlled bottom trawl haul with net metering instrumentation attached to the trawl to monitor gear performance. After the trawl settled to the bottom, it was towed for 30 minutes using scope ratios ranging from 1.5 to 2.5. Towing speed was approximately 3.7 km/hour (2.3 knots) at all stations and trawling operations continued around the clock (24 hours per day). The trawl’s fishing dimensions were monitored with the Furuno netsonde at all depths, and with SCANMAR at stations shallower than 1000 m. Station data, including time, geodetic position, trawl dimensions, distance fished, temperature profile, and catch and length information, were stored for later analysis using shipboard computer systems.

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[1]Reference to trade names or commercial firms does not constitute U.S. government endorsement.

All catches were sorted to the lowest possible taxon, weighed, counted, and processed according to standard RACE protocols. Samples of most fish species caught in every haul were measured for length composition. Stratified otolith (age) samples were collected from the primary target groundfish species by sex-centimeter intervals in three depth strata (183-548 m, 549-913 m, and 914-1,279 m). Other biological data were collected from the major fish species encountered. Special study collections were stored in appropriate fixatives or frozen.

RESULTS

Two-hundred-and-fourteen (214) tows were attempted during the survey. Out of 208 possible stations, 207 stations were sampled successfully (Fig. 1). One station was abandoned because it was too rough to tow. The remainder of the attempted tows were unsuccessful due to hang-ups, rips, bad bottom, excessive mud in tows, crossing into the wrong stratum, or gear problems. SCANMAR net mensuration data were obtained from 172 tows, submersible bathythermograph data from 207 tows, bottom contact sensor data from 212 tows, and GPS course and position data from 214 tows.

A total of 183 fish species were identified in catches throughout the survey. Samples also contained representatives from numerous orders of invertebrates. Table 1 summarizes the biological data collected from fish species. Specimen ages will be determined by the NMFS Alaska Fisheries Science Center, NMFS Northwest Fisheries Science Center, and the Oregon Department of Fish and Wildlife using the collected otoliths.

Table 2 lists the dominant groundfish species and selected crab species caught during the survey. Catch rates are expressed in kg/ha and ranked in order of catch per unit of effort (CPUE) by depth stratum. Pacific hake had the highest catch rate in Strata 1 or 2. Spiny dogfish had the second highest mean catch rate in Strata 1 and Dover sole in Stratum 2. Either longspine thornyhead or Dover sole had the highest mean catch rate in Stratum 3 to Stratum 5 and Pacific grenadier had the highest in Stratum 6. Plots of unweighted size frequency of primary groundfish species are provided in Figures 2 through 7, showing their frequency by depth stratum and by sex for the entire survey area. The lengths reported in these figures are all fork lengths except for Pacific grenadier (Fig. 5) which were measured from the snout to the insertion of the anal fin. Further analyses

will be completed to describe distribution and to estimate biomass, population size, and age composition of these groundfish resources. Length-weight and length-maturity relationships will be derived to assist managers in assessing the status of important upper slope groundfish species.

SCIENTIFIC PERSONNEL

Leg I (Oct. 10 - Oct. 30):

Day Watch (noon to midnight)

Robert Lauth (Chief Scientist), AFSC	Fishery Biologist
Dan Kamikawa (Deck Boss), NWFSC/N	Fishery Biologist
Bill Floering, AFSC	Fishery Biologist
Bob Mikus, ODFW/N	Fishery Biologist
Allen Harvison, AFSC	Gear Specialist
Roger Clark, AFSC	Fishery Biologist

Night Watch (midnight to noon)

Bill Flerx (Watch Leader), AFSC	Fishery Biologist
Jerry Hoff (Deck Boss), AFSC	Fishery Biologist
Lyle Britt, AFSC	Fishery Biologist
Scott McKillip, AFSC	Gear Specialist
Jon Short, AFSC	Fishery Biologist
Wes Shockley, AFSC	Fishery Biologist

Leg II (Nov. 1 - Nov. 9):

Day Watch (noon to midnight)

Robert Lauth (Chief Scientist), AFSC	Fishery Biologist
Robin Harrison (Deck Boss), AFSC	Fishery Biologist
Barnie Baker, AFSC	Gear Specialist
Roger Clark, AFSC	Fishery Biologist
Teresa Turk, NWFSC/S	Fishery Biologist

Night Watch (midnight to noon)

Bill Flerx (Watch Leader), AFSC	Fishery Biologist
Jerry Hoff (Deck Boss), AFSC	Fishery Biologist
Lyle Britt, AFSC	Fishery Biologist
Larry Hufnagle, NWFSC/S	Fishery Biologist
Jim Smart, AFSC	Gear Specialist
Erica Acuna, AFSC	Fishery Biologist

AFSC = Alaska Fisheries Science Center, Seattle, WA
NWFSC/S = Northwest Fisheries Science Center, Seattle, WA
NWFSC/N = Northwest Fisheries Science Center, Newport, OR
ODFW/N = Oregon Department of Fish and Wildlife, Newport, OR

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