A large fishing vessel is shown on the ocean, slightly out of focus in the background. The ship has a white upper hull and a dark lower hull. It features various pieces of equipment, including a crane and a large net. The sea is a light blue-grey color, and the sky is a pale, hazy blue. The overall scene is a maritime setting.

Ecosystem-based Businesses: Managing for Economic Benefits in a Multispecies World

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Trends in Harvest Participation

- Medium-term decline in the number of vessels participating
- As bad as it looks?
 - Fisheries were overcapitalized
 - Is number of firms good proxy for
 - Output value?
 - Size of industry?
 - Does leaving one fishery mean leaving fishing?

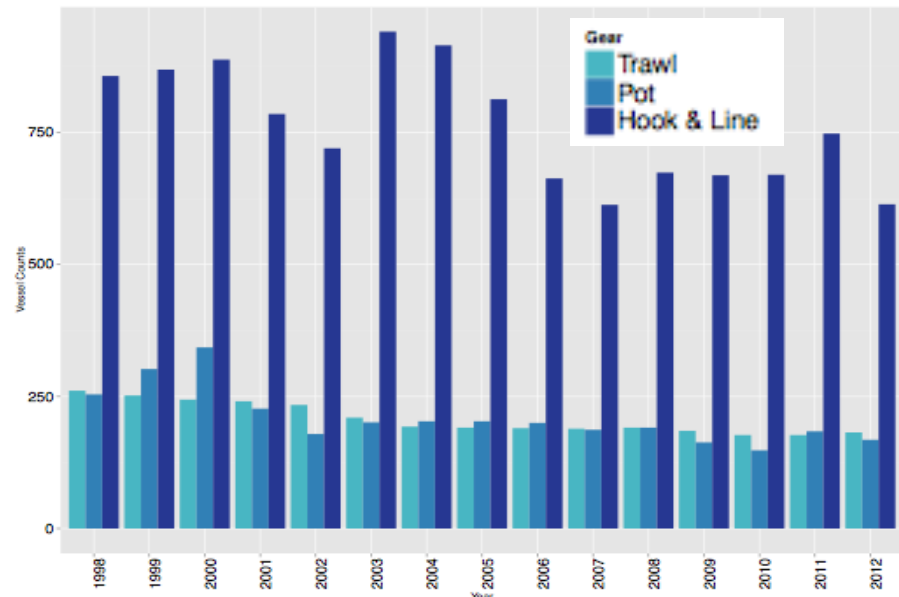
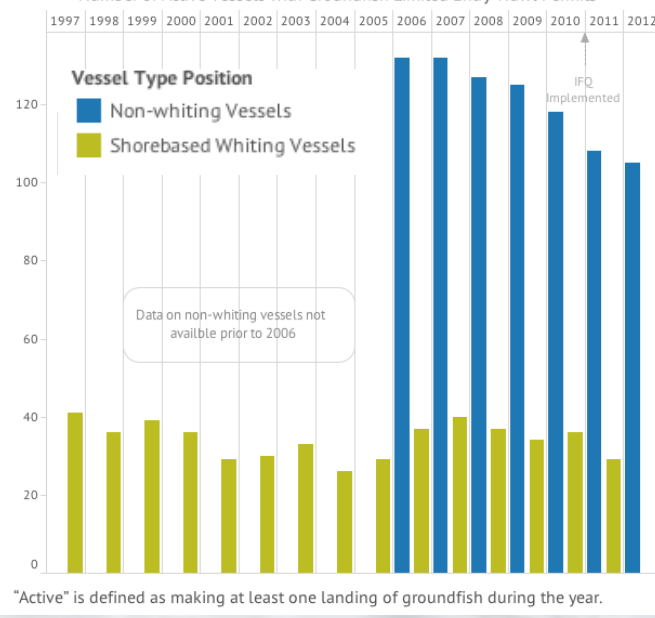


Figure 6: Number of vessels in the domestic fishery off Alaska by gear type

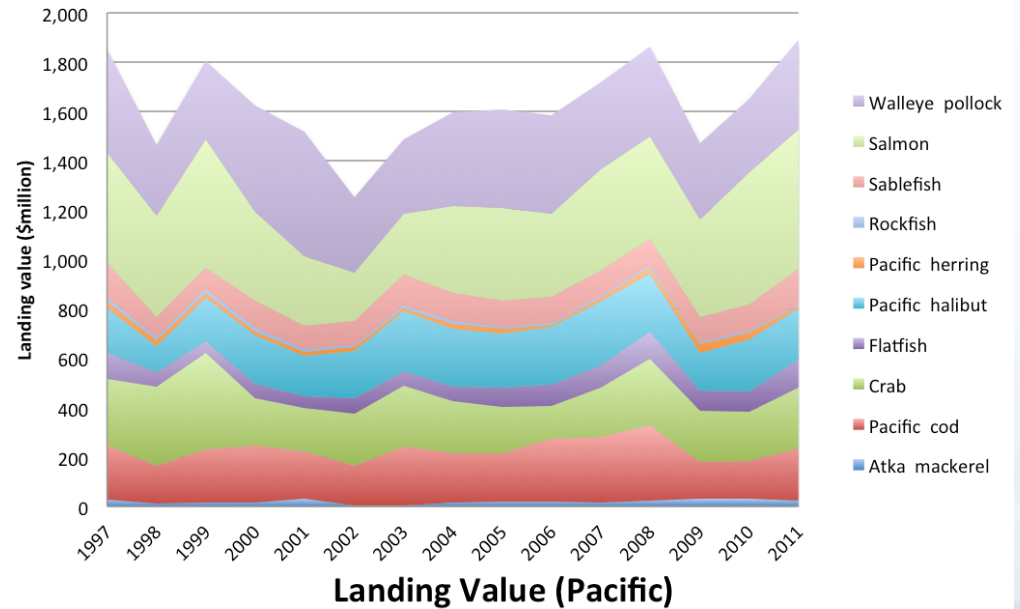


"Active" is defined as making at least one landing of groundfish during the year.

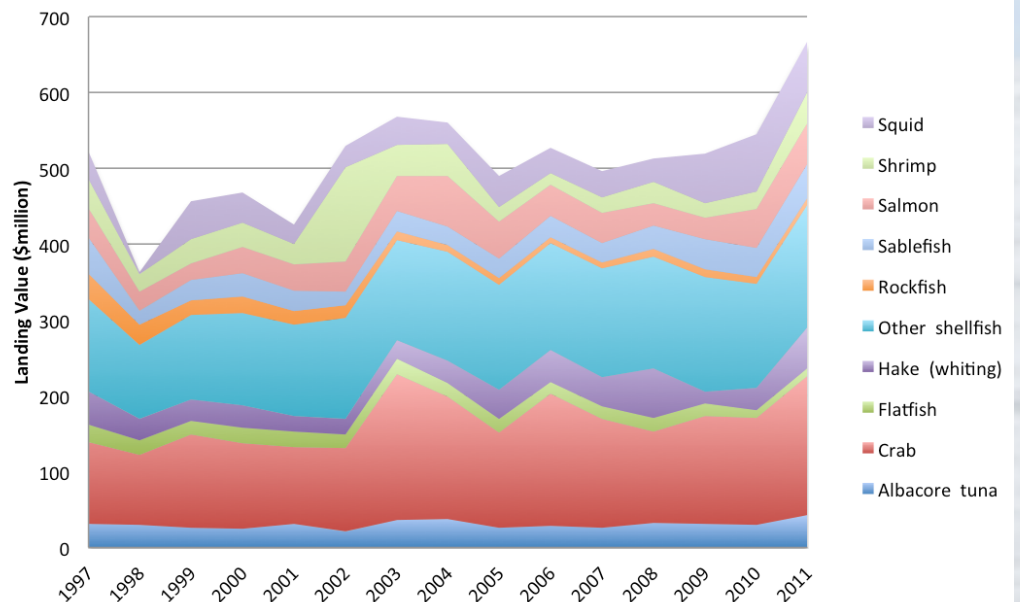
Trends in Ex-Vessel Revenues

- Revenues are increasing
 - Higher food demand
 - Improved processing and product quality
 - Catch shares
 - Improved market timing
 - Higher value product forms

Landing Value by species (AK)



Landing Value (Pacific)



Importance of Post-Harvest Sector

- Focus on harvesters understates value of fishing to society
- Processing is more than half the value, significant component of labor
 - Responsible for realizing value through product form and market development
 - Source of community benefits

2011 Alaska Seafood Industry Economic Impacts

	Direct Impacts
Commercial Fishing	
Number of Workers	32,000
Full-time Equivalent (FTE)	16,500
Estimated Labor Income (in \$Millions)	\$1,080
Output (Harvest Value in \$Millions)	\$2,110
Seafood Processing	
Number of Workers	27,100
Average Monthly Employment	11,500
Labor Income (in \$Millions)	\$410
Output (Less Harvest Value, in \$Millions)	\$2,500 ¹

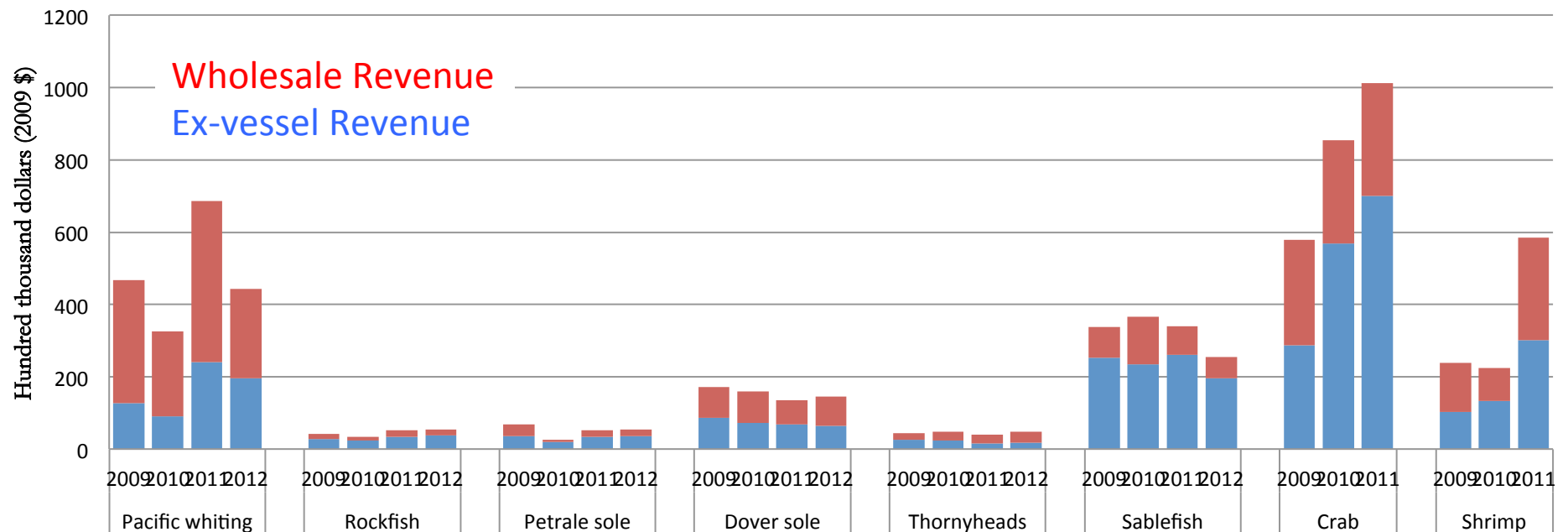
McDowell Group Economic Value of Alaska Seafood Industry (2013)

Processor-Generated Values

- Across products, processors add value
 - Market and management factors govern division of rents

Wholesale Revenue & Ex-vessel Revenue (in blue)
by Species Group

Sample: West Coast Processors with First Receiver Site Licenses



Data Source:

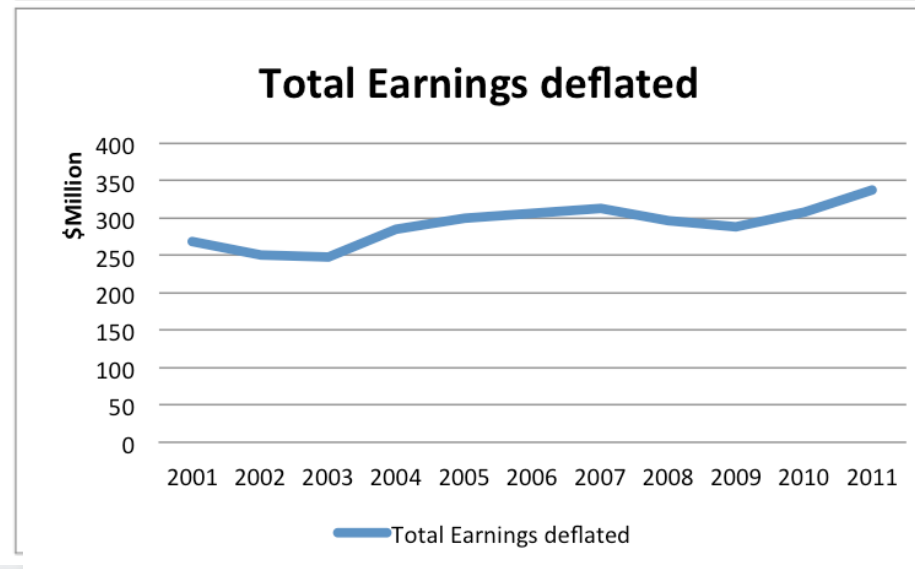
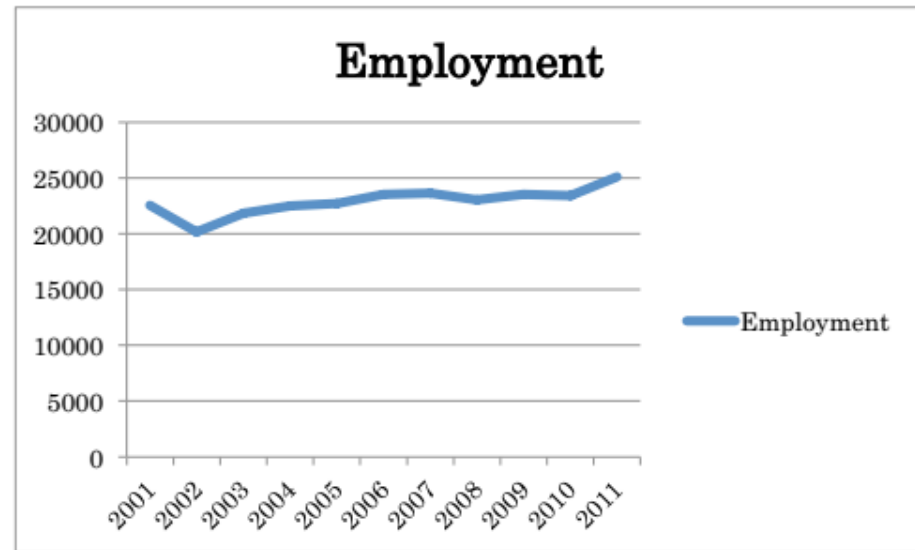
NOAA Fisheries, NWFSC, Economic Data Collection (EDC) Program, Seattle, WA

* Data for 2012 is preliminary

Processing Industry

- Processing higher value products requires labor
 - Employment and earnings increasing

Alaska Seafood processing

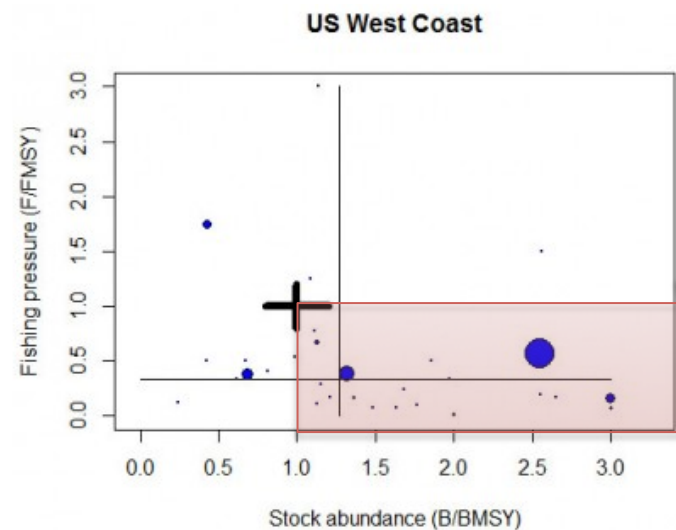
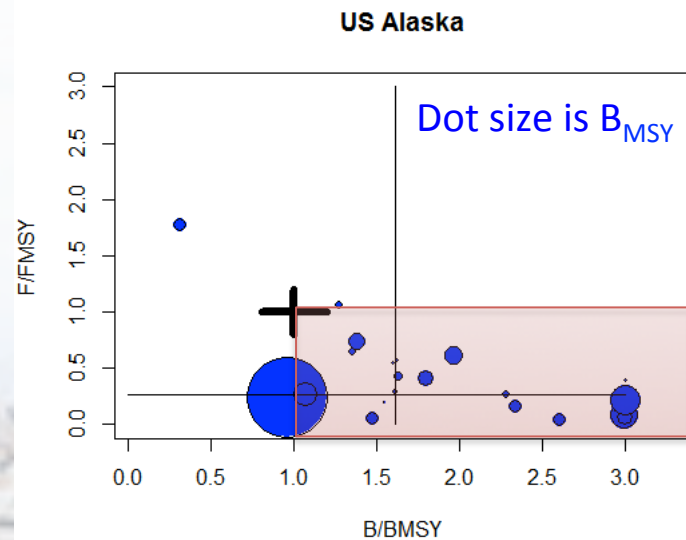


Is Fishing Realizing its Economic Potential?

- MSA structured around designating status and TACs of single species, but businesses depend on multiple species
 - **Multispecies problem:** Fisheries (management plans) often connect multiple species
 - Joint production in mixed stocks
 - Bycatch and prohibited species
 - **Multifishery problem:** Businesses participate in multiple fisheries
 - Changing one management plan influences how participate in separately managed fisheries
- Need shift in perspective comparable to Ecosystem Based Management
 - Recognize that businesses are structured to depend on an ecosystem of harvested products

Multispecies Problem: Underfishing

- We are *underfishing*
 - Median F is below half of F_{MSY}
 - Median B is above B_{MSY}
- Reasons
 - Precaution
 - Not economical
 - Joint harvest with limiting species



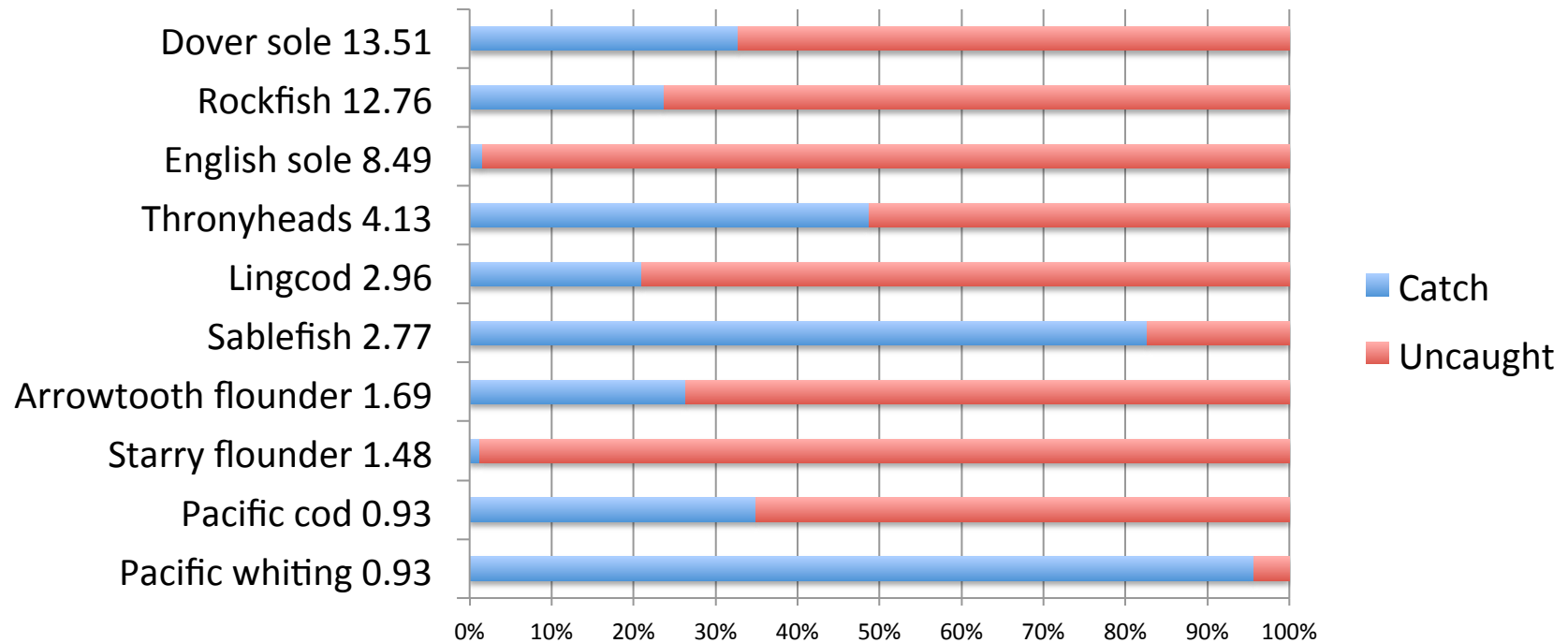
Under fishing region

Figure 1. Stock status of US west coast stocks from most recent NOAA assessments.

Multispecies Problem: Failure to Achieve TACs

- Value of unharvested TAC at market prices: ~\$50M (in ~\$50M fishery)
 - Opportunities in other fisheries
 - Highly constraining rare bycatch
 - Excessive avoidance due to risk

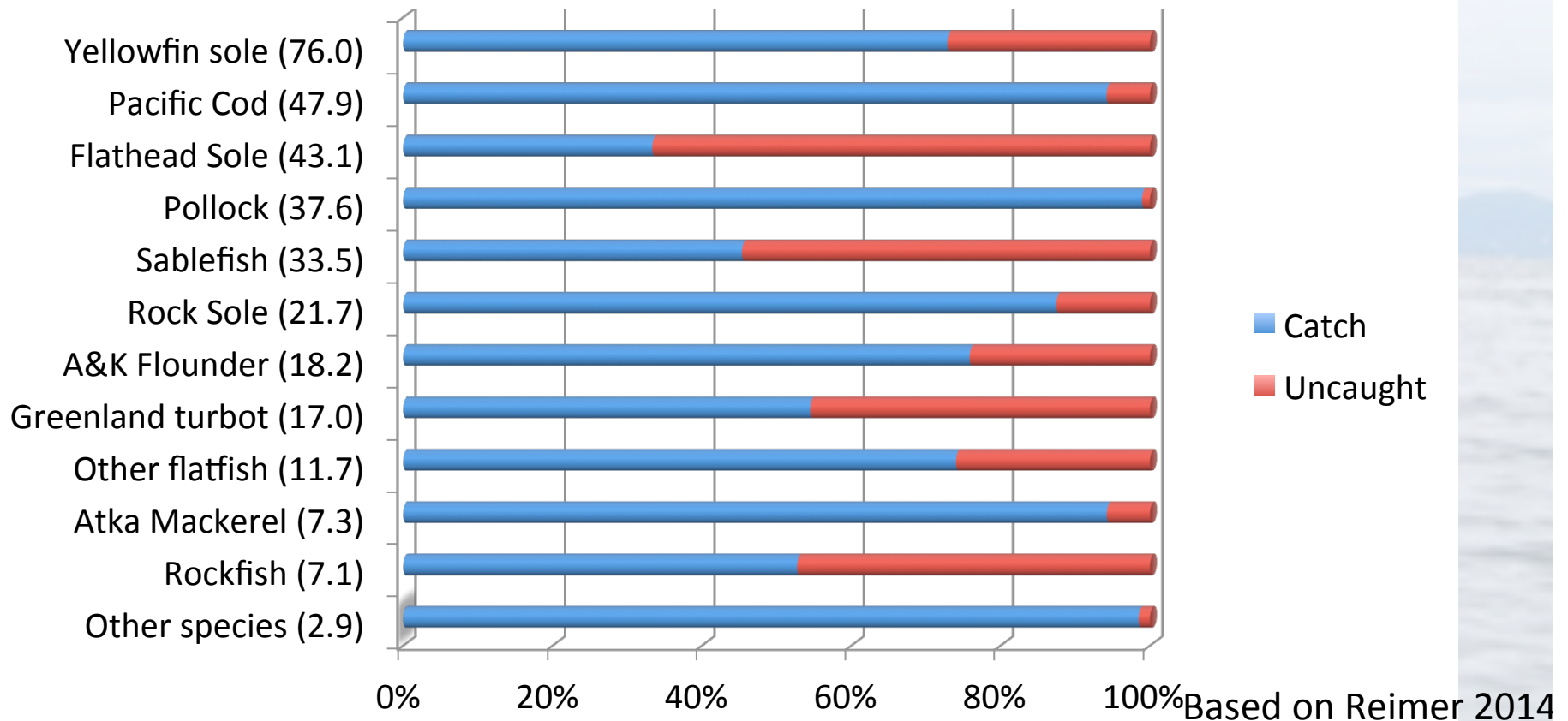
2012 West Coast Trawl Quota Utilization (Exvessel Value of Unused \$M)



Failure to Catch TACs: BSAI

- Wholesale value of unused TAC: \$300-500M
 - \$323.9M in 2012
 - (And 1/3 or more of ABC is above 2MT cap)

2012 BSAI TAC Utilization (Wholesale Value of Unused TAC \$M)



Multispecies Problem: MSA Guidance

- NS 1 “***optimum yield*** (OY) from each fishery”
 - Interpreted as MSY for each stock/species, as *reduced* by relevant economic, social or ecological factors
- But achieving OY from each species in a jointly harvested multispecies fishery is unrealistic
 - How then provide “greatest overall benefit” to nation?
- Mixed stock exception
 - Not currently operational
 - Does not apply to need to rebuild, most applicable in fisheries that have been overfished
 - “Exception”: OY should be the norm
 - Intentionally “Overfishing”: bad for marketing

Multispecies Problem: MSA Guidance

- Need holistic, positive ecosystem-based notion of sustainable OY from mixed stock fisheries
 - Recognize healthy fisheries involve healthy industries
 - Recognize source of food, community livelihoods
- Ecosystem-based management can provide framework
 - Define complete set of technically plausible, sustainable removals
 - Use “overfishing” only to apply to fisheries, not stocks
 - Integrate trophic relationships, nest forage fish
- Industry guidelines
 - Maintain avoidance incentives; catch share programs can do this
 - Cooperatives can better manage portfolios of quota
- Biological guidelines: How low can stocks be allowed to go?
 - MSE: clear of ESA (1998), likely above 50% B_{MSY} (2009)
 - Should depend on ecological significance, vulnerability
- Implementation: Monitor
 - Multi-year targets to deal with variable intermixing
 - Phase in with monitoring of key ecosystem structure variables, consistent with EBM

Multispecies Problem: MSA Guidance

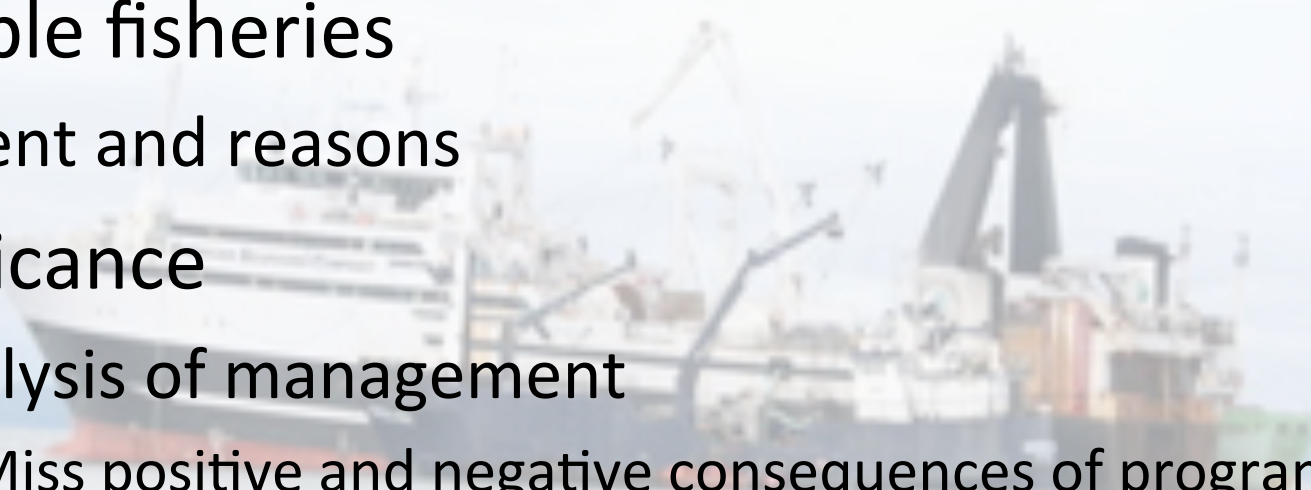
- Need holistic, positive ecosystem-based notion of sustainable OY from mixed stock fisheries
 - Recognize healthy fisheries involve healthy industries
 - Recognize source of food, community livelihoods
- Ecosystem-based management can provide framework
 - Define complete set of technically plausible, sustainable removals
 - Do not apply “overfished” standard on a stock-by-stock basis
 - Integrate trophic relationships, nest forage fish
- Renewal can call for NRC panel to evaluate

Multispecies Problem: MSA Guidance

- Identify *sustainable* mixed stock removals
 - Apply best available science to ensure removals jointly sustainable
 - Capture trophic relationships (this nests forage fish considerations in Senate bill)
 - Some stocks below MSY, but not unsustainable
 - Integrate other ecosystem considerations to ensure sustainability
- Biological guidelines: How low can individual stocks be allowed to go?
 - MSE: clear of ESA (1998), likely above 50% B_{MSY} (2009)
 - Should depend on vulnerability, role in ecosystem function
- Describe the set of technically plausible removals
 - Select ACLs that support sustainable volumes and harvest compositions that provide the greatest contribution to fishery dependent community
 - Respects history of industry, market value
- Industry guidelines
 - Production technology affects established ACLs
 - Maintain avoidance incentives; catch share programs can do this
 - Cooperatives can manage portfolios of quota when catch ratios uncertain
- Implementation: Monitor
 - Multi-year targets to deal with variable intermixing
 - Phase in with monitoring of key ecosystem variables, consistent with EBM

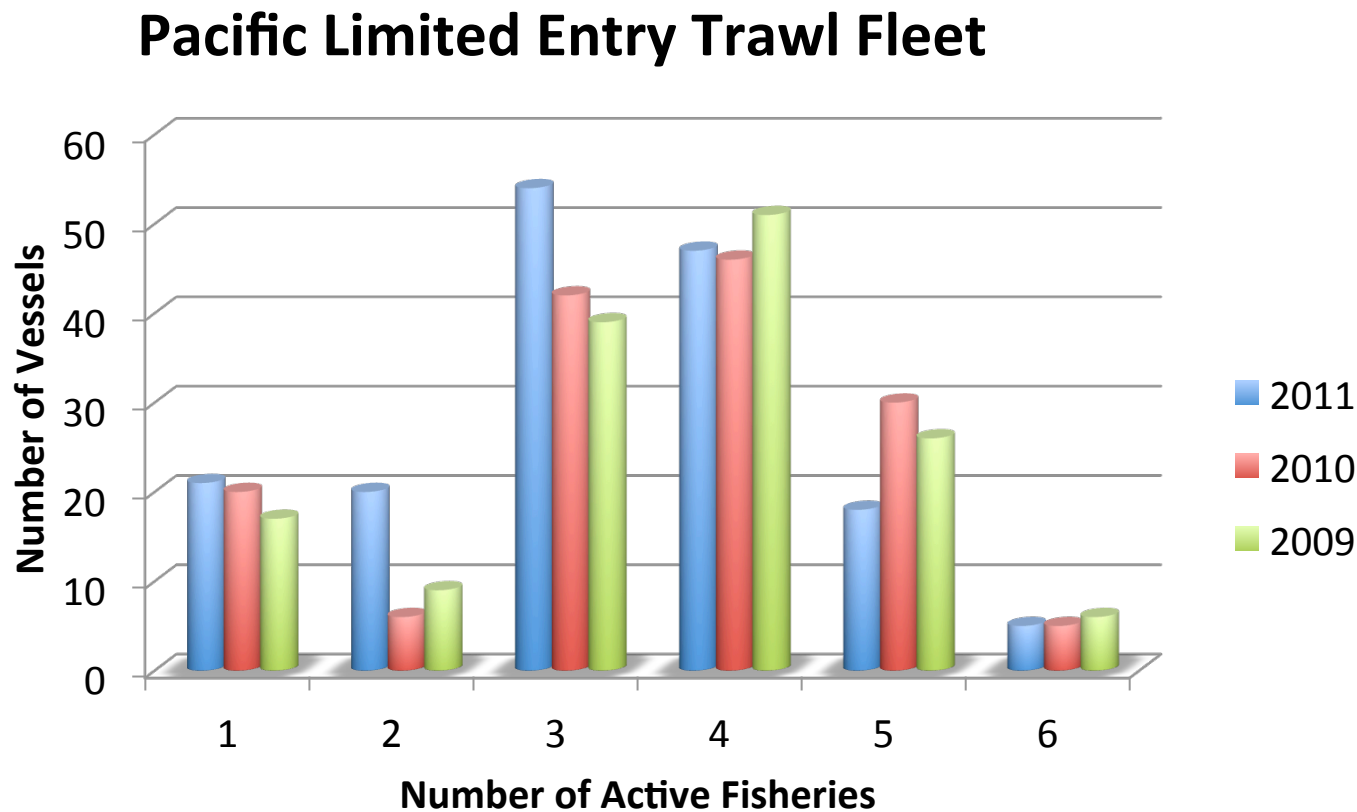
Multifishery Problem

- Ecosystem-based businesses participate in multiple fisheries
 - Extent and reasons
- Significance
 - Analysis of management
 - Miss positive and negative consequences of programs
 - How management should change to accommodate



Mutifishery Participation

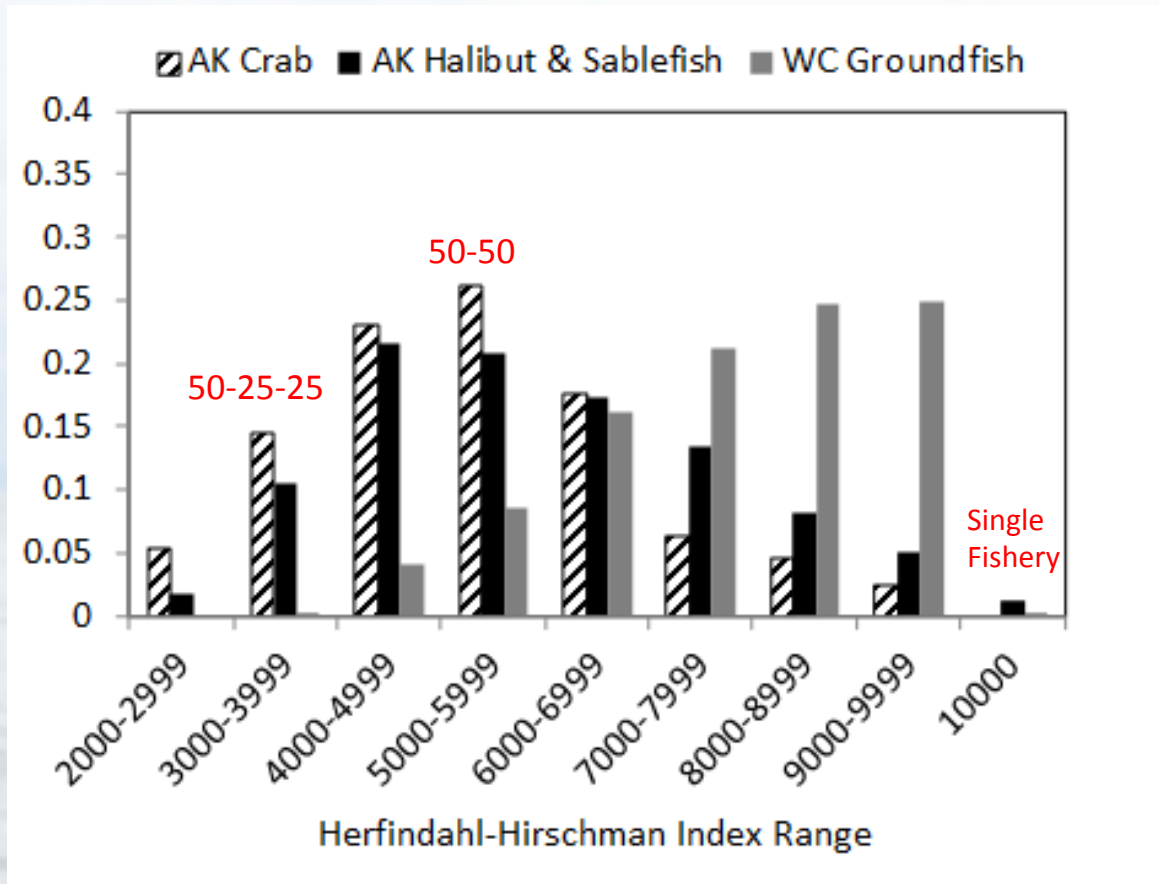
- Most vessels participate in several fisheries during a fishing year
 - These fisheries are often separately managed



Income Distribution Across Fisheries

$$HHI = \sum_i p_i^2$$

- HHIs indicate that most vessels draw substantial portions of income from different fisheries

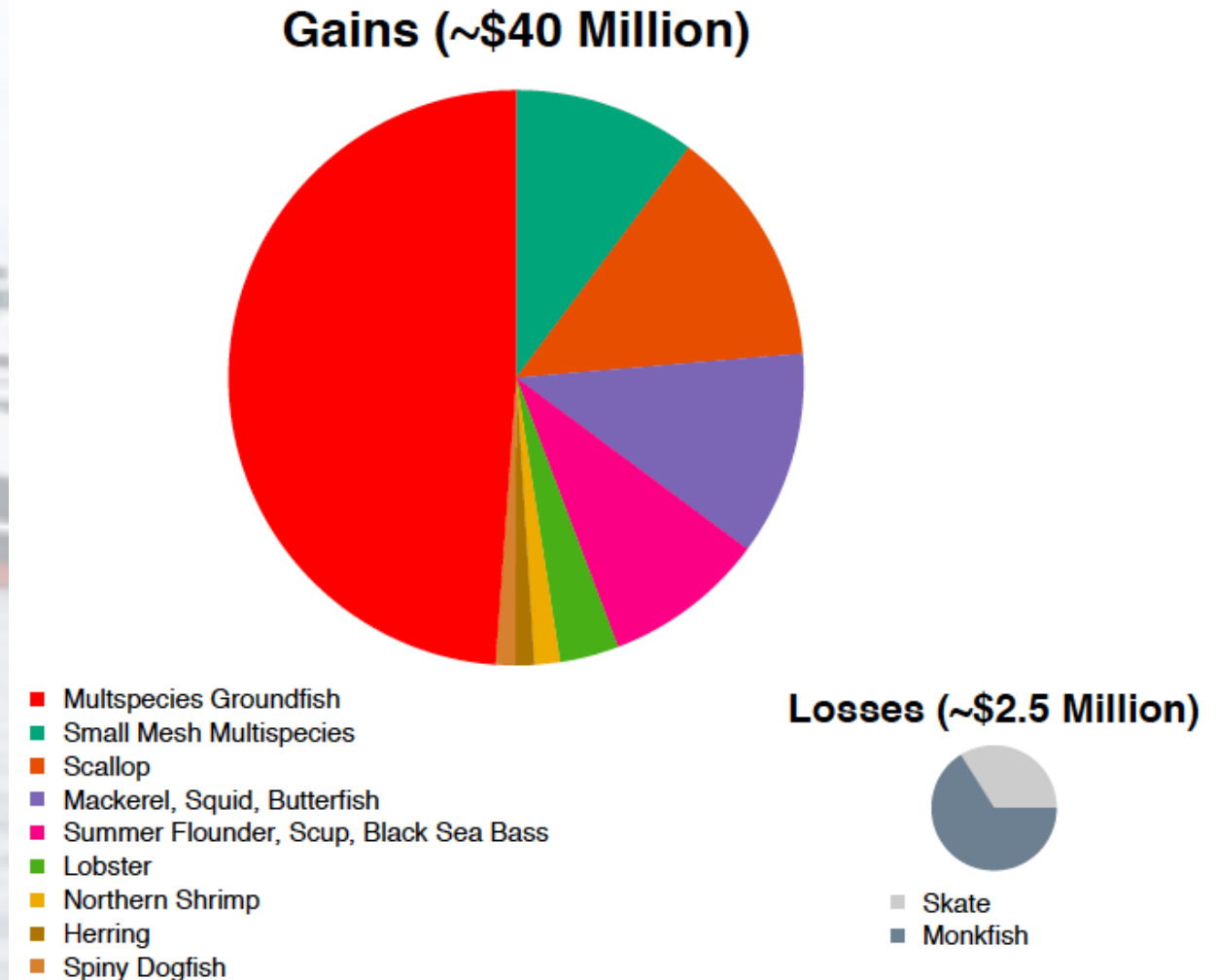


Multifishery Problem: Ecosystem-based Businesses React Across Fisheries

- Effort “spillover” into *unregulated* fisheries well documented
 - Less well understood is effects of shifting effort into *regulated* fisheries
- Catch share programs increase flexibility to participate in other fisheries
 - These effects can dominate effects in changed fishery

Management Effects for EBBs

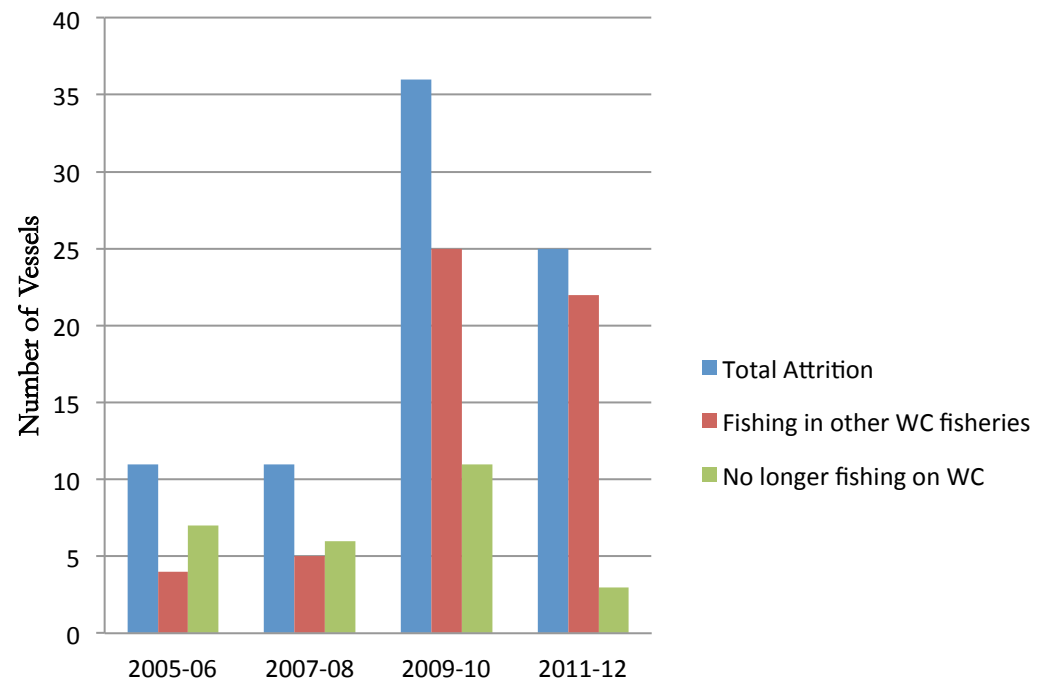
- 2010 revenue effects of NE Multispecies Catch Share, by fishery
 - Half of net gains came from changing timing and participation in separately managed fisheries



Multifishery Problem: Apparently Smaller Fleets?

- Decrease in participation overstates change in number of fishing operations
 - Most are still fishing, just in other fisheries
 - Specialization

Vessel Attrition in Shoreside West Coast Limited Entry Trawl Fleet



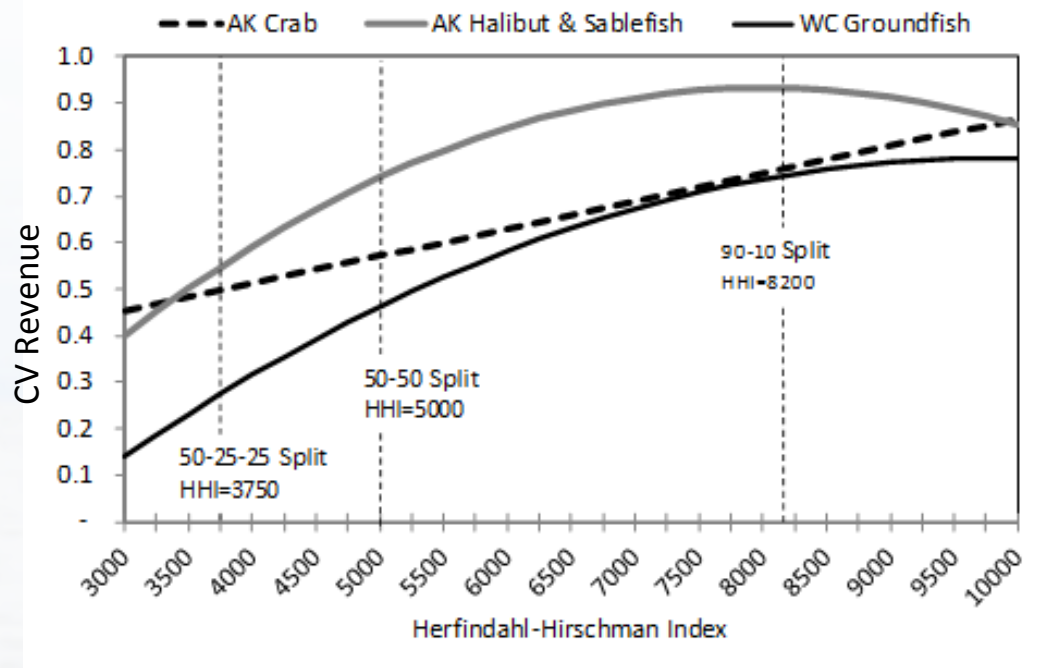
Data Source:

Pacific Fisheries Information Network (PacFIN) retrieval dated 4/11/2014,
Pacific States Marine Fisheries Commission, Portland, Oregon
(www.psmfc.org).

Multifishery Participation: MSA Guidance

- MSA does not recognize participation in multiple plans
- Analysis and monitoring
 - Monitoring NS 8 appropriately requires capturing the benefits and costs when they occur across fisheries
 - Strategic behavioral responses mean constructing counterfactuals to identify and measure policy effects is harder
- Potential MSA improvements
 - Need better standards for data that track business activity across fisheries
 - Improved coordination with state fisheries, fisheries in different Council regions

Multifishery Problem: Why Diversify?



- Keep fishing in “off season” of primary fishery
- Mitigate stock, market risk
- It is ***riskier*** to be concentrated in a single fishery (high HHI)

Risk Management

- Ecosystem-based businesses diversify across fisheries because they are risk sensitive
- Can be (excessively) risk sensitive within a fishery
 - Risk pools set up with best practices that are *too* constraining
 - Yelloweye Rockfish (quota) in Pacific
 - Salmon Savings Plans (PSC) in AFA cooperatives
 - Result can be dramatic underharvest, low utilization and low income
 - High year-to-year variance if mixing varies annually
 - High across-harvesters variance if bycatch is low probability with little control

Managing Ecosystem-based Businesses: MSA Guidance

- MSA catch share programs have increased flexibility
 - Harvesters have taken advantage of it
- Allocation of catch shares locks in historic participation patterns
 - Exposes to risk because cannot
 - Focus more fisheries with low bycatch years
 - Focus more on high abundance fisheries
 - Focus more on fisheries with good market years
- Changes to MSA to compensate for loss of cross-fishery flexibility
 - Multi-year targets of high variance species
 - Transferability of quotas across fleets/sectors
 - Especially for bycatch/PSC species
 - Limits effects of institutionalizing gear groups
 - Methods of managing catch risk
 - Deemed value systems, risk pooling of bycatch quota

Summary

- Ecosystem-based Businesses depend on
 - Mixed stocks in the same fishery
 - Multiple fisheries
- Catch share programs supported by MSA have increased flexibility
 - Harvesters enjoyed greater revenues in both catch share fisheries, and non catch share fisheries in which they also participate
 - Post-harvest sector benefitted through ability to scale capacity, make higher value products through increased season length, and develop better marketing channels
- Continuing to improve performance of our fishing industry will require understanding the businesses that create economic and social value from stocks
 - Acknowledges that MSA has been very successful at curtailing overfishing and assuring healthy stocks
 - MSA revision can unlock some well-known sources of foregone harvest
 - Can improve monitoring of National Standards where most improvement is possible
 - Can help reduce risk, and especially joint harvesting risk, with new mechanisms

- Thanks for extra work:
 - Andy Scheld
 - Marie Guldin
 - Keita Abe
- Contributing figures
 - Steve Kasperski
 - Dan Holland
 - Ray Hilborn
 - Matt Reimer
- Wrangling
 - Andre Punt



Pernicious Misc

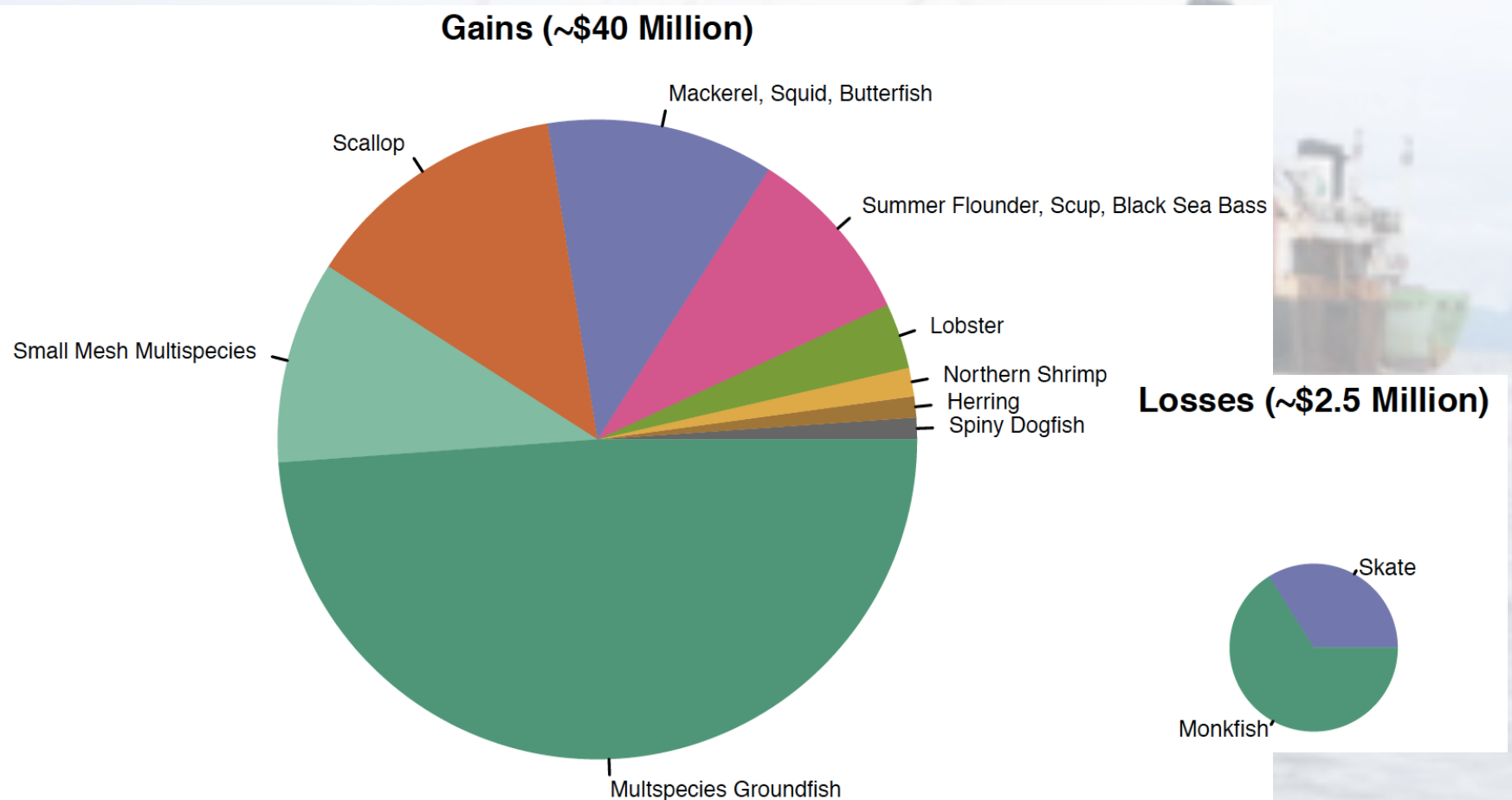
- Interpreting coops as entities for confidentiality
- Subdividing stocks that are geographically isolated
- Identifying and institutionalizing gear groups, reducing flexibility
- Constructing proper counterfactuals
- Division of rents

Single-species conflicts with

- NS 8: “Conservation and management measures shall...take into account the importance of fishery resources to fishing communities in order to: (1) Provide for the sustained participation of such communities; and (2) To the extent practicable, minimize adverse economic impacts on such communities.”
 - Often leads to “choke” species, where allowable catch (MSY or rebuilding level) of one species constrains harvest of significant amounts of other species

Management Effects for EBBs

- 2010 revenue effects of NE Multispecies Catch Share, by fishery
 - Half of net gains came from changing participation in separately managed fisheries



Based on Scheld & Anderson ICES JMS (2014)

Managing Ecosystem-based Businesses

- Effects of changing management in one fishery used by an EBB will manifest in other fisheries
- Management strategies also reduce flexibility to move across fisheries
- [Find some data on multi-fishery participation]
 - Community diversity data
 - Anything direct?
- Need to elevate the scope of management to the level of the fishing business, not just the stock or single fishery

Ecosystem-based Businesses Diversify across Fisheries

- Management strategies also reduce flexibility to move across fisheries
 - Costs may be greater than estimated based on revealed behavior in a single fishery
 - E.g., rationalization reduces harvesters' ability to move among fisheries when stock of one is low, increasing business risk
 - We are poorly set up to understand where people will go, sources of income
 - We cannot track them effectively across fisheries
 - We do not look at how they substitute among fisheries
 - We do not look at how they substitute among fishing and on fishing activities

Managing Ecosystem-based Businesses

- Need to manage the flexibility that is lost through rationalization, increased specialization
- Ecosystem based businesses thrive on flexibility
 - Catch share programs have enhanced this, but outstripped out capacity to analyze all behavioral responses
- Expect analysis to include business-level effects
 - Consideration of participation in multiple fisheries
 - And non-fishery income
 - Data often kept by different agencies (different regions, states)
- Design mechanisms that take advantage of, or compensate for loss of, cross-fishery flexibility
 - Multi-year targets of high variance species
 - Transferability of quotas across fleets/sectors
 - Methods of managing catch risk
 - Deemed value systems, risk pooling of bycatch quota
- Explicitly allow analysis at the business level
 - Encourage cooperatives to manage risk and collective quota allocations, but also permit analysis