

Including Economics in Risk Analysis and Optimum Yield

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Economic issues discussed so far.

Allocate resources to stock assessments according to value of stocks.

Last \$ spent on each assessment adds the same value.

How incentives from catch share programs can change incentives on when and where to fish and how this will affect data times series and hence ability to do assessments.

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Rick's Instructions to me.

Prepare a "can-do" presentation that helps point to way to new approaches that are achievable over the next 3-5 years.

Not nuts 'n bolts implementation issues being tackled by the SSC's today, and not pie-in-the-sky long-term ideas with impossible data demands.

What proxies do we need to develop to fill some information gaps to get started today on a more quantitative approach to OY?

I want to look forward and build on what has been accomplished during the first years of implementation.

I am not saying what has been done is wrong. Quite the contrary, given the task and the mandated new way to approach things and the clunky, deliberative, and sometimes slow way the council system works, I think the work that has been done is extraordinary perhaps revolutionary.

But I am taking my marching orders to look forward and build on what has been done.

David's Paper and mine are related.

To set the stage, consider the well know essay on opportunity cost by Robert Frost.

Robert Frost (1874–1963). Mountain Interval. 1920.

1. The Road Not Taken

TWO roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;

Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same,

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference.

The Road Not Taken

Opportunity Cost

If we are going to “Include Economics in Risk Analysis and Optimum Yield” it makes sense to consider the concept of opportunity cost when determining OY and setting ABCs and ACLs

General operational rule:

Operate where marginal benefit equals marginal cost.

Look at problem of setting ABCs as an example.

On the one hand we are acting to reduce the probability of overfishing.

What exactly do we get from that?

But on the other hand we giving up current harvest.

What are we gaining and what are we giving up?
How far should we go?

What about comparability of decisions concerning different species?.

To put things in the starkest possible terms in terms of economic thinking :

We are making trade offs where the gains are non measurable and non-comparable between species and where the costs are not always considered and are non-comparable between stocks.

There ought to be something the economist can add to this discussion in light of Rick's marching orders.

Can we improve what we are doing?

Status quo

The objective behind setting a buffer between OFL and ABC is to reduce the probability of overfishing to an acceptable level. Same concept applies to buffer between ABC and ACL.

Reducing the probability of overfishing is a good thing, and the generally accepted view is that a little reduction is good and a bigger reduction is better.

Use a P^* rule.

But there is little or no consideration of the opportunity cost of setting buffers. What are we giving up for the reduction in the probability of overfishing.

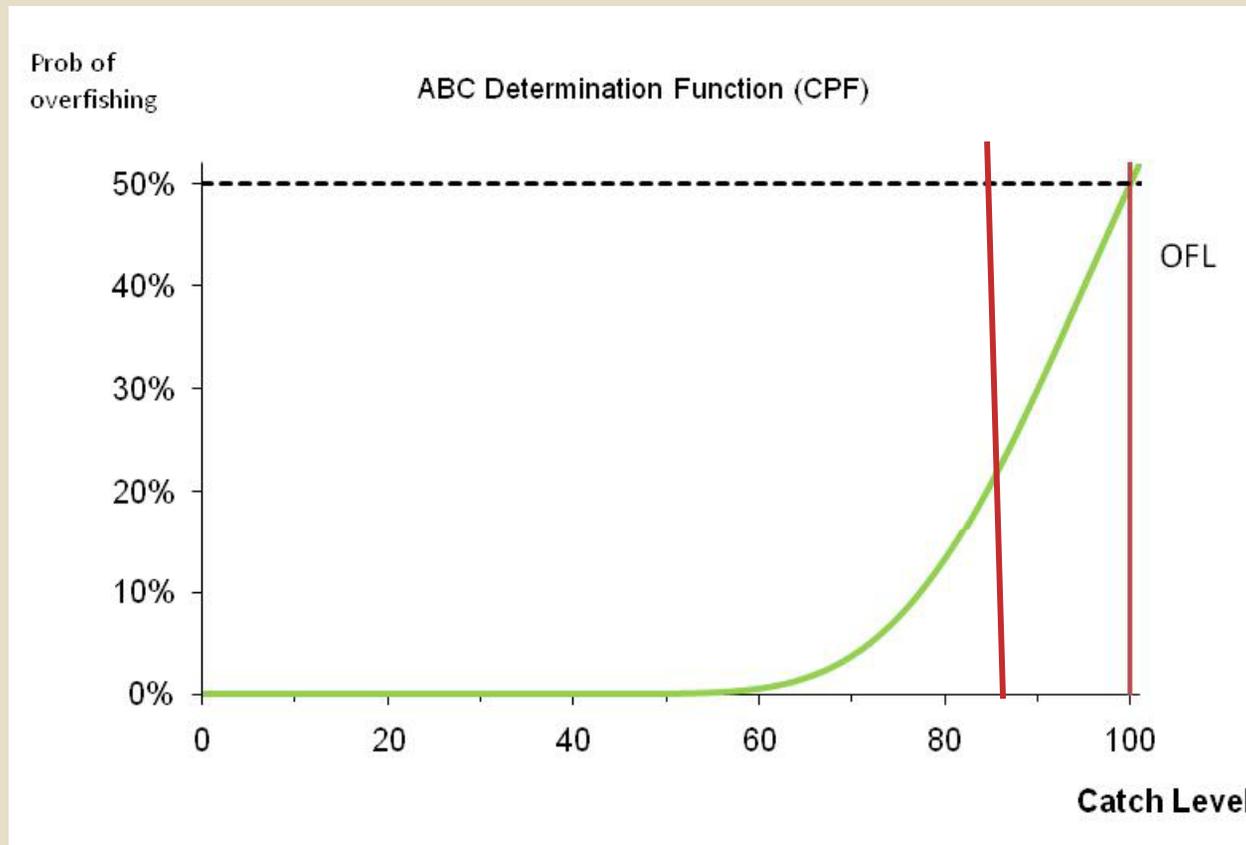
And just as important, it is not clear just what is gained by a reduction in the probability of overfishing.

Take a closer look, what are we giving up?

At a minimum we are giving up potential current harvest.

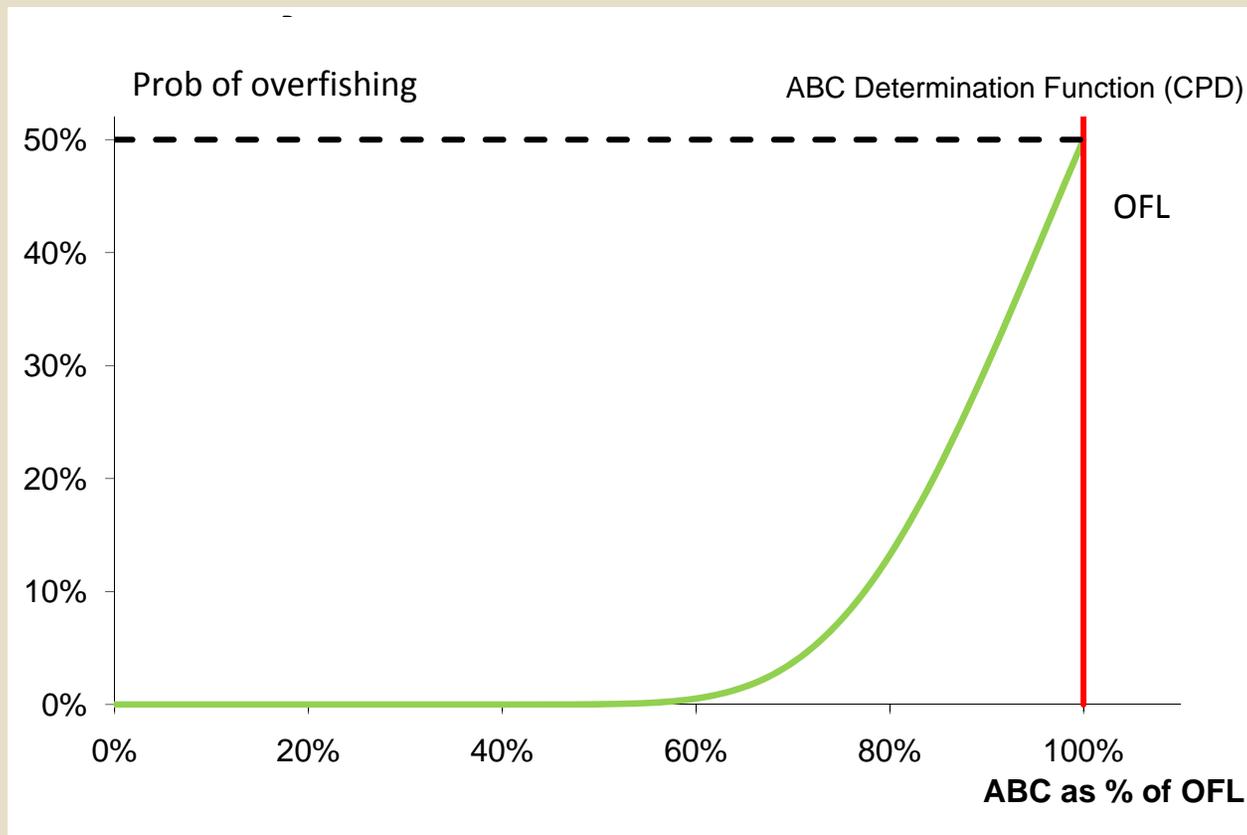
We are giving up a unit of harvest.

Look at the Axis..



Increase the buffer between OFL and ABC and we lower the probability of overfishing at the expense of current harvest.

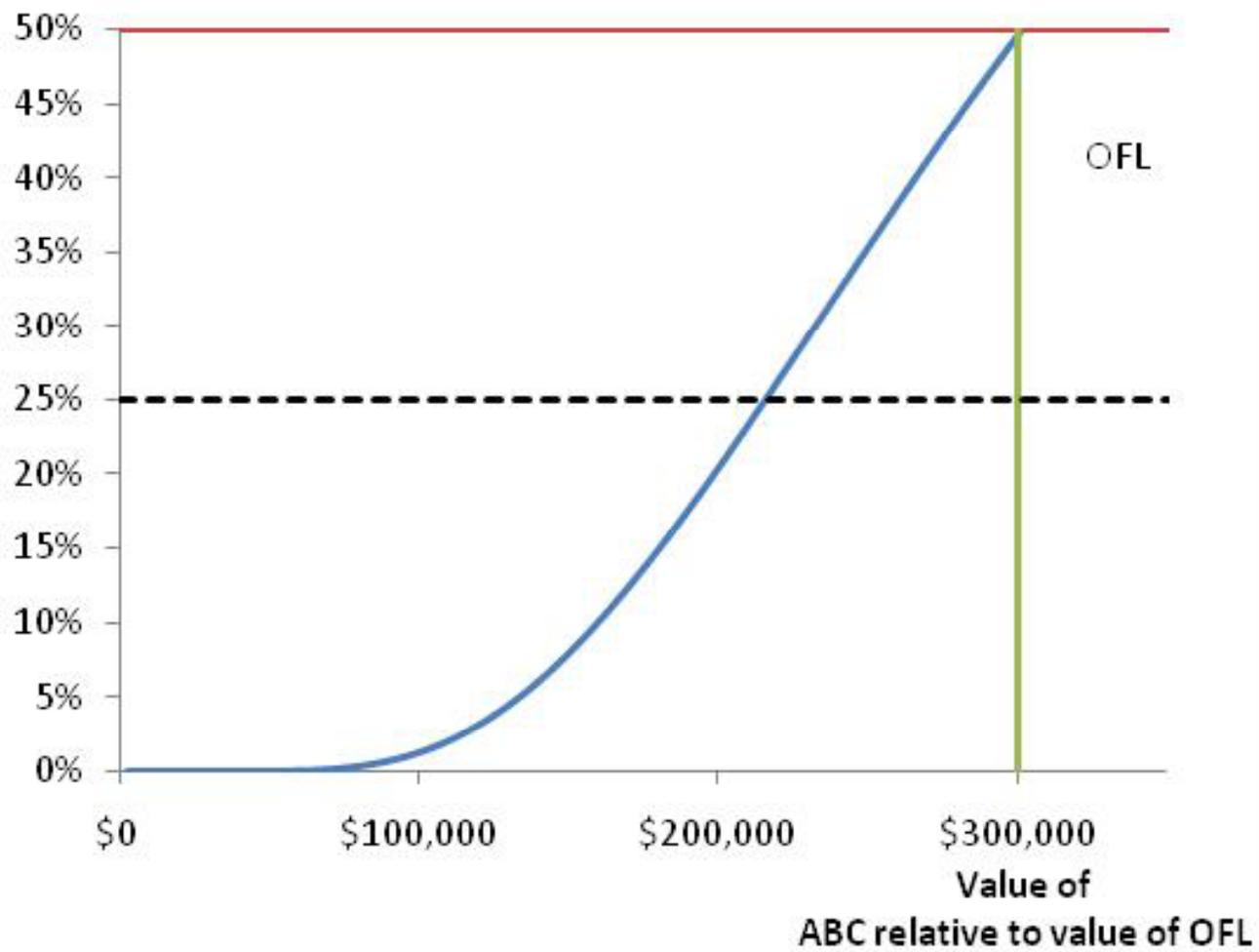
For consistency between different stocks, it will be useful to use ABC and a % of OFL rather than actual catch level on the horizontal axis.



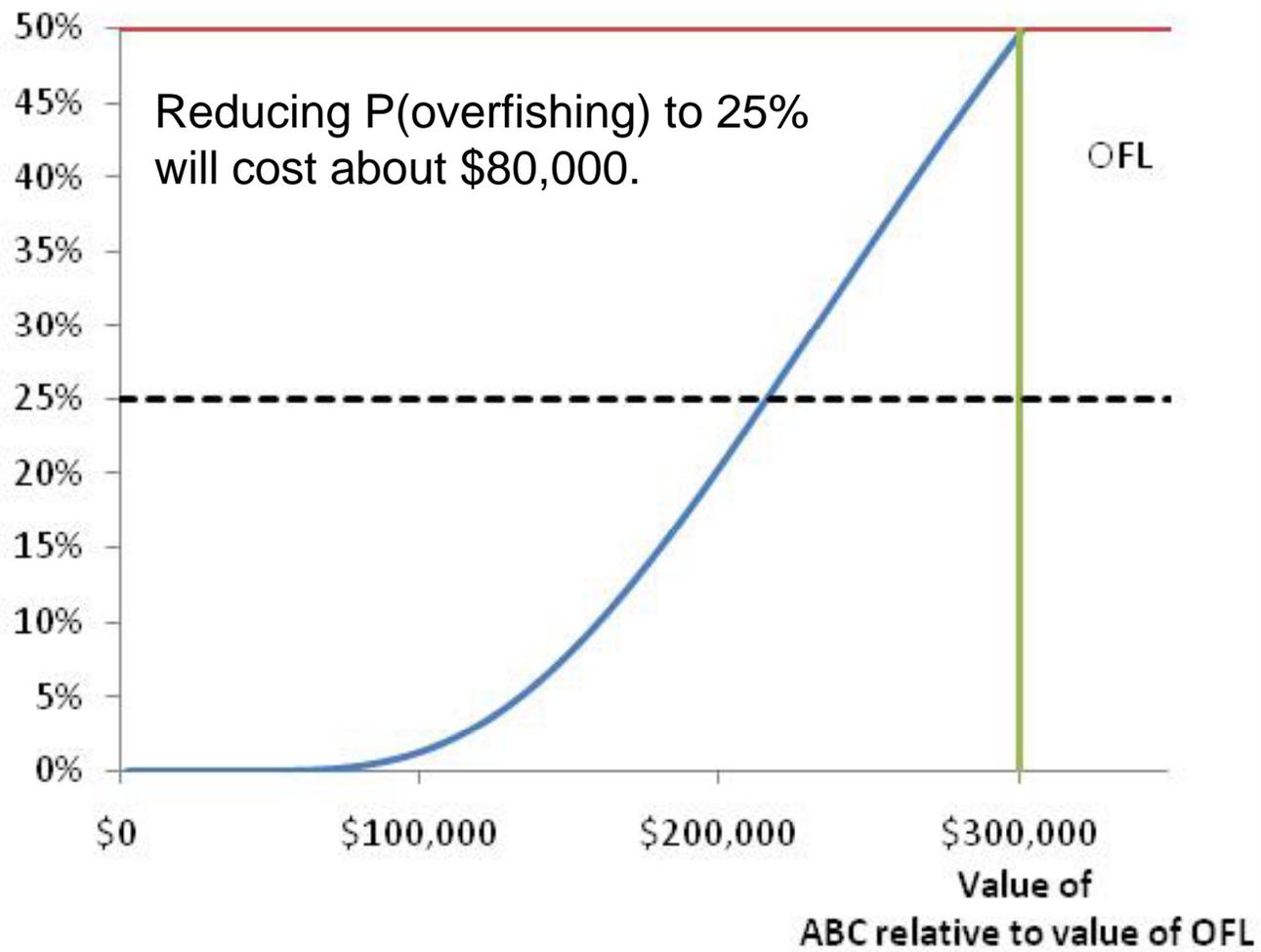
But at ton of catch is not the same in all fisheries.

Consider the comparison between value of OFL and Value of ABC

Probability that given value of ABC will result in overfishing.



Probability that given value of ABC will result in overfishing.



This adds the potential to look at comparability between stocks.

Potential rule of thumb:

Choose suite of ABCs such that the marginal cost of reducing the cost of P(overfishing) is the same in all stocks.

Replace P^* with MC^*

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Potential rule of thumb:

Marginal cost of reducing the cost of P(overfishing) the same in all stocks.

Replace P^* with MC^*

Ignores the absolute and relative gains from reducing P(overfishing)

Closer look as what exactly is gained by reducing probability of overfishing.

This is a more difficult problem.

What are we gaining?

What are the effects of lowering the probability of overfishing?

In a strict sense we are lowering the probability of having the actual catch be higher than MFFM times the estimate of current stock size.

The term overfishing gives the impression that it will cause the world will go to hell in a handbasket.

But 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} .

The possible damages of overfishing are not specified and are likely not comparable between species.

Further they are not comparable to the costs of reducing the probability of overfishing.

From a conceptual economic point of view, the damages of overfishing are the expected loss in the NPV of output from setting the ABC too high.

Again I am not saying that the procedure we have been using is wrong, misleading or a mistake.

General (but narrowly focused) Rule from economics

Keep increasing the buffer until the

marginal benefit in terms of the expected increased discounted value of future production due to the reduced risk of “overfishing”

equals the marginal cost of the loss of current output

The formulation of the problem.

Stopping overfishing has been pushed to the front because of the specific language of the law and the recent state of many fish stocks.

Maybe it is time to drop focus on avoiding overfishing and think about the things we want to do.

Maximize the value received from the fishery.

Focusing on maximizing benefits of fisheries utilization (perhaps with some clearly stated constraints) will by its very nature avoid overfishing and will allow for some more clearly stated operational rules.

David will talk about the general concept.

Final Point

Understand the difference between risk and uncertainty.

Need to understand the formal difference between risk and uncertainty

Risk Randomness with knowable probabilities.

Uncertainty Randomness with unknowable probabilities.

The above analysis only applies to “risk” situations .

It is necessary to use game theoretic approaches to uncertainty situations.

Max – Min

Minimize maximum regret

Frank Knight ***Risk, Uncertainty, and Profit*** Boston, MA: Hart, Schaffner & Marx; Houghton Mifflin Co. 1921.

Response to Rick's Marching orders.

Directly include opportunity cost concepts in the ABC process:

Consider replacing P^* with MC^* .

Restructure the problem to make it more general.

Differentiate between risk and uncertainty according to Knight's definition