Northeast Fisheries Science Center

Effect of Catching/Releasing Various Sizes of Fish on Stock Sustainability: Implications of Lowering Release Mortality on Stock Assessments

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FISHSMAHT
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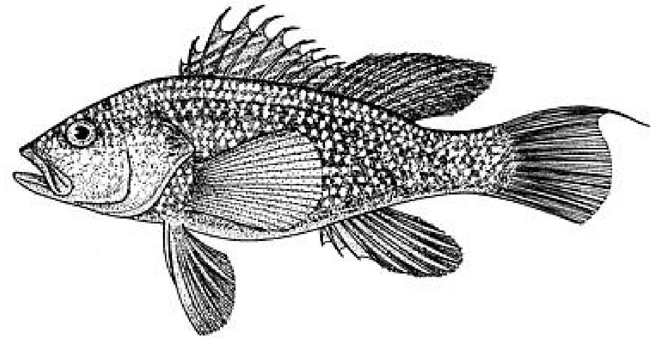


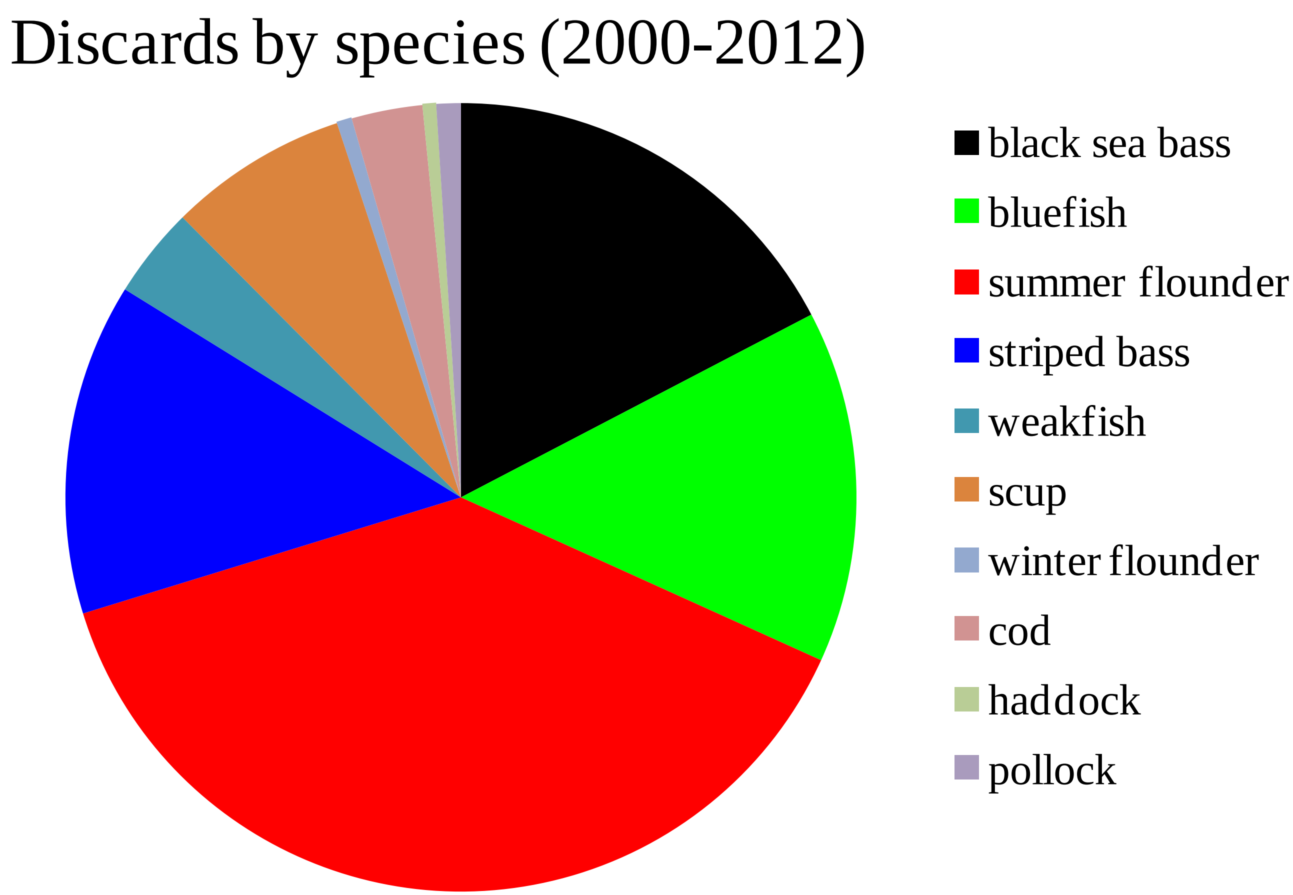
- **Magnitude of the problem**

- **Impact on stock assessment results**
  - Changes in Selectivity
  - Changes in Abundance estimates
  - Impact of uncertainty

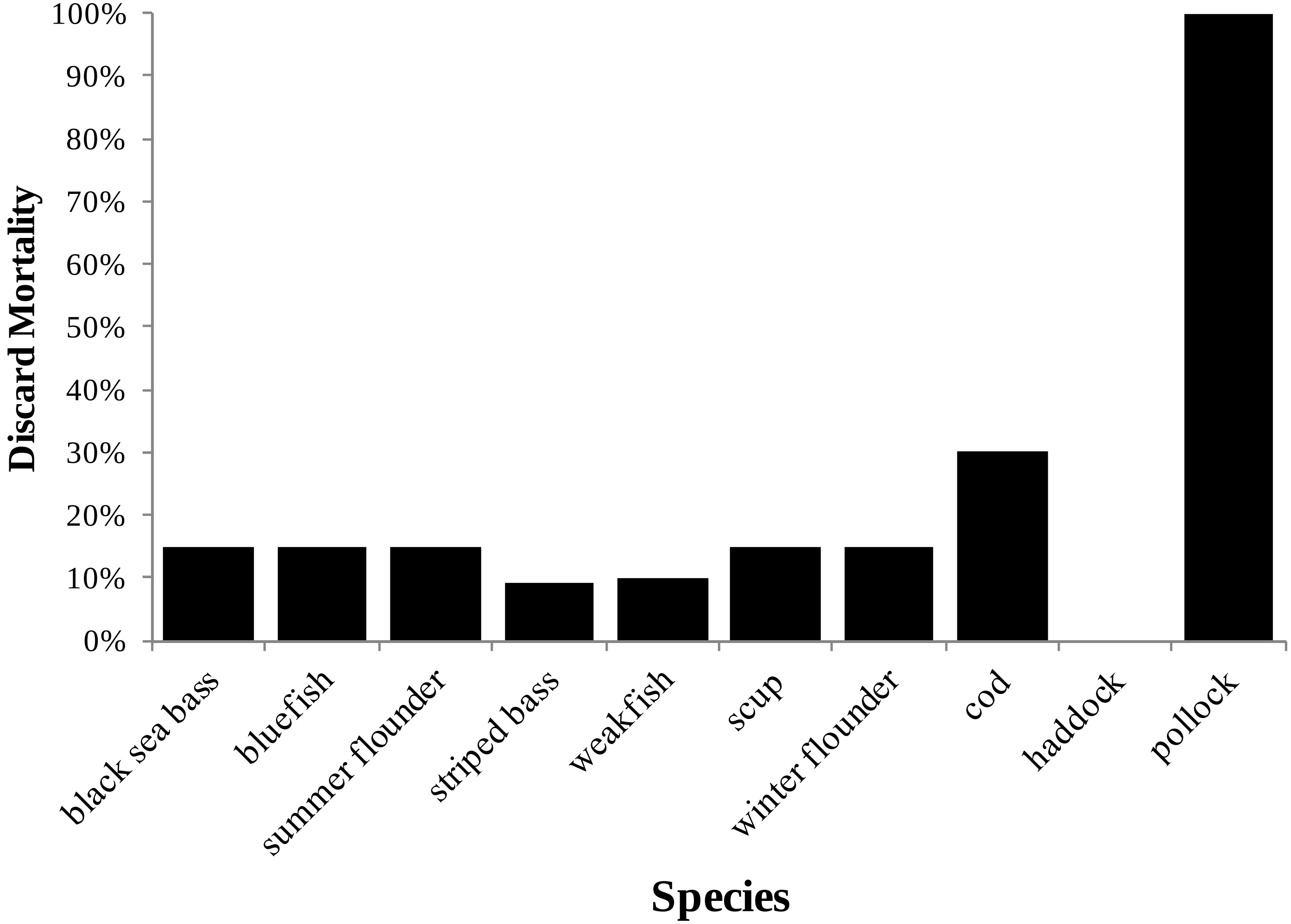
- **Impact on biological reference points**
  - Potential yield and optimal mortality

- **Impact on allocation**
  - Adjust ACL by discard to landings ratio

- **Conclusions**



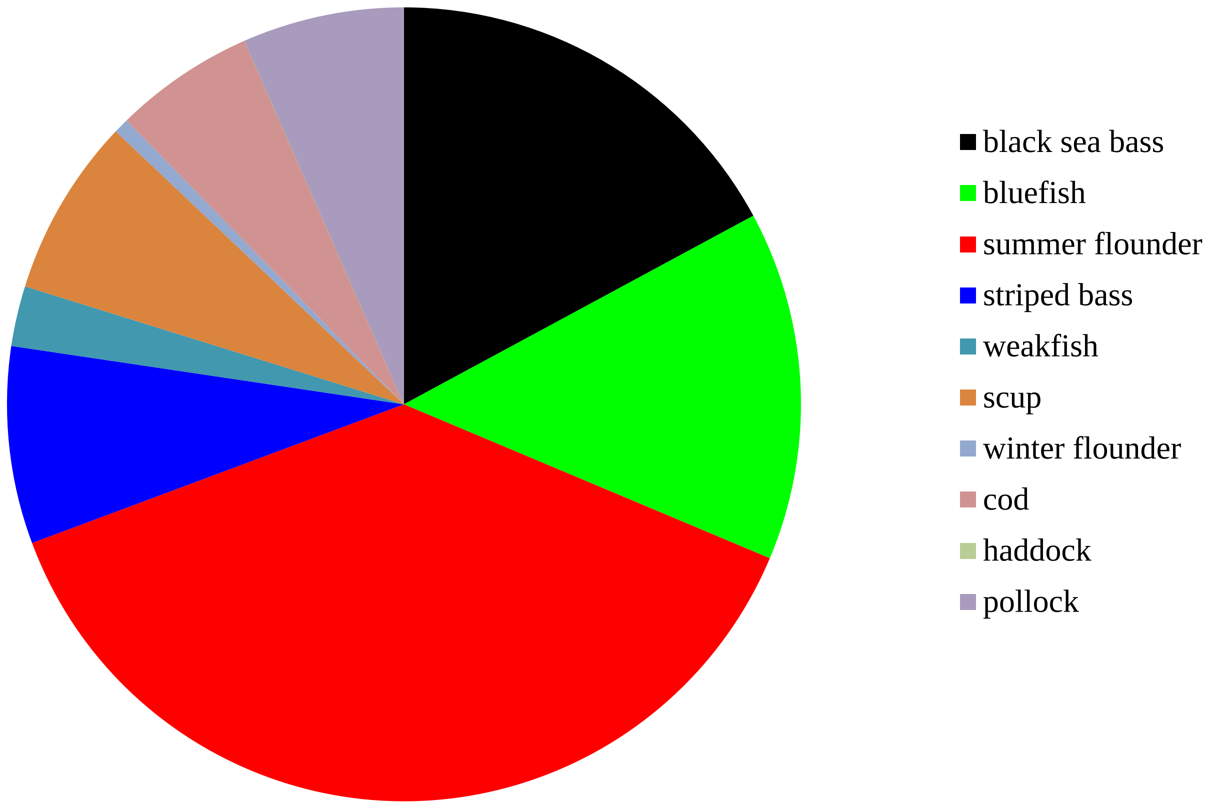
Among these species, an average of <u>54 to 61 million</u> fish released annually in Northeast



Discard mortality rate used in stock assessments range from 0% to 100%

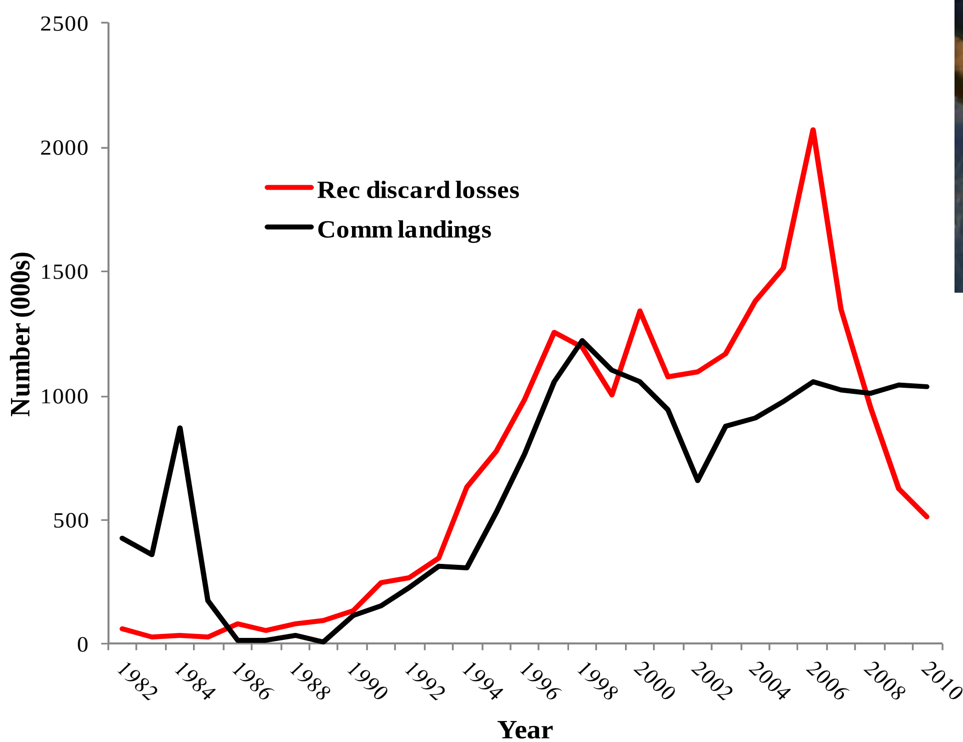
Average of **15%** mortality

Discard loss by species (2000-2012)



Among these species in the Mid-Atlantic/New England, an Average of <u>6 to 7 million</u> fish are assumed dead following release

Striped Bass Recreational Discard Losses (8%[a]) vs. Commercial Landings



[a] Based on field study by Diodati and Richards (1996)

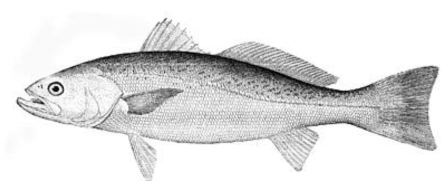
How do these dead discard numbers impact the stock assessment results?

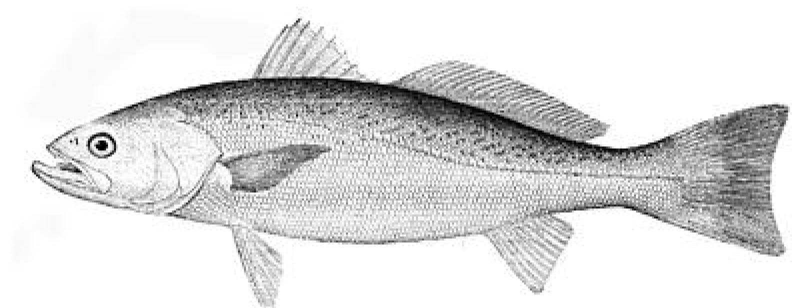
It’s complicated and not as obvious as expected.

• One issue is selectivity.

• Selectivity is a metric to describe the relationship between fish size/age and the proportion removed during fishing.

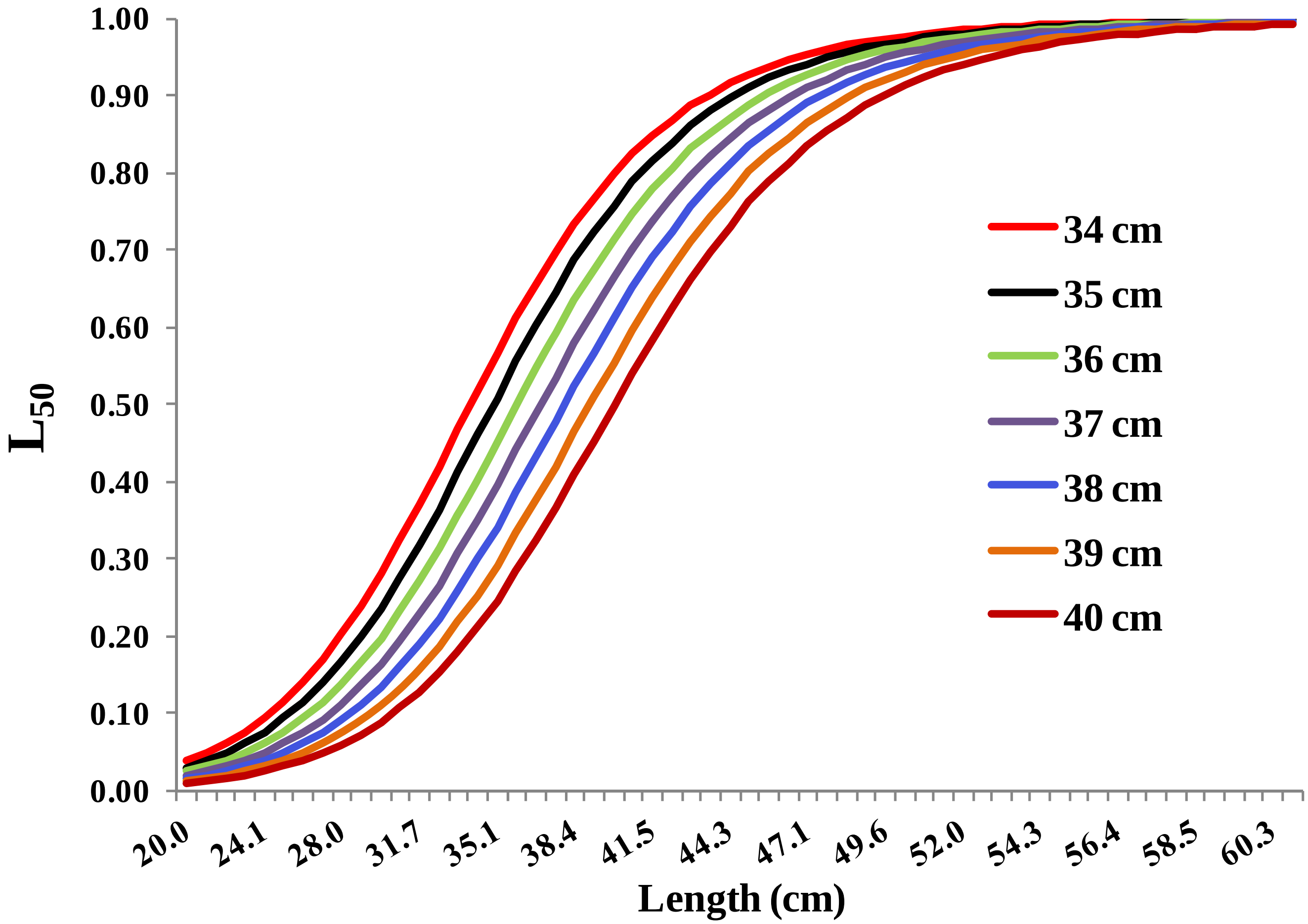
• If Selectivity is 50%, it means only half the fish at that age are vulnerable to being caught.





Size of fish vulnerable to fishing with changes in minimum size

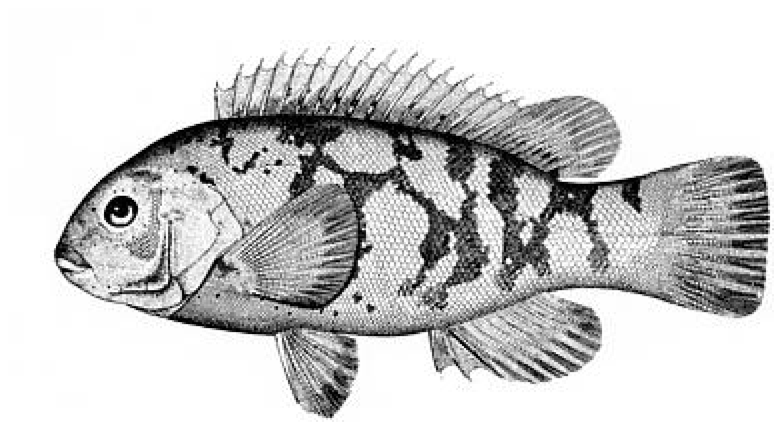
Example:



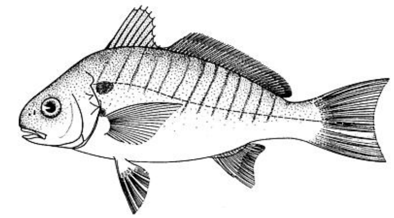
Changes in discard mortality has same effect.

As the proportion of discards which die increases, the selection curve moves to the left, towards smaller fish.

As the fishing pressure increases on smaller fish, the potential yield from the fishery decreases.



But….



Changes to discard rate influences assessment population estimates. But not as one would expect.

In population models, such as a VPA, the population size has to be at least as big as the number of fish removed via catch
(i.e. if you catch a million fish there had to be at least a million in the population)

	AGE										
YEAR	1	2	3	4	5	6	7	8	9	10	total
2001											
2002											
2003	2.4										
2004		741.0									
2005			887.0								
2006				839.7							
2007					1024.0						
2008						182.7					
2009							91.6				
2010								26.9			
2011									10.4		
2012										1.3	
											3,807

So increasing the discard mortality rate means more fish were removed.
More fish removed means more fish had to be in the population.
Consequently, higher discard rates = higher population abundance estimates.

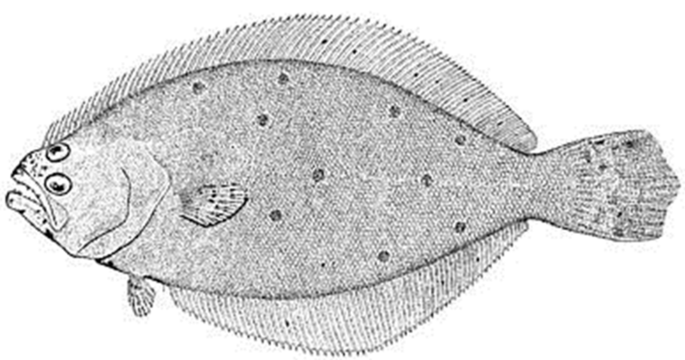
Increase discard mortality rate

→

Increase catch estimate

→

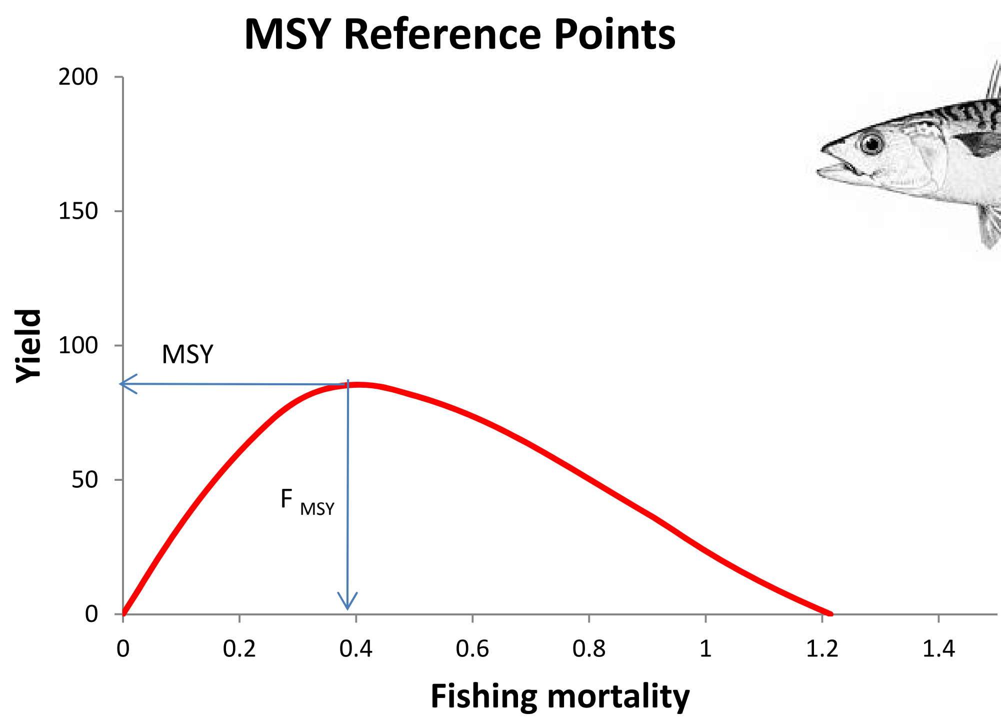
Increase abundance estimate

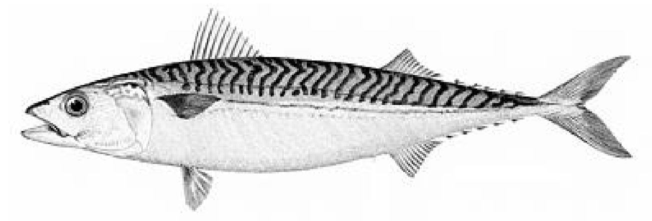


Effect on biological reference points

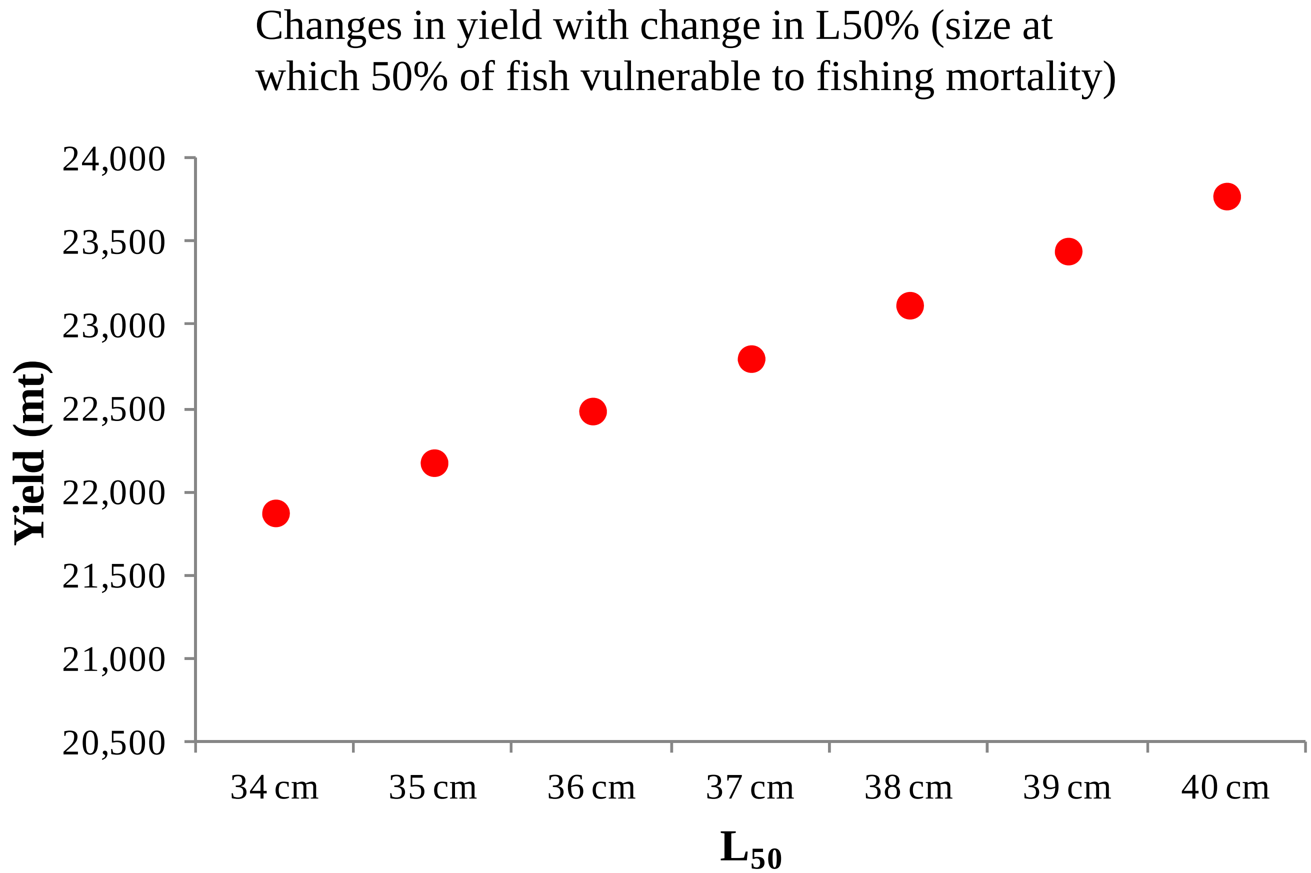
Reference points are metrics that determine how much fishing pressure the population can withstand and still prosper.

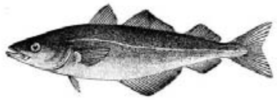
Objective in most Management Plans it to maximize yield without jeopardizing reproduction (MSY)

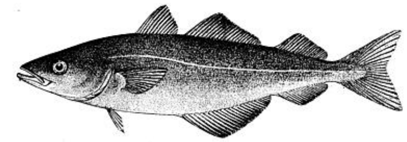




Changes in selectivity previously described can influence potential yield.



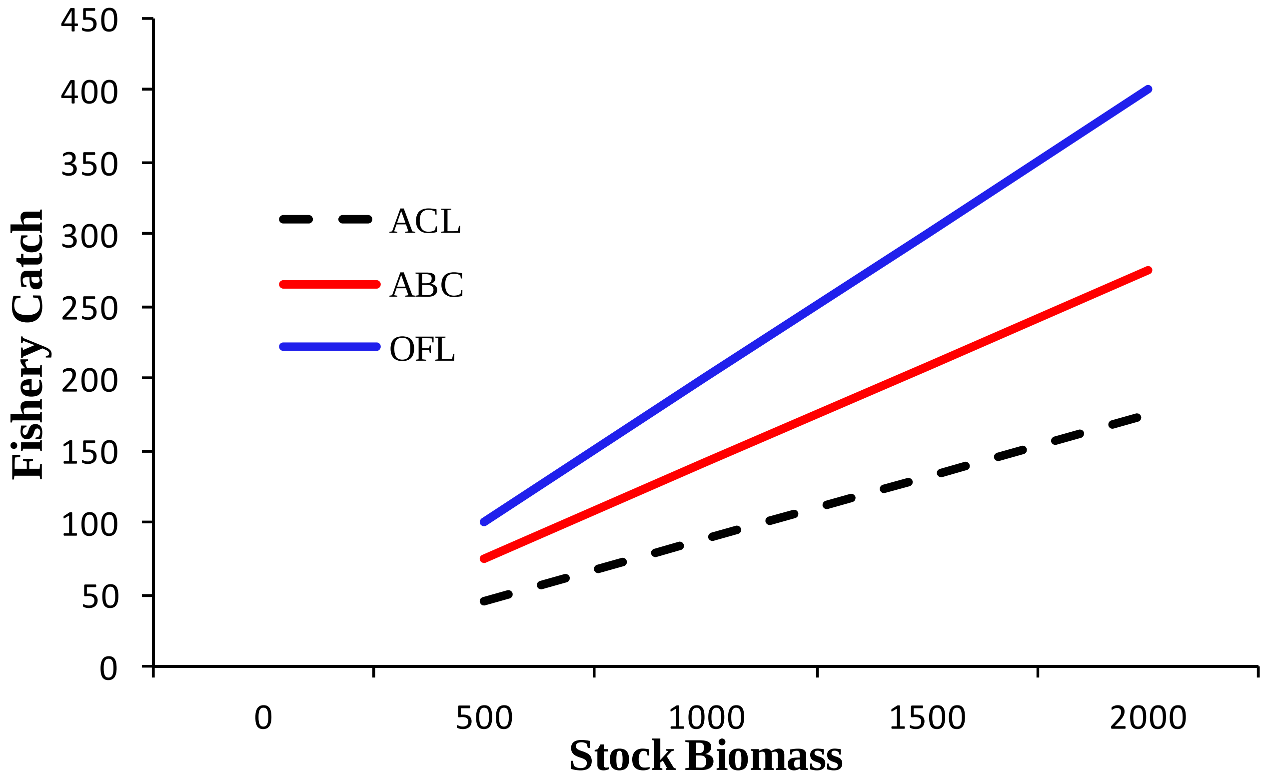




Yield per recruit assuming constant recruitment estimates

Next, a little alphabet soup:

OFL = Overfishing Limit – can’t go beyond that or bad things happen
ABC = Acceptable Biological Catch – quota level which accounts for
scientific uncertainty. Keeps removals below OFL.
ACL = Annual Catch Limit – quota $\leq$ ABC. Catch > ACL trigger
accountability measures.



Greater uncertainty in discard mortality can affect outcome.

Gulf of Maine Atlantic cod example –

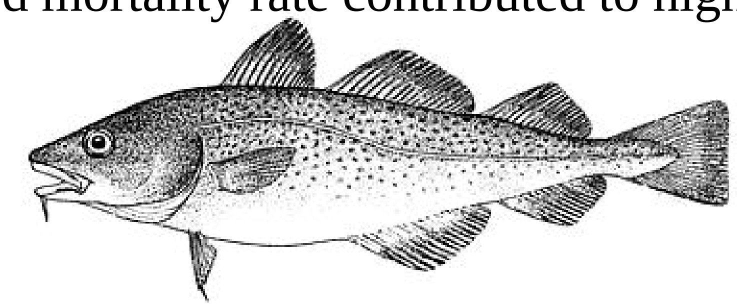
- Initially discard mortality assumed to be 100%. Assessment model fits the data well.

- Mortality rate questioned by industry, etc.

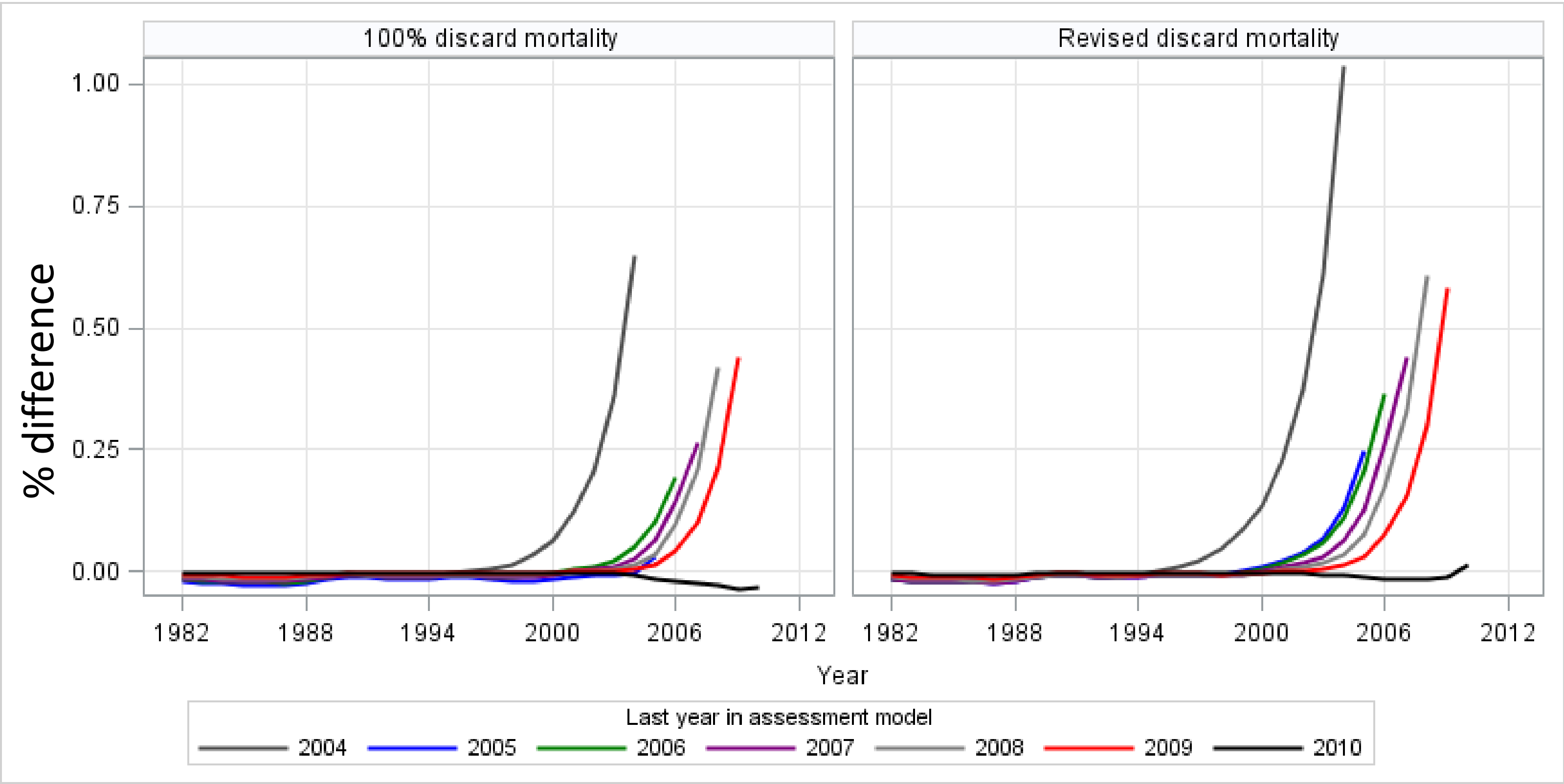
- Group discussion leads to new ‘estimate’ of discard mortality rate of 30%.

- New data leads to poorer fit and higher uncertainty in assessment results.

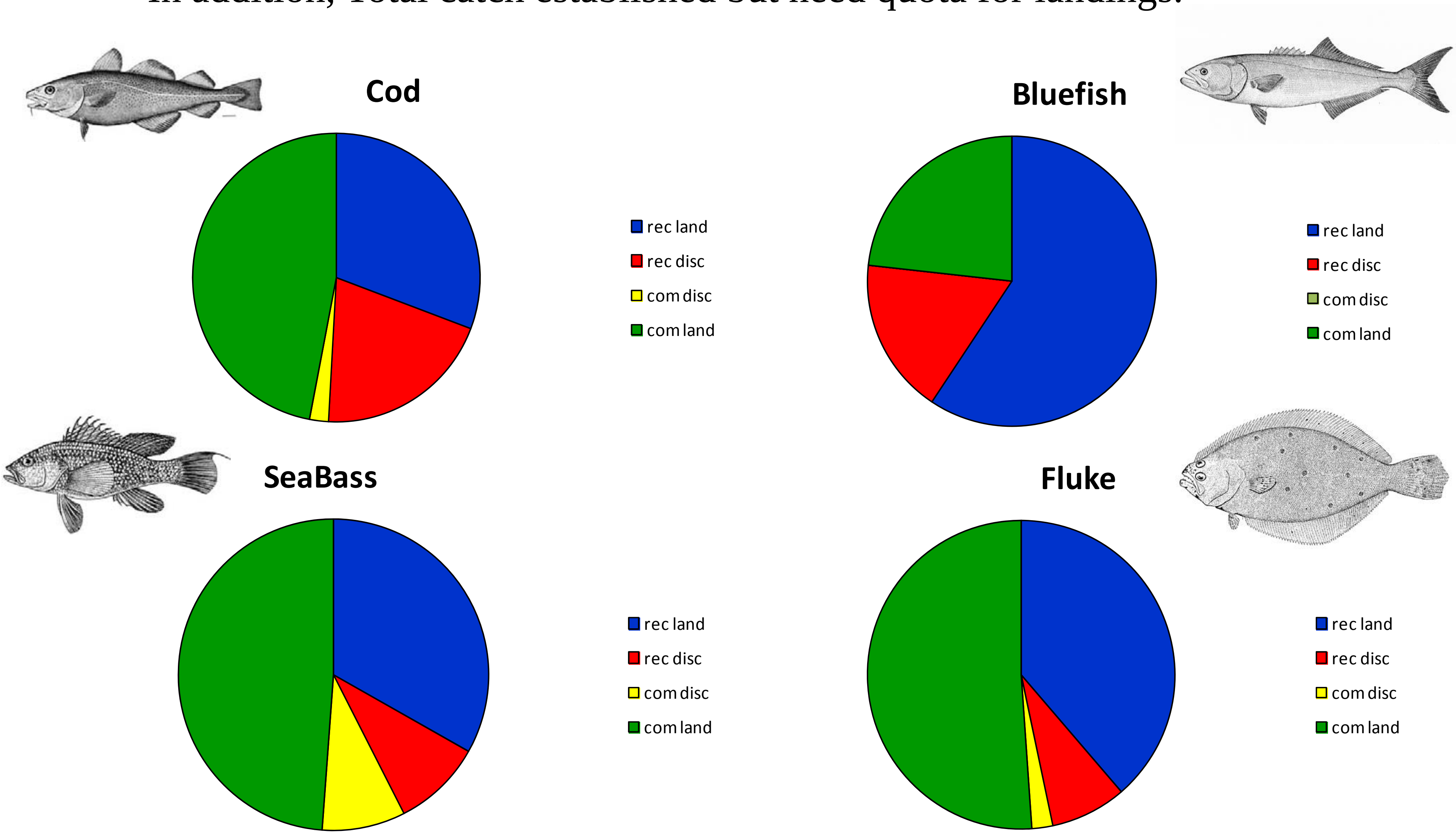
So uncertainty in discard mortality rate contributed to higher uncertainty in model results.



Increased uncertainty in Atlantic cod assessment due to changes in discard mortality estimates



In addition, Total catch established but need quota for landings.



Total landings = total catch – discards

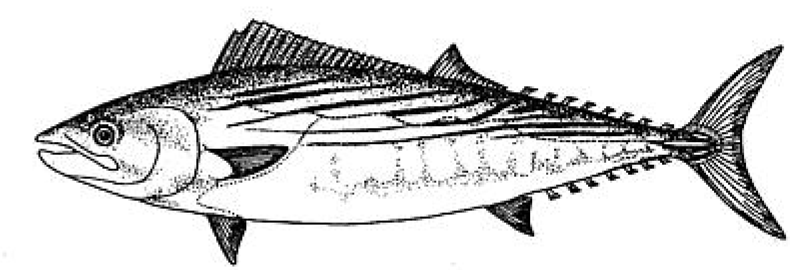
The bigger the proportion of discards, the lower the landings

What does it all mean?

- Poor fishing practices = higher discard mortalities

- Higher discard mortalities may result in:
  - Higher estimates of abundance
  - Lower estimate of potential yield
  - Lower landings from total catch estimate

- Higher uncertainty in discard estimates may result in:
  - Poorer population model estimates
    - Lower Annual Catch Limits



Take home message is that fewer discard mortalities ultimately lead to a healthier fish population and potentially higher long term yields.

Questions?