How Fishermen Balance Incentives
&
Why It Matters For Fisheries Management

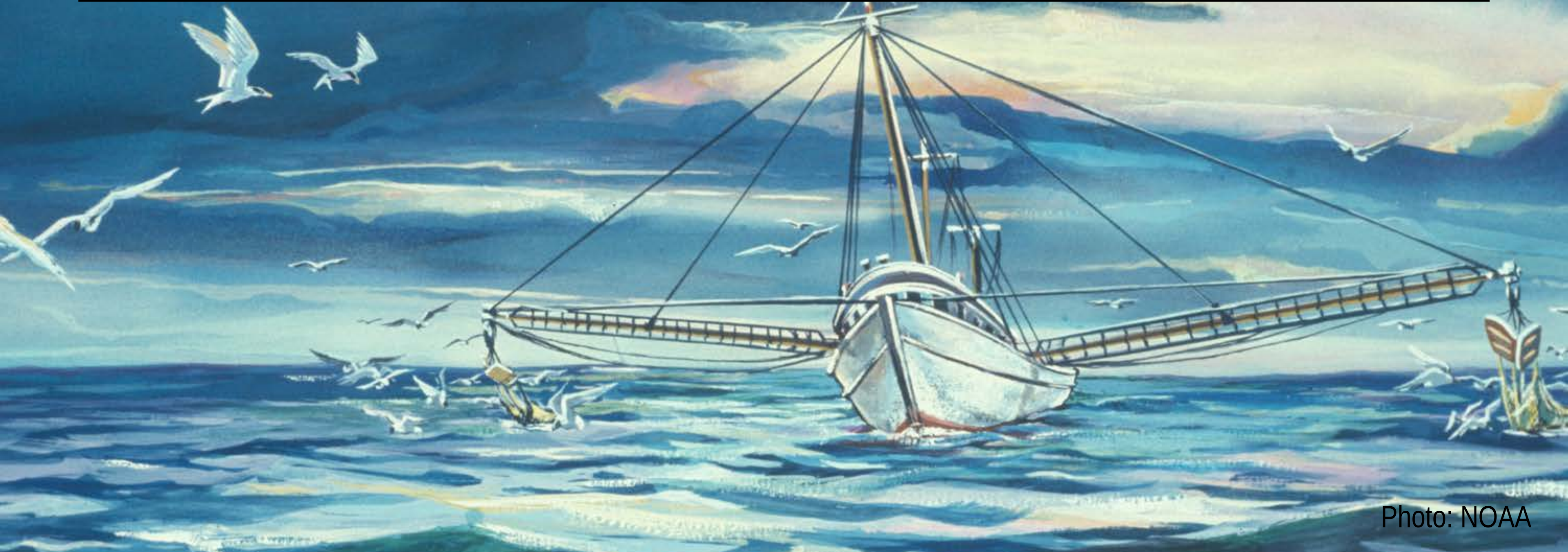


Photo: NOAA

NOAA FISHERIES
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

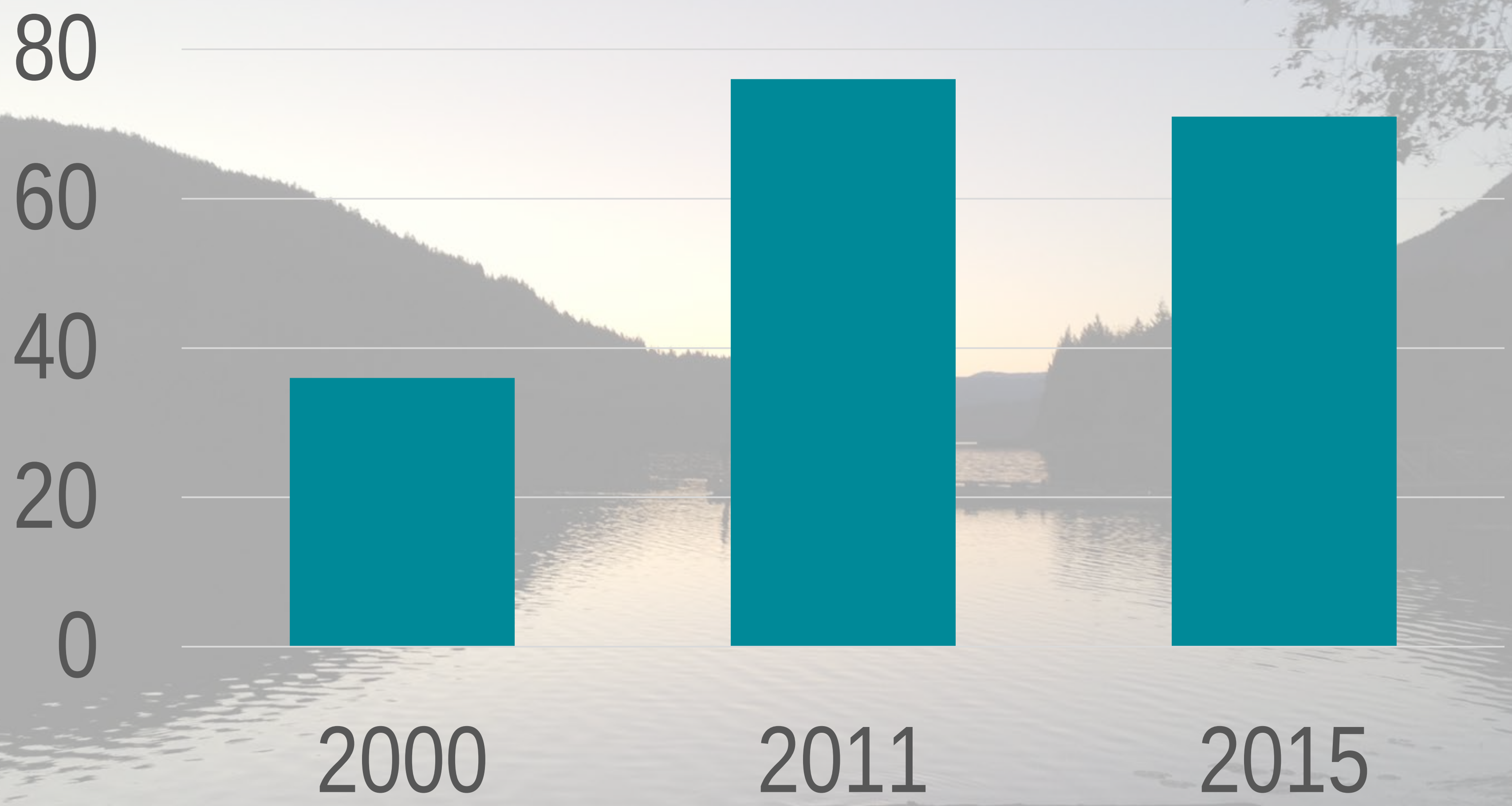
Quest Seminar, January 2015

Alan Haynie, Alaska Fisheries Science Center

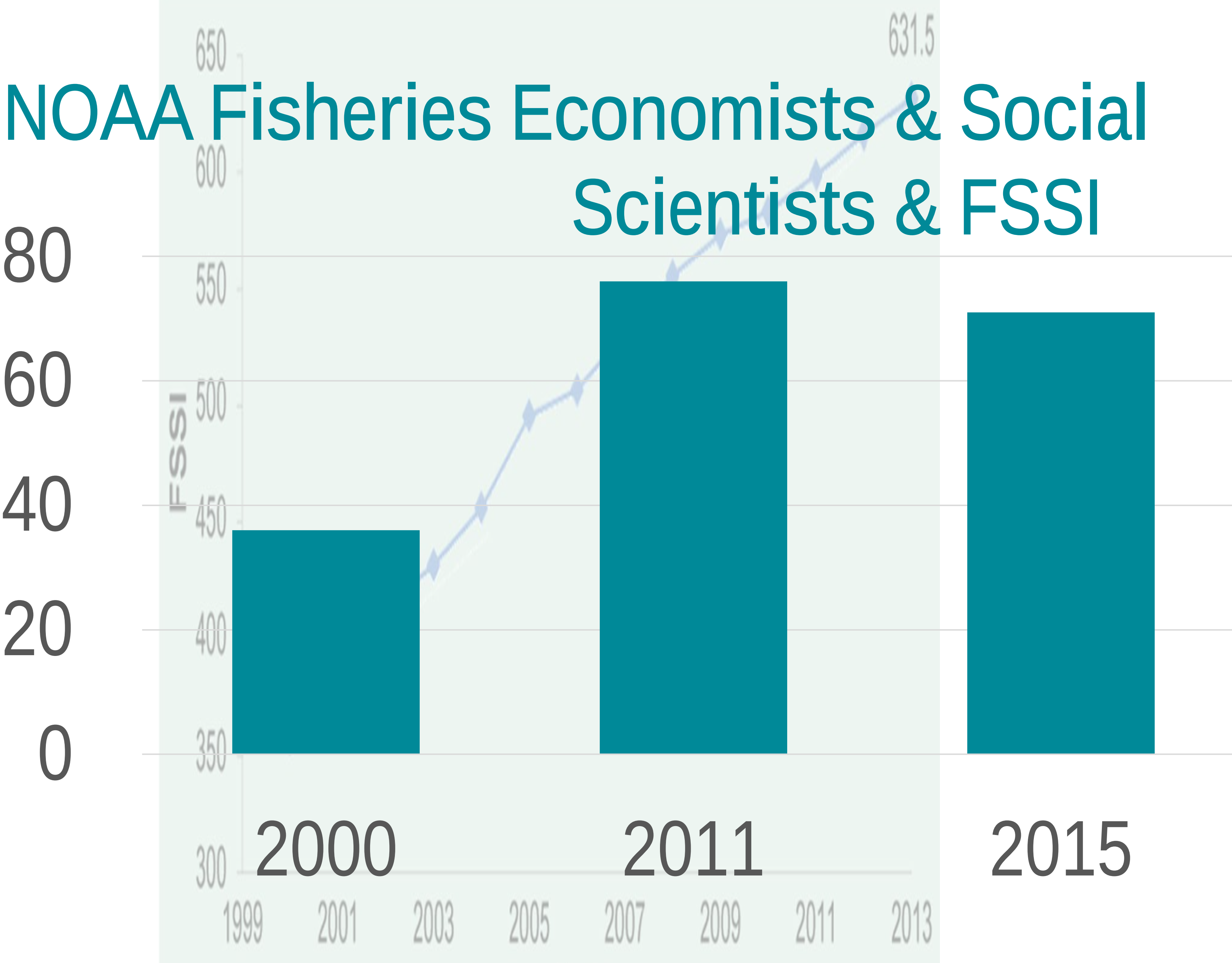
Overview of Today’s Webinar

- Incentives and fisher behavior
- Data
- Four Alaska fish stories
  - Unintended consequences - Red King Crab Savings Area
  - Amendment 80 & halibut bycatch reduction
  - Salmon bycatch & Climate changein the Bering Sea pollock fishery
- FishSET & Education
- Take home messages

NOAA Fisheries Economists & Social Scientists



NOAA Fisheries Economists & Social Scientists & FSSI

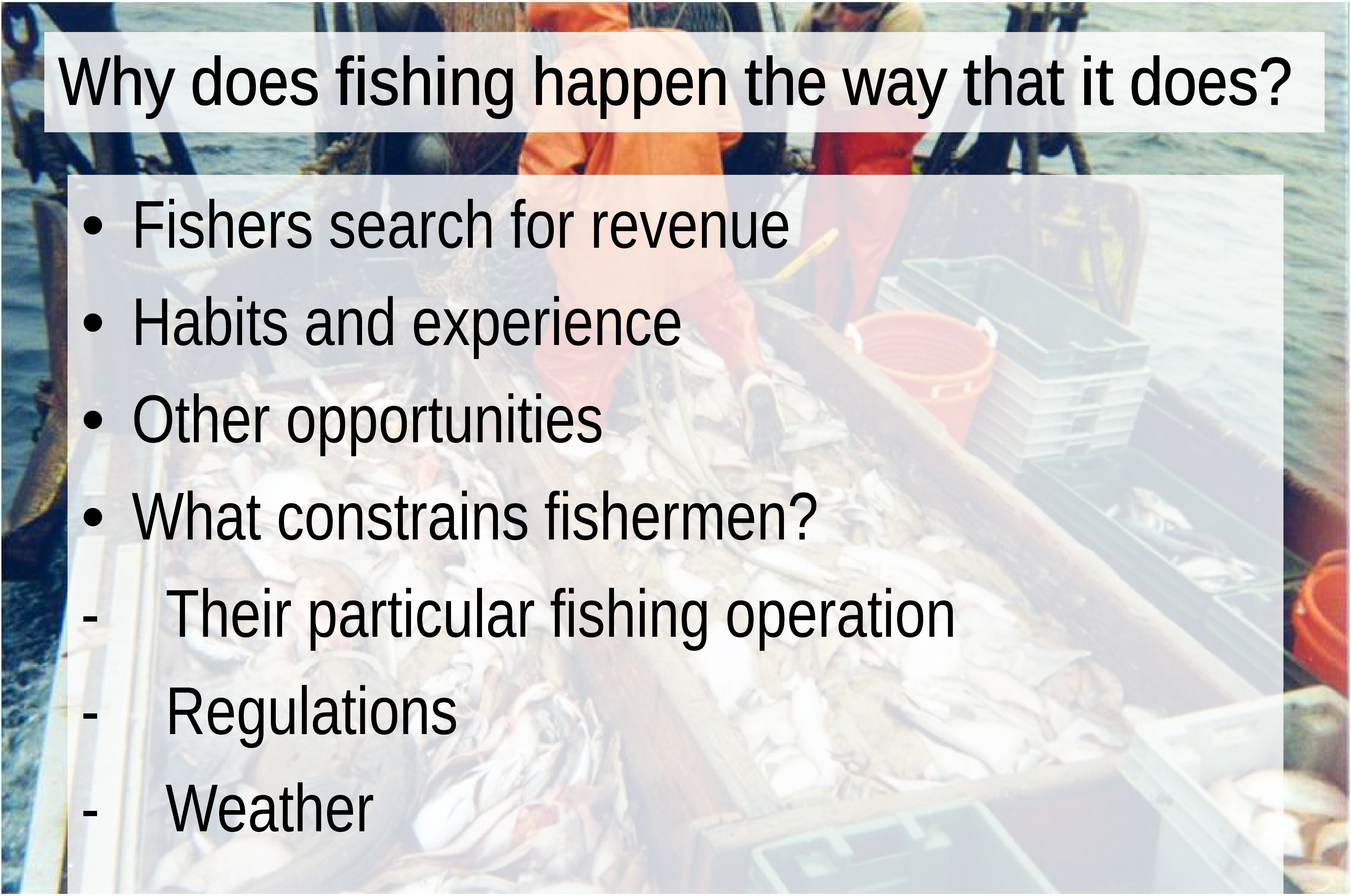


Fishery Stock Sustainability Index:
http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/fssi.html

- How can we better understand how incentives impact fisher behavior?
- How do we design policies that best line up the incentives of fishers with the goals of managers and the Nation?

How do we balance National Standards?

1. …prevent overfishing while achieving, on a continuing basis, the optimum yield ….
4. …ensure fair distribution of resources
5. … consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.
7. …minimize costs and avoid unnecessary duplication.
8. …take into account the importance of fishery resources to fishing communities ….
9. …to the extent practicable, minimize bycatch.



Why does fishing happen the way that it does?

- Fishers search for revenue
- Habits and experience
- Other opportunities
- What constrains fishermen?

- Their particular fishing operation
- Regulations
- Weather

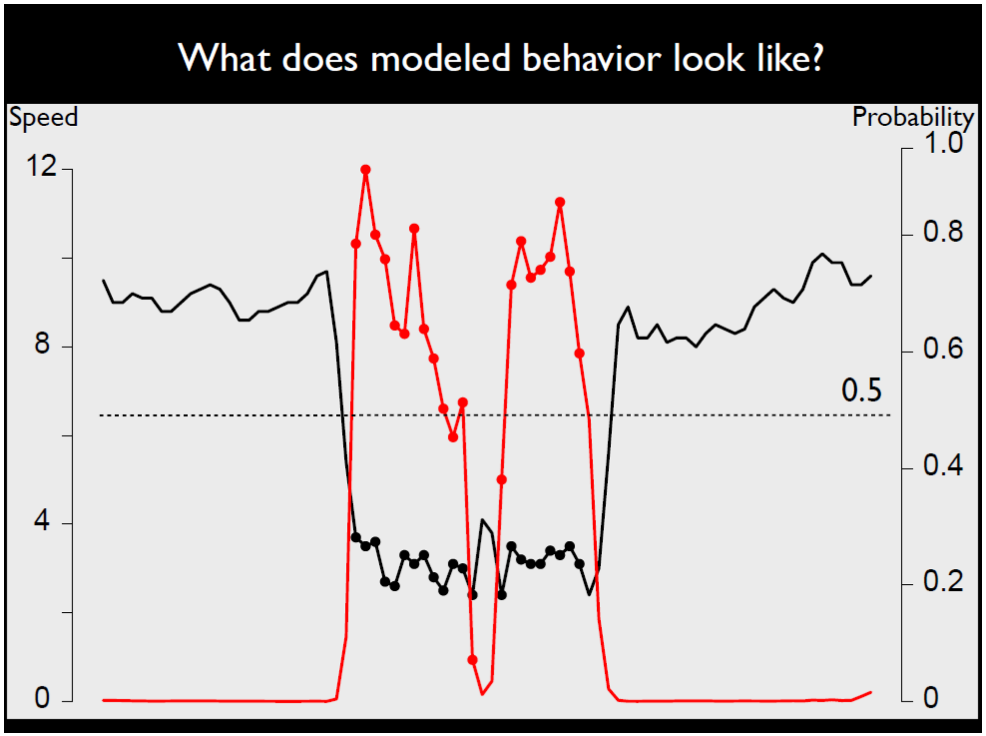
Photo: NOAA Fisheries

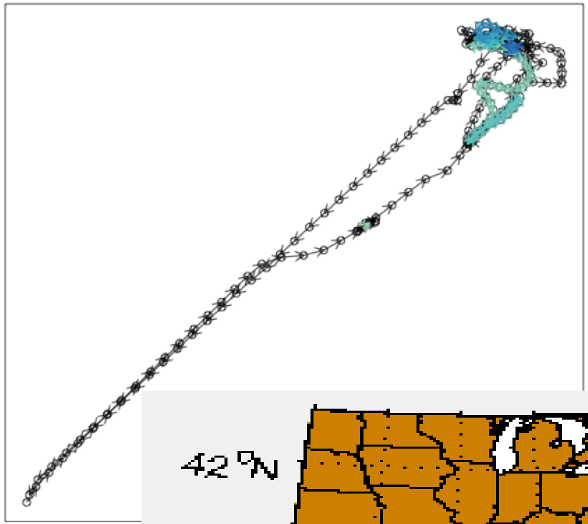
Data to explain the factors that impact fishing

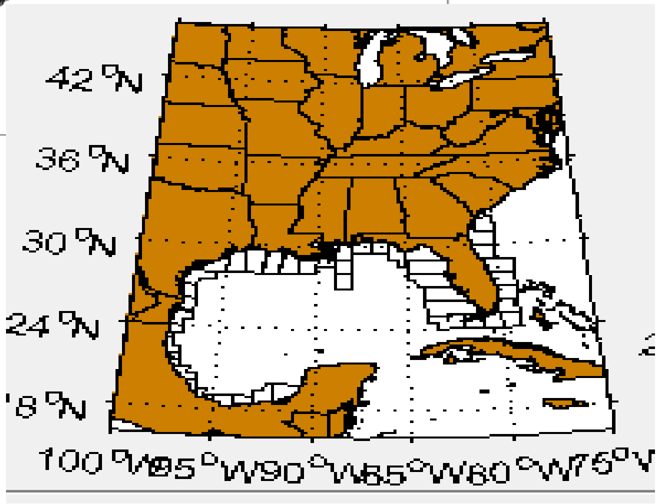
- Spatial fishing information
- Vessel characteristics
- Price Info
  - From markets
  - From vessel surveys
- Biological survey info

- Environmental data
  - Satellite observations
  - Weather station data
  - Buoy data
  - Bathymetry; Ice data; ROMS; Habitat
- Other

Determining fishing behavior from VMS data



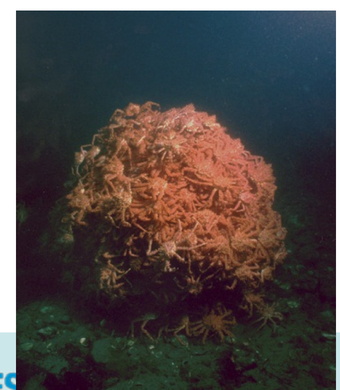




VMS data can provide significant improvements in our spatial understanding of fishing and the impacts of policy

Ongoing work with Watson and Sullivan

First 2 fish stories are about the BSAI multispecies catcher-processor trawl fishery



Fish Story # 1

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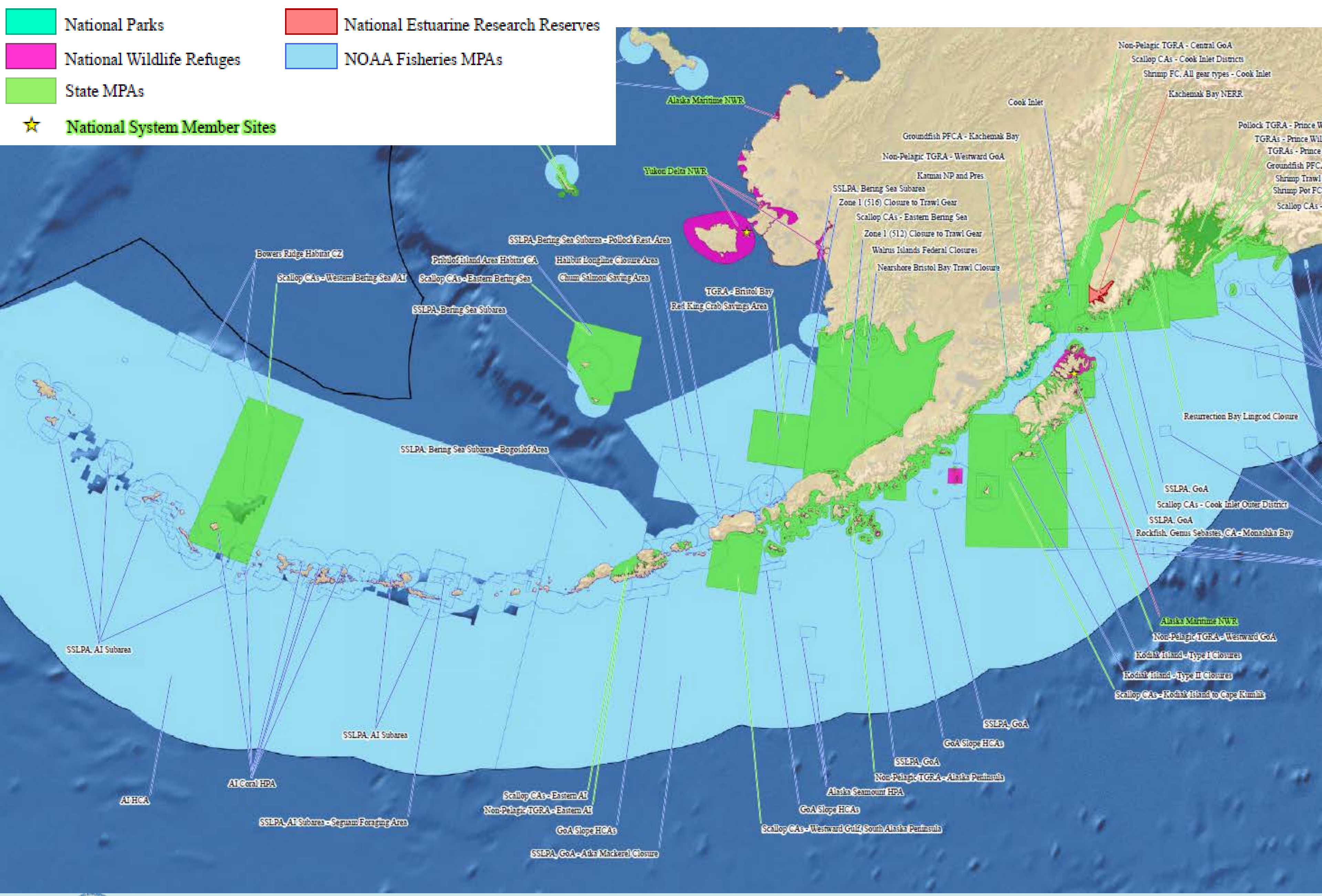
“What Are We Protecting? The Challenges of Marine Protected Areas for Multispecies Fisheries”

Joshua Abbott and Alan Haynie. 2012.

Ecological Applications, 22(3): 762–777.

Alaska Marine Protected Areas



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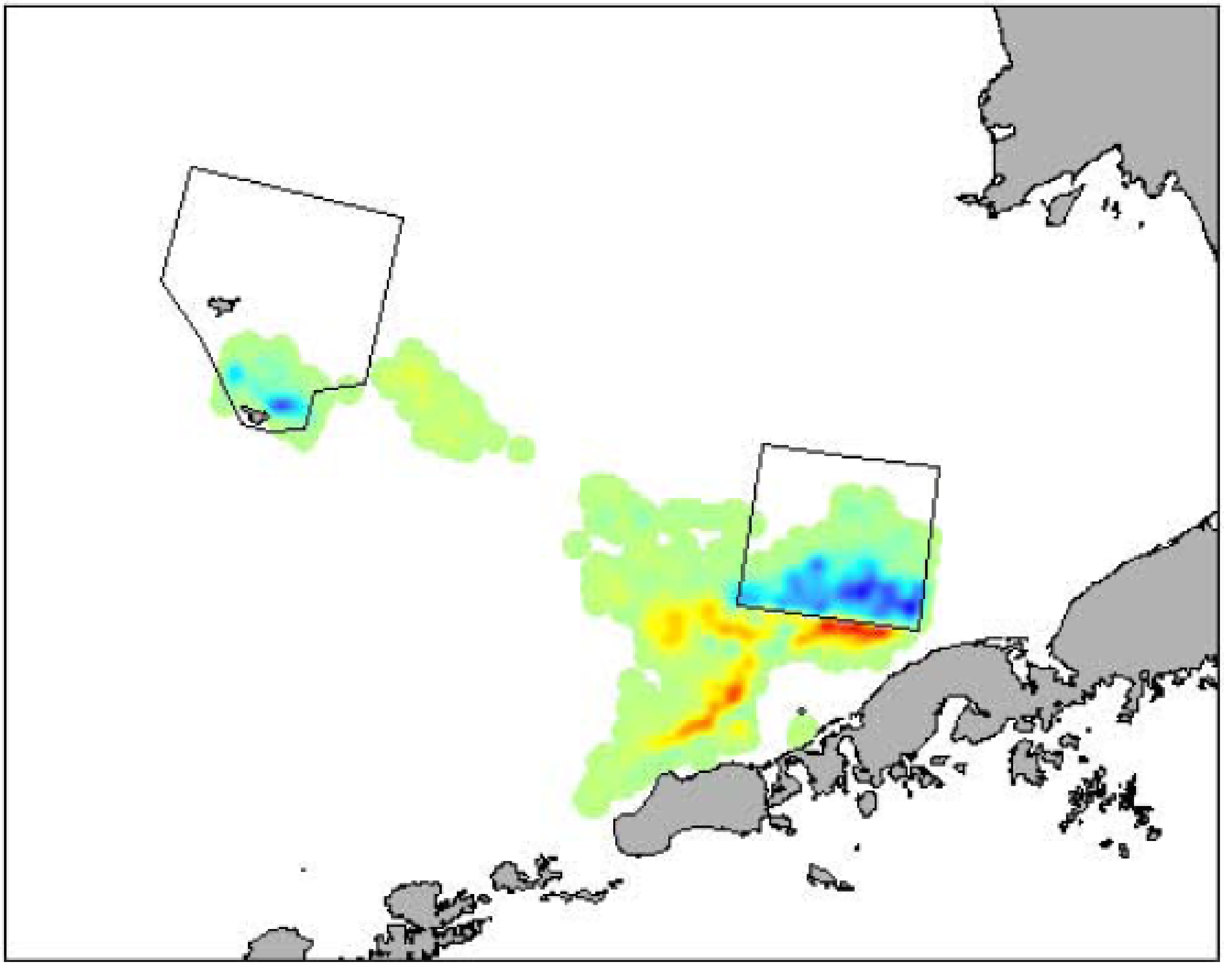
Case Study: The Eastern Bering Sea Rock Sole/ Pacific Cod Fishery

- A small group (<20) of trawl vessels targeting spawning female rock sole and cod from January to March
- The fishery (until 2008) faced common-pool TACs on target and bycatch species – which must be discarded
  - Red king crab
  - Pacific halibut
- These species are valued by other distinct fleets
  - Both allocation and conservation concerns
- Prior to 1995 when Red King Crab Savings Area was implemented, red king crab bycatch typically closed the season prematurely

Data

- Onboard observer data (NPGOP)
  - Complete record of spatial locations of fishing and haul duration
- Data from 100% observer coverage vessels (>125 feet)
  - A handful of vessels have 30% coverage (not representative)
  - Random sampling of 44% of hauls for species composition
  - Estimates of total catch of cod, rock sole, halibut (kg) and red king crab (#).
- We also have data on the weekly production and annual prices
- We focus on 1992-1997 data

Q1: How did the distribution of fishing effort change in the wake of the closures?



Q3: How did the closures impact red king crab bycatch?

	All Areas	
Year	Mean #/hr	Proportion = 0
1992	6.10	0.86
1993	15.20	0.74
1994	16.97	0.71
1995	3.95	0.91
1996	1.87	0.92
1997	3.30	0.95

Table S1: Annual comparisons of mean red king crab bycatch rates and proportion of hauls with zero bycatch from observer data relative to estimates of biomass. Means are weighted estimates calculated from haul-level data using the duration of haul as the weight.

Q3: How did halibut bycatch change as a result of displacement from the closure?

All Areas	
Halibut (kg/hr)	Mean
pre	81.54
post	118.09
Non-Closure Data Only	
Halibut (kg/hr)	Mean
pre	96.82
post	118.09

Positive relationship between cod and Halibut

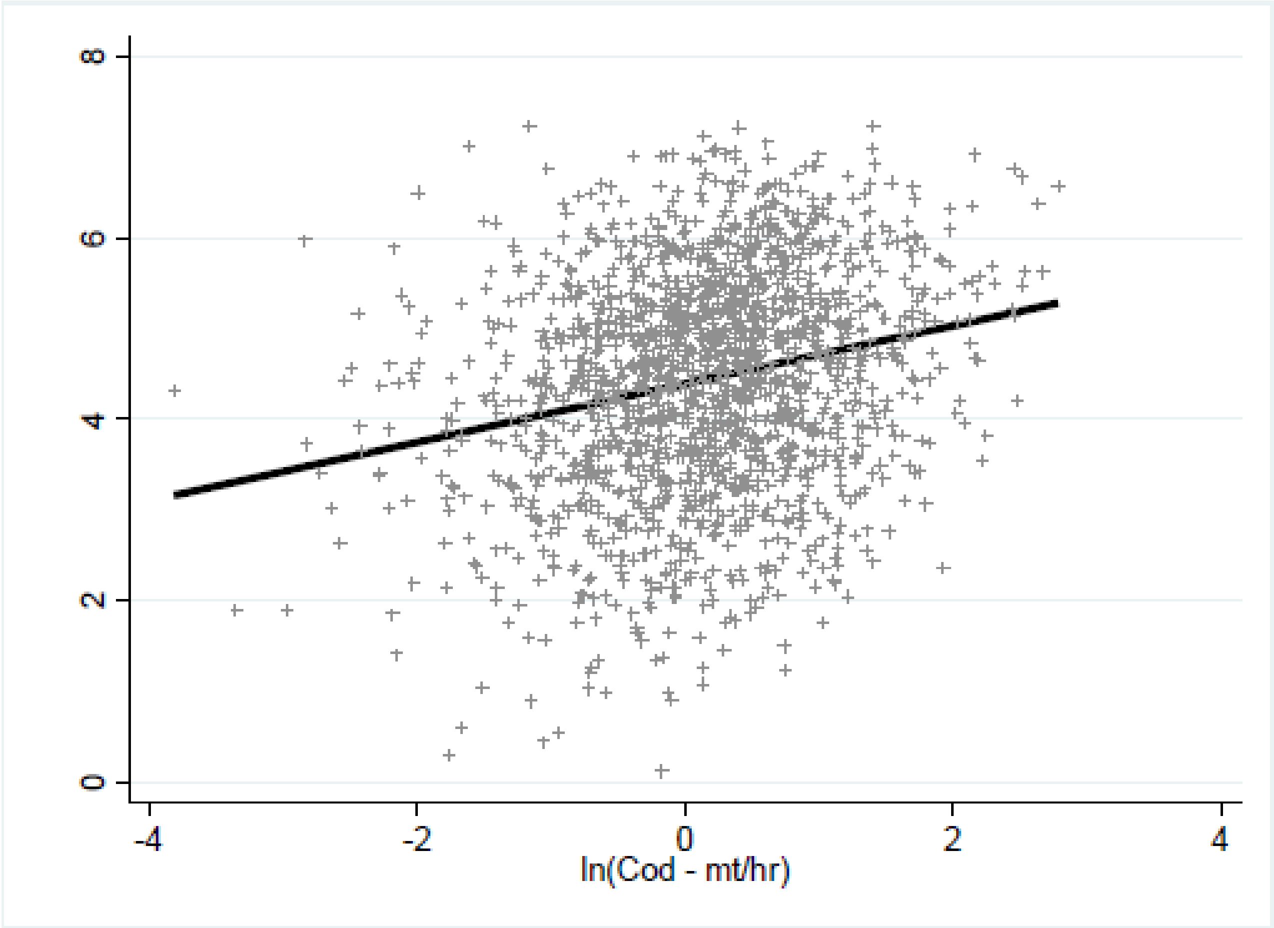


Figure 4: Scatterplot and fitted trend of the natural log of halibut CPUE against the natural log of cod CPUE.

Abbott and Haynie (2012)

Fish Story # 2

Changes with Amendment 80 to the BSAI Fishery Management Plan

"Hidden Flexibility: Institutions, Incentives and the Margins of Selectivity in Fishing."

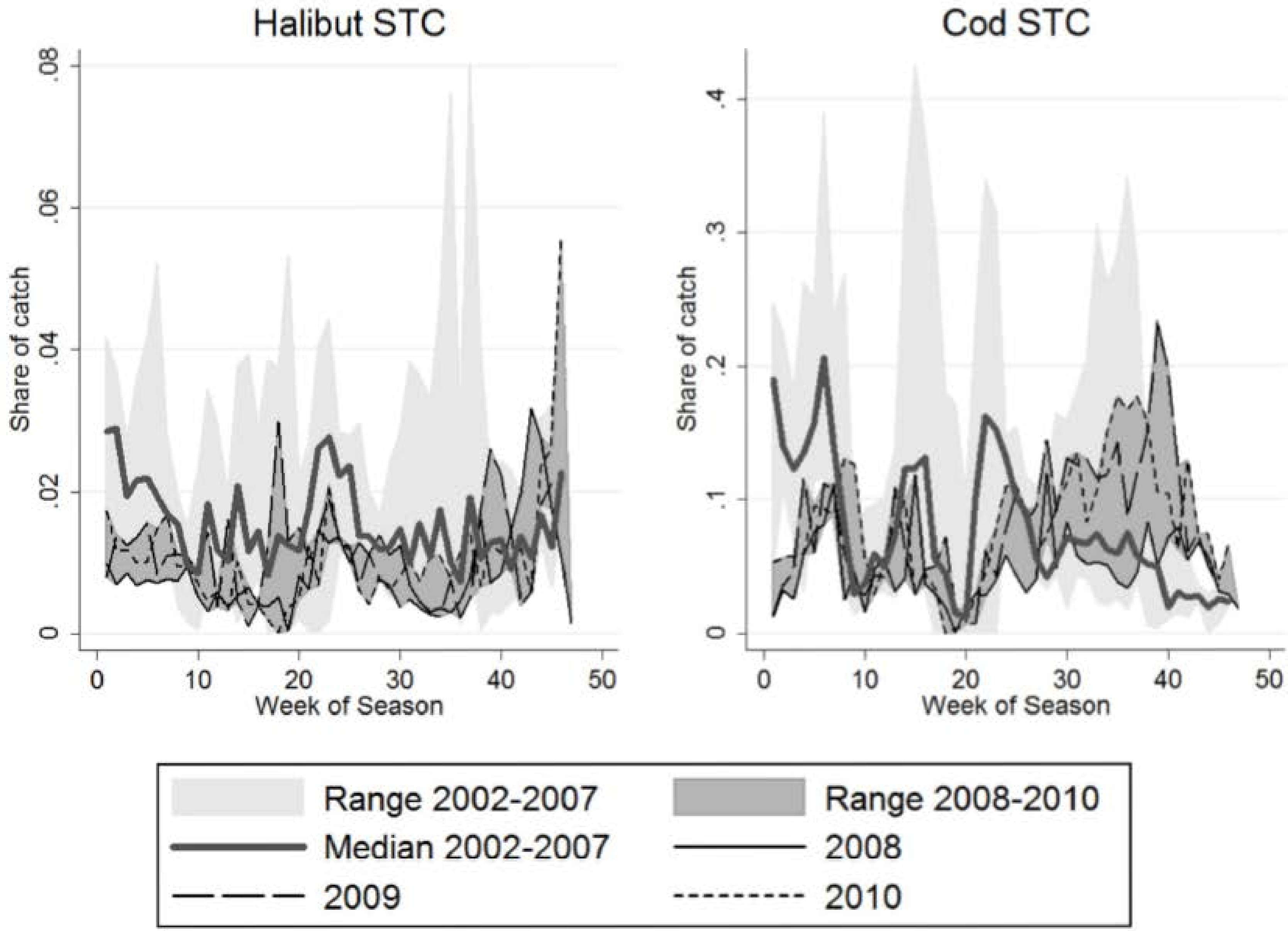
Abbott, Haynie, and Reimer. *Land Economics*, February 2015.

2008: Amendment 80 (A80)

- Designed to increase target catch and profits, reduce bycatch and discards and increased flexibility

- Vessels must join a cooperative or participate in the limited access fishery
- Coop vessels receive a share of 6 A80 target species and PSC
  - In practice the coop has treated the quota like an IFQ
- The limited access vessels remain in a common pool fishery
- <u>16</u> vessels joined the cooperative, <u>6</u> in limited access
- Also in 2008, these vessels had a decrease in cod allocation.

Weekly "Bycatch" Share of Total Catch



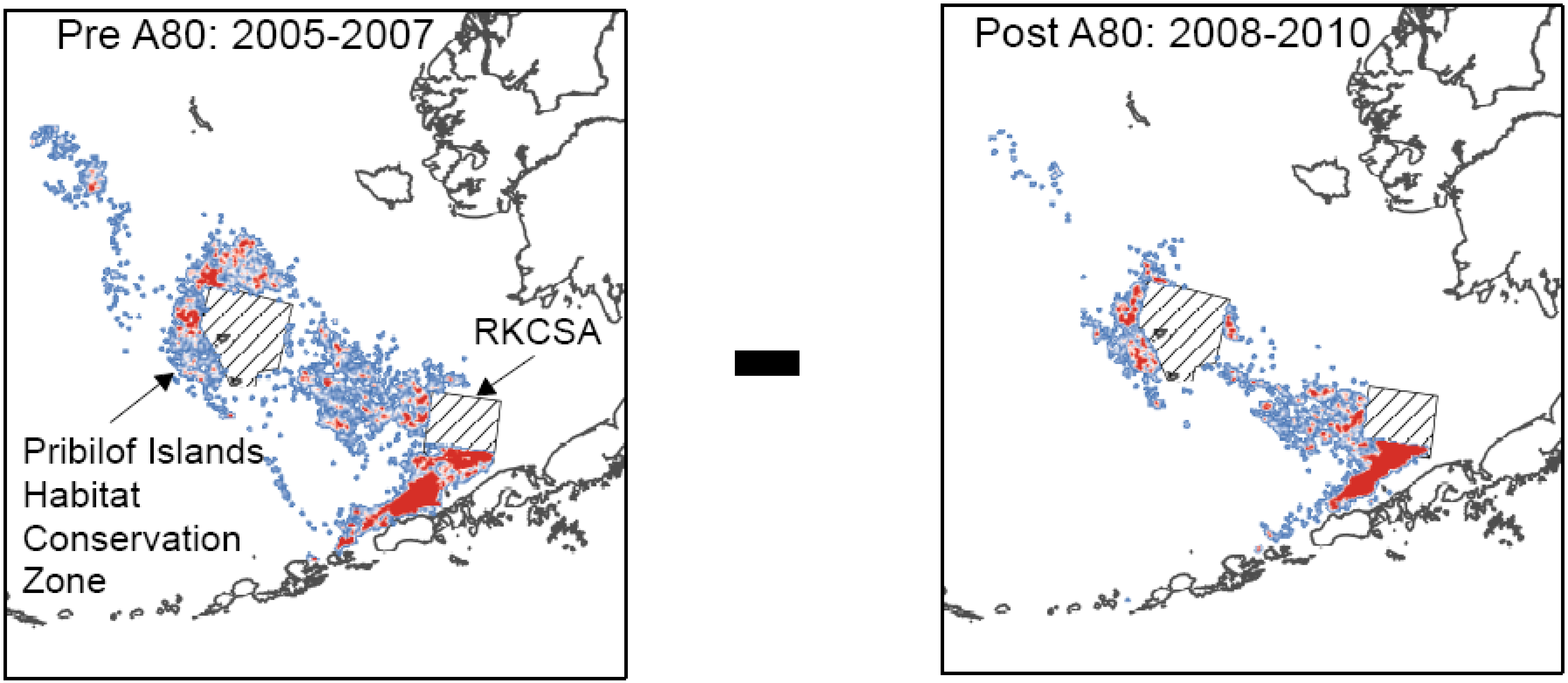
How did vessels reduce their bycatch?

A story of “multiple margins”

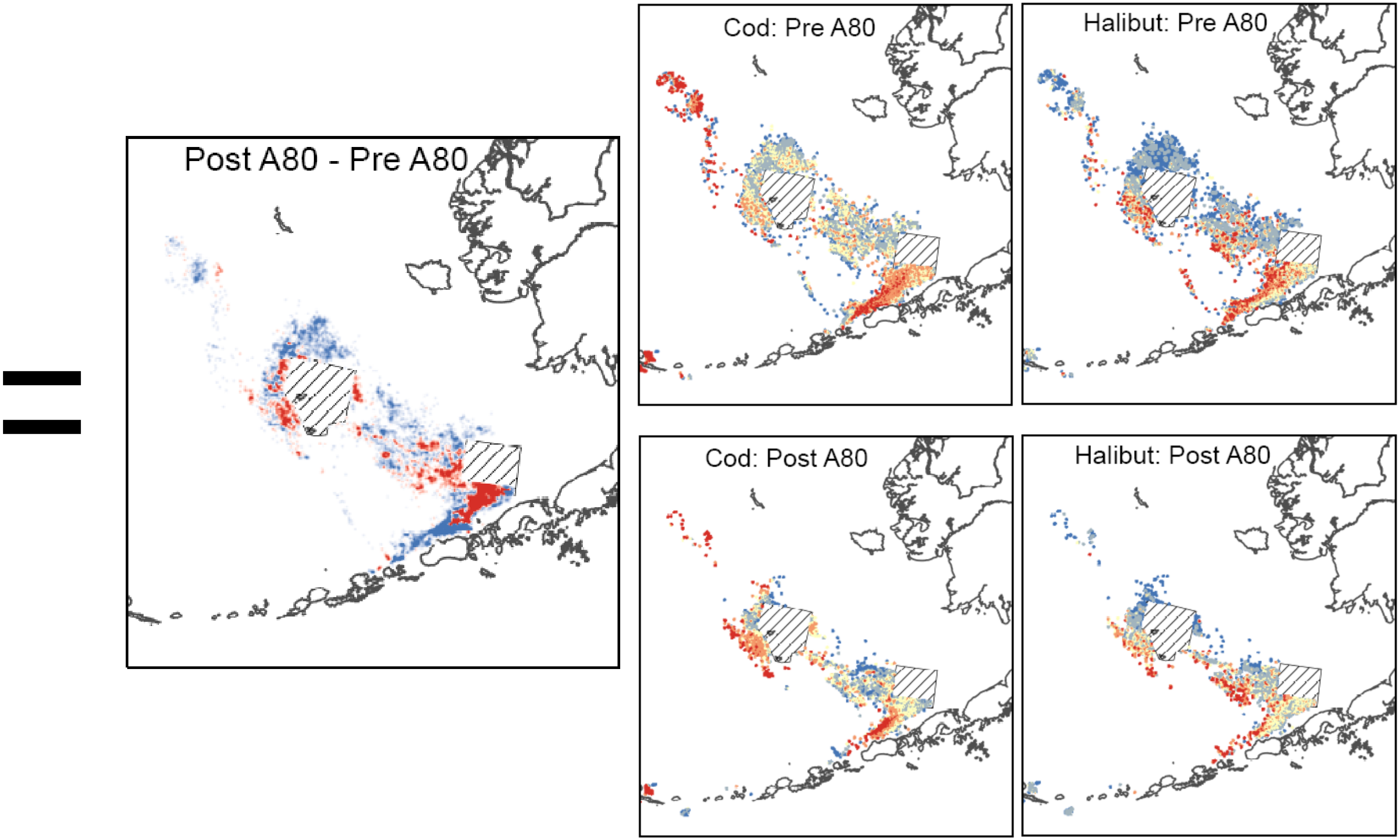
– These margins have all been validated by interviews with captains

1. Large scale choice of fishing ground
2. “Reactive” spatial avoidance
3. Reductions in night fishing
   - a decrease of between 15 and 18% relative to those found in 2007. There is also a pronounced seasonality to the reduction in night-fishing.

Large scale spatial avoidance: Jan - Apr



Large scale spatial avoidance: Jan - Apr



Large scale spatial avoidance: Sep - Dec

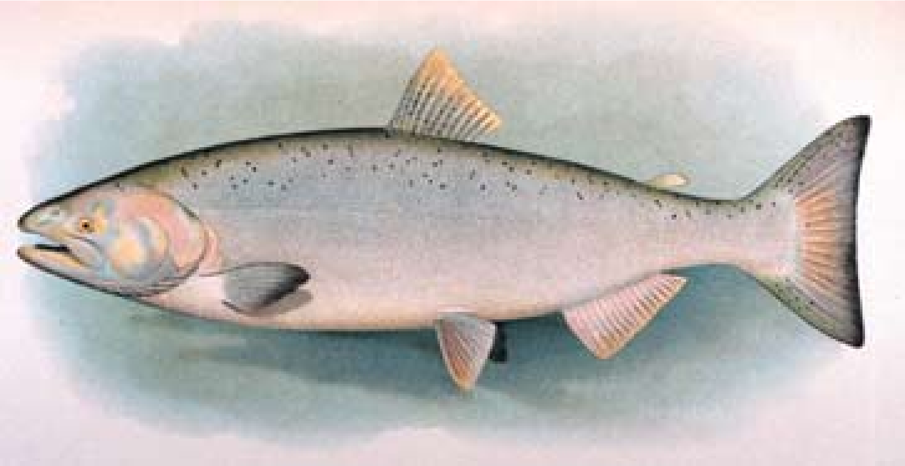
- No discernable large scale pattern of avoidance
  - Consistent with a late-season relaxation of avoidance efforts after uncertainty over multi-species quota scarcity is resolved

Why weren't these behaviors common before A80?

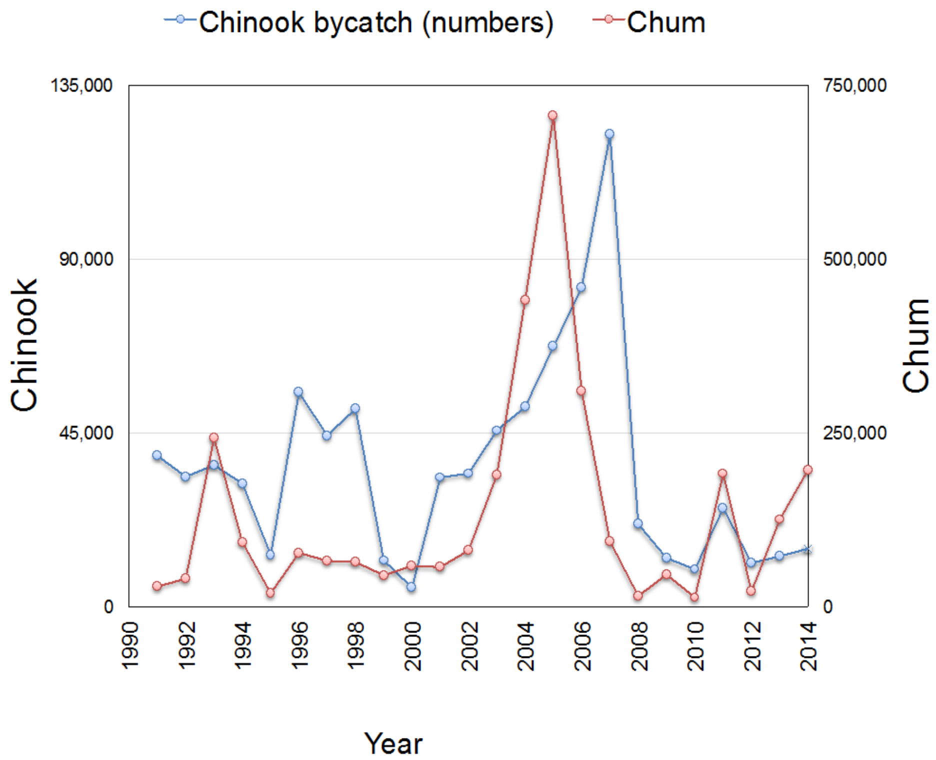
- The margins used to enhance selectivity were known well before Amendment 80 (Abbott & Wilen 2010, 2011)
  - They were mostly "short run" in nature and didn't require fundamental changes to gear
- Nature and technology must cooperate, BUT
- But fishermen had weak incentives to adopt them unilaterally

Fish Story # 3

Salmon bycatch reduction efforts in the Bering sea pollock fishery



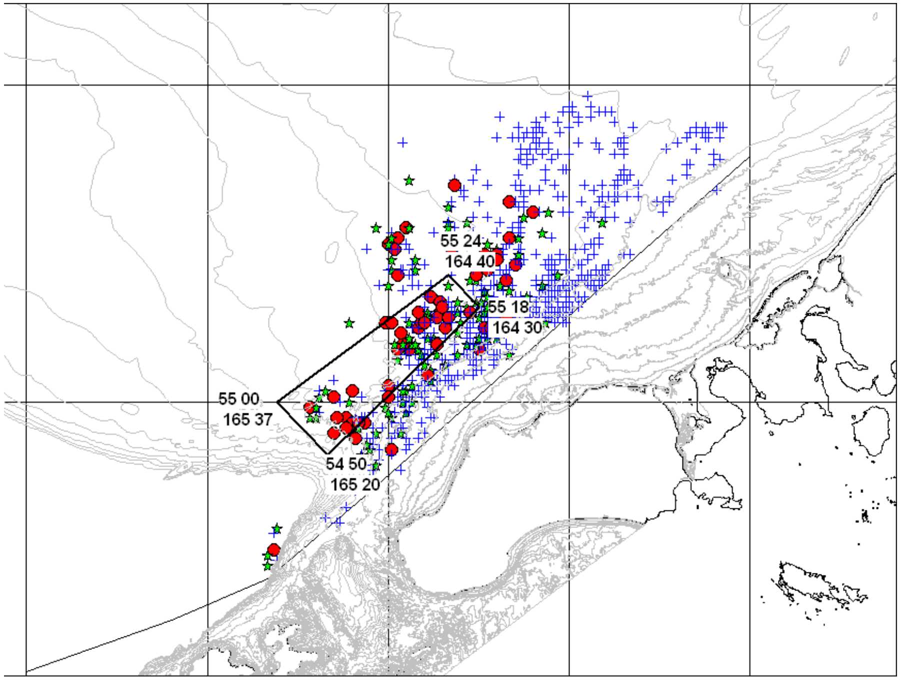
Salmon bycatch in Bering Sea pollock trawl fishery, 1991-2014



Source: NPFMC, November 2014

- Bycatch varies
- Chinook return to many rivers. Some runs are doing well, some very poorly.
- Chinook are of high cultural and subsistence value.
- Majority of chum is from hatcheries but concern about some AK runs.
- Salmon are prohibited species catch (PSC)

Rolling Hotspot (RHS) Program



- Industry-operated program to reduce chum and Chinook bycatch
- Vessels/cooperatives closed out of areas for 0-7 days based on their bycatch rates
- Reduces bycatch, but does not necessarily prevent high levels

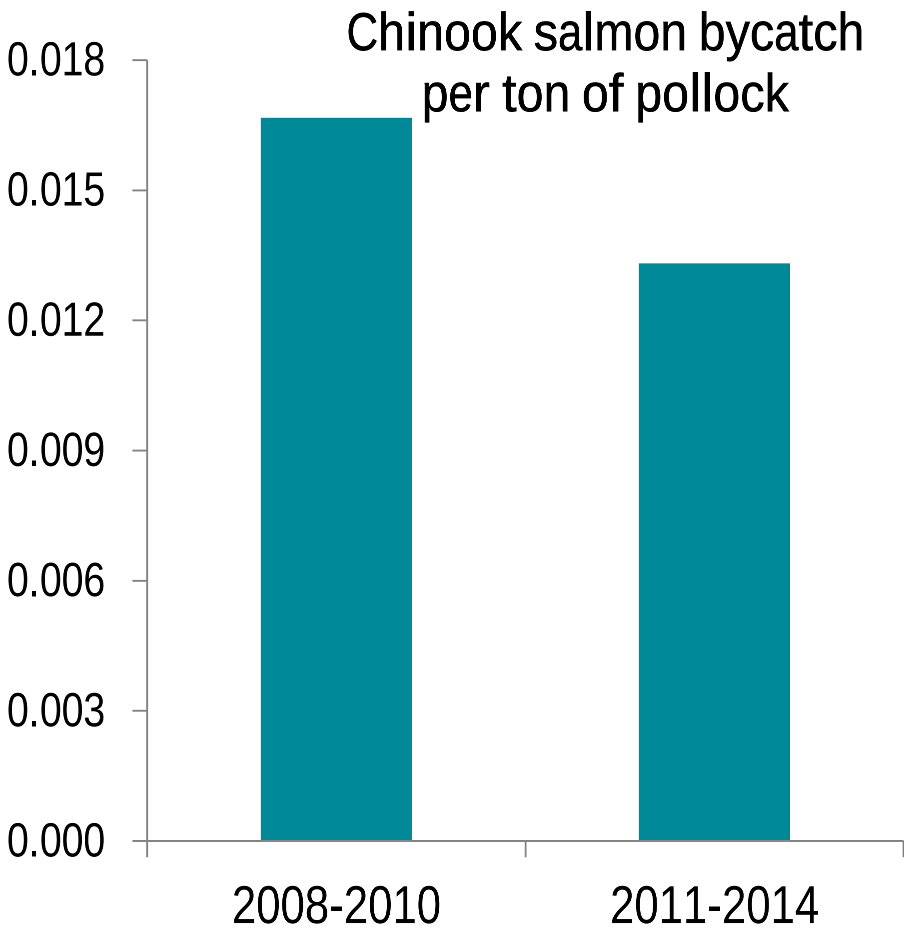
Key features of Amendment 91

- Since 2011, a **hard cap** of 47,591 Chinook / year is allocated by sector, cooperative, and individual vessels.

- Participation in an "**Incentive Plan Agreement**" (IPA) enables catch up to their share of 60,000 Chinook/year in 2 of 7 years.

- IPAs must meet general requirements, but have latitude on the incentives to reduce bycatch below the hard cap.

Chinook Reduction Since Amendment 91



Base year range	Post-A91 reduction
1991-2010	59%
2001-2010	65%
2008-2010	20%

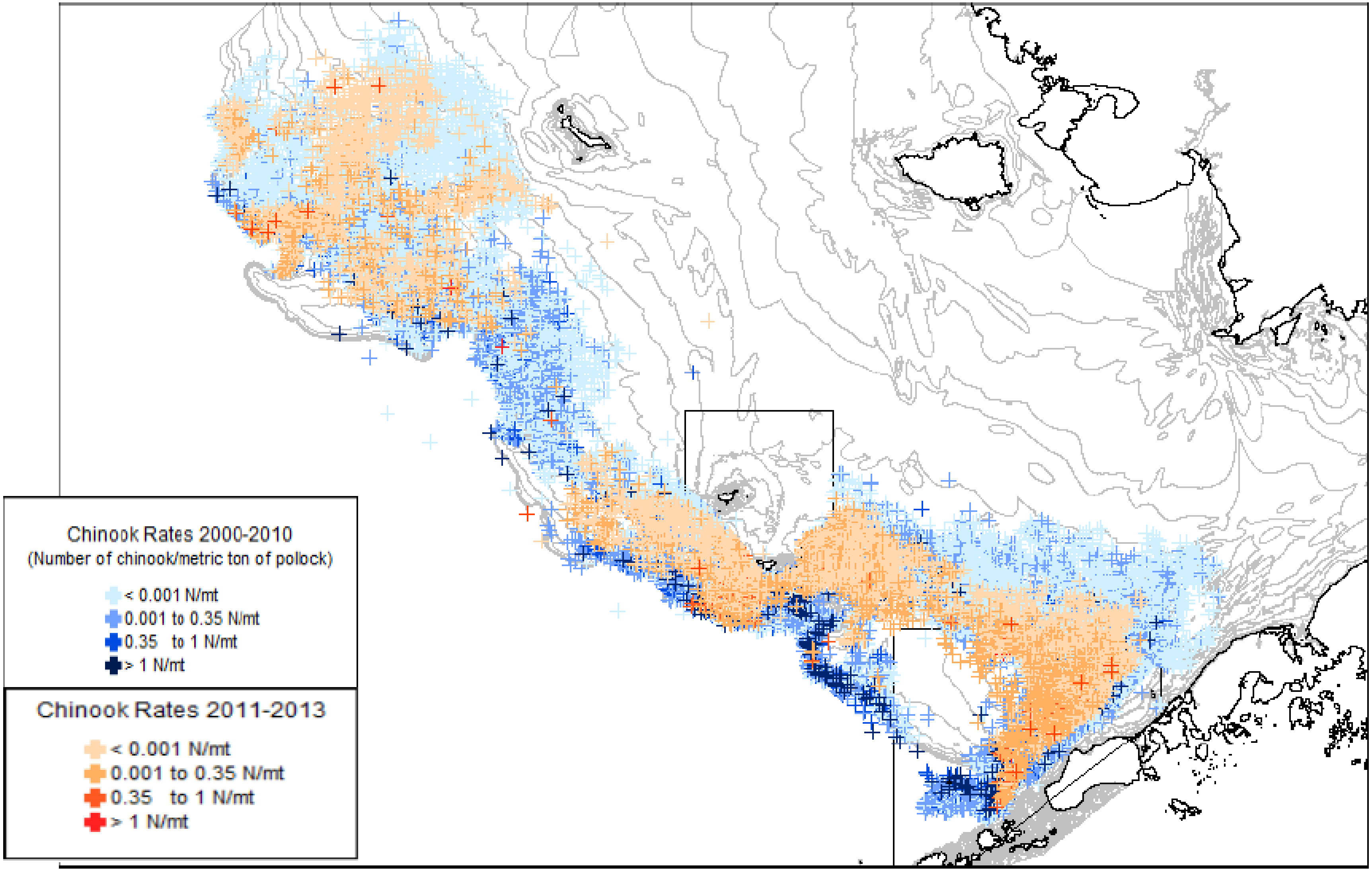


Figure 7. Pollock CP haul locations caught between September 1st and February 28th for the years 2000-2010 (blue) and 2011-2013 (orange). Darker color indicates higher Chinook bycatch rates.

Source: Catcher Processor IPA Report, April 2014

Chinook Incentive Plan Agreements (IPAs)

- Salmon Savings Incentive Plans (SSIP) are in place for the Mothership and Inshore sectors
  - Vessels earn a proportion of a unit of salmon savings for each salmon avoided below the vessel's quota this year
  - Plan also has rolling hotspot closures

Chinook Incentive Plan Agreements (IPAs)

- Fixed closures plus expanded rolling hotspot system for the Catcher Processor and CDQ Sectors.
  - Badly performing vessels can be subject to longer-term closures.

Chinook Hard cap

- Hard cap is allocated at the vessel- or mothership-level
- Significant restrictions on Chinook quota trading imposed under industry plans
- Reaching the cap could be catastrophic
- Uncertainty about late-season levels means extra avoidance early

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Fish Story #4

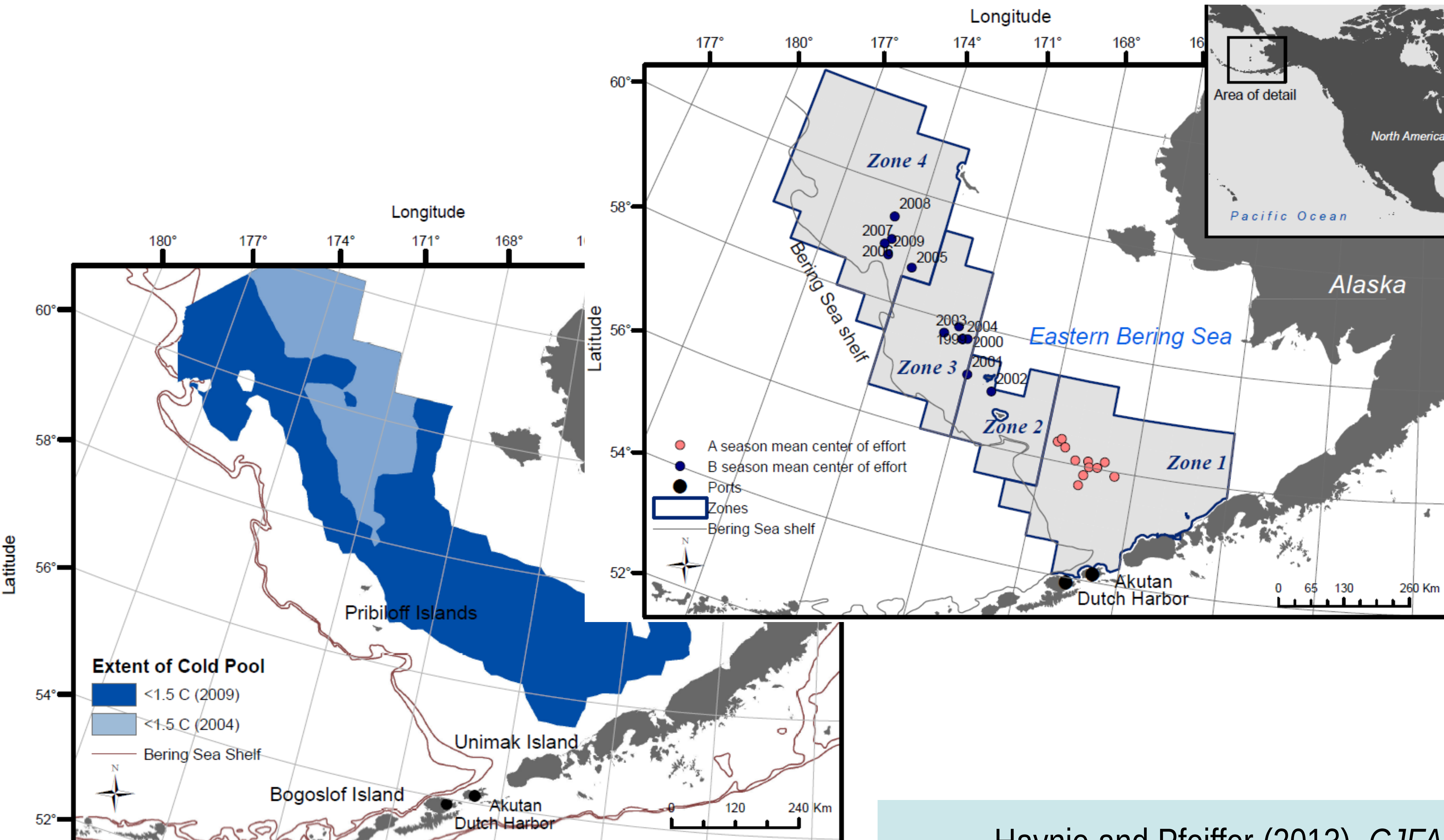
The Bering Sea Integrated Ecosystem Research Program (BSIERP)

Not just a march to the north:

How climate variation affects the Bering Sea pollock trawl and Pacific cod longline fisheries

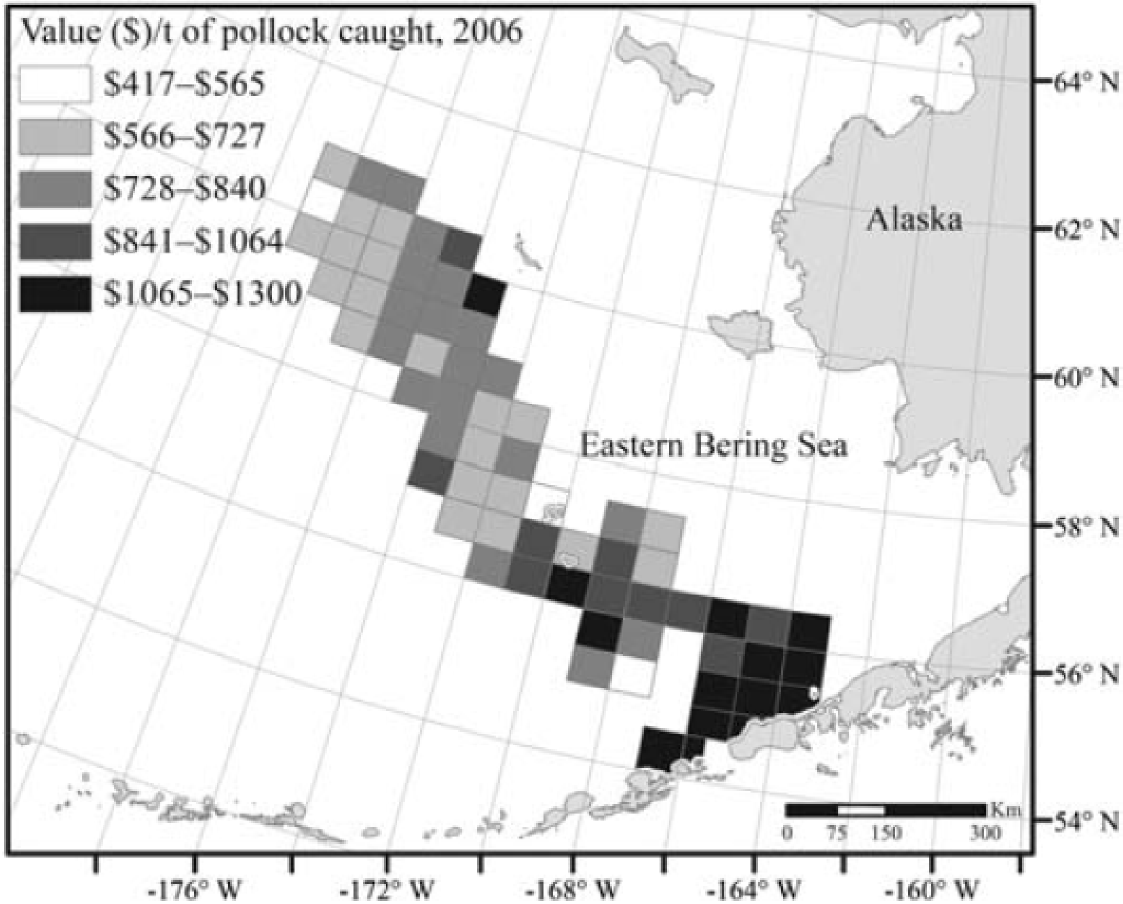
Alan Haynie & Lisa Pfeiffer

Key Finding # 1: The "march to the north" is not a consistent story for pollock catcher processors



Haynie and Pfeiffer (2013), *CJFAS*.

For pollock, prices matter and vary spatially



Haynie and Pfeiffer, *ICES* 2012

Key Finding # 2: Fishers can adapt, at a cost

Harvesters have many means by which to adapt to changes in fishing conditions that may be related to climate variation.

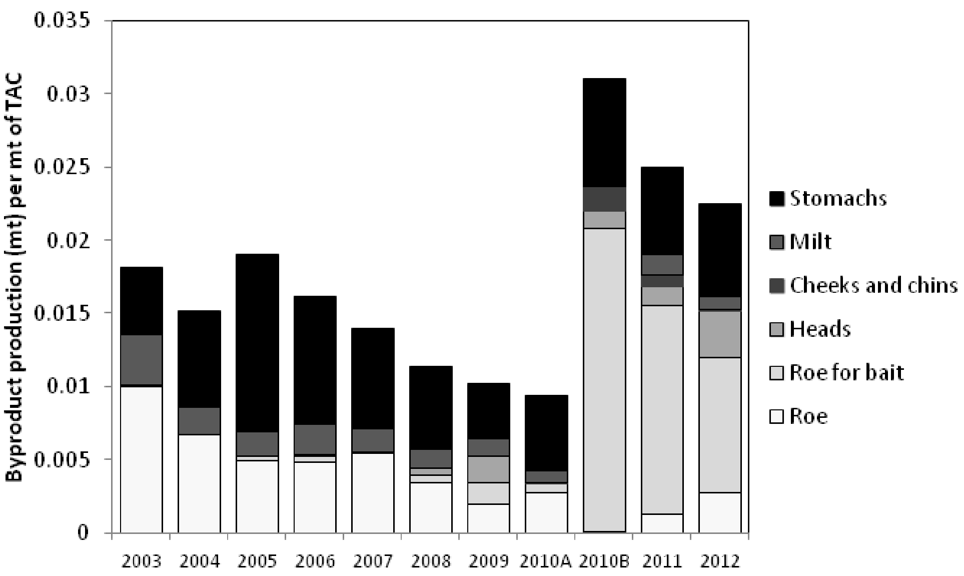
- Location
- Timing
- Distance traveled
- Haul/set-level choices (e.g., soak/trawl time, number of hooks).

Key Finding # 3: Many types of uncertainty will interact in determining future behavior

- <u>Institutions matter.</u> Changes in management such as catch shares

- Understanding interactions between management changes and climate-related variation is essential

Significant increase in Pacific cod byproduct utilization under cooperatives



Pfeiffer and Haynie, *Under review*

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Take-home messages

Fisheries management is largely about getting the incentives right

- Creating catch shares of target and bycatch species encourages efficient utilization of those species… but not necessarily other parts of the ecosystem

Necessary features for successful incentives

- The magnitude of a penalty or reward has to be large enough to encourage the desired behavior
- "Adequate" observer coverage
- Ability to assign responsibility to individual actors
- Ability of vessels to make decisions to reduce or avoid bycatch (e.g. Abbott, Haynie, Reimer 2015)

Incentives can induce a wide range of changes in fishing behaviors

- Changes in time, location, and depth of fishing
- Gear changes such as excluders
- Increased communication about bycatch
- More effort can be exerted by vessels with lower bycatch avoidance costs

Fishermen – the experts – get to make the decisions and adapt to ever-changing fishing conditions.

Encourage transparency

Auctioning a small share of fishing quota would provide a regular market price -- the value for different uses. It would also ensure that the highest value users had access to quota.

Increase temporal flexibility of quota usage

- When there is not a clear relationship between bycatch rates and the stock, there is no biological reason to have temporal rigidity
  - Can be administrative challenges to flexibility
- Eliminate “use it or lose it” situations
  - Reward late-season bycatch avoidance
  - Multi-year quotas can achieve this
    - Quota can be discounted if desired

Summary: What are our priorities for making things “Better”?

- Ensure that groups that want to sell/trade fish can
- Add flexibility unless rigidity is necessary
- Consider bycatch fees and rewards to provide ongoing incentives for bycatch avoidance
- Beware of unintended consequences
- Collect information on trades and quota values across target and bycatch uses
- Communicate, communicate, communicate!

FishSET

Spatial Economics Toolbox for Fisheries

FishSET's goal is to enable NOAA Fisheries economists and social scientists to better inform policy decisions by predicting how a variety of factors might influence fisher behavior.

Many modeling challenges exist. While predictive models are valuable tools for sustainable fisheries management and conservation, challenges to their development include preparing, integrating & updating many data sources, choosing appropriate models, and interpreting results.

FishSET provides:

1. **Superior data organization, analysis, and integration** for spatial models.
2. **Best management practices** for data, modeling, and model comparison.
3. **Many models in a single toolbox** for ease of model comparision and use. Combines several fisheries economics modeling approaches in one toolbox.

FishSET facilitates better and more expedient analyses to improve marine resource management.

To learn more, visit:
www.st.nmfs.noaa.gov/humandimensions/fishset/index

What tools are in the FishSET toolbox?

Data Tools

Data Management & Integration Tool
Facilitates the development and integration of datasets for spatial modeling

Monte Carlo Tool
Simulates real fisheries data while preserving confidentiality, allowing better model testing and comparison.

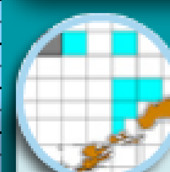
Data Analysis & Mapping Tool
Enables graphical and geographic data viewing and prepares data for spatial modeling

Model Tools

Model Design & Selection Tool
Enables modeling of different combinations of variables and models

Modeling Tool
Runs standard, cutting-edge, and user-designed models

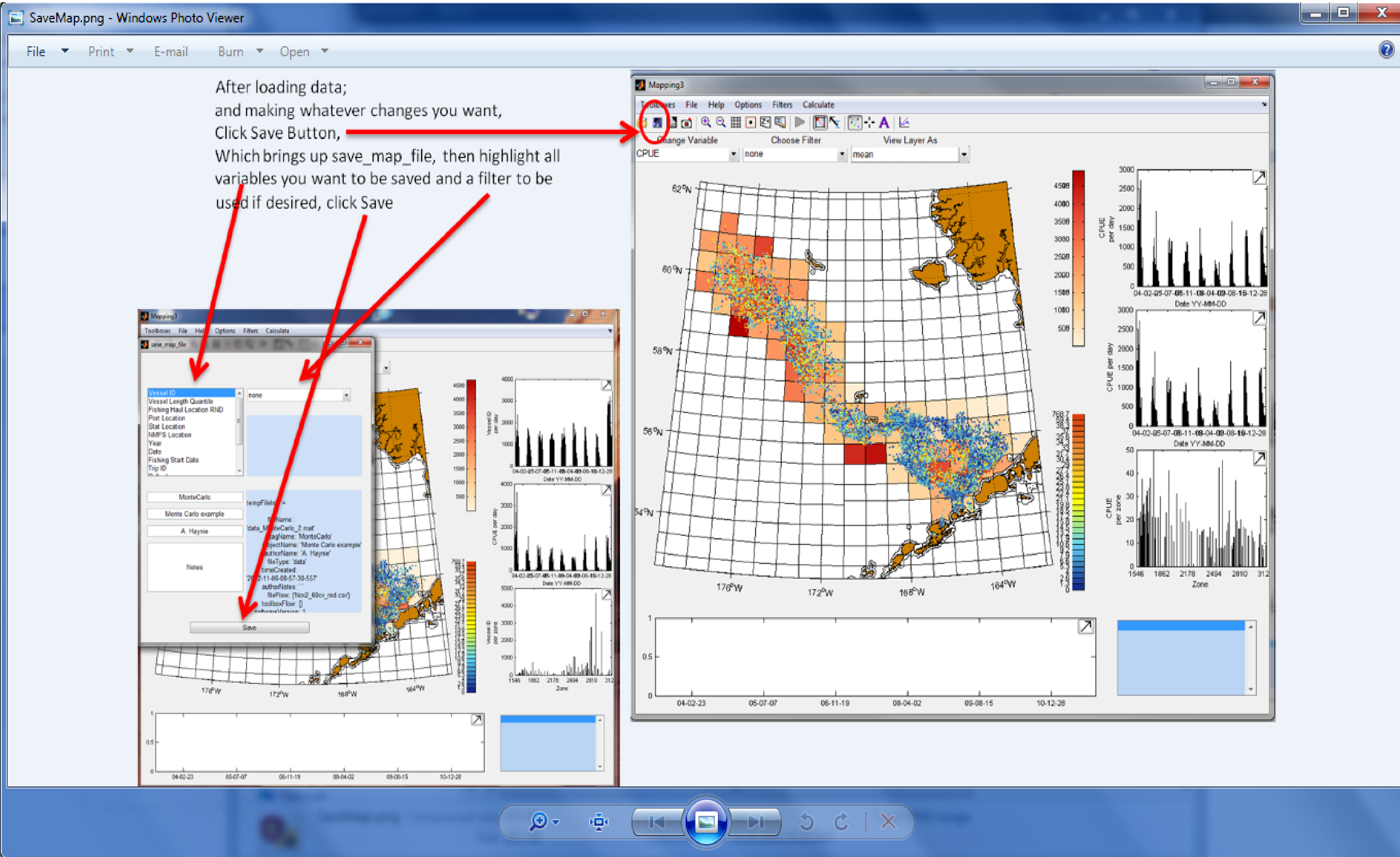
Model Comparison & Reporting Tool
Provides an extensive comparison of model performance and summarizes data, models, and results



Policy Tools

Policy Simulation Tool
Predicts location choices and estimates policy impacts

Help & teaching tools are being developed…



New Online Fisheries Economics Course to be Designed and Taught Over the Next Year

"Current lessons in fisheries economics for fisheries scientists and managers"


The right incentives, institutions, and tools can help us adapt to a changing environment.

Thank you!

Thanks to Josh Abbott, Matt Reimer, Lisa Pfeiffer, Rita Curtis, Corinne Bassin, Jordan Watson, NPRB, Jason Anderson (ASC), John Gauvin, Bill Orr, Dave Wood, Robert Hezel, Ron Felthoven, Steve Kasperski, Marty Smith, Rob Hicks, Kurt Schnier, Larry Perruso Jim Wilen, Jim Ianelli, Diana Stram, Brian Garber-Yonts, John Gruver, Kirstin Holsman, and everyone else involved in FishSET and BSIERP.

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