California MLPA Master Plan Science Advisory Team

Draft Responses to Science Questions Posed at the December 16-17, 2009 Meeting of the MLPA Master Plan Science Advisory Team

Revised January 20, 2010

This document contains draft responses by the MLPA Initiative staff and MLPA Master Plan Science Advisory Team (SAT) to science questions posed by members of the public during the December 16-17, 2009 SAT meeting. These draft responses have been prepared by staff and work groups of the SAT.

1. Why has the level of protection (LOP) for abalone changed from moderate to moderate low?

Staff Response: The rationale for the level of protection designation afforded to the hand harvest of abalone is provided as document I.3 *Draft Supporting Text for Proposed Levels of Protection for the MLPA North Coast Study Region* to the December 16-17, 2009 MLPA Master Plan Science Advisory Team meeting; this document can be found at http://www.dfg.ca.gov/mlpa/meeting_121609.asp.

2. Why is the LOP for sea urchin at moderate low when there is lower predator pressure in the MLPA North Coast Study Region (NCSR)? The LOP should be higher because fishermen are taking urchins and providing benefits to the ecosystem.

Staff Response: The rationale for the level of protection designation afforded to the hand harvest of sea urchins will be provided as a briefing document, "*Draft Supporting Text for Proposed Levels of Protection for the MLPA North Coast Study Region,"* at the January 20-21, 2010 MLPA Master Plan Science Advisory Team meeting; this document will be available for public viewing on the MLPA website.

3. Why is the LOP for hand harvest of edible seaweeds at moderate or low? This should be high because it is a sustainable activity.

Staff Response: The rationale for the level of protection designation afforded to the hand harvest of edible seaweeds is provided as document I.3 *Draft Supporting Text for Proposed Levels of Protection for the MLPA North Coast Study Region* to the December 16-17, 2009 MLPA Master Plan Science Advisory Team meeting; this document can be found at http://www.dfg.ca.gov/mlpa/meeting_121609.asp.

4. How do fishing pressure and number of days fishing influence the recommended size of MPAs?

Draft Response: Fishing pressure and number of days fishing do not influence the recommended MPA size guidelines in the *California Marine Life Protection Act Master Plan for Marine Protected Areas*. The size guidelines are based on adult neighborhood sizes and movement patterns and were developed to accommodate for diversity across a range of depths and movement from nearshore to offshore habitats. A full discussion on the size guidelines may be found in the master plan(www.dfg.ca.gov/mlpa/masterplan.asp). Additional discussion will be provided in the *Methods Used to Evaluate Marine Protected Area Proposals in the North Coast Study Region* as developed by the MLPA Master Plan Science Advisory Team.

5. How are ocean currents incorporated into consideration of MPA size and spacing and modeling evaluations?

Draft Response: The scientific guideline for MPA size is based on adult movement and home range size. Ocean currents are not considered in the guideline for MPA size.

The scientific guideline for MPA spacing is based on estimates of larval dispersal for the California coast derived using genetic techniques (e.g., Kinlan and Gaines 2003) and direct measurements (e.g., Miller et al. 2005). To the extent that these observed larval dispersal patterns are affected by ocean currents (which varies depending on the species in question), spacing guidelines based on these patterns reflect coastal oceanography in the study region. However, an important assumption of the spacing guidelines is that larval dispersal is symmetrical along the coast and has the same general characteristics throughout the study region. Considering average patterns over long time scales (decades), this is probably not an unreasonable assumption. By contrast, the bioeconomic models include a direct representation of larval dispersal patterns that are predicted from a computational model of ocean currents. As a result, they can incorporate spatial structure in larval dispersal, and temporal variability in spatial patterns of dispersal due to ocean circulation.

The bioeconomic models use predictions of larval dispersal based on the transport of Lagrangian drifters within a realistically forced ocean circulation model. That is, the model simulates the movement of small particles due to ocean currents. These particles represent larvae; they are 'released' (i.e., spawned) from adult habitats, allowed to drift for a particular amount of time (i.e., pelagic larval duration), and then those that are within several miles of the coast are considered to 'settle' back to suitable adult habitats. By simulating large numbers of such drifting particles, the average patterns of dispersal can be estimated from the model.

For the MLPA North Coast Study Region, the ocean circulation model has been developed by Chris Edwards and his colleagues at the University of California, Santa Cruz and is based on the Regional Ocean Model System (ROMS). The ROMS methodology is widely used and has been vetted thoroughly. In addition, the Edwards group has confirmed that their model reproduces empirical data from buoys and other sources with acceptable tolerances.

In these simulations, larvae are assumed to be neutrally buoyant, passive drifters subject to transport by currents simulated in the ROMS model. Dispersal pathways are calculated for each of the species used in the bioeconomic model using species-specific spawning seasons, pelagic larval durations, and competency periods. Thus, dispersal estimates for each species reflect oceanography during the appropriate time of year. A draft list of potential model species for the north coast study region includes black rockfish, brown rockfish, cabezon, burrowing shrimp, dungeness crab, red abalone and red sea urchin. The ROMS model can represent ocean conditions for particular historical years for which appropriate forcing data are available, so year-to-year variability in dispersal can be represented by obtaining estimates for different years. At this time, the dispersal estimates are still being generated, but when complete they will reflect dispersal patterns averaged over 6-10 years.

There are limitations inherent in the ROMS model; for example, it does not resolve nearshore circulation (i.e. < 0.5 miles from the coast) very well. Nonetheless, this approach is the best currently available, and is more realistic than the spatially homogenous pattern of connectivity underpinning the spacing guidelines.

References

Kinlan, B.P., and S.D. Gaines. 2003. Propagule dispersal in marine and terrestrial environments: A community perspective. Ecology, 84(8): 2007–2020.

Miller J.A., Bank M.A., Gomez-Uchida D., Shanks A.L. 2005. A comparison of population structure in black rockfish (*Sebastes melanops*) as determined with otolith microchemistry and microsatellite DNA. Canadian Journal of Fisheries and Aquatic Sciences 62: 2189-2198.

6. Can fewer large MPA achieve conservation goals of the MLPA in the NCSR?

Draft Response: Larger MPAs can contribute to the goals of the MLPA by protecting a greater diversity and abundance of marine habitats and species. The scientific guidelines for MPA size are that MPAs should have an alongshore span of 5-10 kilometers (3-6 miles) of coastline, and preferably 10-20 kilometers (6-12.5 miles) to protect adult populations, based on adult neighborhood sizes and movement patterns. Only larger MPAs can fully protect marine birds, mammals, and migratory fish. Additionally, MPAs should extend from the intertidal zone to deep waters offshore to protect the diversity of species that live at different depths and to accommodate the ontogenetic movement of individuals to and from nursery or spawning grounds to adult habitats. Combined and simplified, these two guidelines yield a minimum range of 9-18 square miles and a preferred range of 18-36 square miles.

Additionally, one of the goals of the MLPA is to ensure that MPAs function as a network. The potential for connectivity between fewer large MPAs should be considered in light of the MLPA goal for a network of MPAs. The scientific guideline for MPA spacing is that MPAs should be placed within 50-100 kilometers (31-62 miles) of each other to facilitate dispersal and connectedness of important bottom-dwelling fish and invertebrate groups among MPAs. Because many populations are habitat-specific, MPA spacing is evaluated for each habitat.

To summarize, large MPAs offer considerable conservation benefits and in many ways can achieve MLPA goals more effectively than can smaller MPAs. Yet even large MPAs must be linked to one another by larval connectivity in order to realize the full suite of MLPA goals. This is why the SAT has developed guidelines for both MPA size and spacing. Importantly, a range of different combinations of MPA size and spacing can meet those guidelines.