California Marine Life Protection Act Initiative
Master Plan Science Advisory Team Response to CFC Report
August 1, 2006

1. Introduction and Context

The MLPA Master Plan Science Advisory Team (SAT) was created as a requirement of the Marine Life Protection Act (MLPA). The director of the California Department of Fish and Game (hereafter DFG), appointed 20 members and a chair to the SAT from a list of nominees; three resigned after appointment because of time pressures.

The role of the SAT is to provide advice and guidance to participants in the MLPA process based on the best readily available science. This SAT guidance (e.g. MPA size and spacing, habitats and species likely to benefit) was developed in the first months of 2005 and was based on extensive reviews of the scientific literature. This guidance was incorporated into the MLPA Master Plan Framework (MPF), which was adopted in August 2005 by the California Fish and Game Commission (hereafter the commission) following public comment and positive recommendations by both the MLPA Blue Ribbon Task Force (BRTF) and DFG. In addition, the SAT was charged with providing recommendations to stakeholders, the BRTF, and DFG along with evaluating stakeholder marine protected area (MPA) packages with respect to the commission-approved design guidelines.

Products developed by the SAT focused on addressing the six goals established by MLPA statute, which place emphasis on protecting the structure, function and integrity of marine ecosystems; they did not focus on fishery management. The MLPA was enacted on its own accord, although it is complementary legislation to the Marine Life Management Act (MLMA) that provides the policy context for fishery management in state waters.

Fisheries regulations are developed under different statutory guidance and change frequently according to performance criteria, as compared with guidance required for developing a network of MPAs. Recognizing that the focus of the MLPA is placed on protecting habitats and ecosystems, the MLPA Initiative staff and DFG directed the SAT to focus on the role of MPAs in habitat and ecosystem protection. The SAT was asked to consider state and federal fishing regulations as additional information on the current status of the region's resources. Significant detail on the extent and nature of fisheries regulations were included in a regional profile of the central coast, and stakeholders used this information in developing their packages of proposed MPAs.

Consistent with language in the MLPA, work performed by the SAT was subject to scientific peer review. Accordingly, SAT work products were forwarded to the Oregon and California Sea Grant programs, which selected scientific reviewers qualified to perform this task. Both reviews (Oregon Sea Grant for design guideline documents and California Sea Grant for SAT analyses of stakeholder MPA packages) judged the scientific basis of SAT work to be sound.

In addition to the Sea Grant peer reviews, three scientists were selected and sponsored by a group of recreational and commercial fishing associations and businesses (the California Fisheries Coalition [CFC]) to conduct a review of SAT design guidelines and MPA package analyses. The CFC report (Hilborn et al. 2006, hereinafter referred to as CFC report) was critical of certain SAT findings and conclusions.

SAT advice to policy makers is subject to formal review and approval, and this advice forms the foundation for actions taken by stakeholders in designing alternative MPA packages, for the SAT in evaluating MPA proposals, for the BRTF and then DFG in making their recommendations, and for the commission in making its decisions. The SAT produces guidance judged by its members to serve the goals of the MLPA and does not follow the methodological, species specific, or other interests of its individual members. The SAT is committed to developing improved guidance about the design of MPAs as improved science allows, but incorporating new ideas must be deliberate and public, as has been the case to date with the SAT recommendations that have guided this process.

In assessing the interpretations and conclusions of the CFC report, the following additional comments are offered with respect to the MLPA process:

- ***CFC Point of View***
  The CFC report was commissioned by a group of recreational and commercial fishing associations and businesses, and thus represents a particular point of view. The CFC report was written by accomplished fishery scientists and the SAT welcomes the opportunity to consider the different points of view. However, the findings contained in the CFC report were neither peer-reviewed nor discussed publicly and vetted through the MLPA Initiative process.

- ***Ecosystem Conservation versus Fisheries Management***
  The CFC report is critical of the lack of integrating MPA planning with fishery management strategies. This criticism is not relevant as the California State Legislature chose to address fishery management and MPAs in two separate laws. The MLPA was passed the year after the MLMA, suggesting that the State Legislature recognized that traditional fishery management techniques alone were insufficient to accomplish all the goals and objectives of the MLPA. The SAT was not tasked with developing guidelines for integrating MPAs into fisheries management plans because this is not a goal of the MLPA. The goals of the MLPA are to protect unique and representative marine habitats, species, functioning ecosystems, and non-consumptive uses by regulating fishing and other forms of "take" in geographically-defined areas rather than to provide any specific and direct benefit to fisheries. While the CFC report is valuable for considering the effects of MPAs on fisheries, it does not address all six goals of the MLPA.

  The CFC report states, "We take our primary role, objective and potential benefit to the process to provide advice on the best available science, integrating (largely theoretical) MPA science into existing fishery management" (p. 8). The report thus primarily presents analyses and opinions about the effects of MPAs on fisheries,. and focuses solely on the impact of MPAs on fishery yield and fishing mortality while providing a selective review of the existing scientific literature to reach many of its conclusions. Although the SAT agrees that MPAs should not be the primary means of controlling fishing effort, yield, and mortality, the CFC report does not consider the many other

roles that MPAs might play in fisheries management, including multi-species benefits, bycatch controls, insurance against uncertainty, and evaluating fishing impacts.

- ***Federal versus State Management Responsibility***
  The CFC report suggests that the SAT ignored the value of existing fishery closures, including no-trawl zones (p. 9). These and other similar statements reflect the CFC report's focus on species that are harvested in deeper waters and managed by the Pacific Fishery Management Council (PFMC).

  The SAT recognized the existence of the federal fishery closures, but the MLPA requires guidelines for proposed MPAs that do not consider the influence of these federal closures for two reasons. First, the State of California has limited jurisdiction outside of three miles where many of the PFMC closures are located, and has no assurance that these or any shallow water fishery closures will remain in place long enough to provide the conservation protection required by the MLPA. The PFMC frequently changes the boundaries and allowable activities of these closed areas; just recently the PFMC approved extensive changes to existing closed areas. Second, eliminating trawling while allowing other fishing methods that continue to remove bottom species produces lower protection levels relative to state marine reserves (SMRs) and state marine conservation areas (SMCAs) that eliminate the take of all benthic species. Concurrently, the SAT recognizes that the federal fishery closures are proving beneficial for fishery management and also will have some conservation benefits for other deepwater species as long as they are in place.

  Throughout the CFC report, the authors make statements such as, "the MPAs in state waters will protect only a small fraction of the spawning stock biomass" (p. 19). In fact, the species most at risk in California waters are shallow water species whose populations are entirely encompassed by state waters, yet are not explicitly managed by the PFMC and, in many cases, not actively managed by any state agency. MPAs in California will clearly protect a significant proportion of the spawning stock biomass for many of these shallow water species.

2. Use of Models

The authors of the CFC report developed models from which they concluded that there were few differences in the projected outcomes of the various MPA proposals now under consideration. The SAT reviewed the CFC models and has concluded that these interpretations are inaccurate because of four fundamental concerns with the design and parameterization of the models.

- Although the CFC report concludes that adult movement is a key determinant of the value of MPAs, the adult movement rates used in the CFC models are applied incorrectly. The CFC authors used the annual home range estimates for species and applied these values in a diffusion model in which individuals are constantly dispersing. This conceptual problem is evidenced in the CFC report's Table 4.4.1, which describes

movement as adult emigration rate, rather than home range size. Failing to account for the residential nature of many species (especially shallow water reef-fishes) led to substantial overestimates of the actual movement rates of adults in the CFC report. These overestimates have fundamental implications for the results and conclusions drawn from the models.

As modeled, few individuals will remain within an MPA for their entire lifetime and thus can be caught more frequently, even if the MPA is substantially larger than the size of an individual's home range. As a consequence, CFC models predict that MPAs will provide less protection and that the different proposed MPA packages will function in a similar manner. The SAT review of the scientific literature on movement of California fishes indicates that many species will remain within MPA boundaries of the sizes proposed by the central coast stakeholders. For example, we know that a species with a home range of three miles will stay in a relatively small area for many years. Also, distribution of habitats within state waters is patchy, and there is ample evidence that habitat patchiness further restricts the movement of species from their preferred habitat. This was not considered in the CFC models.

- The models in the CFC report focus on species targeted by fisheries. Three of the five species used in the models are managed by the PFMC, and much information about population abundance and demographics is available to parameterize the models for these species. The report did not address the value of MPAs for conserving species that are not targeted by fisheries or are poorly studied. Additionally, the models used are single-species fisheries models that do not take into account how changes in abundance of one species might influence the response of other species. Moreover, three of the five species modeled in the CFC report have home ranges larger than the range of MPA sizes recommended by the SAT. Clearly, MPAs would provide less protection for these wider-ranging species as the SAT has noted in numerous presentations to the BRTF and central coast stakeholder group. Protection of these species must rely on careful management by fishery agencies. The SAT provided a partial list of the large number of species that have small enough home ranges to make them likely candidates to benefit from MPAs of the sizes chosen by stakeholders. More species are likely to benefit from MPA packages that include larger MPAs, especially those in the preferred size range recommended by the SAT.

- Most of the results presented in the CFC report are based on a model that does not account for life-history traits associated with MPA benefits to long-lived fishes (i.e., increased fecundity and viability associated with increased body size and age, CFC report Appendix A). This simplification omits realistic conditions that influence the benefits of MPAs for long-lived species. Considering these mechanisms in the models would likely yield different results and conclusions.

- The models incorrectly treat all proposed MPAs as if they were "no-take" state marine reserves, with no differentiation based upon levels of protection. Because the proposed MPA packages differ substantially in their use of SMRs and SMCAs with high-to-low

levels of protection, the CFC report's comparisons among the packages are misleading for many species.

In addition, the CFC authors state that the SAT should have based design guidelines and the evaluation of proposals on a model similar to the ones presented in the CFC report. In fact, members of the SAT did develop a new model to evaluate alternative MPA proposals that were based on size and spacing guidelines, and that model has recently been accepted for publication in the peer-reviewed literature (Kaplan et al. 2006). This model was developed during the SAT's evaluation of MPA proposals and results were presented at multiple BRTF meetings. The SAT model was developed after the original design guidelines were drafted, in response to SAT and stakeholder interest in interactions among fishing regulations and MPAs; therefore, it was not used directly in SAT determinations. However, the model was later used to compare results based on SAT science guidelines and showed clear network benefits for different species in some stakeholder MPA proposals.

A key misunderstanding in the CFC report is that the model developed by SAT members was based on a "scorched earth" scenario. In fact, the SAT model evaluated proposals based on a variety of fishery management scenarios. One scenario, used as a worst-case scenario, included no contribution of larvae from animals outside MPAs, enabling the SAT to evaluate the effectiveness of MPAs from a worst-case to a best-case scenario of population abundances outside reserves.

3. Impacts of MPAs on Fishery Yield

The CFC report states that, "… the enactment of MPAs will have little effect on the annual take or abundance of most groundfishes because their management includes the use of annual quotas. Therefore, the annual take for these species will be the same with or without MPAs; but MPAs will determine where the fish are taken" (p. 9). Although the SAT generally agrees with this statement, there is little information with which to predict the effects of MPAs on catches across the great diversity of species fished in California waters.

The SAT believes that the CFC report model parameters reduce the benefits of the proposed MPAs. However, if accurate, the models predict two relevant features of the current MPA package designs. First, the CFC analysis shows that the expected catches and yields will be sustainable, thus the displaced fishing effort caused by MPAs will not affect the overall sustainability for the species they analyzed. Second, their analysis suggests that the abundances of most major fishery species will not be strongly impacted by any of the current MPA package proposals. This conclusion also suggests that it might be difficult to identify any quantitative differences in sustainable catch caused by the proposed MPA packages. The larger public policy choice implied in the MLPA is whether a small impact to fishery yield is balanced by the broad range of conservation benefits afforded by a network of MPAs. Because the CFC analysis results in low impacts on the abundances of modeled species in any of the stakeholder MPA packages, it tests and lays to rest concerns that MPAs "pose potentially ruinous socio-economic impacts" (CFC p. 3).

4. MPA Size and Levels of Resource Protection

The CFC report correctly states that, "For many species, especially those with wide dispersal patterns, the other forms of protection (e.g. existing fishery management measures) are much more effective than MPA status" (p. 9)**.** Additionally, the CFC report suggests that the SAT guidelines reflected a bias in favor of many small MPAs rather than a few large MPAs (p. 8). The limited value of MPAs for protecting highly mobile species is the reason why the SAT conducted a review of the scientific literature on fish movements and provided guidance on the size of MPAs needed to protect a variety of species. The literature review served as the basis for SAT recommendations of a minimum size (9-18 mi^2) needed to protect mostly sedentary species and a preferred size (18-36 mi^2) to protect species that have moderate movement distances. It was left to the discretion of stakeholders to make the policy choice of several smaller versus fewer larger MPAs in their package proposals. The resulting number and size distribution of MPAs also reflected the MLPA requirements of habitat representation and protection of biodiversity. The authors of the CFC report clearly prefer a few, larger MPAs that might result in greater fisheries benefits for more mobile species, but which might also fail to fulfill broader habitat and diversity goals prescribed by the MLPA.

There is little question that a broader range of species will benefit from larger MPAs. However, fewer, larger MPAs as compared to more, smaller MPAs, might reduce the benefits of protection on ecosystems outside MPA borders because of reductions in spillover (Hastings and Botsford 2003). As a result, the MPA packages under consideration for implementation along the central coast differ substantially in their degree of potential resource protection and ecosystem benefits because of significant variations in MPA size. The number of high protection MPAs within the SAT preferred size range varies from two to seven in the proposed packages. We agree with the CFC report's emphasis on the importance of these large MPA sizes and note that this feature indicates that the proposed packages will differ substantially in both their conservation and fisheries benefits.

Table 1. Number of high protection MPA clusters (i.e., adjacent SMRs or SMCAs with high levels of protection) in the preferred size range (>18 square miles)

	Package 1	**Package 2R**	**Package 3R**	**Package P**
# of larger MPA clusters	2	7	7	5

The fact that highly mobile species may not benefit from MPAs does not negate the value of MPAs for the much more diverse groups of species that are less mobile or are unfished. The conclusion of the CFC report that MPAs contribute little to resource protection is based on mathematical models that use abundance and fishery yield as the primary performance measures. This conclusion is at odds with overwhelming empirical evidence for increased species abundances within MPAs around the world. A review of 89 studies from 70 MPAs around the world showed that a majority of no-take reserves (63 % of MPAs) had significantly

greater species abundance per unit area than reference areas while 90% of these reserves had increased biomass over reference areas (Halpern 2003).

In addition, the SAT's recognition of the limited value of MPAs to protect highly mobile species led stakeholders to develop MPA packages that create protection for sedentary species while allowing fishing of more mobile species in deeper waters. The SAT's identification of different MPA protection levels (e.g., SMCA High, Moderate, Low) gave stakeholder groups the flexibility to design MPAs that maximized protection of more sedentary species while allowing fishing for certain mobile species. In order to protect species of all mobilities, other fishery management tools are necessary along with MPAs.

5. Effects of Fishing on Biological Diversity

The CFC report states, "…there is now no evidence that current fishing practices upset the 'natural' biological diversity of the marine ecosystem" (CFC p. 8). At a minimum, there is voluminous empirical evidence from California and around the world that the relative abundances of fish assemblages can be greatly altered by fishing (Jackson et al. 2001, Myers and Worm 2003, Pauly et al. 2002). Furthermore, many studies clearly show that fishing greatly affects the relative abundances of targeted species, with impacts on their life history characteristics (e.g., size and fecundity).

More relevant are the several studies demonstrating the effects of fishing on species other than those targeted by fisheries. Examples include the effects of reduced numbers of lobster and sheephead on the abundances of kelp and species associated with kelp forests (Cowen 1983, Lafferty 2004) and the impact of sea urchin harvesting on abalone recruitment (Rogers-Bennett and Pearse 2001). For these and other similar studies, MPAs were instrumental in determining these effects. It is unreasonable to assume that removal of a large proportion of fish biomass produces no change to the structure, function, and services of marine ecosystems (CFC p. 25 p. 44, section 7.8, p. 61; PFMC Groundfish Fishery Management Plan, DFG Nearshore Fishery Management Plan). The question is particularly relevant to those ecosystems in which fisheries greatly reduce many of the large predatory fishes that influence community composition (e.g., rocky reefs), and to the many invertebrate species that now make up the bulk of commercial economic value in California. In addition to the potential conservation benefits of MPAs, there is ample evidence around the world that MPAs can play a key role in enhancing our understanding of the effects of fishing on the structure and functioning of marine ecosystems.

6. Best Available Science

Aspects of the CFC report suggest that the SAT did not use the best available science. In contrast to that belief, the SAT endeavored to base all of its recommendations on the best readily available science as is required by the formal MLPA process. The SAT process included a thorough review of the scientific literature and the SAT developed guidance relevant to the six goals of the MLPA based on the best available peer-reviewed science. Peer reviews of the MLPA Master Plan Framework and SAT guidelines, conducted by Oregon Sea Grant

and California Sea Grant, provide unbiased and comprehensive critiques; these reviews specifically commend the SAT on its use of best available science.

The CFC report levels its criticism on the presumption that the SAT should have, and did not make use of models, such as the particular fishery model developed in the CFC report. Two important advantages of the literature analysis approach used by the SAT are (1) allowing inclusion of far more species than any available model can consider and (2) facilitating understanding by policy makers and stakeholders, most of whom would find understanding and evaluating the choices made in developing and specifying a model far more challenging. The SAT agrees that models can provide important insights into design and function of MPAs and strongly encourages the continued development and use of appropriate models as the MLPA process continues.

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