

# Analysis of escapement goals for Bristol Bay sockeye salmon

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Presentation to the Alaska  
Board of Fisheries  
Sheraton Hotel, Anchorage,  
Alaska  
March 17, 2105

Presented by Michael Link



# Two Study Components

- An Evaluation of Approaches to setting Biological Escapement Goals (BEGs)
- Analysis of Four Escapement Goal Policies taking into Account Biological and Economic Factors (SEGs, OEGs)

Two reports available at [www.bbedc.com](http://www.bbedc.com)

# Study Team and Advisory Panel

## BEG evaluation

- Curry Cunningham, Ray Hilborn, Daniel Schindler

## Evaluation of escapement goal policies

- Biological and Management Modeling
  - Curry Cunningham and Ray Hilborn
- Economic Modeling
  - Jocelyn Wang and Chris Anderson

## Advisory Panel

**Jeff Regnart, Fritz Johnson, Matt Luck, Abe Williams, Vince Webster, Michael Link,** Bill Monroe, John Heins, John Boggs, Matt Reimer (*6 of 10 here this evening*)

# Funding

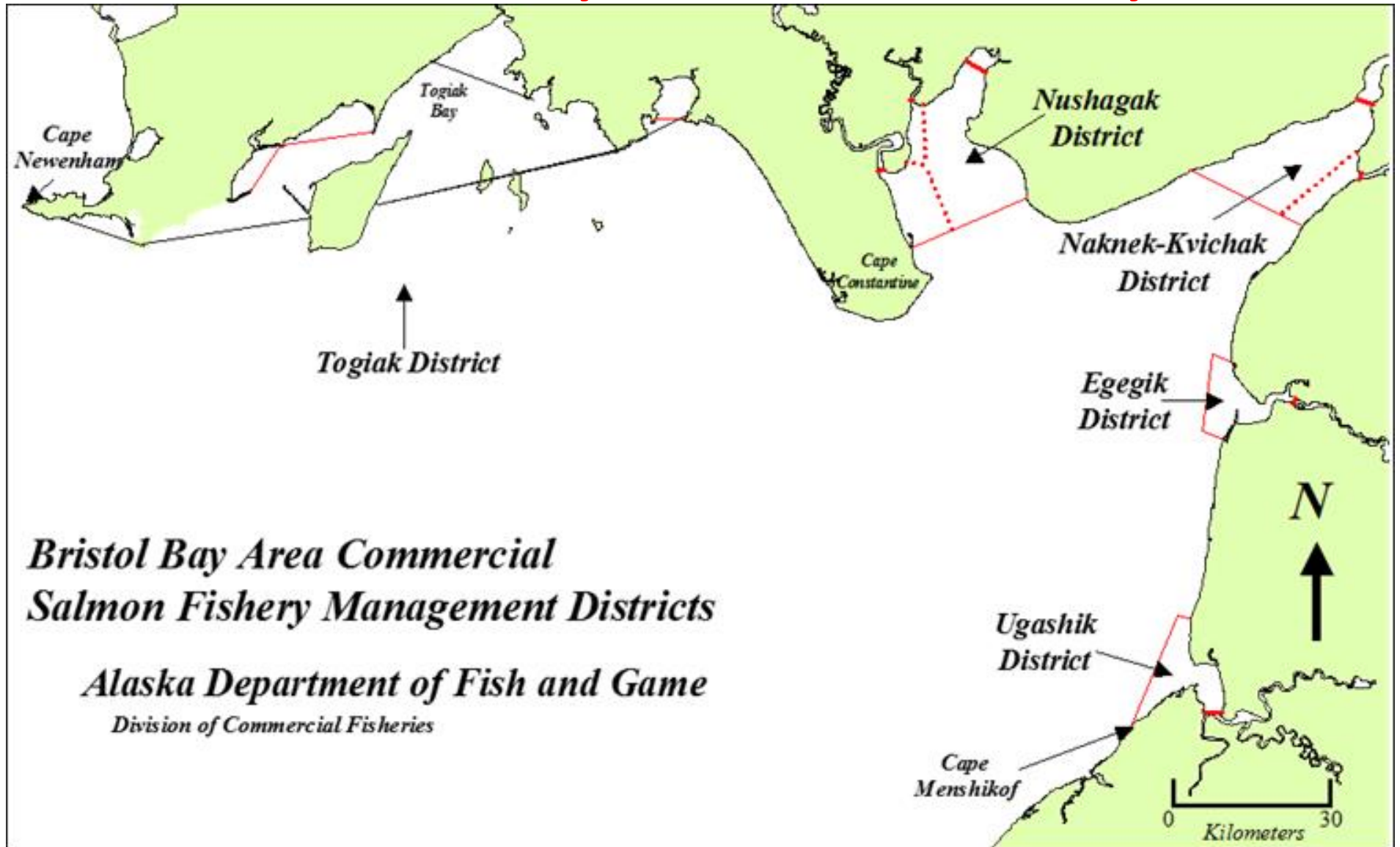
- Bristol Bay Economic Development Corporation, ~80%
- Bristol Bay Regional Seafood Development Association, 20%

Managed through BBEDC's Bristol Bay Science and Research Institute (BBSRI)

# Goals of Presentation

- Appreciate that fish and fishery dynamics influence benefits from different escapement goals in the Bay
- Selected key findings
- Advisory Panel recommendations
- Provide Board and others an opportunity to ask questions about the study

# Bristol Bay Salmon Fishery



# First Report – BEG setting

## Alternative Approaches to Biological Escapement Goals

- Theoretical “Maximum Sustained Yield” – MSY
- Augment the analysis of ADF&G (2012)
- Estimated fish abundance prior to when fishing started to calibrate models (lake sediments)
- Accounted for variation and shifts in productivity over time
- Generally, *additional information leads to BEGs that are smaller*

## Second Report – “The OEG part”

- Naknek, December 2012 – ADF&G proposed to raise escapement goals, again
- Some believed larger runs would not necessarily lead to greater catch or greater value of the catch, and possibly less of both
  - Movement to adopt OEGs at current SEG levels.
  - Deferred decision and implementing new SEGs until 2015

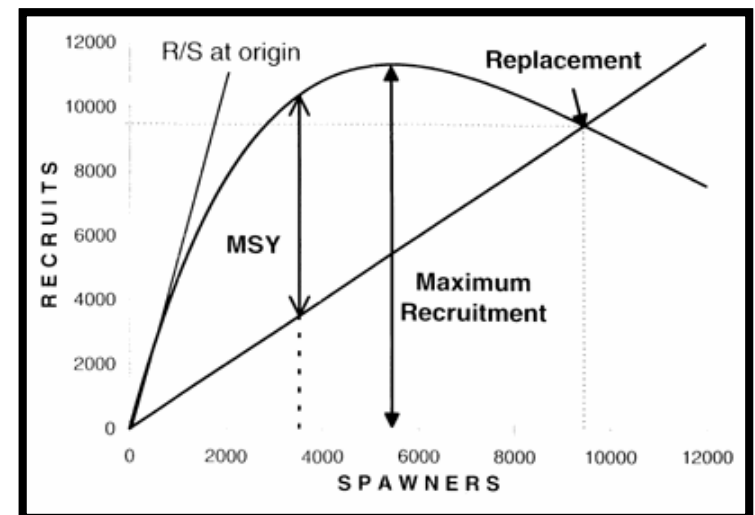


# Study Approach

- Three integrated computer models to mimic key relationships, many on a **daily basis**
  - Fish stock dynamics, accounts for feedbacks to future returns
  - Fishery management, in-season decision making
  - Harvesting and processing
    - Amount of fish caught and processed
    - Amount by product forms and market prices
- Simulate the fishery daily over 100 seasons into the future, replicate 100 times
  - Done for each escapement goal policy
  - Size and variation in catch, escapement, run, and value of catch

# Examined Four Escapement Goal Policies

1. Current SEGs
2. Proposed SEGs (ADF&G, 2012)
3. BEGs (ADF&G, 2012)
4. Total-run based EGs
  - Two ranges, vary with run size



# Economic Modeling

- Processor model
  - Preseason staffing decisions (daily capacity)
  - Daily product-form decisions
  - Long-term capital investments in capacity
- Pricing model
  - Wholesale price by product form quantity and global markets
  - Ex-vessel price from product-form prices and production quantities; are estimated using a processing margin sharing equation

# Product-Mix Decisions



# Economic Modeling – capacity constraints

- Processors gear up based on pre-season expectations
- When daily processing capacity was met, fishermen put on limits, excess potential catch was moved to escapement



# Economic Treatment of Higher Goals

- Were careful to give larger escapements a “fair hearing” ... to avoid perception of bias.
  - Allowed processor capitalization to increase for larger runs, but ignored costs of this
  - No discount rates were used for future catches
  - Ignore impact of building escapement up during transition period
    - Results are from the last 74 years of the 100-year simulations

Therefore, overestimated economic performance of BEGs, but was a good thing to do.

# Selected Key Findings

1. Higher escapement goals will produce larger and more variable runs and escapements, but not necessarily larger catches
  - Pursuing MSY leads to less than past and proposed SEGs
2. Current and ADF&G proposed SEGs are biologically and economically good
  - Improved if vary with total run?
3. Future EG evaluations should consider dynamics of the fish and fishery

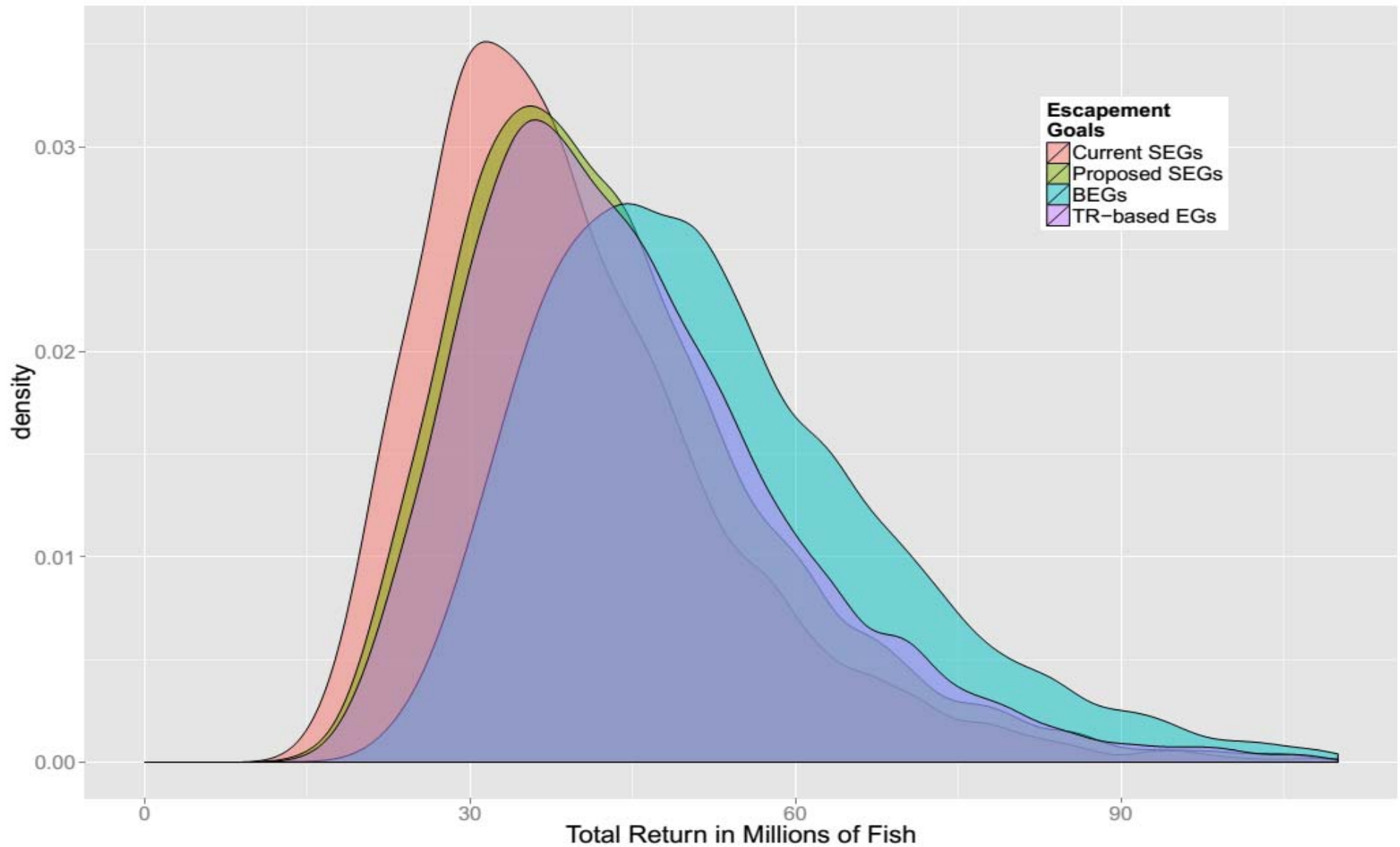


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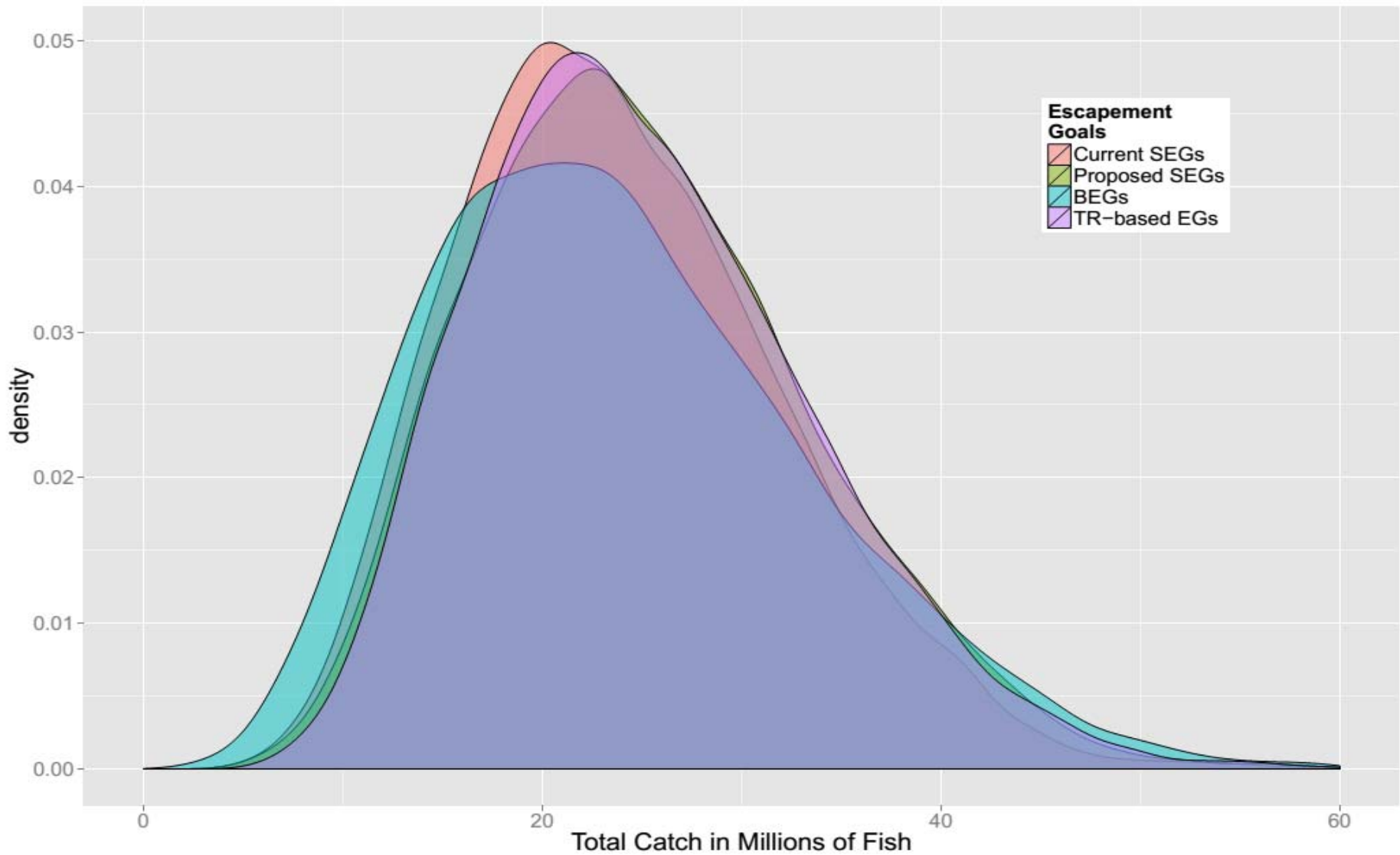
Pursuing MSY leads to less yield than past and proposed SEGs

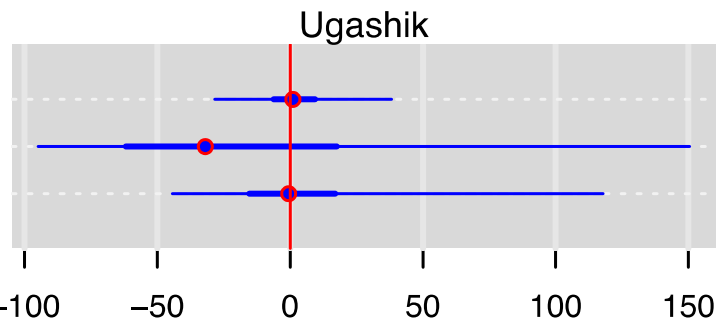
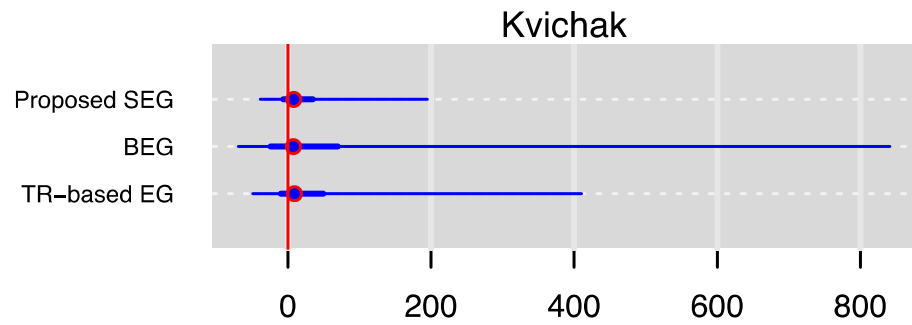
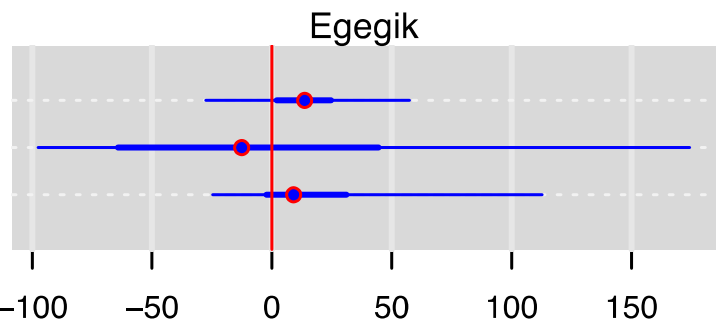
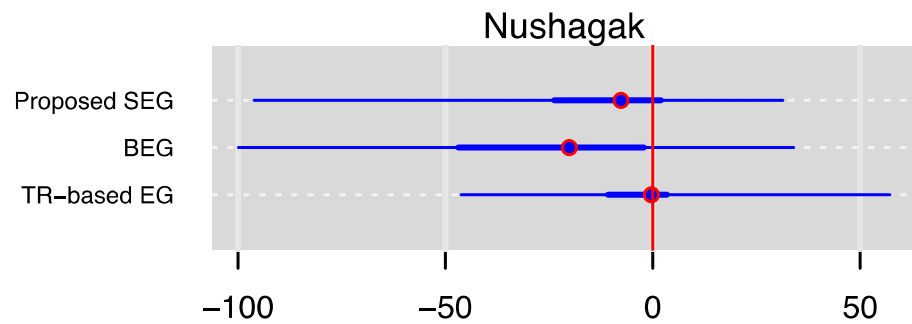
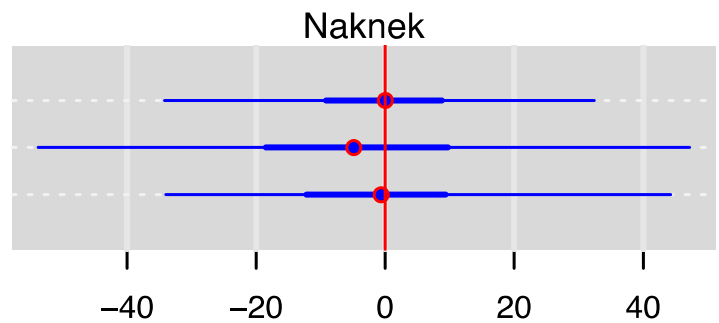
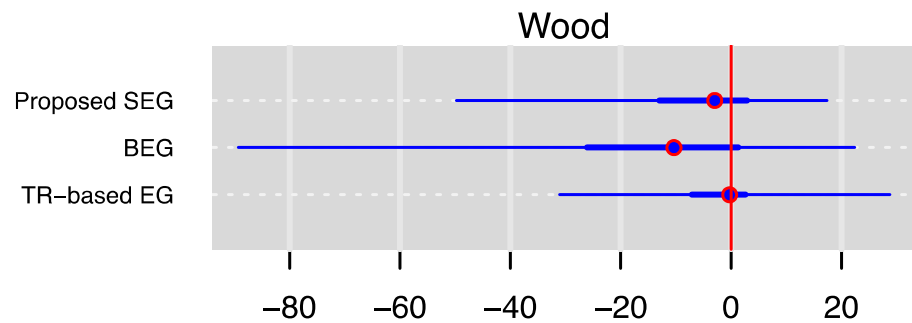
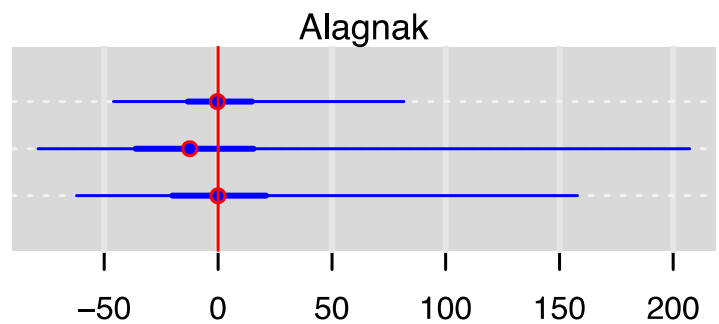
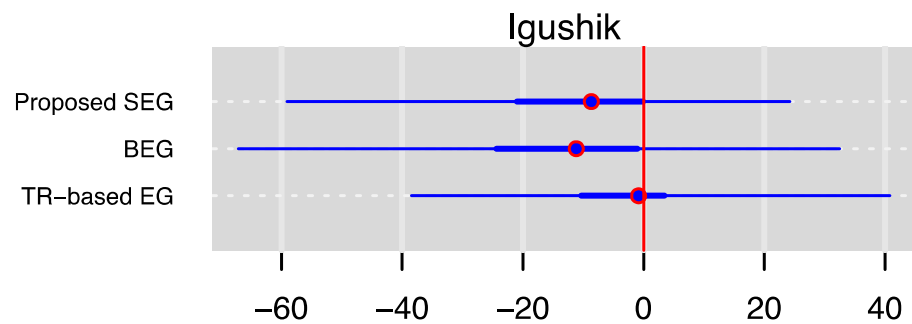


# Bay-wide Run (last 74 years of simulation)



# Bay-wide Catch (after transition period)





**% Difference in Catch from Current SEG**

# Theoretical MSY not really MSY?

- Sustainable salmon policy says pursue MSY when you have sufficient data, i.e., in Bristol Bay
- Yet in the Bay, it does not lead to greatest yield
- So why continue with theoretical BEG setting?

## Implications

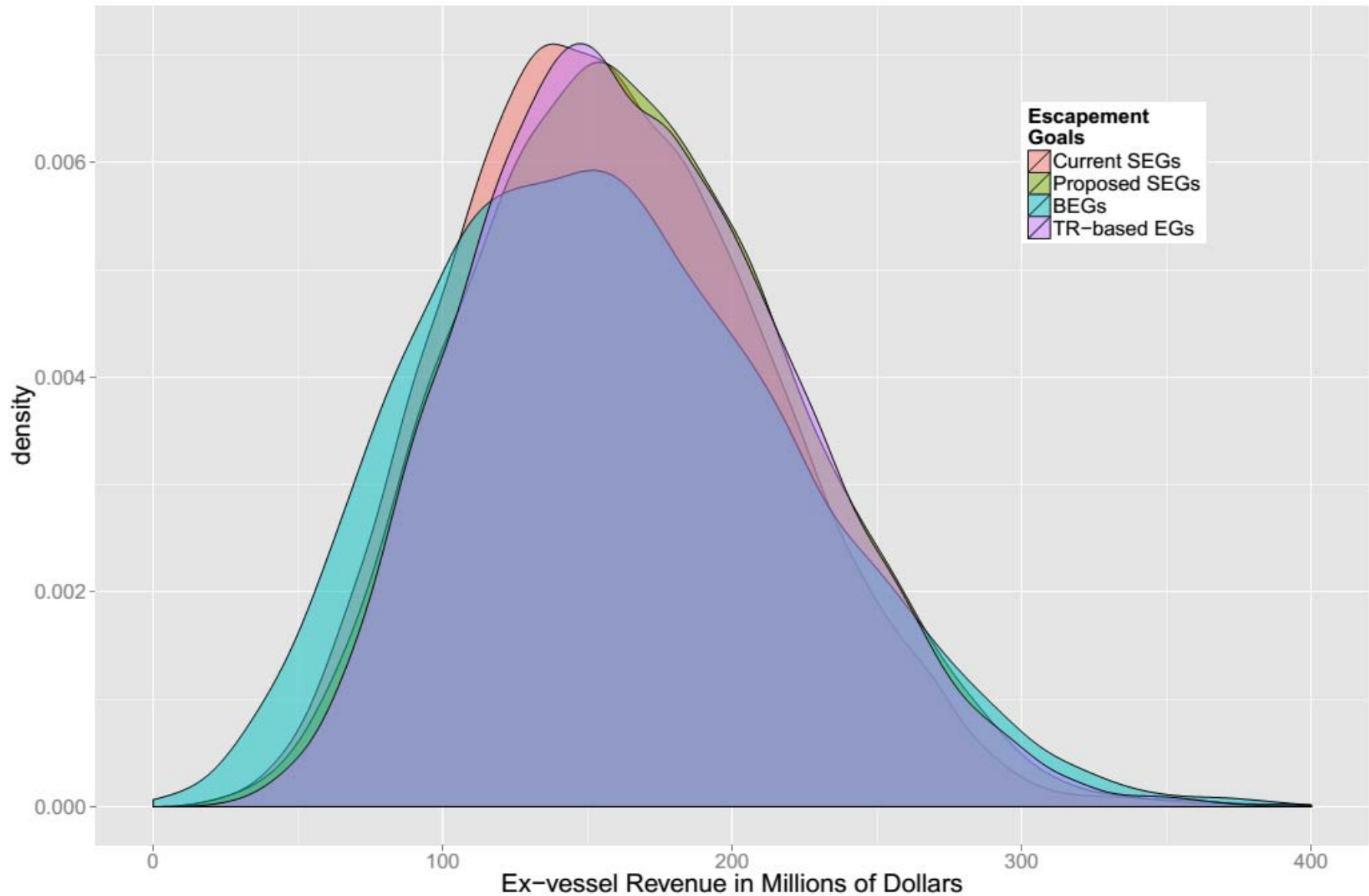
- Can current SEGs be called BEGs?
- In Bristol Bay, is an SEG a BEG, which is also an OEG?

## 2. Current and Proposed SEGs are Biologically and Economically Robust

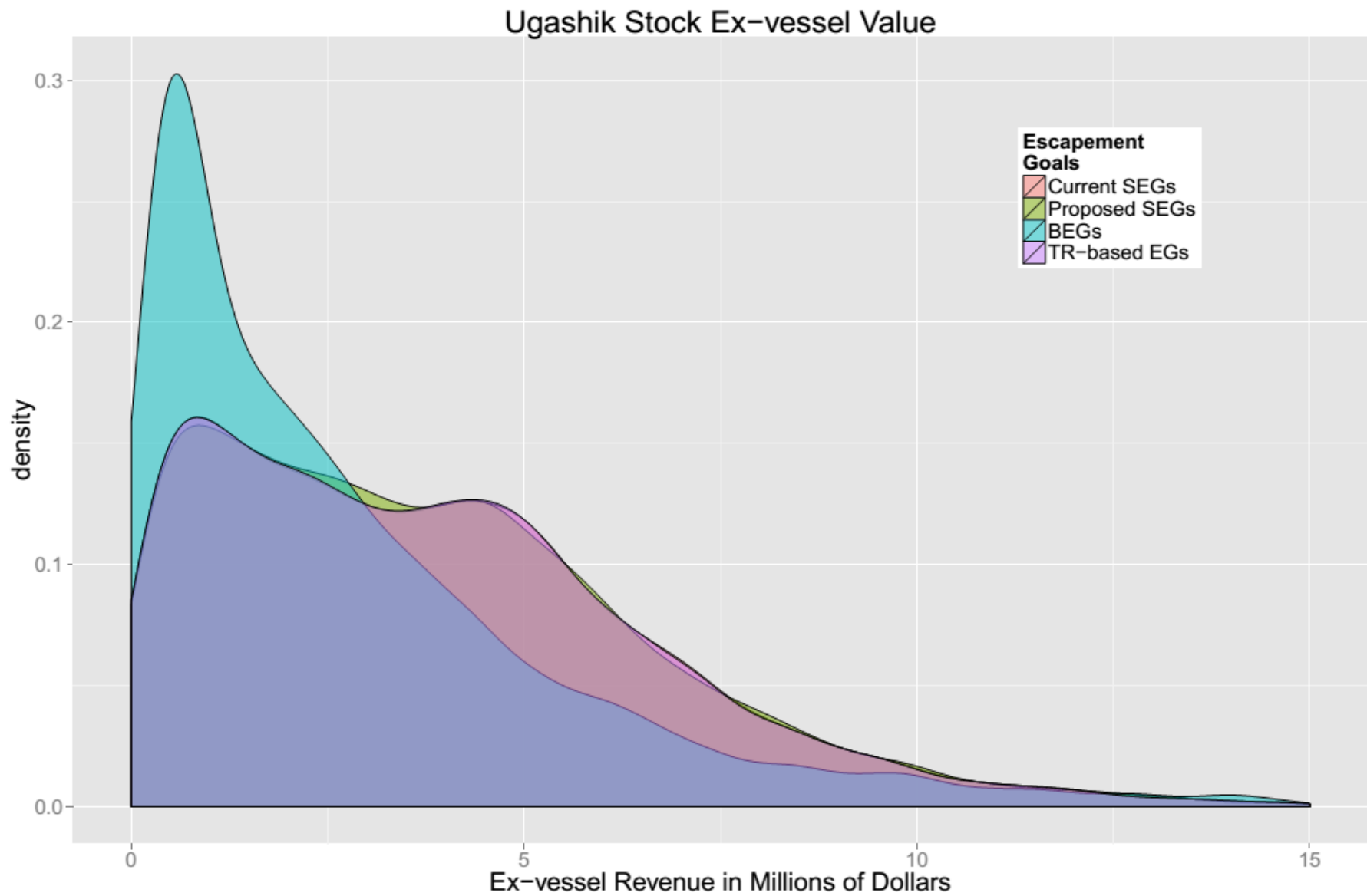
- Greater catch
- Greater value of harvest
- Lower probability of very small catches

Compared to BEGs

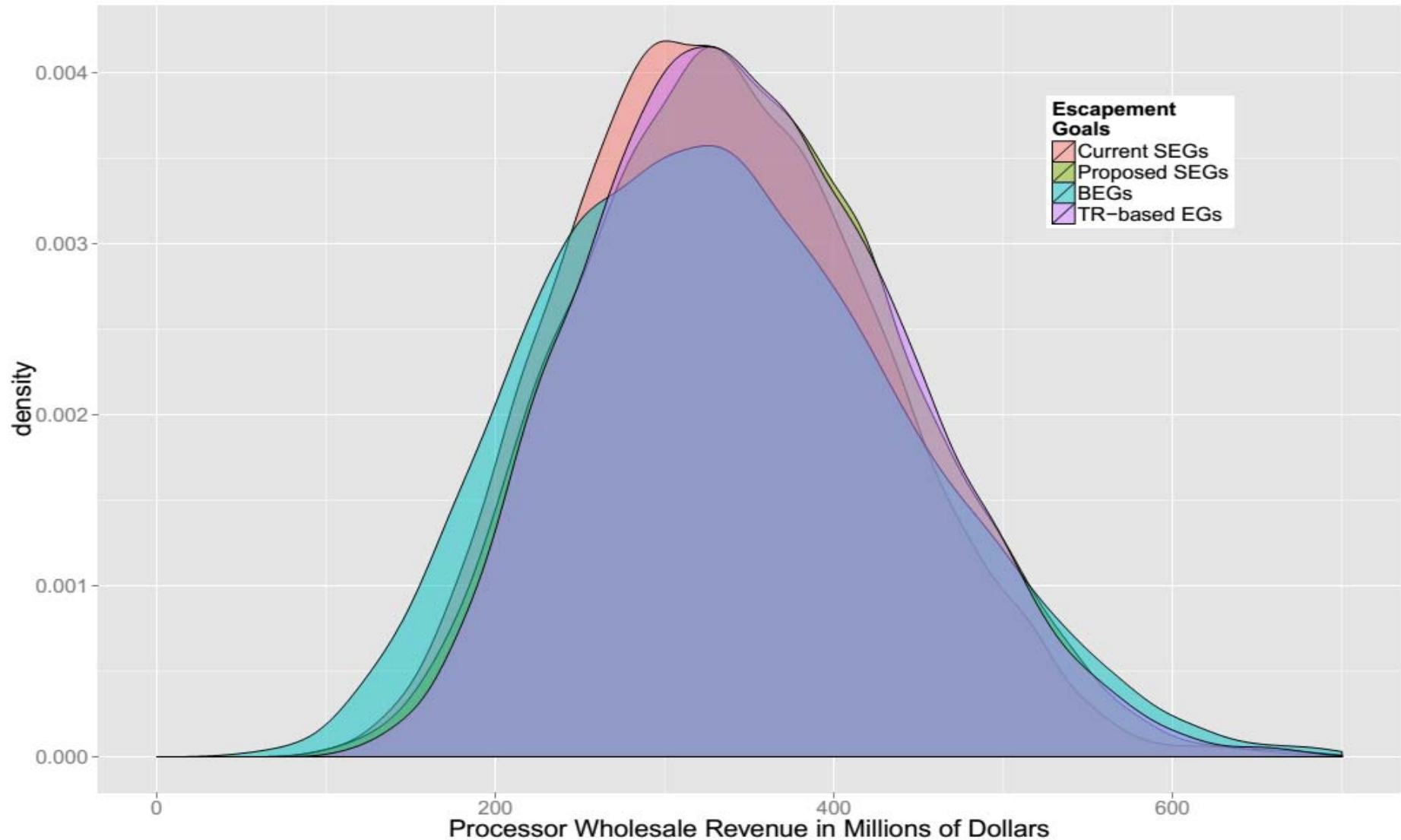
# Bay-wide Revenue to Fishermen (after transition)



# Ugashik, Revenue to Fishermen

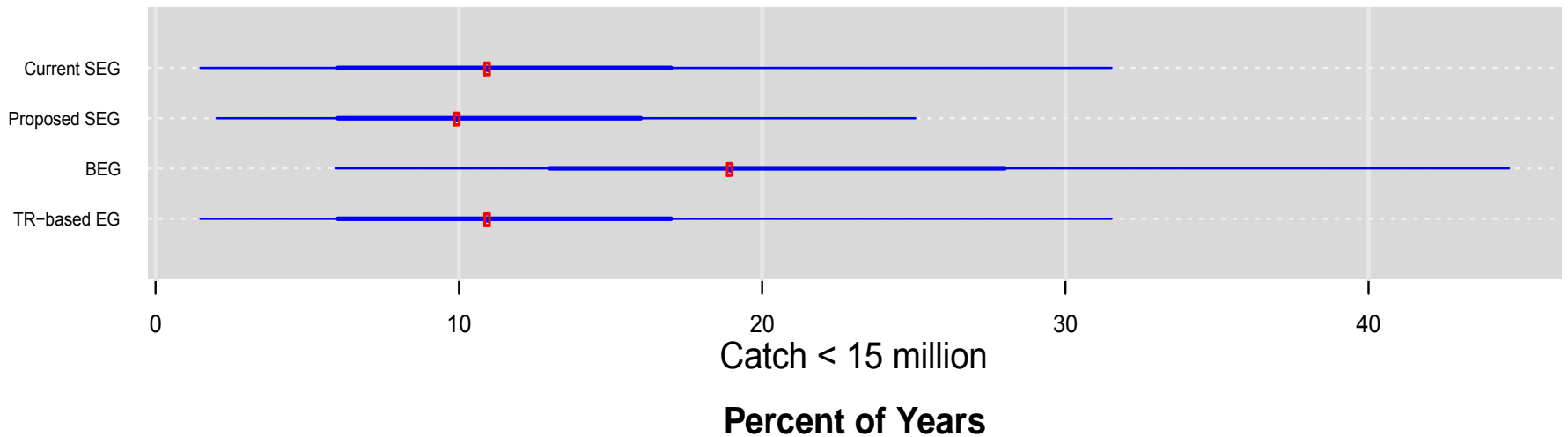
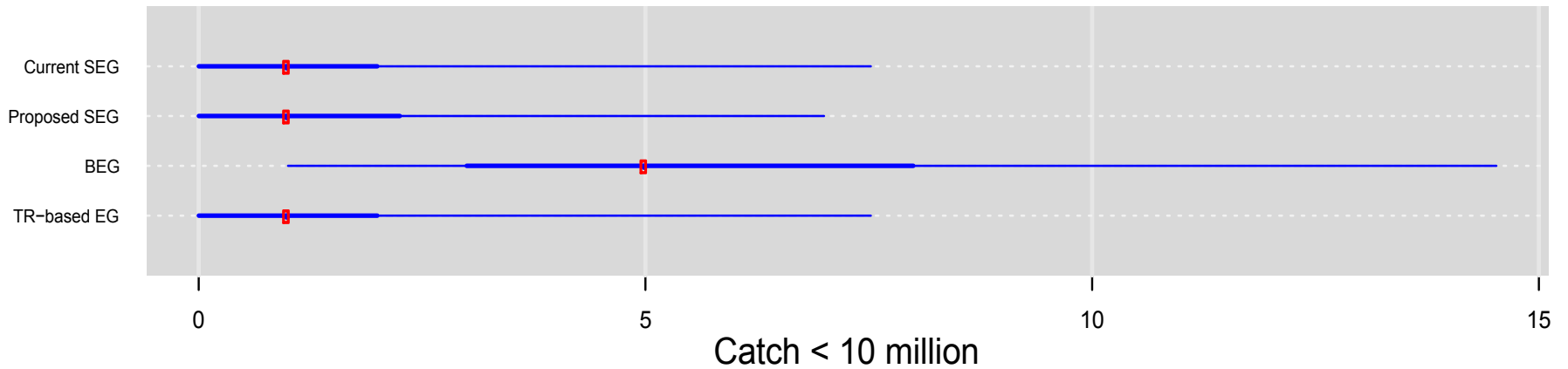


# Wholesale Revenue, Bay-wide





# A cost of variability: Chances of small Bay-wide catch



## 4. Escapement Goal Setting in Future

- Stock dynamics, fishery management, and industry structure can alter conclusions as to how best to achieve maximum yield

# What does the Advisory Panel Recommend to ADF&G and the Board of Fisheries?

## Considered

- Policies that offer flexibility
- Maximize revenue across range of future conditions
- Minimize catch variability and low-catch years

Developed simple, 2-part unanimous recommendation

# AP recommendation, 1 of 2

- Get ADF&G adopt wider range for the SEG
- Hybrid of current SEGs and proposed SEGs

Table 1. Old and proposed escapement goals for six sockeye salmon stocks in Bristol Bay, March 2015.

Stock	Number of Fish in Thousands					Average run size (millions), 1977-2014*
	Escapement Goal Ranges and Midpoints					
	Old SEGs (thru 2014)	ADF&G proposed SEGs for 2015	Advisory Panel (AP) Recommended	Lower half of AP EG range	Upper half of AP EG range	
<b>Ugashik</b>						
Lower	500	600	500	500	950	3.7
Upper	1,200	1,400	1,400	950	1,400	
Mid	850	1,000	950			
<b>Egegik</b>						
Lower	800	900	800	800	1,400	7.8
Upper	1,400	2,000	2,000	1,400	2,000	
Mid	1,100	1,450	1,400			
<b>Igushik</b>						
Lower	150	200	150	150	275	0.84
Upper	300	400	400	275	400	
Mid	225	300	275			
<b>Naknek</b>						
Lower	800	900	800	800	1,400	4.3
Upper	1,400	2,000	2,000	1,400	2,000	
Mid	1,100	1,450	1,400			
<b>Wood</b>						
Lower	700	800	700	700	1,250	4.6
Upper	1,500	1,800	1,800	1,250	1,800	
Mid	1,100	1,300	1,250			
<b>Nushagak</b>						
Lower	370	400	370	370	635	1.6
Upper	840	900	900	635	900	
Mid	655	700	635			
<b>Kvichak</b>						
	-----no change-----					

## AP Recommendation, 2 of 2

- Explicitly guide management as to where to target within the escapement goal range, vary it with run size:

*Manage for escapement to fall within the lower or upper half of the adopted river-specific escapement goal ranges, commensurate with pre-season and ongoing in-season assessment of run strength to the fishing district.*

Unanimous recommendations

# Where's the OEG?

- Not needed
- SEGs and regulatory language/guidance provide for maximum biological yield and economic yield

# Predicted consequences of new SEGs and regulatory change?

- Somewhat larger and, as importantly, less variable annual catches
- Transfers some of the annual variation in run size from the catch to the escapement
- Will probe the upper ranges of escapement when the fish are of least value as catch
  - Greater contrast in escapements will lead to better EGs in future



Questions, please