PEER REVIEW

Ecotrust MLPAI Products

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Commissioned by:

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1. Executive Summary

The 1999 Marine Life Protection Act (MLPA) directed the state to design and manage a network of marine protected areas in order to, among other things, protect marine life and habitats, marine ecosystems, and marine natural heritage, as well as improve recreational, educational and study opportunities provided by marine ecosystems. The Marine Life Protection Act Initiative (MLPAI) was initiated in 2004 to achieve the goals of the MLPA through a cooperative effort funded by a public-private partnership, and enhanced by the advice of scientists, resource managers, experts, stakeholders, and interested members of the public.

In order to better inform the MLPAI process, Ecotrust was contracted to collect spatial socioeconomic data in order to assess the effects of MPA/Network proposals or "packages" on the Central Coast region's (CCR) commercial and recreational fisheries. Ecotrust was hired to a) identify and collect data using OceanMap (a geographic information science (GIS) application) through local knowledge interviews, b) analyze data collected through local knowledge interviews using existing socioeconomic information (landing receipts and logbooks, etc.), and c) design a shared database structure that will house these data and other pertinent data sets. The Ecotrust products are being used by MLPAI staff and participants, and BRTF, Department of Fish & Game and Fish & Game Commission decision-makers in their design and review of the proposed CCR MPA packages.

The California Fisheries Coalition (CFC) commissioned this multidisciplinary peer review of the Ecotrust products because the MPA network packages pose potentially significant socio-economic impacts to central coast fisheries, ocean harvesters, and coastal communities. The major findings of the peer review are as follows:

Contributions of the Ecotrust Products

- The Ecotrust Study (heretofore referred to as "the Study") provides potentially important and useful spatially explicit data about the general locations of fishing grounds in the CCR.

- The Study makes an important contribution to the challenge of engaging fishermen in participatory research.

- In a strict sense the results from this work (maps of the areas from which single species are harvested) are useful and appropriate for single species economic analysis at a highly aggregated level, assuming homogeneous fishery participants and communities. However, a growing body of evidence demonstrates that these assumptions do not hold in fisheries.

Weaknesses of the Ecotrust Products

- Overall, the data produced by the Study are not applicable to comprehensive or systematic economic or social impact analyses of the MPA packages in a way that treats fisheries as human systems.

- The fisheries selected for the study do not reflect species groupings that are typically caught by fishermen in the CCR, and therefore cannot be used in their current form to analyze the specific impacts to fishery participants, fishing ports, and fishing communities.

- The Study population is not sufficiently defined (e.g., definition of a fisherman, total number of fishermen, and characteristics of fishery participants, ports and communities).

- The interview questions used (specifically those in which fishermen were asked about the relative "importance" of economically critical areas "over their cumulative fishing experience") are too vague to accurately elicit data on the ways in which an MPA would currently impact a fishery, fisherman, fishing port, or community.

- It does not appear that the sample data were linked to CDFG landings data in order to generalize results to the population. Because insufficient information was given about the total population of fishermen, it is difficult to determine if the sample data could be reliably generalized.

- Few social data were collected, beyond basic demographic information, and these demographic data were not presented in the Study.

Suggestions for Improvement

The Ecotrust products can be improved in three specific ways:

- The Report should be initially revised to address many of the questions raised in this Peer Review.

- The spatial data collected by Ecotrust should be re-organized into species groups that make sense to Central Coast fishermen, ports, and communities, and linked to CDFG landings data. Ecotrust should design a methodology for adapting the spatial "economic importance" rankings of each fishery to these re-organized species groups.

- The spatial data collected by Ecotrust should be analyzed along with the few social and economic data collected in the Ecotrust interviews, such as home port, place of residence, percentage of fishery income in total income. This re-analysis

will improve the Ecotrust Study in its applicability to a socioeconomic impact analysis.

2. Introduction

In August, 2004, the State of California announced that a Memorandum of Understanding had been signed between the California Resources Agency, the California Department of Fish & Game, and the Resources Legacy Fund Foundation (RLFF). The MOU established a public/private partnership between state agencies and private funders. The MOU also described a process called the Marine Life Protection Act Initiative (MLPAI) to implement the 1999 Marine Life Protection Act. The MOU called for the establishment of a Blue Ribbon Task Force (BRTF) to provide advice to the Department of Fish & Game and Fish & Game Commission regarding the creation of a Master Plan Framework that is to provide a scientific basis for networks of marine protected areas, and evaluation of various MPA network proposals or "packages" developed by an appointed advisory Regional Stakeholder Group. The MOU allowed the RLFF to set a timeline for the implementation of the Initiative and to have significant say in the hiring of staff to the Initiative, subject to the concurrence of the Chair of the BRTF.

The MOU also provided for the establishment of a Science Advisory Team (SAT) that would create the scientific basis for the Master Plan Framework and advise the BRTF, Department, and Commission on science questions related to the development of MPA networks. Central California, defined as the region from Pigeon Point to Point Conception, was the first area targeted for the implementation through the MLPAI process.

2.1. The MLPAI Ecotrust Project

In order to better inform the MLPAI process, the RLFF contracted with Ecotrust to collect spatial socioeconomic data in order to assess the effects of MPA/Network proposals or "packages" on the Central Coast region's commercial and recreational fisheries. Ecotrust was hired to a) identify and collect data using OceanMap (a geographic information science (GIS) application) through local knowledge interviews, b) analyze data collected through local knowledge interviews using existing socioeconomic information (landing receipts and logbooks, etc.), and c) design a shared database structure that will house these data and other pertinent data sets. The Ecotrust products are being used by regional stakeholders, the MLPAI Staff, Department of Fish & Game, the members of the BRTF, and the Fish & Game Commission in their design and review of the CCR MPA packages.

2.2. Rationale and Scope of Peer Review

Ecotrust used a relatively new methodology to collect new data to support the evaluation of MPA network packages in the Central Coast Region of California.[1] Those MPA network packages pose potentially significant socio-economic impacts to central coast fisheries, ocean harvesters, and coastal communities. For these reasons, the California Fisheries Coalition (CFC), a broadly representative statewide group of more than 20 ocean-dependent associations and businesses representing fishermen, seafood processors, abalone aquaculturists, and allied industries, sponsored this peer review.

To evaluate the soundness of the Ecotrust methodology, its implementation, and the reported results, the peer reviewers were asked to review the following Ecotrust products (see attachment A):

- Scholz, A. et al. 2006. "Commercial fishing grounds and their relative importance off the Central Coast of California, a report to the Marine Life Protection Act Initiative"
- Scholz, A. 2006. "Summary of potential impacts of the February '06 MPA packages on commercial and recreational fisheries in the Central Coast Study Region"
- Ecotrust Scope of Work
- Ecotrust Project Description of the "Fisheries Uses and Values Project"
- Ecotrust Interview Questions and Protocol of the "Fisheries Uses and Values Project"
- Ecotrust English and Vietnamese language consent forms for informants participating in the study
- A memorandum dated April 19, 2006 to John Kirlin, Executive Director of the Marine Life Protection Act Initiative from Astrid Scholz, Vice President Knowledge Systems, Ecotrust, on the "Effects on the impact analysis of a squid data processing error."

The peer reviewers were asked to attempt to address the following topics to the extent possible given the materials provided:

- Sampling and representativeness:
    - What was the "population" or scope of fishery participants for the study?
    - How was the population stratified (as indicated in the study report) and sampled?
    - What was the number of responses and response rate for each stratum and overall?
    - How was representativeness of the sample determined?
- Data collection:
    - How were data collected? (e.g., face-to-face interviews, telephone interviews, mail interviews?)

[1] A similar methodology was used by Barilotti and Pomeroy in the 1999-2003 Channel Islands National Marine Sanctuary Marine Reserve Process in California (see: http://channelislands.noaa.gov/marineres/PDF/5.pdf and Pomeroy and Hunter (2005).

    - What questions were participants asked?
    - Were there any likely or known problems with keeping confidentiality? Did any problems affect the representativeness of the sample group?
- Data management and manipulation:
    - How were the data checked for their reliability and validity?
    - How were the raw data managed and manipulated for analysis?
    - How were sample (interview) data linked to the landings data and generalized to the population (in terms of vessels and landings)?
    - What are the limitations of generalizing the sample data to the population?
- Study scope:
    - What other data (from existing studies, through this study using other methods) were collected and analyzed?
    - What do these other data tell us about the social and economic aspects of fishing in the study region as it relates to MPAs?
    - What key things beyond the scope of this work need to be done to accurately and adequately consider impacts as outlined by the Objective to analyze the relative effects of the proposed MPA Packages on commercial and recreational fisheries that are conducted in the waters of the Central Coast study region
- Data analysis and reporting:
    - Are there statistically significant differences among the packages in terms of their impacts on fishing area and ex-vessel value by commercial and recreational fishery and overall?
    - What are the estimated spatial and ex-vessel value impacts for the major central coast fisheries (v. the species distinctions used in the report) individually and overall? (As a first cut, setting aside the possibility that fishermen may adapt in ways that reduce - or increase - these impacts.)
    - What are they by coastal community where landing, shoreside fishery-related and fishing support activities occur?
    - Do the Ecotrust products allow for evaluation with regard to the MLPAI stated objective to "minimize socio-economic impacts" of MPA network proposals, as consistent with the goals of the act and the Science Advisory Team guidelines?

2.3. Introductory Comments about the Ecotrust Products

The Study emerges from the crucial need for basic information concerning the spatial locations of fishing activities in California in particular, and in the U.S. in general to inform the design of management measures and as a basis for evaluating their socio-economic and biophysical impacts. While some fisheries in some jurisdictions do have good spatial information about the locations of fishing, most do not. The spatial data that are available from federal or state sources are often problematic for a number of reasons. The authors of the Study have explained why the existing spatial data should not be relied

upon. They justify their project as a data collection effort for assessing the "first order"[2] impacts of proposed MPAs and describe their approach to that data collection.

With a growing reliance upon spatial fisheries and marine management measures throughout the coastal U.S. (e.g. MPAs, "rolling closures," seasonal closures, designated sanctuaries, etc.) as well as the ongoing use of measures with clear spatial ramifications (e.g. limiting days at sea), the pursuit of accurate locational data for regulatory design and impact analyses is critical and timely. While the need is clear, it is not yet clear or standardized among marine scholars, managers, and fishermen as to how such data will be collected, how that collection might be participatory, in what ways the data will be used, the impacts of revealing fishing locations, etc. In recent years, marine managers have begun turning to fishermen and other marine stakeholders for help in identifying fishing grounds, habitats, etc., but the resulting data are often not systematically collected or "ground-truthed," and are thus difficult to integrate into quantitative models for monitoring and management.

While the Study does not claim to answer all these questions, it is a thoughtful attempt to address some of them through an innovative protocol that is designed to be sensitive to the needs and wishes of participating fishermen. Indeed the Ecotrust group is at the leading edge of approaches that use the expert knowledge of fishermen. It is potentially a significant contribution to what is an emerging research dimension in fisheries social science.[3] At the same time, the Study has raised many important questions, leaving much room for improvement in the methodology, the ways in which it was implemented, and the analysis and presentation of the resulting data.

Related to these unanswered questions, it is often difficult to discern the precise scope of the Study that was requested by the RLFF. The "Scope of Work" document is vague, and different explanations of the goals and objectives of the study are presented in the other documents reviewed, including the Project Description, the Consent Forms, and the Ecotrust Report. The broadest description is that:

> Ecotrust has been retained to collect, compile, and analyze socioeconomic information pertaining to commercial fisheries on the central coast. The project is designed to provide spatially explicit socioeconomic information for both the MLPA Initiative and the Monterey Bay National Marine Sanctuary (Project Description, Interview Consent Form).

The documents also indicate a less extensive scope of work, which entails compiling a "comprehensive picture of the commercial fishing use patterns along the central California coast," and developing "accurate maps of the local fishing grounds and their

[2] According to the report, analysis of "first-order maximum impacts… assume[s] that all fishing in an area affected by an MPA would be lost completely, when in reality it is more likely that effort would shift to areas outside the MPA" (Summary of Potential Impacts).
[3] Walker 2001, Chuenpagdee et al. 2004, Scholz et al. 2004, St. Martin 2004, Pomeroy and Hunter 2005, Robinson et al. 2005, Bruce and Eliot 2006, Close and Hall 2006, Aswani and Lauer 2006, St. Martin 2005, St. Martin, McCay et al. in press).

economic importance to the local fleets" (Project Description, p. 1, Interview Consent Form, p. 1).

This ambiguity left the reviewers reluctant to critique a study for not doing what it may never have been intended to do. In terms of its most limited description, that is "to compile a comprehensive picture of the commercial fishing use patterns along the central California coast," the products of the Study should be able to adequately incorporate fishermen's knowledge of fishing grounds in the MLPAI process and improve the spatial resolution of CDFG landings data. However, if the Study was intended to provide data for both social and economic impact analyses of the proposed MPA packages, then the Study represents only a first step toward this goal.

In order to assist MLPAI decision-makers in taking the next steps toward a comprehensive socioeconomic impact analysis, this review points out several useful directions and suggestions for how the Study can be improved, clarified, and expanded upon. The questions raised by this review must be seriously considered, particularly given the amount of negative public comment and testimony received from fishermen and other marine stakeholders in regard to the MLPAI process and the expected effects of the MPA packages. There are many questions and problematic issues that might be easily addressed in a more thorough, revised report. However, there are other questions that require either a) re-working and re-analyzing the existing data, or b) revising and re-doing the data collection components of the Study, with subsequent analysis.

It is important to note that this review focuses solely on the Ecotrust analysis of commercial fisheries. It was mentioned briefly in the "Summary of Potential Impacts" that recreational fisheries were also analyzed, but insufficient information is provided to enable review of that portion of the Study.

3. Sampling and Representativeness

Ecotrust worked with 22 fisheries and interviewed a total of 109 fishermen. This approach captured information about fisheries that comprise 93% of all fish landed in the study areas, as well as almost 80% of average revenues between 1999 and 2004. In most cases, fishermen were selected to be interviewed on the basis of accounting for at least 50% of landings for each fishery, distributed over the northern and southern segments of the study region. The data collected provided geographic and economic coverage of the region's fisheries, however, the Study should be improved in two major ways. First, the fisheries selected for the Study should be changed to reflect the species groups typically caught by fishermen in the CCR. Second, a better understanding of the entire population (number of fishermen and characteristics of fishermen, fishing families, ports and communities) should be integrated into the Study. As it stands, the "Summary of Potential Impacts…" provides information about the region as a whole, but does not include a discussion of impacts on ports, communities, or sub-sectors of the entire population.

3.1. What was the "population" or scope of fishery participants for the study?

The population of fishery participants is not defined in the Study. It is not known how the study defines a fisherman, or how many fishermen work in the CCR fishing grounds. The study region is well defined but there is ambiguity relative to the question of landings. Throughout the report it is not clear whether the term "landings in the study region" refers to landings of fish caught in waters of the study region or to landings of fish in ports that fall within the study region (even if they were caught outside the boundaries of the CCR). Do the landings originating in the waters of the study region land in ports outside the study region and/or vice versa? Clearly this issue matters relative to the sampling strategy and analyses performed (both of which concern "% landings").

3.2. How was the population stratified (as indicated in the study report) and sampled?

Ecotrust worked with CDFG to identify 19 fisheries for study (later increased to 22), defined in most cases as species-specific subgroups, but also including three rockfish species complexes. This approach aimed to be inclusive of the fisheries conducted in state waters with at least some economic importance in the study region. The use of volume (or weight, as opposed to ex-vessel value) of fish landed for this work is useful, but has limitations that can (and should) be mitigated by also estimating and examining ex-vessel value. The implication of using weight landed in the analysis is that the value of a pound of anchovy is equivalent to the value of a pound of salmon. (Ex-vessel prices for anchovy and salmon, respectively, are about \$0.04/lb and \$2.00 – 3.50/lb.[4]).

The selection and use of "fisheries" in this work suggests a potential misunderstanding or lack of knowledge of the region's fisheries in terms of participants, practices and management, and the relationships among fisheries. It also poses significant problems for – and probably made the job of Ecotrust much more difficult in – assessing the impacts of MPA packages on the region's fisheries. The fisheries selected as units of analysis are a mix of species, species groups and complexes that are not amenable to comparative analysis. A better description is needed regarding the ex-vessel value of the selected "fisheries" and the regional total, the total pounds landed in the region, and the number of vessels that land at the region's ports. Although clear criteria were used to select the initial 19 fisheries[5], it is not clear why these criteria were chosen, particularly given that this method omitted two of the region's top five fisheries (2003-2005 mean ex-vessel value) until squid and salmon fishermen themselves asked to be included in the Study. It is possible that the existing data can be re-analyzed in terms of species groups that make more sense to any given fisherman, many of whom fish multiple species. Such a re-aggregation of the data would be problematic given the way in which each fishery was valued in the Study, but we encourage Ecotrust and the MLPAI to craft a solution.

[4] Ex-vessel prices for salmon in 2006 have been much higher, due to environmental and regulatory conditions that have resulted in limited landings.

[5] Criteria used to select fisheries included: conducted in state waters, of some economic importance, have benthic habitat interactions, and lack spatial data.

The sampling frame of commercial fishery participants was generated by identifying vessels that participated in each fishery and ranking them by landed weight in that fishery. Ecotrust primarily used a purposive, proportional quota sampling strategy to achieve representation of the northern and southern subregions of the study region, accounting for at least 50% of landings (by weight) per fishery, OR including a sample size of at least 5 fishermen per fishery. Fishermen from the squid and nearshore rockfish fisheries were identified using a snowball approach. Apparently, most of the fishermen interviewed were identified using vessel registration files associated with the landings data; others were identified using a snowball sample. This is problematic because the vessel registration files identify owners, and not non-owner operators. Moreover, owners of record may be a corporation (even if the vessel is owned by an individual), and contact information is not reliable. Thus, the focus on "fishermen" as understood here (and, indeed, in most fisheries impact analyses) can do much to obscure the socio-economic impacts of fisheries and related marine regulations. A study of all fishermen would include a sample of all those who labor on fishing vessels. The number of people, employed as fishermen, that are actually affected or impacted by a fisheries regulation or MPA is quite different than the numbers of "fishermen" contacted/sampled for this study. Indeed, the project's sample of "fishermen" is likely to correspond more closely to (and should be considered?) a sample of fishing vessels rather than fishermen per se. This difference is significant, and often overlooked, in fisheries impact analyses. The report could easily make this distinction clear and could suggest ways that impacts on all fishermen might be assessed in future studies (e.g., by asking interviewees (skippers and/or owners) for crew counts and other relevant information).

3.3. What was the number of responses and response rate for each stratum and overall?

The 109 fishermen interviewed represent a response rate of 50%. The response rate is reasonable, given the context of a study that involved a time-consuming mapping exercise with fishermen in the context of a regulatory process, notwithstanding the 0% response rate for three fisheries (see % of landings covered by fishermen interviewed – table 2).

3.4. How was representativeness of the sample determined?

The representativeness of the sample was determined by the number of fishermen interviewed per fishery. The authors of the Study assert that "there are no hard and fast rules for what constitutes a representative sample of central coast fisheries, [yet] a census of the entire fleet is impractical." (p. 7). While we agree that a census of the entire fleet is impractical, it is difficult to evaluate the representativeness of the sample(s) without knowing more about the respondents and population(s). For instance it is difficult to determine the importance of the lack of participation by Vietnamese fishermen because no estimate of the population size of commercial fishing vessels or skippers (overall or by ethnicity) is provided. Several questions regarding the sampling strategy and representativeness were left unanswered in the Study. In particular:

- It is not clear how the fisheries selected, or the fishermen interviewed, reflect the social and human dimensions of the region's fisheries.
- How many fishermen are there in total in the region? How many engage in multiple fisheries? Are the listings of fishermen from the landings receipts comprehensive or are there fishermen not covered by this data set? A brief profile of the industry and constituent fisheries would be helpful.

4. Data Collection

Data was collected through interviews, including a participatory mapping component. The use of a particular application called OceanMap made spatial data collection particularly accessible to fishermen, allowing them to draw shapes of important areas at any scale. Ecotrust attempted to maintain the confidentiality of individual data, and fully disclosed one instance in which confidentiality was breached. The primary objective of the Study was apparently to map fishing grounds in general, and fishermen's "economically critical areas" in particular. Although the project was not designed to gather explicitly economic information (which may have been impossible to do), asking fishermen about the relative "importance" of economically critical areas "over their cumulative fishing experience" is too vague to accurately account for the ways in which an MPA would currently impact a fishery, fisherman, fishing port, community, etc.

4.1. How were data collected? (e.g., face-to-face interviews, telephone interviews, mail interviews?)

Data were collected in one-on-one and small group face-to-face interviews. Details on the length of interviews and other types of information collected are not provided in the documents reviewed. Spatial information was a key component of the data collected, and it should be noted that the ArcView interface used, OceanMap, has important features including the ability to enter information about fishing grounds directly into a spatial database and to standardize it across fisheries, informants, or other variables. The following feature, as described in the report is important to note (p. 11): "It is programmed to allow fishermen to draw shapes in their natural sizes (polygons) rather than confining responses to a grid. Although data are summarized to a variety of grids for the subsequent analysis, the raw data are entered in natural shapes and at whatever spatial scale makes sense to respondents." This feature makes this methodology especially accessible to fisherman, facilitating meaningful participation in the mapping project.

4.2. What questions were participants asked?

Ecotrust's document, entitled "Interview Questions and Protocol" was provided for review, although it is not clear that this comprises the actual data collection instrument used in the field. The report indicates that fishermen were asked to identify and assign importance to their fishing grounds, identify the ports within the region at which they

landed their catch, and provide their license numbers (for linking with the landings database). Although the "Interview Questions and Protocol" document suggests that other social and demographic information was elicited in the interviews, no other data on individuals, their fishing operations and practices are discussed in the report. The reported data collection protocol relates only to on-the-water use patterns and ports of landing, and is not a complete protocol. Lacking the complete protocol, i.e., the approach to fishermen used, the "local knowledge interview instrument" or questions asked, and data entry and management procedures other than those related to fishing location data (e.g., for port information, other data collected in the course of the interviews, other socio-economic data gleaned from the logbooks and landings data), it is difficult if not impossible to fully evaluate this work. Some of the key questions that remain are:

- What specific questions were asked?
- How were responses coded?
- How were non-responses dealt with?
- What do these data tell us about CCR fisheries and potential MPA impacts on them?

The report and the project have at their center the definition of fishing grounds and their weighting using a measure of "importance." Although the report is vague as to what is being measured, the interview protocol clearly points to fishermen's perception and ranking of "economically critical areas." A measure of relative importance to fishermen is, of course, needed when aggregating individual fishermen's "fishing grounds" to produce an overall map of "important" areas. The "distributing 100 pennies" approach, adapted from the methodology used in the 1999-2003 Channel Islands Marine Reserve Process, is intuitive and appropriate. At the same time, it would be helpful if the project report could reflect on both the strategy of leaving this key variable only vaguely defined and fishermen's interpretation of "economically critical areas."

Allowing fishermen to value areas themselves in a relative way is potentially a useful approach to elicit qualitative data for an analysis linking fishermen to ports and communities. Was the intention to leave open for interpretation the meaning of "importance"? If so, how then was it interpreted by fishermen? If the intention was to convey something specific to fishermen such that their interpretations were comparable, was this achieved in the interview process, and how? This issue is particularly important given that fishermen were asked to identify areas that were economically critical over their "cumulative fishing experience." Clearly, areas critical over the last 50 years as reported by one fisherman might be incomparable to areas critical in the last 5 years reported by another fisherman. Furthermore, one fisherman's "economically important" areas may be radically different than another's, based on a variety of factors, such as how far the fisherman travels to fish, the type of vessel and gear used, the percentage of household income derived from fishing, etc. In sum, more information is necessary to understand how "importance" is understood by each fishermen. These values might include: monetary value, traditional ground, current profits, historically important, culturally important, proximate and easy to fish, etc.).

4.3. Were there any likely or known problems with keeping confidentiality? Did any problems affect the representativeness of the sample group?

Ecotrust sought to maintain the confidentiality of individual data. The report discusses one accidental breach of confidentiality. The consent form asserted "All the information collected in the interviews is anonymous and confidential on the individual level." Sharing one individual's "anonymized" data with another participant was a clear violation of this commitment to confidentiality. This breach of confidentiality may have affected response rates and representativeness of the sample negatively. In discussing further applications of the data generated (p.21), the Study authors note that in the future it would be possible for someone to link these data to CDFG landing receipts, in order to identify particular fishermen who would be affected by restrictions on fishing in a particular area. Can CDFG personnel be trusted to preserve confidentiality if they have access to codes identifying individuals?

5. Data Management and Manipulation

Data collected from individual fishermen were aggregated, and then reviewed and revised by key informants. The implications of this mixed-methods approach, relative to the statistical claims made for the survey and its resultant maps, should be explained in more detail. Based on the materials reviewed, it does not appear that the sample data were linked to CDFG landings data in order to generalize results to the population. Because insufficient information was given about the total population of fishermen, it is difficult to determine if the sample data could be reliably generalized.

5.1. How were the data checked for their reliability and validity?

The Study protocol is designed for interviewing individual fishermen. The data collected were aggregated to produce composite maps of "fishing grounds" based upon individual fishermen's valuations and the confidence that a representative sample of fishermen was interviewed. The resultant aggregate maps of each fishery were then presented in review sessions to participants in the project as well as other "knowledgeable and longtime fishermen." It is not clear if this was done systematically by fishery, or if fishermen from a variety of fisheries reviewed aggregate maps of a variety of fisheries.

These groups reviewed the aggregate maps and "several revisions" that informed the final versions that were used in subsequent analyses. It is important to note this shift in method. While the interviews were designed as a statistically robust sample of fishermen from each fishery, those invited to the review sessions were "key informants." The latter suggests a qualitative method where key informants were used to vet the results from the quantitative/spatial method. Indeed, the key informants corrected and/or changed the aggregate maps, some in significant ways according to the report. The project results are as much (or possibly more so) a product of a key informant qualitative method as they are a product of a representative sampling quantitative method. While the former can be as

valid as the latter, this mixed method approach and its validity should be more clearly documented in the report.

Related to the above, the key informants were asked to act not as individual fishermen knowledgeable of individual fishing grounds (as in the interviews) but as fishermen knowledgeable of the spatial distribution of the fishery as a whole. This role begs the question of why one needs the individual interviews. It also points to the possibility of key informants providing information on the level of "fleet" or "community" fishing territories rather than just individual fishing grounds or "hot spots." Indeed, asking fishermen to represent fleet or community fishing territories may "get around" many of the confidentiality issues so important to fishermen. If no one, in the end, is interested in individual "hot spots" and if fishermen can provide information at the level of fleet or community activities, then why ask about "hot spots"? There is no doubt that, in this case, the two methods (of individual and key informant) are complementary in important ways, but the report should reflect on this methodological synergy.

It is important to note that aside from corroborating fishermen's data for overall reliability and accuracy, the review process employed by Ecotrust caught at least one error made by the Ecotrust staff (i.e. the squid fishery error discussed in the Memo to John Kirlin). While this mix-up of data sets between discrete Ecotrust projects is troublesome, the solution that developed out of the mistake is worthy of adoption by others collecting digital data of fishermen's knowledge; that is the idea of giving each respondent remote access to his or her shapefiles, allowing for individual verification of data very rapidly.

5.2. How were the raw data managed and manipulated for analysis?

The valuation of fishing areas via the distribution of 100 imaginary pennies is a solution to the problems of standardization and valuation in qualitative interview situations. This is an important alternative to asking for financial information (i.e. how many fish were caught or how much money was made from a particular area). It avoids many methodological pitfalls, enabling comparison among cases, and it reduces resistance from respondents who wish to maintain privacy about their incomes. It is similar to the "wealth ranking" tests used in ethnographic research. However, it raises the problem of how to standardize/normalize that value across spaces that are drawn at different scales or with different intentionality by fishermen. The normalization by area employed by the project team effectively addresses this problem. It does, however, presume that all fishermen are drawing discrete polygons whose area can be transformed into cell units. The reviewers' experience with fishermen's mapping of fishing grounds suggests that there is a substantial gap between what fishermen might draw or indicate as their fishing grounds (e.g. "X", a bathymetric line, an open-ended polygon, a place name, a loran coordinate, etc.) and the needs of researchers, as in the method outlined in this report, to represent those fishing grounds as discrete polygons. This transformation/translation should be addressed in the report in more detail.

5.3. How were sample (interview) data linked to the landings data and generalized to the population (in terms of vessels and landings)?

It does not appear that the sample data were linked to the landings data. It appears that the sample data were generalized to each fishery by inferring that the collective patterns of the sample (i.e., areas of importance relative to range of fishery for each respondent) were representative of the patterns of all fishery participants. The "control totals" appear to be the pounds of fish landed in statistical blocks that lie within the CCR.

5.4. What are the limitations of generalizing the sample data to the population?

Because it is not clear how individuals relate to the population, especially as the population is not clearly identified, it is difficult to generalize with confidence. The meetings with individuals and groups of fishermen to review the resultant maps mitigates this problem to some extent, but there was not sufficient information provided to enable further evaluation of this point.

6. Study Scope

As mentioned earlier, the scope of the Study is not clear. The Study compiled a comprehensive picture of the commercial fishing use patterns, however, neither social nor explicitly economic data were collected, beyond basic demographic information (age, years of fishing experience, home harbor, city of residence, and percent of income from fishing). The Study thus represents a first step toward a comprehensive understanding of the spatial dynamic of fish harvesting. Several next steps are necessary to adequately consider the social and economic impacts of the proposed MPA packages, including, but not limited to: linking the spatial use patterns to economic data, and assessing impacts not only to the fisheries defined in the Study, but also fishing families, communities, ports, fleet groupings, and associated industries.

6.1. What other data (from existing studies, through this study using other methods) were collected and analyzed?

Ecotrust apparently drew on its work done in two National Marine Sanctuaries to the north of the study region, and to some extent used the landings data for the ports within the study region.

6.2. What do these other data tell us about the social and economic aspects of fishing in the study region as it relates to MPAs?

These data were not evident or apparent in the materials we reviewed.

6.3. What key things beyond the scope of this work need to be done to accurately and adequately consider impacts as outlined by the Objective to analyze the relative effects of the proposed MPA Packages on commercial and recreational fisheries that are conducted in the waters of the Central Coast study region?

The focus on individual "fisheries" is an appropriate first step toward documenting and understanding the spatial dynamic of fish harvesting. That spatial dynamic is, however, determined and constrained by a number of processes that are important to consider relative to the establishment of MPAs or any other geographically defined regulatory process. In particular, the spatial practice of fishing varies tremendously such that some fisheries involve large wide-ranging vessels that may be vertically integrated into the processing facilities of single ports while others might involve small vessels that are virtually ubiquitous in all ports across a wide region, and that rely upon proximate fishing grounds. The impacts of closing a specific area may impact, for example, only 10% of the fishing grounds of the wide-ranging single port fleet but the same area might represent 100% of the fishing grounds relied upon by one or more proximate small port fleets. The latter may also lack the capacity to fish elsewhere.

This problematic was not addressed by the Ecotrust project directly. While information on percentages of fisheries landings or areas impacted by any particular MPA is clearly important and a valuable first step, the next vital step is to assess how that impact is distributed amongst fishing communities, ports, or fleets. Knowing that a particular MPA impacts 100% of the fishing important to a given port will suggest a strategy of negotiation and a politics quite different than just knowing the same MPA will impact 10% of the fishing across the entire study region. Importantly, the Ecotrust interviews did collect information on interviewee "home harbor" and "city of residence," as indicated in the "Interview Questions and Protocol" document. This information makes possible an analysis of impacts by port or community, such that maps of fishing grounds can be linked (provided sampling is adequate) to particular ports such that the differential impacts of a given MPA might be estimated. Such an analysis, done with the current data or as a next step in this MPA process, would complement the work already done.

The connection to community (port or fleet) is also vital if the MLPAI is to go beyond impact analysis toward the inclusion of particular stakeholders (embedded in communities and ports) in the MPA process. These kinds of interview-based spatial analyses have the potential to reveal and map the resource areas upon which local communities and economies depend. In addition, the visualization (mapping) of the link between community and resources might facilitate the production of a greater sense of community-based stewardship that is difficult to facilitate when resource dependence is expressed/mapped only in terms of individual fisheries.

Additionally, one would expect a study like this one to look at the fishery or fisheries in terms appropriate for social scientific analysis, perhaps using landings data to link to the biophysical dimensions of the situation. For the commercial fishery, this means considering fisheries differentiated in terms of participants and practices and/or species (group)-gear configurations, and looking at occupational or perhaps geographic groups or

subgroups as a means of classifying participants and supporting representative sampling.[6] With this in mind, this work might be fruitfully re-conceived by looking at the data collected as it pertains to the region's fisheries defined in human and fishery management (as well as biophysical) terms. Some of these fisheries are:

- CPS finfish: anchovy, mackerel, sardine (one fleet, one management unit)
- Market squid (noting overlap with CPS finfish fleet, fishery and management)
- Chinook salmon
- Dungeness crab
- Groundfish
    - Limited entry trawl
    - Limited entry fixed gear
    - Open access
- Nearshore

Other data not mentioned in the Study would be helpful in composing a more complete understanding of the Central Coast fisheries and fishing communities, and in integrating social, political, and cultural components along with economic indicators:

- Basic operational information, such as gear types, crew size/composition, operating costs and revenues.
- Social and economic linkages among fishery participants (i.e., fishermen, buyers, providers of goods and services) and with communities
- Dependence on CCR fisheries and fisheries overall
- Adaptive strategies for dealing with environmental, market and regulatory variability and change
- Demographics of fishery participants, such as age, education, household size and composition, residence, and other sources of income.

7. Data Analysis and Reporting

Notwithstanding the limits of the Scope of the study, the data analysis appears to be valid, based on innovative techniques used in previous MPA impact analyses. The Ecotrust Study allows for limited future evaluations, based on never before developed data sets of fisheries spatial extent and importance to fishermen. The Report and Summary left many questions unanswered, and should be followed up with further analyses.

7.1. Are there statistically significant differences among the packages in terms of their impacts on fishing area and ex-vessel value by commercial and recreational fishery and overall?

With the information provided, it is not possible to determine whether there are statistically significant differences among the packages by fishery or overall.

[6] See Leet et al. 2001, Pomeroy et al. 2002, Starr et al. 2002, Pomeroy and Dalton 2003.

7.2. What are the estimated spatial and ex-vessel value impacts for the major central coast fisheries (v. the species distinctions used in the report) individually and overall? (As a first cut, setting aside the possibility that fishermen may adapt in ways that reduce - or increase - these impacts.), and

7.3. What are they by coastal community where landing, shoreside fishery-related and fishing support activities occur?

With the information provided, it is not possible to estimate the spatial and ex-vessel value impacts or the impacts to coastal communities, for the major central coast fisheries. The present project was not designed to answer these questions. The reviewers did not have maps or other information about the MPA packages being considered. Given the information provided in the Study, it is impossible to know the full socio-economic impact to a community or region, of, for example, a 27% loss in area for nearshore rockfish. Other types of information would be necessary, such as:

- How many fishermen?
- Are nearshore rockfish caught by the fishermen of a single port?
- Is the 27% area lost fished by wide-ranging fleets from several ports?
- How is value added, by whom and where?
- What other businesses (within and outside the community) provide goods and services to the fisheries?

7.4. Do the Ecotrust products allow for evaluation with regard to the MLPAI stated objective to "minimize socio-economic impacts" of MPA network proposals, as consistent with the goals of the act and the Science Advisory Team guidelines?

The Study did not collect sufficient economic data (including for instance employment, costs and revenues), and therefore cannot accurately contribute to an evaluation of economic impacts. Similarly, the Study did not report on the extent of social data collected, according to the "Interview Questions and Protocol" document, and thus does not provide a fully developed socio-cultural description or social impact analysis of Central Coast fisheries or fishing communities.

The Ecotrust Study does, however, allow for an important evaluation based on new data on the spatial extent and importance of fish species (and in some cases, species groups) to fishermen. These can be extremely valuable for fisheries and marine resource management. It is also important to point to the ways that such spatial data is contingent upon participatory methodologies. While there is little spatial data available that would contribute to either siting of MPAs or accurate impact assessment, this is not the same as saying that the "spatial extent of fishing activities is relatively poorly understood" (p. 1). It may be poorly understood by MPA decision makers but it is well understood by fishermen and fishing communities. While this is obviously the premise for the project (ask fishermen where they fish), it is important to state clearly because it speaks not just to an absence of data but an exclusion of fishermen from decision making. While it is

beyond the scope of the Study to address the issue of inclusion/exclusion of fishermen and fishing communities, this is clearly the subtext of this project (and other projects that gather information from fishermen) and it must be addressed by the MPLAI if the goal is to establish not only MPAs but ensure their long term sustainability vis-à-vis fishing community support and understanding.

This project provides new information that will become the backbone of more detailed and nuanced spatial information on California fisheries. Without such information, obtained through sensitive participatory methodologies, MPAs and the spatial management of marine resources will be contentious and difficult to enforce. This review has raised many questions for the authors of the report, some of which can easily be addressed in future reporting and do not necessarily point to any inherent deficiency in the project methodology. However, in consideration of the political sensitivity of the MLPAI among California's fishing communities, efforts should be made to address the problematic issues raised in this peer review for the current stage of the MLPAI process (i.e., the CCR project) and in subsequent stages of the MLPAI process.

The field staff and others on the Ecotrust research team likely now have a wealth of information (both formal and informal) that could contribute to a plan for further and sustained participation by fishermen and fishing communities in the MPLAI. It would be useful for the MPLAI to ask Ecotrust to reflect upon the possibility of further fishermen participation given their experience, and under what conditions they might participate.

8. Comments and Suggestions Not Directly Responsive to Specific Questions in the Reviewer Scope of Work

8.1. In similar studies in the U.S., fishermen have expressed a clear fear that their knowledge might be used to "shut them down." While the researchers were interested in collecting information for impact analyses, the fishermen saw the data as useful for showing regulators which areas should not be closed to fishing (i.e. those areas upon which fishermen most rely). The Study discusses the issue of fishermen's apprehension with this project not as a result of the process just outlined but as the outcome of their competition amongst each other. This difference in fishermen's reactions points to the issue of participation and the protocol employed by Ecotrust. Fishermen were clearly concerned about the fate of the data, how and to whom it would be revealed, and, presumably, how it would be used. This last point is not addressed within this report. How was this issue addressed in the field? What were fishermen told would be the fate of this data; for impact assessment only, or for the siting of MPAs? If the latter, is the logic of siting to avoid fishing areas or to target them? Clearly this issue must have been raised by fishermen and their participation would likely hinge upon it.

8.2. The *Summary of potential impacts* states that "CPFV trips consist of several times the number of anglers as private and boat rental trips" (p.1, ¶ 5). While this may be the case in southern California, it is not clear that this statement is supported by data for the region; it should be double-checked.

8.3. The term *fishery-independent data* is mistakenly used on p.5, III.2. last sentence. Statistical block data found on the landing receipts are fishery-dependent data, i.e., information collected in the course of and directly related to fishing activity.

8.4. Butterfish (or butter fish) is a name commonly used for sablefish (Leet et al.2001: http://www.dfg.ca.gov/mrd/status/sablefish.pdf).

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Reviewers' Biographies

Bonnie McCay is Board of Governors Distinguished Service Professor at Rutgers University, in the Department of Human Ecology. Her doctorate at Columbia University was in ecological anthropology, and she has since focused on the relationships of fishing communities to the marine environment, including the roles of fishery cooperatives in fisheries management and community development, co-management and cooperative research, and the problem of "common property." Her field research has been in Newfoundland and Nova Scotia, Canada; New Jersey and other eastern states of the U.S., Puerto Rico; and Baja California, Mexico.

Caroline Pomeroy is a social scientist whose work focuses on the social, economic and cultural aspects of fisheries as they affect and are affected by management. Since coming to California in 1995, she has developed an applied social science research program focused on California fisheries and ocean management, first as a Research Scientist with the Institute of Marine Sciences at UC Santa Cruz, where she also taught Marine Policy, and since 2005, as a Marine Advisor with the California Sea Grant Extension Program based in Santa Cruz County, with responsibilities in the Monterey Bay region and statewide. The goals of her Extension social science program are to enhance understanding of the socioeconomic interactions in fisheries and the consequences of management for coastal communities; to assist the wise development, conservation and management of marine and coastal resources; and to enable more proactive and effective community responses to related change. Pomeroy's work has included studies of the socio-economic organization of the California squid and wetfish fisheries, the socio-economic impacts of marine reserves on the Channel Islands those fisheries, the human dimensions of collaborative research and marine reserves, and fishing communities to inform management design and impact assessment. In addition, she has served on a number of state and federal committees to inform marine policy such as NOAA's MPA Social Science Research Strategy Planning Team. Most recently, her work has focused on building social scientific understanding of the human dimensions of California's fisheries and fishing communities, and facilitating its application, through a series of collaborative research, education and outreach projects.

Kevin St. Martin received his Ph.D. from Clark University (1999). His dissertation focused on the discourse and practice of fisheries bio-economics and its implications for both resource management and community-based economic development in New England fisheries. In 1999, Dr. St. Martin was awarded a national Research Council (NRC) Associateship to continue his research on the spatial patterns of fishing communities, methods relevant to local ecological knowledge and participatory GIS, and fisheries science and management. Since then, Dr. St. Martin has been involved in several research projects that build upon his NRC work. These include NOAA and CMER funded projects that examine the question of community, community economies, and the commons in the context of fisheries management. Current projects (along with Dr. Bonnie McCay) include two linked grants from the National Science Foundation to examine the interaction of fishers' knowledge with research-based knowledge within the context of natural resource management. This long-term project involves interviewing

fisheries scientists, managers, and fishers themselves. In addition to research in fisheries related topics, Dr. St. Martin continues to pursue his interests in diverse economies, political ecology, critical cartography, and participatory GIS.

Barbara Walker is an Associate Project Scientist at the University of California at Santa Barbara in the Institute for Social, Behavioral, and Economic Research (ISBER). For the last 12 years, she has conducted research and published on economic, social, and political issues related to marine management regimes, economic development, environmental change, society and Geographic Information Systems (GIS), and theories of race, class, and gender. She has extensive fieldwork experience in French Polynesia, California, Mexico, and West Africa. Her multidisciplinary work has been funded by various agencies, including the National Science Foundation, the MacArthur Foundation, and the Social Science Research Council, among others. This research has resulted in several academic publications, the development of GIS databases of fishermen's knowledge in French Polynesia and the Channel Islands, CA, and courses taught at UCSB on public participation, environmental management, and Third World economic development. She has also served on several Regional MPA Social Science Research Workshops for the NOAA Marine Protected Areas Center.

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Appointments

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2000-	Board of Governors Distinguished Service Professor
1999-	Professor II, Department of Human Ecology, Cook College,
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1981-1990	Associate Professor, Department of Human Ecology, Cook College, and Department of Anthropology, Faculty of Arts and Sciences
1975-81	Assistant Professor, Department of Human Ecology and Social Sciences, Cook College
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Publications

In press. Communities, Knowledge, and Fisheries of the Future. International Journal of Global Environmental Issues. (Kevin St. Martin, Bonnie J. McCay, Grant Murray, Teresa Johnson, and Bryan Oles).

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2006-	Committee on International Capacity Building for the Protection and Sustainable Use of Oceans and Coasts, National Research Council, July 2006-2004-06 Governor's Blue Ribbon Panel on Offshore Wind Energy, New Jersey.
2003-05	Chair, Outgoing-Chair, Section H (Anthropology) American Assoc. for the Advancement of Science
2003-08	Vice-Chair, Marine Protected Areas Federal Advisory Committee (Department of Commerce and Department of Interior)
2003-04	Committee on Research Priorities on Environmental Decision-Making, National Research Council
1999-2002	Board of Scientific Counselors Executive Committee, Office of Research and Development, U.S. Environmental Protection Agency.
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1985 B.A., Yale University: Southeast Asian Studies (concentration: political science, anthropology)

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1993-95 Visiting Scientist, Workshop in Political Theory & Policy Analysis, Indiana University
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Selected publications

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Selected professional community service

Friends of Moss Landing Marine Laboratories Fisheries Education Project Advisory Board (2005-present); UC ANR Coastal and Marine Workgroup (2005-present); Human Dimensions of Harmful Algal Blooms, National Ocean Service, Working group member (2005-present); Human Use Patterns and Impacts Workshop, National MPA Science Center, Design advisor and participant (2005); National Marine Protected Areas Social Science Research Strategy (MPA SSRS) Planning Group (2002-present); California Market Squid Preliminary Draft Fishery Management Plan Review Panel (2001); National Research Council Panel on Evaluating the Effects of Bottom Trawling on Seafloor Habitats (2000-02).

Abreviated Curriculum Vita — Kevin St. Martin

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	Clark University	Ph.D.	1999
	National Research Council Associateship at the NMFS		2000

Appointments

2001	Assistant Professor at Rutgers University, Department of Geography.
2000	National Research Council (NRC) Associateship Award recipient located at the DOC/NOAA/NMFS Northeast Fisheries Science Center, Woods Hole, MA.
1999	Adjunct instructor at Clark University and at Tufts University. Research Associate at Clark Labs for Cartographic Technology and Geographic Analysis, Clark University.
1990-1998	Research Associate at the Idrisi Project, Clark University.

Recent Publications

forthcoming	St. Martin, K., B. McCay, G. Murry, T. Johnson, and B. Oles. "Communities, Knowledge, and Fisheries of the Future." *International Journal of Global Environmental Issues*.
2006	R. Schroeder, K. St. Martin, K. Albert. "Political Ecology in North America: An Introduction" *Geoforum* 37(2): 163-168. St. Martin, K. "The Impact of 'Community' on Fisheries Management in the U.S. Northeast," *Geoforum* 37(2) 169-184.
2005	St. Martin, K. "Mapping Economic Diversity in the First World: The Case of Fisheries," *Environment and Planning A* 37: 959-979. St. Martin, K. "Disrupting Enclosure in New England Fisheries," *Capitalism, Nature, Socialism* 16(1): 63-80.
2004	St. Martin, K. "GIS in Marine Fisheries Science and Decision Making," in *Geographic Information Systems in Fisheries*, W. L. Fisher and F. J. Rahel eds. (American Fisheries Society), pp. 237-258.
2001	St. Martin, K. "Making Space for Community Resource Management in Fisheries," *Annals of the Association of American Geographers* 91(1): 122-142.

Recent Conference Participation

2006	St. Martin, K., D. Wilson, B. McCay, and T. Johnson. "Scale, Knowledge and Participation in Ecosystem Approach Management Strategies: Lessons from North Sea and Northeastern US" *The ICES Symposium on Fisheries Management Strategies.* Galway, Ireland, June 27-30, 2006. "Fishermen, Territory, and the Inhabitation of Neoliberal Space" *The Association of American Geographers Annual Meeting*, Chicago, IL, March 7-11, 2006. Panelist "Politics of Participation" *The Association of American Geographers Annual Meeting*, Chicago, IL, March 7-11, 2006. "Counter Mapping and the Production of Alternative Subjects and Spaces" *Indigenous Cartographies and Representational Politics – An International Conference*. Cornell University, Ithaca, NY, March 2-5, 2006.
2005	Hall-Arber, M. and K. St. Martin. "Mapping Fishing Communities At Sea" *American Fisheries Society 135th Annual Meeting*, Anchorage, AK, September 11-15, 2005. McCay, B. J., T. R. Johnson, K. St. Martin, and D. Wilson. "Social, Cultural, and Economic Impacts of Working Cooperatively: How is Fishermen's Knowledge

Incorporated?" *American Fisheries Society 135th Annual Meeting*, Anchorage, AK, September 11-15, 2005.
"GIS and the (Re)production of a Fisheries Commons." *The Association of American Geographers Annual Meeting*, Denver, CO, April 5-9, 2005.
St. Martin, K. and J. Wing. "The Possibility of Heterodox GIS." *The Association of American Geographers Annual Meeting*, Denver, CO, April 5-9, 2005.

2004 "Re-Mapping the Commons and Constituting a Community-based Economy: The Case of Fisheries." *International Association for the Study of Common Property (IASCP)*, Oaxaca, Mexico, August 9-13.
St. Martin, K. and T. Johnson. "Inventing Communities of Fishers in the Northeast U.S.: Emerging Methods for Fisheries Impact Assessment." *International Association for the Study of Common Property (IASCP)*, Oaxaca, Mexico, August 9-13.

Select Funded Research

2004 March 2004 – February 2007. National Science Foundation, Ethics and Values Studies program. "Experience Based Knowledge in a Science Policy Context," McCay, B. (Rutgers University) and K. St. Martin, $180,001.
March 2004 – May 2006. NOAA, New Jersey Sea Grant program. "Cumulative Effects and New Jersey Marine Fisheries," McCay, B. (Rutgers University), B. Oles (Rutgers University), K St. Martin, and M. Danko (New Jersey Marine Sciences Consortium), $78,500.

2003 September 2003 – August 2004. National Science Foundation, Ethics and Values Studies program. "Examining the Fate of Experience Based Knowledge in a Science Policy Process," McCay, B. (Rutgers University) and K. St. Martin, $39,720.
January 2003 – December 2003. NOAA, New Jersey Sea Grant program. "Environmental Knowledge of Commercial Fishermen and Its Application to Fisheries Management," Oles, B. (Rutgers University), K. St. Martin, and B. McCay (Rutgers University), $49,993.

2001 September 2001 – August 2004. NOAA, Cooperative Marine Education Research. "Recreational Fishing and National Standard 8: Assessing Community Impacts of Federal Regulations," St. Martin, K. and B. McCay (Rutgers University), $75,000.
September 2001 – May 2005. NOAA, Northeast Consortium. "An Atlas-based Audit of Fishing Territories, Local Knowledge, and the Potential for Community Participation in Fisheries Science and Management," St. Martin, K. and M. Hall-Arber (Massachusetts Institute of Technology), $168,953.

Select Activities

On-going Social Science Advisory Committee, New England Fisheries Management Council.

2004 International Council for the Exploration of the Sea (ICES), Working Group on Fisheries Systems (WGFS) member and workshop participant. April 26-30, Lowestoft, United Kingdom.

2002 Participant at the *Northeast Consortium's 2nd Annual Project Participants' Meeting*, Portsmouth, NH, October 24. The Northeast Consortium is designed to facilitate collaborative science between fisheries scientists and fishermen.
Invited participant in the "Communities Workshop" organized by the Office of Science and Technology of the National Oceanic and Atmospheric Administration, National Marine Fisheries Service. April 23 – 25, Silver Spring, Maryland.

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EDUCATION

Ph.D., 1998	Geography, University of California at Berkeley
M.A., 1994	Geography, University of California at Berkeley
B.A., 1990	Anthropology, Minor in African Studies, University of California at Los Angeles

ACADEMIC APPOINTMENTS

2006-present	Associate Project Scientist, Institute for Social, Behavioral, and Economic Research, University of California at Santa Barbara.
2002-present	Lecturer, Department of Environmental Studies, University of California at Santa Barbara.
2000-2006	Assistant Research Geographer, National Center for Geographic Information and Analysis, and the Institute for Social, Behavioral, and Economic Research, University of California at Santa Barbara.
1998-2000	National Science Foundation Post-Doctoral Researcher, Institute for Social, Behavioral, and Economic Research, University of California at Santa Barbara.

PUBLICATIONS

Walker, B.L.E., and M. Robinson. (in preparation) "The spatial scale of gendered fishing practices and marine protected areas in Moorea, French Polynesia."

Walker, B.L.E. (in preparation) "Agrarian questions in the fisheries sector: economic and ecological constraints to peasant fishing production in Ghana, 1957-2000."

Walker, B.L.E. (in preparation) "The potential role of local knowledge and anecdotal data in fisheries policy: a case study from the Channel Islands, California."

Walker, B.L.E., E.G. Edlund, and Z.S. Maumenee. (submitted) "Mapping conservation and tourism development: GIS and environmental decision-making in French Polynesia," *Annals of the Association of American Geographers*.

Robinson, M., Miller, C., Hoeflinger, C., and Walker, B. 2005. "Problems and Recommendations for Using GIS to Improve Decision-Making in California's Channel Islands Marine Reserves," *MPA News* 7(5): 4-5.

Walker, B.L.E. 2002. "Engendering Ghana's seascape: Fanti fishtraders and marine property in colonial history," *Society and Natural Resources* 15(5):389-407.

Walker, B.L.E. 2001a. "Sisterhood and seine-nets: engendering development and conservation in Ghana's marine fishery." *The Professional Geographer* 53(2): 160-177.

Walker, B.L.E. 2001b. Mapping Moorea's lagoons: Conflicts over Marine Protected Areas in French Polynesia, *Proceedings of the Inaugural Pacific Regional Meeting of the International Association for the Study of Common Property*, Brisbane, Australia, September 2-4, 2001 (http://dlc.dlib.indiana.edu/archive/00001047/).

GRANTS AND FELLOWSHIPS

2003	UC MEXUS Travel Grant. Entitled: "Livelihood and Migration Strategies of Mexican Fisherpeople in California, USA and Baja California, México" ($1,500).

2002-2006 National Science Foundation ADVANCE Fellows Award (SBR-0137458). Entitled: "Mapping Marine Space: Marine-Protected Areas, Geographic Information Science, and Civil Society" ($383,141).

2001-2003 John D. and Catherine T. MacArthur Foundation Grant; Initiative on Population, Consumption and the Environment; Program on Global Security and Sustainability (Grant # 00-65195-GSS). Entitled: "Balancing Conservation, Subsistence, and Economic Growth in French Polynesia's Lagoons" ($210,000).

1999-2000 National Center for Geographic Information and Analysis (NCGIA), Public Participation GIS Seed Grant. Co-PI Paul McNab, Department of Geography, St. Mary's College, Nova Scotia. Entitled: "Mapping Marine Space: The Effects of GIS on Small-Scale Fishing Communities and Fisheries Degradation" ($3,000).

1998-2000 National Science Foundation Postdoctoral Fellowship (SBR-9806256). Entitled: "Catching the Wave of Capitalism in the Wake of the Nuclear Age: Gender and Political Ecology in Moorea, French Polynesia" ($80,000).

1998-1999 UC Berkeley Institute for International Studies/MacArthur Foundation Program on Multilateral Governance Workshop Grant, 1996-1999. For meetings of the UCB Working Group on the Political Ecology of Marine Resources, and the "Conference on Multilateral Ocean Governance and the Globalization of Marine Resources" at UCB ($12,000).

PROFESSIONAL ACTIVITIES

Grant Reviewer for the National Science Foundation (Geography and Regional Sciences and Office of Polar Programs), and The National Fish and Wildlife Foundation.

Manuscript Reviewer for *The Professional Geographer*; *Gender, Place and Culture*; and *Coastal Management Journal*.

Invited Participant, Regional MPA Social Science Research Workshop: Pacific Islands, convened by the NOAA Marine Protected Areas Center, Institute for Marine Protected Areas Science. Waikoloa, HI, April 2004.

Session Organizer and Chair, "GIS and Marine Environmental Management in the Pacific," Annual Meeting of the Association of Pacific Coast Geographers, Portland, OR, September 2003.

Invited Participant, Channel Islands Marine Protected Areas Socioeconomic and Biological Monitoring Workshop, convened by the NOAA Channel Islands National Marine Sanctuary. UC Santa Barbara, March 2003.

Invited Participant, Marine Protected Areas Social Science Workshop, convened by the NOAA Marine Protected Areas Center, Institute for Marine Protected Areas Science. Monterey, CA, April 2002.

Session Organizer and Chair (with Dawn Wright), "GIS in Support of Marine Protected Areas," The Annual Meeting of the Association of American Geographers, Los Angeles, CA, March, 2002.

Invited Participant, Specialist Meeting on Inequality and Equity, The Center for Spatially-Integrated Social Science (CSISS), University of California, Santa Barbara, CA, November 2000.

Conference Organizer and Chair, "Conference on Multilateral Ocean Governance and the Globalization of Marine Resources", UC Berkeley, April 1999, (http://globetrotter.berkeley.edu/macarthur/marine/).

Attachment A

Ecotrust Documents Reviewed

Commercial fishing grounds and their relative importance off the Central Coast of California

Report to the California Marine Life Protection Act Initiative

In partial fulfillment of Contract No. 2005-0067M

Astrid Scholz
Charles Steinback
Mike Mertens

Field staff:

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20 April 2006

Table of Contents

I. Introduction

Ecotrust was retained by Marine Life Protection Act Initiative (MLPAI) in May of 2005 to collect, compile and analyze fishery data in support of the Central Coast Project (see Appendix 1, scope of work).

During the summer of 2005, our research team developed and deployed a local knowledge interview instrument, using an interactive, custom computer interface, to collect geo-referenced information about the extent and relative importance of central coast commercial fisheries. In the fall and winter of 2005/06, we compiled these data in a geographic information system (GIS) that we delivered to the MLPAI for integration into a central geodatabase housed at the University of California at Santa Barbara. We analyzed the fishery data and additional data provided to us by the California Department of Fish and Game to estimate first-order maximum potential impacts of proposed marine protected area networks developed in the MLPA process.

This report completes our deliverables, complementing the data and analytical deliverables already forwarded to the MLPAI under the terms of our contract. It details the approach and methods used for collecting, compiling and analyzing commercial fisheries data in the central coast. We further discuss the results and deliverables from this project. It is important to note, however, that the analysis conducted under the scope of this contract is not the sum total of everything that could be done with the database and the information contained therein. Indeed, the analysis conducted to date is suggestive of many more questions and research directions than could be pursued in the timeframe. We hope that this project not only makes a useful contribution to the MLPA process, but also opens the door to further inquiry drawing on the expert knowledge of fishermen and other mariners.

Conducting qualitative research in coastal communities is as challenging as it is rewarding. Asking sensitive questions about people's livelihoods, and doing so at the height of the summer fishing season and during a frequently contentious policy process should have been daunting. That it wasn't speaks to the commitment and generosity of the fishing community. We have learned a tremendous amount from the participants in this study, and the countless other community members, stakeholders, and observers of the MLPA process.

We are deeply thankful to the 109 fishermen who participated in the interviews—making time in their busy schedules, overcoming sometimes considerable reservations, and sharing their knowledge and experience with us. We thank all the members of the Central Coast Regional Stakeholder Group and the MLPAI staff, and are especially grateful to Jeremiah and Trudi O'Brien and Kirk Sturm for facilitating several project meetings in Morro Bay, Rick Algert, Jay Elder, and Tom Ghio for memorable boat trips, Steve Scheiblauer for the use of his office for project meetings in Monterey, and Paul Reilly for countless close readings of our data and results.

We believe that this project makes a significant, new contribution to the knowledge base on the coast—not just for marine protected area planning, but for enhancing the public's and decision-makers' understanding of the importance of the coastal ocean to coastal communities and economies.

For questions or comments, please contact Dr. Astrid Scholz, Ecotrust, 721 NW 9th Avenue, Portland, OR 97206; email: ajscholz@ecotrust.org; phone: 503 467 0758

In addition to serving as the Principal Investigator on this study, Astrid Scholz is also a member of the Master Plan Science Advisory Team of the Marine Life Protection Act Initiative (http://www.dfg.ca.gov/mrd/mlpa/mpsat.html) and serves on the Ecosystem Protection – Marine Protected Areas working group of the Monterey Bay National Marine Sanctuary as part of the Joint Management Plan Review process (http://sanctuaries.noaa.gov/jointplan/mb_mpa.html).

II. Background – why map the fishing grounds?

In California as elsewhere on the Pacific Coast, commercial and recreational fisheries support coastal communities and economies; they are pursued by vessels of all shapes and sizes, using a variety of gear types and fishing strategies, and covering a large part of the coastal ocean. In general, this spatial extent of fishing activities is relatively poorly understood.

While a variety of data are collected by state and federal agencies to monitor and enforce fisheries and set harvest allocations, the thematic, temporal and spatial resolution of these data sets varies considerably. Data range from agency observer data in some fisheries to voluntary reports in others, from mandatory daily logbooks with detailed location information in some fisheries, to landing receipts using large statistical reporting blocks. With marine and fisheries management becoming more focused on ecosystem-based approaches, using tools such as time and area closures, accurate spatial information about coastal fisheries is central to informing policy decisions.

These spatial information gaps in coastal fisheries can be filled using existing data or collecting new information, and this report describes one such effort undertaken to redress the spatial information gaps in commercial fisheries in the context of the Marine Life Protection Act (MLPA), and its implementation in the Central Coast Study region. In previous iterations of the MLPA processes, the use of existing data was controversial since these data are riddled with artifacts. This is especially prevalent in landing receipts, the only source of data consistently available for all commercial fisheries. Landing receipts are typically filled out by fish buyers at the point of landing, and the data collection forms contain a field for statistical reporting blocks. Fishermen report, and agency staff working with landing receipts confirm, that the block information is typically filled in by the buyer irrespective of the actual provenance of the catch, making the spatial information contained in landing receipts unreliable. For example, most of the catch of Dungeness crab, according to information extracted from landing receipts, would appear to come from depths greater than 2,000 fathoms—waters well past the reach of the San Francisco crab fleet—while the grounds of most economic importance to the fleet look virtually unfished.

Clearly, basing management decisions on the spatial information contained in existing data sources would be undesirable. The alternative, then, is to collect new information about the spatial extent of fishing activities. In the absence of comprehensive observer coverage, vessel monitoring systems or other fishery-independent data collection devices, by far the best source of information about the fishing grounds is the fleet itself.

In this project, therefore, we built on existing approaches to collect fishermen's expert knowledge about the fishing grounds. The goal was to develop maps of the fishing grounds and characterize their relative importance for various fisheries. The next section contains a detailed description of the methods used and the analysis conducted.

III. Methods

In this project, we built on methods developed in previous projects on the coast (Scholz et al. 2004; 2005; 2006), using a computer interface to administer a survey, collecting information from fishermen[1] and analyzing the responses in a geographic information system (GIS). The key innovation in this project was the use of California Department and Fish and Game (CDFG) landing receipts to structure a representative sample.

While the use of GIS technology and analysis in marine and fishery management has expanded steadily over the past decade (Meaden 1996; Kruse et al. 2001; Breman 2002; Valavanis 2002; Fisher and Rahel 2004), its use for socioeconomic research is still somewhat limited. Many of the applications reviewed in the recent literature focus on urban populations or natural resource use in developing countries (Gimblett 2002; Goodchild and Janelle 2004; Anselin et al. 2004). Nevertheless, there are several good examples to build on for improving the spatial specificity of the West Coast knowledge base and data landscape. Some of the most pertinent applications of GIS technology to socioeconomic questions in fisheries concern the spatial extent of fishing effort and intensity (Caddy and Carocci 1999; Green and King 2003), and use participatory methods similar to the ones employed here (Wedell et al. 2005; St. Martin 2004, 2005, 2006).

We built on these approaches and adapted them for the California context, following best practices for the use of participatory GIS in natural resource management (Quan et al. 2001), as described in the remainder of this section.

III.1 The study region

The study region of this project is congruent with the Central Coast Project of the MLPAI, spanning approximately 200 miles of coast between Pigeon Point, north of Santa Cruz, to Point Conception northwest of Santa Barbara (for details of the Central Coast Project, see http://www.dfg.ca.gov/mrd/mlpa/centralcoast.html).

Unlike the Central Coast Project, however, the western extent of our study region is not bounded by the state water boundary. Rather, we considered the entire Exclusive Economic Zone (EEZ) in this project, although in reality most fisheries are confined to within 50 miles offshore. Similarly, we did not impose the southern and northern extent of the Central Coast Project. Methodologically this means that we did not "cut off" the area for fishermen to consider, but asked them to draw their fishing grounds irrespective of political boundaries.

In keeping with the convention adopted by the MLPAI, we stratified our study region into a Northern and Southern part. The Northern section extends from Pigeon Point to the southern border of Monterey County, and includes the ports of Santa Cruz, Moss Landing and Monterey. The Southern section spans the remainder of the coast, from the northern border of San Luis Obispo County to Point Conception, and includes the ports of Morro Bay, Port San Luis and Avila. We considered primarily landings made in these ports for

[1] In keeping with the usage in the fishing community, we use "fisherman" to talk about both male and female members of the fishing industry.

identifying fishermen and describing the resulting sample. It is, however, the case that many fishermen fishing in the study region also make landings outside of it.

III.2 Fisheries studied

In consultation with MLPAI and CDFG staff, we initially selected 19 fisheries to study, listed in Table 1. They are all fisheries that are at least partially conducted in state waters, are of some economic importance in the study region, mostly involve fishing gear that is expected to have some benthic habitat interactions, and are not well captured spatially by existing fisheries-independent data sets. That is to say, the best fishery-independent spatial information available for them is contained in the statistical blocks reported in landing receipts.

Table 1 Fisheries studied

No.	Fishery	Study region landings (1999-2004 average pounds)	Rank by value of study area landings (1999-2004 average nominal ex vessel revenues)	Percentage of total study area landings (in terms of 1999-2004 average nominal ex vessel revenues)
1	Anchovy	9,936,324	12	2.17%
2	Butterfish	14,169	30	0.10%
3	Cabezon	91,359	11	2.73%
4	California Halibut	123,495	14	1.95%
5	*Chinook Salmon*	975,800	2	12.57%
6	Dungeness Crab	103,547	15	1.66%
7	Jacksmelt	28,096	32	0.05%
8	Kelp Greenling	6,731	26	0.25%
9	Lingcod	36,997	23	0.33%
10	Mackerel	294,720	29	0.13%
11	*Market Squid*	22,615,304	1	24.49%
12	Rock Crab	89,200	20	0.78%
13	Rockfish Nearshore	157,573	7	4.83%
14	*Rockfish Deep Nearshore*			
15	Rockfish Shelf	226,369	19	0.87%
16	Rockfish Slope	438,030	16	1.63%
17	Sablefish	758,397	6	5.53%
18	Sardines	26,354,126	5	7.19%
19	Spot Prawn	129,237	4	7.38%
20	Surfperch	15,413	28	0.20%
21	Thornyheads	694,106	8	4.49%
22	White Seabass	33,608	22	0.47%
	Totals	***63,122,597***	***n/a***	***79.81%***

Notes: Fisheries No.'s 5, 11, and 14 salmon, squid, and deep nearshore rockfish, were added upon inception of interviews. The fishery for No. 7, jacksmelt, takes place in the Northern part of the study region, the fishery for No. 10, surfperch, in the Southern part.

We expanded this list by three additional fisheries (salmon, squid, and deep nearshore rockfish, indicated in italics in Table 1).

The inclusion of salmon was prompted by the realization that it would be odd to omit the second most valuable fishery in the study region from this project even though eventual marine protected areas are anticipated to have relatively minor impacts on this particular fishery. Squid was added on the suggestion of the fleet. Initially the thought had been to just use the very well geo-referenced logbooks that exist for this, the most valuable fishery in the study region. Once interviewees begun in some of the other coastal pelagic fisheries, however, participants from these sectors—many of whom also participate in the squid fishery—expressed a desire to incorporate their squid fishing grounds into the analysis. Finally, we treated the deepwater segment of the nearshore rockfish fishery as a separate fishery. This is because species caught in deeper waters require a special permit that is only held by a subset of the fishermen participating in this fishery.

As is apparent from Table 1, the 22 fisheries considered in this study comprise 63,122,597 pounds in average landings, which amounts to almost 93% of all fish landed in the study area between 1999 and 2004. Similarly, in terms of revenues, they comprise nearly 80% of average revenues in the same time period.

Among the fisheries studied, several are significantly larger, in terms of landings or revenues or both, than others. For example, the coastal pelagic species such as squid, sardines and anchovies account for the greatest volume of landings. Of those, squid accounts for the greatest ex vessel value, followed by salmon and the comparatively low volume spot prawn fishery.

III.3. Sampling the fishing fleet

Using CDFG landing statistics, we identified fishermen to interview about the fishing grounds for each of the 22 target fisheries. Given the expert nature of the information we were interested in for this project, a random sample would not have been the appropriate choice. Instead, we constructed a purposive, proportional quota sample that was designed to be representative of the overall fisheries. CDFG staff generated a list of fishermen by landings for the initial 19 fisheries of interest and salmon. We inspected this list to identify participants such that, for each fishery

- both Northern and Southern segments of the study region; and
- at least 50% of landings in 2003-2004; or
- at least 5 fishermen were represented.

We diverged from this strategy in the case of the squid and deep nearshore rockfish fisheries, which were both added in the course of interviewing. In those two cases the sampling was *de facto* a snowball approach, with members of the Regional Stakeholder

Group as well as participants in wetfish and rockfish fisheries making referrals to other fishermen to contact.

Together, these strategies resulted in 218 fishermen whom we contacted to solicit participation in the project. Of those, 108 provided information used in the subsequent fishing grounds analysis, making for an overall response rate of 50%.

We will discuss challenges and confounders associated with this project in more detail in the next section. Among those are the following:

- difficulties experienced contacting the 26 Vietnamese fishermen (12% of the total sample);
- lack of contact information;
- poor timing for setting up interviews during the summer fishing season.

The 108 successfully completed interviews do, however, give a comprehensive picture of most of the fisheries studied, as summarized in Table 2. Several observations stand out:

- Fisheries added on the suggestion of fishermen had some of the highest response rates of the fisheries studied;
- A total of 3 fisheries—butterfish, jacksmelts, and thornyheads—yielded no information and were eliminated from further analysis. The first two of these account for negligible landings and ex vessel revenues, but thornyheads account for close to 5% of study area revenues on average (see Table 2);
- 12 of the remaining fisheries—including the highest value ones for squid, salmon and spot prawns—met at least one of our sampling criteria in the Northern and Southern parts of the study region.

While there are no hard and fast rules for what constitutes a representative sample of central coast fisheries, and a census of the entire fleet is impractical, the performance of the sample vis-à-vis the sampling criteria is informative of the confidence in the data. Fisheries that scored one or both criteria, and ideally in both regions, and amounted to a large part of landings for the study region as a whole are likely better represented in the data than those for which only one of the two regions is represented.

A	B	C	D	E	F	G	
No.	**Fishery**	**Fishermen contacted**	**Fishermen interviewed**	**Response rate**	**% of total study region landings represented by fishermen sampled (2003-2005)**	**Performance in terms of sampling criteria ++ = both criteria met + = one criterion met - = neither criterion met 0 = no interviews**	
						North	**South**
1	Anchovy	11	8	73%	50%	++	Not fished here
2	Butterfish	4	0	0%	---	0	0
3	Cabezon	35	24	69%	46%	+	++
4	California Halibut	45	32	71%	32%	+	+
5	*Chinook Salmon*	89	56	63%	22%	+	+
6	Dungeness Crab	28	14	50%	22%	+	++
7	Jacksmelt	5	0	0%	---	0	0
8	Kelp Greenling	33	17	52%	35%	+	+
9	Lingcod	50	28	54%	33%	+	+
10	Mackerel	11	7	64%	39%	-	Not fished here
11	*Market Squid*	17	16	94%	35%	+	++
12	Rock Crab	21	7	33%	54%	-	+
13	Rockfish Nearshore	45	32	71%	42%	+	+
14	*Rockfish Deep Nearshore*	19	19	100%	31%	+	+
15	Rockfish Shelf	33	6	18%	6%	-	-
16	Rockfish Slope						
17	Sablefish	20	7	35%	7%	-	-
18	Sardines	19	8	42%	46%	+	Not fished here
19	Spot Prawn	9	6	67%	92%	++	++
20	Surfperch	11	3	27%	6%	Not fished here	-
21	Thornyheads	10	0	0%	---	0	0
22	White Seabass	19	6	32%	0%	-	-

Table 2 Description of the fishermen sample

III.4. Collecting and analyzing the fishing ground information

During the summer months of 2005 (June through August) Ecotrust personnel interviewed 108 fishermen along the central coast. Fishermen were selected based on CDFG data and recommendations by the Regional Stakeholder Group, as described above.

Ecotrust personnel contacted fishermen by phone, explained the project and obtained written consent of participants (see Appendices 2 and 3 for sample consent forms). The project was also described on a web page, at http://www.ecotrust.org/mlpa, which included a toll free phone number and on-line form for submitting any questions. Staff at Ecotrust's office in Portland arranged for interviews with contracted field staff based in Santa Cruz, Monterey, Morro Bay and Santa Barbara. The format included one-on-one or small group interviews, with follow-up meetings by fishery and/or gear group during which the information collected was validated by fishermen.

Throughout the project we strove to protect the confidentiality of the information provided by fishermen. In addition to obtaining the explicit consent of individual participants, we undertook several additional steps for protecting sensitive information. These include masking all names and identifying characteristics of shapefiles; showing the aggregated maps for each fishery to no-one outside that fishery; developing a mechanism for incorporating the information into the MLPAI geodatabase at sufficiently aggregated levels; and devising a display format that maintains the information content without making it visible, for use in stakeholder group meetings.

Data were entered into a GIS using a custom-built ArcView interface known as OceanMap originally developed by Environmental Defense, and modified for the Central Coast study region. The interface allows field staff to enter fishing grounds identified by respondents directly into a spatial database, and standardize this information across a number of respondents or fisheries. It is programmed to allow fishermen to draw shapes in their natural sizes (polygons) rather than confining responses to a grid. Although data are summarized to a variety of grids for the subsequent analysis, the raw data are entered in natural shapes and at whatever spatial scale makes sense to respondents.

All interviews follow a shared protocol:

1. Maximum extent: Using electronic and paper nautical charts of the area, fishermen are asked to identify, by fishery, the maximum extent north, south, east and west they would forage or target a specie(s).
2. Scaling: They are then asked to identify, within this maximum forage area, which areas are of critical economic importance, over their cumulative fishing experience, and to rank these using a weighted percentage—an imaginary "bag of 100 pennies" that they distribute over the fishing grounds;
3. Port association: Based on the areas the fisherman have identified, they are then asked about the northern and southern range of ports that they would land their catch, and specific ports within that range. They are also asked for their license number.

The first step establishes the maximum extent of the fleet in each fishery. This differs for all fisheries, some of which range far along the entire West Coast, while others are confined to inshore waters. In the subsequent analysis this allows us to distinguish between fisheries that take place wholly in the MLPAI central coast region from others that take place inside and outside.

The second step serves to scale respondents' reporting of the relative importance of the fishing grounds to a common scale. This is important for making inter and intra fishery comparisons. We chose 100 pennies as an intuitive common sum scale for scoring the relative importance of subareas identified within the larger fishing grounds. It also provides us with a convenient accounting unit for aggregating the stated importance per unit area in the intermediary steps of the various analyses performed.

The port association is relevant for linking the fishing grounds to landing ports, since not all landings are necessarily made in ports adjacent to the grounds. Indeed, several fisheries that are conducted within the study area make significant landings outside the study area. For this project, we had direct use of the fishermen's license numbers, which are also recorded in the CDFG landing receipts.

The analysis of the fishing ground information follows a series of discrete steps:

1. Determining the Fishing Grounds

Through a set interviews following the above protocol, fishermen are asked to identify their fishing grounds for a specific fishery. In order to determine the fishing grounds G for any given fishery, the fishing grounds identified by the fishermen (i.e. the area of all the shapes, *j)* is summarized. Each fisherman *f* interviewed, identifies his/her fishing grounds G_f , per fishery as one or more shapes $G_f = \sum j$, where $j = 1,\ldots,\ldots n$. The number of shapes differs for each respondent and by fishery. If there is only one shape, then $G_f = j$.

Each shape *j* in fisherman's *f's* fishing grounds is then converted to a grid with a 100m-cell size. For example, in the Dungeness crab fishery, each shape identified by a fisherman now equals some multiple of 100m cells, so the total number of cells in one shape, $C_j = n$, where $n = 1,\ldots,C$. The crab fishing grounds for each fisherman G_f , is now represented by the total number of cells for all of his\her shapes:

$$G_f = \sum_{n=1}^{j} C_j$$

But, in order to normalize each shape by the total area, the entire crab fishing grounds G_{crab}, need to be determined. This will be used in a later step that effectively weights the response according to the relative size of the respondent's fishing footprint to the composite fishing grounds. The composite fishing grounds G_{crab} , is based on all the shapes provided by all fishermen, and it is necessary to account for the possible overlap

of shapes identified by multiple fishermen. This is done by expressing whether a cell exists for *j* in any given location (cell) through the following equation:

$G = \sum b$

Where b = result of the Boolean expression:
does *j* exist for any *i* for location *x, y.* 1 = true, 0 = false.

If we were to just sum the number of cells of every *j,* identified by every *f,* the resulting sum would not be for a unique *x, y* location and count multiple occurrences in the same location. In other words, the fishing grounds of any one fisherman G_f , are smaller or equal to the total grounds for that fishery.

2. Determining the Relative Importance (RI)
Each respondent allocates a budget, Ω, of 100 "pennies," representing his or her total effort for that fishery, by allocating some portion of pennies, *P,* to each shape, *j,* on their fishing grounds, G_f , such that $\sum P_j = 100$. Each shape *j* is now associated with a distinct number of cells, C_j , and a weight, P_j.

The value of each cell in the shape is then the number of pennies allocated to the shape divided by the number of cells in the shape. So as not to overstate the relative importance of cells associated with shapes identified by fishermen who reported smaller fishing grounds (thus concentrating value in a sub-section of the composite grounds, *G),* we multiply the value of each cell (P_j / C_j), by the number of cells for that fisherman's grounds, G_f , divided by the total number of cells in the composite fishing grounds for the entire shape (G_f / G). This weights the response according to the relative size of the respondent's fishing footprint, C_j , to the composite fishing grounds, *G,* or normalizes by the total area.

Each cell for every given shape is now represented by the relative importance value normalized by the total area, or *V*.

$V_j = (P_j / C_j) * (G_f / G)$

Where:
P = the stated importance value
C = the number of cells
j = the shape
G = the total number of cells in the entire fishery
G_f = the total number of cells in the fishing grounds of one fisherman

Consider this example:

For this example there are only two respondents. Collectively they have drawn five shapes: respondent *A* has identified three shapes and respondent *B* has identified two shapes. They have each allocated their budget of pennies accordingly.

Respondent A identifies three shapes, which cover 50, 100 and 10 cells, respectively. She then weighs them 20, 75, and 5 pennies each, for a total budget of 100 pennies.

Shape *j*	**No. of cells C_j**	**No. of pennies P_j**	**Value per cell (P_j / C_j)**
$j_{A,1}$	50	20	20/50 = 0.4
$j_{A,2}$	100	75	75/100 = 0.75
$j_{A,3}$	10	5	5/10 = 0.5
A's total grounds $G_{f,A}$	160 cells	100 pennies	

Respondent *B* identifies two shapes, which cover 20, and 100, respectively. He then weighs them 80 and 20 pennies each, for a total penny budget of 100.

Shape *j*	**No. of cells C_j**	**No. of pennies P_j**	**Value per cell (P_j / C_j)**
$j_{B,1}$	20	80	80/20 = 4
$j_{B,2}$	100	20	20/100 = 0.2
B's total grounds $G_{f,B}$	120 cells	100 pennies	

All of respondent B's first shape ($j_{B,1}$), overlaps with a portion of respondent *A*'s second shape ($j_{A,2}$). The total number of cells in the composite fishing grounds, *G,* thus equals 260. In order to account for the relative size of each respondent's fishing footprint, $C_{(j)}$, to the composite fishing grounds, *G*, the value per cell (P_j / C_j) is multiplied by the number of cells for that shape, divided by the total number of cells in the composite fishing grounds (C_j / G).

Respondent A

Shape j	**Value per cell** (P_j / C_j)	**Relative Importance Value** $V_j = (P_j / C_j) * (G_{f,A} / G)$
$j_{A,1}$	20/50 = 0.4	0.4 * 0.6 = 0.24
$j_{A,2}$	75/100 = 0.75	0.75 * 0.6 = 0.45
$j_{A,3}$	5/10 = 0.5	0.5 * 0.6 = 0.3

Respondent B

Shape j	**Value per cell** (P_j / C_j)	**Relative Importance Value** $V_j = (P_j / C_j) * (G_{f,B} / G)$
$j_{B,1}$	80/20 = 4	4 * 0.46 = 1.84
$j_{B,2}$	20/100 = 0.2	0.2 * 0.46 = 0.092

For each cell shared between the two shapes, such that $C_{sA,2} = C_{sB,1}$, the relative importance value of the cell is the sum of the values assigned by each fisherman whose shapes (i.e. fishing grounds) overlap in that cell.

$$O_{x,y} = \sum_{n=1}^{i} V_{x,y}$$

Where O = the sum of all Vs for any given location (cell).

So for the 20 cells in respondent B's shape $(j_{B,1})$, with a REI value of 1.84, which overlap with 20 of the 100 cells in respondent A's shape $(j_{A,2})$, with a RI value of 0.45, the aggregate value equals 2.29.

The aggregate value, O, is the share of the total fishing effort budget, $B = i * 100$, where $i = 2$ for this example, that is apportioned to $O_{x,y}$. In the case of our example, 2.29 pennies out of a total of 200 would get assigned to each of the 20 cells where there is overlap. The remaining area that comprises the rest of the fishing grounds is assigned the RI values that are calculated for each cell for each shape, $O_{x,y} = V_{x,y}$.

The result of this analysis is a weighted surface of the extent and stated importance of the fishing grounds for each fishery.

In September and October of 2005, we went back to ports in the southern and northern parts of the study region. There we met with groups of representatives of the fisheries studied, which included participants in the project as well as other knowledgeable and longtime fishermen designated by members of the Regional Stakeholder Group. We reviewed paper maps of the aggregated fishing grounds for each fishery in these groups, as well as the digital files for any participant who wanted to review and/or make changes to his or her information. Several revisions resulted from these meetings, and the final versions of the fishing grounds were used in the subsequent analysis, which we describe in the following two sections.

IV. Results and deliverables

There are two data products and one analytical product, all of which we forwarded to the MLPAI, resulting from this research to date.

The data products were conveyed to the MLPAI's geodatabase housed at UC Santa Barbara. The first was a shapefile of all fishing grounds information summarized to the 1-minute microblocks used by CDFG. This was intended for use by staff and/or stakeholders in designing marine protected area arrays, and the microblocks were chosen as a convenient spatial unit that maintains consistency with the spatial resolution of the other data layers contained in the geodatabase. Examples of how this information could be analyzed are elaborated in the next section.

The other data product was the detailed raster data of all fisheries examined at the 100m cell size, and which served as the basis for the impact analysis further described below. Both datasets were accompanied by metadata conforming to the Federal Geographic Data Committee (FGDC) standards (**http://www.fgdc.gov/standards**).

During the fall and winter 2005/2006, Ecotrust staff conducted a series of analyses of the first-order maximum potential impacts of MPA packages under consideration. The goal was to assess the relative maximum potential impacts of packages, both in terms of the area of the fishing grounds affected and the stated importance of those areas. Since our research showed that not all areas are equal, and some are more important to fisheries than others, the effects typically vary: even a small closure can have a large impact, expressed in units of stated importance. The summary of these analyses was forwarded to Blue Ribbon Task Force in March 2006, and is included in Appendix 4.

Ecotrust is committed to keeping as much information about our methods and tools used in the public domain as possible, and will make available the specific Arc Macro Language (AML) code used for interpreting and analyzing the data to researchers interested in replicating this research.

As we will discuss further in the next section, these products do not cover all that can be done with the fishing grounds information.

V. Discussion and Conclusion

There are several methodological and process lessons that are worth reflecting on, in the hope of informing future iterations or applications of this approach. We also describe some opportunities for further analysis.

V.1 Timing

Conducting detailed, fieldwork based, participatory research concurrently with a sometimes contentious policy process, is ambitious—especially when the work period coincides with the summer fishing season. Ideally, detailed information about the fishing grounds and their relative importance would be available to decision-makers prior to the beginning of a policy process. In the case of this project, the timing between the field, verification, and data compilation stages of this work and the information needs of the MLPAI's Central Coast Project process never fully aligned. For example, the data—although it was integrated into the geodatabase used in the process and could have been rendered in formats that maintained confidentiality—was not made available to stakeholders to inform the design of MPA alternatives directly, contributing to the palpable frustration of some stakeholders that they did not have desirable information at their fingertips. Similarly, time constraints and the timing of the project made expanding the sample to achieve a greater proportion of the local fleet difficult. In the future, timing can be improved considerably by making explicit arrangements to either conduct research prior to the policy process and at times more convenient for participants.

V.2 Scale

One issue of key importance in the endeavor to map the fishing grounds is that of scale. Given the paucity of data about the footprint and spatial behavior of the various fishing fleets operating in California, there was no logical choice of what scale to use for this project. We deliberately chose not to restrict respondents to a particular chart of map scale, but rather opted to let them draw the fishing grounds and the various subareas of greater importance at whatever level of detail made most sense to them. Not surprisingly, most respondents opted to draw their grounds at the scale of familiar nautical charts. Some drew large shapes indicating the relatively equal importance of large areas of the ocean, for example in the salmon fishery, while others made highly site specific and localized distinctions between the grounds and their relative importance, for example in fisheries like that for spot prawns. Based on the 108 interviews, we are now in a position to analyze the distribution of these natural shapes, allowing an inference about a best scale to use in subsequent work. This will be particularly helpful for aligning the spatial scale of research efforts such as this with the spatial scale at which policy measures, in this case MPAs, are designed. Given the concurrent nature of this work with the Central Coast Project, it was not possible to align the spatial scales, creating the perception—at least among some stakeholders—that the fishing ground information is not informative at the scale of the eventual MPA alternatives whose boundaries sometimes differ by mere feet.

Another caveat to our analysis is entailed by the geographic extent of the project. The fishing grounds used by the fleet extend farther north, south, and west than the study

region. Several respondents noted that, for example, the area between Point Arguello and Point Conception is important for many fisheries, including the Southern Fleet. Effectively, because of the delineation of our study region in congruence with the MLPAI's Central Coast Project, areas on the northern and southern boundary could not be completely analyzed. Some care would need to be taken to integrate data and analytical results from this project with subsequent characterizations of fishing grounds to the north and south.

V.3 Quality assurance and quality control

This project contains valuable lessons for improving quality assurance and control mechanisms. Two of the most important ones center on questions of confidentiality and verifying the information collected.

Confidentiality

The protocol we developed for this project conforms to human subject standards used at the University of California and elsewhere in academic research. Given the sensitive nature of fishing ground maps and the economic information they contain, at least implicitly, we took additional measures to mask individual informants, and gave the fleet control over what, if any, information they wanted to display publicly, in the Central Coast Project stakeholder meetings.

An incident involving a well-intentioned field staff is illustrative of the special nature of this information and the extra care required in working with it: wanting to illustrate the mapping protocol, she showed the anonymized shapes of a previous respondent (A) to a second respondent (B). Even though no identifying information was shared, respondent B thought he recognized the fishing grounds, and called A, who promptly called Ecotrust staff demanding an explanation. We were able to reassure A, and he opted to continue his participation in the project. Since it is not generally the case that fishermen can recognize each other's grounds, we had not foreseen this possibility, and used this incident to sharpen our protocols for field staff. Specifically, they were instructed to never use actual shapes for demonstration purposes.

Data verification

The main mechanism for verifying the data collected were individual and group meetings with respondents and others in each fleet, conducted in both Monterey and Morro Bay towards the end of the field period. This provided sometimes very detailed verification and sign-off on the extent and relative importance of the fishing grounds for each fishery. Internally, at Ecotrust, we employ several QA/QC protocols that are designed to catch inconsistencies and other problems with the data. For example, we run an automated check to make sure each respondent's shapes and weights add up to the 100 pennies. These protocols notwithstanding, there are several ideas for process improvements coming out of this project.

There was one instance of the wrong file being used for the impact analysis, a circumstance we only discovered after the fact. This involved a respondent who had previously participated in another project, and who edited his previous shapefile for this

project. We inadvertently used the file containing the edits—essentially a small number of shapes representing both additions and subtractions—rather than the previous file. We offered, and he accepted, to remove his shapes from the analysis. While this was an isolated case, in conversation with this participant, we conceptualized a mechanism for giving each respondent remote access to his or her shapefiles either through an on-line interface or by email, allowing for individual verification of data even in short timeframes. We will implement this mechanism in subsequent iterations or applications of this approach.

V.4 Improving the sample

While our approach of constructing a proportionate quota sample based on the CDFG landing statistics provided a satisfactory representation of central coast fisheries, there remain formidable challenges in ensuring all sectors are adequately represented. This is illustrated by the difficulties we had in engaging what is frequently referred to as "the Vietnamese fleet" in this project. Every mode of contacting this subset, which constituted 12% of our sample population and represents considerable fishing expertise and success on the central coast, failed. We tried several modes:

- We had the project description and consent form translated in Vietnam, by people working on coastal management issues (see Appendix 3);
- A native speaker on contract contacted all fishermen in the sample by phone, with very limited success. Typically phone calls, if answered at all, would go unreturned, or messages left with family members were apparently disregarded;
- We worked with a fish buyer who has business relations with a large segment of the fleet, explained the purpose of the project, and asked him to relay this information to the fishermen he buys from; we also posted the project information on his dock, and attempted to talk to fishermen at the receiving dock, to no avail;
- Made contact with the president of the Vietnamese Buddhist Association in Monterey, explained the importance of project and the need to represent the Vietnamese fleet; left Vietnamese documents with her to post at temple and to send to fishermen, garnering very little response: the one fisherman whose number she provided in the hopes that he would make referrals to additional fishermen did not respond to repeated calls; her overall assessment was that they would not participate, partially due to the time period, and because it would require a long time to persuade them to participate; and
- An employee of the Monterey Bay Aquarium contacted several fishermen he knows in the community but they did not want to participate.

The experience with the Vietnamese fleet in this project illustrates the need for a concerted effort to reach out to various language and cultural groups that participate in California fisheries, to ensure their effective participation—whether in research projects such as this or in policy processes such as the MLPAI.

V.6 Further analysis

To date, the information provided by the fishermen participating in this project was used to estimate the first order maximum potential impacts of a suite of MPA alternatives. The focus on averages in that analysis masks the sometimes considerable effects on individual fleets or fishermen. While the policy process can use these estimates and other information for coming to a decision on which alternative to implement, we would like to conclude this report with a discussion of the kinds of additional questions that can be answered with the data collected in this project. When linked with CDFG landing statistics, for example, it is possible to identify particular fishermen who would be affected in a particular area, yielding insights into any disproportionate effects on particular people or fleets.

The following two figures contain examples of additional analyses that would likely be of interest to decision-makers and stakeholders involved in the MLPA process. Figure 1 shows the number of fisheries present in any one ocean area, summarized to the microblock level. The darker the color, the greater is the number of fisheries that take place in a block. Not surprisingly, nearshore waters are utilized by more fisheries, but there is some variegation. This is not to suggest that all areas are equally important to all fisheries that take place there. Rather, this sort of analysis provides a count of the number of fisheries likely to be affected by a management measure, and can be combined with counts of other user groups. Again, this information can be summarized at smaller spatial scales, too, essentially allowing a user of the database to determine how many fisheries occur in any one area under consideration.

Figure 2 summarizes some of the information about the relative importance of different ocean areas. So as not to compromise confidentiality regarding the "hot spots" of any particular fishery, we show here all the areas that scored in the top 20% of importance for a fishery, again summarized to the microblock level. The darker the color, the more fisheries a particular block is most important to. A large part of the study region is most important to at least 1-2 fisheries, but there are clearly some areas that are very important to several fisheries studied. It stands to reason that stakeholders would want to examine those areas with extra care.

There are many more analyses possible using the data collected in this project. The 108 interviews with fishermen yielded a very rich and deep data set about the fishing grounds, which we hope will continue to inform the MLPA process as it unfolds in the Central Coast Project region and beyond.

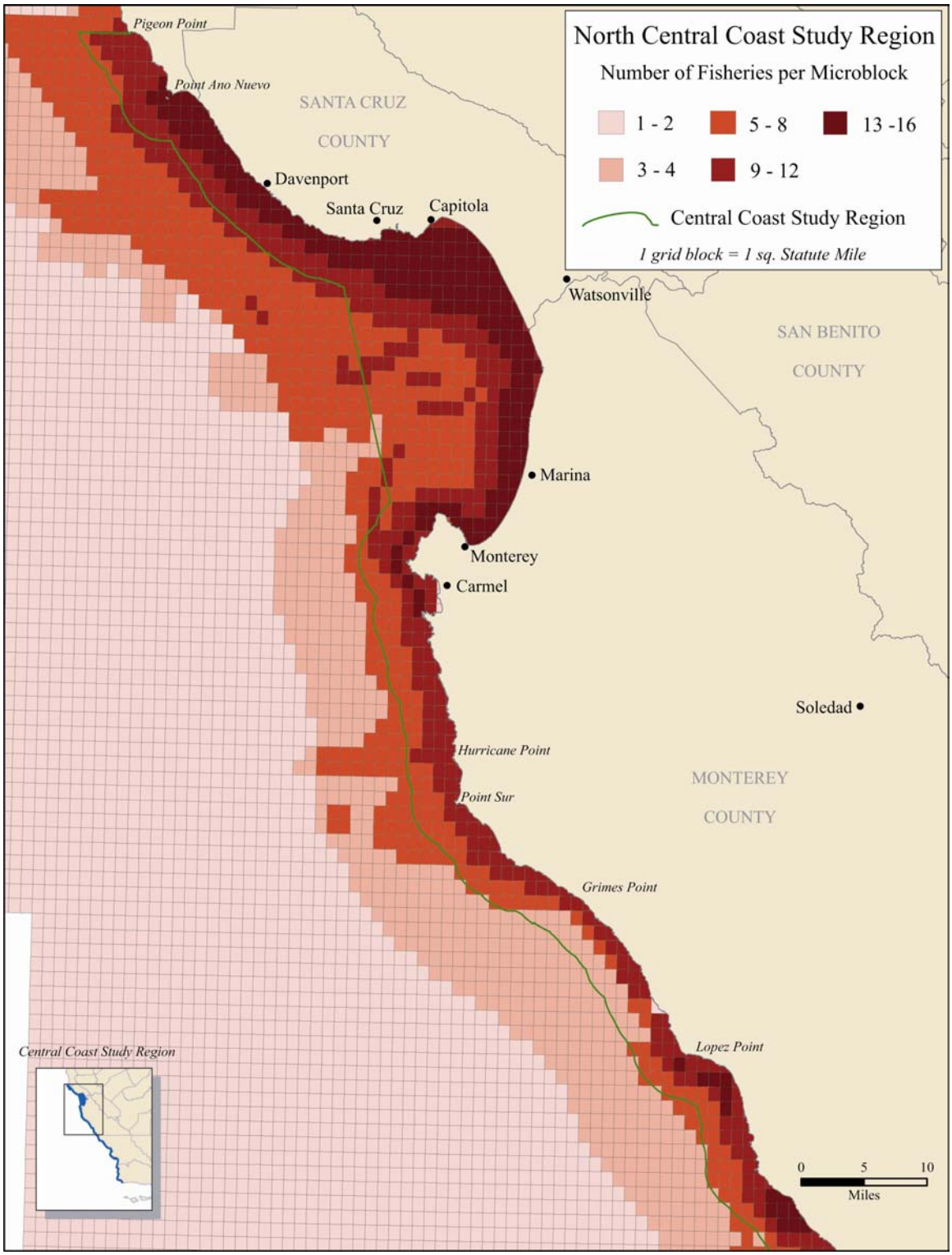

Figure 1a Number of fisheries per unit area (microblocks) in the Northern part of the study region

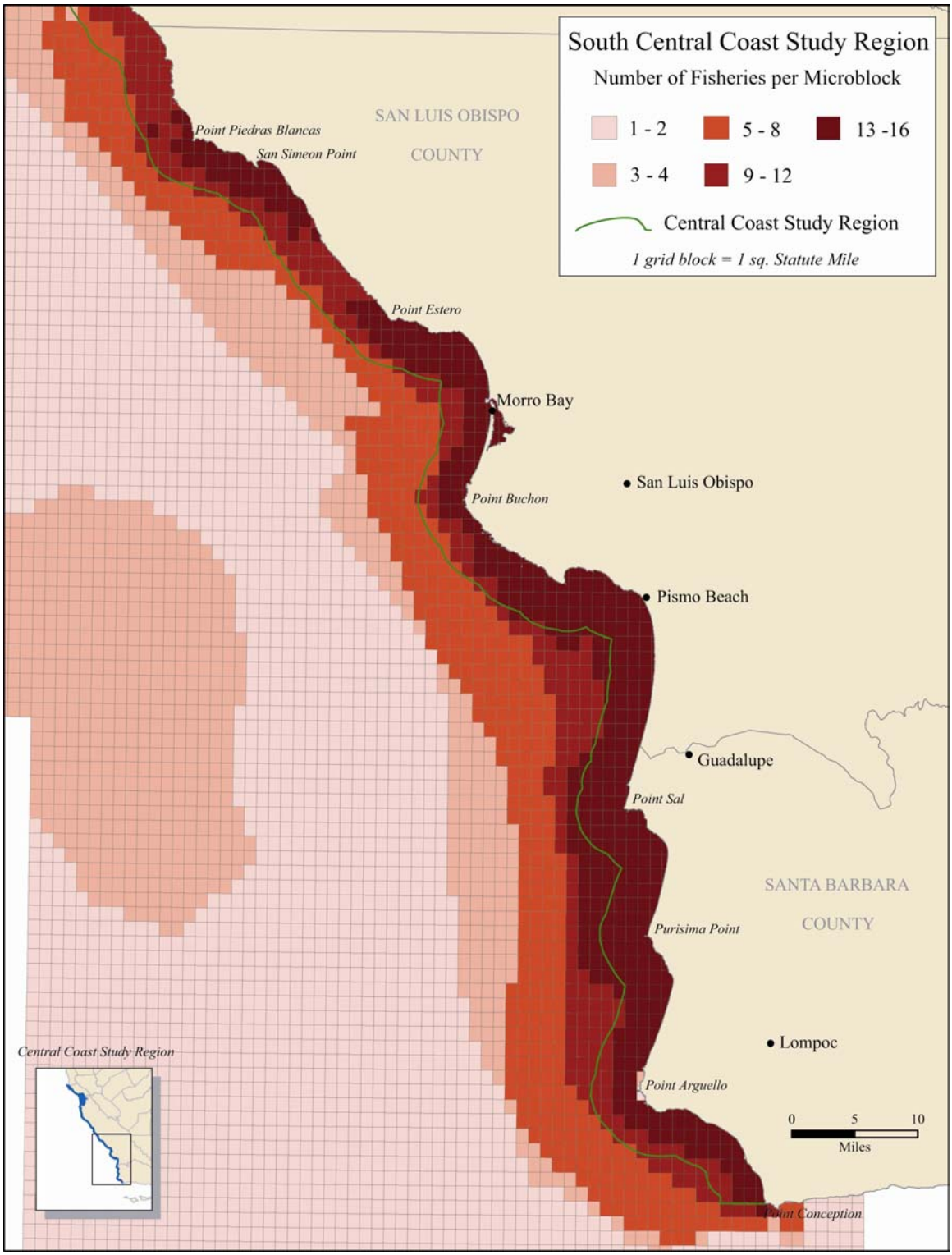

Figure 1b Number of fisheries per unit area (microblocks) in the Southern part of the study region

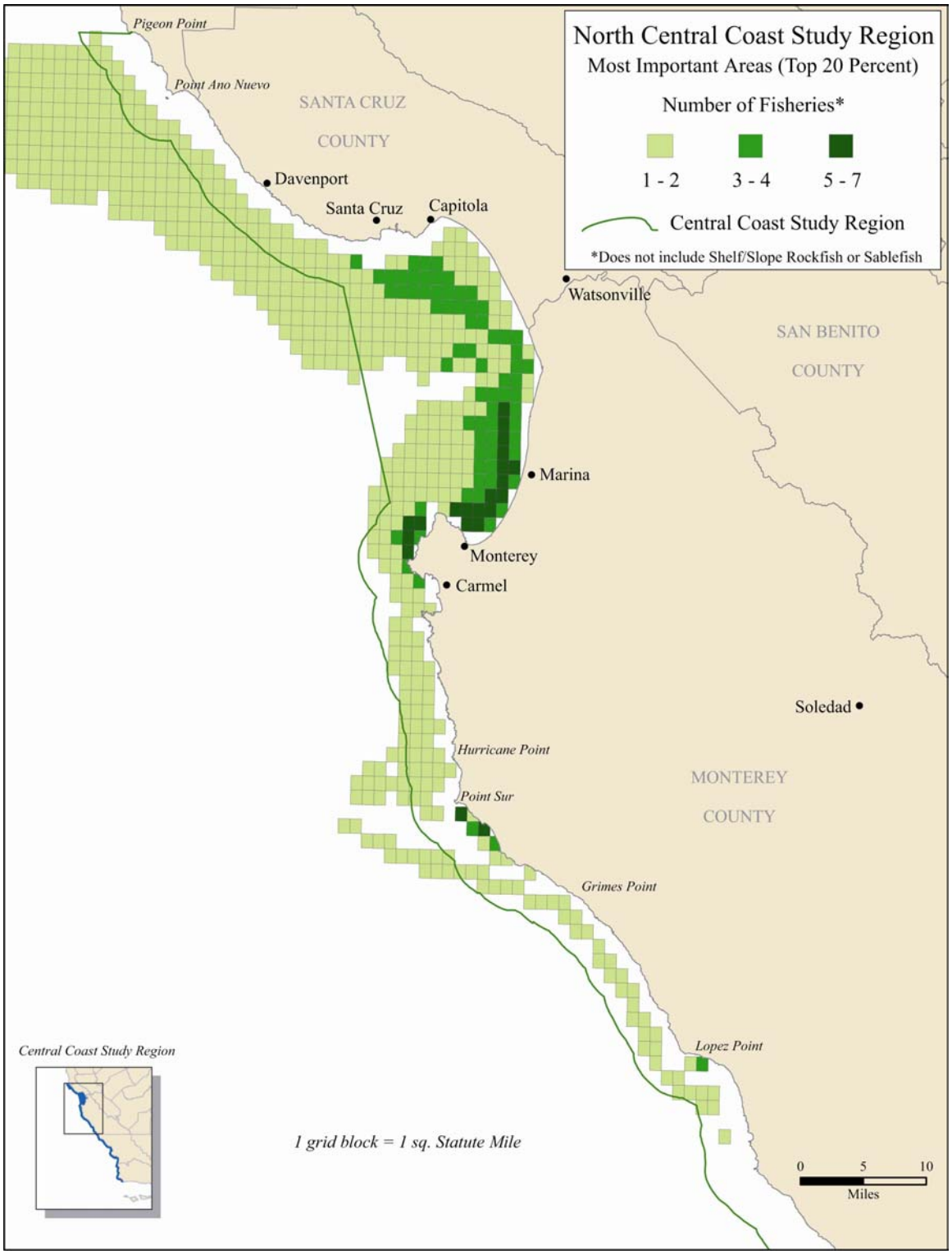

Figure 2a Most important areas (top 20% of stated importance) by number of fisheries in the Northern part of the study region

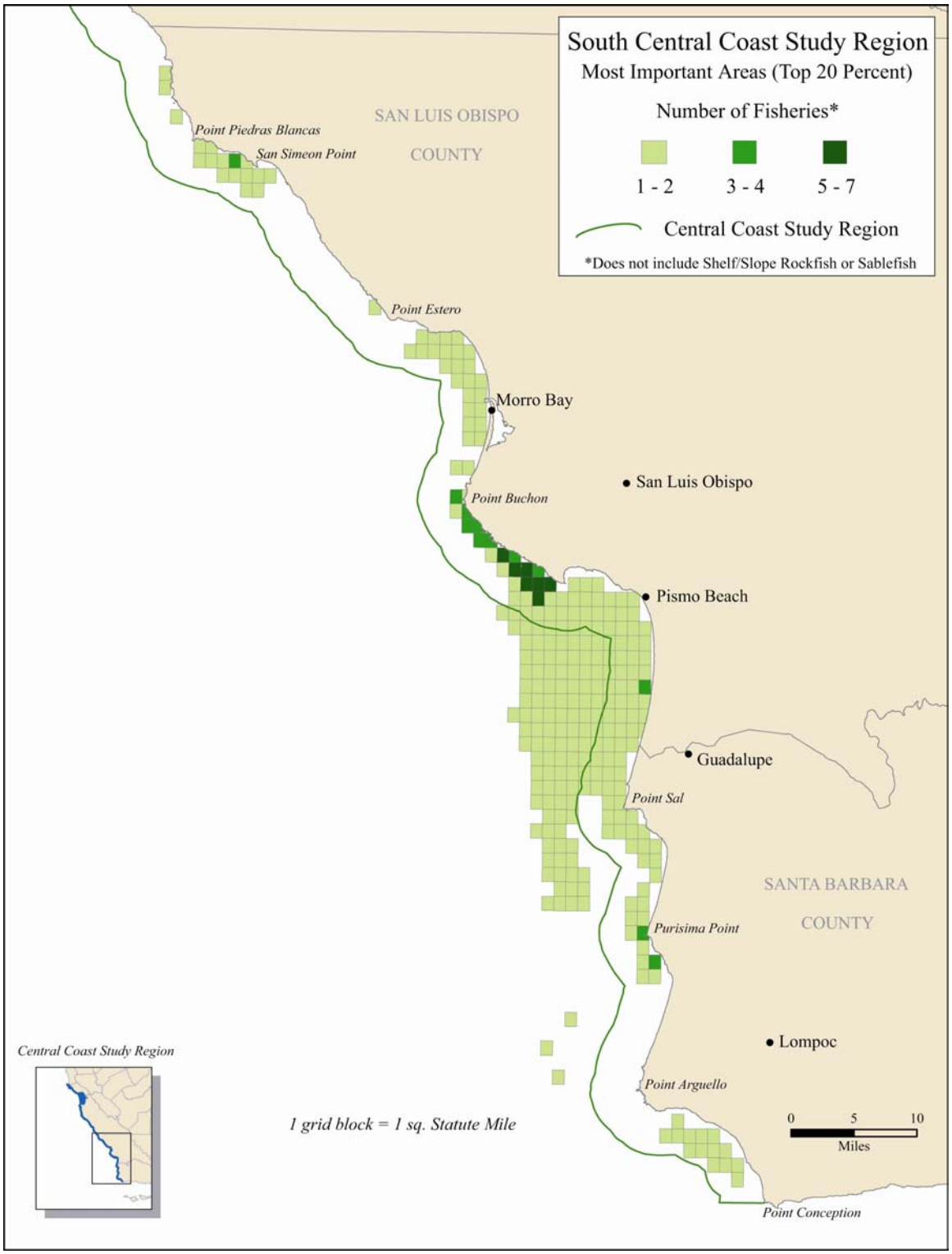

Figure 2b Most important areas (top 20% of stated importance) by number of fisheries in the Southern part of the study region

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VII. Appendices

1. Scope of work
2. English language consent form
3. Vietnamese language consent form
4. Final Executive Summary of impact analyses conducted, forwarded to the Blue Ribbon Task Force in March 2006, as an example of analyses of proposed packages of MPAs in the Central Coast.

EXHIBIT A

SCOPE OF WORK

ACCORDING TO THE SEPARATE MEMORANDUM OF UNDERSTANDING ("MOU") BETWEEN THE RESOURCES AGENCY ("AGENCY"), THE DEPARTMENT OF FISH AND GAME ("DEPARTMENT") AND RESOURCES LEGACY FUND FOUNDATION ("RLFF"), RLFF HAS AGREED TO FUND PROFESSIONAL SERVICES FOR FISHERY DATA COLLECTION AND ANALYSIS FOR THE MARINE LIFE PROTECTION ACT (MLPA) INITIATIVE, A PUBLIC-PRIVATE PARTNERSHIP BETWEEN THE AGENCY, THE DEPARTMENT, AND RLFF.

Professional Services and Deliverables

- Identify and collect data using OceanMap through local and knowledge interviews
    - Consult with MLPA science team and Monterey Bay National Marine Sanctuary staff to identify fisheries to assess in the central coast region
    - Define sample population within each fishery and use California Department of Fish and Game data to target fishermen to represent each fleet
    - Set up interviews with fishermen
    - Deploy three teams into the field to collect data

- Analyze data collected through local knowledge interviews using existing socioeconomic information (landing receipts and logbooks, etc.); design a shared database structure that will house this data and other pertinent data sets
    - Develop an automated approach for incorporating new data gathered through OceanMap
    - Provide analysis of data generated from interviews with other socioeconomic information derived from landing receipts and logbooks
    - Develop documentation and quality assurance protocols for analyzing data with existing confidential datasets (landing receipts and logbooks)
    - Design a shared database (clearinghouse) to consolidate data with the upload and download capability to capture local knowledge. Database to be housed on the servers at the University of California at Santa Barbara
    - Identify, integrate and document additional data layers with input from MLPA Science Advisory Team GIS subcommittee and Resources Agency GIS departments

- Copies of the final drafts of deliverables, delivered to RLFF and the Central Coast MLPA Program Manager, with the final invoice at the end of the Professional Services Period, or, if there are no deliverables, a summary of services provided.

Expenses

The total amount for all reimbursable expenses is not to exceed the amount specified in paragraph 4 of the Agreement.

Reimbursable expenses include reasonable costs for travel from contractor's principal place of business, meals and incidentals, lodging, printing/copying (if required), and other reasonable costs with appropriate documentation.

Key Staff

- **Michael Mertens**
- **Sarah Klain**
- **Aaron Racicot**
- **Charles Steinback**

Point of Contact

Contractor will work at the direction of the MLPA Initiative Central Coast MLPA Manager for matters pertaining to services and work products. For matters pertaining to compensation and reimbursement associated with this contract, Contractor will report to California Coastal and Marine Initiative (CCMI) Program Analyst Robin Jenkins at (916) 442-4880 or rjenkins@resourceslawgroup.com.

ecotrust

The Marine Life Protection Act (MLPA) is a state law directing the California Department of Fish and Game (CDFG) to design and manage an improved network of marine protected areas off California's coast. To implement this law, a public-private partnership has been formed between the California Resources Agency, CDFG, and Resources Legacy Fund Foundation—the MLPA Initiative. As part of this effort, Ecotrust has been retained to collect, compile and analyze socioeconomic information pertaining to commercial fisheries on the central coast. The project is designed to provide spatially explicit socioeconomic information for both the MLPA Initiative and the Monterey Bay National Marine Sanctuary (MBNMS).

The goal of the Fisheries Uses and Values Project is to compile a comprehensive picture of the commercial fishing use patterns along the central California coast, using the expert knowledge of fishermen themselves. The purpose of this project is threefold:

1. Incorporate commercial fishermen's knowledge into the deliberations of the Regional Stakeholder Group in the MLPA Central Coast Study Region and of the MBNMS Marine Protected Areas Working Group;
2. Use this information to improve on the spatial resolution and accuracy of CDFG landings and logbook data; and
3. Develop accurate maps of the local fishing grounds and their economic importance to the local fleets.

This kind of spatially explicit information on commercial fisheries and their value can ensure representation of socioeconomic values in the design, implementation and management of marine protected areas.

During the summer months of 2005 (June through August) Ecotrust personnel will interview approximately 100 fishermen along the central coast. Fishermen will be selected based on CDFG data and recommendations by the Regional Stakeholder Group. The sample is designed to capture the majority of landings in 10-12 of the most significant regional fisheries, as well as the depth of expertise of longtime and successful fishermen.

Results from this project will be made available to CDFG and MBNMS for use in the context of the MLPA Initiative and the discussion, implementation, and management of marine protected areas in state and federal waters off California—specifically the Central Coast Regional Stakeholder Group and the Sanctuary's MPA Working Group.

Ecotrust personnel will contact fishermen directly, and arrange for interviews with contracted staff based in Santa Cruz, Monterey, Morro Bay and Santa Barbara. The format includes one-on-one or small group interviews, with follow-up meetings by fishery and/or gear group. Due to the sensitive nature of commercial fishing information, only Ecotrust staff (operating under a strict confidentiality protocol) will handle the raw data generated during the interviews. All information collected in the interviews is anonymous and confidential on the individual level. All analyses and results will be presented in aggregate form, and will be reviewed in aggregate form by participating fishermen from each fishery. The information will be used to create a comprehensive picture of the commercial fishing use patterns and values along California's central coast, and may also be written up in a peer-reviewed journal. As a participant, you agree to let your information be used in this manner.

Your willingness to participate is appreciated. If you have any questions or concerns, please contact Ecotrust at 1-866-872-1333, or fish@ecotrust.org, or Paul Reilly of CDFG at 831.649.2879, preilly@dfg.ca.gov

If you agree to participate under the conditions described above, please print and sign your name.

Participant's name _____ Signature _____

Field Staff signature _____ Date _____

Appendix 2 – English language consent form

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Luật bảo vệ Tài nguyên biển (MLPA) là luật của bang liên quan trực tiếp đến cơ quan nghề cá và vui chơi giải trí của bang California (CDFG) được soạn thảo ra để quản lý và hoàn thiện hệ thống quản lý các khu bảo tồn ở khu vực biển của California. Để thực hiện được luật này, một sự hợp tác giữa cá nhân và cộng đồng đã được hình thành giữa California Recourse Agency; CDFG và Resource Legacy Fund Foundation với MLPA Initiative. Một phần của nỗ lực này, Ecotrust đã được thuê để thu thập, tập trung và phân tích những thông tin kinh tế xã hội đi đôi với thông tin nghề cá thương mại ở vùng bờ chủ yếu. Dự án đưa ra không gian rõ ràng thông tin KTXH cho cả MLPA Initiative và Khu bảo tồn biển (KBTB) Monterey Bay National Marine Sanctuary (NBNMS).

Mục tiêu của Dự án Sử dụng và Giá trị Thuỷ sản là để hoàn thiện một bức tranh toàn diện về việc nghề cá thương mại điển hình ở vùng đánh bắt chủ yếu của biển California, qua việc sử dụng những kiến thức của các chuyên gia và những ngư dân. Muc đích của dự án tập trung vào 3 điểm sau:

1. Kết hợp chặt chẽ hiểu biết của ngư dân nghề cá thương mại vào những cân nhắc, suy tính của Nhóm các bên liên quan trong khu vực của MLPA khu vực vùng bờ nghiên cứu chủ yếu (central coast study region) và MBNMS nhóm làm việc của KBTB.
2. Sử dụng những thông tin này để hoàn thiện về nghị quyết không gian (on the spatial resolution) và sự chính xác của khu vực CDFG (CDFG landings) và thông tin số liệu của nhật ký hàng hải; và
3. Xây dựng bản đồ phù hợp của những ngư trường và những ngư cụ đánh cá kinh tế quan trọng của địa phương

Loại thông tin không gian rõ ràng này về đánh cá thương mại và những giá trị của nó có thể đảm bảo sự có mặt của những giá trị KTXH, việc thực hiện và quản lý KBTB.

Trong mùa hè 2005 (tháng 6 đến tháng 8) nhân viên của Ecotrust sẽ phỏng vấn khoảng 100 ngư dân ở khu vực dựa vào dữ liệu CDFG và được giới thiệu đến nhóm các bên liên quan khu vực. Phỏng vấn dựa vào việc đánh giá đồng cấp (peer reviewed), dựa vào phương pháp khoa học xã hội để thu thập các hiểu biết của dân địa phương. Mẫu được thiết kế để thu được thông tin của 10-12 cảng cá chính của những vùng có nghề cá quan trọng, cũng như chuyên môn sâu trong của ngư dân thành công và trong thời gian dài.

Nhân viên của Ecotrust sẽ liên lạc trực tiếp với các ngư dân, và sắp xếp các cuộc phỏng vấn với các nhân viên tại Santa Crus, Monteray; Morro Bay và Santa Barbara. Form phỏng vấn bao gồm cho từng người một hoặc cho một nhóm phỏng vấn. Cùng với các cuộc họp tiếp theo về nghề cá và nhóm ngư cụ mà những thông tin thu thập được sẽ được công nhận (phê chuẩn) bởi ngư dân. Do sự nhậy cảm của các thông tin nghề cá thương mại, chỉ nhân viên Ecotrust (được hoạt động dưới một điều lệ nghiêm ngặt) sẽ sử dụng những số liệu phỏng vấn này. Tất cả các thông tin thu thập được trong quá trình phỏng vấn giấu tên và bí mật ở mức độ cá nhân. Tất cả các phân tích và kết quả sẽ được xem xét đánh giá bởi những ngư dân tham gia. Thông tin sẽ được sử dụng để thể hiện một bức tranh toàn diện về hình mẫu và giá trị nghề cá thương mại của California Central coast, và cũng có thể được đăng vào những Tạp chí đánh giá đồng cấp (peer reviewed). Như một người tham gia, bạn đồng ý để thông tin của bạn được sử dụng cho mục đích này.

Sự sẵn lòng trả lời các câu hỏi của bạn thật quý giá, Nếu bạn muốn biết thêm thông tin hoặc có câu hỏi gì hãy liên lạc với chúng tôi theo số: 1-866-872-1333; fish@ecotrust.org; hoặc Paul Reilly of CDFG at 831.649.2879 (preilly@dfg.ca.gov)

Nếu bạn đồng ý tham gia v ới điều kiện nêu trên, hãy ghi danh và ký tên dưới đây.

Tên người tham gia_____ K ý t ên

Chữ ký của nhân viên thực địa _____ Ngày

Appendix 3 – Vietnamese language consent form

Summary of potential impacts of the February '06 MPA packages on commercial and recreational fisheries in the Central Coast Study Region

Final version, revised 8 March 2006

Astrid Scholz, ajscholz@ecotrust.org, Charles Steinback, and Mike Mertens

Introduction

The following data sets were used in the analysis of relative effects of the MPA packages on commercial and recreational fisheries that are conducted in the waters in the Central Coast Study Region:

- For the commercial fishery, we used data layers characterizing the spatial extent and relative stated importance of fishing grounds of 19 commercial fisheries in the Central Coast Study Area (SA) previously transmitted by Ecotrust to the Marine Life Protection Act Initiative (MLPAI) under the terms of contract agreement No. 2005-0067.[2] This information was collected during interviews in the summer of 2005, using a stratified, representative sample of 100+ fishermen whose individual responses about the relative importance of ocean areas for each fishery were standardized using a 100-point scale and normalized to the reported fishing grounds for each fishery;

- For the recreational fishery, we used recreational private and rental boat fishing effort data from the California Recreational Fisheries Survey (CRFS) 2004 and made available to Ecotrust by the California Department of Fish and Game (CDFG). This information consists of observed number of angler trips per mircoblock, and is grouped for trips for particular species. Of those, we analyzed the trips for rockfish and salmon in order to characterize two of the most important recreational fisheries in the study area. Similar survey data for Commercial Passenger Fishing Vessels (CPFV) were not available in time for this analysis.

Overview of fisheries considered in the analysis

The commercial fisheries considered in this analysis are of varying importance in terms of ex vessel revenues. Table 1 below lists the species or groups considered and their share of Central Coast Study Region commercial fishing revenues, using the 6-year average of nominal ex vessel revenues between 1999 and 2004. In most cases, the same fisheries account for substantially different proportions of statewide landings. For example, Dungeness crab accounts for only 1.66% of CCRS landings (by ex vessel revenue), but 17.33% of state totals.

Interestingly, private and rental boat fishing for both rockfish and salmon account for double the percentage of all trips in the Central Coast Study Region (22% and 50%, respectively) than trips for the same species statewide (10% and 23%). Corresponding data for the charter boat fleet were not available at the time of this analysis. In general, however, CPFV trips consist of several times the number of anglers as private and rental boat trips.

[2] Scholz et al., forthcoming, "Commercial fishing grounds and their relative importance off the Central Coast of California", Final report on contract No. 2005-0067.

Table 1 – Summary of fisheries considered in the analysis

Commercial			Recreational		
Species or group	*% of CCSR fisheries revenues, 6-year average (1999-2004)*	*% of CA statewide fisheries revenues,6-year average (1999-2004)*	*Species or group*	*% of CCSR observed private and rental boat recreational angler trips [No. of total trips: 84,000]*	*% of CA statewide [No. of total trips: 663,000]*
Anchovy	2.17%	0.65%	n/a	n/a	n/a
Cabezon	2.73%	0.59%	n/a	n/a	n/a
Dungeness crab	1.66%	17.33%	n/a	n/a	n/a
Halibut	1.95%	2.24%	n/a	n/a	n/a
Kelp Greenling	0.25%	0.08%	n/a	n/a	n/a
Lingcod	0.33%	0.17%	n/a	n/a	n/a
Mackerel	0.13%	1.10%	n/a	n/a	n/a
Deep Nearshore Rockfish	4.83%	1.24%	Rockfish	22%	10%
Rockfish Nearshore					
Rockfish Shelf	0.87%	0.72%			
Rockfish Slope	1.63%	0.48%			
Rock Crab	0.78%	1.03%	n/a	n/a	n/a
Salmon	12.57%	8.08%	Salmon	50%	23%
Sardine	7.19%	3.95%	n/a	n/a	n/a
Sablefish	5.53%	3.40%	n/a	n/a	n/a
White Seabass	0.47%	0.47%	n/a	n/a	n/a
Surfperch	0.20%	0.09%	n/a	n/a	n/a
Spot Prawn	7.38%	2.25%	n/a	n/a	n/a
Squid	24.49%	18.81%	n/a	n/a	n/a

Approach

The five MPA network proposals under review (Packages 1, 2, 3, AC and S) vary according to their spatial extent and the commercial and recreational fishing uses they affect. Specifically, they vary by the number and types of fisheries permitted within the boundaries of particular MPAs within a network. Furthermore, study area (SA) fisheries themselves vary in spatial extent and frequently overlap. Most of them are conducted in fishing grounds that extend beyond the state waters of the CCSR, and we report the effects both in terms of total fishing grounds (G) and those that fall within the study area. Since any one MPA may have different effects on different uses, and different uses may be affected differently by all MPAs, it is therefore necessary to consider single MPAs and single fishery uses independently. Note that Package 0, the "no action" alternative of existing MPAs, has no differential effect on fisheries and was therefore not evaluated. Similarly, since current fishery closures such as the Rockfish Closure Area affect all proposals equally, they have no differential effect.

We conducted an overlay of each MPA with each potential use. MPAs were grouped according to level of protection, using the same levels of protection as elsewhere in the Science Advisory Team (SAT)

evaluations and as described in the January 10th draft of the "Rationale for SAT categorization of MPAs by relative levels of protection" (ProtectionLevels_draft_10Jan06.doc), but uses were considered individually. In other words, for each MPA and protection level within each package, we assessed the fishery uses that would be affected.

We quantified the first order maximum effects of proposed MPAs on both commercial and recreational fishing, analyzing the percent of total fishing grounds for any one fishery included in a given MPA. This is a first-order, "worst case" analysis that is silent on the eventual behavioral response. In other words, the analysis assumed that all fishing in an area affected by an MPA would be lost completely, when in reality it is more likely that effort would shift to areas outside the MPA. There are, however, currently no data available to support an analysis of such an adaptive response.

We compiled results in a series of spreadsheets transmitted to the MPLAI and Science Advisory Team, summarizing the effects of the various MPA packages on commercial and recreational fisheries both in terms of the area affected and the relative value lost. For the purposes of this analysis, "value" was measured not in terms of Dollars, but using two proxies: 1) an index of relative, stated importance derived from interviews with fishermen in the case of the commercial fisheries, and 2) number of observed private and rental boat trips to a microblock in the case of the recreational fisheries.

For this first order evaluation, we assumed that all fishing in an area intersected by MPAs and fishing grounds would be affected. Where an MPA straddled a reporting block in the recreational data, we apportioned the number of trips associated with that block proportional to the area overlap. In the case of the commercial fisheries, data are at a sufficient spatial resolution to allow for direct summation. It is important to note that the analysis specifically does not constitute an economic impact analysis, nor account for behavioral responses such as shifts in fishing effort to other areas.

The percent of area and value affected was calculated based on the grounds identified within the Central Coast region, not for the whole state

Assessing MPA packages

The percent change in area and value for each of the commercial fisheries were determined by the intersection of each MPA package and the fishing grounds specific to that use. Each MPA within a package was classified by whether it would affect the fishery or not. If a fishery was affected by an MPA, the area and value were summarized and then divided by the total area and value for the entire fishing grounds (G), as derived from interviews with fishermen, and the total study area (SA).

The total percent of the area and value affected for both the total fishing grounds and the grounds inside the study area was then summarized for all MPAs that affected each fishery per package. Packages vary considerably in their effects, both between and across fisheries, as the following table illustrates for commercial fisheries. Packages 1, 2 and 3 are based on the proponents' February 9th revisions. No revisions were made to the December 15th version of Package AC, and Package S is based on the draft of February 22, 2006.

Table 2 – Summary of effects on commercial fisheries

	Package 1	Package 2	Package 3	Package AC	Package S
Area of total fishing grounds affected					
Anchovy	4.39%	7.98%	6.01%	10.62%	4.35%
Cabezon	13.27%	16.96%	14.95%	24.31%	15.82%
Dungeness crab	3.38%	7.09%	6.75%	11.77%	7.06%
Deep Nearshore Rockfish	13.02%	16.54%	14.97%	23.86%	16.46%
Halibut	9.08%	10.09%	9.50%	18.04%	9.99%
Kelp Greenling	12.33%	17.74%	16.16%	23.82%	17.43%
Lingcod	12.61%	18.44%	16.31%	23.45%	17.40%
Mackerel	6.66%	12.30%	9.41%	16.64%	6.96%
Rockfish Nearshore	11.92%	15.39%	13.70%	23.72%	14.38%
Rockfish Shelf	5.18%	13.21%	16.13%	29.16%	11.53%
Rockfish Slope	0.64%	1.10%	0.97%	6.96%	0.96%
Rock Crab	4.79%	6.63%	6.10%	9.57%	6.23%
Salmon	0.44%	1.05%	0.91%	1.47%	0.80%
Sardine	4.38%	7.91%	5.16%	10.55%	4.30%
Sablefish	0.86%	2.26%	2.26%	2.94%	2.30%
White seabass	9.47%	7.84%	8.36%	16.56%	8.50%
Surfperch	8.07%	16.77%	22.78%	15.18%	15.65%
Spot Prawn	0.87%	2.50%	2.88%	3.70%	2.88%
Squid	6.82%	10.89%	9.76%	15.65%	9.92%
Area of fishing grounds within the study area affected					
Anchovy	10.14%	18.40%	13.88%	24.55%	9.99%
Cabezon	15.11%	19.31%	17.05%	27.73%	18.05%
Dungeness crab	6.96%	14.57%	13.87%	24.18%	14.51%
Deep Nearshore Rockfish	14.39%	18.26%	16.54%	26.39%	18.20%
Halibut	11.07%	12.30%	11.59%	21.98%	12.18%
Kelp Greenling	12.74%	18.35%	16.73%	24.61%	18.03%
Lingcod	13.32%	19.53%	17.25%	24.85%	18.38%
Mackerel	9.49%	17.58%	13.44%	23.82%	9.97%
Rockfish Nearshore	13.73%	17.70%	15.73%	27.23%	16.55%
Rockfish Shelf	5.67%	14.48%	17.68%	31.97%	12.64%
Rockfish Slope	14.33%	24.76%	21.87%	32.49%	21.64%
Rock Crab	11.28%	15.59%	14.38%	22.49%	14.63%
Salmon	6.07%	13.82%	11.85%	19.26%	10.71%
Sardine	10.14%	18.40%	11.98%	24.55%	9.99%
Sablefish	8.05%	21.22%	21.22%	27.58%	21.61%
White seabass	11.56%	9.58%	10.22%	20.24%	10.36%
Surfperch	8.07%	16.79%	22.78%	15.18%	15.65%
Spot Prawn	6.49%	18.36%	21.17%	27.08%	21.12%
Squid	9.00%	14.37%	12.88%	20.64%	13.08%

	Package 1	Package 2	Package 3	Package AC	Package S
Value of total fishing grounds affected					
Anchovy	3.65%	6.97%	5.26%	10.46%	4.16%
Cabezon	14.42%	27.34%	21.85%	32.02%	24.58%
Dungeness crab	1.92%	5.50%	5.78%	12.33%	5.61%
Deep Nearshore Rockfish	15.78%	21.81%	17.54%	35.65%	20.59%
Halibut	5.92%	9.24%	9.66%	12.59%	8.24%
Kelp Greenling	12.95%	23.60%	18.44%	30.44%	21.36%
Lingcod	12.87%	25.15%	21.30%	33.44%	23.39%
Mackerel	4.52%	8.72%	6.83%	12.94%	5.99%
Rockfish Nearshore	13.82%	24.78%	20.83%	32.74%	23.24%
Rockfish Shelf	6.99%	11.86%	15.33%	26.30%	10.57%
Rockfish Slope	0.64%	1.10%	0.97%	6.96%	0.96%
Rock Crab	5.79%	6.42%	6.78%	10.99%	6.27%
Salmon	0.77%	2.31%	1.89%	3.57%	1.53%
Sardine	3.45%	7.30%	4.57%	10.60%	4.14%
Sablefish	0.90%	3.09%	3.09%	4.15%	3.14%
White seabass	8.21%	7.38%	7.92%	11.59%	7.15%
Surfperch	2.73%	5.06%	9.41%	5.94%	4.72%
Spot Prawn	1.97%	4.19%	5.30%	8.37%	5.22%
Squid	5.87%	9.49%	7.34%	17.77%	9.10%
Value of fishing grounds within the study area affected					
Anchovy	5.72%	10.89%	8.24%	16.35%	6.51%
Cabezon	14.64%	27.72%	22.15%	32.47%	24.95%
Dungeness crab	4.50%	12.83%	13.52%	28.79%	13.10%
Deep Nearshore Rockfish	16.49%	22.82%	18.39%	37.37%	21.55%
Halibut	6.44%	10.00%	10.49%	13.68%	8.96%
Kelp Greenling	13.12%	23.91%	18.66%	30.83%	21.64%
Lingcod	13.11%	25.58%	21.68%	34.02%	23.79%
Mackerel	5.36%	10.28%	8.09%	15.30%	7.10%
Rockfish Nearshore	14.30%	25.65%	21.56%	33.91%	24.07%
Rockfish Shelf	7.46%	12.67%	16.37%	28.07%	11.28%
Rockfish Slope	14.33%	24.76%	21.87%	32.49%	21.64%
Rock Crab	11.99%	13.29%	14.07%	22.69%	12.96%
Salmon	3.42%	10.30%	8.49%	15.85%	6.84%
Sardine	5.24%	11.08%	6.94%	16.07%	6.26%
Sablefish	6.83%	23.30%	23.30%	31.41%	23.71%
White seabass	9.11%	8.16%	8.78%	12.82%	7.93%
Surfperch	2.73%	5.06%	9.41%	5.94%	4.72%
Spot Prawn	7.28%	15.48%	19.53%	30.82%	19.26%
Squid	6.27%	10.13%	7.83%	18.91%	9.70%

For example, package 1 has lesser effects (both in area and value) on fisheries such as squid and spot prawn than on, say, Kelp greenling. Illustrating another set of effects, package 3 affects 10% of the total fishing grounds for halibut, but 12% when considering those that fall into the (nearer to shore) study area waters. In this case, the effects on fishing area and importance are almost identical, with 10% and 11% of stated importance affected, respectively. In addition, from Table 1, the halibut fishery constitutes

a little under 2% of study area commercial fisheries. In some cases, for example, Deep nearshore rockfish, alternatives can have markedly different effects on area and relative "value". For example, package AC affects 26% of the study area fishing grounds for Deep nearshore rockfish, but well over 1/3, 37%, of stated importance.

Table 3 summarizes the effects on recreational fisheries. The estimated effect on trip numbers is an upper boundary, since a trip may be counted twice in the data when it covered more than one microblock. Furthermore, the analysis assumes that all trips to a block would be lost.

Table 3 – Summary of effects on private and rental boat recreational fisheries

	Package 1	**Package 2**	**Package 3**	**Package AC**	**Package S**
Recreational Salmon Area affected statute miles^2	0.05	9.68	3.72	7.08	4.51
Maximum Number of Salmon Trips affected	4	79	69	39	30
Recreational Rockfish Area affected statute miles^2	17.58	43.52	49.26	49.26	37.88
Maximum Number of Rockfish Trips affected	269	487	479	479	351

Results in terms of the percent area of the fishing grounds affected to follow.

Summary of results from the analysis of fisheries effects

There are several patterns that emerge from the analysis of the four MPA packages:

- Compared to the previous versions, packages 1, 2, and 3 are converging in terms of economic impacts: Package 1 now has 41% greater economic impacts, while Packages 2 and 3 now have 13% and 4%, respectively, lesser impacts on commercial fisheries—both in terms of grounds and relative value (stated importance) in the study area;
- All packages affect the 19 commercial fisheries differently, with the smallest effects in terms of both value and area affected generally evidenced in Package 1;
- In the commercial fishery, for 16 out of the 19 species investigated, Package 1 has the least effects on area and Package AC the most, Packages S and 3 lie between Packages 1 and 2 in 12 of the 19 fisheries;
- There are some deviations from this pattern in terms of the relative value of the affected areas, i.e., larger areas affected do not always correspond to higher stated importance;
- In the commercial fishery, for 18 out of the 19 species investigated, Package 1 has the least effects on the relative value and Package AC the most, Packages S and 3 lie between 1 and 2 in 11 of the 19 fisheries;
- Package S, has the least impact on area for 2 of the fisheries, anchovy and white seabass, with comparable impacts to Package 1 for 8 of the fisheries, (anchovy, halibut, mackerel, salmon, sardine, white seabass, and squid);
- Package S, has less than 10% impact on the stated importance within the study area for 8 of the 19 commercial fisheries, compared to 12 for Package 1, 7 for Package 3, 2 for Package 2 (5 additional fisheries for Package 2 are between 10% - 11%), and 1 for Package AC.
- Packages have similar effects on the two recreational fisheries considered, with the package that affects the smallest area of grounds being the one that affects the least number of trips;
- Package 1, followed by Package S, affects the least amount of recreational fishing area and trips for both salmon and rockfish, with Package 2 having the largest effect on the recreational

fishing area and number of trips for salmon, while Packages AC and 3 have the largest effect on the recreational fishing area and number of trips for rockfish.

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MLPA Initiative - Central Coast Study Region

Fisheries Uses and Values Project – Interview Questions & Protocol

This document outlines interview questions and protocols for one-on-one or small group interviews with commercial fishermen using OceanMap. This is in support of the Marine Life Protection Act (MLPA) Initiative for the central coast study region (CCSR), fisheries use and values project.

The MLPA is a state law directing the California Department of Fish and Game (CDFG) to design and manage an improved network of marine protected areas off California's coast. To implement this law, a public-private partnership has been formed between the California Resources Agency, CDFG, and Resources Legacy Fund Foundation—the MLPA Initiative. As part of this effort, Ecotrust has been retained to collect, compile and analyze socioeconomic information pertaining to commercial fisheries on the central coast. The questions and protocols outlined in this document have been designed to provide spatially explicit socioeconomic information for both the MLPA Initiative and the Monterey Bay National Marine Sanctuary (MBNMS).

The questions are below with the protocol on the next page.

1. Demographics and Vessel, Fishing and Economic Information –
    a. Fisherman Name
    b. Interviewer Name 1
    c. Interviewer Name 2
    d. Age
    e. Years of Experience Fishing
    f. Percent of Income From Fishing
    g. Percent of Income from this Fishery
    h. Federal Vessel ID
    i. State Vessel ID
    j. Fisherman License ID (L number)
    k. Home Harbor
    l. City of Residence (Where they live)
    m. Fishery (This is a combination of species and gear used)
    n. Licenses or permits held pertaining to this fishery (Can select more then one)
    o. Interviewer mood
    p. Habitat types
    q. Economically critical areas (importance of all mentioned areas weighted on cumulative scale of 100)

One-on-One Interviews in Ports or Place of Residence

Part 1 – Ecotrust Portland staff (Sarah Klain) identifies and makes initial contact with potential fishermen (interviewees) in the CCSR, and schedules the time and place where the interview will occur. Sarah will coordinate with and direct the Field Staff (interviewers) to follow-up with each fisherman [this is the preferred term, even for women, and that using "fisher" or "fisherperson" may actually convey a lack of respect by seeming too academic] and confirm that the scheduled time and place is convenient and that they are still available to participate. Interviewers will then travel to ports or places of residence (it is very possible that most of the fishermen don't live in the port where they fish out of) to conduct semi-structured, one-on-one or small group interviews, using the questions above as a guideline and recording the fishermen's answers directly into OceanMap.

Part 2 – When conducting interviews, interviewers will enter information into OceanMap, by drawing shapes identified by fishermen as to what are their areas of critical economic importance. This is done by:

1. Using electronic nautical charts in Oceanmap, fishermen are asked to identify by fishery which areas they would forage for or target a specie(s).

2. They are then asked to identify, based on the areas they have identified, over their cumulative fishing experience, to rank these areas using a weighted percentage; this is done through an imaginary "bag of 100 pennies" that they distribute over the fishing grounds.

In many cases fishermen will be providing information for multiple fisheries. Prior to the interview, the interviewer will know what fisheries the interviewee participates in, those fisheries will be of primary interest, any additional fisheries that the interviewee provides information for is welcome, but supplementary. It is important that each set of shapes that represent the interviewee's fishing grounds for each fishery are maintained and stored separately (*see Naming Conventions*).

In addition to capturing the critical economic importance of their fishing grounds for each fishery, interviewers will capture associated socioeconomic and demographic information based on the questions outlined above using Oceanmap's dialog interface.

After the interviewer has reviewed the inputted data with the interviewee, checking for accuracy, correcting for mistakes, and confirming that the fisherman is satisfied with the information they have provided, the field staff is then responsible for zipping (*see Naming Conventions*) all shapefiles that were generated during the interview and sending

them via email to Sarah Klain, sarahk@ecotrust.org, and carbon copying (*Cc*) Charles Steinback, charles@ecotrust.org. Once Sarah has received the data, she will review it, notify the field staff she has received it, and follow-up if there are any problems, discrepancies, or questions concerning the data that was submitted.

Part 3 – Plenary sessions by fishery and/or port will be conducted later, and/or in conjunction with MLPA regional stakeholder meetings over the course of the project. This will provide an opportunity for stakeholders to review data and converse with each other to discuss general areas of agreement and/or concern based on the surveyed results. Ecotrust will then correct any mistakes and conduct the final analysis.

Naming Conventions

The Ecotrust staff in Portland will assign a unique code or id for each fisherman participating in the study. Sarah will provide the field staff with the fisherman's id before the interview begins. When creating a shapefile in Oceanmap, a dialog box will appear and ask you, "What do you want to name your drawing?" Interviewers will type the fisherman's id, followed by the fishery, followed by the order in which each shape was drawn. For example, fisherman A's unique id is "CF0001" and they are providing their first area of critical economic importance for the Dungeness crab fishery. The drawing's name would be CF0001Dungenesscrab1. The second shape would be CF0001Dungenesscrab2. Since an interviewee can and will provide shapefiles for multiple fisheries, all files should be zipped into one file using the fisherman's id (CF0001.zip).

Below is a list of fisheries that are of interest for the CCSR:

Anchovy	Jacksmelt	Rockfish nearshore
Butterfish	Kelp greenling	Rockfish shelf
Cabezon	Lingcod	Rockfish slope
California halibut	Mackerel	Sablefish
Chinook salmon	Market Squid	
Dungeness crab	Rock crab	

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MEMORANDUM

TO: John Kirlin, Executive Director, Marine Life Protection Act Initiative

FROM: Astrid Scholz, Vice President Knowledge Systems, Ecotrust

DATE: 19 April 2006

SUBJECT: Effects on the impact analysis of a squid data processing error

While reviewing the squid fishing grounds with members of the Monterey fishing fleet on March 30, 2006, one participant in the study asked to see the grounds he provided that were used in the Ecotrust impact analysis for the MLPAI.

When reviewing his shapes it became apparent that they were incorrect. Specifically, we discovered that one shape was placed in an area that the participant deemed unfishable, and also that there were only a total of 4 shapes in his file, where he recalled drawing close to 15.

Taking this information, Ecotrust staff retraced our steps and located an earlier file of fishing grounds that he provided to us in another project (a fisheries profile compiled for the central California National Marine Sanctuaries' Joint Management Plan Review process; www.ecotrust.org/jmpr; henceforth JMPR). Overlaying those shapes with the ones we used in the MLPA impact analysis, we determined that 2 of those shapes were to be removed (unfishable) and the other 2 were to be appended. In other words, it appears that Ecotrust staff inadvertently used the file containing the 4 shapes being edited, rather than the resulting layer of revised shapes.

We then contacted the fisherman in question via email, explained our reconstruction of what happened, and when presented with the logic described above, he was able to remember and did confirm that our explanation matches his recollection.

Following that correspondence, we proposed to him that we step through each of his original shapes (JMPR) combined with the new and assign the correct number of weights to them. The participant was unresponsive to that suggestion, and when contacted again via phone opted to, in his words, "respectfully withdrawal his shapes from the process" because he felt it wouldn't make a difference to the stated package impacts.

At the participant's request we removed his shapes from the analysis of the squid grounds. We then analyzed the effects of removing them from the impact analysis, as well as the effects of using the earlier JMPR shapes. These analyses are of packages as they existed on February 22, 2006. Packages S and AC were subsequently dropped from consideration and Packages 2 and 3 modified.

The modified packages will be analyzed without this response, as noted below. Ecotrust staff checked the entire set of responses and ascertained that this was an isolated data processing error.

As illustrated in the table below, the effects are as follows:

- removing the wrong shapes leads to no change to the total area\study area affected for all packages;
- removing the wrong shapes leads to minimal change to the total\study area value affected for all packages, with impacts of Packages 1 and AC decreasing, the other three increasing;
- using the original shapes (JMPR) in the analysis, there would be a minimal increase in the total\study area affected for all packages;
- using the original shapes (JMPR) in the analysis, there would be a minimal decrease in the total\study area value affected for all packages except package S.

The last two observations confirm that while the overall effects of removing this one fisherman's information result in minor changes to the impact analysis, using the correct ones would have corroborated the participant's sense that package S performs relatively more poorly, i.e., has somewhat larger impacts, than the others.

Given that this participant withdrew his shapes from the project, we reanalyzed the squid grounds, and they are—as of this writing—being resummarized to the microblocks and will be forwarded to CDFG staff as an updated layer along with the raster layer for that fishery.

Area of total fishing grounds potentially affected:

Fishery	Package 1	Package 2	Package 3	Package AC	Package S
Squid With participant	6.82%	10.89%	9.76%	15.65%	9.92%
Squid Without participant	6.82%	10.89%	9.77%	15.65%	9.92%
Squid With JMPR shapes	6.87%	11.17%	9.89%	15.82%	10.08%

Area of fishing grounds within the study area potentially affected:

Fishery	Package 1	Package 2	Package 3	Package AC	Package S
Squid With participant	9.00%	14.37%	12.88%	20.64%	13.08%
Squid Without participant	9.00%	14.37%	12.88%	20.64%	13.08%
Squid With JMPR shapes	9.06%	14.68%	13.00%	20.85%	13.29%

Value of total fishing grounds potentially affected:

Fishery	Package 1	Package 2	Package 3	Package AC	Package S
Squid With participant	5.87%	9.49%	7.34%	17.77%	9.10%
Squid Without participant	5.77%	9.69%	7.43%	17.73%	9.18%
Squid With JMPR shapes	5.62%	9.49%	7.36%	17.38%	9.26%

Value of fishing grounds within the study area potentially affected

Fishery	Package 1	Package 2	Package 3	Package AC	Package S
Squid With participant	6.27%	10.13%	7.83%	18.91%	9.70%
Squid Without participant	6.17%	10.31%	7.93%	18.87%	9.78%
Squid With JMPR shapes	5.98%	10.14%	7.85%	18.57%	9.88%