CRUISE REPORT

ECHO INTEGRATION-TRAWL SURVEY OF WALLEYE POLLOCK IN THE CENTRAL ALEUTIAN ISLANDS

NOAA Vessel *Oscar Dyson*
February 16 – March 3 2008

Ship's cruise #DY0802
FOCI cruise # 1DY08

Chief Scientist: Elizabeth (Libby) Logerwell
NOAA/AFSC
Resource Ecology and Fisheries Management
Status of Stocks and Multispecies Assessment (SSMA)

Introduction

The primary objective of this cruise was to collect echo integration data and trawl data necessary to determine the distribution, biomass and biological composition of walleye pollock in the central Aleutian Islands between Seguam Pass and Tanaga Island. This cruise is part of a larger effort to assess the spatial and temporal patterns in pollock distribution near Steller sea lion rookeries and haulouts. This cruise was also an "ecosystem survey", so the other objectives were to: collect physical oceanographic data (temperature, salinity, chlorophyll and nutrient profiles) at selected sites with conductivity-temperature depth (CTD) profilers and Niskin bottle water samples, and continuously collect sea surface temperature, salinity, oxygen, nitrate and fluorescence data; conduct Bongo tows at selected sites to collect samples of ichthyoplankton and zooplankton; conduct midwater and bottom trawls to collect stomach specimens and gonads from selected species to elucidate key predator-prey relationships and spawning behavior; and conduct seabird and marine mammal surveys. There were also several special projects, such as the collection of fish livers, genetic samples and samples for microchemistry analysis of fish eye lenses and otoliths. This report presents the sampling methods used and a summary of transects surveyed and samples collected. Detailed results will be prepared for publication in a peer-reviewed scientific journal.

Scientific personnel

Name	*Position*	*Organization*
Libby Logerwell	Chief Scientist	AFSC
Steve Barbeaux	Fish Biologist	AFSC
Sandi Neidetcher	Fish Biologist	AFSC
Kim Rand	Fish Biologist	AFSC
Liz Conners	Fish Biologist	AFSC
Darin Jones	Fish Biologist	AFSC
Tamara Mills	Seabird observer	USFW
Holly Fearnbach	Mammal observer	NMML

AFSC - Alaska Fisheries Science Center, Seattle, WA
NMML – National Marine Mammal Laboratory, Seattle, WA
USFWS – U.S. Fish and Wildlife Service, Anchorage, AK

Vessel itinerary

Feb 16	Embark scientists in Dutch Harbor
Feb 16-17	Transit to survey start at Seguam Pass
Feb 17-21	Echo integration-trawl survey from Seguam Pass towards the west
Feb 21-22	Transit from Nazan Bay (Atka Island) to Tanaga Island
Feb 22-28	Echo integration-trawl survey from Tanaga Island towards the east
Feb 28	End survey operations near Amlia Island
Feb 28-29	Transit to Dutch Harbor. Scientists debark
Feb 29-Mar 3	Transit to Kodiak

At the request of MACE, the vessel surveyed through specific waypoints in the Bogoslof area to collect opportunistic acoustic data.

Sampling Equipment

Acoustics

Acoustic data were collected with a Simrad ER60[1] quantitative echosounding system. Five split-beam transducers (18, 38, 70, 120, and 200 kHz) were mounted on the bottom of the vessel's retractable centerboard, which extended 9 m below the water surface. System electronics were housed inside the vessel in a permanent laboratory space dedicated to acoustics. Acoustic data were logged using SonarData EchoLog 500. Echo integration data were collected from 14 m (45.9 ft) below the surface to 0.5 m (1.6 ft) of the bottom. Echo integration data were collected simultaneously for all sounder-transducer combinations.

Trawls

Midwater and near-bottom echosign was sampled using an Aleutian Wing 30/26 Trawl (AWT). This trawl was constructed with full-mesh nylon wings and polyethylene mesh in the codend and aft section of the body. The headrope and footrope each measured 81.7 m (268 ft). Mesh sizes tapered from 325.1 cm (128 in) in the forward section of the net to 8.9 cm (3.5 in) in the codend. The net was fitted with a 1.3-cm (0.5-in) codend liner. The AWT was fished with 82.3 m (270 ft) of 1.9-cm (0.75-in) diameter (8x19 wire) non-rotational dandylines, 170.1-kg (250-lb) tom weights on each side, and 5-m^2 Fishbuster trawl doors [1,247 kg (2,750 lb) each]. Vertical net opening and depth were monitored with a Simrad FS70 third wire trawl monitoring system attached to the trawl headrope. The vertical net opening for the AWT trawl ranged from 15-25 m (52-105 ft).

Demersal echosign was sampled with a poly nor'eastern bottom trawl (PNE) with roller gear. The PNE was a high-opening trawl equipped with roller gear and constructed with stretch mesh sizes that ranged from 13 cm (5 in) in the forward portion of the net to 89 mm (3.5 in) in the codend. The codend was fitted with a 3.2 cm (1.25 in) nylon mesh liner. The 27.2-m (89.1-ft) headrope held 21 floats [30-cm (12-in) diameter]. A 24.7-m (81-ft) chain fishing line was attached to a 24.9-m (81.6-ft) footrope constructed of 1-cm (0.4-in) 6 x 19 wire rope wrapped with polypropylene rope. The trawl was rigged with triple 54.9-m (180-ft) galvanized wire rope dandylines. The roller gear was attached to the fishing line using chain toggles [2.9 kg (6.5 lb.) each] comprised of five links and one ring. The 24.2-m (79.5-ft) roller gear was constructed with 36-cm (14-in) rubber bobbins spaced 1.5 to 2.1 m (5 to 7 ft) apart. A solid string of 10-cm (4-in) rubber disks separated some of the bobbins in the center section of the roller gear. Two 5.9-m (19.5-ft) wire rope extensions with 10-cm (4-in) and 20-cm (8-in) rubber disks were used to span the two lower flying wing sections and were attached to the roller gear. The net was fished with the 5-m^2 Fishbuster trawl doors. The vertical net opening and depth were monitored with a Furuno netsounder system attached to the headrope. The PNE trawl vertical mouth opening ranged from 6-8 m (16-23 ft).

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

Oceanography
Tow depth and water temperature profiles were obtained for all hauls by attaching a small, retrievable micro bathythermograph (Sea-Bird SBE39 temperature and pressure recorder) to the headrope of the net. Water temperature and salinity profile data were collected at selected locations with a Sea-Bird conductivity-temperature-depth (CTD) system, SBE 09. Water samples for nutrients, chlorophyll, salinity and microchemistry were collected during CTD casts using Niskin bottles on the CTD rosette. The Scientific Computing System (SCS) was configured to log data on surface seawater temperature, salinity, nitrate and fluorescence from the seachest flow-through sensors. The oxygen sensor was not operational during this cruise. The collection of the oceanographic sensor data was synchronized with the navigational data so that the temperature, salinity, fluorescence, etc. data could be assigned the date, time and position collected. Water was sampled from the continuous flow-through system to calibrate chlorophyll (fluorescence), nitrate, and salinity sensors.

Zooplankton sampling
A 60-cm aluminum Bongo frame with 333-μm mesh nets, flow meters, hard plastic cod-ends, and a 40-kg lead weight for a depressor was used to sample zooplankton and ichthyoplankton at selected locations. A 20-cm Bongo with 505-μm mesh nets was deployed above the 60-cm frame on the same cable.

Survey Methods

Echo-Integration Trawl
Survey operations were conducted 24 hours per day. The primary echo integration-trawl (EIT) survey operations were conducted during nighttime hours (approximately 12 hours per day). Acoustic data were collected continuously along a series of parallel transects. Transect spacing was 2.5 nm, except in areas of anticipated high pollock biomass where transect spacing was smaller, at 1.25 nm. See Figure 1 for transect locations. Transects were sometimes broken to conduct midwater or bottom trawls for acoustic verification. Transects then resumed at break point when trawling was completed. Daytime activities included making CTD casts, deploying the Bongo net, and conducting additional trawls for biological samples.

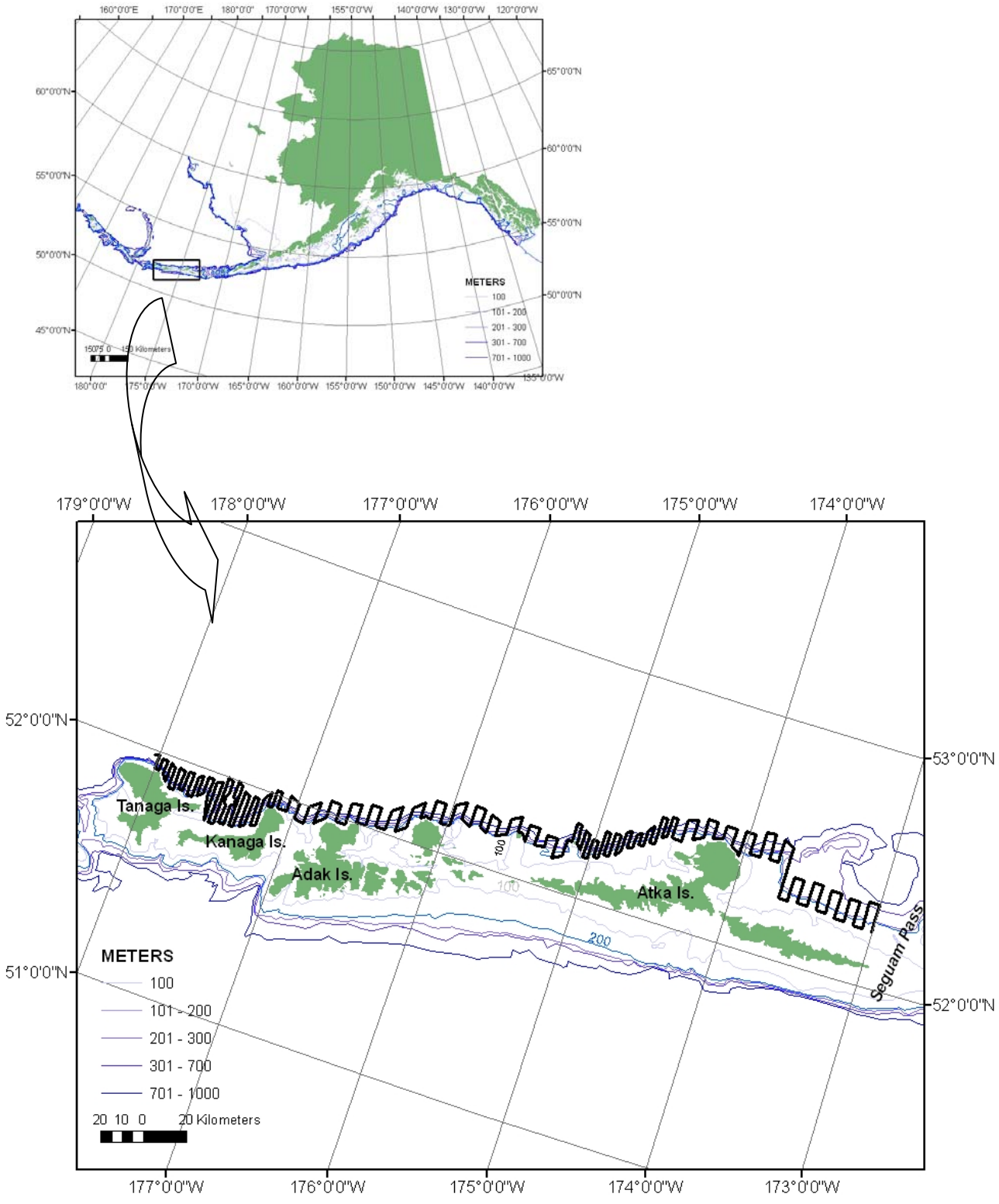

Figure 1. Study area for DY0802, EIT survey of walleye pollock in the central Aleutian Islands. Lower panel shows acoustic survey transects.

Acoustic system settings used during the survey were based on results from previous system calibrations and on experience from prior surveys. Calibrations were performed after the MACE Shumagin survey (DY0801) and before the Shelikof survey (DY0803), so calibrations did not take place during this survey (DY0802). The following settings were used:
temp = 4
salinity = 31.5
sound speed (manual) =1466

Trawl hauls were conducted to identify echosign and to provide biological samples (a.k.a. "verification tows"). Individual pollock from verification tows were sampled to determine sex, fork length (FL, in cm), body weight, age, and maturity. Maturity was determined by visual inspection and categorized as immature, developing, pre-spawning, spawning, or post-spawning. Other scatterers, primarily Pacific ocean perch (POP) were sampled for sex and FL. The location of trawls is shown on Figure 2. A total of 14 trawls were conducted during this cruise.

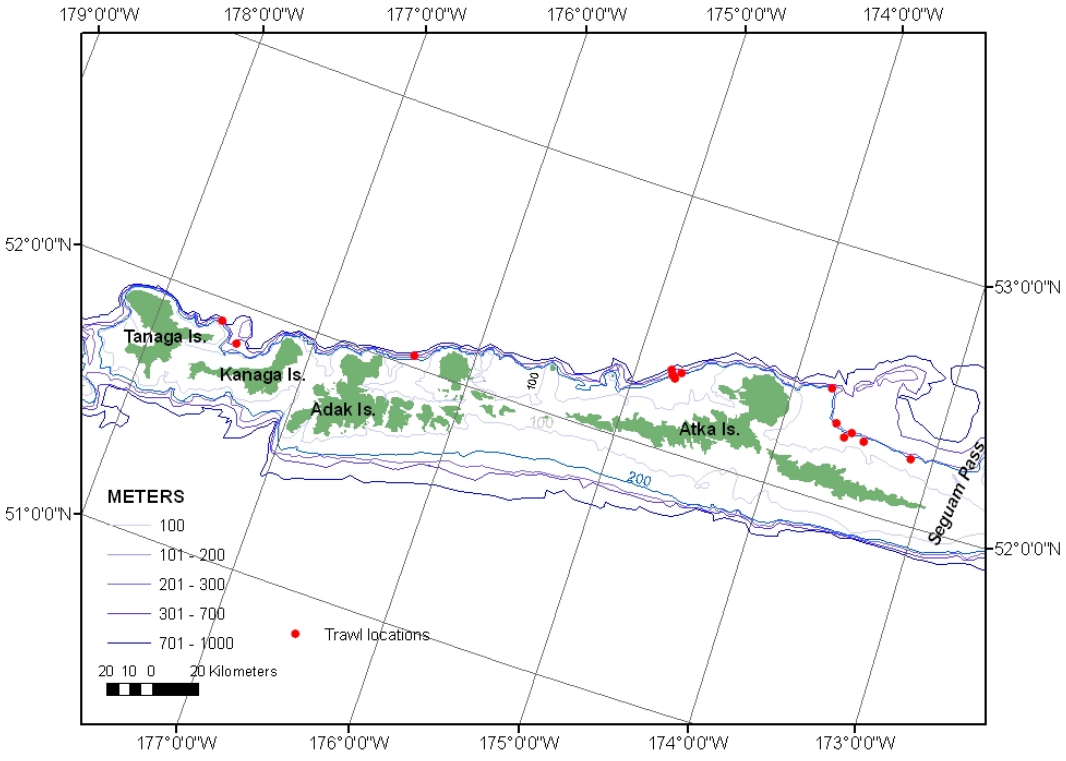

Figure 2. Locations of bottom and midwater trawls

Oceanographic Sampling

Conductivity-temperature-depth (CTD) data were collected with the vessel's CTD/rosette system. CTDs were deployed opportunistically throughout the survey, primarily during the day, at water depths from 100 to 200 meters (Figure 3). Additional CTD casts were made at selected areas, shown on Figure 3. In these areas, CTDs were deployed at water depths around 100 to 200 meters and around 500 meters. A total of 26 CTD casts were made during this cruise.

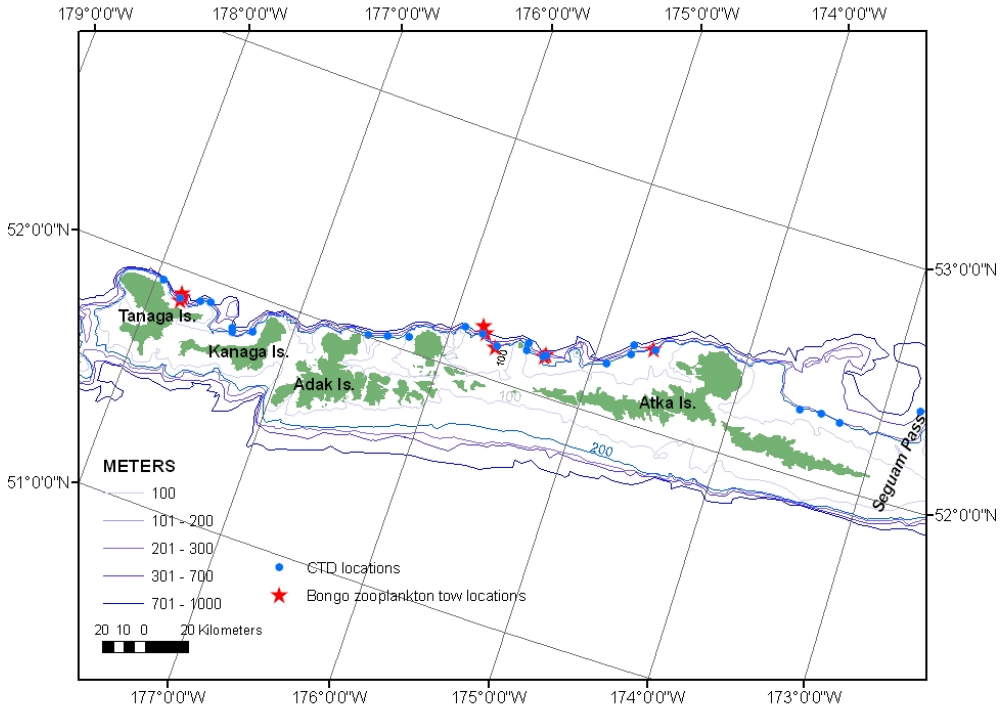

Figure 3. Locations of CTD casts and Bongo zooplankton tows.

Water samples were collected from Niskin bottles deployed at the depths shown in the table below. The samples were filtered for chlorophyll and frozen for nutrients and microchemistry. In addition, water samples from the surface and bottom were bottled for calibrating the conductivity/salinity sensor.

Depths of bottle samples on CTDs

depth (m)	salinity	nutrients	micro-chem[2]	chl
0	x	x		x
10		x		x
20				x
30				x
40				x
50				x
75		x	x	
10 off bottom	x	x	x	
200	x	x	x	

The Scientific Computing System (SCS) was configured to log data from temperature, salinity, nitrate and fluorescence sensors. Two continuous files were generated. One file has all sensors polled at the maximum frequency (once per second). Another file has all sensors polled at 1-minute intervals. The data includes: GPS time, GPS position, water depth (m), seawater temperature, seawater salinity, fluorometer voltage, and nitrate sensor data (ISI). Water was sampled from the continuous flow-through system to calibrate chlorophyll (fluorescence), nutrient, and salinity sensors. An Event file in SCS was set up to record each calibration sample collection (sample number, time, and date). The table below summarizes the frequency of calibration sampling.

Sample type	Frequency	Day/Night
chlorophyll	2/24 hours	Day and Night
nutrient	1/24 hours	Day
salinity	1/48 hours	Day
oxygen	1/24 hours	Day

Zooplankton Sampling

Bongo tows were conducted to 400 m, or 10 meters off the bottom, whichever was shallowest. Tows were conducted during the day, at three different depths, if time allowed: shallower than 200 m water depth, between 200 m and approx. 400 m water depth, and offshore of 400 m water depth. Bongo tows and CTD casts were made at the same stations whenever possible. Figure 3 shows the location of Bongo tows. An Event file in SCS was set up to mark Bongo tow number, position, date, time and bottom depth when net is at surface, at-depth, and has returned to surface. A SeaCat was attached to

the wire above the bongo frame to provide real-time tow data. Flowmeters in the nets recorded the amount of water filtered and the SeaCat recorded the depth profile of the tow. A total of nine Bongo tows were made during the cruise.

Special Projects

Stomach samples.
Stomachs were collected from verification and supplementary tows for the following species: Pacific cod, walleye pollock, Pacific Ocean perch, and Myctophidae (all species). Pacific cod and walleye pollock were collected in a size-stratified manner. No more than 5 specimens per size-category were sampled from each haul. Pacific Ocean perch and Myctophidae were not size stratified, up to 15 fish per haul were sampled. For Myctophids and small pollock (<15cm), whole fish were collected and bagged; for larger fish, stomachs were dissected out of the fish and collected. Stomach specimens were then preserved in 10% formalin. The table below shows the total number of stomachs collected.

Species	Length (cm)	# Stomachs
Pacific ocean perch		55
Myctophid spp.		112
Walleye pollock	<24	7
	25-39	3
	40-54	20
	55+	43
Pacific cod	<59	0
	60+	46

Gonad and liver samples.
Gonad and liver weight and a sample of liver tissue were collected from two species of gadoids – Pacific cod and walleye pollock. Gadoids primarily store excess energy (not being immediately used for growth or reproduction) in the liver. Seasonal patterns in the size of liver energy reserves will provide an integration of recent feeding success relative to metabolic requirements. Samples were collected from size categories shown in the table below. The sex, length, gonad weight, total fish weight and stomach weight for each specimen was recorded. Samples were frozen as quickly as possible. The table below summarizes the gonad and liver collections.

Species	Length (cm)	# Gonad and Liver Samples
Pacific cod	<50	0
	50-69	2
	70+	28
Walleye pollock	<30	0
	30-39	3
	40+	48

Pacific cod gonads
Gross maturity of all Pacific cod caught was determined using a visual key. Gonads of female Pacific cod were also collected and preserved in 10% formalin for later histological analysis. Otoliths were also extracted from sampled cod, and individual lengths and weights were recorded. A total of 54 cod were sampled in this special project.

Pacific cod genetics
Fin clips for genetic analysis of Pacific cod were collected from 2 tows located near Amlia Island. Fin clips from a total of 94 fish were collected. The fin clips were preserved in 95% non-denatured ethanol.

Fish eye lens and otolith microchemistry
The purpose of this study is to measure fish eye lens and otolith microchemistry and compare to the microchemistry of water samples taken in the same area. The ultimate goal is to develop the methods to analyze the microchemistry of fish eye lenses and otoliths in sea lion scats and identify the area in which the sea lions foraged. Fish heads were collected from 50 pollock and 50 Pacific Ocean perch. The sampling was distributed across two trawls/sites for each species, 25 heads per species per site.

Pollock length regression data
Three different length measurements were taken on a subset of pollock caught: total length, fork length and standard length. The purpose of these data is to develop a regression between different length measurements (e.g., total length v. fork length). A total of 196 fish from 4 hauls were measured in this way.

Seabird Operations
A U.S. Fish and Wildlife Service (USFWS) seabird observer conducted observations when the vessel was underway. The observer operated from the bridge (on the port side) for several hours at a time during daylight hours. The observer scanned the water ahead of the ship using hand-held 10X binoculars and recorded all birds and mammals within a 300-m arc, extending 90^0 from the bow to the beam. Strip transects with three distance bins extending from the vessel were used: 0–100 m, 101–200 m, 201–300 m. Distance to bird sightings was determined using geometric and laser hand-held rangefinders. Birds on the water were counted continuously, but flying birds were counted during 'scans' at

intervals that varied with ship speed, typically about every minute. Bird or mammal behavior was noted (flying, on water, on ice, feeding, following the ship), and ship-following individuals were recorded only when first encountered. Unusual sightings beyond the 300-m strip transect were recorded as 'off transect'; this is used for rare birds, large forage flocks, for mammals, and presence of other vessels, particularly fishing vessels.

Observations were entered directly into a laptop computer using the DLOG2 program (R.G. Ford Consulting Co.) with a GPS interface to the ship's system. For each observation, the program provides latitude/longitude, time, and associated environmental conditions. Location data are automatically written to the program at 20 sec intervals, which allows the analyst to map and determine effort (km surveyed) and record changing weather conditions, Beaufort Sea State, ice type and coverage, and glare. Other environmental variables were recorded at the beginning of each transect, including wind speed and direction, air temperature, and sea surface temperature. The seabird observation files will be proofed and entered into the North Pacific Pelagic Seabird Database (NPPSD).

See Appendix 1 "Seabird and Marine Mammal Observations During the SSMA February 2008 Cruise, Onboard the NOAA Ship Oscar Dyson, Kodiak to central Aleutian Islands" for details.

Marine Mammal Operations

Primary operations

Visual sighting surveys.

Visual surveys were conducted during daylight hours. Marine mammal sightings and weather conditions were entered into the real-time data logging program WinCRUZ. When killer whale sightings are made, the observer took photographs to document ecotype and individual identity if the group is sufficiently close to the ship.

Secondary operations

Photo-identification.

Where opportunity allowed, marine mammal groups were approached for photo-identification. This occurred during transit legs, or when transect lines had been completed, and the primary target species was killer whales. Digital SLR cameras equipped with telephoto lenses and telephoto extenders were used to take high quality photographs to document species occurrence, ecotype (for killer whales), and individual identity based on natural markings. Images were shot as Nikon Electronic Format (NEF) files, allowing later conversion to high-resolution TIF files for storage. Inert laser-pointers were also used to project two beams at a fixed distance apart onto the body of killer whales, and photographs of these laser dots will be taken to allow morphometric measurements.

A total of 2080 miles were surveyed during the cruise. "On effort" marine mammal observations were conducted over 500.4 nm, resulting in 18 sightings of three different cetacean species (killer whales (5), sperm whales (2) and Dall's porpoise (11)). Four of

the killer whale sightings were confirmed from photographs to comprise the fish-eating "resident" lineage. One of these groups contained an adult male with distinctly white coloration, and identification photographs revealed a match to a 2001 sighting of a white whale in the central Aleutians. An additional sighting of a single killer whale was recorded, but was not re-sighted or photographed. Photographs were also obtained from one group of sperm whales, which was notable for containing relatively small animals of varying sizes, indicating that this may have represented a nursery group of females and their young.

See Appendix 2 "2008 Marine Mammal Observations during the DY0802 Pollock Trawl Survey Aleutian Islands and Bering Sea" for details.

APPENDIX 1

Seabird and Marine Mammal Observations During the SSMA February 2008 Cruise, Onboard the NOAA Ship Oscar Dyson, Kodiak to central Aleutian Islands.

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Surveys for marine birds and marine mammals were conducted during the SSMA cruise between 16 February and 2 March, 2008, onboard the NOAA Ship *R/V Oscar Dyson*. The seabird surveys started at Dutch Harbor, continued west to Adak, and ended in Kodiak (Fig. 1). These data will be archived in the North Pacific Pelagic Seabird Database (www.absc.usgs.gov/research/NPPSD/index.htm).

Surveys were conducted by a single observer using standardized techniques during daylight hours while the vessel was underway. The observer was stationed on the inside port bridge and used hand-held 10X binoculars to identify and record all birds and mammals within a 300-m arc, extending 90^0 from the bow to the beam. We used strip transects in three distance bins: 0 – 100 m, 101 – 200 m, 201 – 300 m. Birds on the water were counted continuously, and flying birds were counted via 'scans' at intervals that varied with ship speed. We entered observations into a laptop computer with DLOG2 (Ford Ecological Consultants, Inc.) with a GPS interface.

We surveyed a total of 1,198 km during 14 survey days. Weather and sea conditions prohibited surveys during portions of most days. On transect, we recorded a total of 2,900 marine birds, and 17 marine mammals. Marine mammals were sperm whale, killer whale, and Dall's Porpoise. We recorded 21 species of birds, with five species accounting for 85 % of the total. The most abundant birds were whiskered auklets (*Aethia pygmaea*; 35 % of total birds), Northern Fulmar (*Fulmarus glacialis*; 33 %), Laysan albatross (*Phoebastria immutabilis*; 5 %), glaucous-winged gull (*Larus glaucescens*; 6 %), and common murre (*Uria aalge*; 7 %).

The seabird data collected during this cruise will be valuable in part because it occurred in winter, for which there is relatively little data in this region. The high numbers of whiskered auklets recorded near Akutan Pass may be the first confirmation that this species remains near breeding sites during winter, unlike other auklet species (Jeff Williams, AMNWR, Homer, AK, pers. comm.). The auklets were foraging in the pass and near island points; this behavior is typical of whiskered auklets in summer as well. We observed predation on whiskered auklets by Peregrine falcons (*Falco peregrinus*) on two occasions.

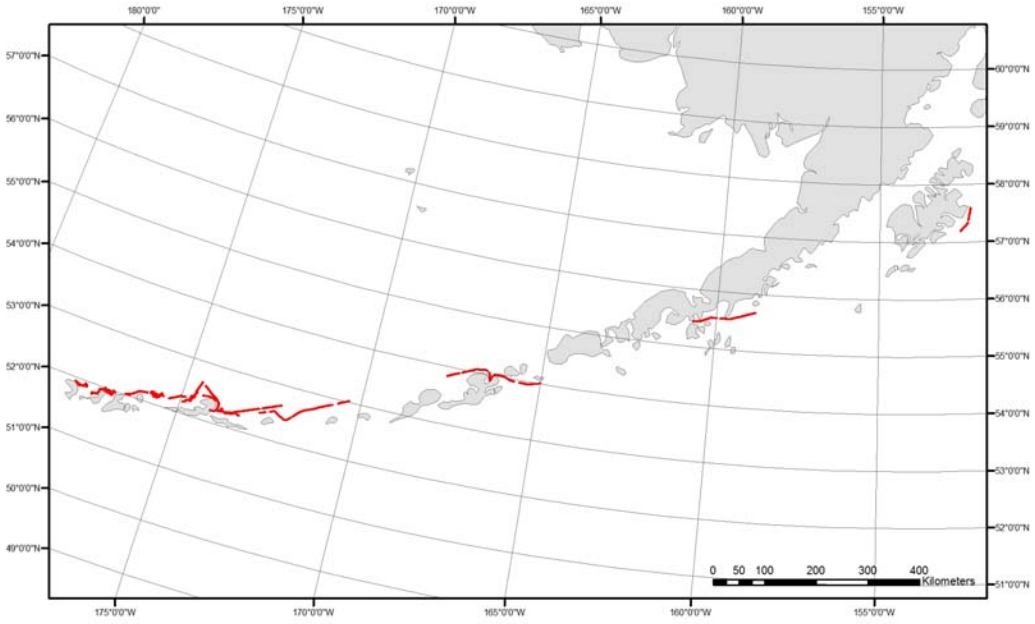

Figure 1. Marine bird and mammal survey track lines (red lines) during the NOAA/SSMA February 2008 cruise.

APPENDIX 2

2008 Marine Mammal Observations during the DY0802 Pollock Trawl Survey Aleutian Islands and Bering Sea NOAA R/V Oscar Dyson

National Marine Mammal Laboratory, Alaska Fisheries Science Center, NOAA Fisheries
Co-investigator: Holly.Fearnbach@noaa.gov

SUMMARY

Marine mammal observations were conducted during the DY0802 Echo Integration-Trawl Survey of Walleye Pollock in the Central Aleutian Islands, onboard the NOAA R/V Oscar Dyson. A total of 2080 miles were surveyed from February 16, 2008 to Feb 29, 2008, ranging from Unalaska Island in the eastern Aleutian Islands, west to Tanaga Island in the central Aleutians. "On effort" marine mammal observations were conducted over 500.4 nm, resulting in 18 sightings of three different cetacean species (killer whales (5), sperm whales (2) and Dall's porpoise (11)). Four of the killer whale sightings were confirmed from photographs to comprise the fish-eating "resident" lineage. One of these groups contained an adult male with distinctly white coloration, and identification photographs revealed a match to a 2001 sighting of a white whale in the central Aleutians. An additional sighting of a single killer whale was recorded, but was not re-sighted or photographed. Photographs were also obtained from one group of sperm whales, which was notable for containing relatively small animals of varying sizes, indicating that this may have represented a nursery group of females and their young.

APPROACH

The primary objectives for the survey were: 1) to collect echo integration data and trawl data necessary to determine the distribution, biomass, and biological composition of walleye pollock in the central Aleutian Islands between Seguam Pass and the Tanaga Island area; 2) conduct Methot tows to groundtruth multi-frequency acoustic data on euphausiid distribution; 3) collect physical oceanographic data (temperature and salinity

profiles) at selected sites with and continuously collect sea surface temperature, salinity, oxygen, nitrate and fluorescence data; 4) conduct Bongo zooplankton tows at selected sites to collect samples of ichthyoplankton and zooplankton; 5) conduct midwater and bottom trawls to collect stomach specimens and gonads from selected species to elucidate key predator-prey relationships and spawning behavior in the Aleutian Islands; 6) conduct a seabird census survey; and 7) conduct marine mammal surveys (DY0802 Cruise Plan, Logerwell/RACE/AFSC).

All marine mammal observations were conducted on the R/V Oscar Dyson, a 190 foot NOAA ship. There were 8 scientists on board during the survey, including one marine mammal observer and one bird observer. Visual surveys were conducted by a single marine mammal observer, during daylight hours, between ~0930 and 2015, using 7x magnification hand-held binoculars. All marine mammal sightings were recorded using the real-time data logging program WinCRUZ. Effort was stopped when a marine mammal sighting warranted breaking transect and taking photographs (e.g. killer whale and sperm whale) and during oceanographic operations (e.g. trawling, CTDs, bongos).

Where possible, photographs of marine mammals were obtained during close approaches by the ship. Digital SLR cameras were used to take high quality photographs to document species, occurrence, ecotype (for killer whales) and individual identity based on natural markings. Images were shot as Nikon Electronic Format (NEF) files, allowing later conversion to high-resolution Tif files for storage.

RESULTS

A total of 2080 miles were surveyed from February 16, 2008 to Feb 29, 2008, ranging from Unalaska Island in the eastern Aleutian Islands, west to Tanaga Island in the central Aleutians (Figure 1). A total of 500.4 nm we conducted “on effort”, visually searching for marine mammals, resulting in 18 cetacean sightings. These sightings comprised three different species, killer whales, sperm whales and Dalls’ porpoise (Table 1), an additional three observations were made of Steller sea lions hauled out on land. There were five sightings of killer whales, two sightings of sperm whales and eleven sightings of Dall’s porpoise. Four killer whale groups were photographically documented

in “encounters”. Preliminary field observations and photographs indicate that all four encounters comprised the fish-eating, “resident” lineage, with an average group size of 12 (median= 12 ; range: 10-12). The fifth killer whale sighting was comprised of a single animal, approximately 0.5 to .75 nm from the ship. Several surfacings of this animal were observed, but it was not re-sighted after the ship turned for a close approach and no other animals were sighted.

One of the four killer whale encounters involved a group of twelve individuals, including an adult male with distinctly white coloring. Sightings of white killer whales are extremely rare and only two such events have been previously documented in Alaskan waters. An adult white male killer whale was first observed on August 7, 1993 in the Northern Bering Sea near St. Lawrence Island. No photographs were taken in this sighting. The second sighting occurred on August 27, 2000, just N of Adak Island. Photographs were available from this sighting and we confirmed a match between this whale and the white male we observed on this cruise. A white male killer whale was part of a 12 member social group in all three sightings.

The sperm whale encounter involved a group of an estimated 50 animals, comprised mostly small animals that were probable females and juveniles. This encounter is notable because adult male sperm whales are the age class commonly sighted in Alaskan waters during the summer months and females and juveniles have been absent from these recent summer records.

Table 1: List of marine mammal species sighted, along with the number of sightings for each species.

Species	# Sightings
Killer Whale (Orcinus orca)	5
Sperm Whale (Physeter macrocephalus)	2
Dall’s Porpoise (Phocoenoides dalli)	11

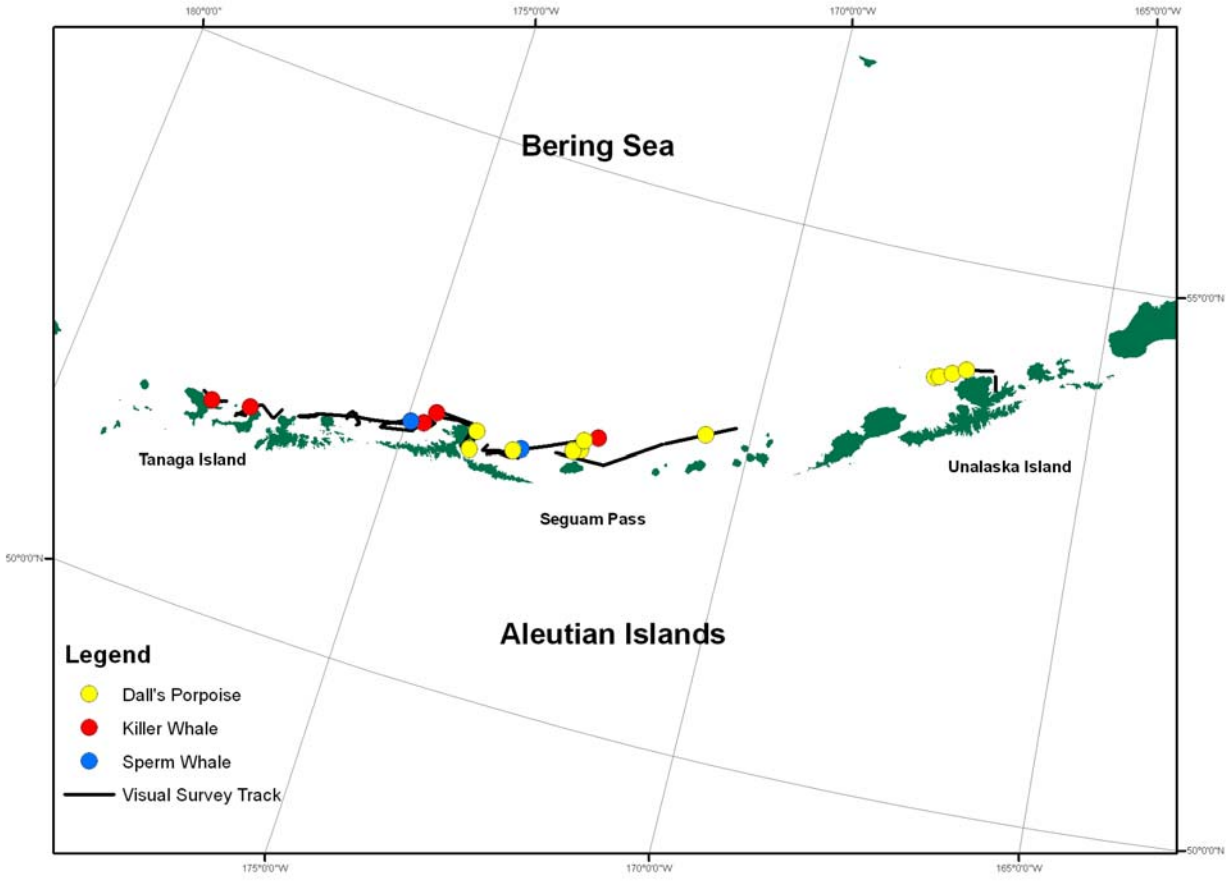

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Figure 1. Map of marine mammal sightings and visual survey tracks