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RESEARCH NEEDS ON KELP BED RESOURCES

**An Interdisciplinary
Approach**

*Summary of a Program Development Workshop
Sponsored by the California Sea Grant College*

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Editor

Deborah A. McArdle

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An Interdisciplinary Approach

**Summary of a Program Development Workshop
Sponsored by the
Sea Grant Extension Program
University of California, Cooperative Extension**

**June 7, 1994
San Francisco, California**

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INTRODUCTION

The California Sea Grant College sponsors workshops periodically to identify needed research on coastal- and marine-related topics. In previous Sea Grant workshops on kelp bed resources, and particularly the 1992 International Conference on Sea Urchins, Abalone, and Kelp, participants called for an increase in interdisciplinary interactions that would link biological, physical, and social scientists with resource managers, policy makers, and industry representatives.

In an effort to address that need, representatives from the California Sea Grant Extension Program organized a subject area meeting on June 7, 1994, in San Francisco. Scientists and managers from a number of disciplines and different locations throughout the state were invited in order to provide a wide representation of expertise and geographic range.

Dr. James J. Sullivan, director of the California Sea Grant College, opened the workshop by explaining the role of Sea Grant in bringing people with different perspectives together to study and resolve coastal and marine issues. Associate director Dolores Wesson provided a description of the Southwest Regional Marine Research Program and explained its relationship to kelp bed research. Dr. Mia Tegner, Scripps Institution of Oceanography, University of California, San Diego, then provided a general overview of research needs identified at previous workshops, as well as a description of the current status of kelp bed resources. Following Dr. Tegner's remarks, Dr. Chris Dewees and Rick Starr from the Sea Grant Extension Program led a general group discussion to identify broad categories of research and management needs. On the basis of this, participants were divided into three interdisciplinary groups—led respectively by Marine Advisors Susan McBride, Deborah McArdle, and Rick Starr to develop more specific lists of research and resource management needs. The results of each group were summarized and presented to all meeting participants, and a draft document of research priorities was written.

The draft was sent out to participants for review (Appendix I). It was also distributed to a broadly representative group of resource users, researchers, and agency representatives for additional comment (Appendix II). This document incorporates the result of discussions that occurred at the meeting, as well as subsequent reviews.

We hope that this document will inspire new interdisciplinary approaches to kelp bed research and management, both of which are needed in order to sustain the resources on a long-term basis.

OVERVIEW

The increased complexity of resource conservation in the coastal zone requires a more complex approach to research and management. In particular, an interdisciplinary approach is needed to successfully confront the numerous problems that threaten kelp bed resources. New interdisciplinary connections would facilitate (a) the identification of research gaps by resource users, managers, and researchers; (b) the development of research projects by biological, physical, and social scientists; and (c) the integration of research results into management decision-making.

Workshop participants generally agreed that we need to learn more about the oceanographic processes involved in recruitment in order to recognize or make meaningful predictions of trends. For example, there can be orders of magnitude in the variation of yearly recruitment levels of the red sea urchin, *Strongylocentrotus franciscanus*. And declines in fisheries may be influenced by natural variability in oceanographic processes as well as by anthropogenic impacts such as pollution and overharvesting; additional research on factors affecting recruitment may allow resource managers to distinguish the difference.

Participants also stressed the need for more integrated research in population biology and genetics, which might allow researchers to identify the genetic differences between populations of individual species, as well as the significance of these individual populations to kelp bed communities as a whole. We have observed major declines in resources such as kelp, sea urchins, and abalones as a result of large-scale disturbances (e.g., El Niños, disease, and overharvesting). A knowledge of the genetic diversity of individual populations might help resource managers to predict population resilience to future disturbances.

Since resource species are integral parts of kelp bed ecosystems, a variety of ecological processes, including interactions with other species, will affect the population dynamics of the individual resource species. Consequently, workshop participants suggested that it may be important for managers and researchers to study the system as a whole. This would include an investigation of alternative, "multispecies" or "habitat" approaches to management, including temporary or permanent spatial closures. Participants also agreed that increased efforts should be made to incorporate economic and social research into management plan development along with physical and biological research. The success of any management strategy also depends, in part, on the involvement of resource users in management strategy development, implementation, and enforcement.

Although the need for interdisciplinary approaches to research and management is recognized throughout the world, the means to achieve such an approach are not fully developed. Many of the identified research objectives for kelp bed resources would require studies of long duration and broad geographic range. Workshop participants discussed the need to bridge institutional gaps and to fund studies appropriately, so that research results can reflect both the spatial and temporal scales of the parameters or species being studied. It is essential that interdisciplinary investigations of kelp bed resources begin now, but the means to pursue interdisciplinary approaches to research and management also need to be further explored.

KELP BED RESOURCE RESEARCH NEEDS

I. BIOLOGY

A. Recruitment

As was true of previous meetings, members of all discussion groups thought the factors controlling kelp bed resource recruitment are still not well understood. Discussion groups generally agreed that the top priority was to study the effects of small and large scale physical processes on the spatial and temporal variability of recruitment. Identified recruitment issues that couple biological and physical disciplines include:

1. *Physical/Biological Factors*

- Is there a relationship between ocean circulation patterns and larval dispersal and settlement? Can ocean circulation patterns be used to predict larval distribution and settlement patterns?
- Can patterns of larval distribution and settlement be detected and/or predicted by data available on physical parameters (e.g., satellite imagery, sea surface temperatures, winds, salinities and sea levels)?
- What is the spatial and temporal variability in the production and dispersal of kelp and kelp bed resources?
- Can patterns be detected in episodic recruitment events by larger-scale spatial and temporal monitoring?
- Is there a relationship between large-scale physical disturbances (e.g., El Niño events) and recruitment and settlement patterns?

B. Population Dynamics

Participants identified two primary areas in which research is needed: 1) genetics and 2) the effects of disturbance (e.g., storms, disease, harvesting pressure, extreme water temperature fluctuations and introduced species) on resource population size and distribution. The role of marine diseases in structuring resource populations (e.g., abalone withering foot syndrome) continues to be a high priority research area. Studies of the population dynamics of species experiencing an increase in harvest pressure (e.g., lobster, sheephead, purple sea urchins, and bull kelp) are needed in order to conserve and utilize these species on a long-term basis.

Listed below are potential research questions associated with the high-priority issues in population dynamics.

1. *Genetics*

- How are populations of kelp bed resources structured spatially coastwide (including Mexico), and is there genetic flow among resource populations? What are the primary means of genetic dispersal between resource populations (e.g., ocean currents, migration, kelp "rafts")?

- What is the coastwide genetic composition of individual kelp bed resource populations? Does this genetic composition affect the resiliency of resource populations to disturbances? Is there a relationship between population size and genetic composition?

2. *Marine Diseases*

- How do diseases alter the genetic structure of kelp bed resource populations?
- Do large scale disturbances (e.g., El Niño, overharvesting, etc.) make resource populations more susceptible to disease?
- How can diagnostic techniques to identify diseases be improved?
- How do specific environmental changes (e.g., pollution and sediment deposition) alter transmission of and resource susceptibility to diseases?
- Does resource population size affect its susceptibility to disease?

3. *Biology of Newly Harvested Species*

- What is the current population size of the resource? Is the population size consistent or does it vary temporally and/or spatially?
- How can data from population studies of previously harvested species (e.g., giant kelp, *Macrocystis pyrifera*, and the red sea urchin, *Strongylocentrotus franciscanus*) be used to understand the population dynamics of species experiencing new or increased harvest efforts (e.g., bull kelp *Nereocystis luetkeana* and the purple sea urchin *Strongylocentrotus purpuratus*)?
- How does harvesting pressure affect the population structure of newly harvested species? Can the effects of harvesting on resource population size and distribution be modeled or predicted?

C. Community Aspects

The participants of this and previous kelp bed meetings expressed a need for a better understanding of the interactive relationships between members of the kelp bed community. A particular emphasis was placed on the need to implement long-term monitoring programs coastwide to allow often undetectable large-scale patterns in the temporal and spatial fluctuations of kelp bed communities to be recognized. High-priority issues and related research questions include:

1. *Community Interactions*

- How does harvesting one species of a kelp community affect other species in the community? (e.g., What is the effect of kelp harvesting on species in the benthic community? How has the benthic community evolved to utilize drift algae in areas where kelp is harvested in comparison to areas where kelp is not harvested.)

2. *Community Level Surveys and Long-Term Monitoring*

- What are the temporal and spatial fluctuations in the distribution of kelp bed communities?
- What is the long-term resilience of kelp bed communities to large-scale biological and physical disturbances?
- How do northern and southern kelp bed communities compare?

3. *Relationship of Physical Conditions to the Kelp Bed Community*

- How does kelp canopy shape and size affect water movement, light dispersal and other physical and biological parameters.
- How do small and large scale fluctuations in physical conditions affect kelp bed communities?

II. SOCIAL, ECONOMIC AND CULTURAL

The discussion groups identified several social, economic and cultural issues related to the kelp bed community. Their recommendations for high priority research topics are as follows:

1. What is the economic value of the kelp ecosystem resources (e.g., sportfishing, commercial fishing, tourism, and related businesses)?
2. What are the economic, social and cultural implications of the changes in traditional kelp bed fisheries?
3. What are the social, economic and cultural benefits and costs of implementing long-term, multispecies or habitat approaches to kelp bed management (e.g., temporary or permanent spatial closures) to resource users?

III. RESOURCE MANAGEMENT

It was generally agreed that a multispecies or habitat approach to kelp bed management (e.g., temporary and/or permanent spatial closures) needs to be further investigated. Appropriate biological, physical and social questions need to be determined and addressed and the involvement of industry representatives at all stages of this process is essential.

The development of methods to make research information more accessible to decision makers and more relevant to their mandates and responsibilities was also a high priority. Questions raised by scientists to managers included: what are the goals of management and at what scale are you trying to manage (species, populations or communities)? Resource management questions that need to be addressed include:

1. Are temporary and/or permanent spatial closures a viable scientific, social and political option for a long-term multispecies approach to kelp bed management?

- Will spatial closures lead to a concentration of effort in “open” areas?
 - How will enforcement of spatial closures be funded?
 - Will funding be available to effectively research and monitor closed areas?
2. How can biological, physical and social scientific knowledge be more efficiently and effectively integrated into the formation of kelp bed management decisions?
 3. What methods can be used to increase the involvement of industry representatives in every stage of the management process including development, implementation and enforcement of management strategies? How can industry representatives become more involved in the research studies conducted by resource managers and university-based scientists?
 4. Have single-species approaches to kelp bed resource management succeeded or failed in the past and why?

IV. INFORMATION NEEDS

An essential component of developing and implementing strategies for interdisciplinary kelp bed research and management strategies is the existence of channels that allow for information exchange. The discussion groups identified several areas in which additional information exchange is needed. Identified information needs include:

1. Improvement in the exchange of information among scientists, legislators, resource managers and resource users. Forums are needed that would foster discussions on topics such as the integration of scientific information into the formation of management strategies and the role of resource management in the development of political objectives.
2. The identification and discussion of issues involved in developing long-term, multispecies or habitat approaches to management (e.g., temporary and/or permanent spatial closures) among industry representatives, resource managers and scientists. Questions include, but aren't limited to:
 - What species would benefit most from such management strategies?
 - What are the appropriate criteria for site selection?
 - What are the appropriate measurements of success?
3. The continuation of conferences that update scientists, resource managers, and industry representatives on the most recent developments in kelp bed resource research, enhancement, and management.

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