Agenda Item H.6.a
Attachment 3
November 2013

SSC ECOSYSTEM-BASED MANAGEMENT SUBCOMMITTEE WORKSHOP ON ECOSYSTEM CONSIDERATIONS IN THE GROUNDFISH HARVEST SPECIFICATIONS EIS ANALYSIS

Background

At the June 2013 meeting the Council directed staff to organize a workshop with ecosystem experts from the Council's Scientific and Statistical Committee (SSC) and the NOAA Fisheries Science Centers to evaluate ecosystem modeling capabilities and how they might be integrated into the impact analysis in the environmental impact statement (EIS) being prepared for setting groundfish harvest specifications for 2015 and beyond. This EIS is intended to evaluate both the short-term effects of establishing harvest specifications for the 2015-2016 biennial period and the long-term effects of managing the groundfish fishery under the biennial process.

The workshop is scheduled for Wednesday, October 30, immediately preceding the November Council meeting. The SSC Ecosystem Subcommittee will meet with researchers from the Northwest Fisheries Science Center Conservation Biology Division and Southwest Fisheries Science Center Fisheries Ecology Division. The meeting is open to the public and representatives from the Groundfish Advisory Subpanel (GAP) and Groundfish Management Team (GMT) have been invited to attend. The SSC will report the results of the workshop, and any full SSC recommendations, to the Council under Agenda Item H.6. The GAP and GMT may also submit reports

To support ecosystem-based fishery management, researchers in the Conservation Biology Division, NMFS Northwest Fisheries Science Center, have developed a specific application of the Atlantis simulation model, the Central California Atlantis Model (CCAM). The application developers describe Atlantis as follows (internal citations omitted):

> Atlantis is a recently developed simulation modeling approach that successfully integrates physical, chemical, ecological, and anthropogenic processes in a three-dimensional, spatially explicit domain. In Atlantis, ecosystem dynamics are represented by spatially explicit submodels that simulate hydrographic processes (light-driven and temperature-driven fluxes of water and nutrients), biogeochemical factors driving primary production, and food web relations among flora and fauna. The model represents key exploited species at the level of detail necessary to evaluate direct effects of fishing, and it also represents other anthropogenic and climate impacts on the ecosystem as a whole. (Horne, *et al.* 2010, pages 1-2).

After developing and calibrating the CCAM, these researchers conclude:

> While no such model will ever perfectly replicate ecosystem processes in nature, we have calibrated and tested CCAM under a wide variety of conditions, and we believe the model produces an adequate representation of ecosystem dynamics. Thus we believe CCAM to be a powerful management tool, providing a platform for addressing important hypotheses relating to the effects of perturbations (e.g., harvest), characterizing the

potential trade-offs of alternate management actions, and testing the utility of ecosystem indicators for long-term monitoring programs. (Horne, *et al.* 2010, page 17).

The Council has expressed interest in using the CCAM to evaluate the impacts of the alternatives for the Groundfish Harvest Specifications EIS. The alternatives represent different ways of determining "default ACLs" at the outset of future biennial decision-making cycles. The proposed action maintains the Council's flexibility to depart from these default catch limits when setting harvest specifications for the next 2-year period (as long as the specifications are consistent with the framework established in the Groundfish FMP). Under the No Action alternative, the default ACLs would be computed based on the harvest control rules in place during the year preceding the biennial period for which the Council is adopting harvest specifications. Alternative 1 is like No Action except that the p-star value used to determine ABCs would be set to 0.45. Under Alternative 2 the p-star value would be set to 0.25.[1] To analyze impacts, it is assumed that harvests will be consistent with the default ACLs since future ad hoc changes in catch limits made by the Council cannot be predicted.

The main numerical tool used to evaluate the alternatives (default harvest control rules) is 10-year forward projections of stock status for all assessed groundfish stocks. These projections are made under different "states of nature." A state of nature expresses uncertainty about an influential parameter in the stock assessment by estimating stock status using at least three parameter values from a statistical distribution. These are expressed as a "low state of nature" (a parameter value that results in lower future yield compared to the most likely value), a "base case" (the statistically most likely parameter value), and a "high state of nature" (a parameter value that results in higher future yield). The results provide a range of "catch streams" for each assessed stock (along with indicators of stock status) based on both the p-star value in an alternative and the state of nature. The catch streams could represent catch at the ACL or some reduction from the ACL based on historical attainment rates.

The CCAM has been used to evaluate the impacts of different fisheries and management policies on ecosystem attributes (Kaplan, *et al.* 2013a; Kaplan, *et al.* 2012; Kaplan, *et al.* 2013b). Results are reported as the change in abundance of species or functional groups defined in the model. In the simulations reported in Kaplan, et al. (2013a; 2012) the researchers computed annual harvest rates (% year^{-1}) based on historical catch and held constant over the model period (50 years).[2]

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[1] P-star expresses a risk that overfishing may occur due to abundance forecasts being higher than the true status of the stock. It is part of a formula used to compute a precautionary reduction from the overfishing limit (OFL) to determine the ABC. The lower the value of p-star, the larger the precautionary reduction. For example, a p-star value of .25 presumes that there is a 75 percent chance the true abundance (status) of the stock is higher than the point estimate, and a 25 percent chance the true abundance is lower than the point estimate. Note that the annual catch limit (ACL) is not set equal to the ABC for all stocks, although the ACL cannot exceed the ABC. For stocks where the ACL is not equal to the ABC there would be no difference among the alternatives.

[2] The simulation reported in Kaplan, et al. (2013b) tests different management scenarios. Catch is driven by fleet dynamics incorporated into the simulation as affected by management constraints, using constant annual quotas based on 2005 limited entry trawl fishery commercial harvest guidelines. In this case the simulation period is 30 years.

Workshop Questions

Would it be appropriate to use the CCAM to evaluate the impacts of the alternatives?

The stock assessment projections being requested as part of the impact evaluation could be used as inputs to a CCAM simulation. (These projections provide results both in the policy dimension and "state of nature" dimension suggesting 3 x 3 = 9 scenarios). The workshop should consider the following points:

- Can the stock assessment projections be used as inputs for a CCAM simulation? If so, how would they need to be adapted for use in the simulation?
- Is it appropriate to use the catch streams based on different states of nature as inputs to the CCAM (given that stock dynamics are internal to the CCAM)?
- Is the CCAM sensitive enough to detect meaningful differences, in terms of effects (changes in abundance due to species interactions rather than just fishery removals), given the range of catch streams that would be provided?
- Is further peer review of the CCAM necessary before it is appropriate to use in this context?
- Are there other practical constraints to the use of the CCAM in this context (e.g., deadlines for results, interpretation of results)?
- Aside from the CCAM are there other ecosystem models that should be considered for the impact evaluation (e.g., Ecosim-NCC)?

How should the impacts of the proposed action on the California Current ecosystem evaluated?

Workshop participants have been provided a preliminary draft of the sections of the Groundfish Harvest Specifications EIS dealing with ecosystem impacts. Section 3.2 describes the affected environment or baseline conditions. In environmental impact assessment the baseline is used as a benchmark against which to judge the future impacts of taking action (under the different approaches described by the action alternatives) or not going forward with the proposed action (the no action alternative). Section 4.2 is the impact evaluation. The workshop should consider the following points:

- Given a qualitative evaluation, is it reasonable to conclude that the effects of the alternatives are indistinguishable (see section 4.2)?
- Is a qualitative assessment of the effect on other trophic groups of changes in abundance of groundfish due to fishing (the proposed action) reasonable/feasible (section 4.2.2)?
- Are there other metrics/indicators that could be used to evaluate the impacts of the alternatives?

References

Horne, P. J., I. C. Kaplan, K. N. Marshall, P. S. Levin, C. J. Harvey, A. J. Hermann, and coauthors. 2010. Design and parameterization of a spatially explicit ecosystem model of the central California Current. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-104.

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