

SUGGESTED ISSUES AND QUESTIONS ON REBUILDING FOR THE SCIENTIFIC AND STATISTICAL COMMITTEE

Introduction

In June, the Council requested that the Groundfish Management Team (GMT) identify a list of questions and issues to the Science and Statistical Committee (SSC) related to the rebuilding plans. The GMT suggested this review to the Council after noting possible misperceptions, misunderstandings, and unaddressed issues that have arisen during the litigation and deliberations over the Council's rebuilding plans.

The Council recommended pursuing this review as part of the "off year" science activities considered at the September meeting. The review is meant to take place in time to inform consideration of long-term changes to the process for adjusting groundfish harvest specifications and management measures, which is currently scheduled for discussion at the March and September 2012 Council meetings. The Council requested the list to bring more specificity to the review and to aid in planning of a workshop or similar activity in 2012. The GMT will be attending the SSC discussions and both bodies may offer further comment on planning matters during this agenda item.

The issues and questions are divided into three broad categories: (1) interpretation of scientific (2) overfished status and population viability, and (3) tradeoffs between the short-term and long-term. We expect to refine and modify the questions before the workshop with the SSC, although the general topics will not change. In planning for this activity, the GMT hopes to have discussions with the SSC on how the issues can be most constructively presented and discussed.

The Council also requested that the questions for the SSC be science related. The GMT's intent all along has been to raise questions of analysis so as to better ground policy and legal decisions in appropriate interpretations of the science. Yet in our experience so far, the lines between science, law, and policy mingle and tend to be viewed differently by different people. So to be as transparent as possible, we describe where we see those lines falling out. These statements are offered so that the Council, its advisors, and the public can offer alternative visions if desired. They also provide context for the list of issues and questions that follow.

1. Science, Policy, Law and Rebuilding

- There is a wide range of timeframes over which the objective of rebuilding can be accomplished. The fundamental policy question involves how much catch, and in turn what delay, to allow during rebuilding given each stock's status, biology, and interaction with the managed fisheries. Some nations choose to not rebuild stocks at all (catch can remain sustainable even without rebuilding). In the fisheries literature, the central policy consideration is typically described as the tradeoff between short-term and long-term yield from the stock. Other tradeoffs are potentially at play as well (e.g., ecological impacts).
- The law represents the broad policy choice made by Congress with the Magnuson-Stevens Fishery Conservation and Management Act and places limits on the Council's policy discretion to set rebuilding times. There have been different interpretations of what Congress intended for stocks unable to rebuild within ten years. The Council has been advised that it must justify delays from the "no fishing" and quicker rebuilding trajectories based on impacts to fishing communities, yet the calculus between impact and delay is still unclear (i.e., the level of negative impact needed to justify a given level of delay in rebuilding). Interpretation of congressional intent is a question decided based on principles of administrative law.
- Scientific analysis—biological, economic, and otherwise—focuses on a particular policy objective or set of objectives. To the best of its ability, science measures how well we are doing with respect to a particular objective and makes predictions about how we will fare against that objective if a particular course of action is taken. With rebuilding, science estimates a stock's status, i.e. its current abundance relative to B_{msy} and $B_{unfished}$; and predicts how long it will take to rebuild back to B_{msy} under a future stream of catches given the best estimate of the stock's productivity. The policy objective being tracked is successful rebuilding to B_{msy} within the time period chosen by policymakers.
- Scientific analysis also focuses on tradeoffs between potential policy objectives and options for achieving them. For example, science can focus on tradeoffs between two alternative rebuilding periods or on options for achieving rebuilding within a single period. Tradeoffs from options not currently allowed by law are frequent topics of analysis in scientific and legal journals.

2. Interpreting rebuilding estimates and scientific advice: Separating the Scientific Signal from the Noise.

Estimates of past, current, and future stock status and biology are uncertain and can change each time a stock is assessed. Sometimes the estimates reflect real changes in the stock and other times such changes occur just because of residing uncertainty in past estimates. In the commonly

used metaphor, rebuilding estimates contain a “signal” on the trend in stock abundance and “noise” from the uncertainty in those estimates. The SSC’s advice to the Council has been to not “chase noise” in rebuilding, yet isolating the signal can be difficult for non-experts and interpretation of the science can be quite nuanced. Rebuilding estimates from two alternative rebuilding trajectories might look quite different on their face yet to an expert they might be more or less indistinguishable given the level of uncertainty in the projections.

As we understand it, the SSC’s advice has been to follow a particular constant spawning biomass per recruit (SPR) harvest rate toward the chosen T_{target} year while monitoring the probability to rebuild by that year. “Not chasing noise” involves not “overreacting” to changes in those probabilities of rebuilding. Yet what amounts to an “overreaction” and what is a necessary adjustment are, again, not easy to see for non-experts. Over the last few harvest specifications cycles the scientific advice has become tangled with law and policy and we see a need for clarification and further advice from the SSC.

The GMT suggests the following topics for SSC discussion. Some are discussed in the SSC Terms of Reference for Groundfish Rebuilding Analyses, but the GMT thinks that the public, industry, and all interested parties could benefit from further explanation of the justifications for these methods and the tradeoffs inherent in developing rebuilding plans. Again, the general request is for more guidance on the use and interpretation of the rebuilding analyses and discussion on how we can better separate the scientific signal from the uncertainty in policy (i.e., rebuilding).

- ***What are the rebuilding analyses and resultant estimates designed to track?*** Our understanding was that the rebuilding analyses were designed with scientific uncertainty in mind and the objective of successfully rebuilding stocks by T_{max} , which is either ten years for stocks able to rebuild that fast, or ten years plus one mean generation time suggested by the National Standard 1 guidelines for those that cannot.
- ***Stability of T_{target} under uncertainty.*** A lot of analysis and Council time is spent on considering changed estimates or rebuilding. Because of scientific uncertainty, T_{target} years that are set closer to $T_{\text{min}}/T_{F=0}$ and based on the median (i.e., 50%) probability of rebuilding are less likely to hold throughout rebuilding than T_{target} years set further out in time and with higher than 50% probability of rebuilding. This stability was one reason why the original rebuilding analyses were set up to monitor progress against T_{max} in addition to T_{target} .
- ***Noise vs. Signal.*** Changes in stock assessment have been described as leaving stocks “worse off” or “better off,” and there is an expectation that management will react when stocks do look “worse off.” More precisely, rebuilding estimates can change along three dimensions:

- *status*, i.e. current abundance relative to reference (e.g., unfished) abundance;
- *scale*, absolute abundance (i.e., the overall size of the population); and
- *productivity*, which can be described in various ways and determines how quickly we think the stock will rebuild.

The best available signal on rebuilding progress comes from within a single stock assessment and rebuilding analyses and the retrospective change in status since rebuilding measures went into place.

- ***Constant SPR harvest rates*** maintain similar rebuilding estimates across some stock assessment changes yet changes in status, scale, or productivity do result in changes in the ACL, T_{target} , and other rebuilding estimates for a given SPR harvest rate.
- ***Constant catch scenarios*** could be viable strategies for rebuilding as well, as are phased catch strategies, as long as they too are adjusted based on updates estimates of stock status, scale, and productivity.
- ***Constant SPR harvest and Encounter Rates.*** Another oft-stated justification for the constant SPR harvest rate is that it factors in the “*rebuilding paradox*” i.e., the expectation that encounter rates with a rebuilding stock will go up as it rebuilds. With area closures and “pulse” recruitment seen in rockfish though, the increase in the encounters rate may not be directly proportional to SPR harvest rate. In other words, the “needs of fishing communities” do not necessarily increase in step with a projected increase in abundance. The 2010 year class of bocaccio provides an example being considered during the 2013-14 cycle. There are other ways of addressing this issue, for example, holding management measures stable and using ACT buffers to address pulsed increases in encounter rates.
- ***Projecting Encounter Rates and Catch.*** Rebuilding estimates are based on the assumption that future catches, on average, will be fully harvested. This means that estimates are not sensitive to catch coming in lower in some years, and higher than others, as long as catch remains near the expectation. Our experience so far is that catch has come in lower than projected for many of the stocks. Are there better ways to interpret rebuilding estimates based on uncertainty in our ability to predict catch?
- ***Describing the signal:*** would it be more appropriate to describe the projections of rebuilding times using a range of years instead of a single T_{target} ?
- ***Meaningfully distinct alternatives:*** we consider alternative SPR harvest rates that show a year, sometimes larger, difference in the T_{target} yet may be too similar to one another given the level of uncertainty involved. How can we distinguish alternatives that are meaningfully different from one another based on the science?
- Rebuilding analyses produce the same output for each stock, including the probability of reaching B_{msy} by year for each alternative analyzed, yet they are not always equal in the way they way they incorporate uncertainty. For example, analyses base their projections on a fixed value of steepness in the stock-recruitment relationship (which

defines the number of recruits that can be expected at various stock sizes) whereas others are based on uncertainty in that steepness value.

2. Overfished status and population viability

We can point to court decisions and other documents from the legal proceedings where rebuilding stocks are described as “threatened” or as facing “dire” circumstances. The courts have also juxtaposed the “needs of the species” against the “needs of the fishing communities.” Such statements suggest possible association of overfished status and rebuilding with the recovery of “threatened” and “endangered” species that are at risk of extinction or extirpation. The general view of the GMT is that rebuilding is not meant to address such a risk, and would not even be necessary, if the objective were simply to ensure the continued existence of the stocks.

The general request to the SSC is to advise the Council on how population viability relates to rebuilding. We offer the following statements for comment.

- The minimum stock size threshold (MSST) that triggers overfished status was developed primarily for the objective of managing stocks for maximum sustainable yield (MSY). Overfished status indicates that stocks are at lower abundance than desired for producing MSY, but not necessarily that the stock is threatened with extinction. Small populations are at increased risk of extinction because of various demographic, environmental, and genetic risks. Overfished stocks at low status can still consist of a substantial number of spawning individuals.
- Overexploitation was the primary pressure causing the rebuilding rockfish to drop in abundance. That pressure has been adjusted based on the best available information on stock status and biology and the science projects that stocks are expected to increase in abundance under the harvest levels allowable under rebuilding.
- The fisheries literature suggest that the F_{msy} harvest rate—including the proxy harvest rates used in the Groundfish FMP—do not raise appreciable risk of driving stocks toward extinction. The literature also suggests that the gap between F_{msy} and the harvest rates that threaten a stock with extinction is proportional to the amount of compensatory density dependence in the stock-recruitment relationship. Council uses F_{msy} proxies because the true F_{msy} is not known, and the proxy may be more aggressive for some stocks than what the true F_{msy} would allow, yet not so aggressive to drive the stock to collapse. Moreover, the rebuilding harvest rates used for rockfish are set considerably lower than F_{msy} proxy. This suggests that harvest during rebuilding is not likely to further threaten the continued existence of stocks.
- Uncertainty in estimates of biomass, the F_{msy} rate, forecasts of recruitment, changing environmental and ecological conditions, and so on mean that the risk of population

declines cannot be ruled out and argue for continued monitoring of all harvested stocks.

- Area closures provide some buffer against the risk posed by uncertainty in estimates of stock biomass and F_{msy} .

3. Emphasis of Short-Term Needs

In disapproving a number of the Council's rebuilding plans (i.e., darkblotched, yelloweye, and canary), the courts have remarked that the expected rebuilding times were too long and thus emphasizing short-term economic interests at a disproportionate cost to long-term economic return and the marine ecosystem. The GMT has remarked that the assumption about disproportionate costs had not been analyzed but that it was unlikely to hold true based on our comparison of cumulative yield projections from the rebuilding analyses.¹

The Magnuson-Stevens Act requires the Council to consider the shortest rebuilding time possible and to justify delays from that time based on consideration of impacts to fishing communities, among other considerations. Rebuilding quickly is also commonly assumed to be the best option on economic grounds because it returns the stock to B_{msy} where they produce their highest yields. We see many reasons—including published studies—that give reason to question this assumption.

Rebuilding quickly is unquestionably the most risk-averse strategy with respect to the objective of successful rebuilding (i.e. stock abundance reaching B_{msy} successfully). Yet risk-aversion comes at a potential cost of yield that could have been harvested while rebuilding. The more rebuilding harvest rates are set below the “true” F_{msy} , the more yield we would expect to be “lost” during rebuilding. If probabilities and outcomes were known with reasonable precision, then we could weigh that cost against the benefits of rebuilding. Our main claim has been that without weighing those benefits and costs, it should not be automatically assumed that the economic benefits of rebuilding will outweigh the costs and vice versa.

A similar calculus holds for costs to the “marine environment.” A stock's impact on the rest of the ecosystem is a function of its abundance, although current knowledge of how impact varies over various stock sizes is limited. The rebuilding trajectories considered by the Council are so similar in terms of expected abundance over time that large difference in impact to the ecosystem would seem unlikely.

The general request to the SSC is to discuss and advise the Council on what the rebuilding analyses can tell us about relative costs to long-term conservation. The focus is on the

¹ PFMC June 2010 Briefing Book, Agenda Item B.3.b, Supplemental GMT Report 2. http://www.pcouncil.org/wp-content/uploads/B3b_SUP_GMT2_JUNE2010BB.pdf

assumptions being made and to be explicit about what is known and unknown about rebuilding tradeoffs. It is not necessarily to identify the economically optimal rebuilding trajectory.

Some specific statements and questions we would raise include the following:

- The basis for choosing mean generation time as a basis for T_{\max} is counterintuitive to some because it allows longer times to rebuild for the slowest growing stocks. What is the biological basis for using mean generation time? Are there general patterns that can be drawn, for example in terms of the tradeoff in yield, for stocks successfully rebuilt within one mean generation time plus ten years?
- The rebuilding analyses produce median estimates of catch by year. To what degree can these be used to draw patterns about cumulative yield available for harvest during rebuilding for alternative rebuilding trajectories? We used this approach to compare the Council's rebuilding alternatives for petrale sole last cycle.
- Economic (i.e. financial) value of a stock derives in some way from the annual yield available from a stock. Various assumptions can be made about how that value changes over stock sizes. The main economic value of the rebuilding rockfish is indirect and derives from the value of the target stocks they co-occur with. We expect the marginal value of yield from the rebuilding stocks to show a diminishing relationship.

PFMC

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