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Rebuilding Overfished Fisheries under the
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Rigidity in Rebuilding and Management Goals -- A Recipe for Failure

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In the most simple terms, the goal of federal fisheries management is to maintain fish stocks at a biomass that will generate maximum sustainable yield. This is normally considered to occur when the biomass is one-half of carrying capacity. Carrying capacity is the theoretical maximum biomass that can be sustained by the environment without fishing. Without going into great detail, the estimation of the biomass at carrying capacity and at maximum sustainable yield is one of the more difficult issues facing the stock assessment scientist. Often, multiple interpretations are available from a given set of data, or at least a great deal of uncertainty exists as to the exact numbers to employ. It is ironic that the federal management system puts such emphasis on characteristics of the stock most difficult to assess.

The task of setting these required management goals is now difficult and will continue to increment in difficulty as global warming proceeds to influence the range, within-range distribution, and carrying capacity of species. The dominant, indeed nearly the only, approach to estimating carrying capacity and biomass at maximum sustainable yield is through the use of time series data and mathematical models. This approach requires the assumption of constancy. That is, the assumption is made that the stock has been more or less equivalently influenced by the environment over the time series, or at least, the influence of environment on the stock has been more or less random with facilitating and debilitating years distributed throughout the time series. We now know that regime shifts occur in natural populations that catastrophically change the relationship of the environment to the stock resulting in long-term changes in carrying capacity. We now know that global warming is modifying the range and carrying capacity of species in ways that cannot yet be predicted from established time series. Habitat degradation, particularly in estuarine ecosystems, and the influence of endocrine disrupters increasingly influence fecundity and recruitment in unknown ways. These unpredictable processes limit the usefulness of historical time series in determining present-day carrying capacity and hence present-day estimates of biomass at maximum sustainable yield and therefore rob from the stock

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assessment scientist the most important tool available to meet the statutory demands of management. One cannot expect but to observe an increasing frequency of errors in management that, unfortunately, cannot be recognized until years after their implementation.

The management of fisheries must be understood in the following context. Because of the uncertainty in identifying carrying capacity and biomass-maximum-sustainable-yield, decisions made to set allocations must be viewed as experiments to determine if the expected outcome actually occurs. This does not mean that the process is cavalier in any way, but that the process deals with hypothesis and not certainty. In my opinion, this fact should warrant care when decisions will result in closure or near-closure of fisheries and conservatism in the yearly `tweaking' of allocations because several years must pass before the outcome of a management approach can be clearly documented. That is, the management system should seek less draconian ways to test the hypothesis put forward by the promulgation of a biomass-maximum-sustainable-yield, and implement limited interannual variations in allocation until the outcome of a management approach is clear. Simply put, we cannot know if our estimate of biomass-maximum-sustainable-yield is correct until we observe the outcome over a period of years of a consistent management approach designed to achieve the goal being tested. Recognize that it is the change in stock abundance with time that is a key measure in evaluating the outcome and that the direction of change is a much stronger metric than the rate of change that tends to be volatile year to year and much more dependent on complex survey estimators of biomass. We should focus first on trend and only secondarily on rate of change.

The case of summer flounder is a good example of the perils of the present statutory rigidity that limit the ambit of management and the outcome of what may be retrospectively recognized as errors in management that issue forth from pushing the demands of science beyond the capabilities of the extant time series. The decade of the 2000s has been an experiment to rebuild summer flounder stocks to a hypothetical biomass-maximum-sustainable-yield. We are uncertain as to the verity of the value set for this goal, not least because of considerable uncertainty in the relationship of recruitment (the number of small summer flounder added to the population each year) with the adults that create them. When stocks are low, an increase in adult numbers should result in an increase in recruits. When stocks are near carrying capacity, an increase in adult numbers will not result in an increase in recruits because the environment cannot sustain more fish. Unfortunately, for summer flounder, the relationship between broodstock and recruitment is poorly understood, so that important clues normally anticipated to come from it concerning the relationship of the stock to biomass-maximum-sustainable-yield are ambiguous or indiscernible. Unfortunately for summer flounder, the relationship of broodstock to recruitment seems to have changed circa 1997 so that the earlier time series is no longer representative of the stock and the later time series is not sufficiently long to permit robust prediction of future changes in the stock.

Some pertinent facts concerning the trajectory of the stock are these. From 1999 through 2004, the stock expanded by a factor of nearly 4 under total allowable landings (commercial+recreational) values of 18.5-23.3 million pounds. By 2004, the stock had reached a level representative of the highest values previously recorded in the 1968-2006 survey, during the mid-1970s. A reasonable interpretation would be that this level is likely nearer carrying capacity than biomass-maximum-sustainable-yield and the age demographics of the population would support that interpretation. Nevertheless, that interpretation is as uncertain as the alternative. But, if the hypothesis concerning the value of biomass-maximum-sustainable-yield is correct, we would expect continued expansion of the stock with this scale of fishing.

Continuation of this experiment would seem to have been the most prudent course, as the trends were appropriate, with the expectation that either the stock would continue to expand if the hypothesis was correct or fail to continue if the hypothesis was incorrect; neither outcome being damaging to the present-day fishery, and one of the two outcomes guaranteed to occur.

Alas, the experiment of the first half of the 2000s was compromised in two ways. First, the MAFMC* and NMFS allowed the allocation to increase in 2004 and 2005, so that the stabilization in stock abundance that occurred simultaneously during that time frame cannot be unambiguously interpreted. The allocation increases during these two years are most unfortunate and generate increased uncertainty as to the the explanation for the trajectory of the stock. Second, the allocation was reduced in three consecutive years (2006, 2007, and the planned reduction in 2008) to levels well below the level already proven to provide population expansion at lower stock biomass. This result comes from the uncompromising rigidity of the Magnuson rebuilding requirements for a species in which the rebuilding goal is highly uncertain.

The summary of the 2000s management program for summer flounder is this. During 1999-2003, a five-year experiment was conducted logically, and with precaution, to determine if the stock could be rebuilt to an hypothesized biomass-maximum-sustainable-yield. The evidence supports the conclusion that this experiment was providing interpretable results with the expectation that its continuation would resolve some uncertainty as to the biomass goal for the stock and ultimately provide a stable fishery and stable stock goal. From 2004, however, this experiment was unwisely modified twice in such a way as to compromise further interpretation. I would strongly recommend a return to the 18-23 million pound total allowable landings level and a return to early 2000s experimental conditions, unless it can be clearly shown that the present evaluation of biomass-maximum-sustainable-yield is substantively more certain than the evaluation of circa-1999. Unfortunately, the present statutory requirements do not permit so sane an approach.

Continued reduction in the quota does not provide information substantively improved from a return to the 1999-2003 experimental conditions, because the stock had already proven to have the capacity to expand rapidly under 1999-2003 landing limits and forces upon the fishery a draconian penalty risking collapse of the industry. At this time, I do not see evidence that the uncertainty as to the biomass goal has been substantively reduced since 1999. If nothing else, the ambiguity in the broodstock-recruitment relationship continues apace and no information exists to conclude that the stock can sustain a biomass considerably exceeding the highest values recorded in the 1968-2006 survey that occurred in the mid-1970s and again, after rebuilding, in the mid-2000s. The data do suggest however, that continued quota reductions will do great harm to the fishery and fail to increase our confidence in the estimate of biomass-maximum-sustainable yield beyond that achieved by an 18-23 million pound total allowable landings limit, while leaving us in the incongruous and indefensible position of reducing total allowable landings to the lowest values in decades while stock biomass is near historical highs.

The present statutory requirements codified in the Magnuson-Stevens Act leaves us in an utterly illogical position. The requirements foist upon the stock assessment scientist a nearly impossible task of resolving the most difficult of management goals in a period of earth's history when the environment is markedly varying with resulting unpredictable outcomes for stock carrying capacity. The requirements are unforgiving of errors in management and, most illogically, impose sanctions on the consuming public, not the manager, for these errors. Today,

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for summer flounder, these sanctions fall on the consumer of seafood and the commercial industry supplying it and the recreational family who simply seeks to enjoy the experience of fishing, none of which had any input into the management of the stock nor any culpability in any perceived failure to reach management goals. The requirements prevent, and this is the most illogical of all consequences, the return to a management approach that was demonstrably promising. Without question the stock expanded year after year with a yearly allocation of 18-23 million pounds and yet we are prevented from a return to so successful an approach by uncompromising rigidity in a rebuilding plan based on uncertain science that taxes our present capabilities and at a time that the stock is at or near historical highs. How can so illogical an outcome be anything but a motivator for statutory change?