

*Science, Service, Stewardship*



# Economic Analysis of Red Snapper Allocation Alternatives in the Gulf of Mexico (RF 28)

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NOAA Fisheries Economic Considerations of Allocation Decisions

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# Task: Measure Economic Net Benefits of Reallocation

	Commercial Sector		Recreational Sector	
Alternative	Quota (mp gw)	Percent	Quota (mp gw)	Percent
<b>1 (Status quo)</b>	5.06	<b>51.0</b>	4.86	<b>49.0</b>
2	4.76	<b>48.0</b>	5.15	<b>52.0</b>
3	4.56	<b>46.0</b>	5.35	<b>54.0</b>
4	4.06	<b>41.0</b>	5.85	<b>59.0</b>
5	4.61	<b>46.6</b>	5.30	<b>53.4</b>
6	4.19	<b>42.3</b>	5.72	<b>57.7</b>



# Commercial Sector Analysis



## Fishery Background

In 2013, 368 vessels landed 4.9 mp. g.w. of red snapper were valued at \$21 m. dockside.

Multispecies, multi-gear fishery.

Management regime:

Pre-2007: limited entry, trips limits, seasonal closures and quotas

2007- present: IFQ (good for mitigating race to fish but overcapacity still a problem)



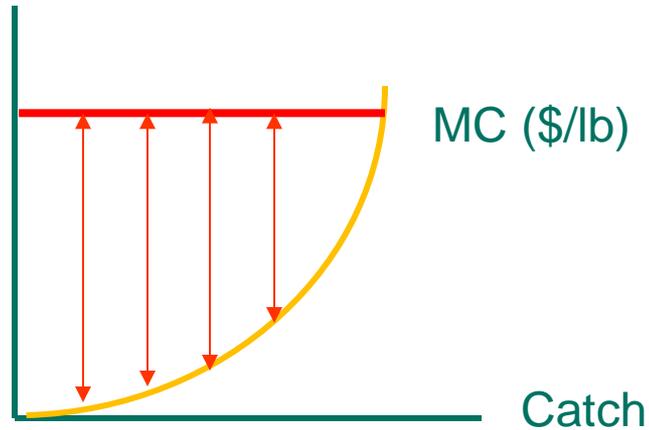
## Commercial Sector Valuation

- **General Equilibrium Approach**
  - “Retail” demand (Thurman & Easley, 1992)
- **Partial Equilibrium Approach**
  - Virtual pricing (Carter *et al.*, 2008-GOM red grouper; Gentner *et al.*, 2010-NE summer flounder, Agar & Carter, 2011, Gentner, 2012-Scup)
  - Harvesting privilege price relationship (IFQ, Newell *et al.*, 2005, Agar and Carter, 2014)

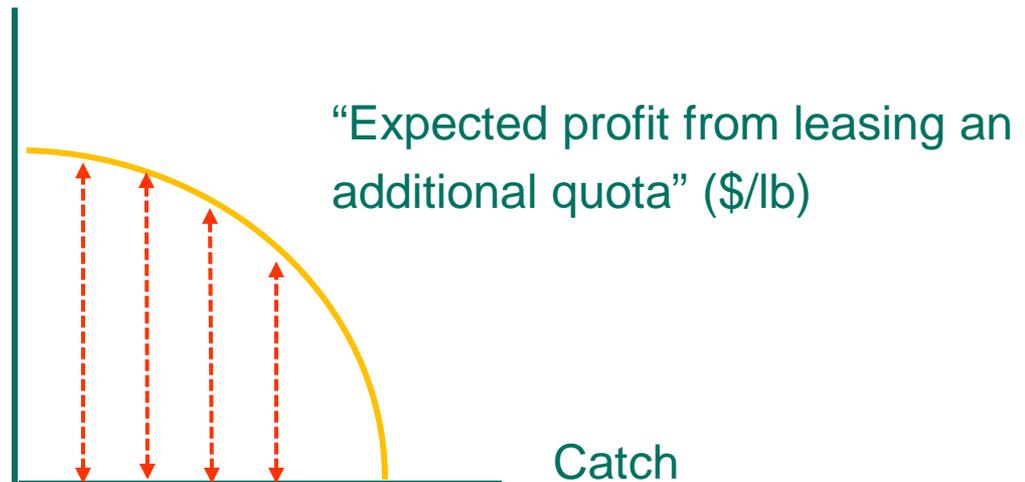


# Allocation Price Equals Incremental WTP

Price/cost  
(\$/lb)



Allocation price =  
Incremental WTP  
for leasing quota (\$/lb)





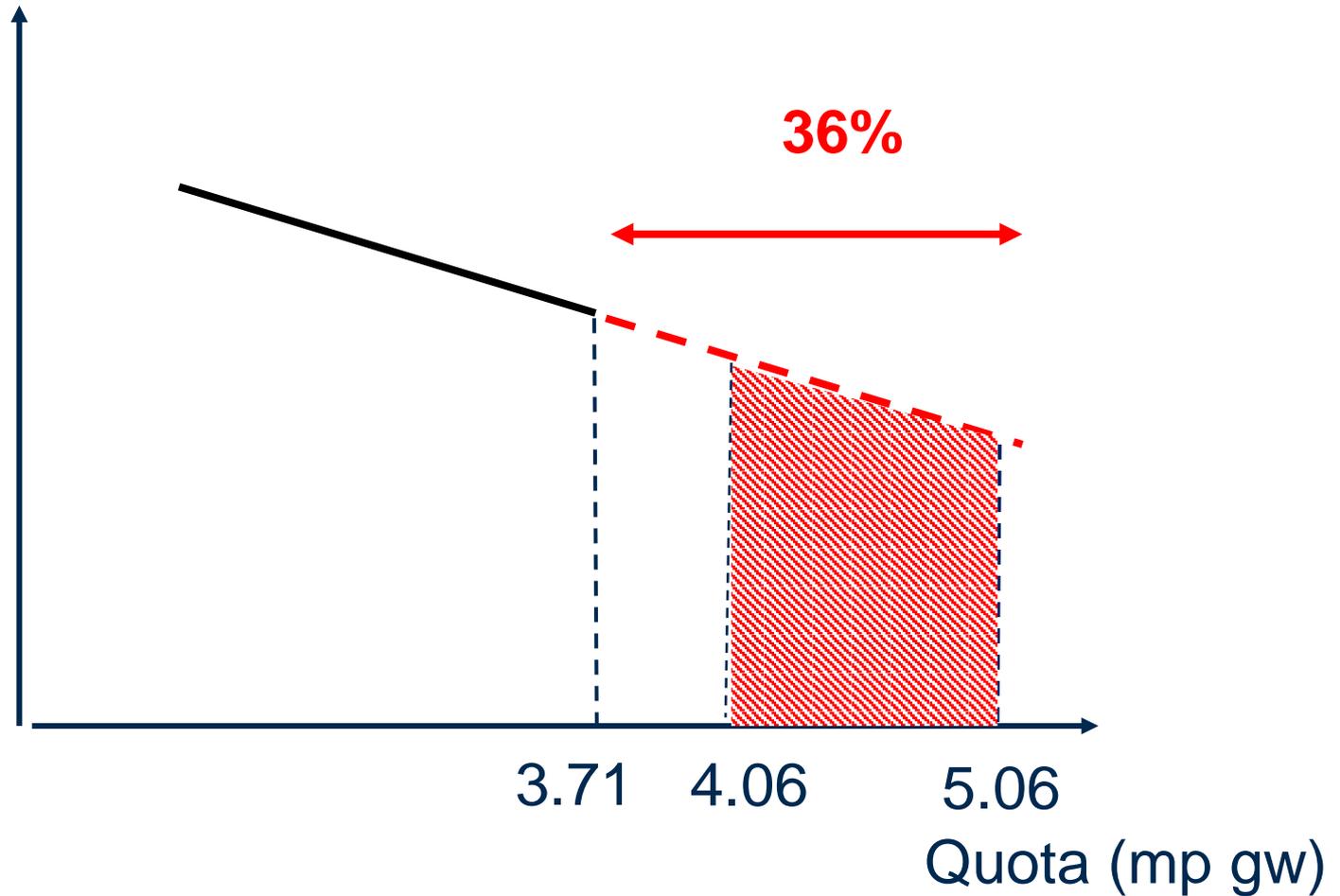
# Framework

- Objective: Examine changes in commercial net benefits as a function quota levels.
- Allocation prices is used as a proxy of net benefits
- Allocation price =  $f(\text{dockside price, harvesting costs, quota, temporal dummies})$
- Measure welfare changes by integrating under the net benefit function between the status quo and the other 5 reallocation proposals.



# Allocation price relationship

Allocation  
price  
(\$/lb)





## Methods

OLS to model monthly allocation prices as function of dockside prices, costs, quota (ACL) and quarterly and yearly dummy variables.

Data:

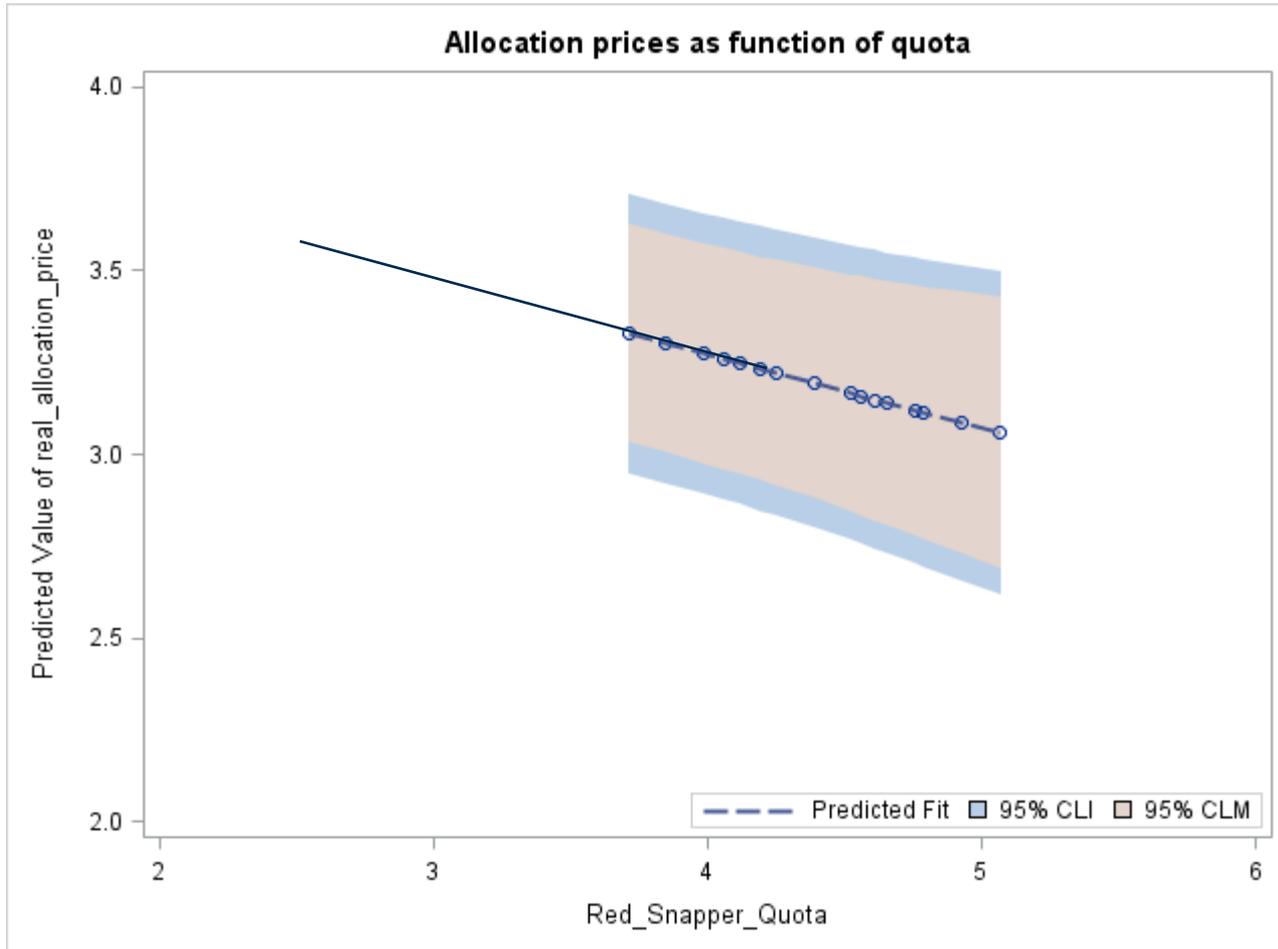
SERO IFQ Program: allocation, dockside prices and quota (ACL) levels (2007-2012)

BLS: diesel 2 index (proxy for harvesting costs)

N=72



# Allocation prices as function of quota





# Results of Commercial Analysis

## Status Quo

Alt	Quota (mp gw)	Quota share (%)	Difference from Alt1 (mp gw)	Forgone Net Benefits (\$ million)
1	5.06	51	-	-
2	4.76	48	<b>0.30</b>	<b>1.2</b> <b>(0.9-1.6)</b>
3	4.56	46	<b>0.50</b>	<b>2.0</b> <b>(1.5-2.6)</b>
4	4.06	41	<b>1.00</b>	<b>4.0</b> <b>(3.0-5.2)</b>
5	4.61	46.6	<b>0.45</b>	<b>1.8</b> <b>(1.3-2.3)</b>
6	4.19	42.3	<b>0.87</b>	<b>3.5</b> <b>(2.6-4.5)</b>



## Limitations of analysis

- Data limitations (identification of arm's length transactions)
- Statistical methods geared towards predicting small changes in allocation (not 10-36% increases from the highest quota levels~2012)
- Model only captures forgone benefits to the harvesting sector, not post-harvest sector (i.e., wholesalers, distributors, and consumers).



# Recreational Sector Analysis



# Increase recreational harvest

## More pounds per trip

- More fish (biology, bag limits, tech., fishing time)
- Bigger fish (biology, size limits, tech., selectivity)

## More trips (e.g., season length)

- New anglers
- New trips
- Redirected from other species



## Some Assumptions

**Increases implemented via longer season**

**No new trips are created with longer season**

- **Trips previously fishing other species redirect to red snapper**
- **Other species include grouper, king mackerel and dolphinfish**



# Some More Assumptions

**All trips harvest 2 fish per angler**

**Only measuring changes in value to angler**

**WTP estimated using data from 2003**



# Recipe for the Change in Economic Value

Change in  
allocation  
(MP)

X

**Net benefit for 2  
red snapper per trip**  

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**2 × lbs per fish**

Benefit per pound



# Example Choice Question from 2003 SPCE

Features	Trip A	Trip B	No Trip
Target species	Grouper	Dolphin	
Total number caught per	20	25	
Catch of target species you are legally allowed to keep	1 Grouper	1 Dolphin	
Catch of other fish you are legally allowed to keep	3 fish	3 fish	

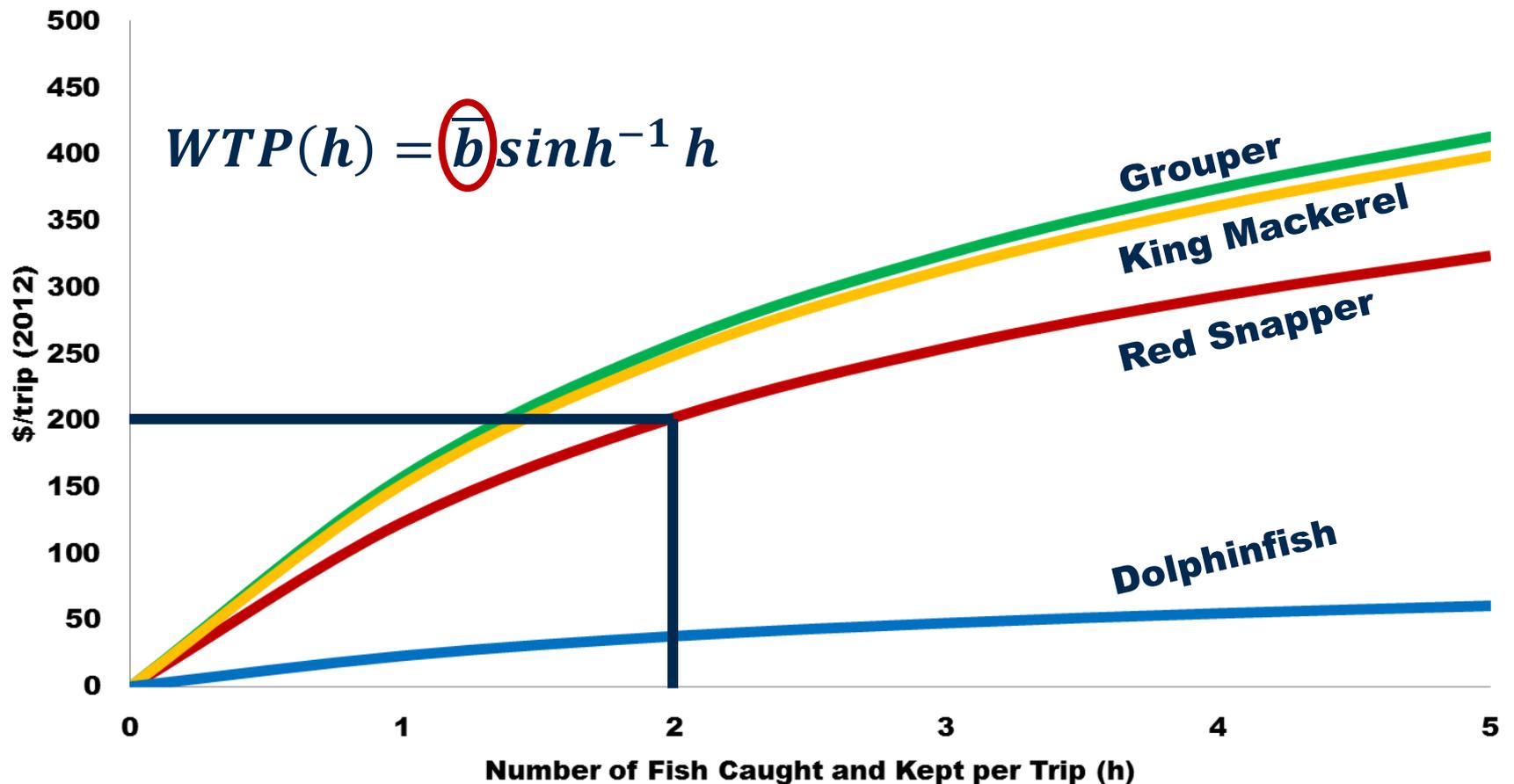
Random utility model in WTP space:

- 45,416 choices from 5,677 anglers
- Kept fish, released fish, min. size
- Kept and released transformed with inverse hyperbolic sine
- Random-correlated parameters on keep



# Average WTP (benefit) by # of Fish per Angler per Trip

$$WTP(h) = \bar{b} \sinh^{-1} h$$





## Net Benefit for 2 red snapper per trip: Calculation

Draw 10k “anglers” (coefficient vectors,  $\mathbf{b}$ ) from the multivariate normal

Calculate total benefit (TB) for 2 fish per trip for each species

Keep the “red snapper angler” if the TB for red snapper is greater than the TB for other species

For each “red snapper angler”, calculate TB for red snapper *minus* TB for next best species

**Do this 10k times.**



## Net Benefit for 2 Red Snapper per Trip (2012 dollars)

Measure	Simulated Mean	Simulated Median
95Lower	\$130.46	\$104.76
Mean	\$142.11	\$115.56
95Upper	\$154.16	\$126.76



## Some Assumptions and the Effect on Results

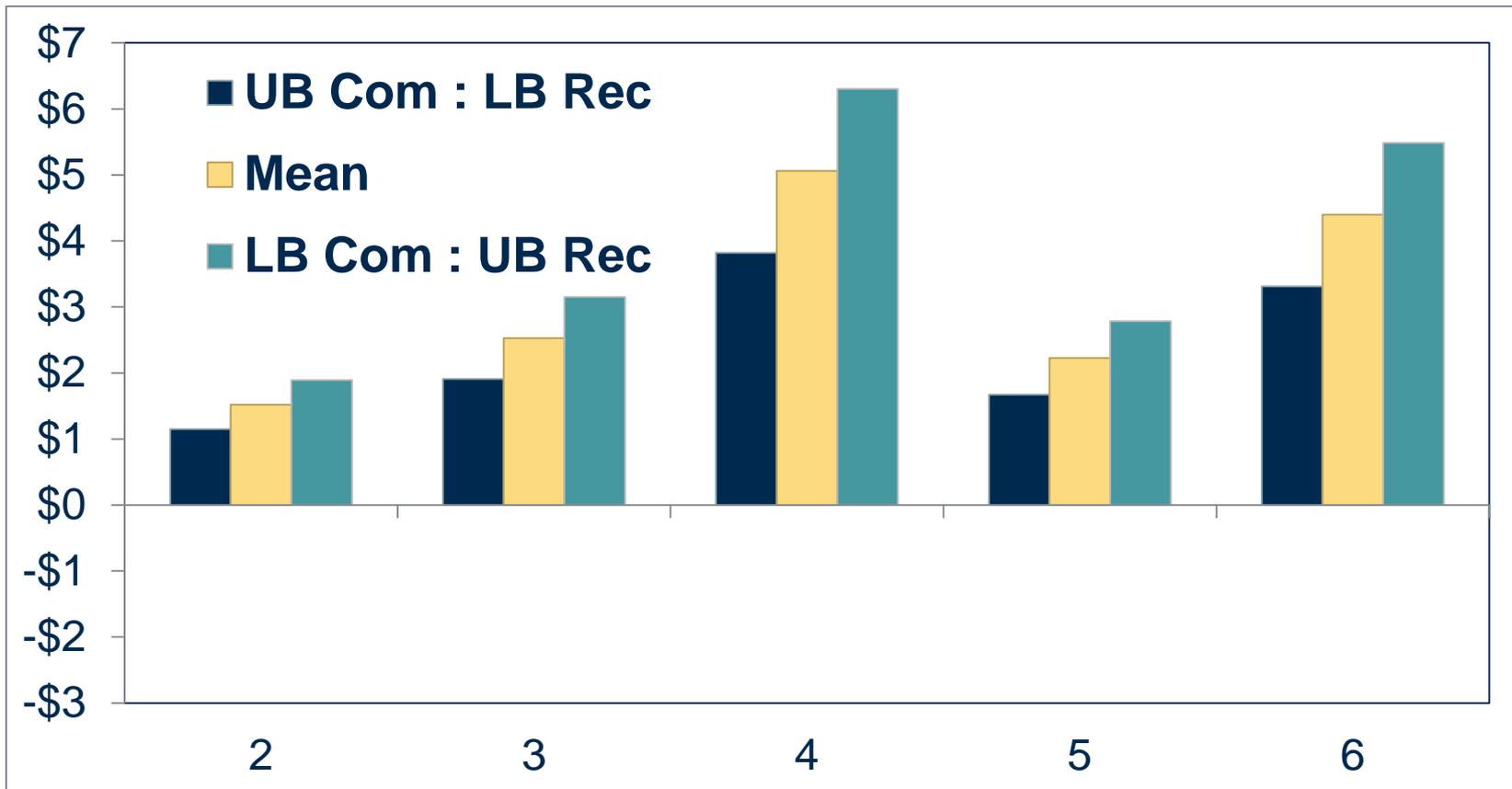
Assumption	Relaxing Assumption Makes Results
No new anglers or trips	Higher
All trips harvest 2 red snapper	Higher
Only measured value to angler	Higher
Data from 2003	?



# Summary



# Net Economic Benefits: Confidence Intervals (\$millions)





# Uncertainty Not Addressed in Confidence Intervals

## Commercial

- Model specification
- Extrapolation
- Prices

## Recreational

- Model specification
- Lbs per fish
- Fish per trip



# Some Issues

Do the assumptions hold over the range of alternatives?

Have enough resources been “allocated” to allocation?

Other allocation mechanisms?

- Market-based approaches in the recreational sector
- Auctioning some harvest for research purposes