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CRUISE RESULTS
NOAA Ship *Miller Freeman*, Cruise 95-12
1995 Alaska Fisheries Science Center
West Coast Upper Continental Slope Groundfish
Trawl Survey
October 23-November 22, 1995

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) completed a bottom trawl survey of the groundfish resources of the upper continental slope off southern Oregon and northern California on November 22, 1995. The survey covered the upper continental slope habitat 183 m to 1,280 m deep in the International North Pacific Fisheries Commission (INPFC) Eureka management area (lat. 40°30'N to 43°00'N). Sampling for the survey began near Cape Blanco and progressed southward during the first leg and from Cape Mendocino northward during the second leg. This report summarizes the preliminary results of the survey.

ITINERARY

The West Coast survey was conducted during two legs aboard the NOAA Research Vessel *Miller Freeman* between October 23 and November 22, 1995. Scientific personnel were exchanged during a mid-cruise break in Eureka, California on November 6-7.

OBJECTIVES

The annual groundfish slope surveys are designed to describe and monitor the abundance, geographic and bathymetric distribution, and biological characteristics of major groundfish resources inhabiting the upper continental slope of the U.S. Pacific coast. Data derived from annual 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*). It presently takes 4-5 years to complete a trawl survey of the entire U.S. west coast because of the length of the coastline, the time necessary to collect trawl samples from deep water, and the availability of only one month of vessel time for the survey each year. The 1995 slope survey covered the entire INPFC Eureka area, which was last surveyed in 1990.

During this year's survey, changes from the research conducted during the 1994 experimental gear cruise (see Cruise Results for R/V *Miller Freeman* Cruise 94-9) were implemented to trawl gear and trawling methodology to improve gear performance.

The specific objectives for this cruise were:

1. to describe and monitor the abundance, geographic and bathymetric distribution, and biological characteristics of major groundfish resources inhabiting the upper continental slope of the northern INPFC Eureka area;

2. to obtain age samples from shortspine and longspine thornyhead, sablefish, Dover sole, giant grenadier *(Albatrossia pectoralis*), and arrowtooth flounder (*Atheresthes stomias*) for stock assessment purposes;

3. to obtain biological data including sex, length-weight relationships, and maturity for sablefish, Dover sole, shortspine and longspine thornyhead, arrowtooth flounder, and giant grenadier;

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

5. to perform gear trials with the slope survey trawl net by making adjustments until consistently good gear performance could be established; and,

6. to record video footage of the performance of the modified slope trawl system when trawling over soft mud bottom in deep water (>183 m) at a target towing speed of 3.7 km/hr (2.3 knots).

A representative from the Oregon fishing industry participated for the first 3 days of the second leg evaluating the modifications made to the trawl gear and trawling procedures.

VESSEL AND GEAR

The NOAA R/V *Miller Freeman* is a 65.5 m (215 ft) stern trawler equipped with modern trawling, oceanographic and hydrographic sampling systems and navigation and fishing electronics. A standardized polyethylene high-opening Nor'eastern bottom trawl equipped with mud-sweep roller gear was used to collect all samples. The roller gear is constructed of 203 mm (8 in) solid rubber disks strung on 16 mm high tensile chain. The dimensions of this net are: a 27.2 m (89 ft) headrope, and a 37.4 m (123 ft) footrope including the "flying wings." The body is constructed of 127 mm stretched-mesh polyethylene netting, 89 mm of stretched-mesh web in the codend, and a 32 mm stretched-mesh codend liner. Each wing was attached to

a 1,000 kg (2,200 lb), 1.8 x 2.7 m (6 x 9 ft) steel V-door by three 55 m (180 ft) dandylines made of 16 mm galvanized steel cable.

The changes made to the trawl gear and trawling methodology to improve gear performance included a 4-point door bridle, shortened drop chains connecting the roller gear and the footrope, and a faster target towing speed from 3.2 km/hr (2.0 knots) to 3.7 km/hr (2.3 knots). Instrumentation was attached to the trawl gear which improved monitoring gear performance. Besides the SCANMAR[1] equipment for measuring net dimensions, a bottom contact sensor was also attached to the footrope, a tilt sensor to the starboard V-door, and a Wesmar[1] net sonar system to the headrope. The Wesmar sonar provided real-time video images of the mouth of the trawl while it was fishing on bottom. These video images provided a better understanding of the trawl's dynamics when adjustments were made in speed and wire length. For deeper tows, a Furuno[1] wireless netsonde system was used in lieu of the Wesmar system to monitor real-time bottom contact and net height. 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 sampling design used for this survey was a combination of 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). There were 108 stations along 17 east-west tracklines spaced 16.7 km apart between lat. 43°00'N near Cape Blanco and lat. 40°30'N near Cape Mendocino. Stations were surveyed with the ship's fathometer and GPS plotter before setting the net. 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). Trawl fishing dimensions were monitored with SCANMAR at stations shallower than 900 m. Station data, including time, geodetic position, trawl dimensions, distance trawled, temperature profile, and catch and length information, were stored for later analysis using shipboard computer systems.

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

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

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

One-hundred-and-forty-seven (147) tows were accomplished during the survey. All 17 of the east-west tracklines within the survey area were completed. Out of 108 possible stations, 106 stations were sampled successfully (Figure 1). Two stations were abandoned because the bottom was too rough or too steep. Eleven (11) test tows were conducted with an underwater video camera attached to the trawl in addition to the other net metering instrumentation, to observe and assess the performance of the trawl with the new modifications. The remainder of the attempted tows were unsuccessful due to hang-ups, rips, bad bottom or gear problems. SCANMAR net mensuration data were obtained from 111 tows, submersible bathythermograph and bottom contact sensor data from 103 tows, door tilt sensor data from 125 tows, video tape of the Wesmar net sonar video output from 65 tows, and GPS course and position data from 128 tows.

A total of 121 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 Moss Landing Marine Laboratory (giant grenadier) using the collected otoliths.

Table 2 lists the dominant groundfish species and selected crab species caught by depth stratum and ranked in order of catch per unit effort (CPUE) expressed in kg/ha. Longspine thornyheads and grooved Tanner crab had higher mean CPUE in the four deepest strata compared to the two shallow strata. Pacific hake, spiny dogfish and Dover sole had the highest mean catch rates in strata 1 and 2, and longspine thornyhead, Dover sole, true Tanner crab, sablefish, Pacific grenadier and giant grenadier had the highest mean catch rates in the deepest 4 strata. Plots of unweighted size frequency of groundfish species are provided in Figures 2 through 5, showing their frequency by depth stratum and by sex for the Eureka management area. 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. 23 - Nov. 6)

Day Watch (noon to midnight)

Robert Lauth (Watch Leader), AFSC	Chief Scientist
Terry Sample (Deck Boss), AFSC	Fishery Biologist
Ben Page, AFSC	Fishery Biologist
Scott McEntire, AFSC	Fishery Biologist
Mike MacEwan, AFSC	Gear Specialist
Roger Clark	Fishery Biologist

Night Watch (midnight to noon)

Bill Flerx (Watch Leader), AFSC	Fishery Biologist
Michael Martin (Deck Boss), AFSC	Fishery Biologist
Dan Kamikawa, NWFSC	Fishery Biologist
Allen Harvison, AFSC	Gear Specialist
Jim Smart, AFSC	Gear Specialist

Leg II (Nov. 7 - Nov. 22)

Day Watch (noon to midnight)

Robert Lauth (Watch Leader), AFSC	Chief Scientist
Robin Harrison (Deck Boss), AFSC	Fishery Biologist
Gary Stauffer, AFSC	Fishery Biologist
Dave King, AFSC	Gear Specialist
Troy Buckley, AFSC	Fishery Biologist
Jim Burns	Commercial Fisherman

Night Watch (midnight to noon)

Bill Flerx (Watch Leader), AFSC	Fishery Biologist
Michael Martin (Deck Boss), AFSC	Fishery Biologist
James Orr, AFSC	Fishery Biologist
Allen Harvison, AFSC	Gear Specialist
Dan Kamikawa, NWFSC	Fishery Biologist

AFSC = Alaska Fisheries Science Center, Seattle, WA
NWFSC = Northwest Fisheries Science Center, Newport, OR

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