

# The Incorporation of Basic Economic Principles into the Legal Mandates of a Fisheries Management Regime.

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Seminar in Honor of the 70<sup>th</sup> Birthday of Rögnvaldur Hannesson

June 6, 2013  
Norges Handelshøyskole

1981



1983



2003







I am going to make what I consider to be constructive criticism of the current fisheries program in the United States.

But it should be clear that I fully respect the folks who developed the principles and support the current version as a very useful first step. Look at what has happened to the health of the stocks.

An Advanced Notice of Proposed Rulemaking [ANPR] to initiate a revision of the current version of the National Standard 1 Guidelines has been issued. I will suggest that the guidelines could be improved by adding some basic economic principles and there are indications that this may occur.

Except for rare exceptions, economic concepts are not, and never have been, part of the principles and guidelines of legal fisheries management regimes

This is certainly true of the current fisheries management law in the US which can be summarized as follows:

**Basic Goal.** Choose harvests levels and target stock sizes so as to maximize the greatest overall benefit to the Nation.

Basic principle to achieve this goal is encapsulated in National Standard #1

Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the U.S. fishing industry.

Under the current version of the National Standard 1 Guidelines, the procedure is to

1. Set a Target Stock Size

$X_{msy}$

2. On an annual basis set an allowable biological catch (ABC) that will cause the stock to approach or remain at  $X_{msy}$  taking into account uncertainty in all its forms -- data, parameter estimation, choice of model, enforcement, etc. .

3. More particularly set an annual ABC that is less than the Over Fishing Limit such that the probability of overfishing is not greater than 50% .

$$OFL = F_{mxy} * X_t$$



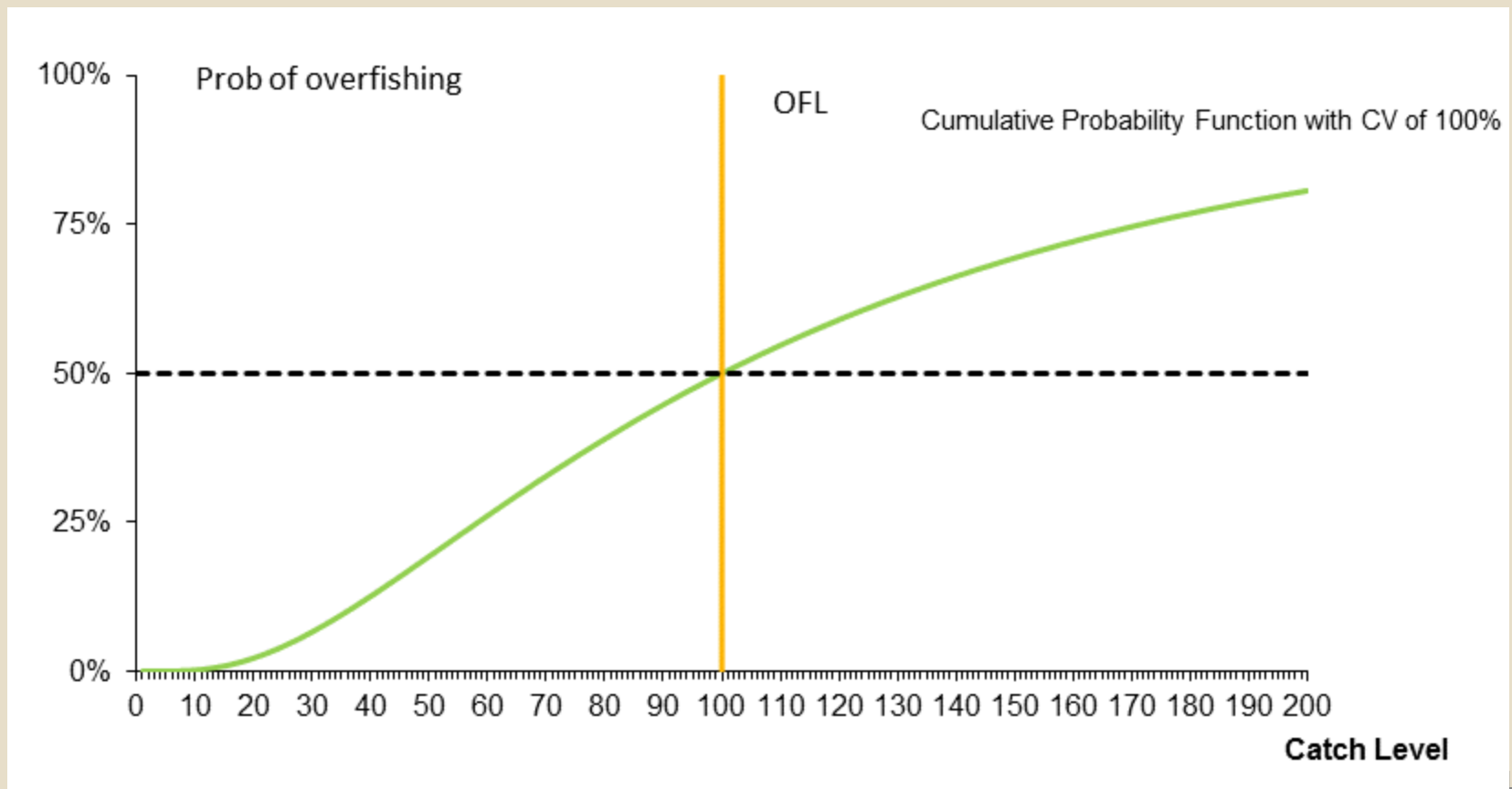
# Making It Operational

In order to make this operational we need

1. A Cumulative Probability Distribution Relating Size of ABC and the probability of overfishing.
2. A specification of an acceptable level of risk referred to as  $P^*$ .

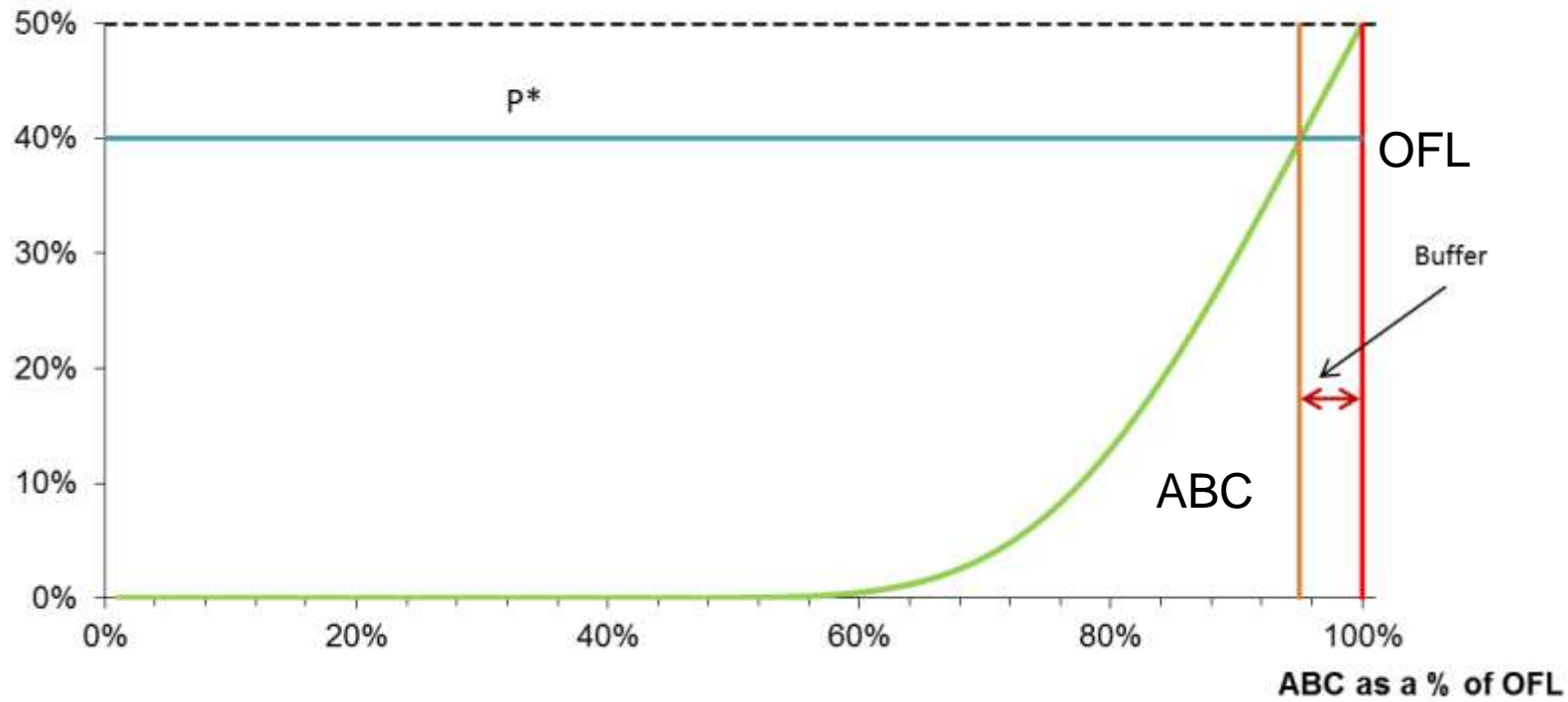
$$\text{OFL} = F_{\text{msy}} * X_t$$

If the PDFs of the critical variables ( $F_{\text{msy}}$  and  $X_t$ ) have normal distributions the probability of overfishing is 50% when ABC is set equal to the point estimate of OFL.



Prob of overfishing

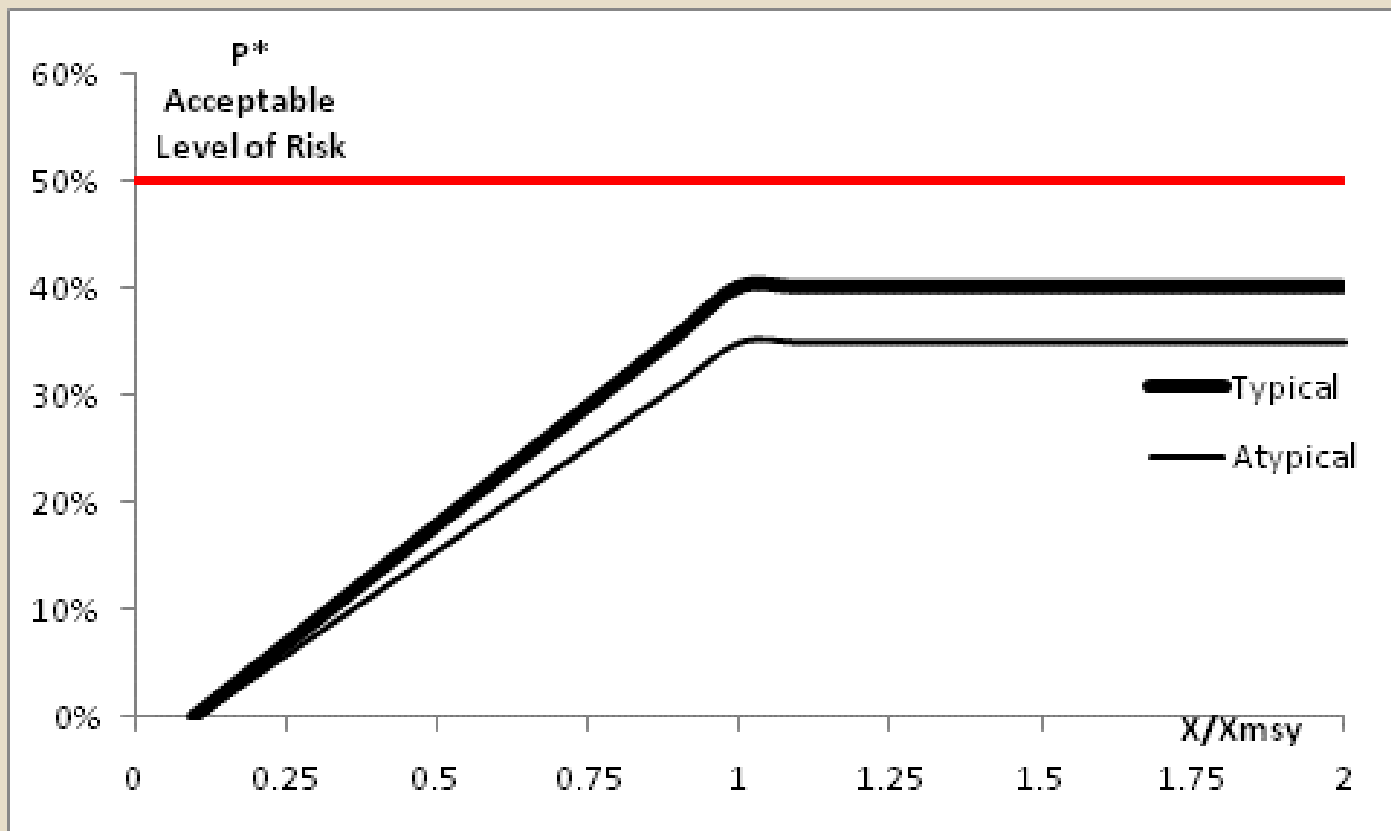
Truncated Cumulative Probability Function with CV of 20%



We have a graphical solution!

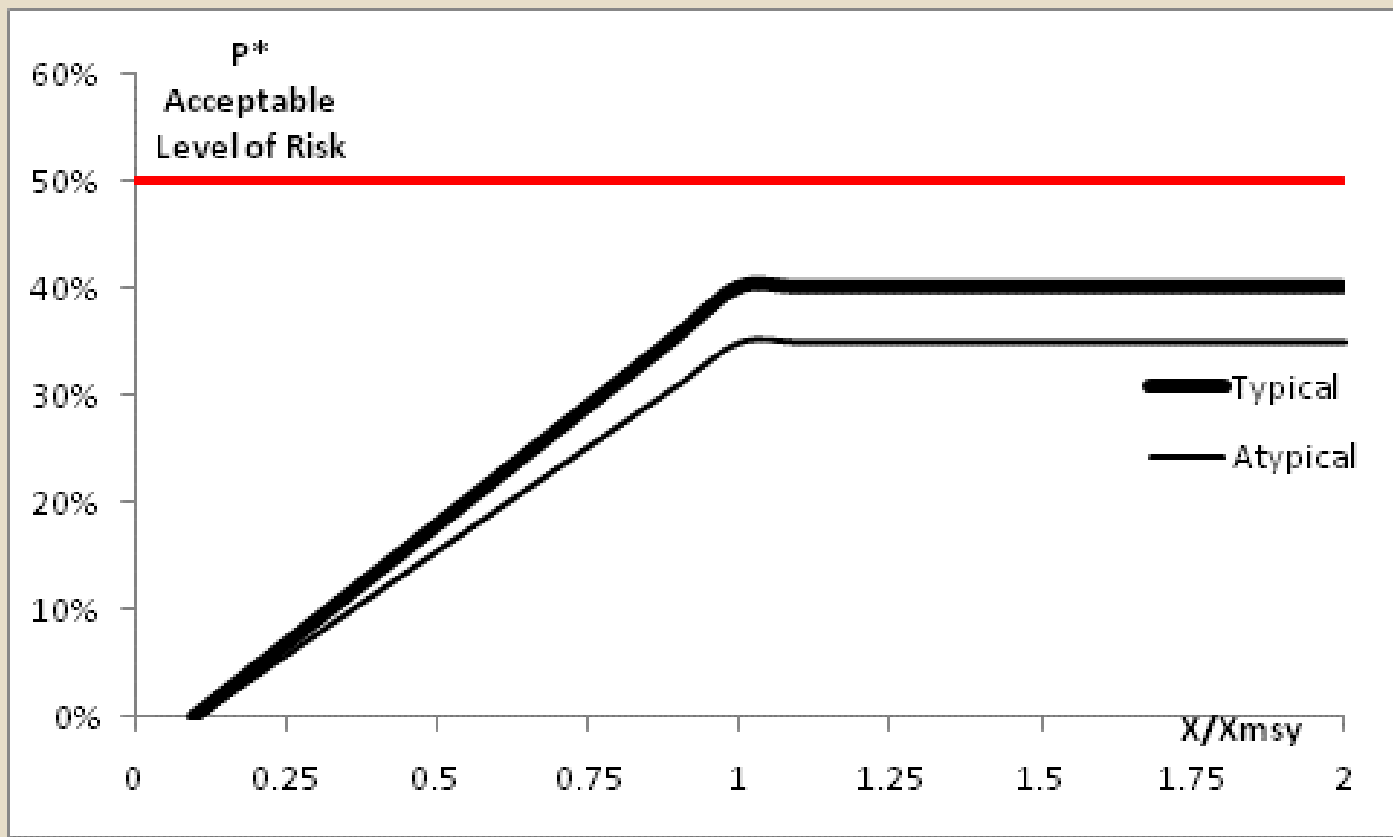
Although the CPDs are a critical part of the process they are not available in most cases. My council assumes a lognormal distribution with mean at point estimate of OFL with a CV of 100%.

The Mid Atlantic Fishery Management Council decided to set  $P^*$  as a function of stock size.

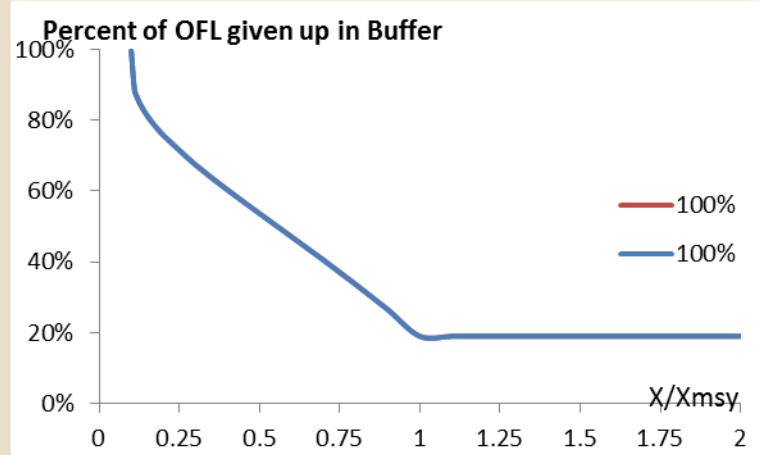
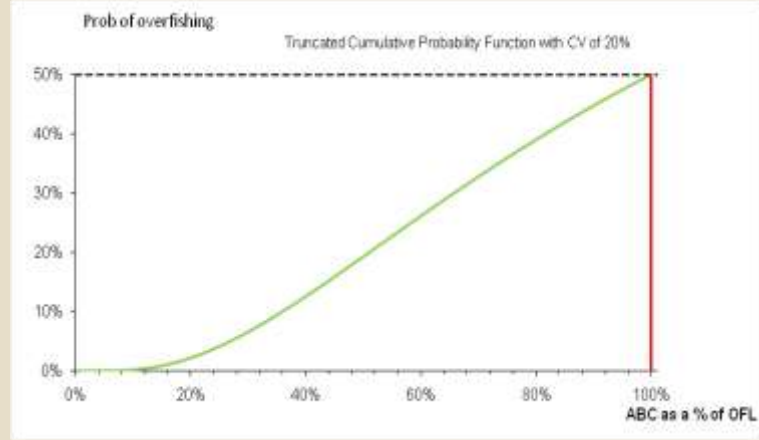
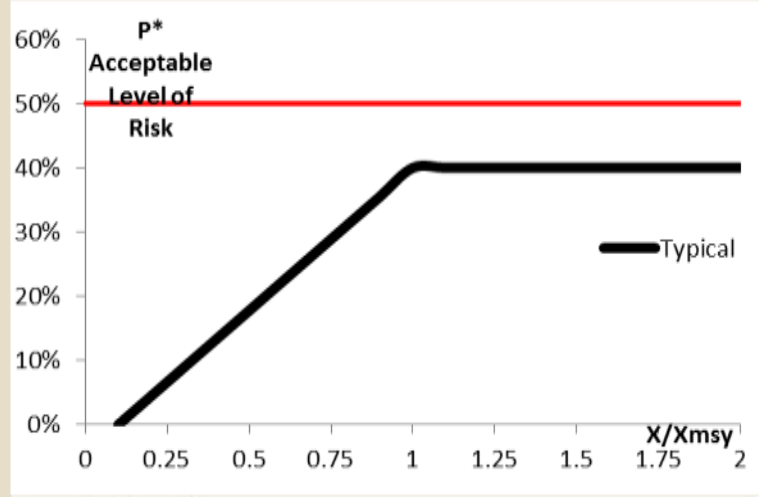




Did they know the implications when they made the selection?. Opportunity cost?



# Needs to be interpreted



And just as important, it is not clear that the participants in the process have a clear or a common understanding of what is gained by a reduction in the probability of overfishing.

The potential damage depends upon many things not the least of which is the size of the existing stock relative to the estimate of  $X_{msy}$ .

There is not a clear conceptualization of what is being given up or what is being gained.

With this brief introduction to principles and workings the National Standard 1 Guidelines of the US law, lets turn to my main topic which is suggestions for improving the National Standard 1 Guidelines.

1. Except for rare exceptions, economic concepts are not and never have been part of the principles and guidelines of legal fisheries management regimes .



2. I will argue that the National Standard 1 Guidelines would be more likely to lead to utilization of our fisheries resources for the ***maximum benefit to the nation*** by introducing the concept of opportunity cost.

Compare marginal benefit of reducing (the probability of) overfishing with the marginal cost of doing so.

Improving the operational definition of overfishing is also needed.

3. There are encouraging signs that this may occur.

To set the stage let me restate the argument between MSY and MEY in terms of the principle of opportunity cost.

The principle of MSY, which is the basic fundamental underlying principle of most fisheries laws, can be operationally stated as:

Operate the fishery so as to maximize the long term sustainable yield from the stock.

In operational **marginal** terms this can be restated as:

Continue to increase long term effort as long as it results in a increase in sustainable harvest.

The principle of Maximum Economic Yield, which is ignored in fisheries management law and likely misunderstood by many fisheries managers, can be operationally stated as:

Operate the fishery so as to maximize the net value of output, which is the difference between the **value** of fish harvested and the **full** cost of harvesting the fish.

In operational marginal terms this becomes:

Continue to increase long term fishing effort as long as the **value** of the extra sustainable production is greater than the **full** cost of using that effort.

Not interested in profit per se, but the optimal utilization of all resources.

Main Difference: Go from biomass measures to value measures and consider opportunity cost.

## National Standard 1

Conservation and management measures shall prevent **overfishing** while achieving, on a continuing basis, the **optimum yield** from each fishery for the United States fishing industry.



## Plain English definition of overfishing

“Overfishing occurs whenever a stock is subjected to a level of fishing mortality or total catch that **jeopardizes the capacity** of the stock to produce MSY on a continuing basis.

Formal definition of overfishing according to the national standards.

Overfishing occurs when catch exceeds the overfishing limit (OFL) measured in units of harvest where  $OFL = F_{msy} * X_t$

So overfishing occurs when

$$\text{Harvest} > F_{msy} * X_t$$

Sidelight;

The term overfishing by its nature sounds like something that should not be done, that it is bad.

Do not overfish. Do not rob banks.

If overfishing occurs according to the formal definition will it jeopardize the capacity of the stock on a continuing basis?

While it may make sense to specify a rule that says do not ever rob banks, the same can not be said of a rule that says do not ever let catch be greater than  $F_{msy} * X_t$ .

Let me state an obvious point here.

In order to “achieve” optimal yield it is necessary to define it (MSY) and then, considering the current stock conditions, to determine the time path of annual harvests levels to achieve it.

The ABC setting process can be looked at as the step by step process of achieving OY.

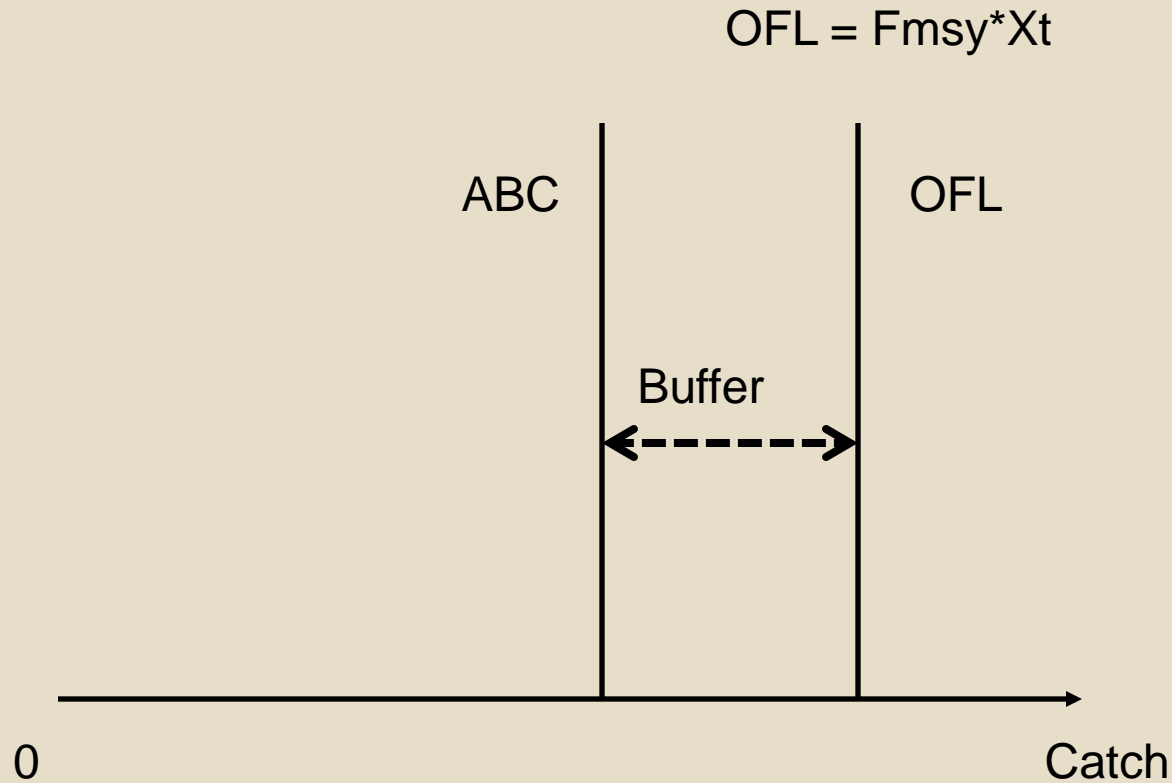
Now to my main point. How to improve the ABC setting process by utilizing the concept of opportunity cost.

The current guidelines say this about the ABC control rule.

For stocks and stock complexes required to have an ABC, each council must establish a control rule based on scientific advice from its SSC.

*The determination of ABC should be based , when possible, on the probability that an actual catch equal to the stock's ABC would result in overfishing (as defined). **This probability that overfishing will occur cannot exceed 50 percent and should have a lower value.***





Set a buffer between OFL and ABC such that the probability that an actual catch equal to ABC would result in overfishing (as defined) is less than or equal to 50%.

Ignoring the fact that we do not have sufficient data to apply this standard, there is **no conceptual basis** for doing so.

It implicitly says that the marginal benefit of lowering the ABC when the probability of “overfishing” is greater than 50% is infinite.

To put it another way, it says that the marginal cost of lowering the ABC is zero.

Instead of specifying a specific minimum acceptable probability of overfishing, let us specify the following general principle.

Increase the buffer and reduce the probability of overfishing as long as the marginal **expected** “benefits to the nation” in terms of future harvests are greater than the marginal opportunity costs of lost benefits to the nation in terms of current harvest.

In pure economic terms:

Increase the buffer and reduce the probability of overfishing as long as the marginal expected benefits in terms of increased net present value (generally defined) of harvest are greater than the marginal costs in terms lost current value of harvest.

For this to work, the operational definition of overfishing must be reworded such that there is a direct relationship between “overfishing” and benefits and costs to the nation of overfishing.

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Look at this again:

Reduce the probability of overfishing as long as the marginal expected “benefits to the nation” in terms of future harvests are greater than the marginal opportunity costs of lost benefits to the nation in terms of current harvest.

The question is can we do that? I contend that we can do that as well as we can, and have, applied the 50% rule and this has the advantage of being conceptually sound.

The councils and their SSCs were quite imaginative in coming up with control rules based on the current specifications. I would hope and I predict they can do better when there is a solid conceptual basis involved.

Why haven't we done this before? Why keep the 50% rule?

1. There is an incorrect conception of the problem. People think that you can not have too much of good thing and reducing the probability of overfishing (no matter how it is defined) is good thing. If some is good then more is better. Do not understand the concept of opportunity costs.

2. There is a fear of political manipulation if fisheries managers are allowed to interpret potential benefits and costs.

Translation. Folks do not trust the councils. That is why control rules were developed.

There are hints that this sort of thinking is gaining traction.

Comments before the ANPR.

Wording of the ANPR

Responses to the ANPR

NMFS early reporting on responses to the ANPR.



## Early Hints

National Science Workshop on Implementation of Annual Catch Limits

Feb 15-17, 2011

Richard Methot Organizer

### Workshop Topics

- Collecting data needed for assessments.
- Improving fishery monitoring programs to better support stock assessments, ACL monitoring, and catch share programs
- Understanding impact of fisheries for the data-limited and minor stocks
- Using cooperative research to augment the needed assessment data
- Calculating, communicating and responding to uncertainty
- **Bringing socio-economic considerations into OY specification**
- Bringing ecosystem/climate/habitat into assessments and OY
- Building efficient and effective relationships among Science Centers, SSCs, and peer review systems in providing the best scientific information available for updating ACLs

## Hints from ANPR

The MSA defines OY as being reduced from MSY to account for relevant economic, social, or ecological factors, and states that OY in an overfished fishery must provide for rebuilding the fishery (MSA 3(33)). **There is interest from stakeholders in improving guidance to better address economic, social, and ecological considerations in the establishment of OY and to more clearly describe the relationship between ACL and OY.**

## Hints from ANPR

2. Overfishing and multi-year impacts. The current NS1 Guidelines provide that overfishing must be determined either by comparing catch to the overfishing limit (OFL) or by comparing fishing mortality to the maximum fishing mortality threshold (§ 600.310 (e)(2)(ii)(A)). Overfishing determinations are made for the most recent year for which there is information. **Stakeholders have expressed interest in exploring alternative definitions of overfishing that would take a longer, multi-year view of the impact of fishing on the stock's ability to produce maximum sustainable yield (MSY).**

## Hints from responses to the ANPR

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Two commenters made the specific point that the definition for overfishing in the guidelines should be based on the expected impact of overfishing. They believe that overfishing definitions should be based on whether the overfishing is expected to have a negative impact on the benefits to the nation or reduce the biomass of the stock to an overfished condition.

Page 5

## Hints from responses to the ANPR

Several commenters stated that more guidance is needed to better address the economic, social, and ecological considerations in OY. One commenter stated that the NS1 guidelines do not identify where reductions for ecological, economic, and social factors should be applied in the OFL-ABC-ACL-ACT framework. Page 6

One commenter expressed that there is a need for increased collection of economic and social data so that trade-offs between catch levels could be better analyzed. Page 7

## Hints from responses to the ANPR

Several NGOs, one public commenter, and one Council requested that NOAA Fisheries clarify the responsibilities of Councils and SSCs in setting ABCs and related risk policies, and to have the Councils show in FMPs and FMP amendments in a more clear and transparent fashion how their risk policy was determined (e.g., consider vulnerability of the stock, trade-offs in risk of overfishing versus yield over the short and long term, page 11

## Hints from responses to the ANPR

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Similarly, another commenter suggested that the current guidelines do not adequately emphasize the use of socio-economic information when developing rebuilding plans.

An additional commenter asked NOAA Fisheries to convene an expert panel to discuss current rebuilding policies and approaches while discussing socio-economic tradeoffs. Page 20

## Hints from responses to the ANPR

Some commenters suggested that, given the complexity of mixed-stock fisheries, more guidance is needed to address economic, social, and ecological considerations in establishment of OY. Some suggested that the guidelines should clarify how OY should be specified and how it should provide for rebuilding. Some felt that bio-economic models, which incorporate economic contributions of stocks, should be used. Page 8



## Hints from early NMFS reply to ANPR comments

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What is the right amount of catch?

Determining the long-term optimum yield (OY) and the appropriate annual catch levels for a fishery involve many complex issues and **tradeoffs**, and may benefit from:

- Increased consideration of **social and economic** factors
- Improved understanding of the importance of ecosystem factors to stock productivity and multispecies interactions.

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- Increased consideration of **social and economic** factors
- Improved understanding of the importance of ecosystem factors to stock productivity and multispecies interactions.

Boy I hope so.

## Summary

### Suggestions for improving the NS#1 Guidelines

Replace the 50% rule with a mandate to reduce the probability of overfishing as long as the marginal expected “benefits to the nation” in terms of future harvests are greater than the marginal opportunity costs of lost benefits to the nation in terms of current harvest.

Improve the definition of overfishing.