

January 30, 1994

CRUISE RESULTS

CHARTERED VESSEL CRUISE NO. 93-1
F/V ARGOSY, F/V ALSEA, AND F/V PROGRESS
1993 GULF OF ALASKA TRIENNIAL GROUND FISH ASSESSMENT SURVEY
JUNE 2-SEPTEMBER 8, 1993

The fourth comprehensive triennial bottom trawl survey of western and central Gulf of Alaska (GOA) groundfish resources was conducted by the Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC), from June to September 1993. Previous surveys in this series were conducted in 1984, 1987, and 1990.

OBJECTIVES

The primary focus of the triennial groundfish surveys is to continue a standardized time series designed to assess, describe, and monitor the distribution, abundance, and biological condition of various Gulf of Alaska groundfish stocks. The specific objectives of the 1993 survey were to:

1. define the distribution and relative abundance of the principle groundfish and commercially-important invertebrate species that inhabit the western and central Gulf of Alaska;
2. obtain data to estimate the absolute abundance of selected groundfish species;
3. collect data to define various biological parameters i.e., age, sex, size, growth, length-weight relationships, feeding habits, and age composition;
4. collect integrated net configuration and position data for all trawl hauls to obtain precise area-swept estimates;
5. collect bottom (headrope depth), and sea-surface temperature data; and,

6. obtain ancillary data and specimen collections as requested by cooperating research groups.

VESSELS AND GEAR

The survey was conducted aboard the chartered commercial trawlers Argosy, Alsea, and Progress from June to September 1993. The Argosy is 37.95 m (124 ft 6 in) in overall length, 13.71 m (45 ft) wide and powered by a single main engine generating 1,750 continuous horsepower. Deck equipment included paired hydraulic winches with 1,646-m (800-fm) of 2.54-cm (1-in) cable per drum mounted on the main deck, two hydraulic net reels (one mounted over the stern ramp and the other mounted forward on the working deck), and two gilson winches mounted on the main boom for pulling/lifting. The Alsea is 38.05 m (124 ft 10 in) in overall length, 13.71 m (45 ft) wide and also powered by a 1,750 continuous horsepower single main engine. Deck equipment included paired hydraulic trawl winches with 1,463-m (900-fm) of 2.54-cm (1-in) cable per drum mounted on the bridge deck, two hydraulic net reels configured as previously noted, and two gilson winches mounted on the main boom for pulling/lifting. The Progress is 35.42 m (115 ft) in overall length, 9.29 m (30.5 ft) wide and powered by a single main engine generating 1,285 continuous horsepower. Deck equipment included paired hydraulic trawl winches located on the working deck with 1,219-m (650-fm) of 2.22-cm (7/8-in) cable per drum and two hydraulic net reels and gilson winches configured the same as the Argosy and Alsea. Electronic equipment on all vessels consisted of Trimble Navtrak¹ Global Positioning System (GPS) receivers, Loran C receivers with converters for geodetic positions, video plotters, dual radars, single band and VHF radios, paper and color video fish finders.

All vessels used standard RACE Division Poly-Nor'eastern high opening bottom trawls rigged with rubber bobbin roller gear (Figure 1). Gear specifications included a 27.2-m (89-ft 1-in) headrope with twenty-one 30-cm (12-in) diameter floats, and a 24.3-m (79 ft-7 in) chain "fishing line" attached to a 24.9-m (81-ft 7-in) .95-cm (3/8-in) diameter 6 X 19 galvanized wire footrope. The roller gear was 24.2 m (79 ft 6 in) long and constructed of 1.91-cm (3/4-in) diameter 6 X 19 galvanized wire rope, 36-cm (14-in) rubber bobbins separated by 10-cm (4-in) rubber disks. In addition, 5.9-m (19-ft 6-in) wire rope extensions with 10-cm (4-in) and 20-cm (8-in) rubber disks were used to span each lower flying-wing section.

Trawls were constructed of 12.7-cm (5-in) stretched-mesh polyethylene web with a 3.2-cm (1-1/4-in) mesh nylon liner in the codend. Net rigging consisted of triple 54.84-m (180-ft) 1.59-cm (5/8-in) diameter galvanized wire rope dandylines.

¹Reference to trade names or commercial firms does not constitute endorsement by the National Marine Fisheries Service, NOAA.

The dandylines were rigged with 22.9-cm (9-in), 45.7-cm (18-in), and 60.7-cm (24-in) chain extensions to the headrope, side, and bottom wing attachments, respectively.

Steel V-doors, measuring 1.83 m x 2.74 m (6 ft x 9 ft) weighing approximately 800 kg (1,700 lb) each were used. The fishing dimensions of the trawls were measured aboard each vessel using Scanmar acoustic net mensuration equipment.

Seawater temperature profiles were collected by all vessels at most sampling sites using a headrope mounted Richard Branker Research Ltd. model micro-bathythermograph (MBT). All accompanying sea-surface temperature observations were taken using bucket thermometers.

ITINERARY

The Alsea and Argosy were rigged for survey operations from June 2-3 and departed Dutch Harbor, Alaska, on June 4. Scheduled port calls were made by both vessels on June 24 in Sand Point, Alaska, and on July 16 at Kodiak, Alaska. The Alsea broke its propeller shaft on August 6 and was towed to Seward, Alaska, on August 7 by the Argosy for repairs. The Argosy departed Seward, Alaska, August 8 and completed its assigned survey stations, arriving in Kodiak, Alaska, on August 23. Due to the prolonged period anticipated to return the Alsea to service, the contractor provided the F/V Progress to complete the charter. The Progress departed Seward, Alaska, August 16, completed the unfinished Alsea stations and arrived in Kodiak, Alaska, on September 8.

SURVEY AREA

The central and western GOA triennial survey area is dominated by the continental shelf, which is generally shallower than 200 m and varies in width from approximately 10 nmi in the Fox Islands region to nearly 100 nmi off the Kenai Peninsula and Kodiak Island (Figure 2). Representing approximately 90% of the 76,000 nmi² survey area, the continental shelf is transected by numerous 100-300 m troughs or gullies which extend from the outer shelf to the coast. These bathymetric features, along with an extensive and complex shoreline region, provide a rich variety of habitat types for many juvenile and adult groundfish such as walleye pollock (Theragra chalcogramma), Pacific cod (Gadus macrocephalus), flatfish species such as Pacific halibut (Hippoglossus stenolepis), rockfish species such as Pacific ocean perch (Sebastes alutus) and many invertebrates including several commercial crab species, scallops, and pandalid shrimp.

The continental slope between 200 m and 500 m represents approximately 10% of the survey area. Often steep and rugged, the continental slope provides habitat for several important rockfish species—adult sablefish (Anoplopoma fimbria), shortspine

thornyheads (Sebastolobus alscanus), and grenadiers (Macrouridae).

SURVEY DESIGN AND METHODS

A stratified random sampling design developed in 1984 was used for the 1993 survey. The continental shelf region was divided into 24 sampling strata—based primarily on the 100 m and 200 m depth contours and geographical features such as banks, gullies, and flats. The 100 to 200-m, 200 to 300-m, and 300 to 500-m depth intervals, which form narrow bands along the outer edge of the continental shelf, were divided into four strata, each according to the International North Pacific Fisheries Commission statistical boundaries.

The survey area was overlaid by gridpoints defining the centers of squares measuring 5 x 5 nmi. Stations to be sampled were randomly selected from this grid. Strata were assigned one of three sampling densities based on the coefficients of variation, mean catch per unit effort, and sampling densities for all fish species combined from the 1984, 1987, and 1990 surveys. The 1990 survey results were given more weight in this process than the previous surveys. A total of 748 preselected stations were randomly generated for the survey.

Trawl tows were 30 minutes in duration. Efforts were made to maintain each tow at a constant depth. In cases where depths increased or decreased during a tow, trawl warps were adjusted accordingly. Fishing effort and trawl performance were monitored and evaluated with an integrated data collection system consisting of real-time trawl configuration using headrope and wing-tip mounted (Scanmar) sensors, geographical positioning (using the Trimble GPS), and a MBT (time-temperature-depth) unit mounted to the trawl headrope. All data were downloaded to a PC and analyzed with a program (SCANPLOT) developed by RACE Division researchers. Catches were sorted to species, weighed, and enumerated. A variety of biological data (age, length, sex, weight, and maturity of individual specimens) were collected. Special requests were also fulfilled for stomach, tissue, and whole-fish samples.

RESULTS

Almost all of the 748 preselected stations were visited, but not all sites were sampled—primarily because of unsuitable bottom conditions. Successful trawls ranging in depth from 20 to 513 m were achieved at 623 of the 674 stations attempted, an increase of 23% over the 508 stations completed during the 1990 survey (Figure 3). Sea-surface temperatures were observed at 637 stations, and 621 bottom temperatures were obtained with the headrope mounted bathythermograph.

A total of 109 fish species were identified in survey catches. In addition to the groundfish species, catches also contained representatives from numerous invertebrate orders. The types and numbers of biological data collected from fish are summarized in Table 1. Age structures will be read by the Age Determination Unit of the AFSC in Seattle.

In terms of total numbers, Arrowtooth flounder (Atheresthes stomias) was by far the predominant species in the survey area. Other important catch components included walleye pollock, Pacific ocean perch, flathead sole (Hippoglossoides elassodon), rock sole (Pleuronectes bilineatus), rex sole (Errex zachirus), Pacific cod, and northern rockfish (Sebastes polyspinis). Over 237,000 length-frequencies were taken from 39 fish species along with 6,828 age structures, 6,423 length-weight measurements, 677 maturity determinations, and 5,756 preserved stomachs.

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**STAFFING FOR 1993
GULF OF ALASKA TRIENNIAL SURVEY**

ALSEALEG I

DATES: JUNE 2-24
PORTS: Dutch Harbor, AK-Sand Point, AK

FPC Eric Brown, AFSC
Robin Harrison, AFSC
Ronald Payne, AFSC
Nick Hodges, AFSC
Mei-Sun Yang, AFSC
Mark Zimmermann, AFSC

LEG II

DATES: JUNE 25-JULY 16
PORTS: Sand Point, AK-Kodiak, AK

FPC Michael Martin, AFSC
Gary Mundell, AFSC
Tom Gerber, AFSC
Lynn Faughnan, AFSC
Wendy Emerson, SWR

LEG III

DATES: JULY 17-AUGUST 7
PORTS: Kodiak, AK-Seward, AK

FPC William Flerx, AFSC
Robert Lauth, AFSC
Frank Shaw, AFSC
Sand Borrego*, AFSC
Richard Wiggins, AFSC
Stephen de Blois**, AFSC

* Left vessel July 22

** Joined vessel July 22

PROGRESS

DATES: AUGUST 16-SEPTEMBER 8
PORTS: Seward, AK-Kodiak, AK

FPC Eric Brown*, AFSC
FPC Robin Harrison**, AFSC
Gary Mundell, AFSC
Ron Erickson, AFSC
Mike Brown, AFSC
Kirsten Rohrbach, AFSC

* Left vessel August 31

** Joined vessel September 1

ARGOSYLEG I

DATES: JUNE 2-24
PORTS: Dutch Harbor, AK-Sand Point, AK

FPC William Flerx, AFSC
Jim Stark, AFSC
Michael Martin, AFSC
Sand Borrego, AFSC
Larry Haaga, AFSC

LEG II

DATES: JUNE 25-JULY 16
PORTS: Sand Point, AK-Kodiak, AK

FPC Peter Munro, AFSC
Theresa Turk, AFSC
Denise McKelvey, AFSC
Chris Johnston, AFSC
Chris Settevendemie, SWR

LEG III

DATES: JULY 17-AUGUST 7
PORTS: Kodiak, AK-Seward, AK

FPC Robin Harrison, AFSC
Steve Syrjala, AFSC
Theresa Turk, AFSC
Ingrid Spies, AFSC
Mike MacEwan, AFSC

LEG IV

DATES: AUGUST 8-23
PORTS: Kodiak, AK-Kodiak, AK

FPC Ronald Payne, AFSC
James Stark, AFSC
Mike MacEwan, AFSC
Stephen de Blois, AFSC
Theresa Turk, AFSC
Susan Manion, SWFSC

Abbreviations:

FPC = Field party chief

AFSC = Alaska Fisheries Science Center, Seattle, Washington

SWFSC = Southwest Fisheries Science Center, La Jolla, California

SWR = Southwest Region, Long Beach, California

Table 1.-- Biological data collected during the 1993 triennial trawl survey of the central and western Gulf of Alaska. Abbreviations: total catch (TC), length-frequency (LF), age structure¹ (Age), specimen weight (Wgt), maturity (Mat), stomach (St).

Number of observations or specimens collected						
<u>Species</u>	<u>TC</u>	<u>LF</u>	<u>Age</u>	<u>Wgt</u>	<u>Mat</u>	<u>St</u>
Walleye pollock	96,802	31,689	1,126	1,126	13	1,163
Pacific cod	23,125	17,161	885	852	--	1,070
Sablefish	15,338	7,124	--	--	--	356
Arrowtooth flounder	216,075	60,098	665	664	--	1,313
Pacific halibut	16,893	14,770	--	--	--	563
Rock sole	32,320	16,333	244	244	--	--
Flathead sole	72,568	25,652	330	330	--	680
Rex sole	26,556	16,551	332	324	--	--
Dover sole	10,147	6,901	241	241	--	--
Sand sole	51	43	--	--	--	--
Butter sole	6,378	3,208	--	--	82	--
English sole	941	458	--	--	109	--
Yellowfin sole	19,964	2,611	--	--	--	--
Alaska plaice	256	233	--	--	--	--
Starry flounder	1,693	1,140	--	--	--	--
Shortspine thornyhead	10,122	5,488	635	366	344	259
Pacific ocean perch	76,277	11,210	586	524	--	--
Northern rockfish	23,019	5,306	357	357	--	--
Rougeye rockfish	8,308	5,058	351	344	--	280
Shorthead rockfish	399	392	335	233	--	20
Dusky rockfish	6,275	2,503	516	516	31	--
Redstripe rockfish	168	161	--	--	--	--
Silvergray rockfish	91	67	--	--	--	--
Black rockfish	5	4	--	--	--	--
Redbanded rockfish	95	32	--	--	--	--
Yelloweye rockfish	35	10	--	--	--	--
Sharpchin rockfish	5,327	541	--	--	--	52
Harlequin rockfish	4,729	1,599	--	77	98	--
Quillback rockfish	35	33	--	--	--	--
Chinook salmon	102	44	--	--	--	--
Coho salmon	9	7	--	--	--	--
Pink salmon	3	1	--	--	--	--
Sockeye salmon	71	12	--	--	--	--
Chum salmon	178	15	--	--	--	--
Atka mackerel	1,899	630	225	225	--	--
Giant grenadiers	1,528	149	--	--	--	--
Lingcod	85	5	--	--	--	--
Pacific herring	7,629	9	--	--	--	--
Yellow Irish Lord	2,279	12	--	--	--	--

¹ Scales and otoliths were collected from Pacific cod. Otoliths were collected from all other species.