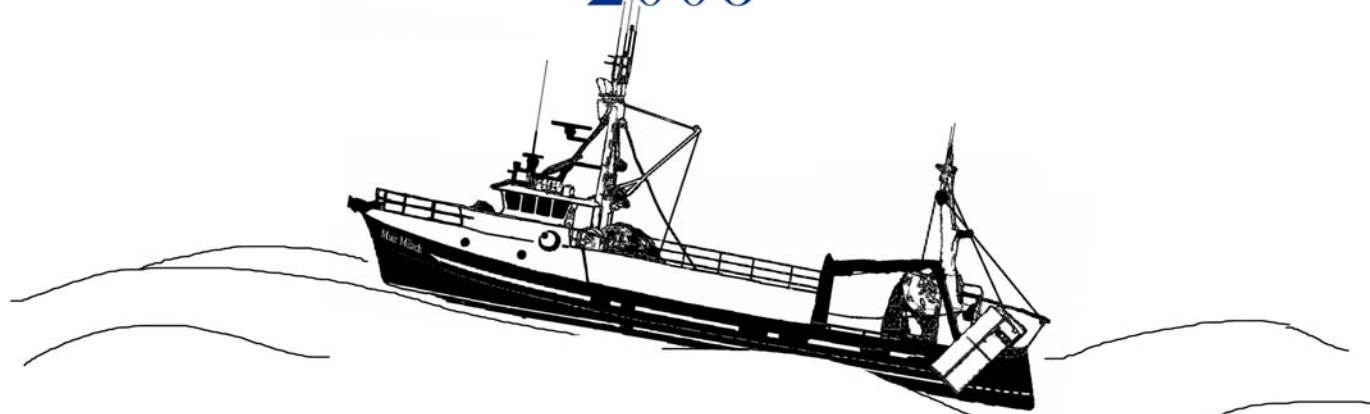


Aleutian Islands Cooperative Acoustic Survey Study 2006



F/V Muir Milach - Adak, AK

Steven J. Barbeaux

Steller Sea Lion Mitigation Committee

- June 27, 2006 -

2006 AICASS Goal

- The purpose of this study was to test the feasibility of using commercial fishing vessels to conduct acoustic surveys for pollock in the Aleutian Islands

2006 AICASS Objectives

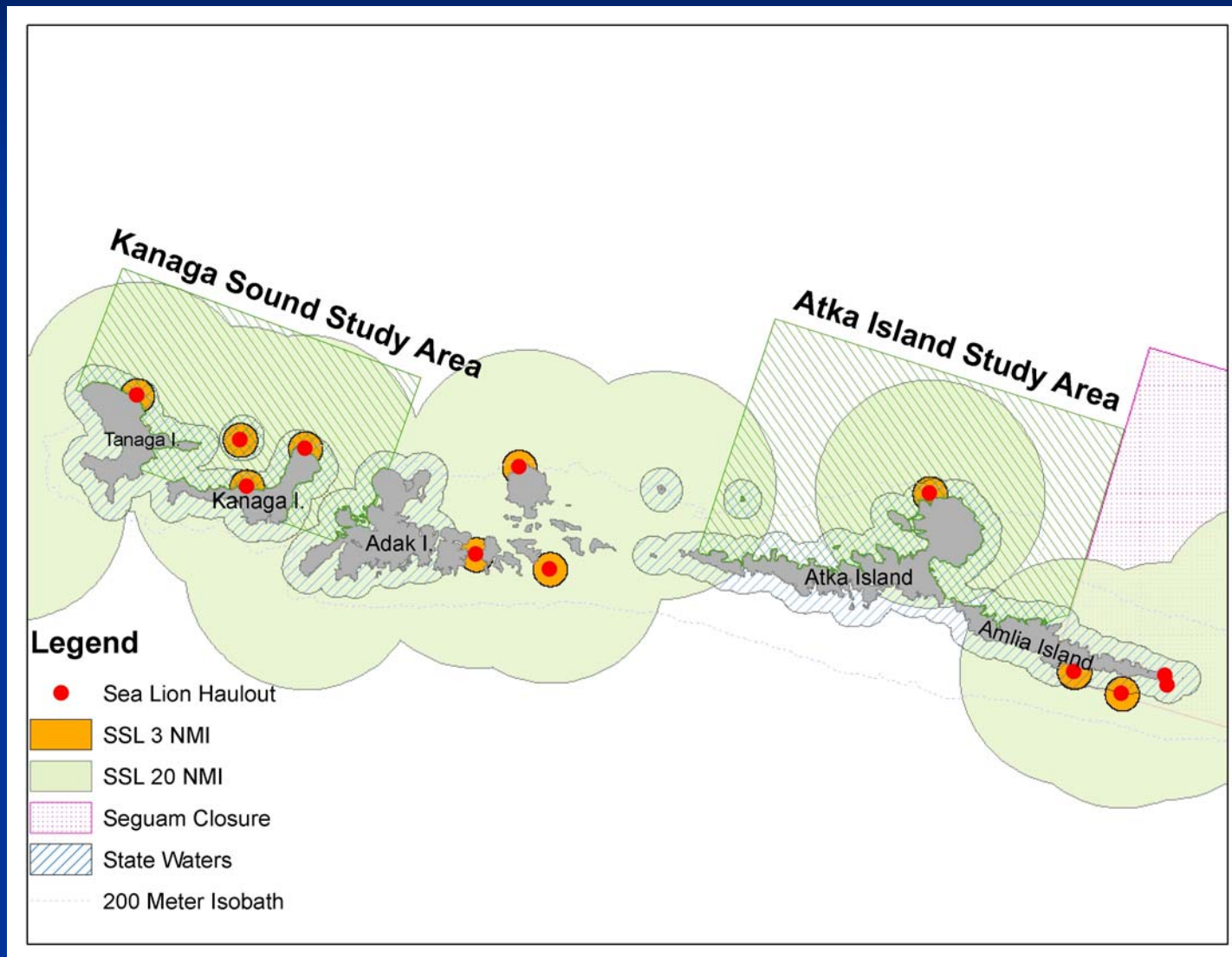
- The acoustic and biological information from the study is being used to assess;
 - 1) if it is feasible to conduct acoustic surveys in the Aleutian Islands using commercial fishing vessels,
 - 2) if the data collected is of sufficient quality for management purposes, and
 - 3) if the local aggregations of pollock are sufficiently stable to allow fine scale spatial and temporal management

F/V Muir Milach



- 32 meter stern trawler
- ES 60 echosounder with a 38kHz transducer

2006 AICASS Proposed Study Sites

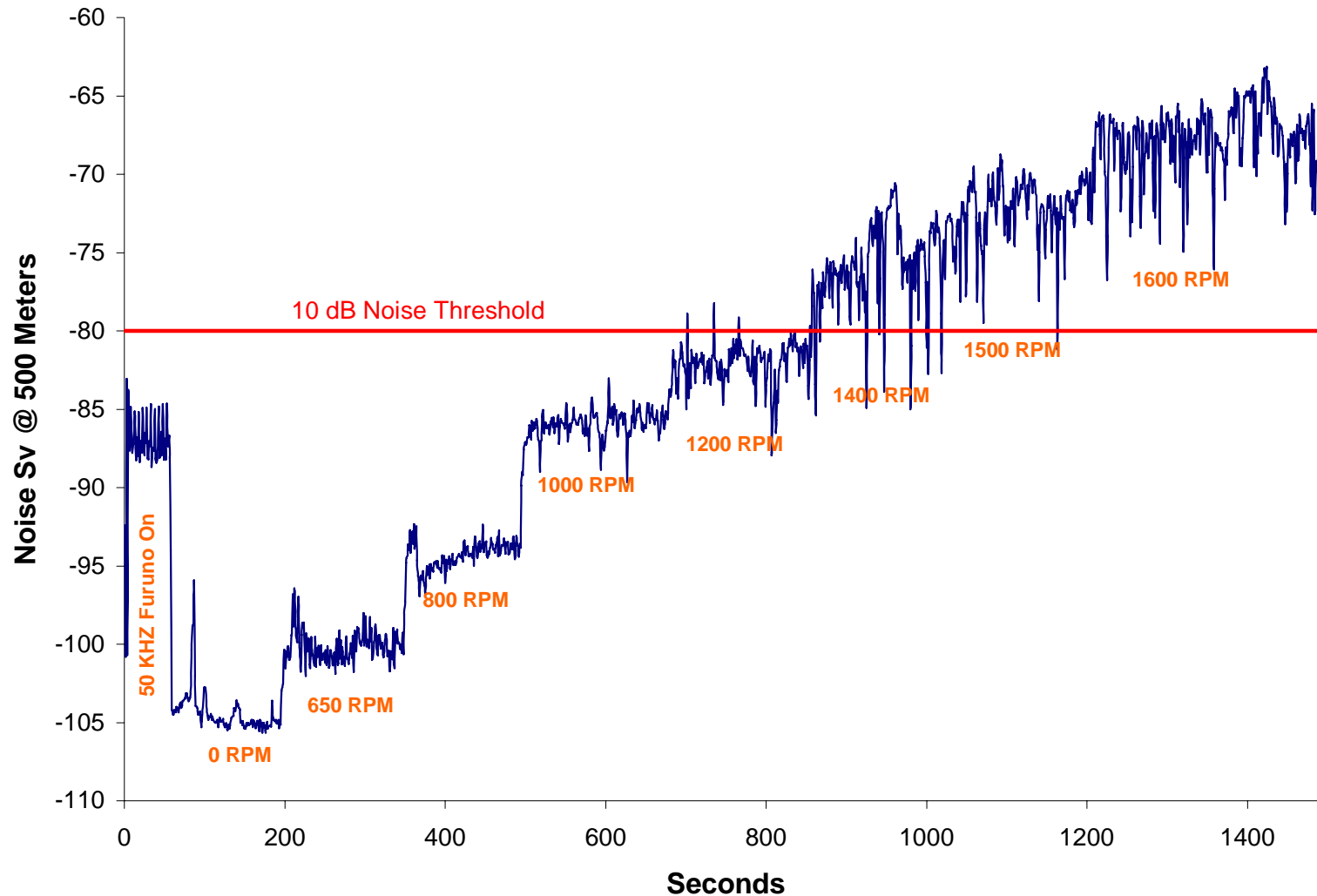


2006 AICASS Cruise Plan

- **Three Phases:**
 - **Phase 1:** Evaluate the commercial fishing vessel's appropriateness as an acoustic sampling platform
 - **Phase 2:** Opportunistically collect acoustic data of fish distribution in the two proposed study sites
 - **Phase 3:** Conduct acoustic and biological data sampling and commercial fishing at one of the two study sites

Phase 1: SONAR Self-noise Test

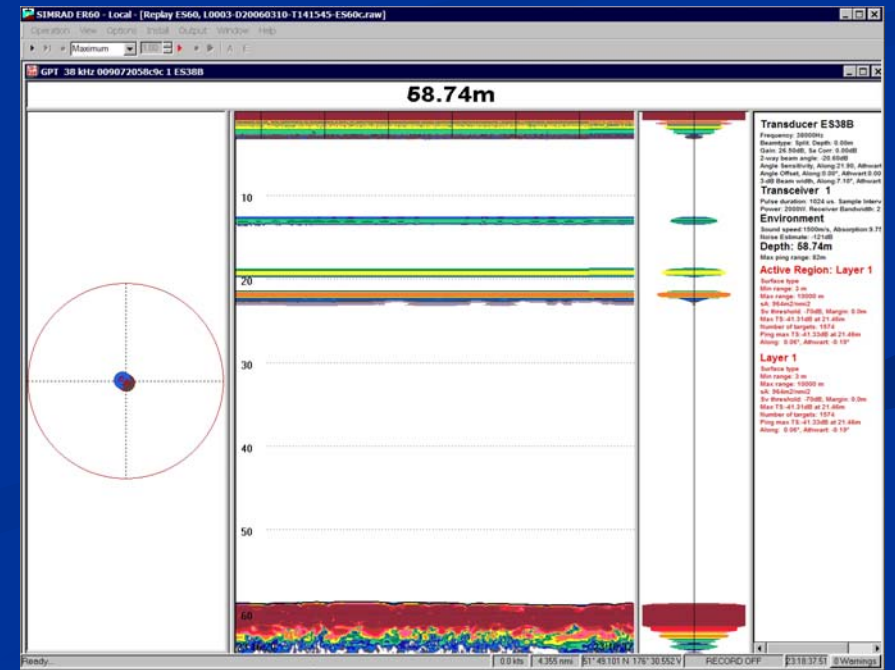
15 February 2006



Phase 1: Acoustic System Calibration

10 March and 4 April 2006

- System sphere calibration of the ES 60
 - Both calibrations in Scabard Bay, Adak Island
 - System settings remained consistent between two calibrations
 - Sa correction of -0.58 dB



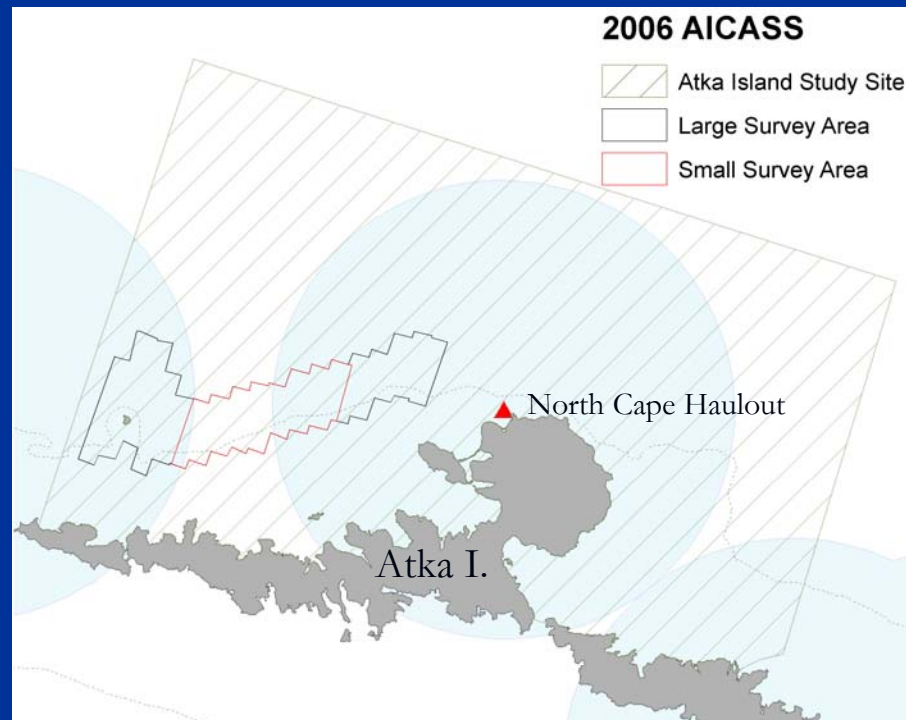
Phase 2: Opportunistic Acoustic Data Collection

10 February – 10 March

- Acoustic data collected within study areas while in transit between Pacific cod fishing grounds and Adak
- Data used to assess suitability of the two areas for the study and evaluate the quality of the acoustic data under varying weather conditions
- Atka Island study area selected

Atka Island Study Area

- Total area $\sim 2,200$ n.mi.²
- Large survey site 180 n.mi.²
- Small survey site 72 n.mi.²



Atka Island Study Area



Phase 3: Acoustic Survey-Transects

15 March – 4 April

- Large Acoustic Surveys
 - Three total - Beginning, middle, and end of phase 3
 - 180 n.mi.² each, “large survey area”
 - 18-23 transects with 1.5 n.mi. spacing
 - Systematic design with random start point for each
- Small Acoustic Surveys
 - Four total conducted on trips between large surveys
 - Within “large survey area” over highest pollock densities
 - 1 zig-zag survey
 - Poor coverage
 - 3 parallel surveys
 - Systematic design with random start point for each
 - One 0.5 n.mi. spaced survey (9 n.mi.²) - parallel to shelf break
 - Two 1.0 n.mi. spaced survey (72 n.mi.²)- perpendicular to shelf break
- Physical Oceanography
 - Sea-bird conductivity-temperature-depth (CTD) system
 - 17 total profiles
 - 3 during calibration
 - 14 in survey area

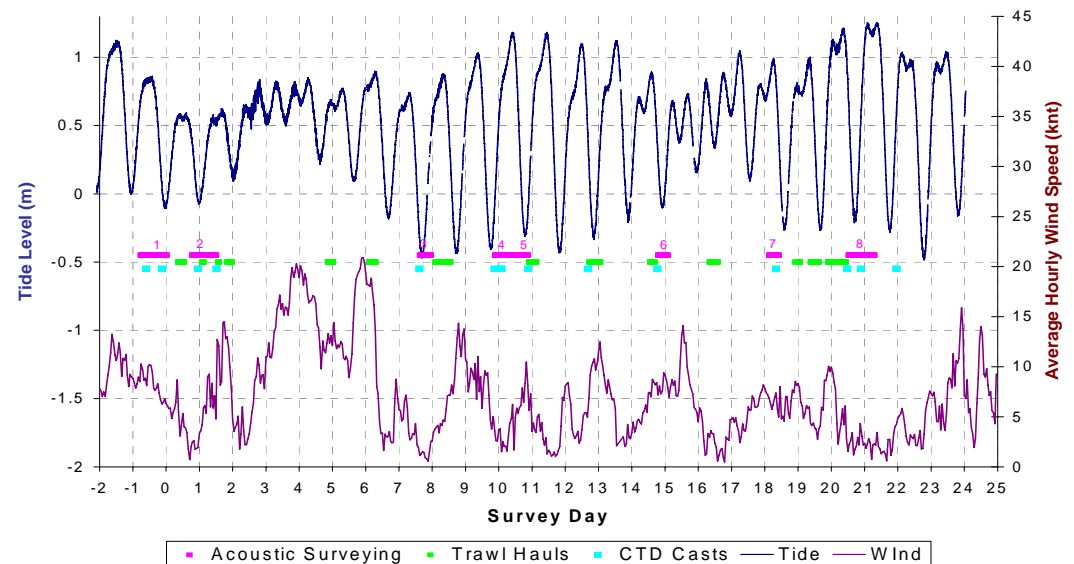
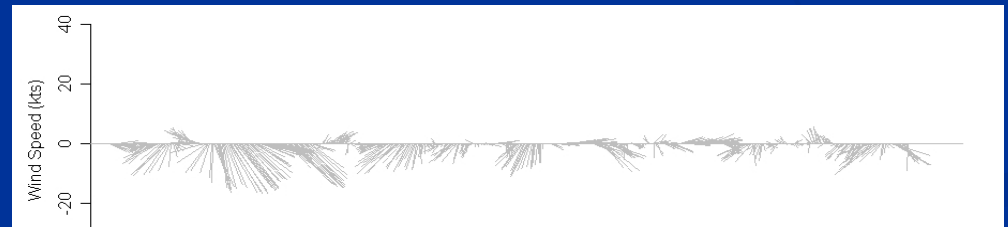
Phase 3: Acoustic Survey- Trawling

15 March – 3 April

- Verification Trawling
 - At the direction of the NMFS scientist
 - < 10 t tows to verify acoustic sign
 - Total catch and species composition for each verification tow
 - Length and weight, maturity scans, and otolith samples were collected from pollock, and length measurements from POP
- Commercial Trawling
 - Within study area but outside of 3 n.mi. of SSL haulouts
 - Total catch and species composition, pollock length, and fin clip samples
 - All catch delivered to the Adak processing plant and weighed
- Additional Opportunistic Acoustic Data Collection
 - Acoustic data collected during fishing and while in transit

Phase 3: The Weather

- Intermittent storms
 - Winds generally southerly
 - Day 2-5 unable to survey
- Max gusts
 - > 30 knots for 19 of 25 days
 - > 50 knots for 9 of 25 days



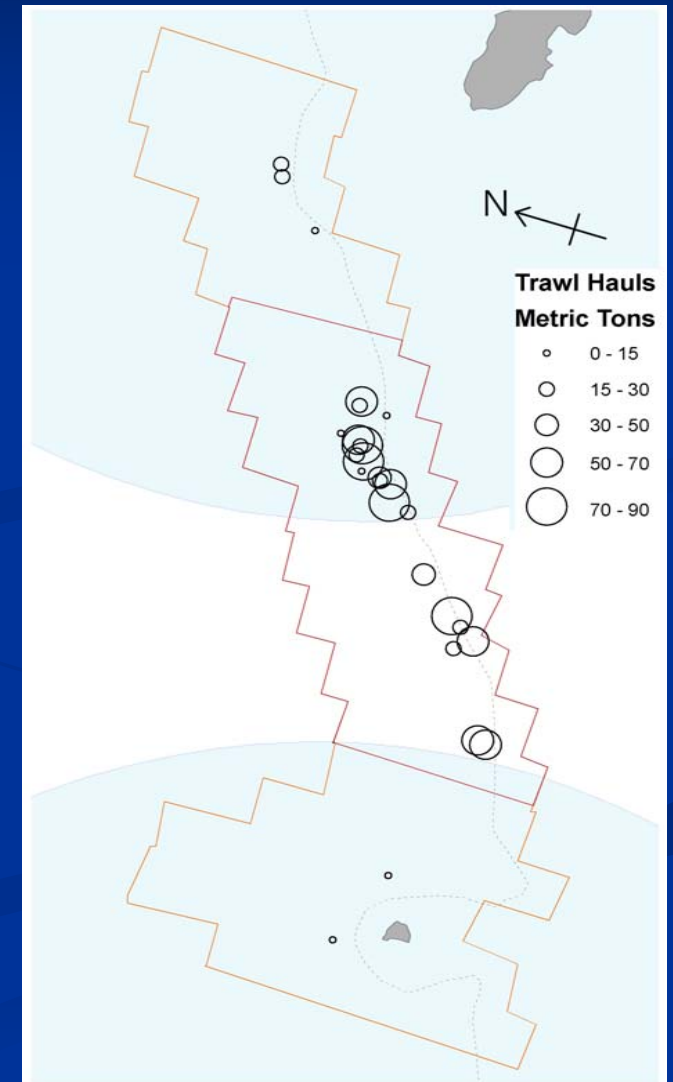
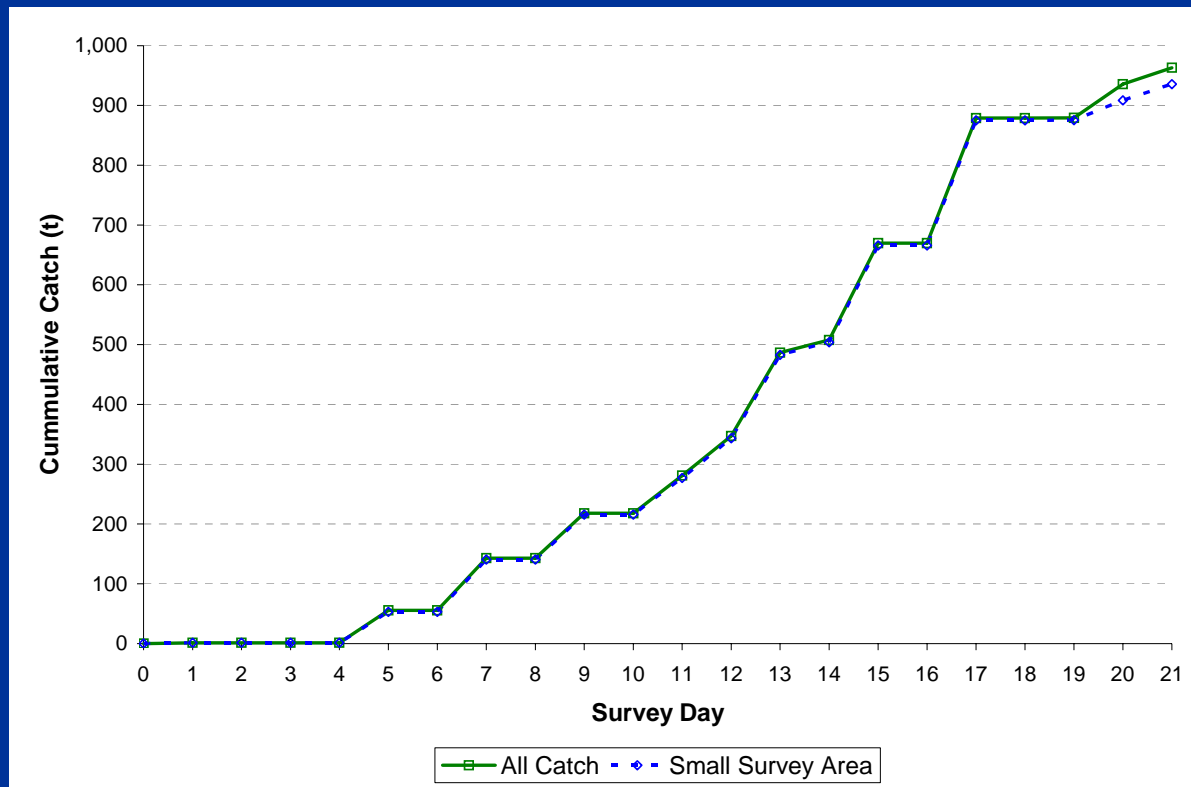
Phase 3: Verification and Commercial Fishing

- 965 t of groundfish harvested
- 30 hauls
 - 7 verification tows
 - 23 commercial tows



Verification and Commercial Fishing

- 21 days from first to last tow
- 97% or 935 t from small survey area
- 85% or 822 t from last 12 days

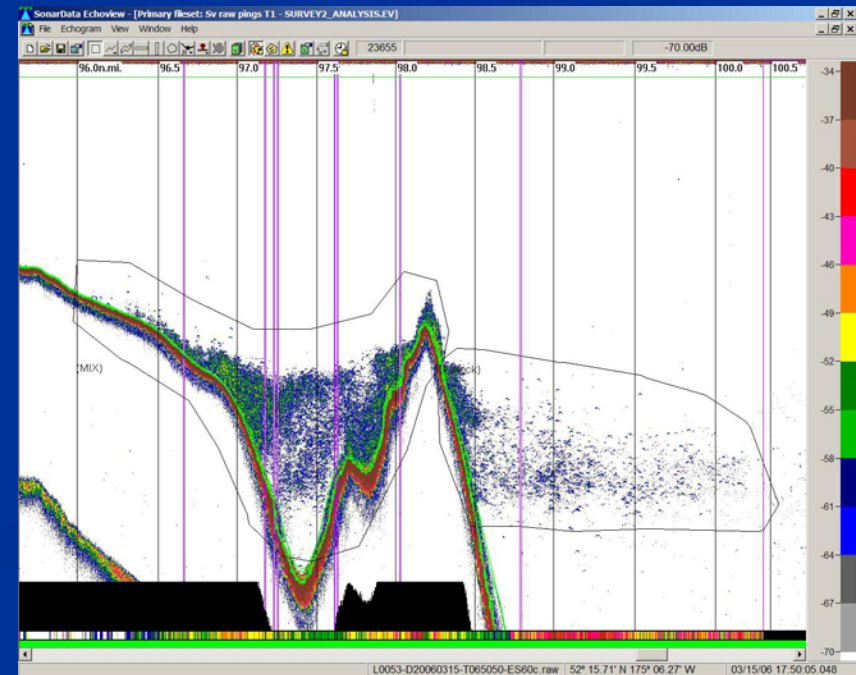
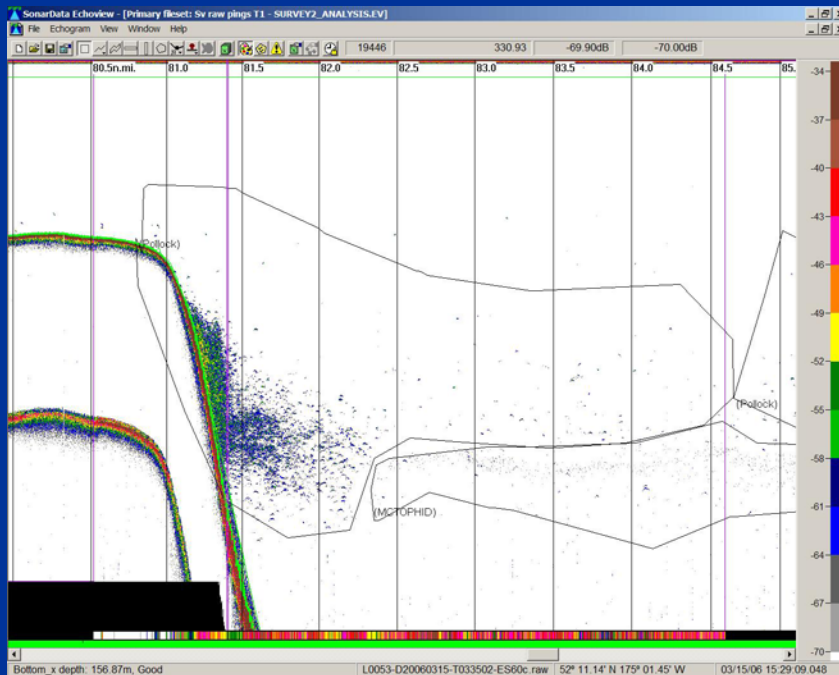


Phase 3: Acoustic Surveys

- 8 surveys in total
 - 3 large surveys (180 n.mi. ²)
 - 3 usable small surveys (9-72 n.mi. ²)
 - 2 quantitatively unusable surveys
 - Survey 1, exploratory on east side of Atka Island.
 - Survey 3, zig-zag survey resulting in significant wasted effort.

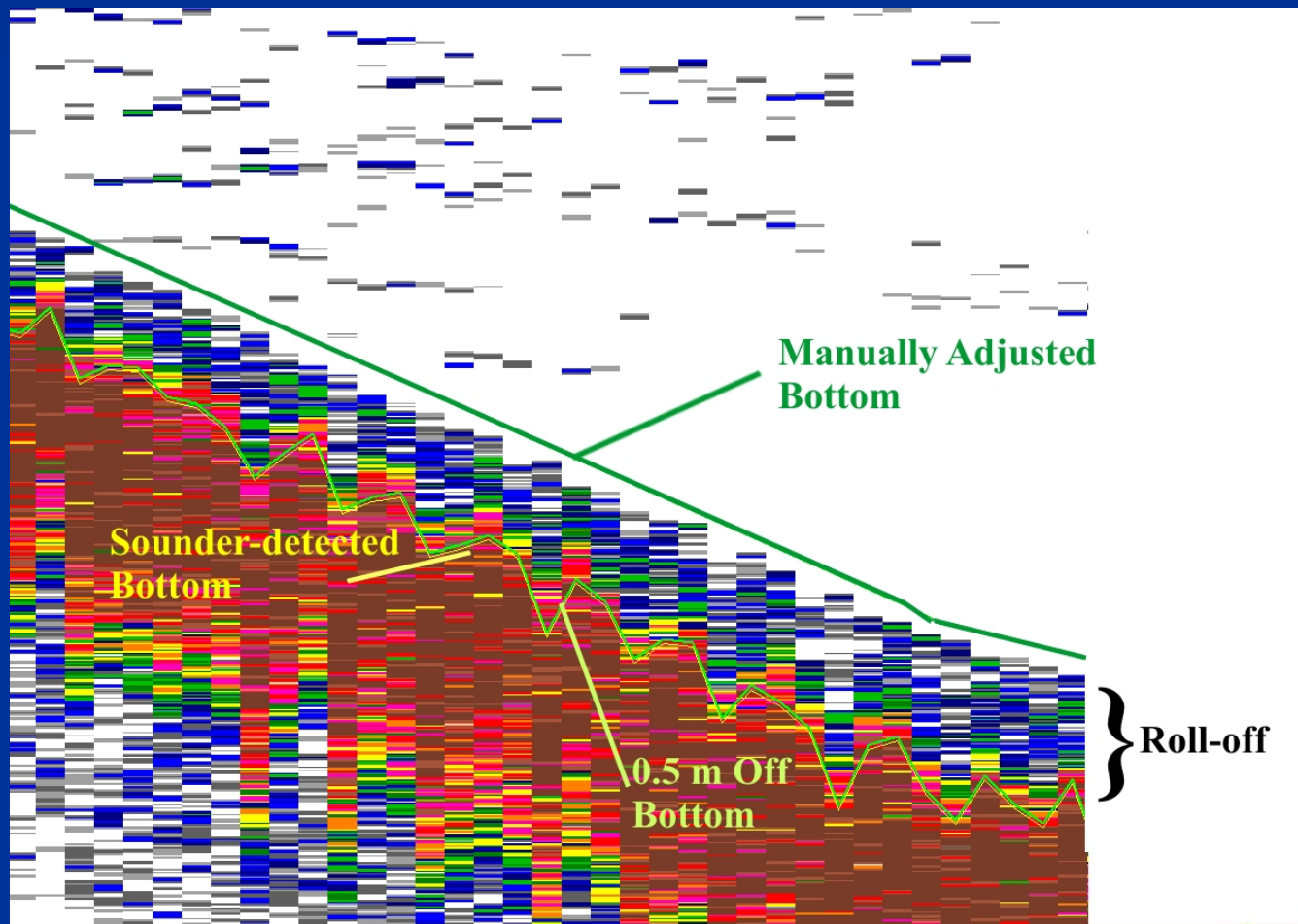
Phase 3: Acoustic Data Processing

- Scrutinized in Echoview
 - -70 dB threshold
 - Three region classifications
 - Pollock - > 85% pollock
 - Mixed – Pacific Ocean perch with some pollock
 - Deep scatterers – Mctophidea



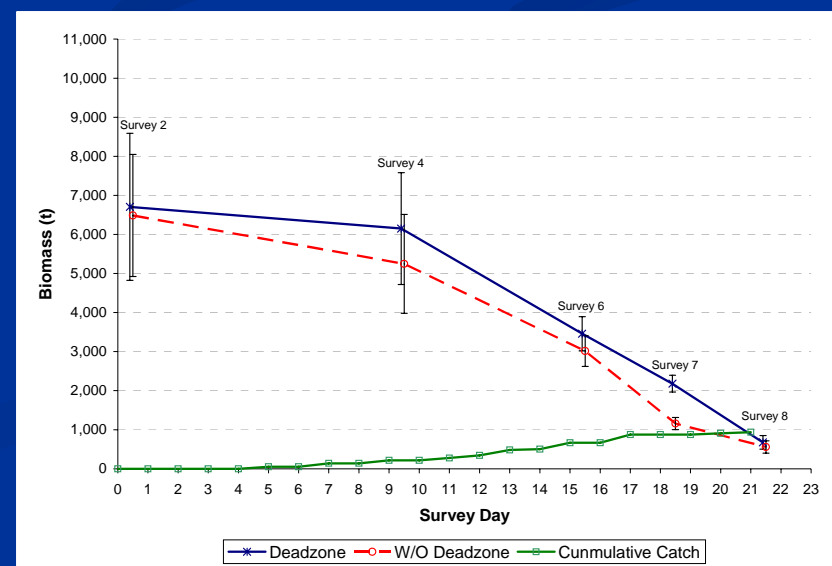
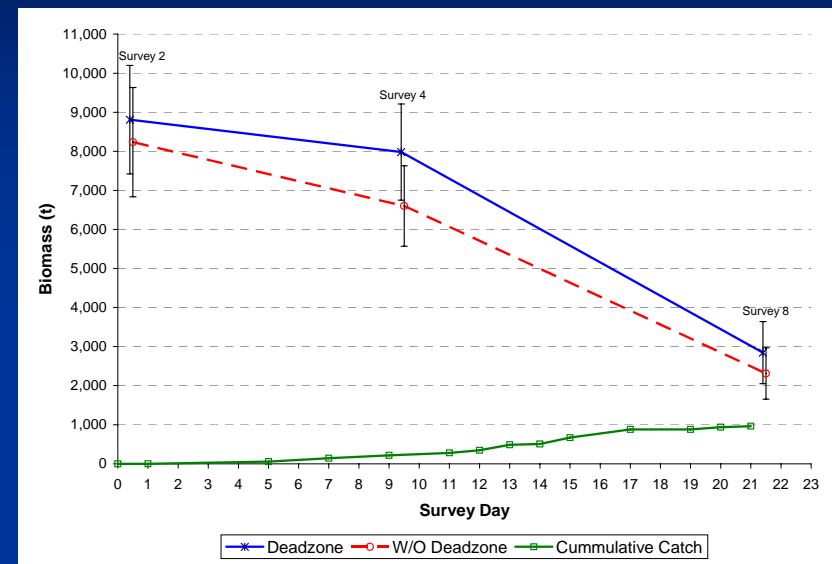
Phase 3: Data Processing

- Biomass vs. deadzone biomass



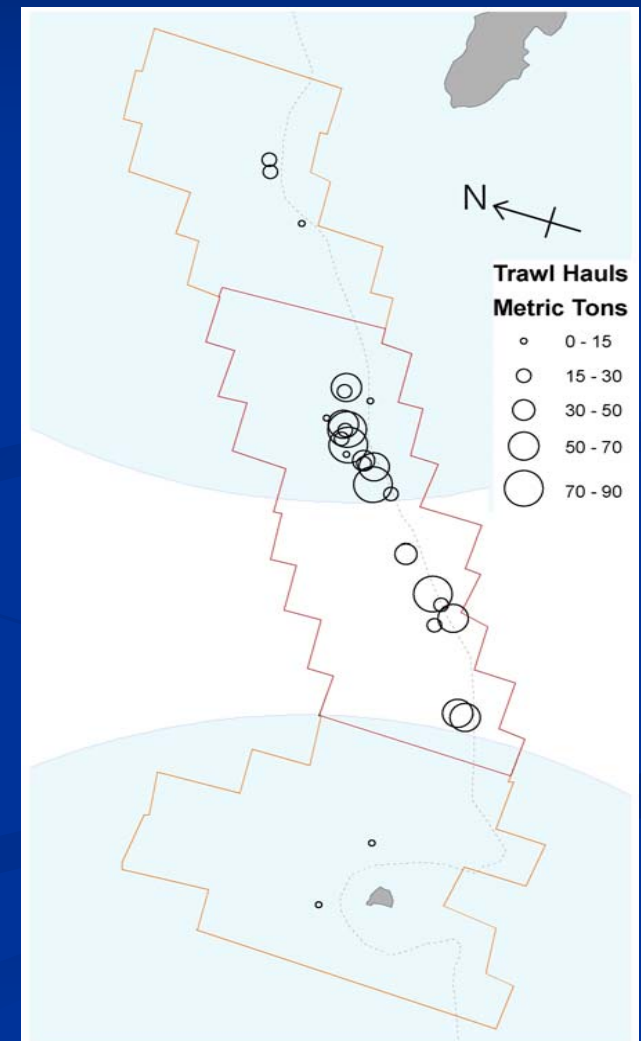
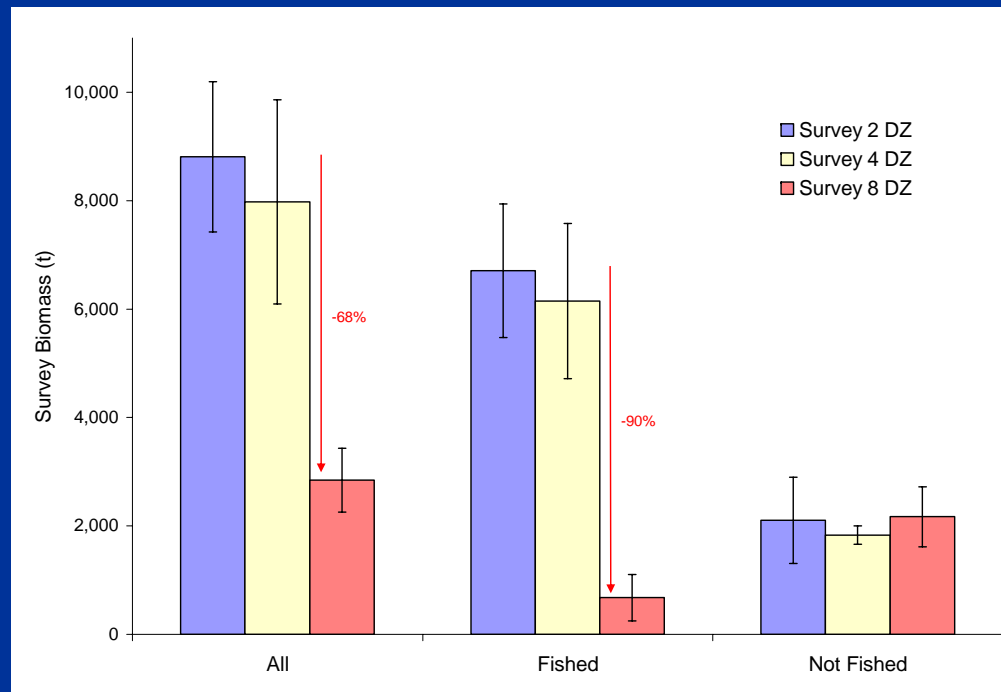
Phase 3: Pollock Abundance

| Survey | Area (n.mi. ²) | Deadzone (Y/N) | Biomass (t) | Relative Precision (E _i) | Density (t / n.mi. ²) |
|--------|----------------------------|----------------|-------------|--------------------------------------|-----------------------------------|
| 2 | 180 | N | 8233.8 | 8.67% | 45.7 |
| 2 | 180 | Y | 8809.9 | 8.04% | 48.9 |
| 2 | 72 | N | 6484.5 | 12.29% | 90.1 |
| 2 | 72 | Y | 6706.6 | 14.32% | 93.1 |
| 4 | 180 | N | 6600.4 | 7.96% | 36.7 |
| 4 | 180 | Y | 7980.2 | 7.87% | 44.3 |
| 4 | 72 | N | 5246.4 | 12.31% | 72.9 |
| 4 | 72 | Y | 6149.8 | 11.89% | 85.4 |
| 5 | 9 | N | 890.8 | 5.29% | 99.0 |
| 5 | 9 | Y | 1036.6 | 4.75% | 115.2 |
| 6 | 72 | N | 3015.0 | 6.64% | 41.9 |
| 6 | 72 | Y | 3458.5 | 6.44% | 48.0 |
| 7 | 72 | N | 1159.0 | 6.83% | 16.1 |
| 7 | 72 | Y | 2179.7 | 5.05% | 30.3 |
| 8 | 180 | N | 2313.6 | 14.51% | 12.9 |
| 8 | 180 | Y | 2845.2 | 14.24% | 15.8 |
| 8 | 72 | N | 559.2 | 14.32% | 7.8 |
| 8 | 72 | Y | 677.0 | 12.96% | 9.4 |

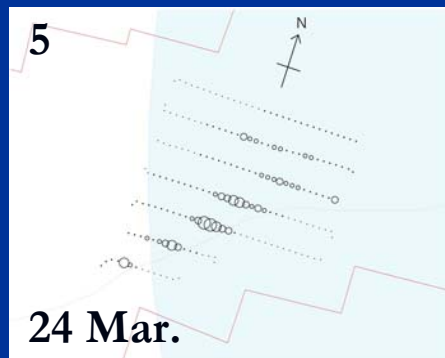
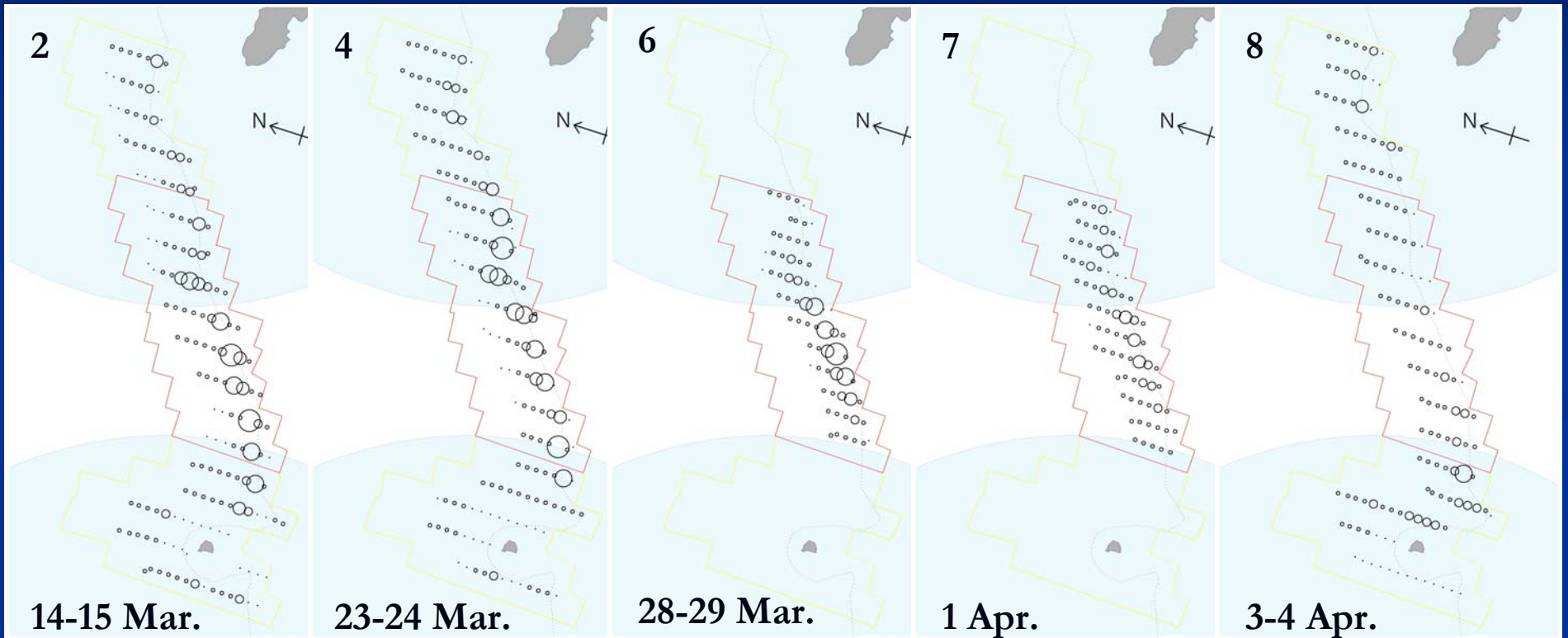


Phase 3: Pollock Abundance

- 68% decline in large survey area
- 90% decline in small/“fished” survey area
- No measurable decline in “not fished” region

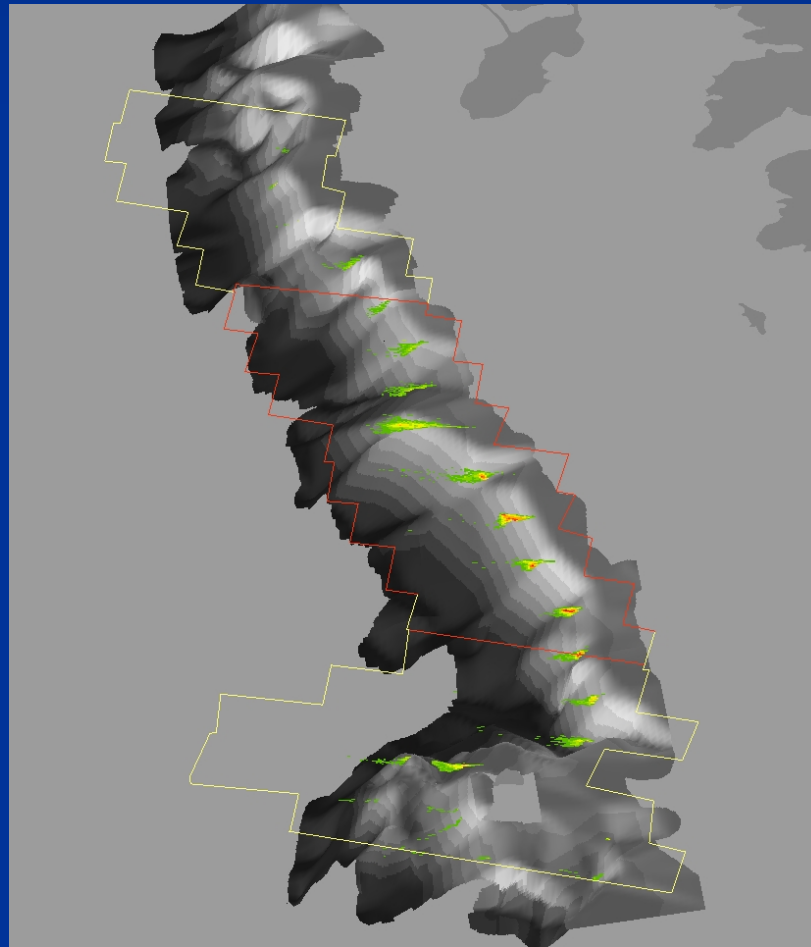


Phase 3: Pollock Distribution



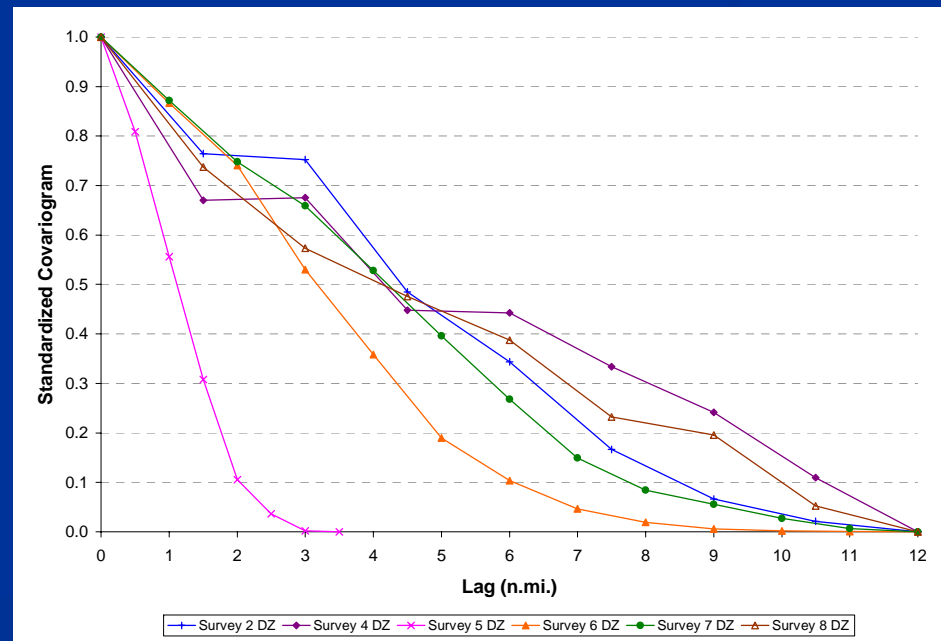
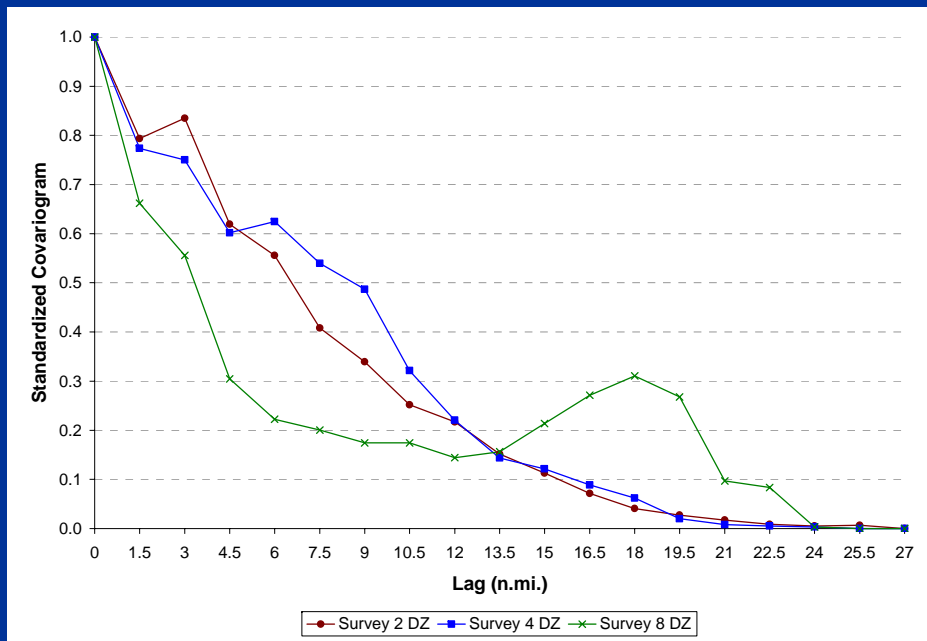
Phase 3: Pollock Distribution

- 3-dimensional pollock density plots



Phase 3: Pollock Distribution

- 1-dimensional covariogram – across transects
 - Change in pollock distribution in large area
 - No apparent change in small area



Phase 3: Biological Data

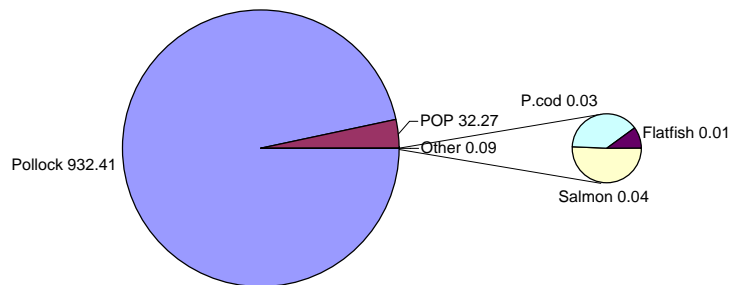
- 2,945 pollock length measurements
- 1,645 female pollock maturity scans
- 333 pollock otolith pairs
- 99 pollock fin clip samples
- 842 POP length measurements
- 200 POP whole fish collection for OSU



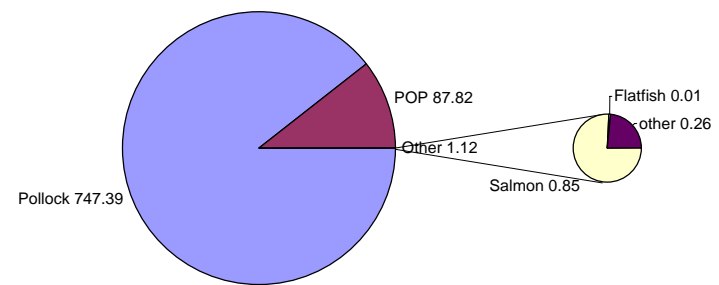
Biological Data: Species Composition

- 96.6% pollock
- 3.3% POP
- < 0.1 % other

Species Delivery Weight (t)



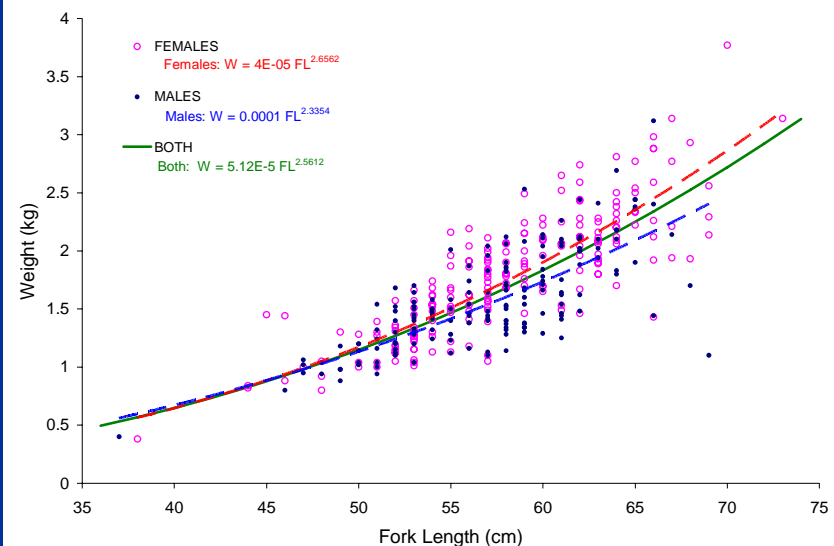
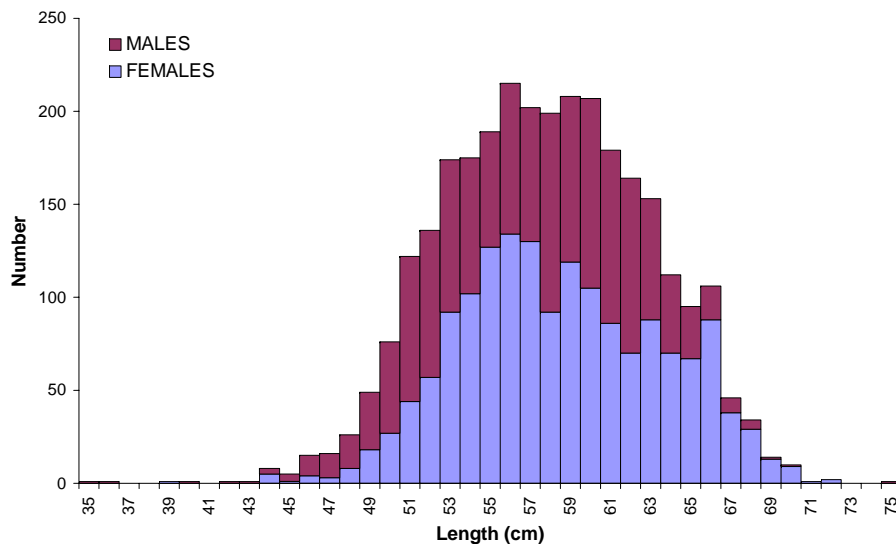
Extrapolated Species Composition Samples (t)



* Excluding 128 t from unsampled hauls.

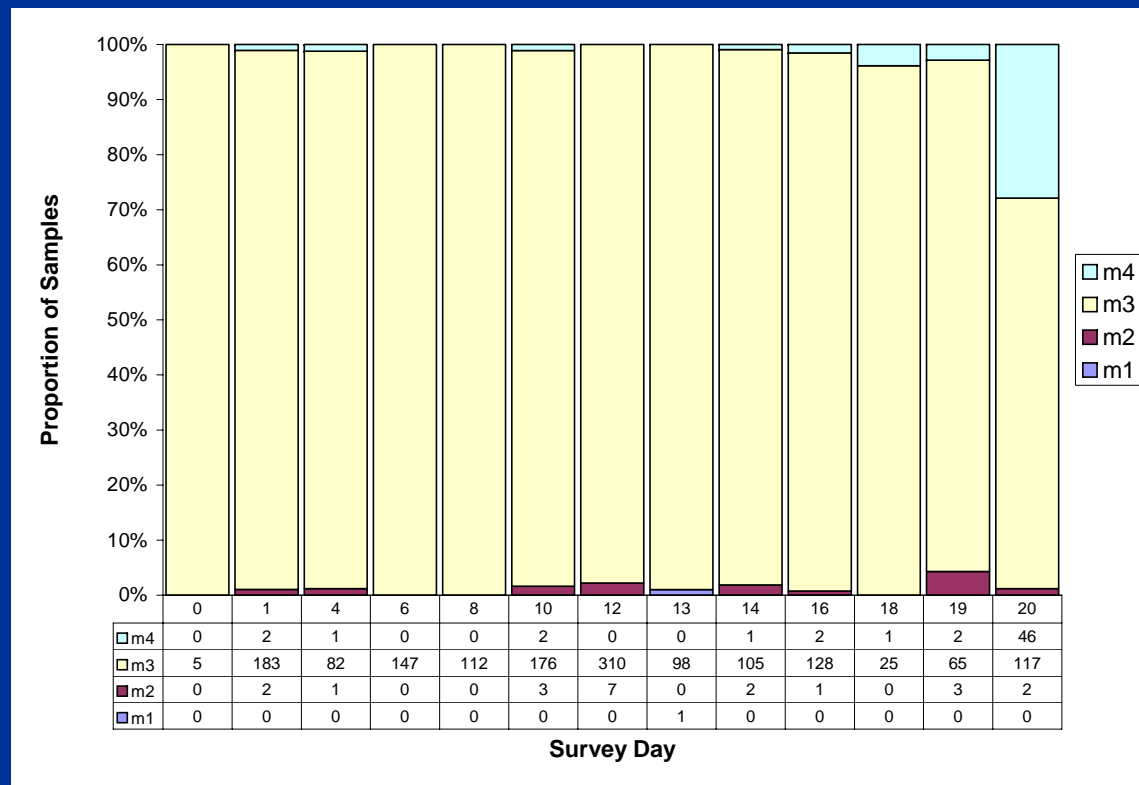
Biological Data: Length and Weight

- Sex Ratio: 55% female or 1.24:1
- Mean length and weight:
 - Males 56.9 cm and 1.58 kg
 - Females 58.5 cm and 1.80 kg



Biological Data: Maturity

- Female maturity:
 - 98.6% of females pre-spawning or spawning
 - 0% post-spawning



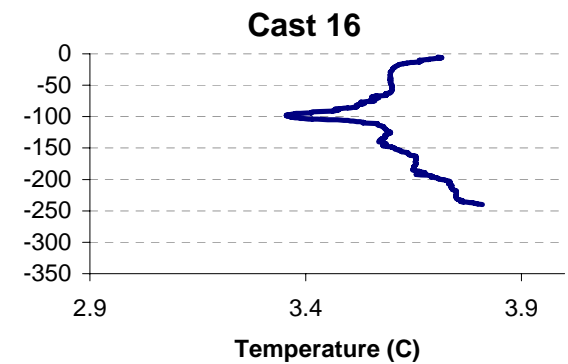
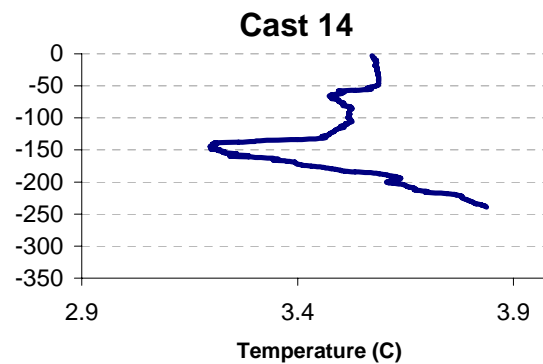
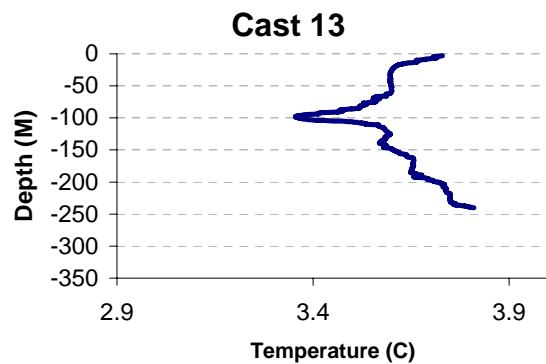
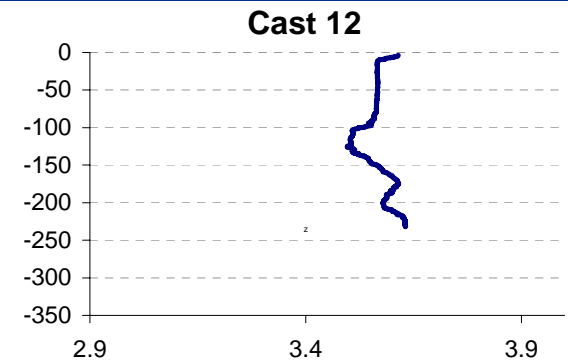
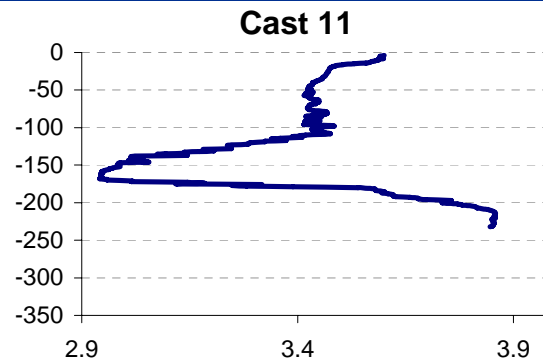
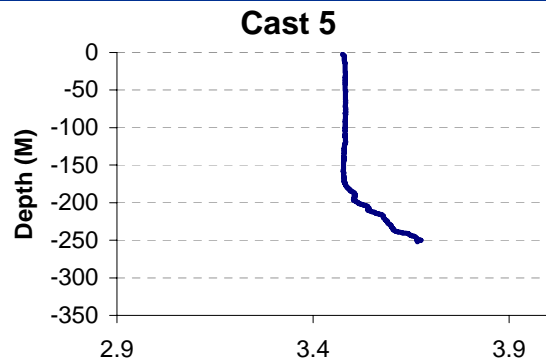
Phase 3: Physical Oceanography

- 14 CTD casts in study area over duration of the survey



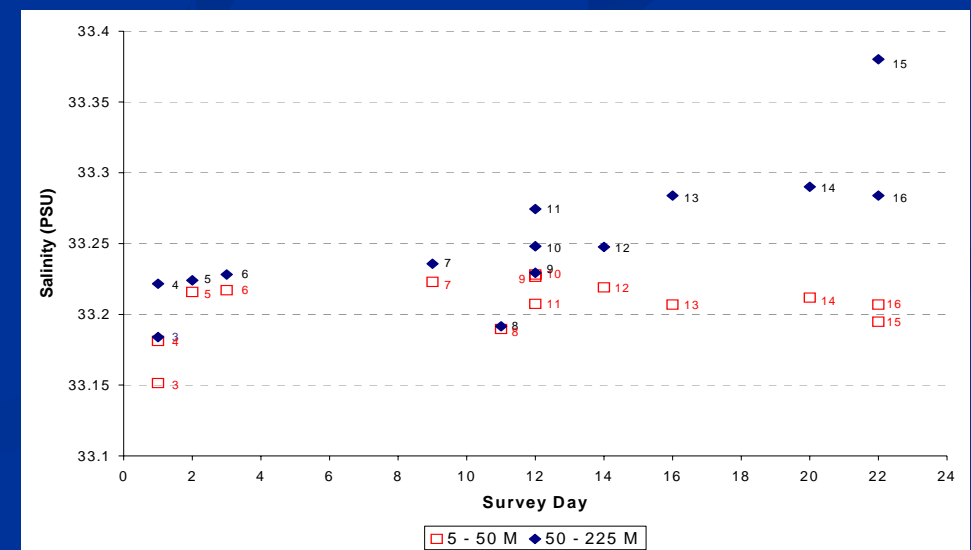
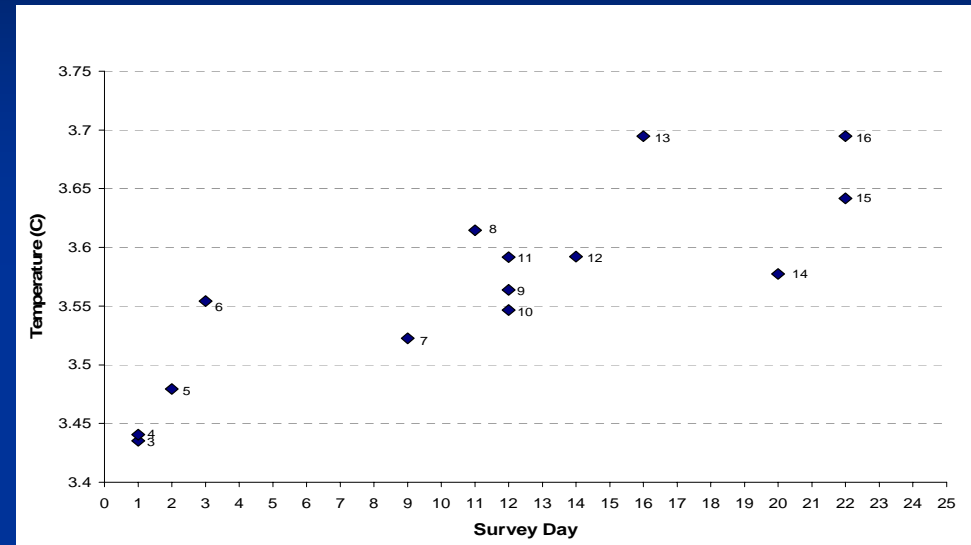
Phase 3: Physical Oceanography

- Stratification over duration of the survey



Phase 3: Physical Oceanography

- Some warming of surface waters (5-10m) over duration of study
- Stratification of salinity over duration of the survey



Conclusions

- It is possible to collect high quality acoustic data on pollock abundance and distribution from a small commercial fishing vessel during winter in the Aleutian Islands.
- Data are of sufficient quality for management purposes such as abundance estimation.
- Pollock abundance/distribution may remain stable for periods of time, but can change rapidly.

Future Plans

- Finish analyzing data from 2006 AICASS
 - Age data analysis
 - Subarea and temporal differences in pollock biometrics
- 2007 AICASS
 - Acoustic Survey
 - Seguam closure to the north end of Tanaga Island
 - 2 n.mi. spacing, ~ 850 n.mi.²
 - ~ 142 vessel hours or 6 days
 - Commercial fishing
 - Post-survey
 - 350 t per 1 degree longitude inside critical habitat (1,750 t)
 - 100% observer coverage

Thank You

- This study would not have been possible without the cooperation of the Aleut Corporation, Adak Fisheries, Sandra Moeller, and Dave Fraser.
- This study could not have been completed had it not been for the hard work and dedication of the captain and crew of the F/V Muir Milach.
 - Dave, Frank, Brent, Eric, and Carlos

