Science, Service, Stewardship

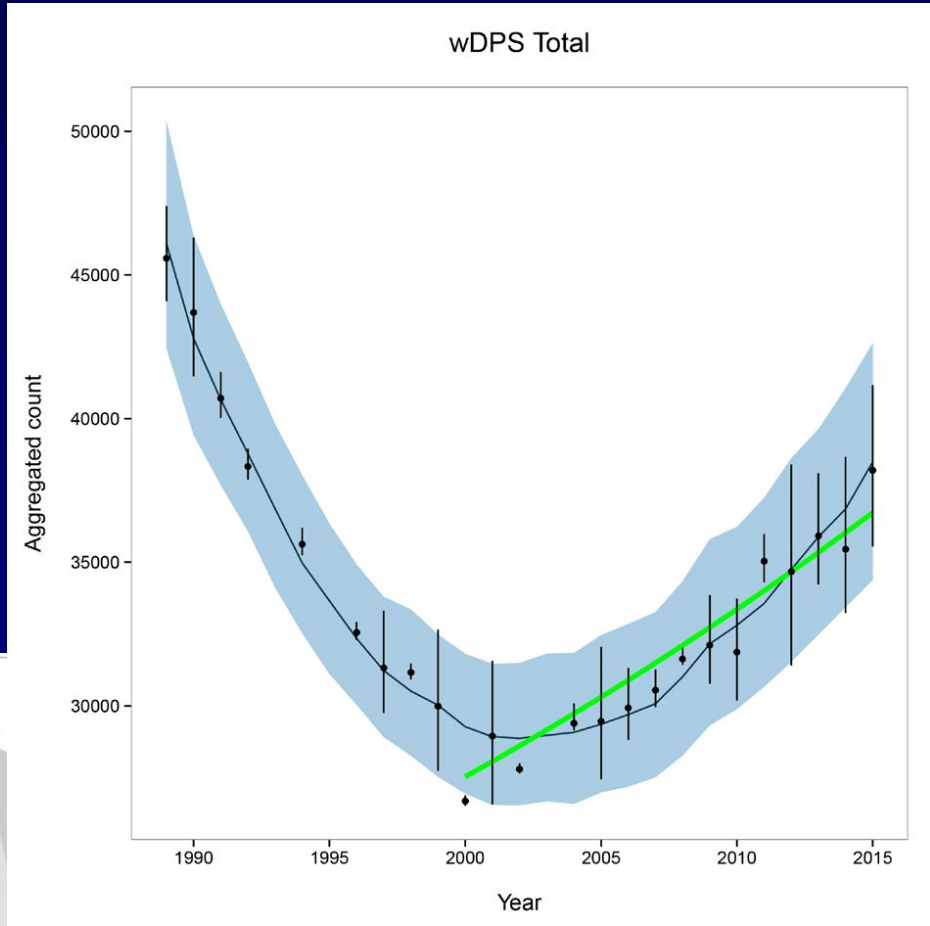
The Fishery Interaction Team (2001 – 2016) The potential effects of commercial fishing on endangered Steller sea lions

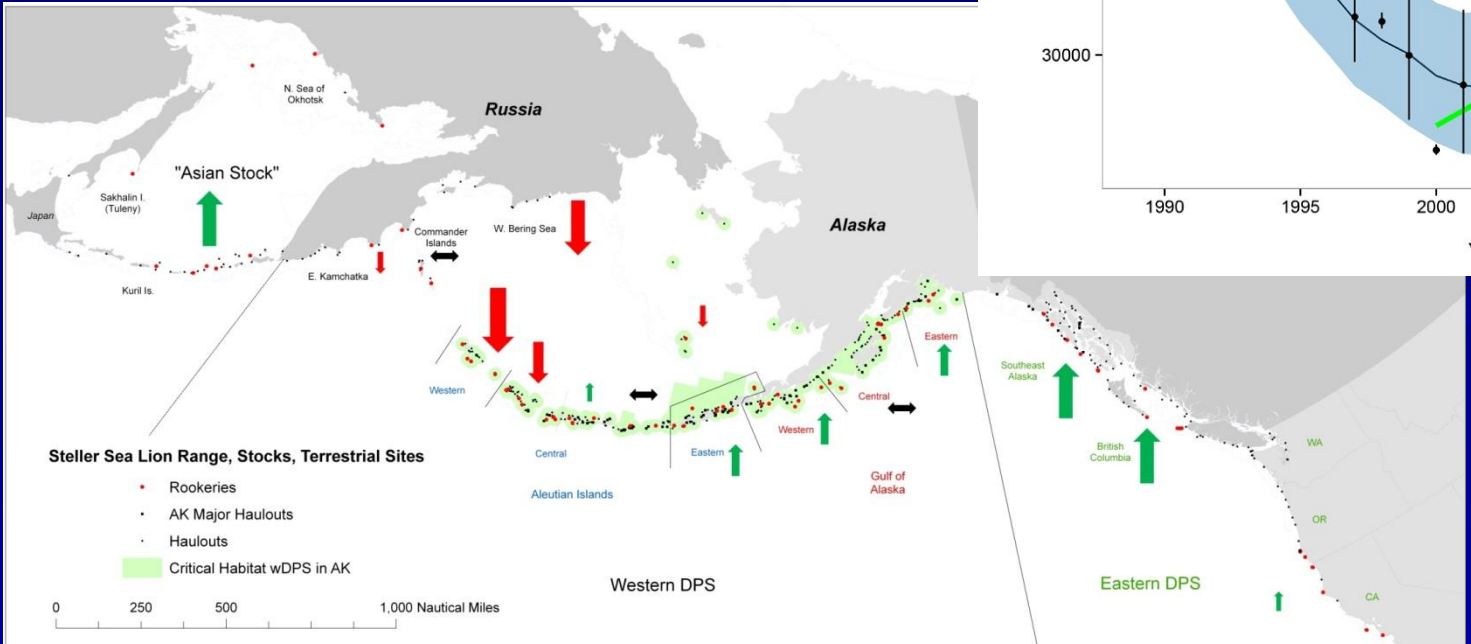
Status of Stocks and Multispecies Assessment
Resource Ecology and Fisheries Management
Alaska Fisheries Science Center

Presented by: Libby Logerwell

NOAA FISHERIES SERVICE

Decline of the western stock of Steller sea lions





Hypotheses to explain the decline

- Intentional and unintentional “takes”
- Climate change
- Disease, pathogens and toxins
- Predators
- Competition with groundfish fisheries

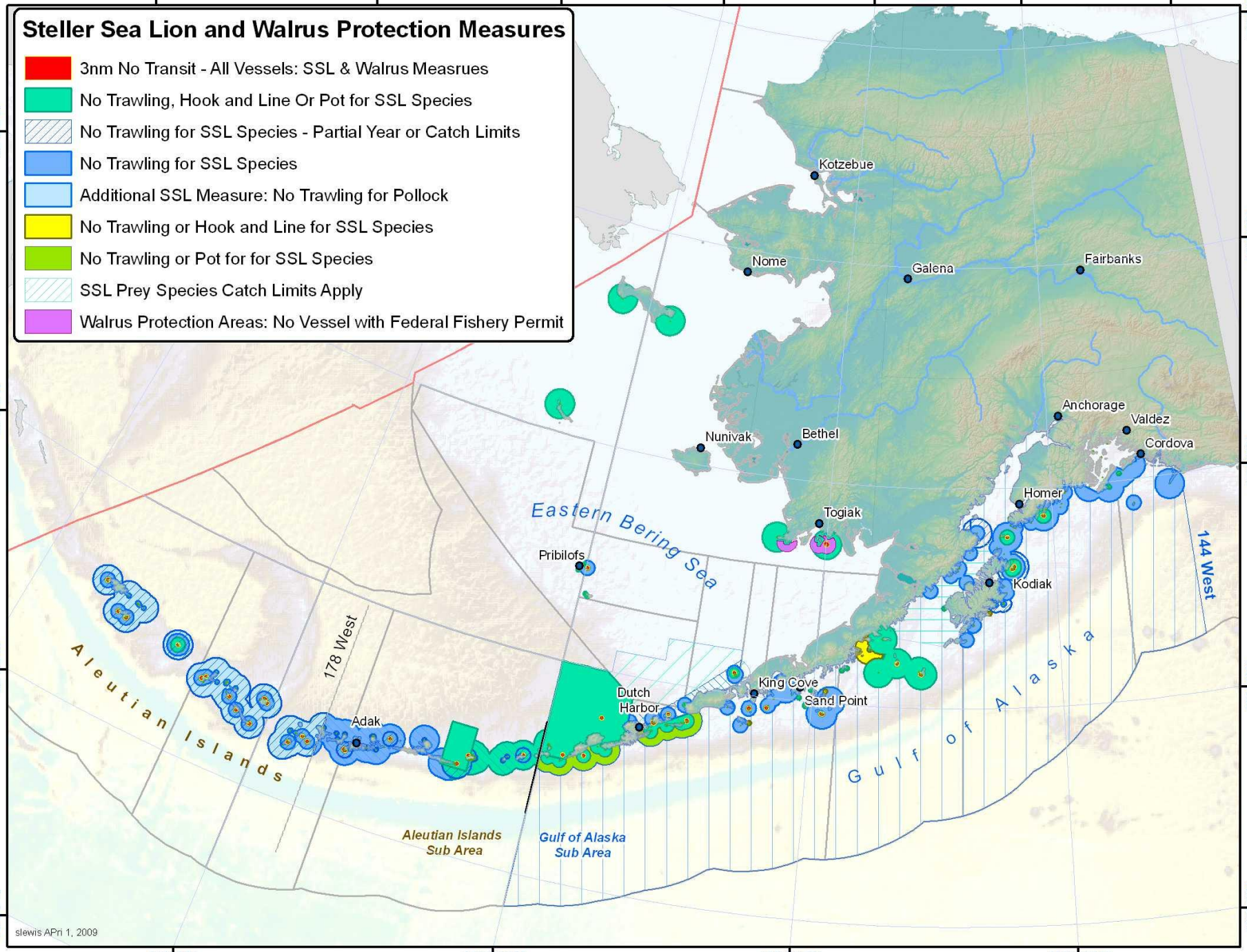
National Research Council, 2003. “Decline of the Steller Sea Lion in Alaskan Waters”

Groundfish prey species

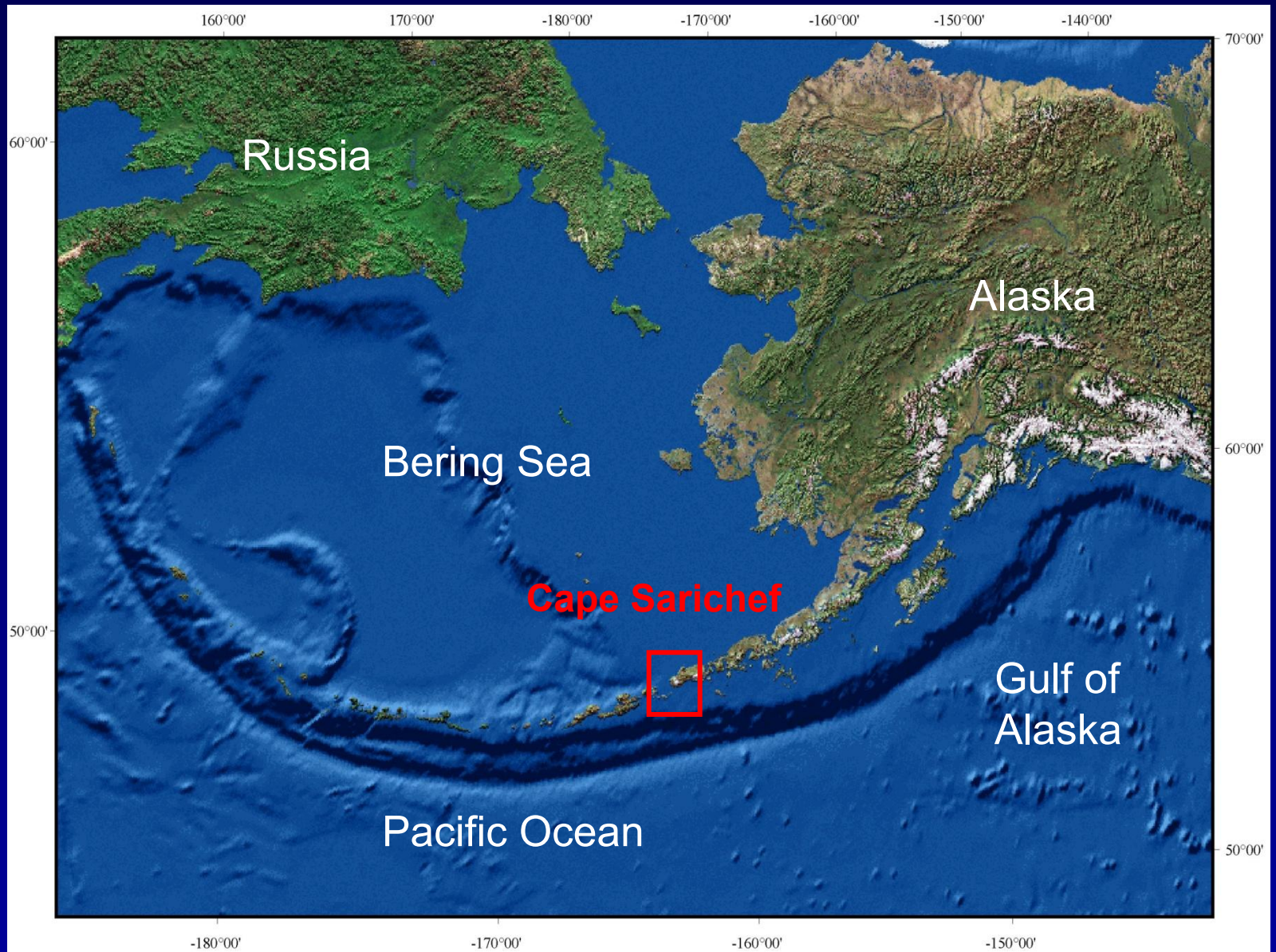
- Walleye pollock (*Gadus chalcogrammus*)
- Pacific cod (*Gadus macrocephalus*)
- Atka mackerel (*Pleurogrammus monopterygius*)

Status and strategies to obtain ecosystem data

- Localized depletion experiments
- Evaluate efficacy of management measures
- Process-oriented studies of prey field dynamics


Steller Sea Lion and Walrus Protection Measures
3nm No Transit - All Vessels: SSL & Walrus Measrues
No Trawling, Hook and Line Or Pot for SSL Species
No Trawling for SSL Species - Partial Year or Catch Limits
No Trawling for SSL Species
Additional SSL Measure: No Trawling for Pollock
No Trawling or Hook and Line for SSL Species
No Trawling or Pot for for SSL Species
SSL Prey Species Catch Limits Apply
Walrus Protection Areas: No Vessel with Federal Fishery Permit
160°0'0"E
170°0'0"E
180°0'0"
170°0'0"W
160°0'0"W
150°0'0"W
140°0'0"W
70°0'0"N
65°0'0"N
60°0'0"N
55°0'0"N
50°0'0"N
45°0'0"N
Kotzebue
Nome
Galena
Fairbanks
Anchorage
Valdez
Cordova
Nunivak
Bethel
Homer
Togiak
Eastern Bering Sea
Pribilofs
Kodiak
144 West
178 West
Aleutian Islands
Dutch Harbor
King Cove
Sand Point
Adak
Gulf of Alaska
Aleutian Islands Sub Area
Gulf of Alaska Sub Area
slewis APri 1, 2009

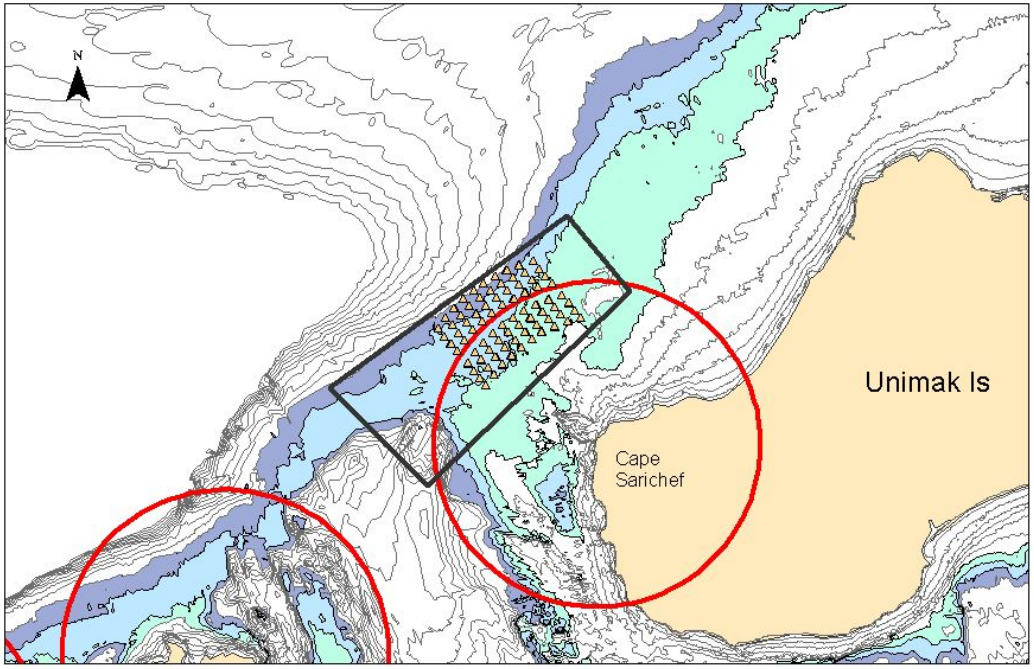
Pacific cod – Study area



Pacific cod – Study site

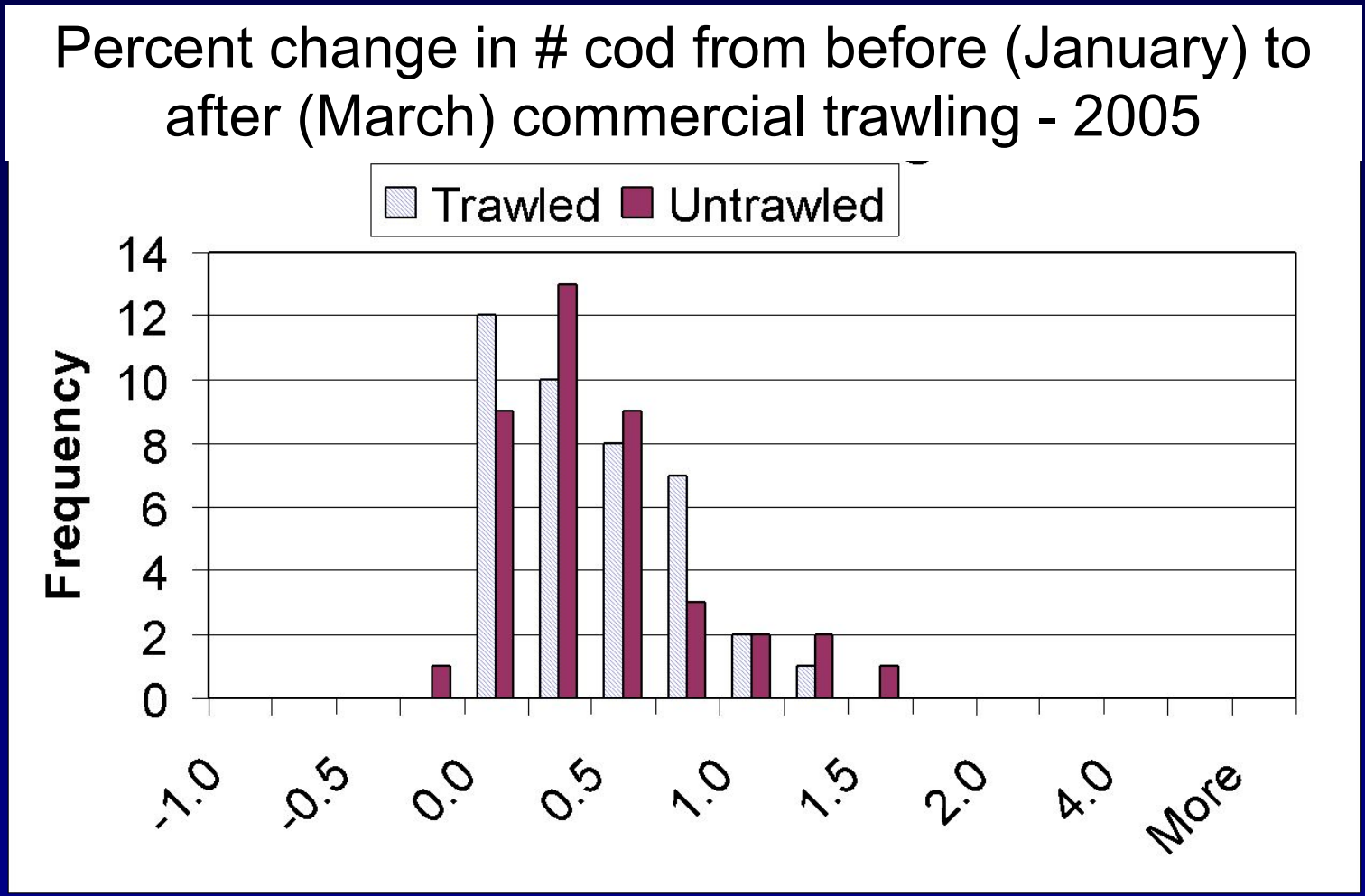
- Heavy commercial fishing
  - 15% of annual catch
  - "cod alley" 70-90m
- Cape Sarichef
  - trawl exclusion zone
  - control & treatment
  - sampling sites
- SSL rookeries & haulouts

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



Pacific cod –Methods

- PIs: Peter Munro and Liz Conners
- Localized depletion experiment
- Experimental design
  - Custom designed research pots (allows for large sample size)
  - Chartered vessels
  - Before (January) and after (March) most intensive commercial fishing
  - Inside (control) and outside (treatment) trawl exclusion zone at Cape Sarichef
- 2004, 2005 successful experiments



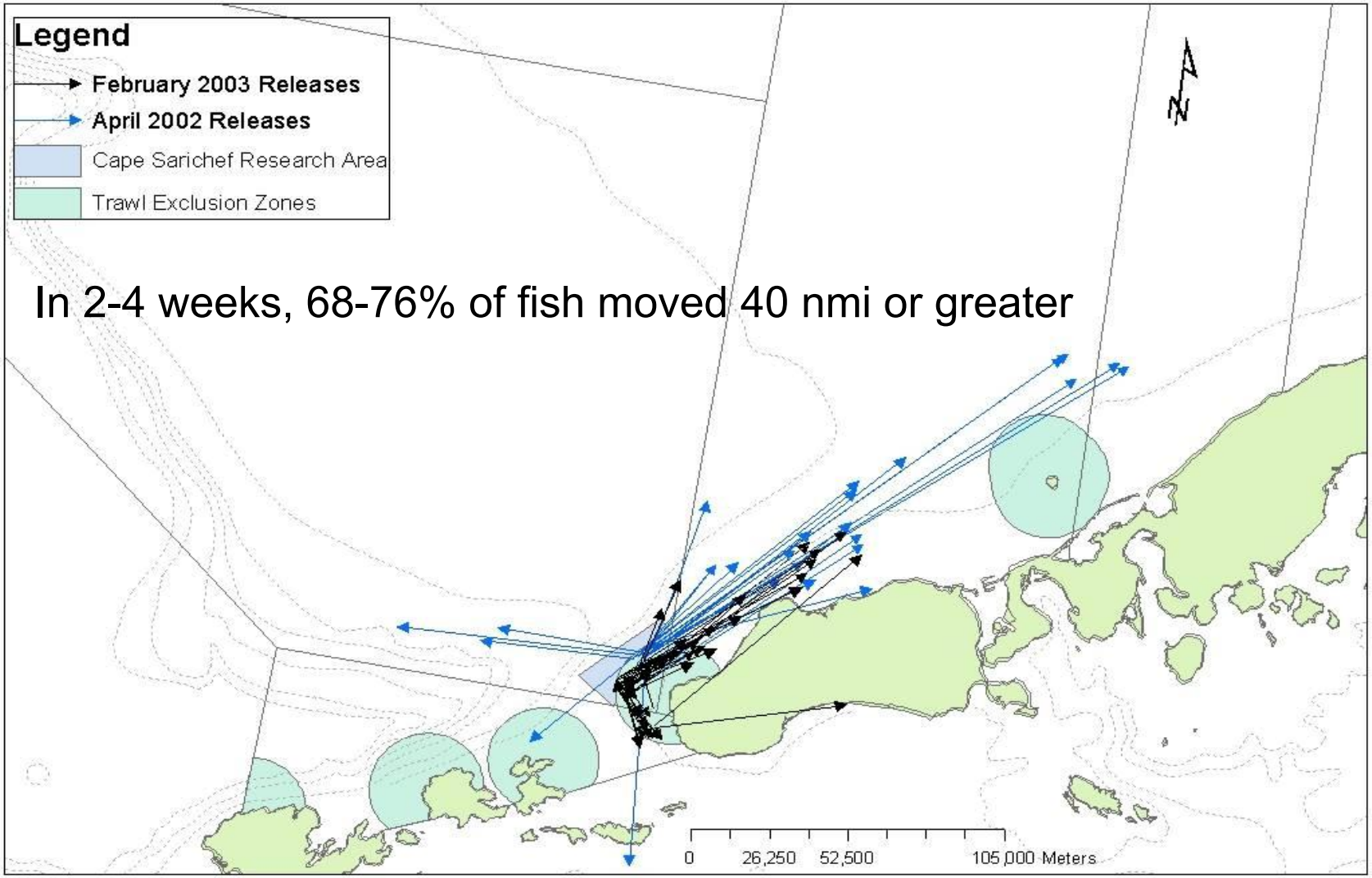
~50% increase in cod abundance, trawled and untrawled

Wilcoxin Rank-Sum Test for difference in means: p=0.807

Power: 75-95% chance of detecting 20% reduction in catch

Conners, M. E., & Munro, P. (2008). *Fishery Bulletin*, *106*, 281-292.

Tags released in Trawl Exclusion Zone (Control Area) at Cape Sarichef and recovered between 7 to 14 days at liberty (n = 73).



In 2-4 weeks, 68-76% of fish moved 40 nmi or greater

Rand, K. M. et al (2014). Marine and Coastal Fisheries : Dynamics, Management, and Ecosystem Science 2014 vol: 6 (1) pp: 287-296

Summary – Pacific cod

- “Localized depletion” due to commercial fishing was not observed
- Movement through study area was great, may be related to spawning
- Suggest that commercial fishing effect could be dispersed or displaced

Status and strategies to obtain ecosystem data

- Localized depletion experiments
- Evaluate efficacy of management measures
- Process-oriented studies of prey field dynamics

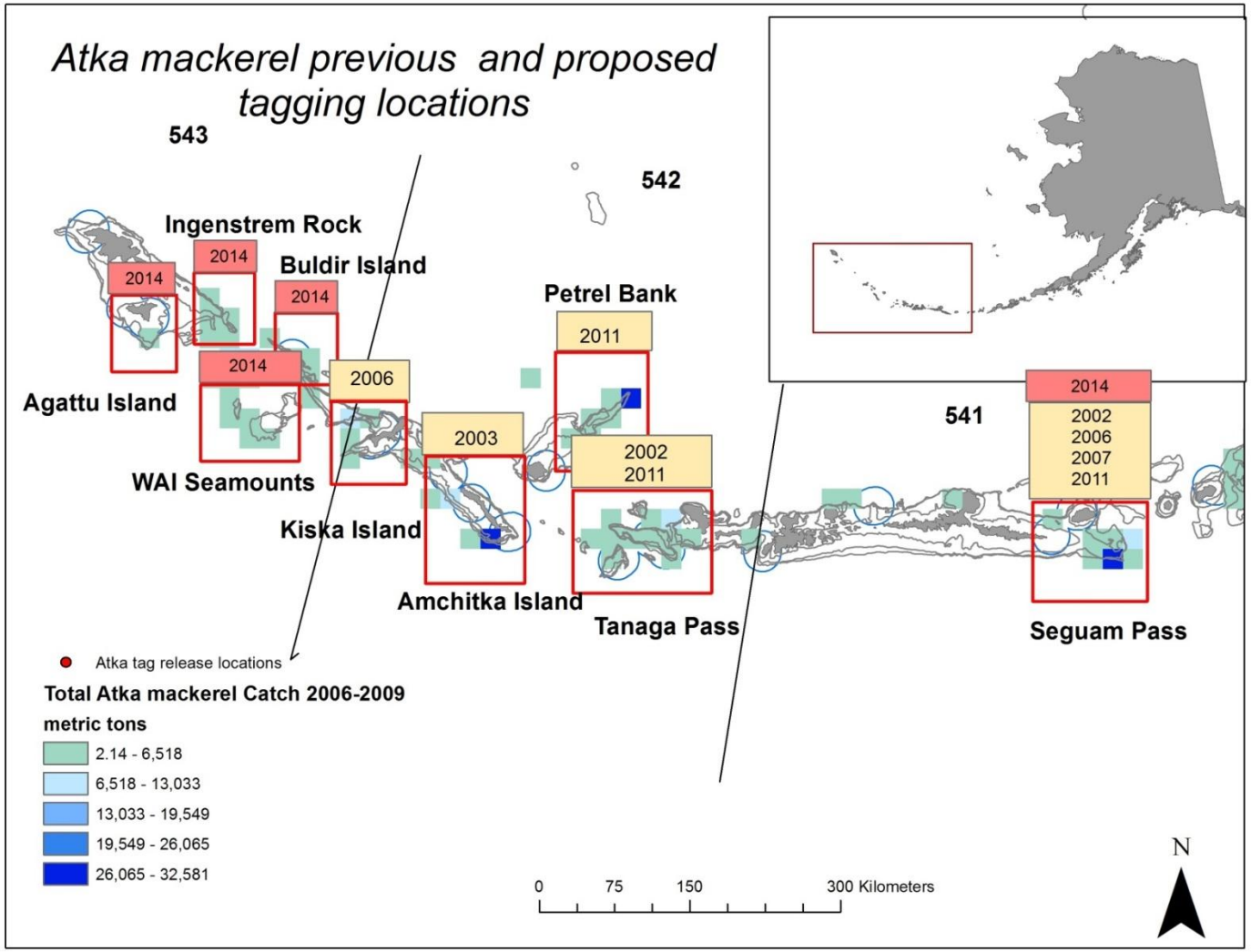
Atka mackerel tagging study

Goals: What are the impacts of fishing on Steller sea lion prey fields? Are the trawl exclusion zones working?

1. Estimate local abundance and movement of Atka mackerel
2. Local Steller Sea Lion consumption model
3. Understand Atka mackerel essential fish habitat
   1. Reproductive life history
   2. Food habits
4. Local species composition of other Steller sea lion prey

Project history

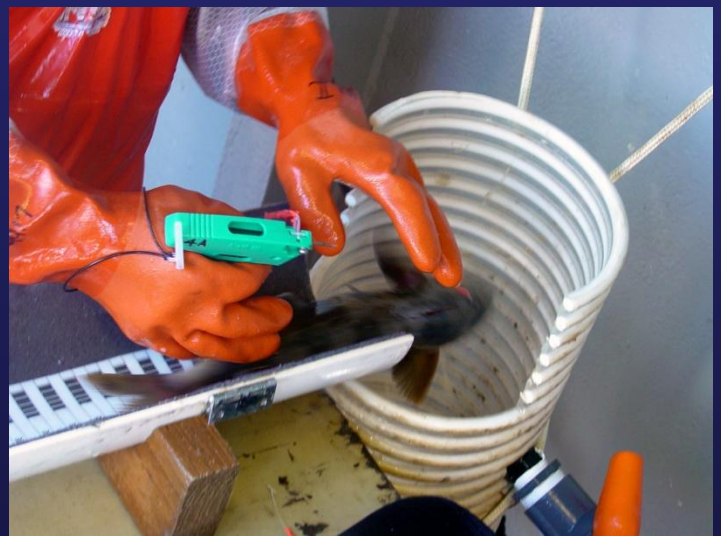
Released over 100,000 tags to date



Catch

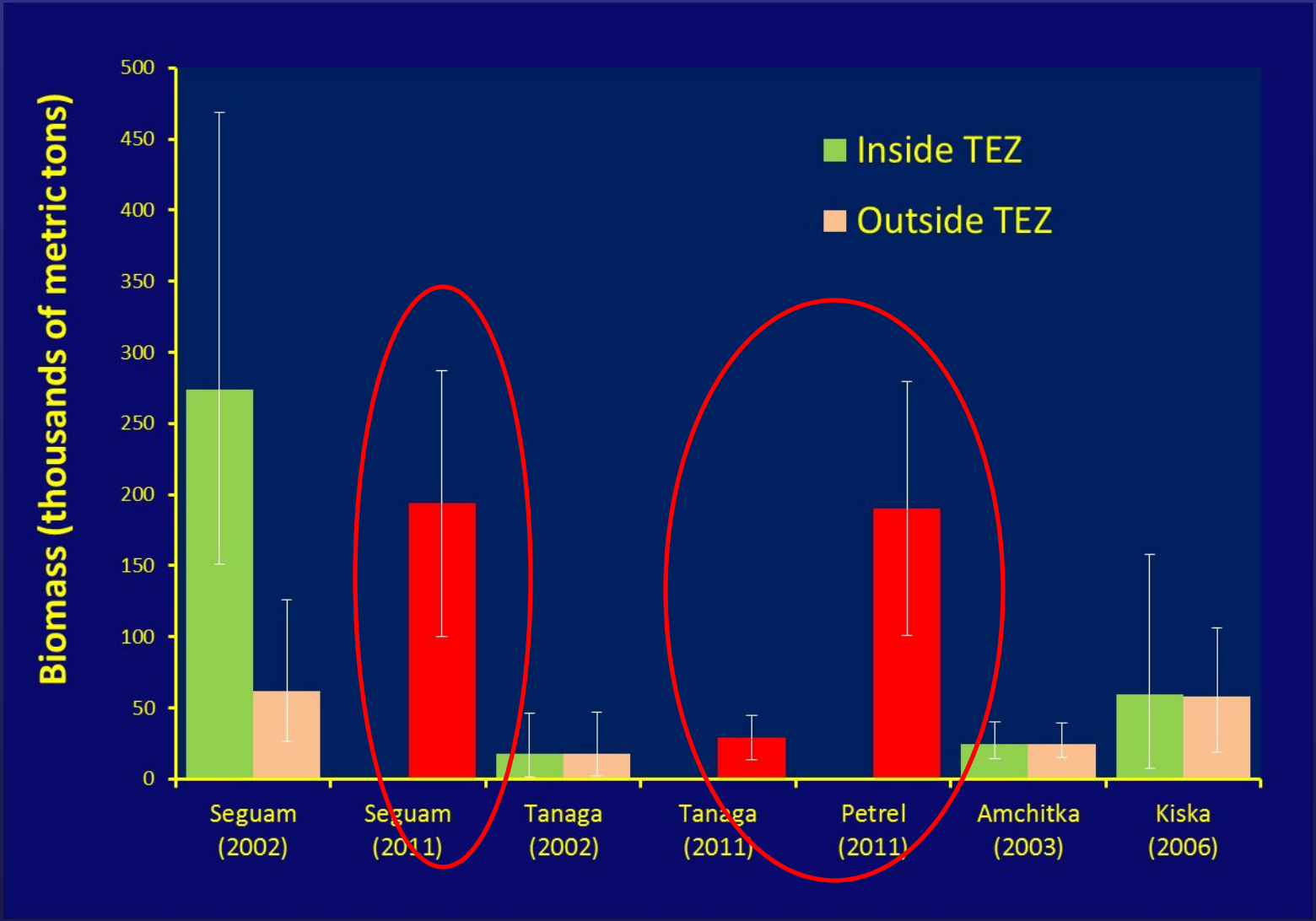
Tag

Release



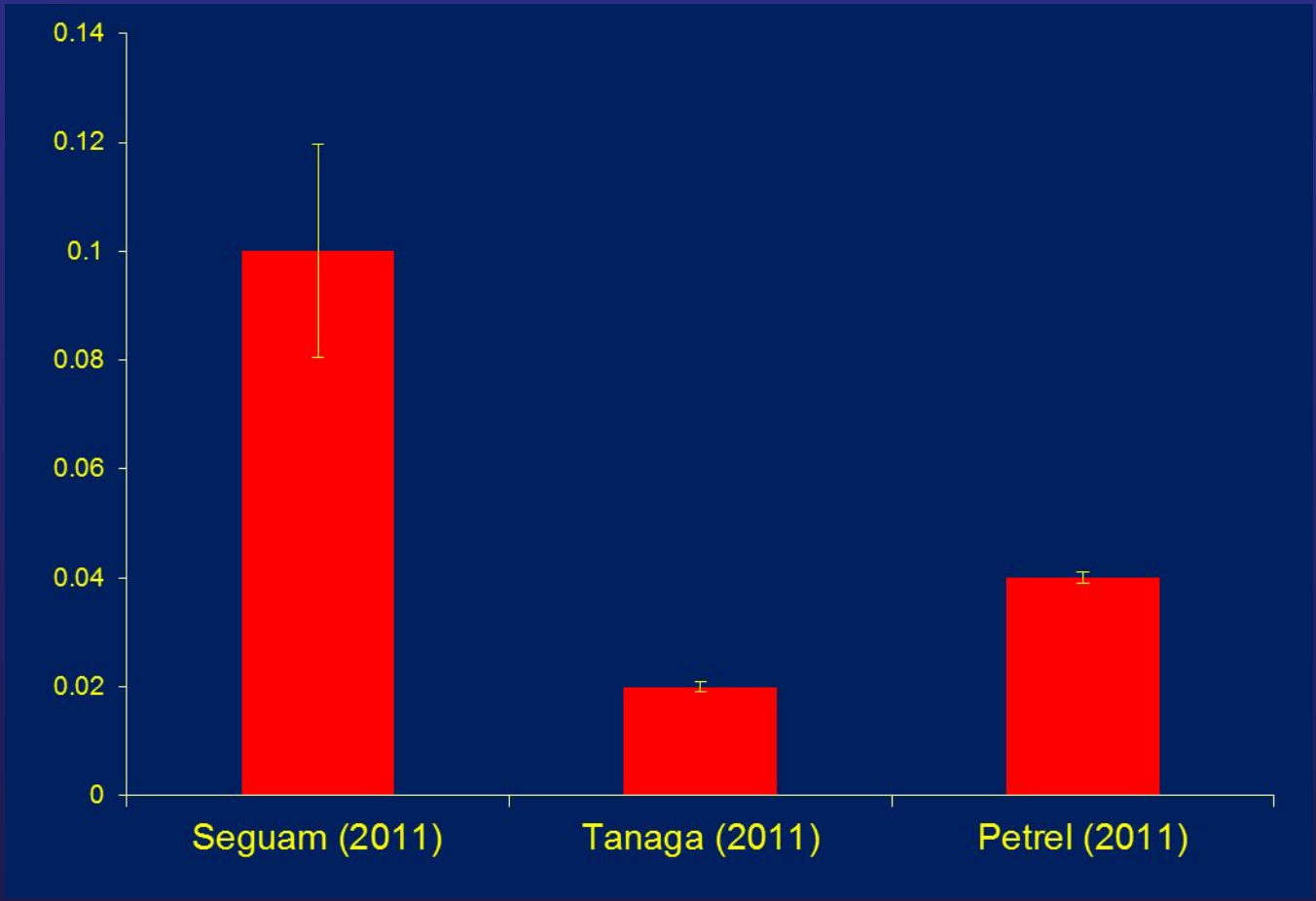
Recapture

Atka mackerel biomass



McDermott, S. F., & Haist, V. (accepted). *Marine and Coastal Fisheries*.

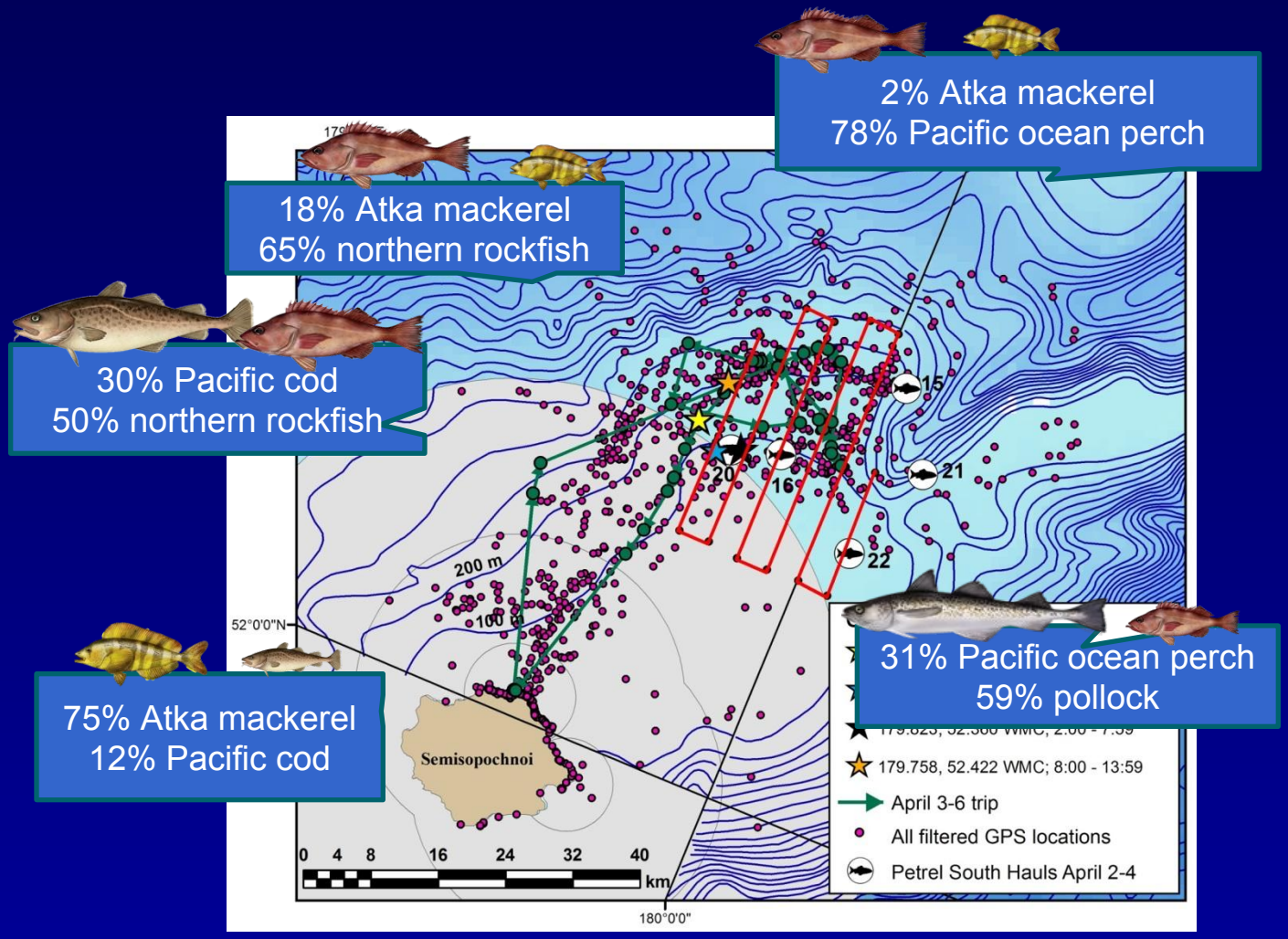
Exploitation rates 2011



Summary Population estimates

- High Atka mackerel population abundance
  - Seguam Pass (Eastern Aleutians)
  - Petrel bank (Central Aleutians)
- Low Atka mackerel population abundance
  - Tanaga pass (Central Aleutians)
- Exploitation rate at 10% at Seguam pass
- Exploitation rate less than 4% in central Aleutian Islands
- Mitigation measures seem to limit exploitation rate

Opportunistic Steller sea lion tracking and prey field sampling



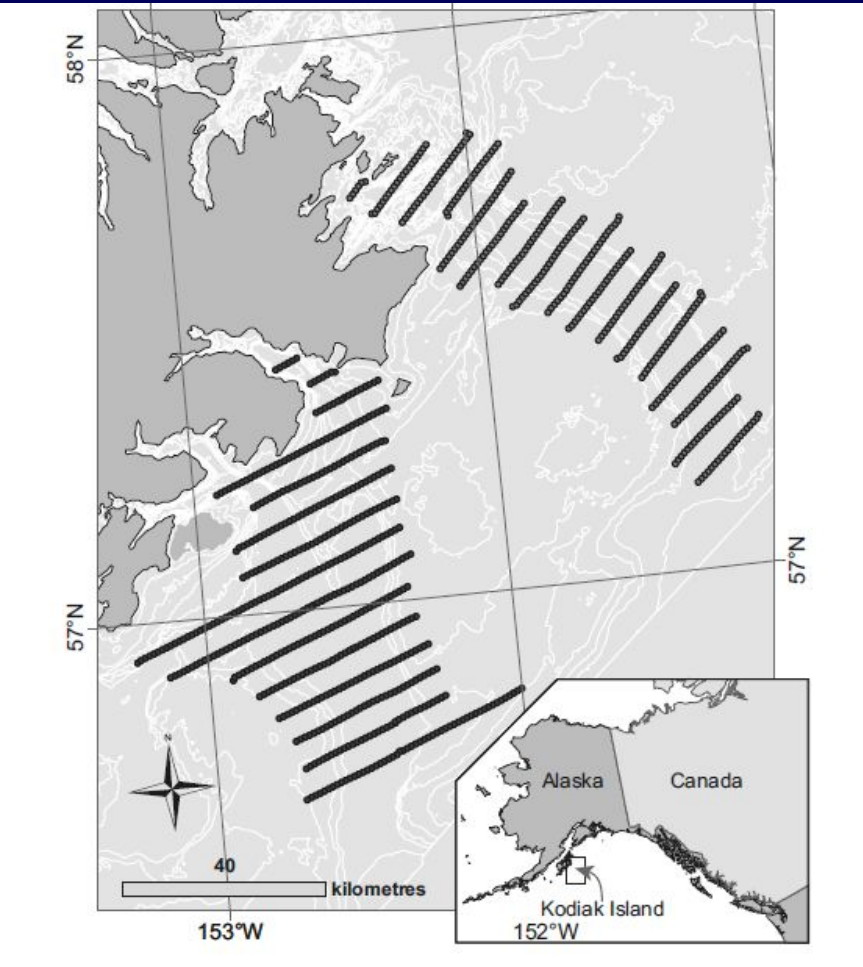
Pollock localized depletion and process studies Kodiak Island, Gulf of Alaska

Walline, P. D., Wilson, C. D., Hollowed, A. B., & Stienessen, S. (2012). Short term effects of commercial fishing on distribution and abundance of walleye pollock (*Theragra chalcogramma*). *Canadian Journal of Fisheries and Aquatic Sciences*, *69*, 354-368.

Hollowed, A. B., Wilson, C. D., Stabeno, P. J., & Salo, S. A. (2007) Effect of ocean conditions on the cross-shelf distribution of walleye pollock (Theragra chalcogramma) and capelin (Mallotus villosus). Fisheries Oceanography, 16, 142-154.

Logerwell, E. A., Stabeno, P. J., Wilson, C. D., & Hollowed, A. B. (2007) The effect of oceanographic variability and interspecific competition on juvenile pollock (Theragra chalcogramma) and capelin (Mallotus villosus) distributions on the Gulf of Alaska shelf. Deep Sea Research II, 54, 2849-2868.

Logerwell, E. A., Duffy-Anderson, J., Wilson, M., & McKelvey, D. R. (2010). The influence of pelagic habitat selection and interspecific competition on productivity of juvenile walleye pollock (Theragra chalcogramma) and capelin (Mallotus villosus) in the Gulf of Alaska. Fisheries Oceanography, 19, 262-278.



Status and strategies to obtain ecosystem data

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Process-oriented studies of prey field dynamics

- Oceanographic drivers of fish distribution
  - Pollock and capelin off Kodiak Island, Gulf of Alaska
- Climate and oceanographic drivers of fish reproductive biology
  - Pacific cod in the Bering Sea
  - Pollock in the Gulf of Alaska
  - Atka mackerel in the Aleutian Islands
- Fish migration and spatial scale
  - Pacific cod in the Bering Sea and eastern Aleutian Islands
- Spatial variation in fish foraging ecology
  - Atka mackerel in the Aleutian Islands

Inclusion of data into management advice, peer review

- ESA Section 7 Biological Opinions (2010, 2014)
- Environmental Impact Statement (2014)
- Biological Report on Critical Habitat (in prep)
- Stock Assessment and Fishery Evaluation
  - Atka mackerel
  - Bering SeaBering Sea and Gulf of Alaska Pacific cod

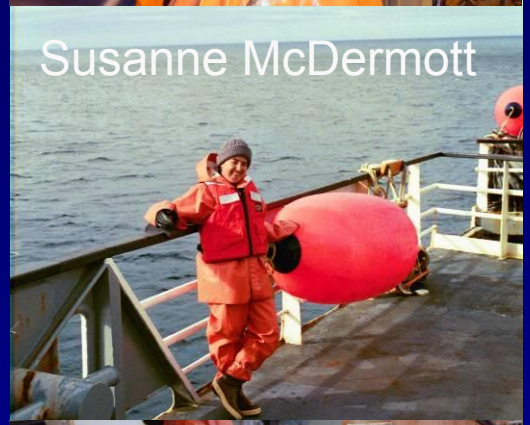
Peer review and communication

Peer-reviewed journal articles

- Fishery Bulletin (3)
- Reviews in Fisheries Science (1)
- Alaska Fisheries Research Bulletin (1)
- Fisheries Oceanography (3)
- Aquatic Mammals (1)
- Deep-Sea Research II (2)
- Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science (6)
- Canadian Journal of Fisheries and Aquatic Sciences (1)

Peer review and communication

Outreach activities

- Presentations to fishing stakeholders
  - Sand Point
  - Kodiak
- Public presentations
  - Museum of the Aleutians, Dutch Harbor
  - Pacific Science Center, Seattle
- Activities at public schools (elementary to college)
  - Dutch Harbor
  - Anchorage
  - Seattle

Thanks to the Team