3C. Quality Control of Data

Issues of data quality control are critical when the results are intended to inform public processes. Enforcing consistent methods for data collection and storage as well as establishing an integrated statewide data and information management structure at the start will prevent problems often associated with analysis of large and complex data sets for broad geographical areas. Different components of the system will have different requirements. Furthermore, peer review of data collection protocols, management practices, and analytical approaches by disinterested parties, as well as legal review and public opinion, will ensure the information system's credibility. A monitoring effort of this magnitude will need processes for quality assurance and control (QA/QC).

Data could be collected by many different types of programs and entities such as staff of the organization implementing the AM&MEF, the DFG, and other monitoring programs (e.g. Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), or Multi-Agency Rocky Intertidal Network (MARINe)). All of these data must be integrated into the MPA information management structure to enable data syntheses and overall assessments of MPA performance.

For volunteer monitoring, an added challenge exists of broadening participation in monitoring and marine stewardship while establishing a protocol framework sufficiently rigorous to produce useful data. The Surface Water Ambient Monitoring Program (SWAMP) was proposed in a report to the California Legislature to integrate existing water quality monitoring activities of the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards, and to coordinate with other monitoring programs (SWRCB 2005a, 2005b). SWRCB addressed the challenge of ensuring data quality and intercomparability by undertaking an intensive effort to define systematic data collection and analysis protocols, data quality objectives, procedures for data storage and management, and many other factors that all participants were trained on and abided by. Learning from this experience, it essential to communicate and implement standardized, universal methods of data collection and storage. Reef Check California, for example, has been working with the DFG to ensure their monitoring protocols will provide useful data. The Great Barrier Reef Marine Park Authority has also succeeded in this effort (Day, 2002). Chornesky (2005:2) advocates documenting standardized monitoring procedures and requirements and making this information easily available online. Such documentation creates transparency and helps ensure that results can be compared across multiple spatial scales, which will be essential for assessing progress for a statewide program.

The Institute staff, with scientific input, will provide clear guidance on indicators, methods, data formats, etc. for each indicator. This will be explained in *Monitoring and Evaluation Report* and new monitoring modules would be periodically developed. It could be an online document that changes as needed. Furthermore, if grantees, subcontractors, or partners are funded to collect data, they should be required to use methods approved by the MLPA M&E process. Such requirements could also be set forth in permits issued by the DFG, for example.

In summary, to ensure the credibility and acceptance of results by decision-makers and stakeholders, data need to receive external scientific review (Pomeroy *et. al*, 2004). The MAC, based on its members insights and experiences, will provide recommendations for a set of operating guidelines and expectations for external review to the DFG for presentation to the FGC. Equally important will be using a scientific process to strategically set the course for the AM&MEF. External reviewers need to be unbiased and disinterested parties. The DFG already has a peer review process in place that might be used or built upon. This review should include consideration of methods and their implementation, quality control/assurance procedures, and, of course, data results and syntheses.

3D. Data Management

Developing an integrated information system concurrent with implementing the network component of MPAs that will be adopted by the FGC can increase and improve data analysis and synthesis as well as the use of data by policymakers and managers to make decisions.

The Institute should develop an overarching strategy for managing, archiving, and communicating monitoring data. This can help avoid inefficiencies in conducting data synthesis and dissemination to interested parties to support public processes. This strategy can also provide a framework for identifying and meeting the future needs and outline the structure, equipment, human and financial needs for implementation. Further, an integrated information system should be developed at the statewide scale that enables broad access to data, provides long-term data archiving, establishes data management standards, and institutionalizes data access policies.

3E. Communication of Process and Results

Data, progress, and results of the AM&MEF need to be communicated with policymakers, managers, stakeholders, and scientists since the main purpose is to communicate information on individual MPA or MPA array trends, status, and performance to improve policy and practice. Audiences include scientists, government staff, policymakers, and Central Coast consumptive users, non-consumptive users, local and private businesses, and the public. Many ecosystem management efforts across the nation now incorporate broad access to monitoring results. Given the multiple audiences, reports should be made accessible to policymakers, local stakeholders, and the public. The MPA monitoring program should have websites that include reports and other relevant information, such as access to data, technical papers, and public education materials.

Contentious public processes require that monitoring data and interpretive reports are easily available and arrive in a timely fashion. It is recommended that communication of progress needs to be presented continuously online. The website could provide information summarizing progress data, products as well as any updates or interesting news related to the AM&MEF. Staff will determine key messages with illustrative examples for each audience and make a report card, a brochure, and/or webpage(s) with relevant information. Other possible approaches include producing synthetic reports that are continuously updated online or

convening open public conferences that bring together scientists conducting monitoring and research activities. Other creative communication strategies using multimedia should be explored. Collaboration with the Department of Parks and Recreation as well as local NGOs is encouraged to assist with outreach. Staff will create and periodically assess and revise a public information dissemination strategy.

Though the FGC will review proposals for changes to the MPA network every three years, a more extensive report will be written five years after MPAs are established. The recommendation to wait until year 5 is consistent with other processes in place already (e.g., Channel Islands MPAs) and provides time for preliminary biological changes to occur. All of these reports will be integrated into the public information dissemination strategy mentioned above.

3F. Role of Research in the AM&MEF Framework

Research is important to enhance the AM&MEF process, and it is an important way to support the adaptive management of ecosystems. Given the size and scope of MPAs and the MPA array, separate research activities will be needed to gain a better understanding of the underlying biological, chemical, or physical phenomena and human dimensions relevant to particular MPAs or an MPA network. Overlap and feedback naturally occur between the research and monitoring discussed above. For example, information about the status of some element of a particular ecosystem may raise questions that can only be addressed through a program of focused research. Focused research will almost certainly make use of the datasets collected through the status and trends monitoring. In addition, applied research and development will be needed to develop new monitoring methods, indicators, modeling approaches, or other analytical methods as needs arise. Scarce financial resources require that research activities be prioritized.

The process employed by the Great Barrier Reef Marine Park Authority (GBRMPA) to determine research priorities for the Great Barrier Reef Marine Park provides one possible approach through which such priorities might be set in the MLPA and revisited over time (GBRMPA, 2001).

The GBRMPA periodically updates its research priorities based on emerging issues and the results of ongoing research and monitoring. The process and outcomes for a recent review of the GBRMPA research priorities are described in detail in “Australian Government GBRMPA 2005, Research Needs for Protection and Management of The Great Barrier Reef Marine Park 2005,” but a similar consultative approach involving previously mentioned participants is used. During the update in 2005, the key research issues considered included importance to the protection of the Great Barrier Reef; national research priorities; legislative and policy imperatives; community interest; and relative urgency (GBRMPA, 2005).

Below is a brief description of three types of research relevant to the MLPA, in order of priority suggested by the SAT. Relevant aspects of all three should ideally be embedded in the

regional plans. Scientists on the MAC in collaboration with Institute staff and external cooperators should identify key science needs, some of which would then need to be incorporated into the operational plan. The third research area is important, but would be supported through partnerships and outside funds rather than using resources to implement the AM&MEF. Implementation of the AM&MEF should motivate and provide resources and infrastructure to encourage scientists to conduct studies and ensure research findings flow to and are incorporated into the MAC and AM&MEF operations and planning. Monitoring data should be broadly available to researchers to advance knowledge. Furthermore, in the MLPA Central Coast Project, for example, one of the regional objectives requires the MLPA to develop collaborative scientific monitoring and research projects evaluating MPAs that link with fisheries management information needs, classroom science curricula, volunteer dive programs, and fishermen of all ages. The research areas listed below relating to MPA monitoring, evaluation, and adaptive management, specifically categories 2 and 3, could be the focus for helping achieve this objective.

1) Research applied to evaluate if MPAs are effective in achieving objectives: In this category: (a) monitoring inside and outside of MPAs, and (b) occasional process-related studies that help explain patterns shown by monitoring work under (a). For example, if a nearshore rockfish species increased in density (an increase inside MPA compared to outside), a process study would be required to show how to interpret monitoring data. The purpose of this study might be to answer any number of questions: What is the potential reproductive capacity of rockfish based on densities within MPAs? What is the larval dispersal distance? Is there evidence of spillover?, etc. These process studies are needed to help interpret monitoring data related to effectiveness. The DFG, MAC and institute could either generate from the beginning what sort of process study needs exist or decide as the plan is implemented and preliminary results presented. An additional key area of needed research is the development of improved indicators that reveal ecosystem condition and trends (e.g., relative health and resilience). Such indicators would go beyond conventional single species approaches to examine patterns and processes related to sustaining multi-species assemblages.

2) Research applied to test MPA effectiveness by decoupling natural and human changes: This line of research would test whether or not MPAs are an effective management tool by clarifying the relative contribution and interactions of different drivers affecting ecosystem condition, such as physical processes, climate change, and various anthropogenic activities including fishing.

3) Research studies of natural ecosystems that are not being influenced by fishing and other anthropogenic activities: These types of studies will provide baseline information that can help in guiding goals and objectives, developing conceptual models, and identifying meaningful monitoring indicators for the AM&ME. Examples include elucidation of natural food web dynamics, assessments of marine larval dispersal, the frequency and roles of diseases and parasites in unaltered systems, and interactions between marine community structure and oceanographic and biogeochemical processes (e.g. nutrient cycling, rate of sedimentation), etc. To the extent that MPA monitoring data are used in such research, mechanisms should be in place to ensure research findings are made available for use in the AM&MEF.

The MLPA is challenged by the immense spatial scope of the MPA network(s) as well as the diversity of entities that will be conducting research and monitoring. In several of the monitoring case studies analyzed by Chornesky (2005), one or more committees have been structured to facilitate the links between data and decision-making. When linking science and policy in this way, it is important to keep the questions developed by policymakers and stakeholders in mind. At the same time, it is necessary to ensure that particular the types of questions the monitoring and research address are based on a scientific approach.

Permits

The DFG will need to work with the MACs to devise a mechanism for frequent review of applications for research permits that involve take, in conjunction with the DFG's scientific permitting process (Carr *et. al.* 2005). Priority should go towards research that will contribute to MPA evaluation and understanding ecosystem effects, projects involving local stakeholders, and existing research programs with historical data of value in understanding the status and trends of ecological systems within the MPAs. It is recommended that the DFG tie the data ownership to the permitting process and require delivery of data to the monitoring program for its use and to incorporate into various data syntheses and communication products.

3G. Ownership of Intellectual and Physical Property

There will be a need for clear guidelines governing ownership of data and associated intellectual property resulting from monitoring activities and research conducted at the state's MPAs. Organizations may include state agencies such as the DFG, as well as separate monitoring enterprises (PISCO, universities, other consortia, etc.) whose data are used in the monitoring and evaluation process. Data collected by the DFG, while owned by the DFG, are available to the public through the normal public information request process. It is recommended that all monitoring data collected for the state's MPAs should be owned by the State and, to the extent possible, made available to the public on the internet. This arrangement should be spelled out in an MOU in order to ensure the State has timely access to data collected for the purpose of MPA monitoring. Data collected by separate monitoring enterprises (see Table 3 below), university researchers, and others should be owned by the State, but made available for research purposes and permission granted by the state for incorporation of the data into other monitoring data systems.

An unresolved issues that requires further deliberation is whether some "lag" period (of a year, for example) should be put in place by an MOU that would either delay public release while allowing use and reporting by the Institute or actually give other monitoring programs and external researchers exclusive use of the data they collect prior to use by the Institute and public release. The relative benefits and risks of such approaches and the extent to which they advance the state's resource stewardship responsibilities should be considered by the MAC and AM&MEF implementation staff.

There should also be clear guidelines to govern physical property (boats, vehicles, ROVs, monitoring instruments, laboratories, etc.) used in data collection and purchased with state funds. It is recommended that these guidelines be developed in concert with intellectual property guidelines and set in place through an MOU between the various public and private entities who will be sharing equipment.

4. Guidance for Regional Implementation

Assuming that the AM&MEF will coincide with the Nearshore Fisheries Management Plan regions, each of the regions will develop a Regional Monitoring and Evaluation and Adaptive Management Implementation Plan. Using the Central Coast Study Region as an example, a framework and some guidance for developing these plans is provided below. The plan for the southern region may differ from that of the other regions, since it will include a network component of MPAs established at the northern Channel Islands in 2003, well before the rest of the southern California bioregion was considered for MPA implementation.

4A. Central Coast Regional Goals, Objectives, and Questions

Goals and objectives in the MLPA network cascades from the state to the regional and then to the site level, in that state goals guide the regional goals and objectives, and the regional goals and objectives guide the individual MPA objectives. At the same time, each individual site has a unique combination of ecology, surrounding human communities and uses, and history. Thus, the goals and objectives of each MPA and network will need to reflect these idiosyncrasies, as will place-based efforts to evaluate ecosystem condition. Because this variation cannot be solely anticipated in a “top down” fashion, evaluations of MPA condition and performance will need to incorporate information at various scales. In accord with the “layer cake” model presented earlier, a relatively small number of performance measures will be applied for specifically for region- or state-level monitoring.

Appendix 2 summarizes the full suite of Central Coast CCRSG regional goals and corresponding objectives. The regional goals come directly from the CCRSG and are derived from the statewide goals in section 2853(b) of the initiative These goals are general, comprehensive statements meant to guide large-scale marine ecosystem conservation, protection, and management. However, they are not meant to serve directly as a basis for monitoring, evaluation, and adaptive management of individual MPAs or the network as a whole. Monitoring needs to address the full set of MPA objectives.

A first step in the process of translating MPA objectives into questions has already been accomplished by the CCRSG in developing for each regional goal a number of more specific regional objectives. These specific objectives provide operational definitions for each goal. These regional objectives, while more specific than the overarching goals, also do not directly serve as the basis for monitoring. They, too, must be further translated into a series of corresponding focused questions and then into a set of variables that will be monitored over time to answer these questions.

Below is an illustrative example, reviewed by the SAT and MLPA staff, to show what types of questions could be translated and developed from the Central Coast goals and objectives and what might be good indicators to monitor. This is a thorough list, and by no means do all of these questions need to be answered and indicators monitored. In cases where only "focal species" are monitored, some care should be given to the criteria for selecting these species.

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Table 3: Illustrative Table of Objectives Translated into Questions for the Central Coast

Goal 1: To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.

Objective	Translated into Measurable Questions	Indicator(s)	Baseline data[7]
1. Protect areas of high species diversity and maintain species diversity and abundance, consistent with natural fluctuations, of populations in representative habitats.	1. Do focal species inside MPAs stay the same or increase in size, numbers, and biomass relative to areas of similar habitat adjacent to and distant from MPAs?	Differential change in focal species size structure, age structure, abundance, and/or biomass inside MPAs vs. outside	Size/age structure of focal species, abundance and biomass measures; species richness and diversity in all key habitats
	2. Do species richness and/or diversity stay the same or increase in MPAs relative to areas of similar habitat adjacent to and distant from MPAs?	Differential change in species richness or diversity inside MPAs vs. outside	same as above
	3. Over what time period does the relative change take place for different species?	same as above	
2. Protect areas with diverse habitat types in close proximity to each other.	1. Has the selected alternative of MPAs protected areas with diverse habitat types in close proximity?	Baseline habitat mapping of all MPAs and adjacent sites; assessment of habitat diversity inside and outside MPAs	Baseline habitat mapping (all habitats, not just seafloor)

[7] Important to clarify that best readily available data that has been collected may not be the appropriate baseline data.

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3. Protect natural size and age structure and genetic diversity of populations in representative habitats.	1. Do focal species inside marine reserves increase in size, numbers, and biomass relative to areas of similar habitat adjacent to and distant from MPAs?	Differential change in focal species size structure, age structure, abundance and/or biomass inside marine reserves vs. marine parks or marine conservation areas vs. outside	Size/age structure of focal species, abundance and biomass measures; species richness and diversity in al key habitats
4. Protect natural trophic structure and food webs in representative habitats.	1. Do the abundance and size/age structure of key predator and prey species differ inside marine reserves and marine parks, marine conservation areas, or outside areas of comparable habitat?	Differential change in abundance and size/age structure of key species at different trophic levels (note- not all species expected to increase)	Size/age structure of focal species, abundance and biomass measures; species richness and diversity in all key habitats
5. Protect ecosystem structure, function, integrity, and ecological processes to facilitate recovery of natural communities from disturbances both natural and human induced.	1. Do changes in fishing effort affect abundance, size/age structure of populations of selected species within and /or close to reserves?	Differential change in focal species size structure, age structure, abundance and/or biomass inside marine reserves vs. marine parks or marine conservation areas vs. outside	Size/age structure of focal species, abundance and biomass measures; species richness and diversity in all key habitats
	2. Does impaired water quality or other outside factors inhibit populations within reserves?	Measurement of a variety of environmental parameters that may affect populations of monitored species	Broad suite of environmental parameters
	3. What is the level of adult spillover/movement?	Catch per unit effort, size, date, and location of tag and recapture	Fishing effort and catch data
	4. Does the nature or timing of recovery of natural communities from disturbance events differ in different types of MPAs relative to outside areas?	TBD: indicator depends on nature of disturbance	Recruitment of ecosystem engineers or keystone species

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Goal 2. To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.

Objective	Translated into Measurable Questions	Indicator(s)	Baseline data
1. Help protect or rebuild populations of rare, threatened, endangered, depleted, or overfished species, where identified, and the habitats and ecosystem functions upon which they rely.	1. Do focal species inside MPAs increase in size, numbers, and biomass relative to areas of similar habitat adjacent to and distant from MPAs?	Predicted differential change in rare/threatened/depleted species size structure, age structure, abundance and/or biomass inside MPAs vs. outside	Size/age structure of rare/threatened/depleted species, abundance and biomass measures; species richness and diversity in all key habitats
2. Protect larval sources and restore reproductive capacity of species most likely to benefit from MPAs through retention of large, mature individuals.	1. Do recruitment rates of selected species change over time inside marine reserves versus areas outside?	Differential recruitment[8] of selected species inside and outside MPAs	Baseline juvenile and adult population abundance; recruitment rates inside and outside marine reserves
	2. Does recruitment affect adult abundance inside and outside MPAs?	Correlation of recruitment rates with adult abundances inside and outside MPAs	same as above
	3. Do reserves retain large, mature, fecund individuals of selected species?	Differential changes in size, age, and expected fecundity over time for individuals inside marine reserves versus marine parks, marine conservation areas, or outside areas	Size, abundance, and fecundity of selected species inside and outside marine reserves

[8] **Recruitment**: The amount of fish added to the exploitable stock each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to the fishing gear in one year would be the recruitment to the fishable population that year. This term is also used in referring to the number of fish from a year class reaching a certain age. For example, all fish reaching their second year would be age 2 recruits. (Source: "Technical Terms" **NOAA's National Marine Fisheries Service Northeast Fisheries Science Center** http://www.nefsc.noaa.gov/techniques/tech_terms.html)

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	4. What is the relative effectiveness for the designated levels of protection? This will be answered by answering the question how does the marine system respond to different levels of protection (SMCA, SMPA, SMR) for a variety of species?	Differential changes in size, age, and expected fecundity over time for a variety of species inside marine reserves versus marine parks, marine conservation areas, or outside areas	Size, abundance, and fecundity of selected species inside and outside marine reserves
3. Protect selected species and the habitats on which they depend while allowing the harvest of migratory, highly mobile, or other species where appropriate through the use of state marine conservation areas and state marine parks.	1. Do the presence of marine parks and marine conservation areas affect fishing patterns for migratory and highly mobile species?	Distribution of catch by block and species group where caught and port where landed	Logbook, CPFV, CRFS data
	2. Are people fishing the boundary or "edge" of a reserve and what are they fishing for? Is there crowding on the edge of the reserve?	Distribution of catch by block and species group where caught and port where landed	Logbook, CPFV, CRFS data

Goal 3. To improve recreational, educational, and study opportunities provided by marine ecosystems that are subject to minimal human disturbances, and to manage these uses in a manner consistent with protecting biodiversity.

Objective	Translated into Measurable Questions	Indicator(s)	Baseline data
1. Ensure some MPAs are close to population centers and research and education institutions and include areas of traditional non-consumptive recreational use and are accessible for recreational, educational, and study opportunities.	1. How do population concentrations change along the coast? How does attendance/visitation change over time?	Measure distance to major population centers, census data. Measure ease of access, distance from major highways, parking availability, public transit. Attendance and visitation data should be stratified by uses and demographics over time.	Year 1 visitor use surveys
	2. Has research increased over time in MPAs and are results disseminated?	Trends in # of research studies conducted in MPAs over time; dissemination of results of research studies within CA MPAs (science citation search or similar).	Year 1 survey of research publications

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	3. Are recreational consumptive users able to mitigate short-term costs of displacement from MPAs by conducting activities along the edge of MPAs? Will there be long-term benefits from the edge effect?	Changes in use patterns and catch of targeted species by consumptive users over time.	Year 1 consumptive use survey
	3. How are knowledge, attitudes, and perceptions regarding the MPAs changing over time?	Public and user group knowledge, attitudes, and perceptions of MPAs	Year 1 public/user knowledge survey
2. To enhance the likelihood of scientifically valid studies, replicate appropriate MPA designations, habitats, or control areas (including areas open to fishing) to the extent possible.	1. Has selected alternative provided a full range of replicate habitats and MPA designations?	Number of each type of MPA and indication of habitat replication inside and outside	Baseline habitat mapping (all habitats) and identification of comparable "impact" sites
3. Develop collaborative scientific monitoring and research projects evaluating MPAs that link with fisheries management information needs, classroom science curricula, volunteer dive programs, and fishermen of all ages, and identify participants.	1. Does access to central coast MPAs by educators/students increase through time?	Number and type of user of all MPAs	Baseline assessment of educational programs and use of MPAs
	2. Are researchers accessing the MPAs?	Number and type of research projects or programs carried out in MPAs	Any existing research programs present (PISCO, CRANE, etc.)?
4. Protect or enhance recreational experience by ensuring natural size and age structure of marine populations.	1. Are non-consumptive recreational experiences in areas subject to minimal disturbance improving? What are the attitudes and perceptions of users and their recreational experience and how has that changed over time?	Predicted increase in user group satisfaction based on user group surveys	Baseline assessment of knowledge, attitudes and perceptions. Year 1 user survey related to experience w/ marine populations. Thereafter survey annually.
	2. Are size and age structure of recreationally valued species increasing in SMRs over time?	Differential size/age structure of selected species inside and outside MPAs over time; onboard and dockside sampling of recreational catch, location, and effort.	Size/age structure of selected species; CA Recreational Fishery Survey data

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Goal 4. To protect marine natural heritage, including protection of representative and unique marine life habitats in central California waters, for their intrinsic value.

Objective	Translated into Measurable Questions	Indicator(s)	Baseline data
1. Include within MPAs the following habitat types: estuaries, heads of submarine canyons, and pinnacles.	1. Did the selected alternative set of MPAs capture sufficient representation of estuaries, canyon heads, and pinnacles?	Habitat mapping within MPAs to groundtruth what is captured in MPAs. Gap analysis for unique habitats.	Baseline habitat mapping
2. Protect, and replicate to the extent possible, representatives of all marine habitats identified in the MLPA or the MPF across a range of depths.	1. Did the selected alternative set of MPAs capture sufficient representation of all central coast habitats?	Habitat mapping within MPAs to groundtruth what is captured in MPAs. Gap analysis for all habitats.	Baseline habitat mapping

Goal 5. To ensure that central California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.

Objective	Translated into Measurable Questions	Indicator(s)	Baseline data
1. Minimize negative socioeconomic impacts and optimize positive socioeconomic impacts for all users, to the extent possible and if consistent with the Marine Life Protection Act and its goals and guidelines.	1. Is the commercial catch or income changing along the central coast?	Quantity and value of catch and relative changes in fisheries	Commercial Fish Landing Receipts
	2. Are commercial catch per unit effort (CPUE), or fishing locations changing along the central coast?	Location, catch per unit effort, and presence and/or amount of displaced effort	Commercial Fish Log Books
	3. Are recreational catch per unit effort (CPUE) or fishing locations changing along the central coast?	Location, level of effort, species, size and amount of catch from recreational fisheries	California Recreational Fishery Survey
	4. Are locations of fishing and boating activities changing?	Level and location of fishing and boating, presence and/or amount of displace effort	

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	5. Do impacts financially harm individual businesses? Do impacts harm local and or regional economies?	Monitor use, catch, and value	
	6. Are use, attendance, and visitation changing over time along the Central Coast?	Identify users and attendance and visitation	Baseline and recurring surveys and determine decline, maintenance, or an increase
	7. What is the real value of expenditures associated with identified users?	Surveys to estimate expenditures associated with activities above	Baseline and recurring surveys and determine decline, maintenance, or an increase
	8. How many companies and jobs are associated with identified uses and how has this changed over time?	Surveys to estimate number of companies and jobs that rely on user groups/activities	Baseline and recurring surveys and determine decline, maintenance, or an increase
	9. What is the non-market value per visit and total non-market values and how has that changed over time?	Surveys to estimate non-market value of these activities	Baseline and recurring surveys and determine decline, maintenance, or an increase
2. For all MPAs in the region, develop objectives, a long-term monitoring plan that includes standardized biological and socioeconomic monitoring protocols, and a strategy for MPA evaluation, and ensure that each MPA objective is linked to one or more regional objectives.	1. Are all MPAs in the region developing objectives and do they have a monitoring and evaluation program linked to one or more regional objective?	Number of MPAs with objectives linked to regional objectives, with long-term M & E plans linked to objectives	
	2. Are all MPAs using standardized biological and socioeconomic monitoring protocols?	Number of MPAs using standardized monitoring protocol	
	3. Is each MPA effective in meeting its stated objectives?	Measure indicators linked to objectives, changes in use patterns over time, changes in biological resources over time	
3. To the extent possible, effectively use scientific guidelines in the Master Plan Framework.	NA - will be part of evaluation		

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Goal 6. To ensure that the Central Coast's MPAs are designed and managed, to the extent possible, as a component of a statewide network.

Objective	Translated into Measurable Questions	Indicator(s)	Baseline data
1. Develop a process for regional review and evaluation of implementation effectiveness that includes stakeholder involvement to determine if regional MPAs are an effective component of a statewide network.	1. Is there a process for regional review and evaluation of MPA effectiveness that includes stakeholders?	Stakeholder knowledge of process, number of opportunities for stakeholder comment, number of reports and data sets available to the stakeholders	NA
	2. Are individual and regional MPA arrays effective in building a statewide "network"?	Changes in biological resources over time; changes in use patterns over time; improvement in monitoring and management over time	NA
2. Develop a mechanism to coordinate with future MLPA regional stakeholder groups in other regions to ensure that the statewide MPA network meets the goals of the MLPA.	1. Is there a process for central coast stakeholders to engage with neighboring regions to ensure meeting statewide goals of MLPA?	Mechanism for statewide coordination	NA
	2. Is there coordination of MPA planning at the boundaries of study regions to ensure network connectivity and address any potential conflicts?	Mechanism for statewide coordination	NA

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4C. Regional Monitoring Programs and Partnership

The scientific research within the Central Coast study region is diverse, ranging from water quality and fisheries management to deep sea biology, kelp forest ecology, and ocean conservation. Major marine monitoring programs in the region include Cooperative Research and Assessment of Nearshore Ecosystems (CRANE), Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), Central California Ocean Observing System (CenCOOS), Monterey Bay National Marine Sanctuary Integrated Monitoring Network (SIMoN), and Center for Integrative Coastal Observation, Research and Education (CI-CORE), to name a few (see table 4). These organizations implement diverse marine research programs.

Data from major marine monitoring programs, small scientific studies, or even volunteer monitoring, such as Citizen Watershed Monitoring Network in the Monterey Bay National Marine Sanctuary developed by U.S. Environmental Protection Agency, may be used for the monitoring and evaluation if they coincide with indicators selected by the MAC.

Monitoring programs could be assessed to see if they are collecting the right type of data for the MLPA program. Often times the parameters being collected for a long-term monitoring program focus on different questions and may have different goals and objectives not in line with the purpose of monitoring, evaluation, and adaptive management. If the entity(ies) are collecting a desired parameter(s), the Institute staff would ask for these data to be peer reviewed and assessed for quality control. The DFG would then establish an MOU between the monitoring program and California Resources Agency to make the data available for this process as well as available to the public. The AMMEF website could provide links and internet search engines that provide access to relevant data resources. Volunteer and community monitoring programs have benefits that are not just solely for scientific purposes. By engaging in monitoring, a community group can play an active role in management, knowledge, and awareness of MPAs, as well as connect further with California's unique marine environment.

Many concentrated studies take place near marine research stations. Examples include the marine mammal studies at Terrace Point, Santa Cruz by Long Marine Lab, evolutionary physiology, biomechnanics, and ecology studies by Hopkins Marine Station, and fishery and fish population studies at Big Creek State Marine Reserve. PISCO focuses on long-term ecological and oceanographic monitoring to inform ocean conservation and management. The Monterey Bay National Marine Sanctuary's Long-term Monitoring Program & Experiential Training for Students (LIMPETS) trains middle- and high-school students and volunteer groups to monitor the rocky intertidal, sandy shore and offshore areas of Monterey Bay and Channel Islands to increase public awareness and influence policymakers. Elkhorn Slough National Estuarine Research Reserve's (ESNERR) monitoring programs target water quality and weather. The Santa Cruz Laboratory, part of the Southwest Fisheries Science Center of the National Marine Fisheries Service (NMFS), focuses on the Pacific Coast groundfish and salmon species. NOAA has the National Marine Sanctuary Program, National MPA Center and the Fisheries Lab. These examples illustrate the importance and diversity of marine research along the central coast. Map 1 provides location information for marine monitoring sites in and

around the MLPA study region from the CenCOOS, PISCO, LIMPET, and Multi-Agency Rocky Intertidal Network (MARINe) programs (see Table 4).

Table 4: Research and Monitoring Programs in the Study Region[9]

CALCOFI Since 1949 California Cooperative Oceanic Fisheries Investigations (CalCOFI) has organized cruises to measure the physical and chemical properties of the California Current System and census populations of organisms from phytoplankton to avifauna. On each cruise a grid of 66 stations off Southern California is occupied. At each station an entire suite of physical and chemical measurements characterize the environment and map the distribution and abundance of phytoplankton, zooplankton, and fish eggs and larvae. http://www.calcofi.org/
CenCOOS The Central California Ocean Observing System is a new initiative and part of the national ocean observing system, the Integrated Ocean Observing System (IOOS). http://www.cencoos.org/
CRANE Cooperative Research and Assessment of Nearshore Ecosystems (CRANE), established in spring 2003, uses quantitative diver visual surveys to sample kelp forests for fishes, invertebrates, and algae.
LiMPETS LiMPETS is for middle school, high school, and other volunteer groups to monitor the rocky intertidal, sandy shore and offshore areas of the five west coast National Marine Sanctuaries. http://limpets.noaa.gov/
MARINe Scientists from federal, state, and local government agencies, universities, and private and volunteer organizations have formed MARINe to monitor important shoreline resources. The network is currently being supported by 23 organizations. Sites are monitored from San Luis Obispo County to San Diego County on the mainland and offshore Channel Islands. http://www.marine.gov/
PISCO PISCO is a large-scale marine research program that focuses on understanding the nearshore ecosystems of the U.S. West Coast. PISCO integrates long-term monitoring of ecological and oceanographic processes at dozens of coastal sites with experimental work in the lab and field. http://www.piscoweb.org/research/community/subtidal/index.html
SIMoN The SIMoN network is composed of many institutions and agencies that perform monitoring activities in the Monterey Bay National Marine Sanctuary and share their summary information with SIMoN. http://www.mbnms-simon.org/

[9] A map of monitoring sites can be found in the Regional Profile of the Central Coast Study Regional (MLPA, 2005).

As the statewide MPA network(s) and the components of networks continue to develop, the use of applicable methods, where they might exist, for example at the Channel Islands or other monitoring programs already in place, is encouraged. Establishing appropriate collaborations and partnerships between these different scientific agencies will lead to productive results. Such collaborations are essential and will aid in the collection of data for adaptive management and monitoring and evaluation of MPAs.

It will be necessary to obtain baseline data for effective adaptive management and monitoring and evaluation. In order to collect such data in a timely fashion, a panel of marine life scientists should develop a priority list of variables for baseline data collection. Highest priority should be given to data which will be collected over time to support judgments about the effectiveness of marine protected areas (MPAs) at the ecosystem level. The members of the panel will inevitably include researchers likely to conduct baseline or later research, but should also include researchers who are unlikely to participate directly in such research. The resulting priority list should inform decisions of the DFG, the Ocean Protection Council, and other state funders of marine science. This list, in turn, can serve to stimulate productive partnerships with other scientific institutions and funders.

4D. Sample Table of Contents for a Regional Implementation Plan

It is recommended that a *Regional Monitoring, Evaluation and Adaptive Management Implementation Plan* (see Table 5. for a sample) be developed for each region. As with all of these documents, this regional plan will be modified over time as more knowledge is gained and as more regions make plans.

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Table 5: Sample Table of Contents for a *Regional Monitoring, Evaluation and Adaptive Management Implementation Plan*

1. Overview
1A. MLPA requirements for Adaptive Management and Monitoring and Evaluation
1B. Purpose of this plan
1C. Linkage among statewide, regional, and site-specific goals and objectives and statewide adaptive management questions

2. Regional Goals and Objectives and Translation into Measurable Questions with Indicators
2A. List of goals and objectives [will provide table of regional goals and objectives]
2B. Questions derived from regional goals and objectives [will discuss how the questions will be used by policymakers in adaptive management and relevance to stakeholders]
2C. Identification of indicators for each question [will describe each indicator for each question and goal/objective]
2D. Prioritization and review among indicators for each site [will review and prioritize indicators]
2E. Discuss selected benchmarks (if appropriate) [will briefly review indicators and quantifiable benchmarks (of progress on indicators) that will measure progress toward goals and objectives]

3. Methods and Research Design
3A. Indicators and methods [outline methods for data collection of each indicator]
3B. Research design [describe research design for all indicators]
3C. Indicators and monitoring schedule [present a monitoring schedule with locations and times for data collection for each indicator]
3D. Data quality control and assurance and management [outline process for data quality control and assurance and data management system]

4. Implementation Plan
4A. Partners [will discuss partnerships with other organizations and their existing monitoring programs and relevance to measuring indicators, with a map showing locations of monitoring sites relevant to MLPA indicators]
4B. Resource needs and staffing [will assess resource needs for measuring selected indicators]
4C. Communication of results [will present communications plan - discuss audiences targeted to receive results and dissemination, timing, medium etc.]
4D. Existing MPA M & E plans [will briefly review relevant monitoring and evaluation programs at existing MPAs and how these will be used for the region]
4E. AM and M&E project phasing and workplan [will describe detail of implementation]
4F. Steps resulting in adaptive management [will explain process and how adaptive management will work in the region]

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