Science, Service, Stewardship

Center for Independent Experts Review of BSAI Pacific Cod Assessments

Aleutian Islands Bottom Trawl Survey (1980 – present)

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February 16, 2016

Survey Team

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Wayne Palsson, Team Leader

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Outline

- What and Where?
- Survey History
- Present Day
- Standardization
- Limitations

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Fishery Independent Surveys

Primary Objectives

- Distribution & Abundance of principal groundfish and invertebrate species
- Life History Information: age, growth, length-weight, feeding habits, size and sex compositions
- Consistnet trawl performance and effort

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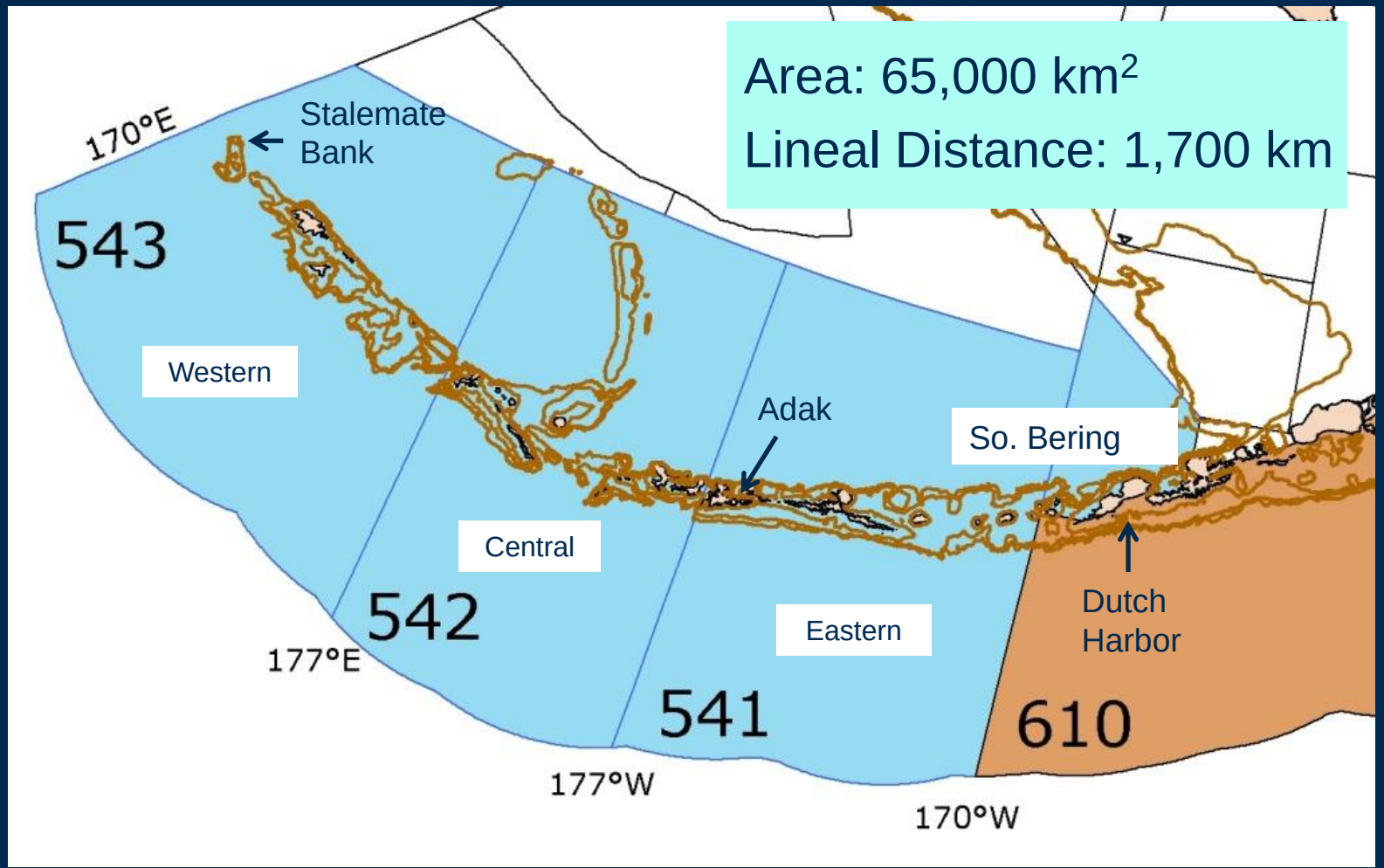
Aleutian Islands Survey Area



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AI Survey Stations

Year	Stations	Max Depth (m)	Comment
1980	126		30 min duration
1983	287		
1986	382		
1991	340		
1994	381		
1997	397		15 min duration
2000	416		
2002	417	500	
2004	420	500	
2006	358	500	
2008			No Survey
2010	418	500	
2012	420	500	
2014	410	500	

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AI Survey Start Dates

Year	Start Date	Boat-Days	Boats
1980	3 July	187	3
1983	15 July	147	3
1986	18 May	148	2
1991	19 July	126	2
1994	3 June	130	2
1997	10 June	137	2
2000	20 May	126	2
2002	17 May	137	3
2004	6 June	116	2
2006	6 June	104	2
2008			
2010	9 June	127	2
2012	8 June	124	2
2014	11 June	117	2

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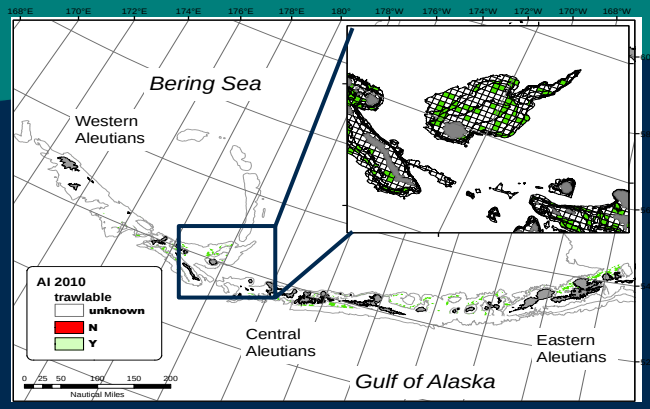
History: Design



- 1980 – systematic survey, 30°longitude, 5 depth strata
- 1983 – random stratified, 2-5°subareas, 5 species
- 1986 – 25 nm^2 sampling units, 11 groundfish species
- 1991 – pool of previously trawled stations, Scanmar
- 1994 – habitat stratification (i.e., banks, passes, shelf, etc.)
- 1997 – Switch from 30 to 15 minute tow duration
- 2000 – modified Neyman optimal method, BCS
- 2002 – 15 minute trawl duration
- 2006 – redefined “station” concept
- 2010 – replaced bottom contact sensor with accelerometer
- 2012 – first use of Marport net mensuration

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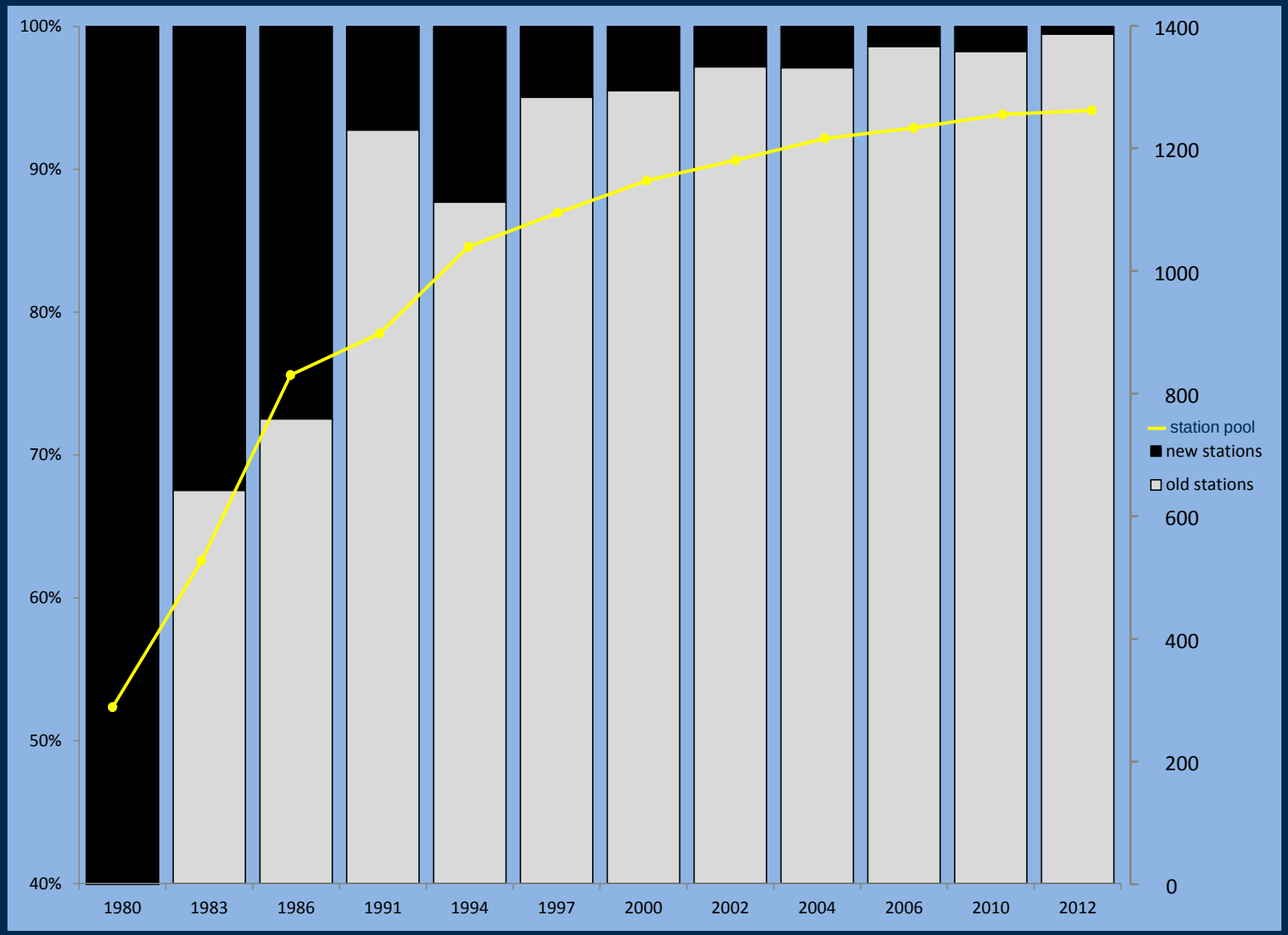
History: Changing Sampling Frame



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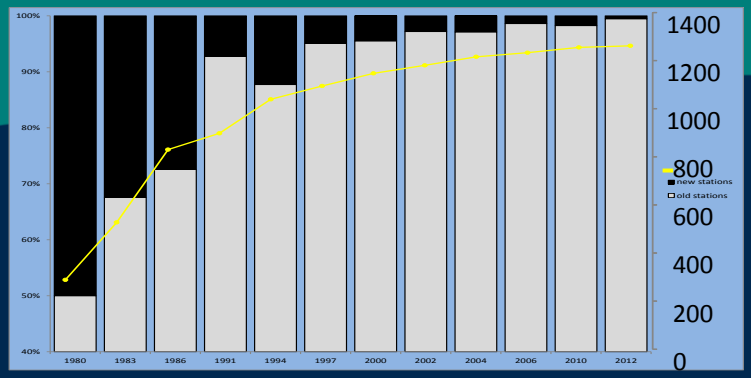
Survey Design



- Stratified-random selection of previously successful stations w/o replacement
  - Pool has grown, rate of increase has declined
- Modified Neyman optimal allocation for principal groundfish species:
  - Abundance (higher abundance = more weight)
  - Variance (higher variance = more weight)
  - Survey area (larger area = more stations)
  - “modified”
    ex-vessel price (higher price = more weight)

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Present Day: Vessels and Crew

- Chartered commercial fishing vessels
- Similar size and capabilities (≥ 30.6 m long, 700 HP min.)
- 5-6 vessel crew + 6 scientists

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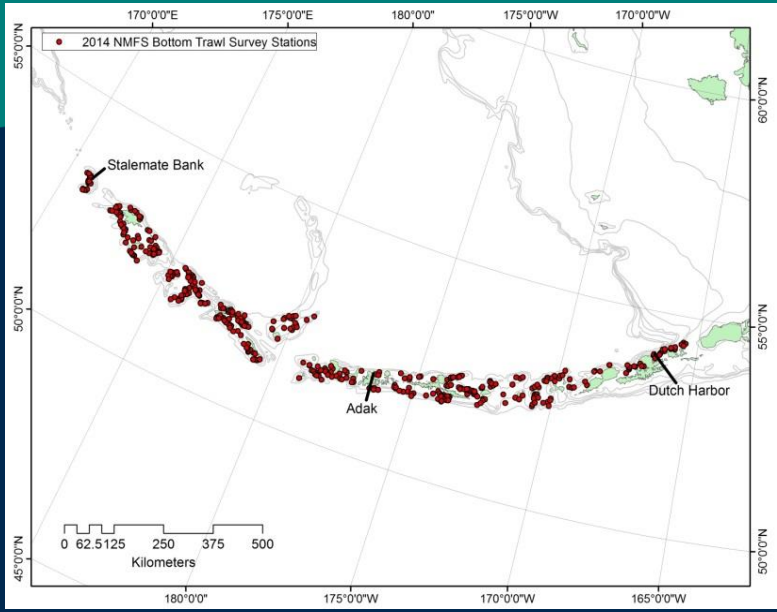
Survey Design: *45 Strata*



<u>4 Regulatory areas (NPFMC areas)</u>

- Southern Bering Sea
- Eastern Aleutian Islands
- Central Aleutian Islands
- Western Aleutian Islands

<u>4 Depth zones</u>

❖ 1-100 m

❖ 101-200 m

❖ 201-300 m

❖ 301-500 m

Min. Depth =15 m

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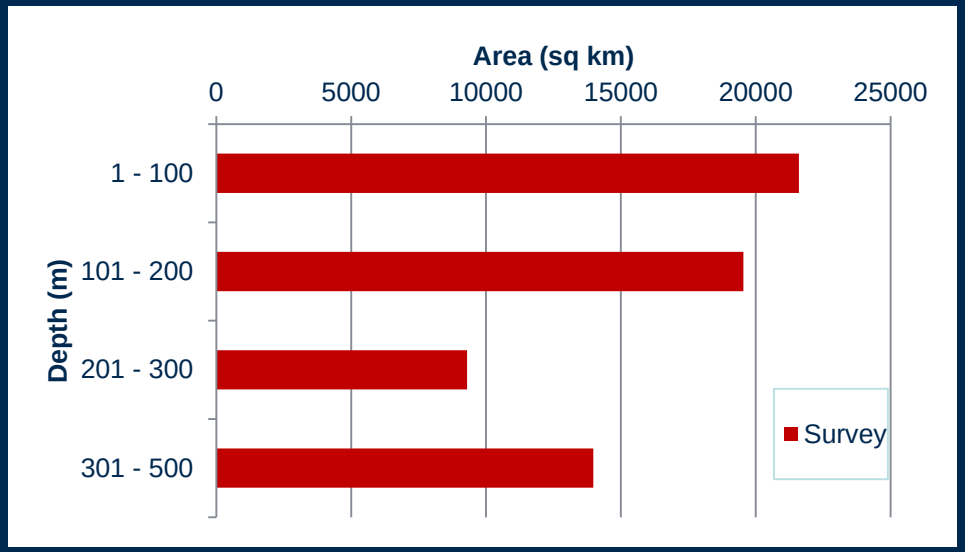
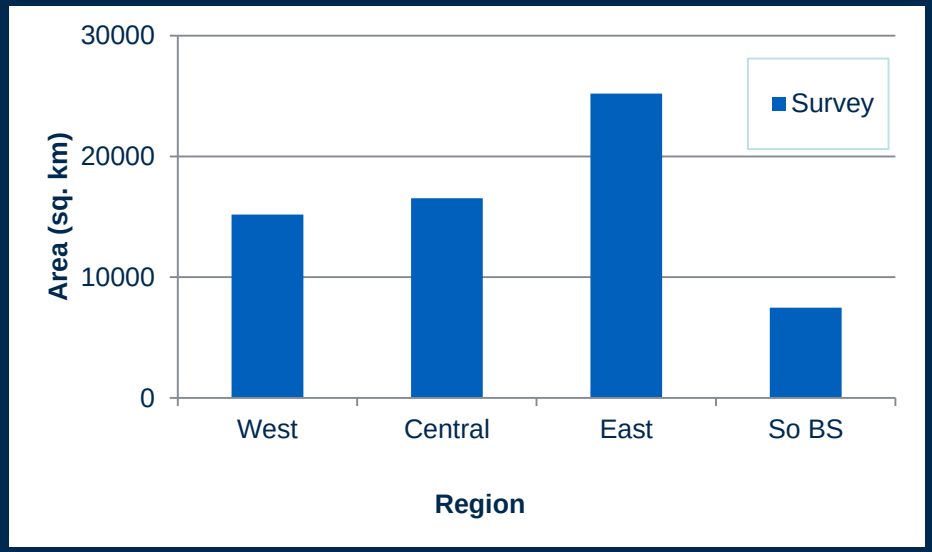
Depth and Regional Survey Characteristics





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Survey Design: Trawling Operations

- Stations randomly assigned to two vessels
- Poly Nor'eastern net with roller gear
- 15 minutes at 3 knots ~ 1.5 km distance
- Collect position, speed, net mensuration, depth, temperature, water column irradiance, and acoustics
- Identify, weigh, and enumerate 100% of catch
- Length, age, and other biological samples

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Poly Nor'eastern Net Characteristics

- 12.7 cm mesh w/ 3.2 cm liner
- 4 seams/panels
- 3 bridles
- 36 cm bobbins
- 10 cm disks
- Net width 8-20 m
- Height ~ 7 m

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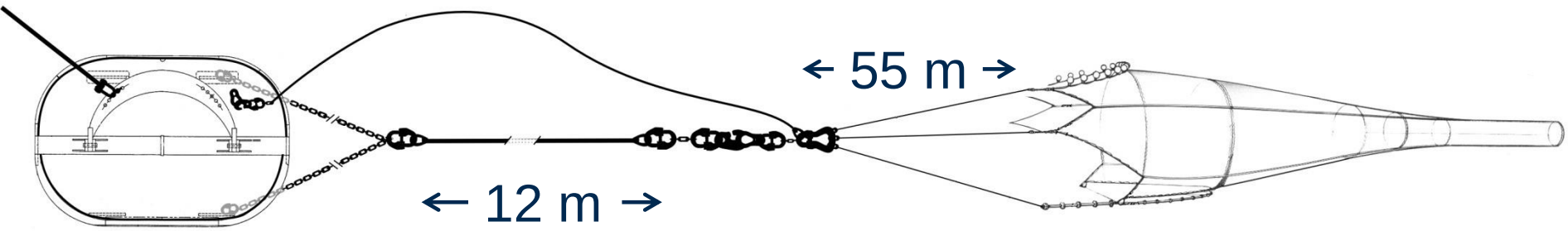
Poly Nor'eastern Net



1.8x2.7 m

816 kg

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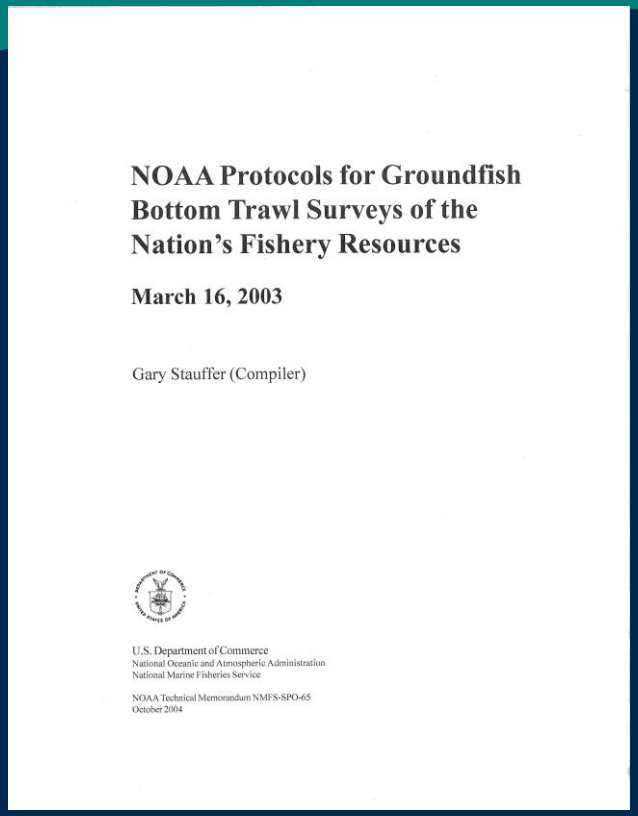
Conforming to Bottom Trawl Survey Standards



NOAA Protocols for Groundfish Bottom Trawl Surveys of the Nation's Fishery Resources

March 16, 2003

Gary Stauffer (Compiler)

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

NOAA Technical Memorandum NMFS-SPO-65
October 2004

- Warp Measurement & Monitoring
- Bottom Contact Sensor
- Net width measurement
- AutoTrawl System
- Operating Procedures
- Trawl Construction & Repair
  - —Description of Trawls and Their Rigging
  - —Gear Repairs Monitored Aboard Vessels or New Nets Used

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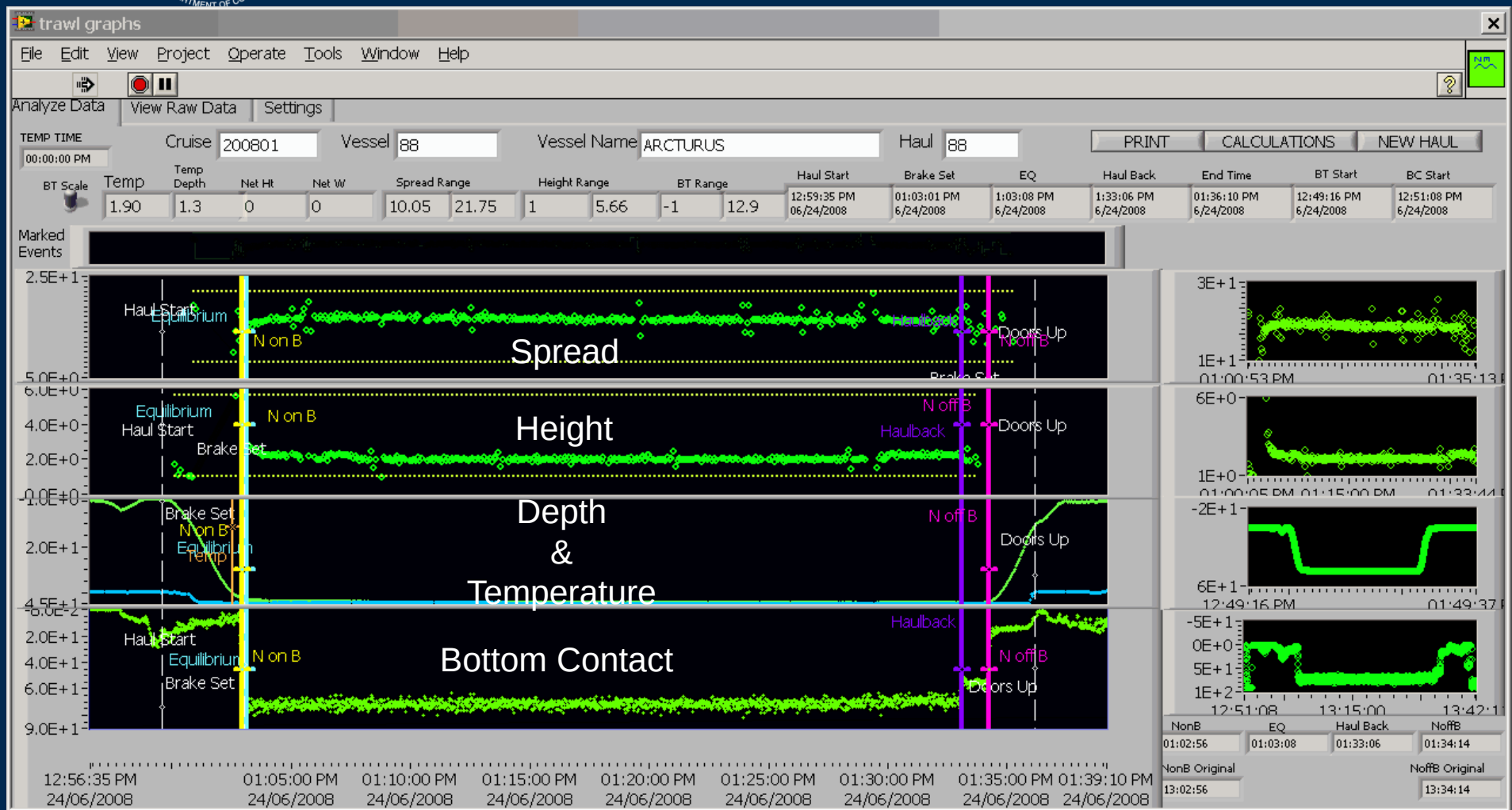
Integrating Net Mensuration & Standardizing Effort



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Catch Processing

- All living specimens are identified to lowest possible taxon, weighed, and counted

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Catch Processing Provides:

- Total weight and count of each species
- Sexed length composition by station for most minor and all principal species of groundfishes (n = 100-200/station)
- Age Structures:
  - length-stratified, area-stratified sampling (e.g., 2 fish/sex/cm/area)
  - random length stratified per tow
  - individual weight and length for otolith fishes
- Other:
  - Food habits, energy content, DNA samples, maturity, environmental data, etc.

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Data Processing

- Manual and Digital Recording
- Interim Database at sea
- Upload to AFSC database in Seattle
- Automated error checking in production database
  - changes are logged in transaction records
- Future: data collected directly into @sea database
  - data checking at point of entry

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Primary Survey Product: Catch-per-unit-Effort (CPUE) & Design-based Estimates

For each Station:

CPUE = Catch / Area Swept (kg/ha)

For each Stratum:

Biomass = mean(CPUE) x Stratum Area

var(Biomass) = var(CPUE) x Stratum Area^2

Simple random sampling means and variances

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Aleutian Islands Survey Limitations

- Multi-species survey
- Species-specific catchability
  - highly contagious distributions
  - availability to trawl
    - Trawlable/untrawlable habitats
    - Depth distributions
  - trawl efficiency
    - vertical escapement
    - herding by bridles

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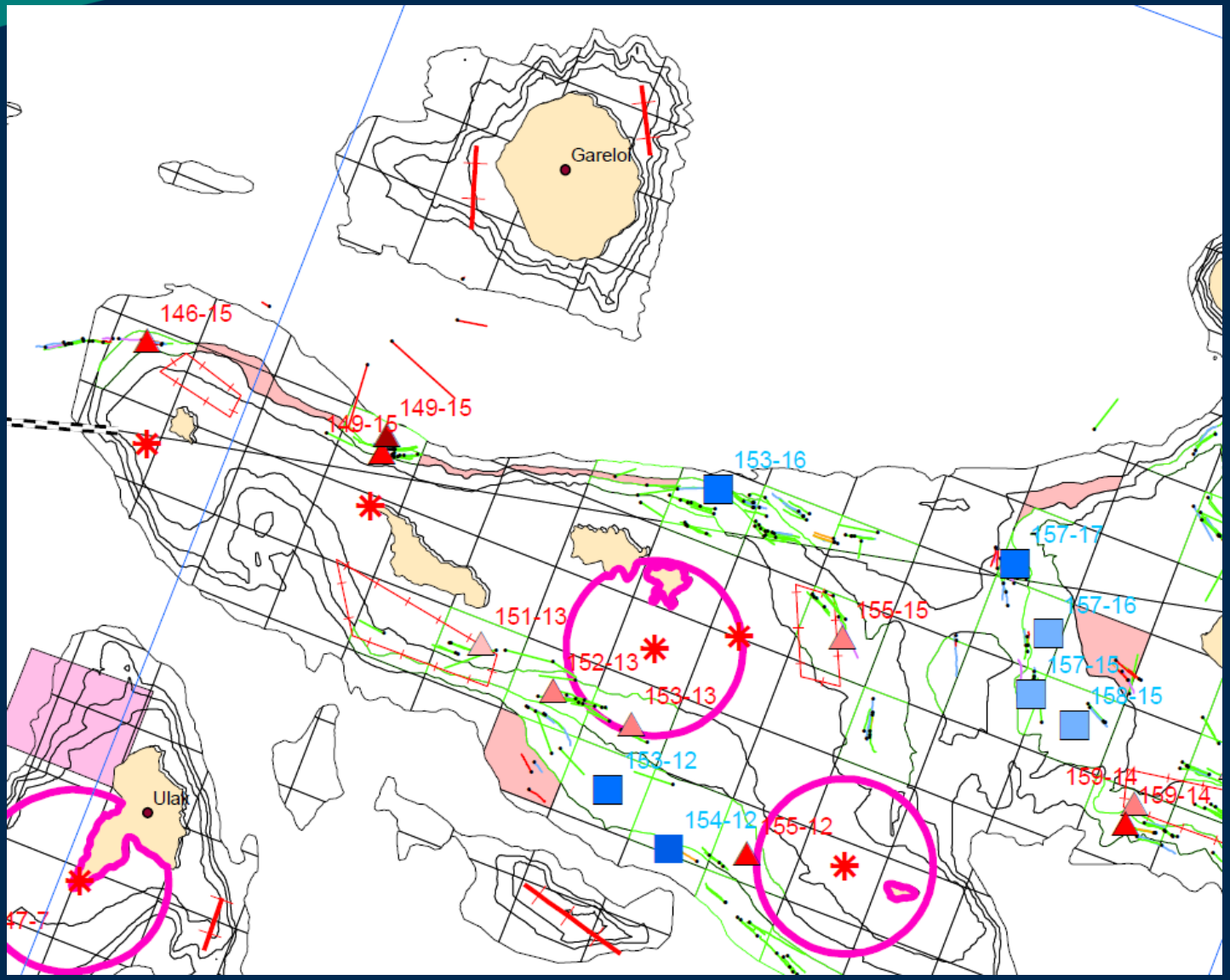
Trawlable v Untrawlable



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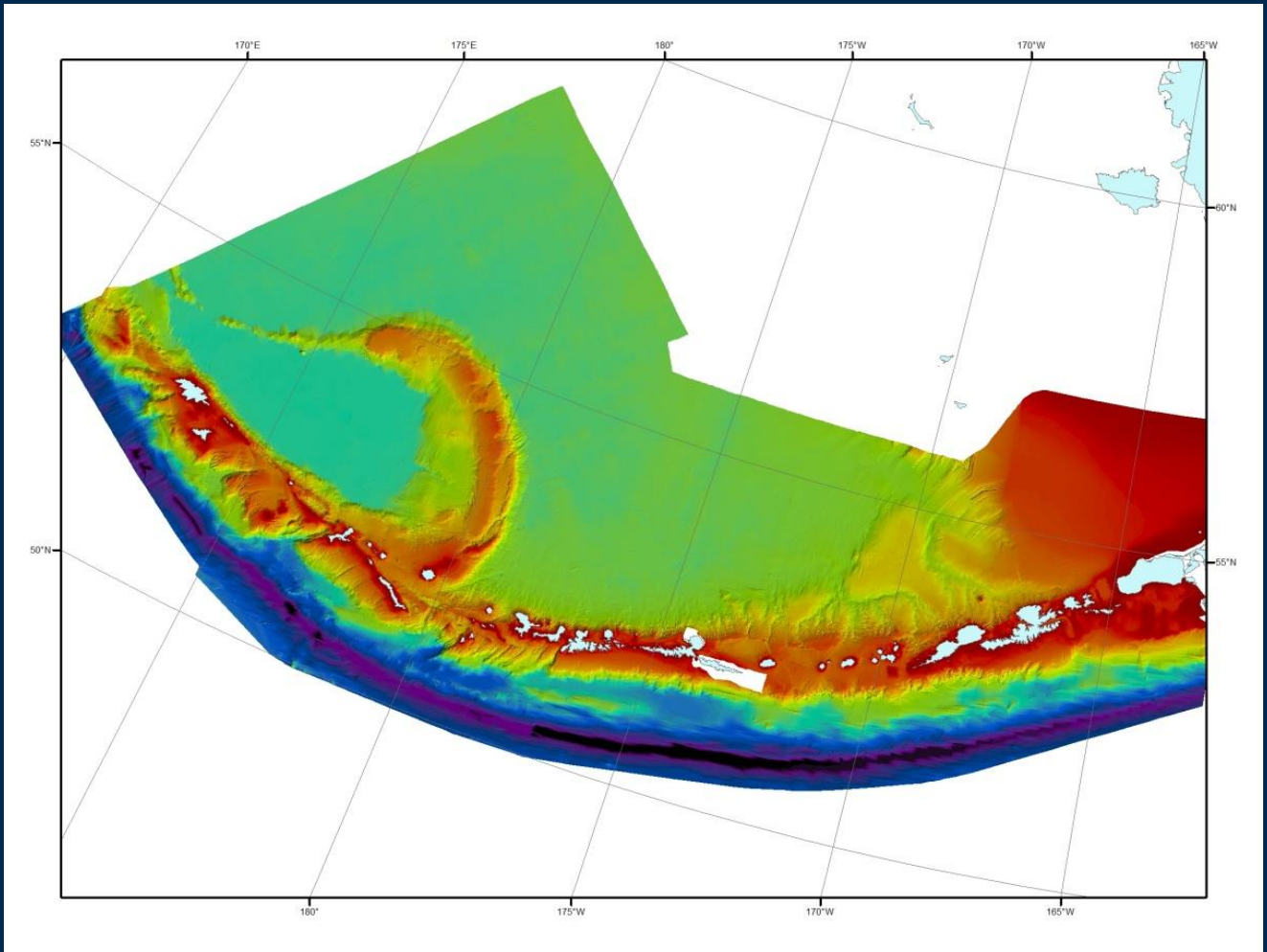
Better Bathymetry Available



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Aleutian Islands Survey Limitations

- Index of relative abundance (biomass)
- Not quite a random survey
- Not quite an index survey

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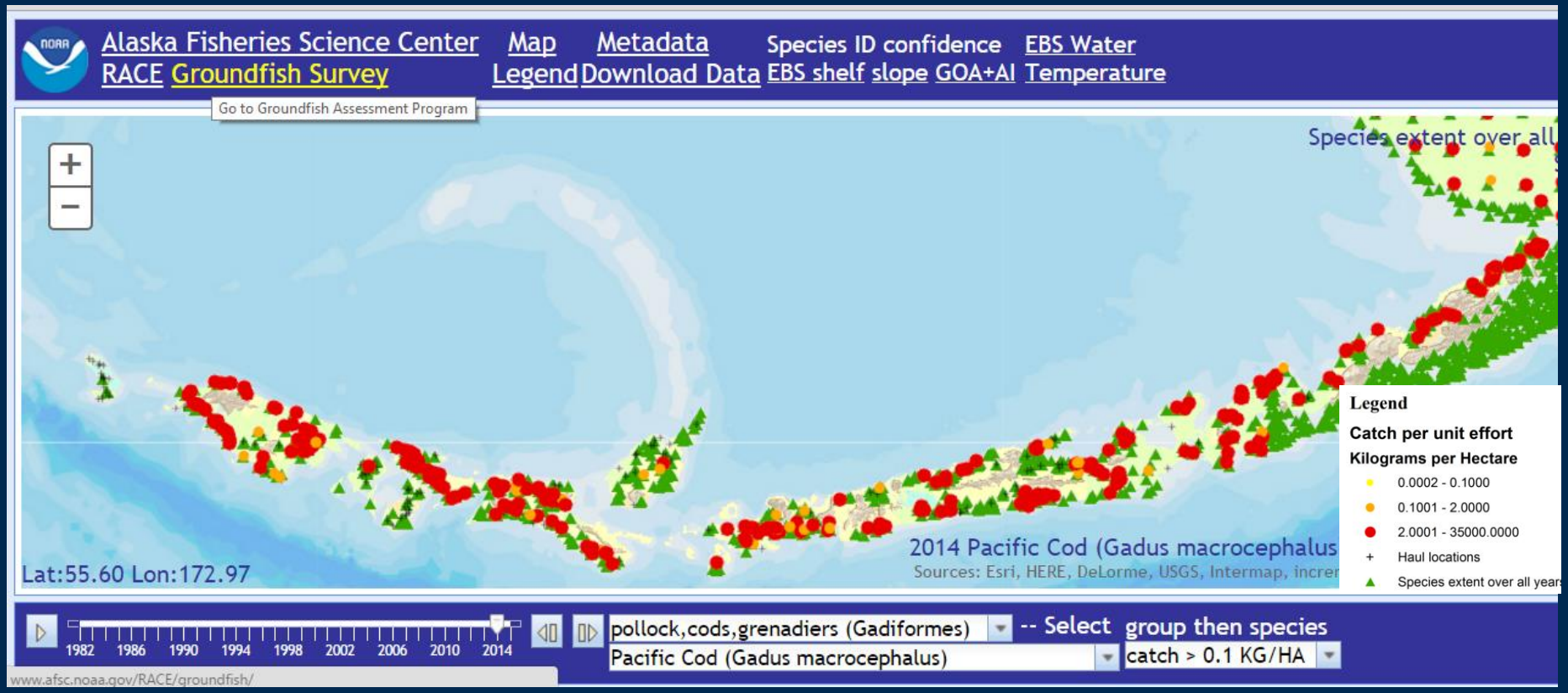
Pacific Cod Distribution



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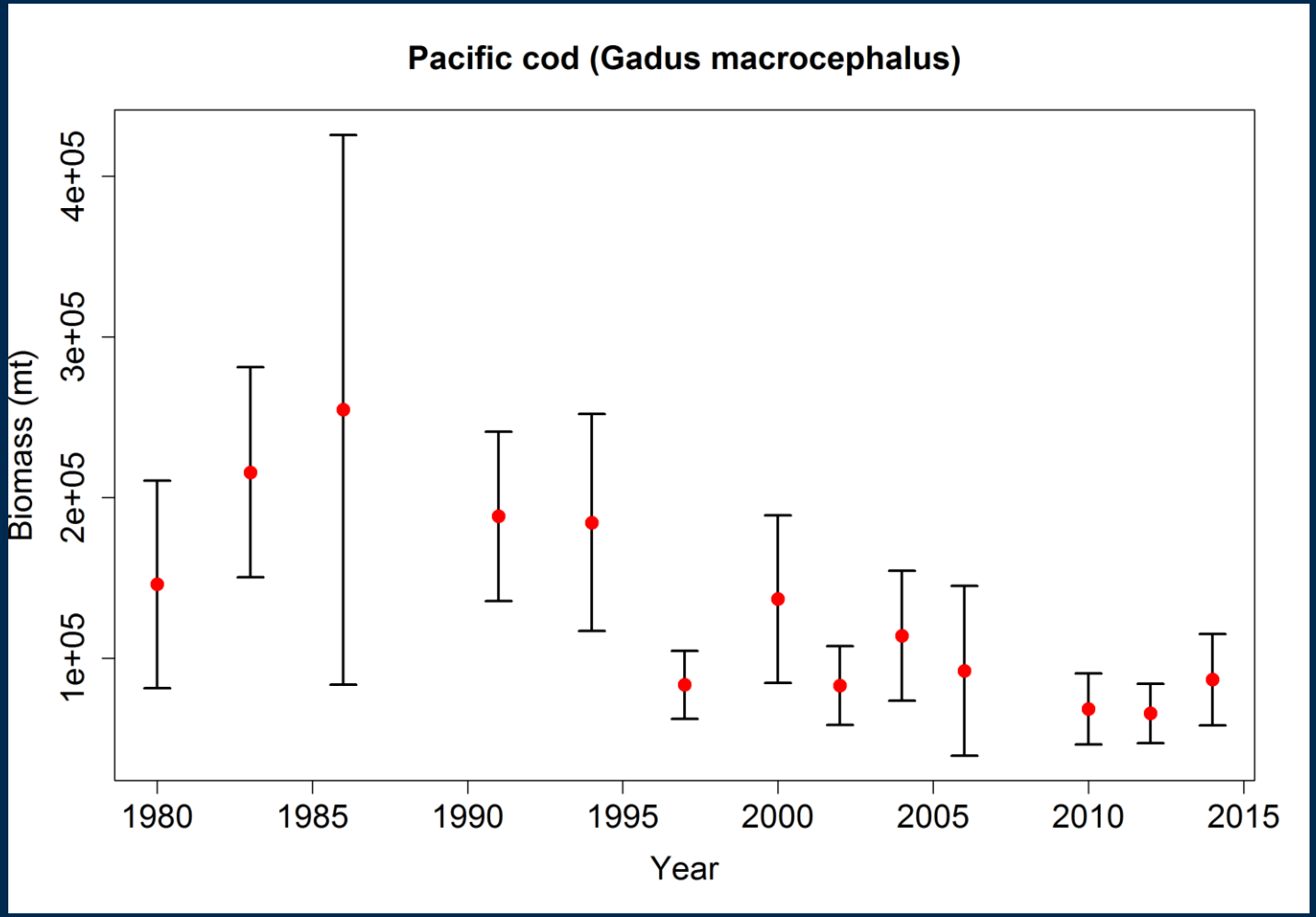
Pacific Cod Design-based Estimates



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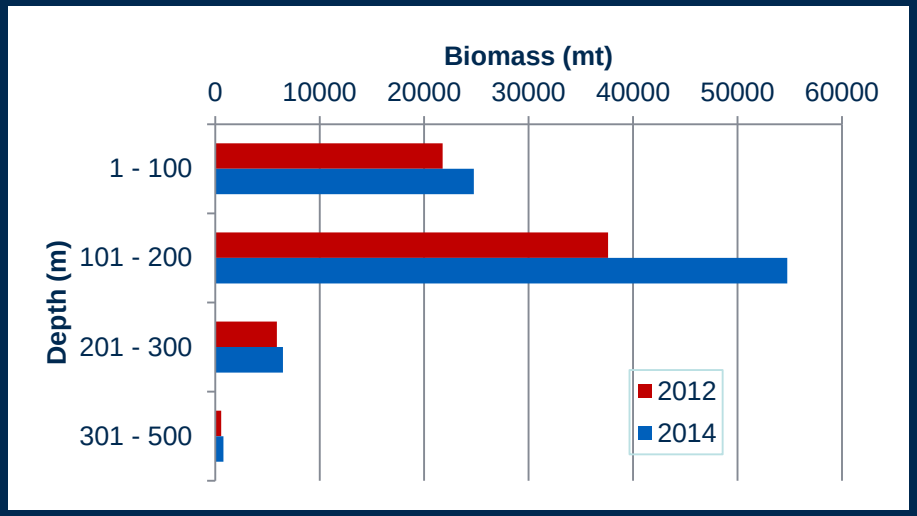
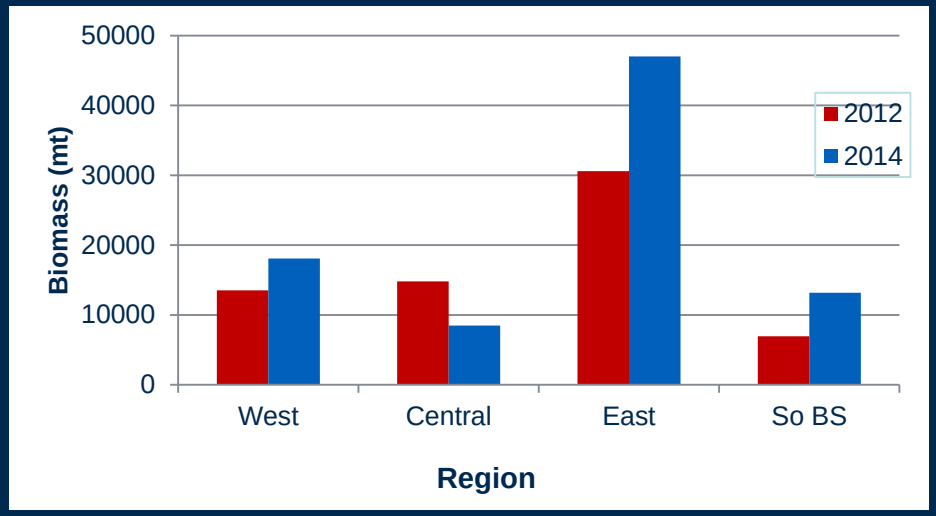
Pacific Cod
Depth and Regional Distributions





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Questions?