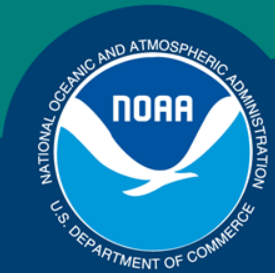


Science, Service, Stewardship



The Fishery Interaction Team: Research Overview

Libby Logerwell

Status of Stocks and Multispecies Assessment

Resource Ecology and Fisheries Management

Alaska Fisheries Science Center

**NOAA
FISHERIES
SERVICE**

Fishery Interaction Team (FIT)



Peter Munro



Susanne McDermott



Liz Connors



Kim Rand



Sandi Neidetcher



Steve Barbeaux



Libby Logerwell

FIT research

- Kodiak Island pollock localized depletion
- Cape Sarichef Pacific cod localized depletion
- Aleutian Islands Atka mackerel tagging
- Aleutian Islands SSL consumption model
- Aleutian Islands cooperative pollock survey
- Bering Sea Pacific cod tagging
- BSAI Pacific cod reproductive maturity

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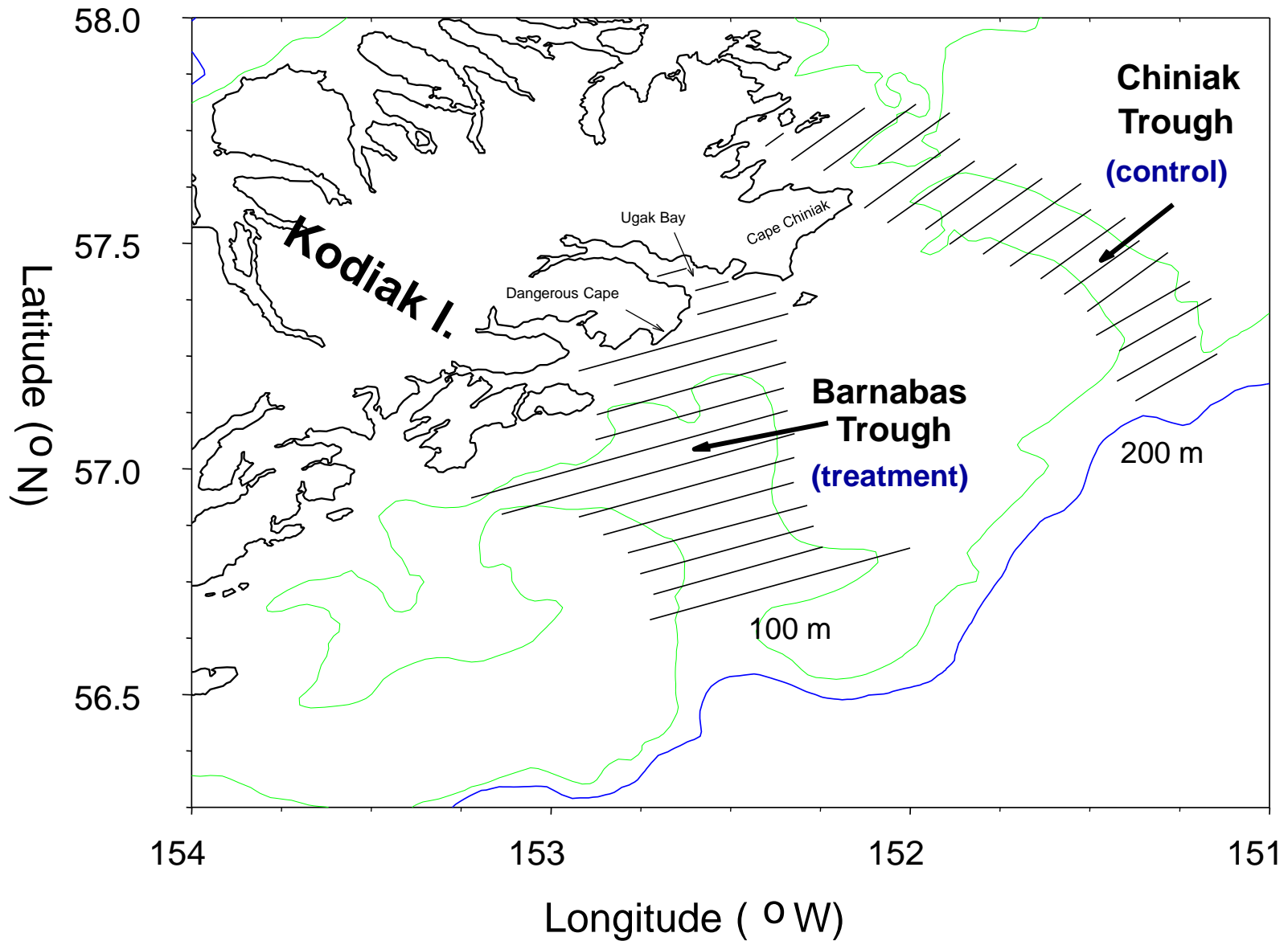
Walleye pollock Kodiak project overview

- P.I.s
 - Chris Wilson and Paul Walline (RACE)
 - Anne Hollowed (REFM)
- At-sea experiment to examine localized depletion or disturbance of prey fields due to fishing
- Acoustic surveys before and after the start of commercial fishing in late August
- Sites open (Barnabus) and closed (Chiniak) to fishing
- Paper published (Walline *et al.* Can. J. Fish. Aquat. Sci. 69: 354-368)

Pollock – Study area



Pollock – Study site



Walleye pollock – Project history

- 2000 feasibility study (fishery closed)
- 2001 full survey, fishery removals 2853 mt
- 2002 full survey, virtually no fishing effort (300 mt)
- 2004 full survey, fishery removals 1723 mt
- 2006 full survey, fishery removals 750 mt

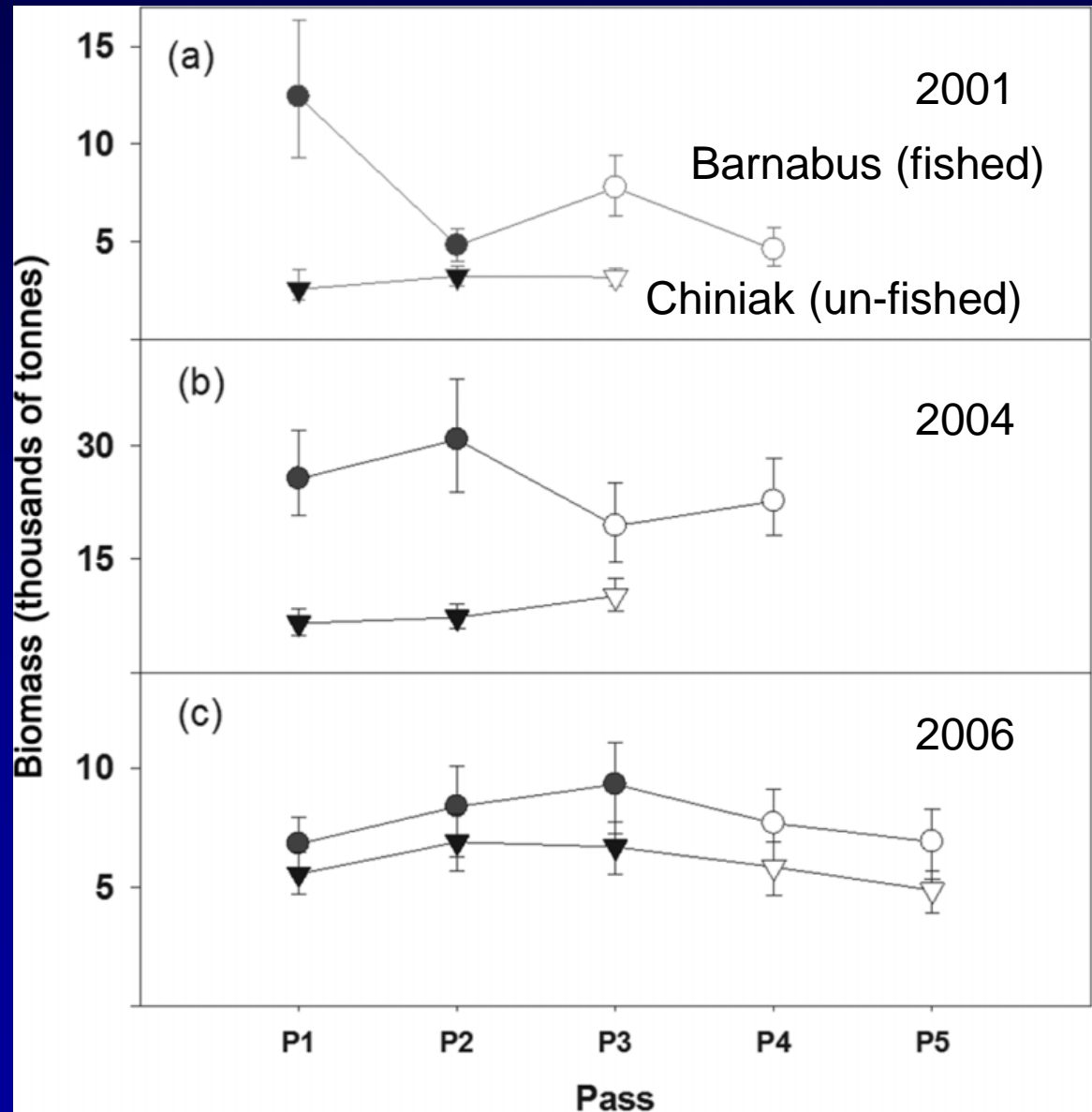
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Results

Solid symbols=pre-fishery

Open symbols=fishery



Conclusions

- Pollock abundance estimates for Barnabas Trough in 2001 exhibited high variability, but not in response to fishing.
- Response to fishing could explain the decrease in abundance of adult pollock observed between the pre-fishing and fishing periods in 2004.
- Abundance was not significantly lower during fishing in either trough in 2006.
- Changes in pollock abundance caused by fishery are likely small compared to natural fluctuations.

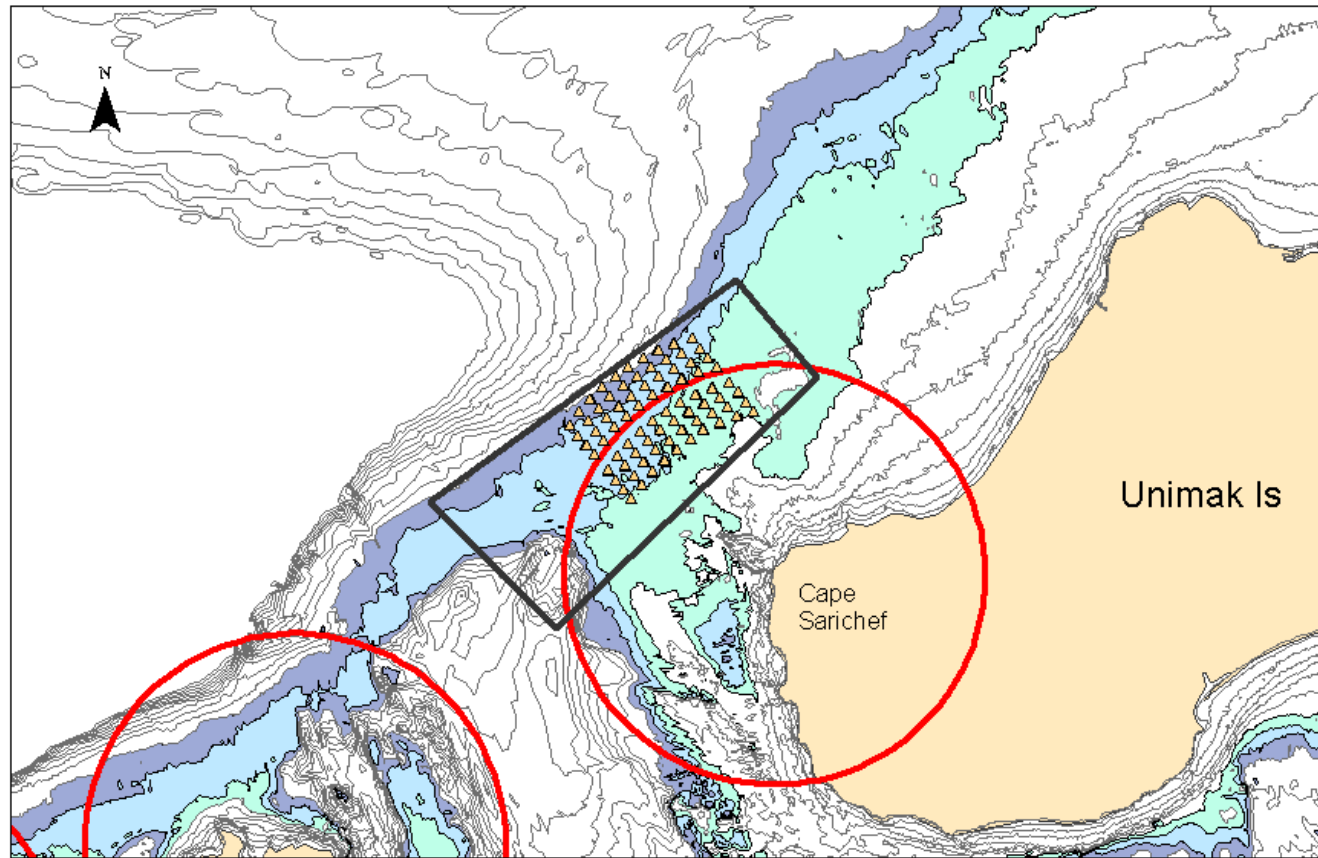
Pacific cod

Cape Sarichef project overview

- Peter Munro and Liz Conners
- Research pots
- Experimental design
 - Chartered crab pot vessels
 - Before (January) and after (March) most intensive commercial fishing
 - Inside (control) and outside (treatment) trawl exclusion zone at Cape Sarichef
- Paper published (Conners and Munro 2008
Fishery Bulletin 106:281-292)

Pacific cod – Study site

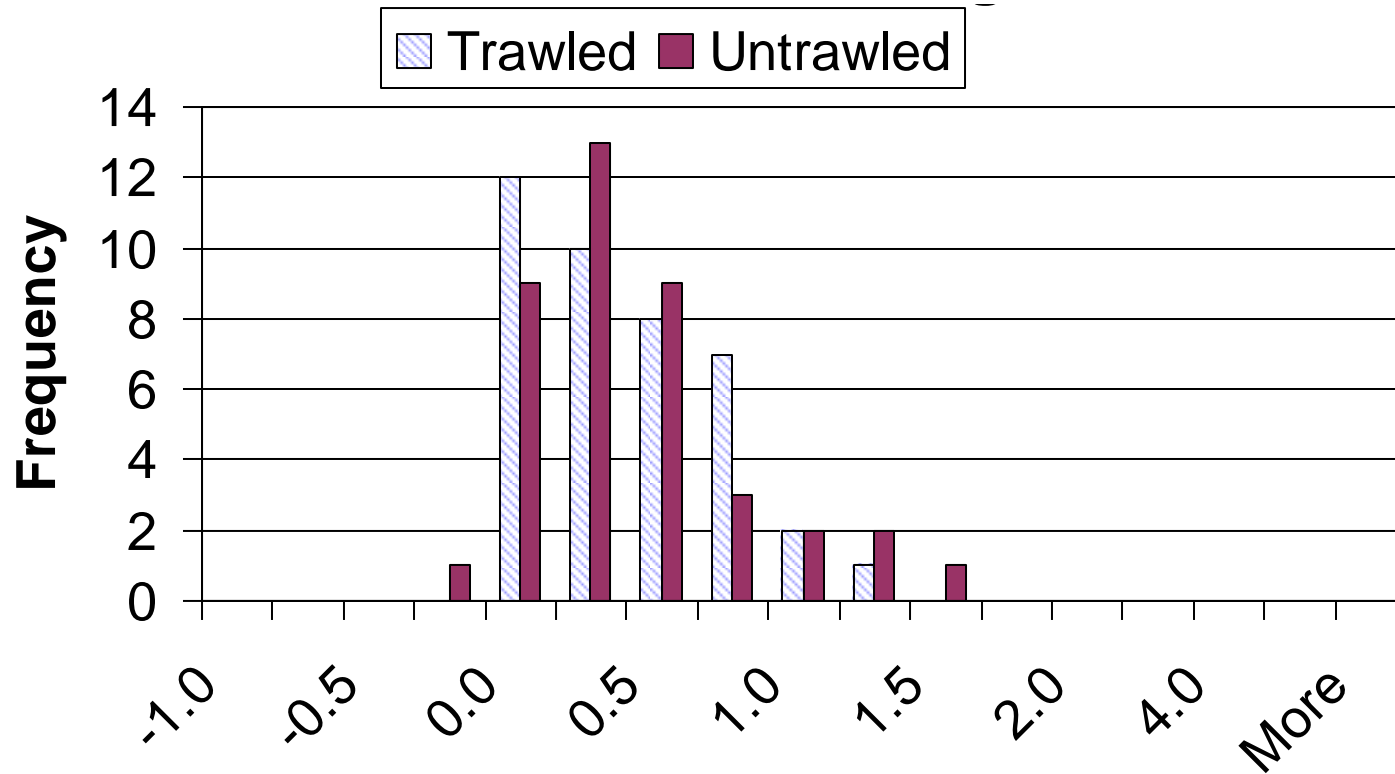
Figure 3. Cod Pot Local Abundance Study Area off Cape Sarichef.
Triangles indicate 2003 study sites, shaded depths 70-90 m.



Pacific cod – Project history

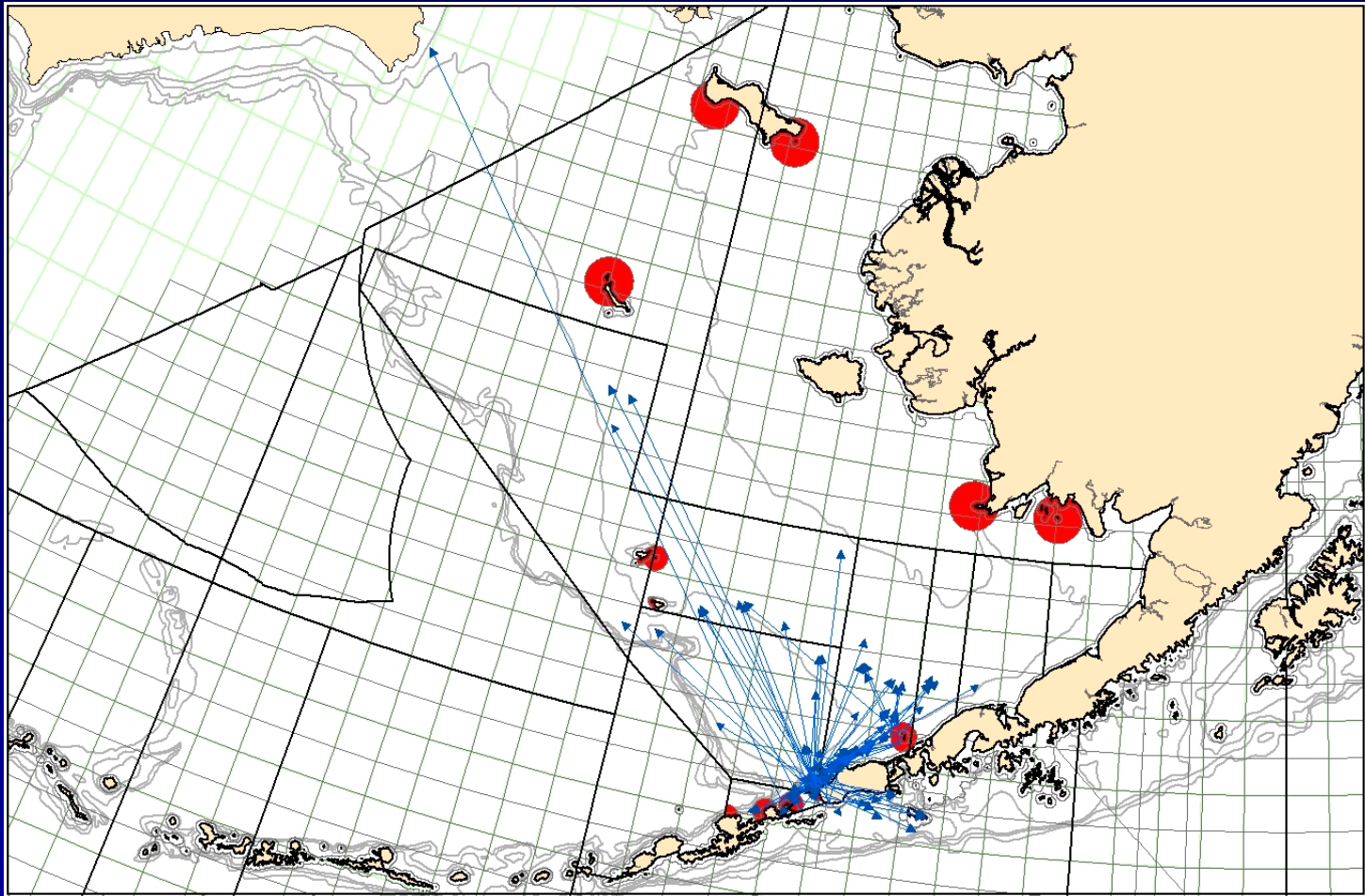
- 2001 feasibility and gear development
- 2002 pilot study
- 2003 experiment not fully successful
 - “before” sampling not complete due to weather and equipment problems
 - 6,000 tagged cod released
- 2004, 2005 successful experiments

Percent change in # cod from before (January) to after (March) commercial trawling - 2005



~50% increase in cod abundance, trawled and untrawled
Wilcoxin Rank-Sum Test for difference in means: $p=0.807$
Power: 75-95% chance of detecting 20% reduction in catch

Distance and direction between release and recovery of tagged Pacific cod



Conclusions

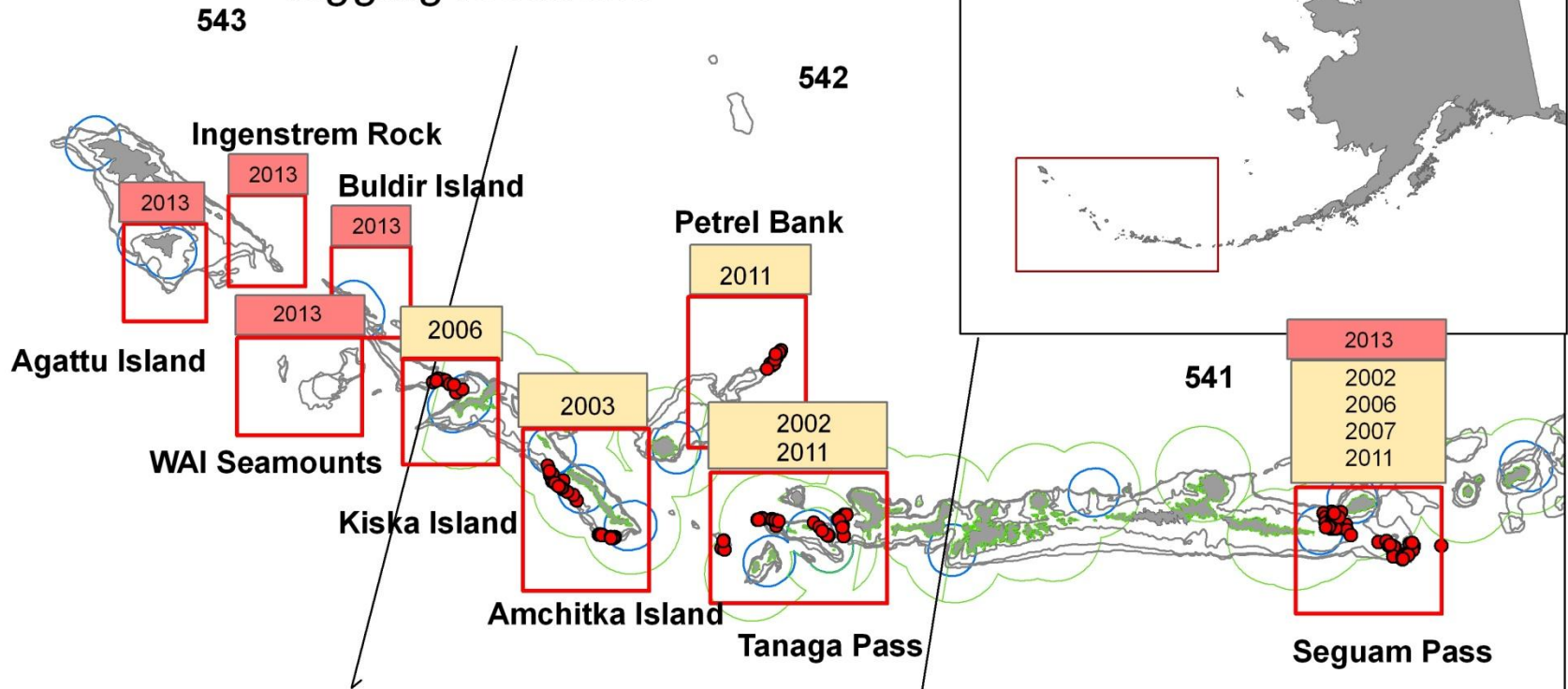
- No difference in seasonal rate of change of Pacific cod abundance between fished and un-fished areas
- Opportunistic tagging studies showed that cod were highly mobile at a spatial scale greater than the no-trawl zone

Atka mackerel

Tagging project overview

- P.I.s
 - Susanne McDermott and Libby Logerwell
- Evaluate efficacy of trawl exclusion zones
 - Do fish move from inside to outside?
 - What is the abundance of fish inside?
- Mark-recapture
 - Inside and outside trawl exclusion zones
 - Fish tagged and released in summer
 - Fish recovered in fall and winter
 - Commercial vessels outside zones
 - Chartered vessel inside* and outside zones

Atka mackerel previous and proposed tagging locations

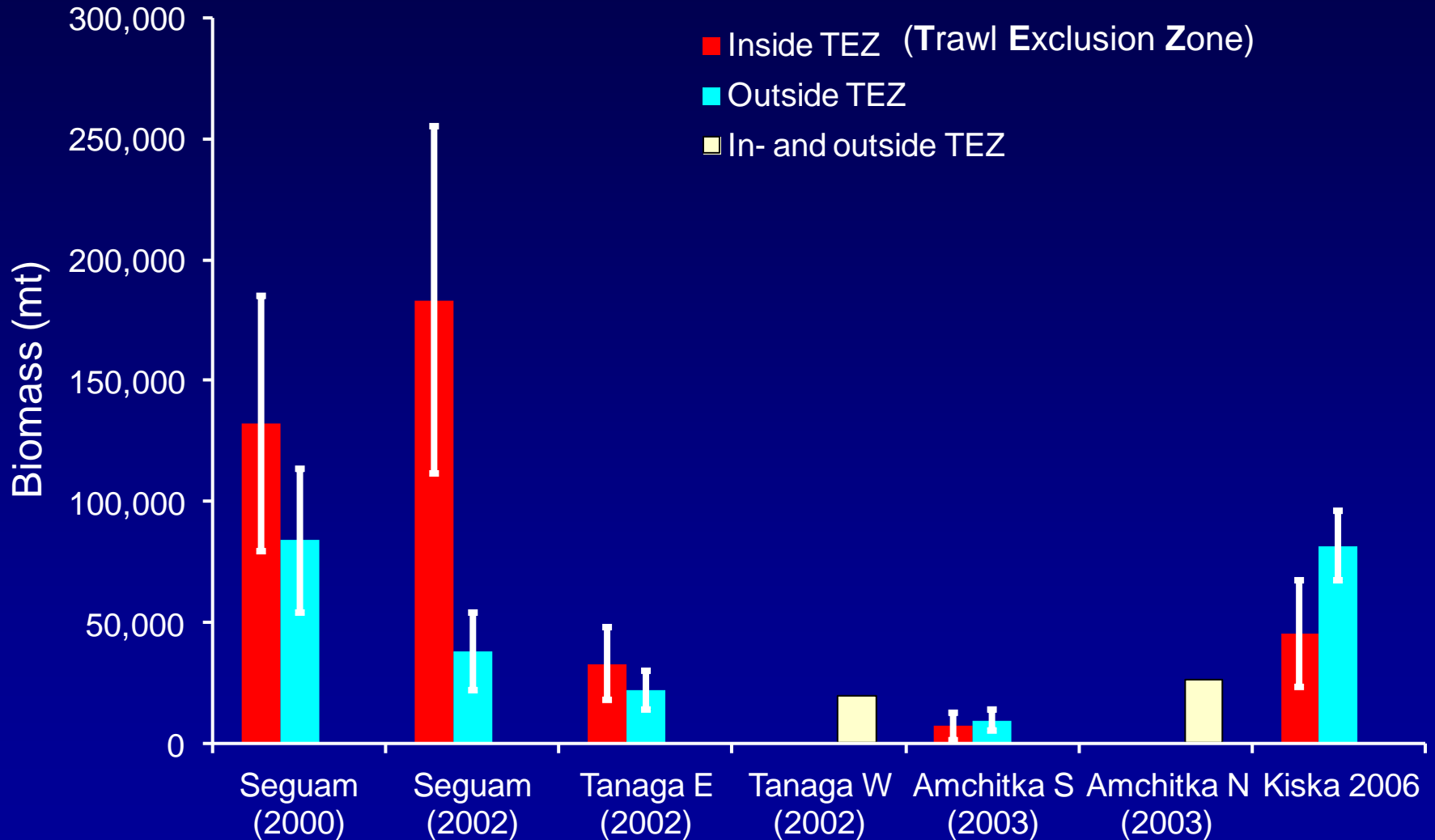


● Atka tag release locations

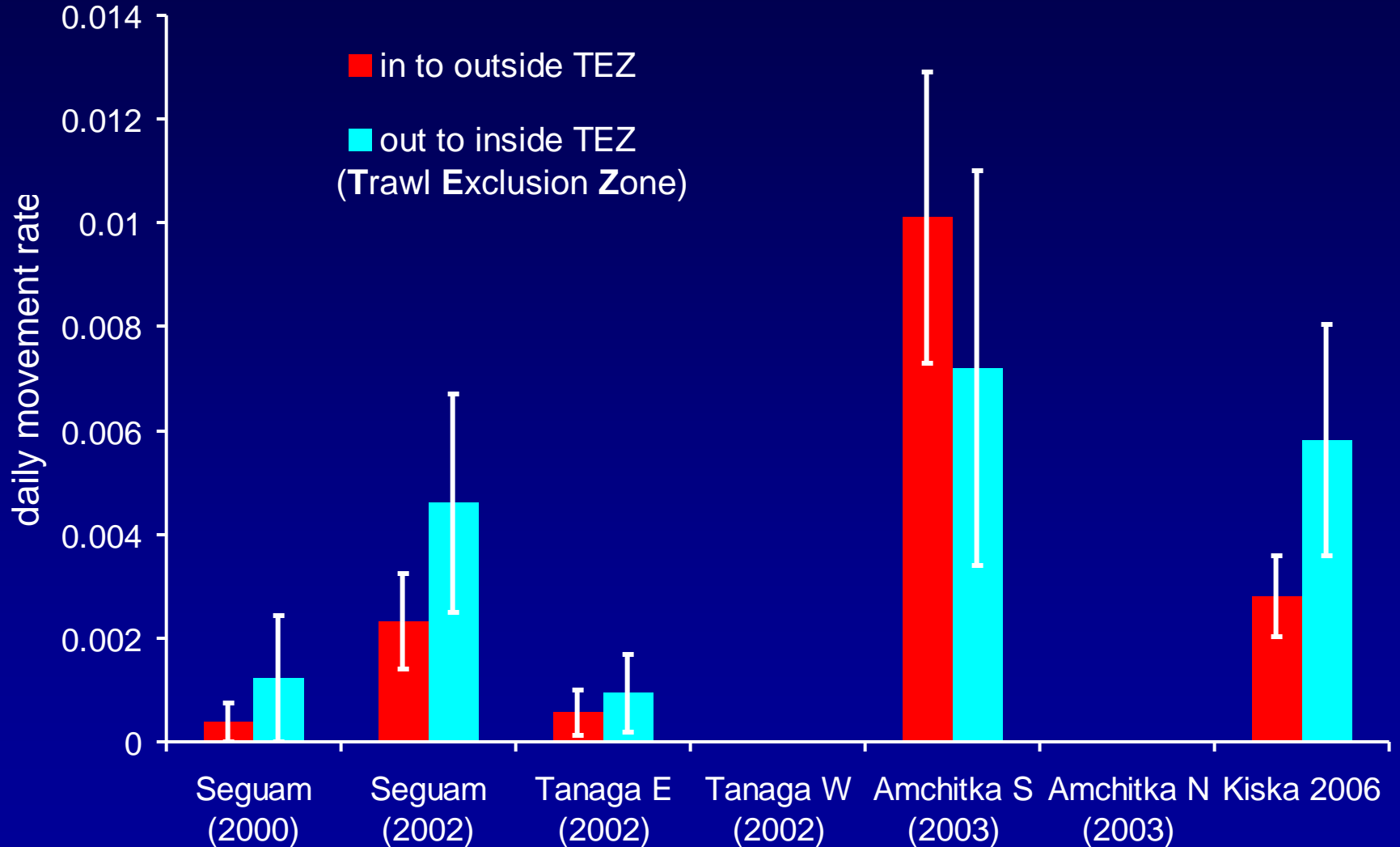
0 75 150 300 Kilometers



Biomass estimates



Movement rate



Conclusions

- Efficacy of trawl exclusion zones at mitigating competition between sea lions and commercial fisheries varies geographically
- Do fish move from inside to outside?
 - Small movement at Seguam, Tanaga and Kiska
 - Large movement at Amchitka
- What is the abundance of fish inside?
 - Large biomass at Seguam, Tanaga and Kiska
 - Small biomass at Amchitka

Underwater Video Camera

(Courtesy of Bob Lauth)

- Underwater camera tows
- At tagging and recovery haul locations
- First step to develop tool for untrawlable grounds



Steller Sea Lion Satellite Tagging

(Tom Gelatt, Brian Fadely, Michelle Lander)

- November 1st 2011 one adult female was tagged on Ulak Island
- Satellite locations collected from November 2011- January 2012
- Overlap with area of Atka mackerel tagging

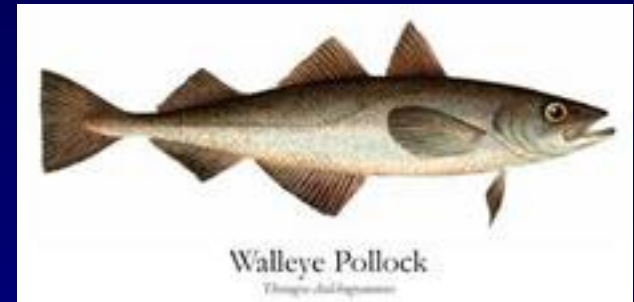
SSL consumption of Atka mackerel

- Ivonne Ortiz, L. Logerwell
- Is there enough Atka mackerel production inside Trawl Exclusion Zones (TEZs) to support Steller sea lions?
- Construct a small-scale food web model for each TEZ

Small-scale food web model



Steller sea lions



Fish predators:
Pollock
Halibut
Pacific cod
Arrowtooth Flounder
Skates

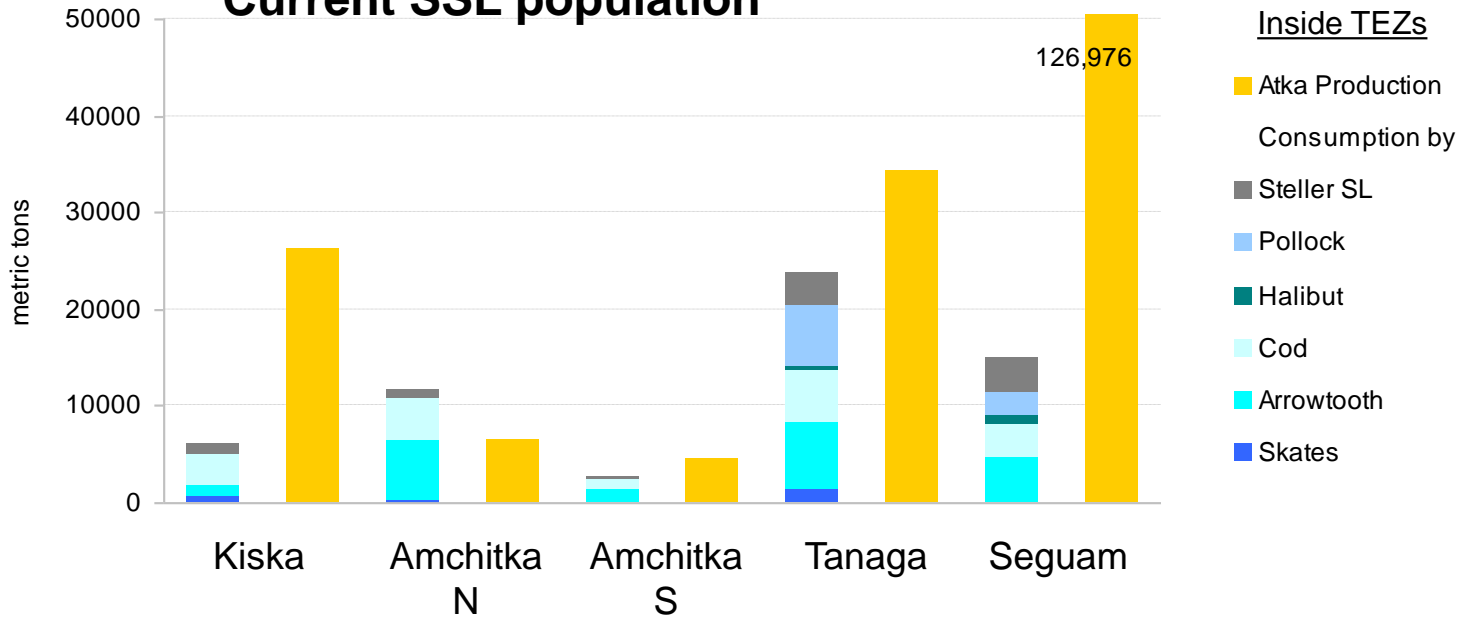


Atka mackerel
Production

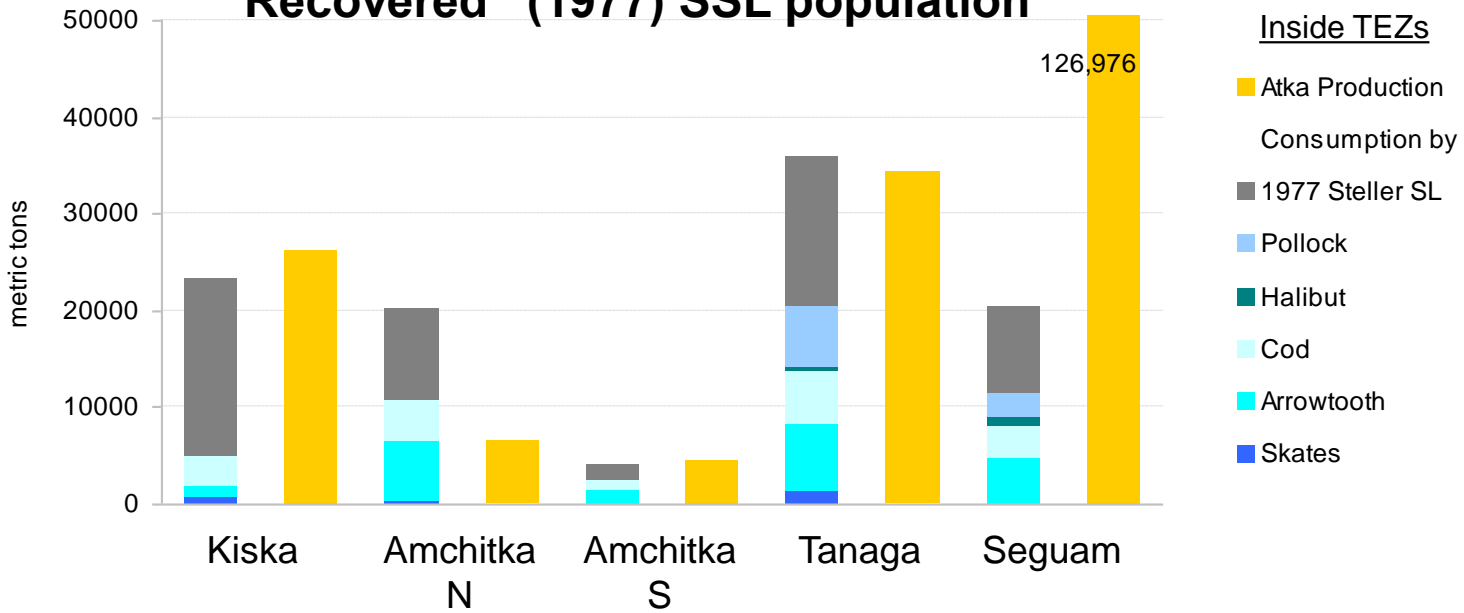
Model data

- Atka mackerel
 - Biomass from tag model
 - Production rate (P/B) from Aleutian EcoPath model
- Steller sea lions
 - Biomass from derived counts, age-structure, sex ratio, pregnancy rate, and weight-at-age
 - Diet from scat collections
 - Consumption rate (Q/B) from Aleutian EcoPath model
- Fish predators
 - Biomass from trawl survey
 - Diet from trawl survey collections
 - Consumption rate (Q/B) from Aleutian EcoPath model

Current SSL population



"Recovered" (1977) SSL population



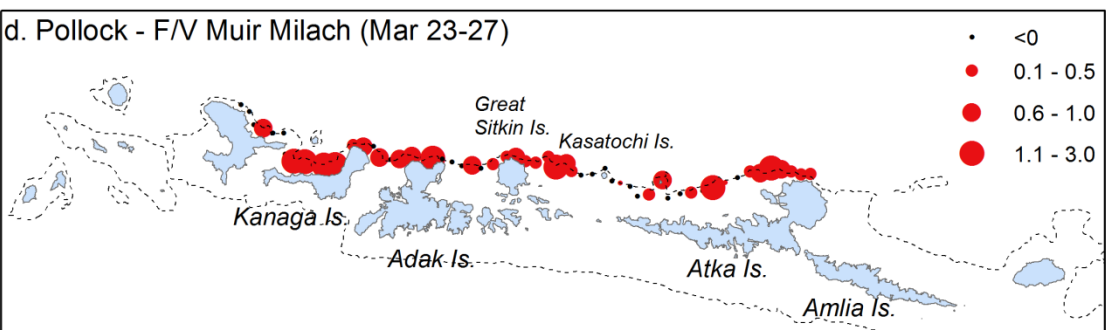
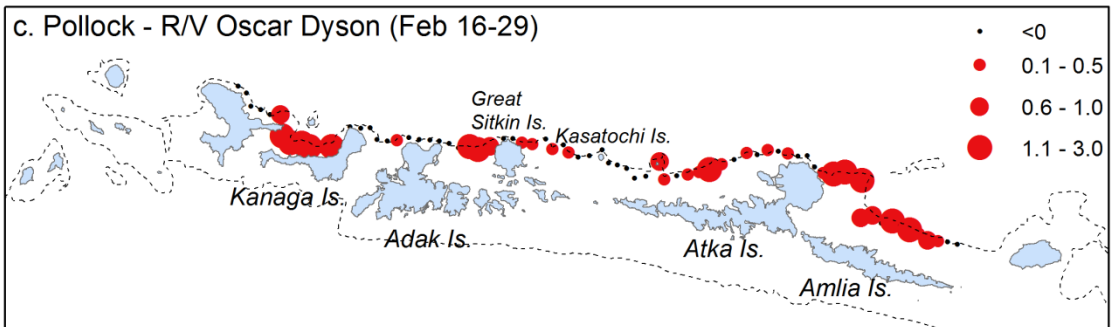
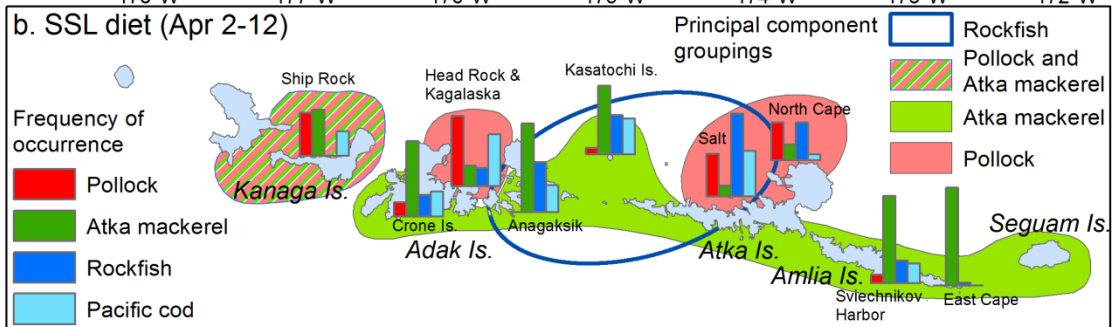
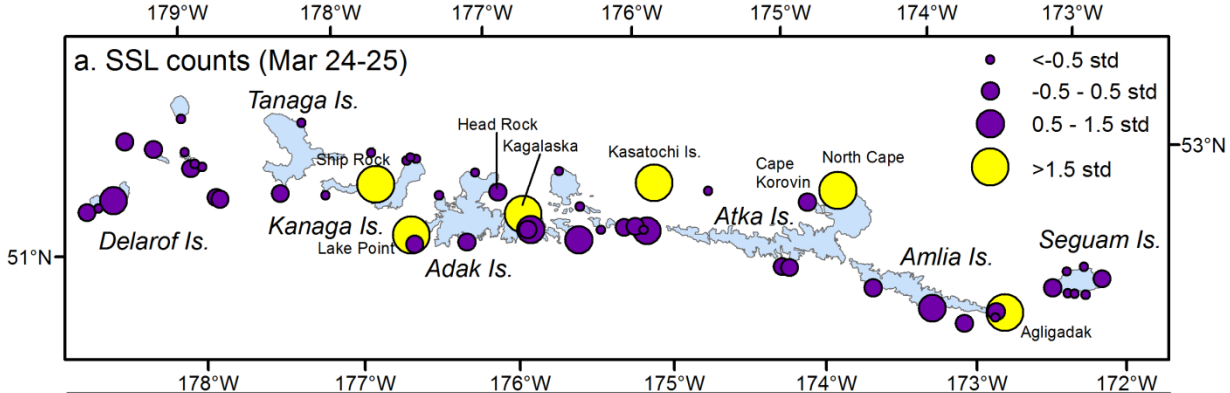
2008 Aleutian Islands Cooperative Acoustic Survey Study

- **L. Logerwell, S. Barbeaux, L. Fritz**
- **Funded by NPRB (Project #730)**
- **Goal:**
 - Whether cooperative biomass assessments and surveys could be an effective way to manage fisheries at the local scales that are important to predators such as Steller sea lions.
- **Methods:**
 - Nighttime acoustic survey 173°-178° W Longitude on board the R/V Oscar Dyson, Feb. 16 – 29, 2008
 - Aerial survey of Steller sea lion rookery and haulouts from 173°-179° W longitude, Mar. 23 - 29
 - SSL scat sampling of haulouts and rookeries from 173°-179° W longitude, Mar. 30 – Apr. 9
 - Nighttime cooperative acoustic survey 174°-178° W Longitude using F/V Muir Milach, Mar. 23-27 , same transects as R/V Oscar Dyson survey

F/V Muir Milach



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



Conclusions

- Results from the *F/V Muir Milach*, although more variable, closely match the *R/V Oscar Dyson* survey.
- Pollock abundance in the Central Aleutian Islands remains low.
- The diets of Steller sea lions on haul-outs near areas where high densities of pollock were observed showed high frequency of occurrence of pollock.
- Local pollock aggregations are important for sea lions in the central Aleutians during winter.
- Paper (Logerwell et al.) approved to be submitted to Marine Ecology Progress Series

Future?

- Management strategy simulations to examine potential indirect effects of fisheries on Steller sea lions
 - Workshops with experts in fish ecology, fisheries management, sea lion ecology and modeling
 - Simulate different amounts of fishing in different areas over several years
 - Examine effects on groundfish and sea lion feeding, growth, reproduction, etc.
 - Identify knowledge gaps and design field studies to fill them.
- Process-oriented studies of the effects of targeted fishing removals, fish movement and oceanography

Contact information

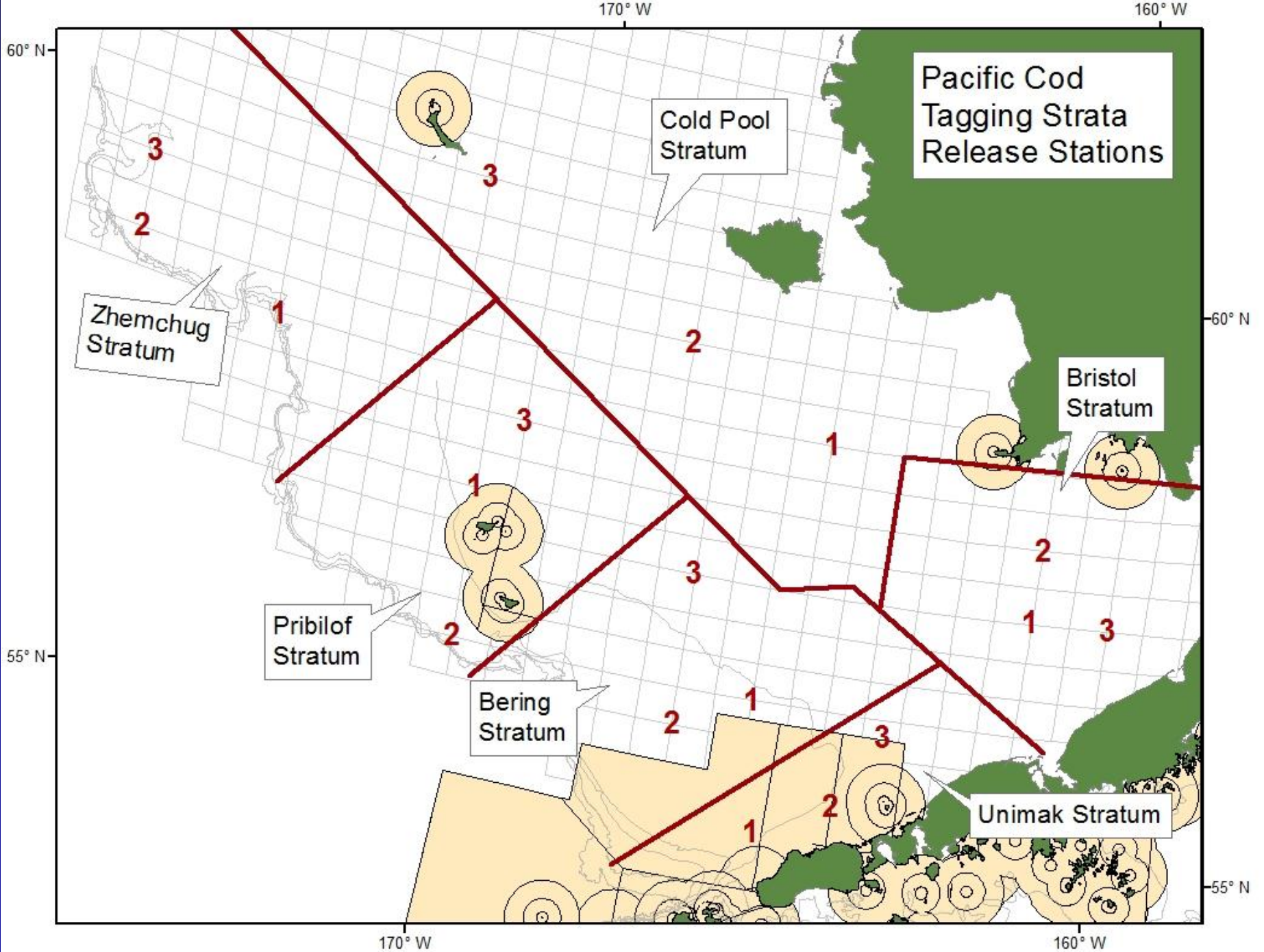
<http://www.afsc.noaa.gov/refm/stocks/fit/FIT.htm>

Libby.Logerwell@noaa.gov

206-526-4231

Pacific cod tagging – Bering Sea

- Purpose
 - Estimate movement from fall to winter
 - Large geographic areas
- Mark-recapture
 - Tagging in fall 2012 (chartered pot vessel)
 - Tag recovery in winter 2013
 - Commercial fishery
 - Chartered head-and-gut trawlers



Pacific Cod
Tagging Strata
Release Stations

Cold Pool
Stratum

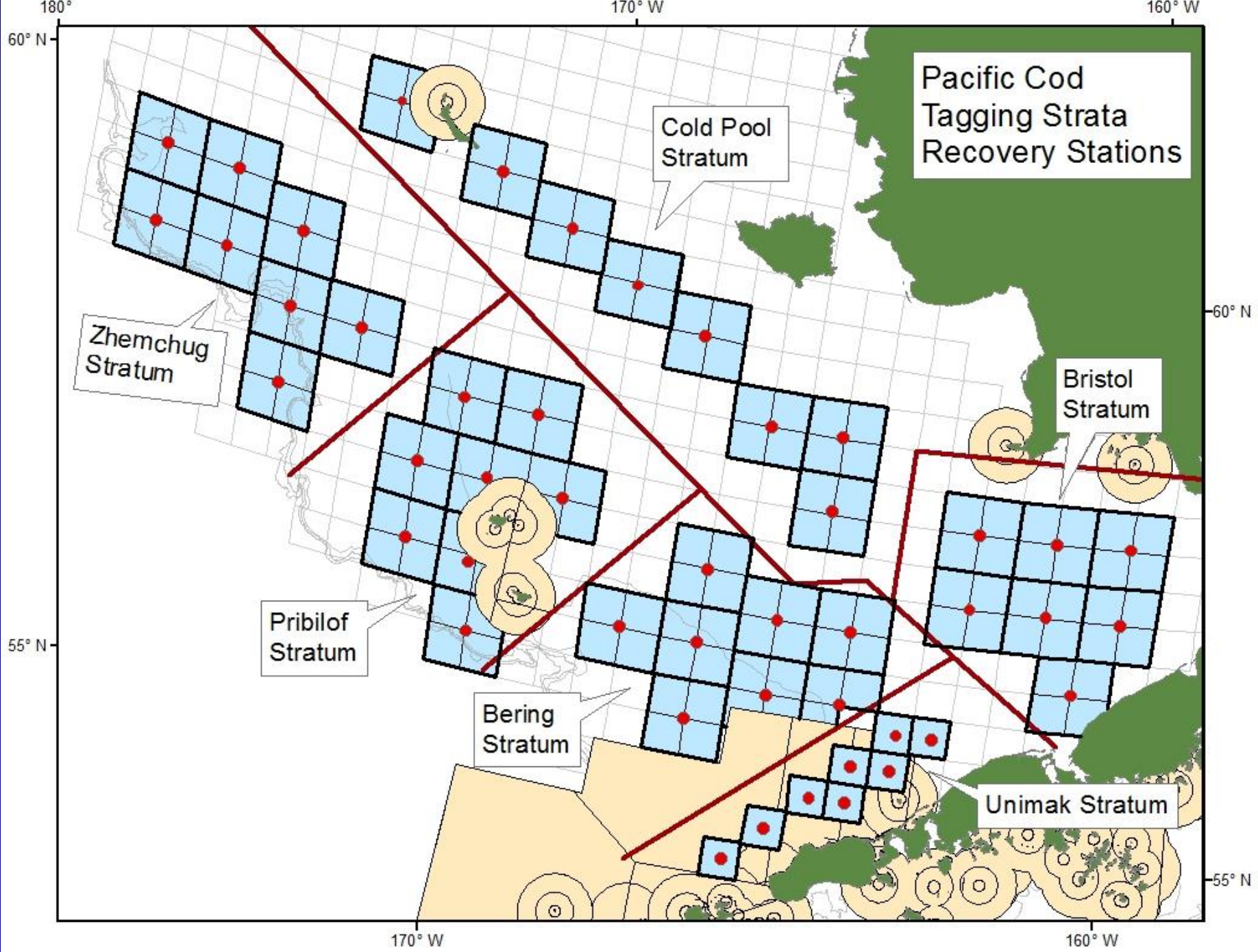
Zhemchug
Stratum

Bristol
Stratum

Pribilof
Stratum

Bering
Stratum

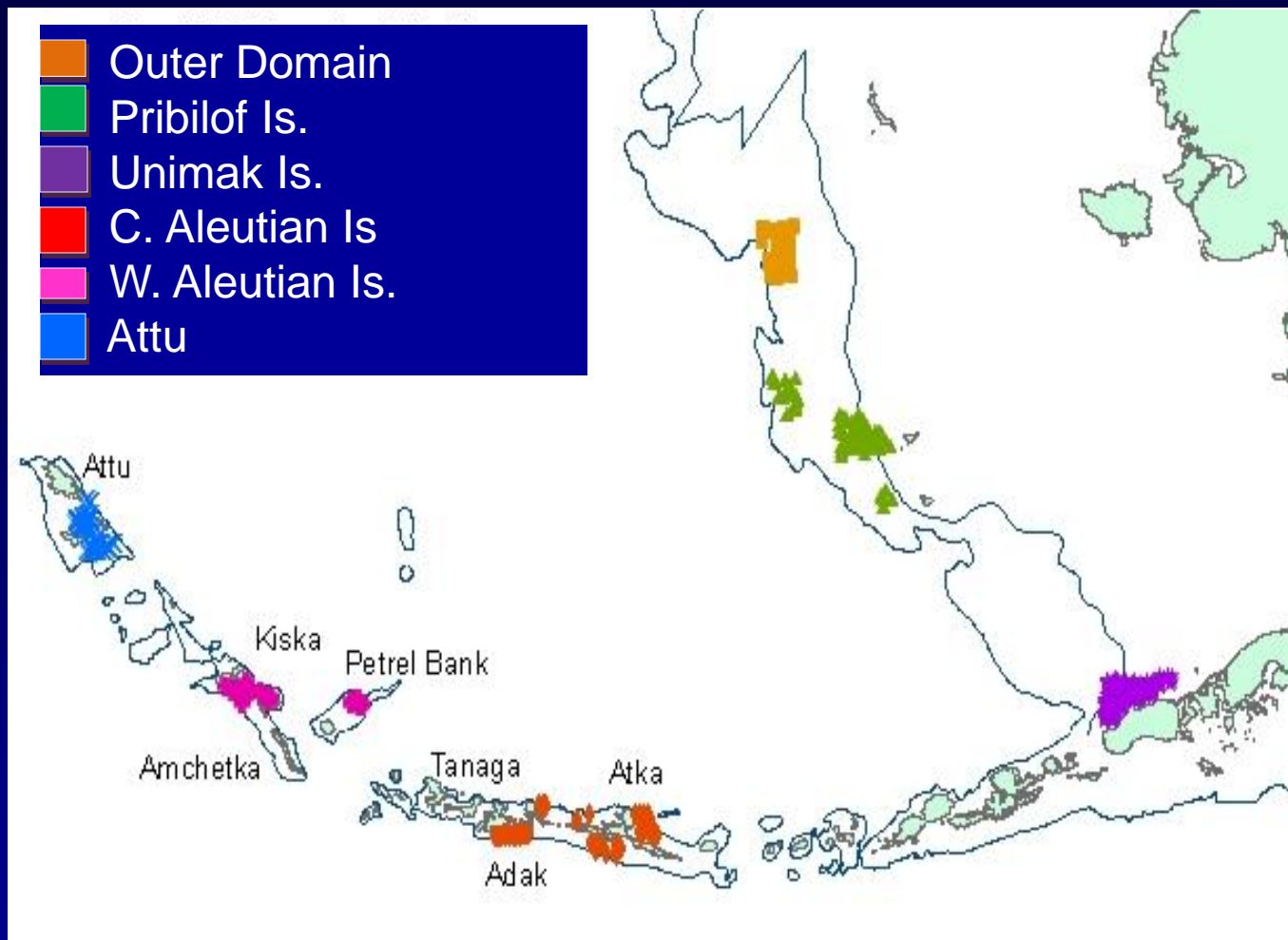
Unimak Stratum



Pacific cod maturity

- **Develop and deploy gross anatomical keys:**
 - trained and equipped FMA groundfish observers deployed on commercial vessels in the Bering Sea and Aleutian Islands
- **Validate visual keys with histological staging:**
 - observers collected ovary tissue samples from same fish assessed for gross anatomical maturity
- **Analyze temporal and spatial spawning patterns:**
 - Mapping spawning locations
 - Phenology charts

2005 Pacific cod spawning hot spots identified by observer assessed maturity



Month	Week	Outer Domain	Pribilof	Unimak	Central Aleutians	Western Aleutians	Attu
February	3						
	4						
March	1						
	2						
	3						
	4						
April	1						

Spawning phenology for hot spot location showing peak spawning