CONSIDERATIONS FOR INTEGRATING MARINE RESERVES WITH EFFECTIVE FISHERY MANAGEMENT

Situation: Three individuals have been invited to the Council meeting to make presentations under the general topic of "Considerations for Integrating Marine Reserves with Effective Fishery Management" (Exhibit D.1.a). The Council has seen information that indicates that for species with certain life history characteristics, biomass within no-take marine reserves will tend to increase; however, the Council has expressed great interest in the effect of marine reserves on fish and fisheries outside the reserve, particularly when marine reserves are put in place where there is an active and effectively enforced fishery management system.

The first presentation will be by Drs. Jane Lubchenco and Mark Hixon, who have been asked to speak on the science behind this issue with relevance to West Coast areas. Drs. Lubchenco and Hixon are professors at Oregon State University. Dr. Lubchenco is one of the senior editors of the recently completed report *The Science of Marine Reserves*, published by The Partnership for Interdisciplinary Studies of Coastal Oceans (separate enclosure in the briefing book). Dr. Mark Hixon, also member of the Federal Advisory Committee on Marine Protected Areas, is the author of a recent paper focusing on relevant information from the West Coast (Exhibit D.1.b, Attachment 1).

The second presentation will be by Dr. Dave Fluharty, who will discuss some of the practical aspects of implementing marine reserves in the Regional Council system. Dr. Fluharty is a professor at University of Washington, and is also a North Pacific Fishery Management Council member.

Council Task:

1. Discussion.

Reference Materials:

1. Invitation Letters to Drs. Lubchenco and Fluharty from Donald McIsaac dated December 3, 2002 and January 24, 2003, respectively. (Exhibit D.1.a, Attachment 1).
2. "The Science of Marine Reserves" (Separate Enclosure).
3. "Fishery Effects of Existing West Coast Marine Reserves: Scientific Evidence" (Exhibit D.1.b, Attachment 1).

Agenda Order:

a.	Agendum Overview	Jim Seger
b.	Presentations	Drs. Jane Lubchenco/Mark Hixon/Dave Fluharty
c.	Reports and Comments of Advisory Bodies	
d.	Public Comment	
e.	Council Discussion	

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

The GFSP calls for the Council to "use marine reserves as a fishery management tool that contributes to groundfish conservation and management goals, has measurable effects, and is integrated with other fishery management approaches."

PFMC
02/25/03

PACIFIC FISHERY MANAGEMENT COUNCIL

7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

CHAIRMAN
Hans Radtke

EXECUTIVE DIRECTOR
Donald O. McIsaac

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December 3, 2002

Dr. Jane Lubchenco
Oregon State University
5088 Cordley Hall
Corvallis, OR 97331-4501

Dear Dr. Lubchenco:

The Pacific Fishery Management Council (Council) would like to extend an invitation to you to make a presentation on March 12, 2003 during its meeting at the Columbia River DoubleTree Hotel in Portland, Oregon. The Council has been considering marine reserves as a possible fishery management tool since the spring of 1999 and marine reserves are the subject of two groundfish fishery programmatic Environmental Impact Statements (EISs) currently under development - a programmatic EIS guiding the board spectrum of management options and a groundfish Essential Fish Habitat EIS. We feel your expertise in this area would be of great value in considerations for establishing marine reserves on the West coast, and hope you will accept our invitation.

Research such as that summarized in the recent Partnership for Interdisciplinary Studies of Coastal Oceans report, "The Science of Marine Reserves" seems to clearly indicate that for species with certain life history characteristics, biomass within no-take marine reserves will tend to increase. What is of great interest to the Council is the effect of marine reserves on fish and fisheries outside the reserve, particularly when reserves are put in place where there is an active and effectively enforced fishery management system. Most case studies on external effects of marine reserves that have been presented to the Council thus far were studies of reserves placed in areas where there was no effective fishery management system or where reserves were established at the same time that effort reduction measures were imposed. There appears to be little doubt of an edge effect that results in higher catch per unit of efforts in the areas around the reserve, however, the overall impact on harvest production from the marine system is unclear.

In terms of the kind of presentation that would be most useful to the Council, we would appreciate a presentation focused on the effects of marine reserves on system productivity and yield in the presence of an effective fishery management program. If information is still inadequate to address this issue, identification of the types of actions the Council might take to support development of the needed information may be of interest.

The Council is aware there are reasons for creating marine reserves other than the possible enhancement of fishery management and production. Protection of habitat and providing hedges against uncertainty regarding stocks for which we have little information are two

such reasons. There may also be advantages for protecting low productivity stocks that are part of a multispecies harvest complex. The value of marine reserves in managing a multispecies harvest complex in the context of uncertain information, as compared to traditional fishery management techniques, would be a useful secondary topic for your presentation.

Finally, we ask if you would be willing to make your presentation in a forum in which another scientist would make a presentation on the limits of the use of marine reserves in fishery management. When multiple perspectives are presented on a controversial topic at once with the opportunity for questions and comment, there is often a better chance for improved understanding and less opportunity to delay action on the basis of uncertainty about the information presented.

We anticipate making up to 30 minutes available for your presentation, as well as providing 30 minutes for follow-up questions and answers. Please let us know if this amount of time will be adequate. We will also need to know what audio-visual aids you would like available.

Enclosed for your information, please find the Council's Phase I Report on marine reserves and a review conducted by our Scientific and Statistical Committee on the size of reserves recommendation made by the Channel Islands National Marine Sanctuary Science Advisory Panel.

Thank you for your consideration to assist the Council improve its understanding of this controversial issue. Please contact Mr. Jim Seger at the Council Office as to whether you can accept our invitation, or if you have any further questions on this matter.

Sincerely,

D. O. McIsaac, Ph.D.
Executive Director

JLS:dsh

c: Council members
Council staff officers
Habitat Committee
Paul Engelmeyer

Enclosures

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PACIFIC FISHERY MANAGEMENT COUNCIL

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January 24, 2003

Dr. David Fluharty
University of Washington
School of Marine Affairs
3707 Brooklyn Ave NE
Seattle, WA 98105

Dear Dr. Fluharty:

The Pacific Fishery Management Council (Council) takes pleasure in inviting you to its upcoming meeting in Sacramento, California on March 12, 2003 to make a presentation to the Council on the subject of marine reserves. The umbrella working title for this agendum is "Considerations for Integrating Marine Reserves with Effective Fishery Management." The context of fishery management is specific to West Coast marine fisheries as it exists and is developing under the Sustainable Fisheries Act.

This presentation would be in tandem with a presentation by Dr. Jane Lubchenco and possibly Dr. Mark Hixon of Oregon State University. We have asked Dr. Lubchenco and Dr. Hixon to focus their presentation on the effects of marine reserves on system productivity and yield in the presence of an effective fishery management program and the value of marine reserves as a fishery management tool in multispecies fisheries. We would like you to consider addressing the integration of marine reserves with fishery management from a policy point of view in the context of Council processes, current Council mandates, recent federal fishery management actions, and typical goals and objectives for the creation of marine reserves. We would like to ensure there is ample time for questions from the Council; and therefore, ask that you try to keep your presentation to 20 minutes or less.

The Council will cover your travel expenses, and information on making travel reservations will be provided under separate cover. Thank you for considering this invitation to improve fishery management in West Coast marine fisheries.

Sincerely,

D. O. McIsaac, Ph.D.
Executive Director

DOM:kla

c: Ms. Sharon Conyers
Dr. John Coon
Mr. Jim Seger
Ms. Kerry Aden

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2002. Report submitted to the Oregon Ocean Policy Advisory Council and the California Fish and Game Commission.

FISHERY EFFECTS OF EXISTING WEST COAST MARINE RESERVES: THE SCIENTIFIC EVIDENCE

compiled by Dr. Mark Hixon, Department of Zoology, Oregon State University
(541-737-5364, hixonm@science.oregonstate.edu)

Although fully-protected marine reserves are being touted as effective fishery management tools worldwide, it is important to consider in detail whether existing reserves along the West Coast of the United States provide fishery benefits, or more specifically, would provide benefits if scaled-up. It is clear from the outset that existing West Coast reserves are much too small and too few to benefit fisheries in ways that are directly detectable statistically. Indeed, there are only about 7 reserves in Washington (all in Puget Sound, accounting for only ca. 0.003% of state waters), only 1 in Oregon (Whale Cove, ca. 0.003% of state waters), and 11 scattered along the California coast (ca. 0.2% of state waters). Only half of these reserves are truly fully-protected. However, it is nonetheless possible to examine indicators of whether a scaled-up network of reserves would provide fishery benefits.

The predicted fishery benefits of fully-protected reserves are twofold: (1) the "**seeding effect**," whereby reserves function as a source of eggs and larvae that replenish fish and shellfish populations outside reserves via dispersal in ocean currents, and (2) the "**spillover effect**," whereby reserves function as a source of juvenile and adult emigrants that literally swim or crawl out of reserves into adjacent fished areas. The **seeding effect** occurs only if the *number* and especially the *size* of organisms inside reserves is substantially greater than outside, so that abundant eggs and larvae produced inside reserves can effectively seed a large area outside. The **spillover effect** occurs if (a) the *number* of mobile animals inside reserves becomes great enough that crowding occurs and a substantial number of animals consequently emigrates to adjacent fished areas or (b) the life history of mobile animals is such that they gradually move from habitat to habitat as they grow, so that the early stages of the life history can be protected within reserves, and the animals later move into fished areas. Thus, comparisons inside vs. outside reserves can provide an indication of whether seeding and spillover effects are probable, and examination of *movement* patterns can further suggest whether spillover is likely.

There have been scientifically rigorous comparisons inside vs. outside about a dozen existing reserves in Washington, Oregon, and California that were studied at least 10 years after the reserves were established (**Table 1**). Excluded from this compilation are analyses of (1) the Edmunds Marine Park in Washington, because seafloor habitats inside and outside the reserve are not strictly comparable, and (2) the Big Creek Reserve in California, because protected status was implemented only in 1994. In all studies, SCUBA divers compared areas inside and outside reserves by visually censusing plots or transects. Compared indicators included seafloor habitats, fish (mostly rockfish) and invertebrate (sea urchin and abalone) number and size, and sometimes calculated egg production. Egg production is well-documented in increase dramatically with body size in these fish and invertebrates, so areas with high abundance and large sizes of animals clearly produce numerous eggs that may contribute to the seeding effect.

Table 2 summarizes 9 independent scientific studies that compared unfished marine reserves with nearby fished areas of similar seafloor habitat. A total of 22 comparisons involving 17 fished species (1 species of sea urchin, 2 species of abalone, and 14 species of fish) were conducted among the 13 reserves listed in Table 1. Considering cases where statistical differences were detectable, in 15 of 17 comparisons (88%), animals were more abundant inside reserves than outside. In 12 of 15 comparisons (80%), animals were larger inside reserves than outside. In 15 of 17 comparisons (88%), animals were inferred to produce more eggs inside reserves than outside. The exceptions may be cases of smaller species that are out-competed or eaten by more abundant or larger fish inside reserves, although there are presently no definitive data.

Table 3 summarizes movement patterns of representative West Coast groundfish determined from tag-and-recapture studies. The general life history pattern is that lingcod and rockfishes, among other species, live in shallow water as young, then slowly migrate to deeper water as they grow, eventually living within relatively limited home ranges as adults. Movement distances suggest that these fish could spillover from marine reserves of substantial size. Exceptions include exclusively shallow species that inhabit coastal rocky reefs for their entire juvenile and adult life.

Overall, for a wide variety of fished species along the U.S. West Coast, available data indicate that the existing few and small marine reserves are effective in supporting substantially more abundant, larger, and more fecund animals (i.e., more eggs) than comparable fished areas outside. Moreover, many groundfish move sufficiently during their lifetimes to allow for spillover to occur from reserves of substantial size. These results are consistent with the prediction that a scaled-up network of numerous larger reserves would produce detectable fishery benefits via both the spillover and seeding effects.

TABLE 1. Existing U.S. West Coast marine reserves that have been the subject of inside vs. outside scientific comparisons. Comparisons made at two other reserves are not included: (1) Edmunds Marine Park in Washington (0.04 nmi^2, established in 1970) because seafloor inside and outside are not directly comparable; and (2) Big Creek in California (1.11 nmi^2, established in 1994) because protection is only recent.

Reserve	Area (nmi^2)	Year	Protection
WASHINGTON:			(reference 2)
Shady Cove	0.49	1990	herring and salmon fishing allowed
Shaw Island	0.37	1990	herring and salmon fishing allowed
Yellow Island	0.07	1990	herring and salmon fishing allowed
OREGON:			(reference 8)
Whale Cove	0.04	1967	seaweed collection allowed
NO. CALIFORNIA:			(reference 7)
Pt. Cabrillo/Caspar	0.13	1975/90	only sea urchins protected
Salt Point	1.60	1990	only sea urchins protected
Bodega Marine Lab	0.18	1965	only invertebrates protected
Hopkins Marine Lab	0.09	1984	fully protected
Pont Lobos	0.80	1973	fully protected
SO. CALIFORNIA:			(reference 7)
E. Anacapa Island	0.04	1978	fully protected
Laguna Beach	0.04	1973	fully protected
Catalina Marine Lab	0.05	1988	fully protected
La Jolla	0.54	1971	fully protected

TABLE 2. Comparisons of number, size, and calculated egg production of fished species inside vs. outside existing U.S. West Coast marine reserves listed in Table 1. "Yes" means that values were statistically greater inside, "No" means that values were statistically greater outside, "ns" means no statistically detectable difference, and "?" means not reported. ("Yes") and ("No") are conclusions regarding egg production based on relative number and size of fish (i.e., egg production not calculated directly, but if number and size of adult fish are greater inside the reserve, than egg production must be greater). "Ref" refers to the reference number(s) cited.

Species	Number	Size	Eggs	Comments	(Ref)
WASHINGTON:				[all WA data from 3 reserves]	
lingcod	ns	Yes	Yes		(2,10,11)
black rockfish	Yes	Yes	(Yes)	seen only in reserve	(2)
copper rockfish	Yes	Yes	Yes		(2,10,11)
quillback rockfish	No	No	(No)	competition or predation?	(2)
yellowtail rockfish	Yes	Yes	(Yes)	seen only in reserve	(2)
OREGON:					
red sea urchin	Yes	Yes	Yes		(8)
NO. CALIFORNIA:					
red sea urchin	Yes	?	?	Caspar, Salt Pt., Bodega	(13)
red abalone	Yes	?	?	Caspar, Salt Pt., Bodega	(13)
lingcod	ns	Yes	(Yes)	[fish data from Pt. Lobos]	(18)
cabezon	ns	No	(No)	competition or predation?	(18)
black rockfish	ns	Yes	(Yes)		(18)
black-&-yellow rockfish	No	No	?	conflicting egg data	(9,18)
copper rockfish	Yes	Yes	(Yes)	seen only in reserve	(18)
gopher rockfish	Yes	Yes	(Yes)		(18)
kelp rockfish	ns	Yes	Yes		(9,18)
olive rockfish	Yes	Yes	(Yes)		(18)
vermilion rockfish	Yes	Yes	(Yes)		(18)
SO. CALIFORNIA:					
red sea urchin	Yes	?	?	Anacapa	(1)
pink abalone	Yes	?	?	Anacapa	(1)
barred sand bass	Yes	?	Yes	Laguna (sand bottom)	(17)
kelp bass	Yes	?	Yes	pooled So. Cal. reserves	(17)
California sheephead	Yes	?	Yes	pooled So. Cal. reserves	(17)
Total Yes (greater inside):	15	12	15		
Total No (greater outside):	2	3	2		

TABLE 3. Movement patterns of commonly fished West Coast groundfish. The general pattern is that lingcod and rockfish, among other species, live in shallow water as young, then slowly migrate to deeper water as they grow, eventually living within relatively limited home ranges as adults. These data suggest that these fish move sufficiently for the spillover effect to occur from marine reserves of substantial size. Exceptions include exclusively shallow species (e.g., black-and-yellow and gopher rockfish) that inhabit coastal rocky reefs for their entire juvenile and adult life (reference 4). "Ref" refers to the reference number(s) cited.

Species	Location	Movement Distance	Ref
JUVENILE FISH:			
bocaccio rockfish	California	move up to 80 nmi over 2 yr	(3)
brown rockfish	California	move up to 27 nmi as they migrate from San Francisco Bay to the outer coast	(5)
yellowtail rockfish	Washington	move up to 195 nmi as they migrate from Puget Sound to the outer coast	(6)
ADULT FISH:			
lingcod	Alaska	mean movement of 7.2 nmi	(15)
lingcod	British Columbia	95% of males move up to 9 nmi/yr 95% of females move up to 18 nmi/yr	(14)
bocaccio rockfish	California	10 of 16 adults spent less than 10% of 4 mo within 3.5 nmi^2 area, one for 50% of the time, and 5 for the entire time	(16)
yellowtail rockfish	Oregon	adults move up to 0.7 nmi/mo	(12)

Literature Cited

(1) Davis, G. Unpublished data. U.S. National Park Service, Ventura, California.

(2) Eisenhardt, E. 2001. Master's thesis. School of Fisheries, University of Washington, Seattle, Washington.

(3) Hartman, A. R. 1987. Movement of scorpionfishes (Scorpaenidae: *Sebastes* and *Scorpaena*) in the southern California Bight. California Fish and Game 73:68-79.

(4) Larson, R. J. 1980. Territorial behavior of the black and yellow rockfish and gopher rockfish (Scorpaenidae, *Sebastes*). Marine Biology 58:111-122.

(5) Love, M. S., M. H. Carr, and L. J. Haldorson. 1991. The ecology of substrate-associated juveniles of the genus *Sebastes*. Environmental Biology of Fishes 30:225-243.

(6) Mathews, S. B., and M. W. Barker. 1983. Movements of rockfish (*Sebastes*) tagged in northern Puget Sound, Washington, U.S. Fishery Bulletin 82:916-922.

(7) McArdle, D. A. 1997. California marine protected areas. California Sea Grant Extension Program, La Jolla, California.

(8) Montaño, G. 2001. Master's thesis. Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon.

(9) Paddack, M. J., and J. A. Estes. 2000. Kelp forest fish populations in marine reserves and adjacent exploited areas of central California. Ecological Applications 10:855-870.

(10) Palsson, W. A., and R. E. Pacunski. 1995. The response of rocky reef fishes to harvest refugia in Puget Sound. Puget Sound Research '95 Proceedings 1:224-234.

(11) Palsson, W. A. 1998. Monitoring the response of rockfishes to protected areas. NOAA Technical Memorandum NMFS SWFSC 255:64-73.

(12) Pearcy, W. G. 1992. Movements of acoustically-tagged yellowtail rockfish *Sebastes flavidus* on Heceta Bank, Oregon. Fishery Bulletin 90:726-735.

(13) Rogers-Bennett, L., and J. S. Pearse. 2001. Indirect benefits of marine protected areas for juvenile abalone. Conservation Biology 15:642-647.

(14) Smith, B. D., G. A. McFarlane, and A. J. Cass. 1990. Movements and mortality of tagged male and female lingcod in the Strait of Georgia, British Columbia. Transactions of the American Fisheries Society 119:813-824.

(15) Starr, R. M. Manuscript. Lingcod movements in Edgecumbe Reserve, Alaska.

(16) Starr, R. M., J. N. Heine, J. M. Felton, and G. M. Cailliet. 2002. Movements of bocaccio (*Sebastes paucispinis*) and greenspotted (*Sebastes chlorostictus*) rockfishes in Monterey submarine canyon: implications for the design of marine reserves. Fishery Bulletin 100:324-337.

(17) Tetreault, I. 2002. Doctoral dissertation. Department of Biology, U.C.L.A., Los Angeles, California.

(18) VenTresca, D. A., M. L. Gingras, M. Donnellan, J. Fisher, B. Brady, H. King, C. King, and D. Osorio. Manuscript. Density and length estimates of some kelp forest fishes within and adjacent to central California marine protected areas.

BIOGRAPHICAL SKETCHES OF PRESENTERS

Dr. Jane Lubchenco
Distinguished Professor of Zoology
Oregon State University

Jane is a marine ecologist with expertise in coastal ecosystems. She has been on the faculty at Oregon State University (OSU) for 25 years. She grew up in Colorado, but fell under the spell of the oceans after spending a summer at Woods Hole, Massachusetts in college and has lived and worked in coastal areas ever since. Her M.S. degree is from the University of Washington and her Ph.D. is from Harvard, both in marine ecology. She has extensive experience working in coastal marine ecosystems along the shores of Washington, Oregon, California, New England, Chile, New Zealand, and Panama. She was elected to the National Academy of Sciences in 1996, has served as President of the American Association for the Advancement of Sciences and the Ecological Society of America. She has received numerous awards, including a MacArthur Fellowship, the 2002 Heinz Environment Award, and eight honorary doctoral degrees, including one from Princeton University. She was nominated by President Clinton and confirmed by the U.S. Senate to the National Science Board.

Dr. Mark Hixon
Professor of Zoology
Oregon State University

Dr. Mark Hixon is a professor in the Department of Zoology at OSU, where he teaches undergraduate ecology, marine ecology, and marine biology, as well as a graduate course on the ecology of marine fishes. His expertise is marine ecology and conservation biology, emphasizing coastal marine fishes.

Mark was an undergraduate at the University of Southern California and the University of California at Santa Barbara (UCSB). As a graduate student at UCSB studying kelp-forest fishes, he documented nocturnal predatory behavior of electric rays and was one of the first to demonstrate experimentally that marine fish species compete with each other. He completed his Ph.D. in 1979.

As a National Science Foundation Postdoctoral Fellow, Mark derived and tested a model of territorial behavior with hummingbirds at University of California at Irvine and with coral-reef fish at the University of Hawaii. While in Hawaii, he also examined the effects of fish grazing on succession and local species diversity of coral-reef seaweeds. Leaving Hawaii in 1981, he was a lecturer and researcher at University of California at Irvine, continuing research on both hummingbirds and marine fishes until becoming an assistant professor at OSU in 1984.

During his tenure at OSU, Mark has studied the community ecology of reef fishes in the U.S. Virgin Islands, explored groundfish assemblages on the outer continental shelf of Oregon using manned submersibles, and studied the population ecology of reef fishes in the Bahamas, Australia, and French Polynesia. His research in Australia was funded by a Fulbright Senior Scholar Award. His current research, funded by the National Science Foundation and NOAA's National Undersea Research Program, focuses on the mechanisms that drive and regulate the population dynamics of marine fishes, emphasizing field experiments with reef fishes that are conceptually relevant to conserving and managing fisheries.

More recently, Mark has become active in fisheries replenishment and sustainability issues. He is a fellow of the Aldo Leopold Leadership Program, sits on the Board of Directors of the Pacific Marine Conservation Council, and serves on several scientific advisory panels focusing on marine conservation, including the Communication Partnership for Science and the Sea, Stanford University's Connections Program, the Sustainable Ecosystems Institute, and the U.S. Coral Reef Task Force Marine Reserve Working Group. He recently was appointed by the Secretaries of Commerce and Interior to serve on the new Federal Advisory Committee on Marine Protected Areas. He has received various honors as an effective teacher and public lecturer, and serves on the editorial boards of three professional journals: *Coral Reefs*, *Ecology*, and *Ecological Monographs*.

Dr. Dave Fluharty
Associate Profess, School of Marine Affairs
University of Washington

Dave Fluharty is an Associate Professor (Without Tenure) at the University of Washington's School of Marine Affairs. He receive his Doctorate in Natural Resource Management and Conservation in 1977 from the School of Natural Resources, University of Michigan. Apropos the issues of fishery management and the use of MPAs, Dave is a member of the North Pacific Fishery Management Council (nine years) where he chairs the Ecosystem Committee. Dave served as Chair of the panel mandated by Congress in the Sustainable Fisheries Act 1996 to develop a report on the use of ecosystem-based fishery management in the United State (see NMFS Sustainable Fisheries Act Reports website). Fluharty served on the National Academy of Science, National Research Council study to produce the report, "Marine Protected Areas: Tools for Sustaining Ocean Ecosystems" (see National Academy of Science, NRC website). Dave fully believes that confronting this complex set of issues is the crux of the issue. Involvement of the fishery community, scientific community, and the environmental advocacy is extremely important in figuring out what should be done.

PFMC
03/06/03

PISCO

March 11, 2003

Mr. Mike Ricketts & Ms. Kathy Fosmark
Chairpersons
Alliance of Communities for Sustainable Fisheries
P.O. Box 1309
Carmel Valley, CA 93924

Dear Mr. Ricketts and Ms. Fosmark,

Thank you for your letter about the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) products and activities associated with sharing new scientific information about marine reserves. We welcome the opportunity to hear your perspectives and to share information about this topic. We wish to assure you that PISCO is dedicated to both creating new scientific information and sharing that new knowledge with a broad range of interested people in an honest and unbiased fashion.

Our recent booklet and video on the scientific aspects of marine reserves are summaries of the best scientific information available. These products focus squarely on the science and are intended to make publicly accessible the recent scientific information formerly available only in the peer reviewed scientific literature.

One reason we decided to produce "The Science of Marine Reserves" materials was simply that there has been so much new scientific information on this topic produced in the last few years. We believe that scientific findings should be readily available to interested audiences. Our goal was to distill the best available scientific information about a complex topic into a succinct summary for the interested public, policymakers, and resource managers.

The information in the booklet and video is based almost exclusively on the information in scientific papers published in the peer-reviewed scientific literature, much of it appearing very recently. For example the February 2003 issue of the journal ***Ecological Applications*** has devoted an entire Special Issue to The Science of Marine Reserves. This journal is published by the Ecological Society of America, one of the oldest and most respected professional scientific societies in the US. Papers are not published in the journal until they undergo rigorous peer review. Quite a few papers are rejected or significantly modified during this process. This Special Issue is just one example of the explosion of new scientific knowledge about reserves. Numerous other professional journals are publishing new information about reserves as well.

We believe that it is unreasonable to expect most members of the public to wade through the technical and jargon-laden scientific literature such as this entire special issue (though they are welcome to do so!). And yet, much of this information is of general interest to many non-scientists and needs to be presented to them in an objective and readily understood manner.

Our brochure and video present an accurate summary of the latest scientific information in an unbiased fashion. For every concern you raised in your letter, there is credible, well-designed research and synthesis of the scientific information available to backup what is in the brochure or video.

For example, several biological benefits of reserves have now been well documented. As stated in the brochure: "Reserves protect marine habitats in a particular place and the diversity of animals and plants that live in those habitats. Consequently, many animals and plants in reserves tend to live in greater numbers, grow larger, and reproduce more than their counterparts outside reserves." Most of these benefits are associated with the role of reserves for the conservation of marine ecosystems and certain species targeted by fisheries.

The materials do not promise a "one size fits all" solution with marine reserves. They simply state what has been learned about some of the benefits they provide. The brochure is carefully worded: "Research shows that marine reserves are one tool that can help to prevent, slow, or reverse negative changes in the ocean." (page 1 of brochure) "Marine reserves are one tool for managing ocean ecosystems, but they cannot protect oceans from all human influences. Reserves alone may not address such pervasive problems as pollution and climate change, and they may have fewer direct benefits to some fishes and mammals that move long distances. However, the most recent scientific research shows that marine reserves usually boost the abundance, diversity and size of marine species living within their borders." (page 1)

There are many areas where there is insufficient scientific information to provide clear guidance, especially in the realm of fisheries management. Obviously this is the topic that is of greatest interest to you and many others. Most of these areas of uncertainty are the topics of active scientific investigations, including many of our own. We focused the materials on areas where there is strong scientific consensus, not on defining the current and future research agenda. We would be happy to engage in discussion about any of these interesting, important but unresolved topics, but the purpose of the brochure and video was to share the new information where consensus is emerging.

We are keenly aware of the responsibility that comes with conveying scientific information to the general public and to decision-makers and we took great pains to represent the information accurately. We deliberately sought reviews of the brochure and video by other scientists with relevant expertise and a wide range of perspectives. In response to their comments, we revised the materials to ensure they were broadly representative.

We regret that Dr. Ray Hilborn feels his comments on the marine reserve booklet were ignored. He is incorrect in this judgment. As we illustrate in our response to his "Comment" (see attached), both the booklet and the video were extensively modified in response to his review. We respect that scientists will have differences of opinion on issues, which is why we claimed sole responsibility for the content of the booklet.

You express concern that the manuscript by Dr. Robert Shipp was not cited in "The Science of Marine Reserves" booklet. We were certainly aware of the existence of his unpublished manuscript when we created our document. We did not include it because we believe the Shipp report is erroneous in its analysis and conclusions. As you know, Shipp's report is not a review of marine reserves *per se*. Dr. Shipp uses a set of rules to estimate how much a particular species moves as an adult, and concludes that species with extensive movements will not be protected by reserves (this is discussed on page 9 of the booklet). The methodology leads to misclassifications of species, such as classifying rockfish (which are generally sedentary) as "highly mobile" because the species as a whole occurs over wide geographic areas. Dr. Shipp suggests that 98% of fished species move too much to be enclosed in reserves. If this were so, reserves would not show such dramatic increases in abundance and size of the species protected within their borders (discussed on page 9 of the booklet). Additionally, if most species really are that mobile, then reserves will be neutral: as they move, the fishes will be available to be caught outside reserve boundaries. A number of scientists have already pointed out the serious and extensive scientific shortcomings in Dr. Shipp's report. We append one of these documents here for your information.

Regarding the media briefings, we certainly did not intend to be seen as exclusive or divisive. The objective of the workshops was to create an opportunity for local news media and local scientists to discuss marine reserve science. PISCO was involved in two of the three workshops. Scripps Institution of Oceanography hosted the first workshop in San Diego. PISCO hosted the ones in Santa Cruz and Corvallis. The Ocean Wilderness Network (OWN) sponsored all three workshops; Scripps and PISCO provided the scientific expertise. Information about the recent polling conducted in California and Oregon was also presented by the pollsters to provide the journalists with a sense of their readership's perceptions of marine reserves. PISCO's role in these events was to coordinate the natural science presentations and manage local logistics.

We have and would be happy to continue to provide the same information to fishing associations and organizations.

Let us assure you that it was not our intent to exclude journalists from the media events. We invited journalists from the major news outlets in Monterey Bay and Oregon. Our list was limited by the organizers' awareness of news publications in each region. If any journalists from special interest group publications had expressed interest to us, we would have welcomed their attendance.

Those particular workshops were not open to the public due to space and resource constraints. Only members of local media and only few outside observers (primarily agency representatives who are working on marine reserve implementation in the given region) were invited to attend. The observers were invited to serve as resources in the event that journalists posed questions about management issues that the scientists could not address. In both the Santa Cruz and Corvallis workshops, all observers were welcome to ask questions (and did) with the ground rule that the media had priority due to time constraints.

Thank you for the opportunity to address the concerns expressed in your letter of January 6, 2003. We appreciate the openness with which you communicated the issues and we would be happy to have an ongoing, open dialogue on the topic of marine reserves. We would be pleased to work with members of the Alliance, and anticipate learning from the collective experience that the fishing community offers. It is our hope that PISCO can nurture and sustain a trusting and open relationship with the fishing community in the years to come.

Sincerely,

Dr. Mark Carr
PISCO Principal Investigator, UCSC

Dr. Mark Denny
PISCO Principal Investigator, Stanford

Dr. Steven Gaines
PISCO Principal Investigator, UCSB

Dr. Jane Lubchenco
PISCO Principal Investigator, OSU

Dr. Bruce Menge
PISCO Principal Investigator, OSU

Dr. Peter Raimondi
PISCO Principal Investigator, UCSC

Dr. George Somero
PISCO Principal Investigator, Stanford

Dr. Robert Warner
PISCO Principal Investigator, UCSB

Cc:
The Honorable Sam Farr
The David and Lucile Packard Foundation
The Leon and Sylvia Panetta Institute for Public Policy
National Science Foundation
Michael Flores, President, CFG Commission
Robert Hight, Director, CDFG
William Douros, Superintendent, MBNMS
Stephanie Harlan, Chair, MBNMS Advisory Council

Enc.

March 11, 2003

Dr. Ray Hilborn
School of Aquatic and Fisheries Sciences
University of Washington
1122 NE Boat Street
Seattle, Washington 98105

Dear Ray,

We write in response to your publicly released (November 27) "Comment" on our "Science of Marine Reserves" brochure and video. In your Comment, you made three points, all of which are inaccurate. We address each of these in turn.

(1) You said that although you provided comments to us on the original draft of the brochure, none your comments seemed to have any impact on the final draft. In fact, your comments had a major influence on the final brochure, and we were and are grateful to you for them. We sought reviews from 15 scientists with a range of perspectives and took great pains to address **every** comment we received. We listened carefully to the range of feedback we received and attempted to do an honest job of balancing the range of views and comments to produce a balanced and understandable summary of the current state of the science. You may not agree with every word in the document, but this does not mean your comments were ignored.

In case you are skeptical that we modified the brochure and video in response to your review, read through the next eight pages. In those pages you will find a clear documentation of the extent to which we responded to your review. We reprint your review of June 22 in its entirety (*in italics*) and following each point you made, we provide specific information (in regular type) to indicate how we changed the text in response to your comments or we provide the rationale for why we disagree with your interpretation. After reading the rest of this communiqué, anyone would be hard pressed to draw any conclusion other than that we responded to all of your concerns, and made modifications accordingly. We thank you again for helping us identify areas where the original text for the brochure and video needed alteration and for helping ensure the final product is balanced and accurate.

(2) You assert that the brochure and video are not an accurate summary of the state of scientific knowledge regarding marine reserves. The "Science of Marine Reserves" products have been widely recognized and praised as the most accurate and balanced summary of the science, for public audiences, as it stands today. That was our intent.

It is important to note that (contrary to your suggestion) our goal was to write a summary of scientific knowledge **for the public**, not a paper for publication in the scientific literature. A wealth of published scientific information about marine reserves already exists, but is not widely understood or communicated. Our intent was to summarize the existing, peer reviewed, information in an easy-to-understand format.

In seeking a wide range of reviews from a variety of qualified scientists across the nation, we tried to produce a summary of the scientific information that was broadly representative and accurate. We had no obligation to seek this outside review; we did so because we thought it would help make the documents more broadly representative and accurate. We incorporated the comments of each of the other reviewers just as we did yours, and the document benefited substantially from that review. We named each of the reviewers of the document to acknowledge their efforts and thank them publicly.

We certainly recognize the controversies (both scientific and social) that surround marine reserves, and indeed many of us, as you know, are actively engaged in doing experiments, studies or analyses to resolve these issues. Some of the issues you raise (e.g., appropriate levels of effort reduction following reserve implementation) have received little scientific attention, so are premature to summarize. Those and other topics are ripe for investigation. It is our hope that "The Science of Marine Reserves," as well as other scientific materials, will foster discussions regarding some of these difficult and important issues and spur additional scientific research. It was not our goal to flag all of the unresolved issues, but rather to summarize many of the new findings that have not been widely disseminated.

(3) You suggest that we misinterpreted some of the examples in the brochure or used examples selectively. In the detailed replies in the next few pages, we provide specific information to answer the points you raised. In most of these cases, we investigated a range of possible interpretations and satisfied ourselves that the information in the brochure represents the most likely explanation based on all of the available evidence. In doing so, we sought information directly from the authors of the other studies and based our information on those closest to the actual study.

In your 27 November Comment, you raise an additional point, criticizing our use of the Merritt Island information in the following fashion: "the Merritt Island and St. Lucia examples were both published in a paper by Roberts et al. in *Science*" and *Science* subsequently published several critiques of this work. In fact, the brochure text about Merritt Island (pages 8 and 10) is based entirely on a paper by Johnson et al. in the American Journal of Fisheries Management, and on the actual IGFA World Records for black drum in Florida. (One of us is a member of IGFA and thus has access to the database for the world records for black drum.) The reference to Roberts et al. was included at the end of the brochure only to provide readers with additional information. The St. Lucia example was not used at all in the booklet.

We fully appreciate the importance of open exchange of ideas and information and for highlighting areas that have not yet been addressed. We, too, hope for significant progress in resolving the remaining uncertainties. At the same time, we feel is it useful and important to communicate many of the areas in which there is strong consensus within the scientific community. The "Science of Marine Reserves" products were designed specifically to share new scientific information that is emerging with the broader world interested in those results, and especially in areas where there is strong consensus. We note that you state you are "broadly in favor of Marine Reserves and believe they are a valuable tool for protection of biodiversity, and in some cases may be an important tool in fisheries management." We think the brochure says the same thing.

Sincerely,

Jane Lubchenco, Oregon State University (OSU)
Steven Gaines, University of California at Santa Barbara (UCSB)
Robert Warner, University of California at Santa Barbara (UCSB)
Brooke Simler, Communication Partnership for Science and the Sea and OSU
Satie Airame, UCSB and NOAA

Encl: Seven pages that detail your June 22 2002 review of earlier drafts of the brochure and video and provide information about the ways in which we incorporated them into the final products or why we did not change the text.

Original comments from Ray Hilborn to Brooke Simler who coordinated the scientific review process for "The Science of Marine Reserves" brochure and video. Ray's comments are presented here in their entirety, in italics.
Following each comment, we provide a description of how Ray's comments were incorporated or addressed, or we explain why the concerns were not valid, in normal typeface.

From Ray Hilborn rayh@u.washington.edu
Date Saturday, June 22, 2002 10:42 am
To Brooke Simler simlerb@science.orgeonstate.edu
Subject Re: Review: The Science of Marine Reserves

A few comments from a skeptic.

MPA's promise you can have your cake (protected areas) and eat it to [sic] *(improve fish yields). None of the pain of effort reduction, stock rebuilding plans, etc. It would be nice if this was true.*

Some of the limitations of MPAs are emphasized in the booklet so that the reader will understand that MPAs may not be successful in the absence of other types of management. With specific reference to fisheries management we noted:

Page 20: "However, other types of management are still critical. Traditional practices, such as fishing quotas, seasons, and gear restrictions are important to achieve sustainable fisheries in surrounding waters. Scientists are developing fisheries management models that incorporate both marine reserves and more traditional methods of regulating fishing effort."

In addition, we highlighted several other limitations that affect *both* conservation and fisheries goals:

Page 1: "Marine reserves are one tool for managing ocean ecosystems, but they cannot protect oceans from all human influences. Reserves alone may not address such pervasive problems as pollution and climate change, and they may have fewer direct benefits to some fishes and mammals that move long distances."

Page 20: "Marine reserves cannot address all that ails the ocean. Problems such as pollution, invasive species, disease epidemics, and climate change affect whole regions and require complimentary solutions. However, by protecting critical habitats, reserves can contribute to the protections and restoration of healthy marine ecosystems."

In a general description of potential effects of marine protected areas, it is not possible to predict the amount of effort reduction that will be necessary to restore sustainable fisheries in a specific location. However, the question "How will marine reserves affect commercial and recreational activities?" is presented on page 19 as part of the considerations for reserve design. Stock rebuilding plans were not mentioned specifically, however the question "What other management strategies will be needed to complement marine reserves?" is presented on page 19 as part of the considerations for reserve design.

Specific comments

Is it true that the oceans are supporting less abundant life, or just things that we harvest are less abundant? I don't know of any evidence that biomass has changed.

The original text that provoked this comment was: "Life in the ocean was once more plentiful than it is today."

After incorporating Dr. Hilborn's comment the new text is [Page 1] "Marine environments worldwide are in the midst of a transformation. There is increasing evidence that ocean ecosystems are being altered beyond the range of natural variability by the combination of human activities, including fishing, pollution, and coastal development."

Areas closed to fishing is a very old fisheries management technique, not in all fisheries, but certainly frequently used.

This comment refers to a line in the original script of "The Science of Marine" video that stated "The idea that you can't fish some place is something that's new — that's different..." Dr. Hilborn's comments, and other similar comments, pointed out that this was not a new idea. The line was removed from the narration.

Additionally, several sentences in the text indicate that marine reserves have been used in the past.

Page 2: "—At least 23 nations [which are listed] have established marine reserves to protect biodiversity, manage fisheries, and restore depleted populations of marine animals and plants. –More than 100 marine reserves have been established worldwide."

Page 4: "Scientists have studied the performance of more than 80 marine reserves of many different sizes in a variety of temperate and tropical habitats."

In the initial discussion of areas protected from fishing have more fish—what happened to all that effort—how much did other areas get degraded?

This concern was raised again in the short piece Dr. Hilborn wrote for MPA News. Degradation of outside areas would show up as a decline in biological values (density, biomass, or maximum size) in outside areas in reserve studies with BACI designs. Of the 7 such studies we have been able to locate, density actually increased over time in control areas for five studies, there was no change in one, and an apparent decline in the single remaining study. In each case, densities increased faster within the reserve than in control areas. These findings are consistent with the explanation that the benefits of reserves beyond their borders (spillover of adults and export of larval production) commonly counter the potentially degrading effects of displaced effort.

Values inside reserves increased more than values outside. While we cannot ascribe causality for the overall increase to reserve effects, there is certainly no evidence of degradation in areas outside reserves.

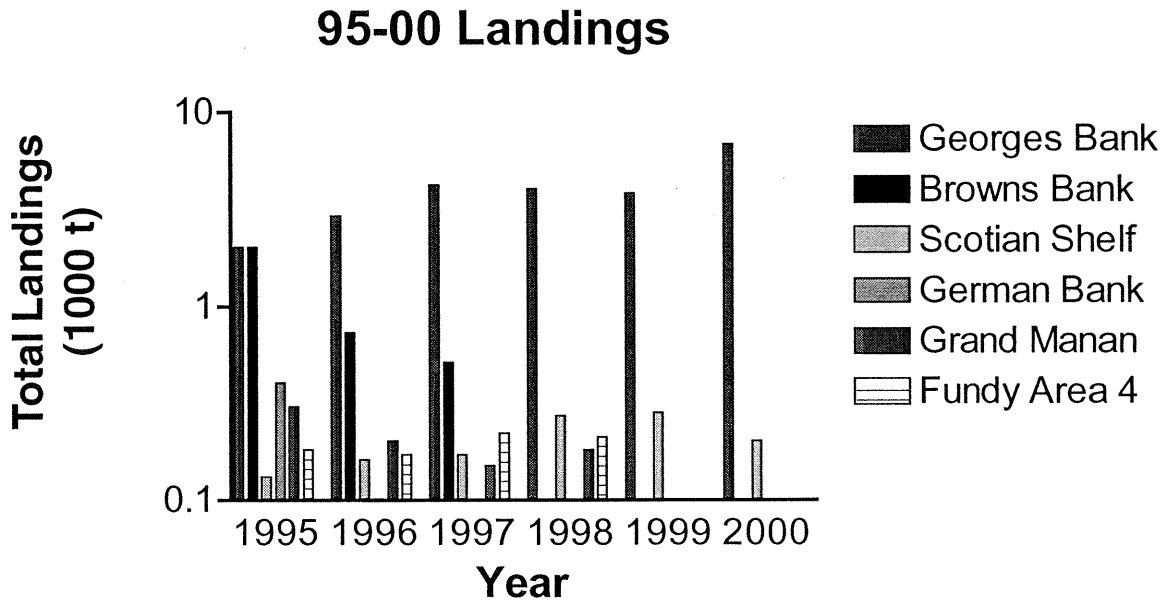
We performed this analysis after the brochure was published, so the results were not included. We do appreciate this as an important point. The goal of this section was to convey the biological responses observed within reserves. Based on the receipt of this, and related comments, the authors added the questions to the "Where Should Reserves Be Located" [Page 19] in order to acknowledge these concerns exist.

While I won't claim to be an expert on the New England scallop fishery, I would note that the scallop increased quite a bit in Canada at the same time where there were no protected areas, and in the 1990s lobsters and crabs did the same thing in most of eastern Canada (much more abundant than previously), with no MPAs.

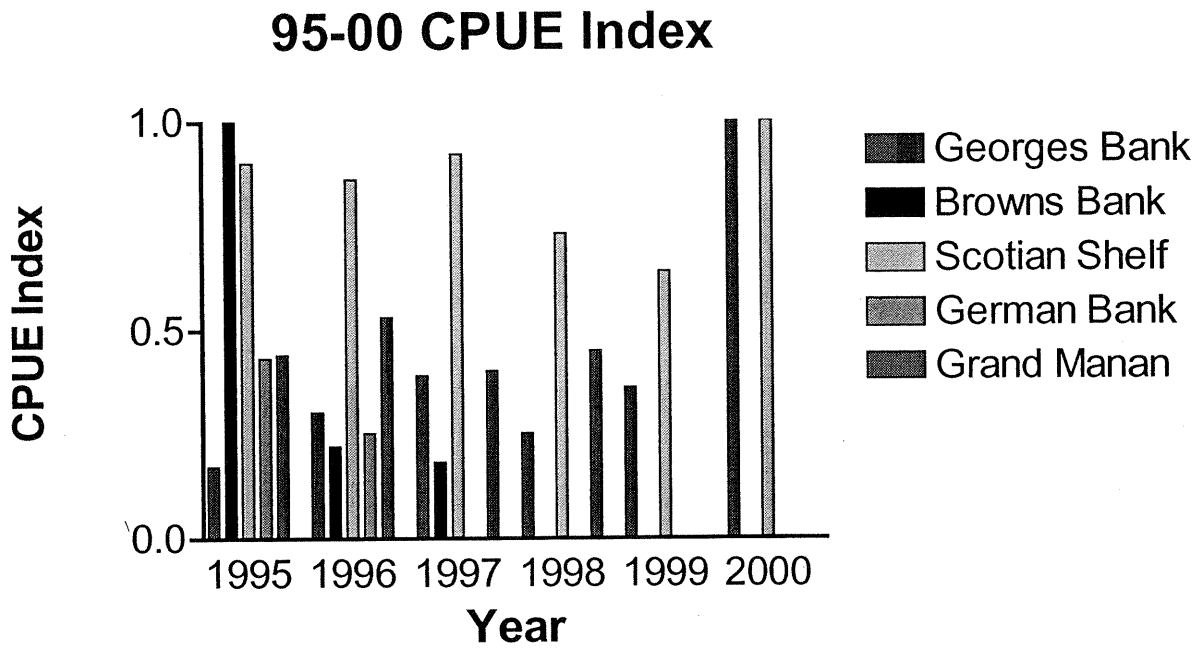
Clearly, yields from fisheries can vary dramatically over time due to many factors. Regulatory changes and interannual variation in climatological and biological factors that affect recruitment of young, survival of juveniles or adults, and fecundity can all play significant roles. As a result, it is a challenge to evaluate the impact of any particular change. The data in *The Science of Marine Reserves* about scallop fisheries in New England, and its interpretation, were provided by fishery biologist Dr. Steve Murawski from the Northeast Fisheries Science Center. Maps were provided by Dr. Craig V. Lewis, who was a postdoctoral student at the Northeast Fisheries Science Center at the time he collected the data and now has a faculty position at the University of California at Berkeley. There are two important findings from these data relevant to reserves. First, scallop densities were dramatically higher inside the closed areas than nearby areas outside. The differences in density and age structure are striking. Second, scallop densities increased in areas adjacent to the closed areas where fishing was not eliminated. The key point here is not that the densities increased, but *where* they increased. The pattern of increase was consistent with model predictions of scallop larval dispersal from adults within the closed areas. The fact that scallops landings may have been increasing at the same time in other areas of Canada is largely irrelevant to both points. The crucial data on scallops we addressed both relied on the spatial patterns of increase (e.g., in versus out of closed area, and areas predicted to see high larval settlement), not simply that scallop densities or landings increased.

Although the scallop changes in Canada may not be relevant to these points, they are worth examining. We took a quick look at data from the Canadian DFO website to see how landings have changed since the closures. Overall scallop landings have indeed increased, but the spatial pattern of this increase is quite intriguing. If you break down the landings by region, the only area that shows a substantial increase during this period was Georges Bank, which increased more than three fold. Landings from all other managed areas either declined substantially or remained relatively constant. Since Georges Bank generates the largest yield, total Canadian scallop landings increased. These patterns are not consistent with some regional increases in scallops that could compromise interpretations. They are, however, completely consistent with the conclusions drawn in the *The Science of Marine Reserves*. The Canadian Georges Bank fishery is situated just to the east of Closed Area 1. The boundary of the closed area is the ICI line separating US and Canadian waters. The elevated adult abundances illustrated in the figure in *The Science of Marine Reserves* on page 17 can be clearly seen on the Canadian portion of

the bank. The ocean circulation models for this region suggest that larvae produced in the upper corner of Closed Area 1 should seed the Canadian part of the Georges Bank, which is consistent with the three fold increase in subsequent landings seen below. Ironically, the closed areas may be having some of their largest benefits on Canadian fisheries.



One of the more striking patterns in the Canadian fisheries statistics is that the increases in yield on Georges Bank were achieved while fishing effort declined dramatically. DFO calculates a CPUE index, which scales CPUE to its highest value for a particular region during recent years with catch and effort data. Note that Georges Bank is the only Canadian region where the trend in CPUE is increasing during this interval. Total fishing effort was half as high in 2000 as in 1995 on Georges Bank, yet landings increased three fold. As a result, CPUE increased more than five fold.



I would be careful in drawing and analogy between reserves and hatcheries—there is little evidence that hatcheries actually work!

The original text that provoked Dr. Hilborn's comment was: "Scientific studies show that these processes, known respectively as spillover and export, enable marine reserves to act as natural hatcheries that supply adults and young to replenish nearby populations."

After incorporating Dr. Hilborn's comment the new text is: [Page 7] "Spillover and export may enable marine reserves to replenish nearby populations." The term "hatcheries" was deleted.

Overall you mention that reserves are controversial but you don't present any of the issues about why they might

1—have negative impacts on biodiversity

We incorporated several paragraphs that describe the possible declines of organisms due to establishment of marine reserves.

Please note page 5: "Will reserves increase the abundance of all species? Although many animals and plants become more plentiful within newly established marine reserves, some decline. For example, a fished animal, such as lobster, may increase in number and size in marine reserves and consequently reduce the number of its prey, such as sea urchins (see illustration). In addition, some species that were absent may not become reestablished in a reserve if no viable populations remain nearby.

Although it is difficult to predict the exact changes for any particular species or location, the data from existing reserves show that, on average, increases in abundance, body size, biomass, and the number of species are common outcomes after marine reserves are established."

Please note page 6: "Lessons Learned: —Inside the reserve, kelp forests flourish because lobsters and sheephead, which are predators, reduce populations of kelp-eating purple urchins. –As a result, the kelp forest ecosystem in the reserve is more productive and stable over time than kelp forests outside. –Similar effects through the food web are likely to occur in other reserves because marine animals and plants often strongly affect one another."

Please note page 6: "Lobster and California sheephead protected inside this reserve feed on sea urchins, thereby keeping the urchin numbers in check. Reduced numbers of urchins allow stands of kelp to flourish, which in turn support many other species inside the reserve."

Caption on page 6: "When one species in the food web is fished, other species are affected. For example, when lobsters are fished, sea urchins become abundant and kelp declines. In a reserve, lobsters grow larger and more abundant, keeping the urchin population down and allowing kelp to grow."

2—reduce fisheries yields

To address this comment and other comments about economic and social concerns, we completely revised pages 19 and 20. The new text does not answer these important questions, because very little information exists about potential reduction in fisheries yields following establishment of MPAs. We are unaware of documented declines in fisheries yields due to the establishment of reserves.

However, the text of the "Science of Marine Reserves" does emphasize the importance of economic and social considerations.

Page 19: "A variety of questions must be considered before reserve design can satisfy the goals of diverse communities. –How will marine reserves affect commercial and recreational activities?...The breadth of knowledge and values in each community can help to answer some of these questions. Personal knowledge can fill some gaps in scientific data. Economic modeling, based on data from landing records and logbooks, can be used to evaluate the potential short-and long-term economic impacts of reserves. Societal values can influence the design of reserves so that our traditional relationships with the ocean are protected and sustained."

On the other hand, you don't mention how MPAs could be used in the complex multispecies fisheries like the West Coast US to protect species like bocaccio that are now driving fisheries management for other species. That is where I think MPAs could really improve fisheries yields!

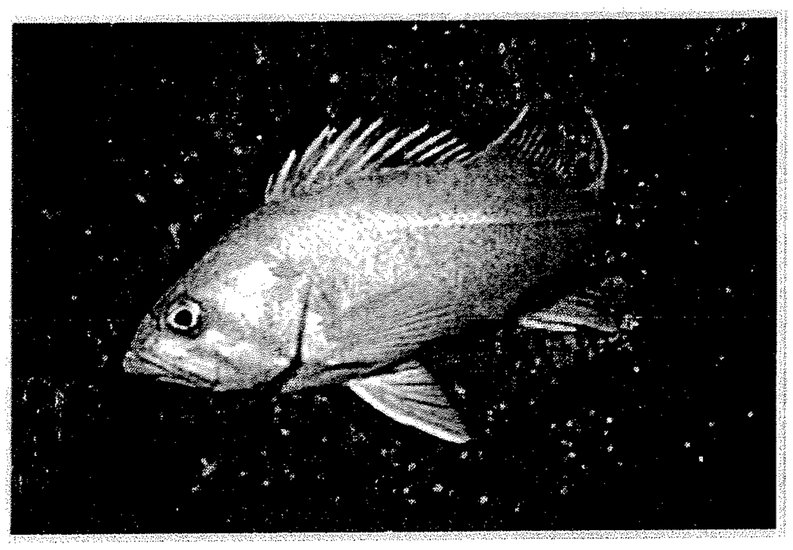
Ray Hilborn

Although complex multispecies fisheries are not specifically named, the booklet emphasizes the use of MPAs as a tool to manage whole systems, rather than single species. Several statements in the booklet indicate that MPAs could be appropriate management tools for multispecies fisheries.

Page 1: "Reserves protect marine habitats in a particular place and the diversity of animals and plants that live in those habitats. Consequently, many animals and plants in reserves tend to live in greater numbers, grow larger, and reproduce more than their counterparts outside reserves."

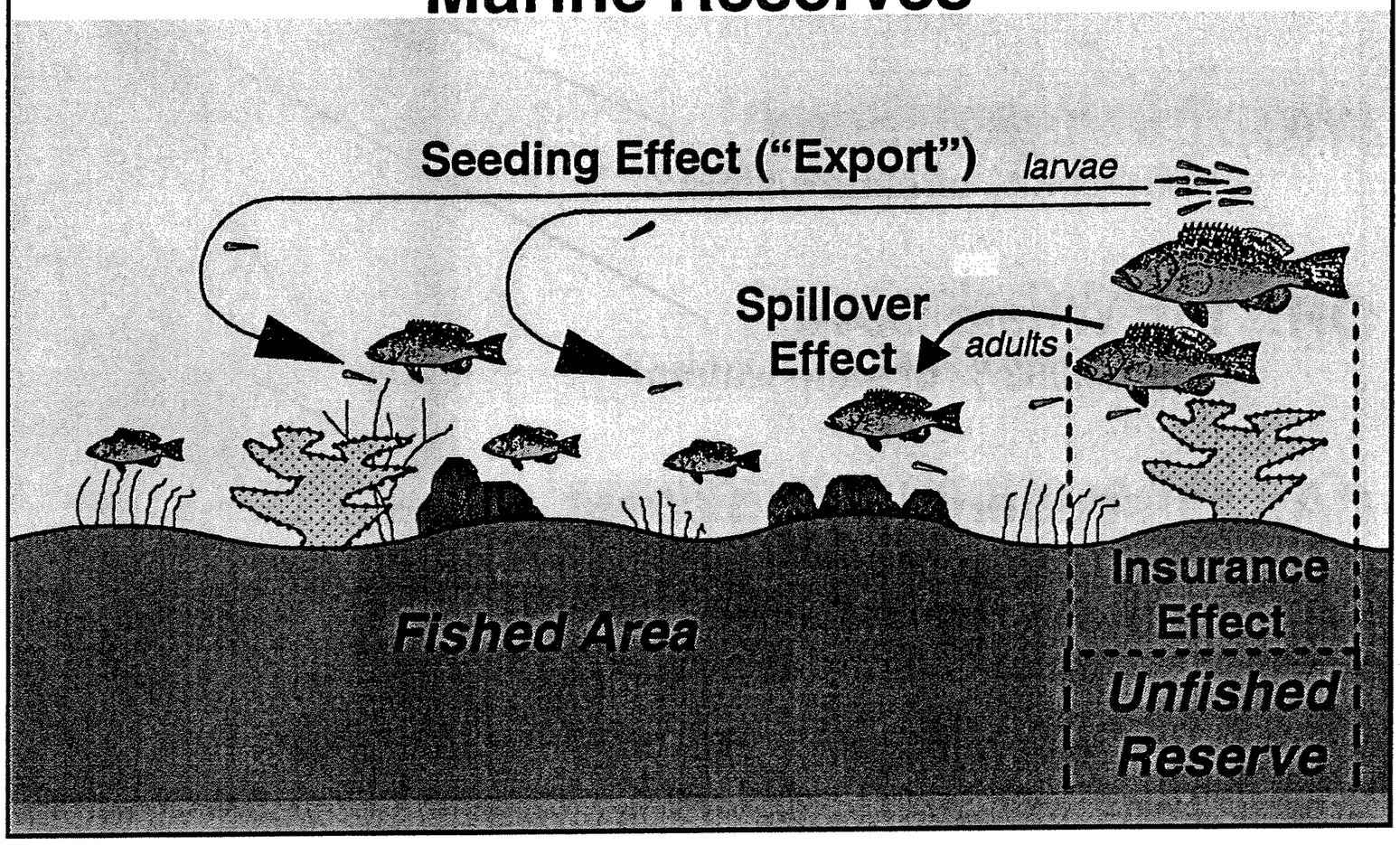
Page 20: "By eliminating extractive and other destructive activities in particular locations, reserves can protect significant portions of entire ecosystems at once. Traditional approaches tend to focus on single species independent of other elements of the ecosystem. The most effective protection for even a single species requires an ecosystem approach, because every species interacts with numerous other species and the environment."

Fishery Effects of Existing West Coast Marine Reserves:
The Scientific Evidence



Dr. Mark Hixon
Department of Zoology
Oregon State University

Predicted Fishery Benefits of Marine Reserves



Do West Coast Marine Reserves Benefit Fisheries?

Inside Reserves:

- Are there more fish?
- Are there larger fish?

Outside Reserves:

- Is there "seeding" of larvae?
- Is there "spillover" of adults?

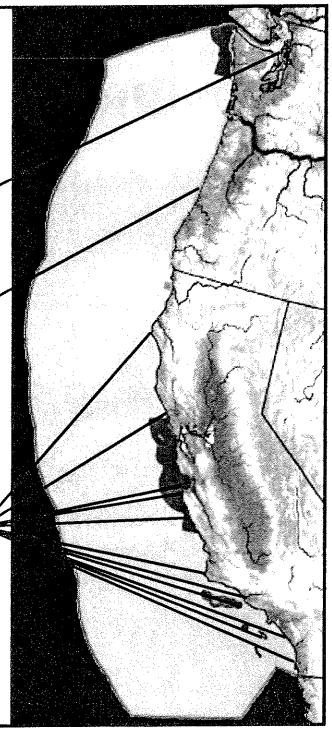
Existing West Coast Marine Reserves

WA: 7 in Puget Sound*
about 0.03 % of state waters

OR: 1 in Whale Cove*
about 0.003 % of state waters

CA: 11 scattered along coast
about 0.2 % of state waters
plus 10 new reserves around Channel Is. implemented January 2003

* some not fully-protected



Do West Coast Marine Reserves Benefit Fisheries?

Problem:

Existing reserves are few, tiny, coastal (mostly rocky bottoms), and often not fully protected.

Approach:

- Compare fish abundance, size, and reproductive output inside reserves (unfished) vs. outside (fished) in similar habitat.
- Examine patterns of fish movement based on tagging studies.

Scientific Studies of Existing West Coast Marine Reserves

13 reserves studied:

3 in Washington (not fully protected)
1 in Oregon (not fully protected)
5 in no. California (3 not fully protected)
4 in so. California

average area = 0.34 square nautical miles
(range: 0.04 – 1.60)

average age = 22 years
(range: 12 – 35)

Scientific Studies of Existing West Coast Marine Reserves

9 independent studies:

22 inside vs. outside comparisons

17 fished species examined:

red sea urchin
red abalone & pink abalone
barred sand bass & kelp bass
California sheephead
cabezon & lingcod
9 rockfishes: black, black-and-yellow, copper, gopher, kelp, olive, quillback, vermilion, yellowtail

More fish in unfished marine reserves than nearby fished areas?

YES

- **15 of 17 comparisons (88%)**
- **37% to >6x more fish inside reserves**

2 exceptions:

quillback rockfish in Puget Sound, WA

black-and-yellow rockfish in no. CA (Pt. Lobos)

Larger fish in unfished marine reserves than nearby fished areas?

YES

- 12 of 15 comparisons (80%)
- fish inside reserves 13-25% larger

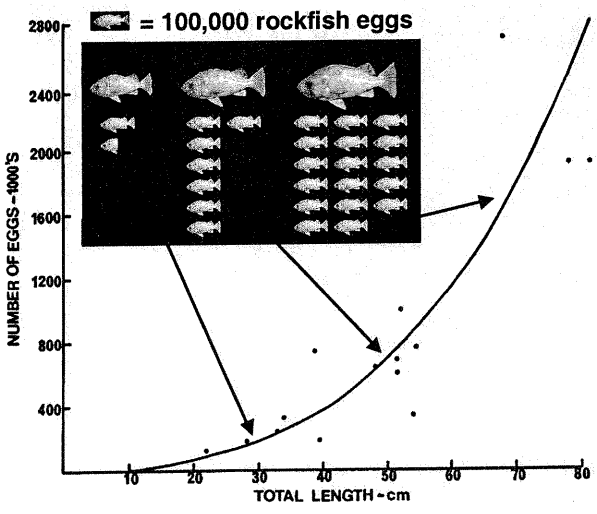
3 exceptions:

quillback rockfish in Puget Sound, WA

cabezon & black-and-yellow rockfish in no. CA (Pt. Lobos)

Seeding Effect?

Egg production increases exponentially with fish size



Love et al. (1990)

Greater egg production
in unfished marine reserves
than nearby fished areas?

YES

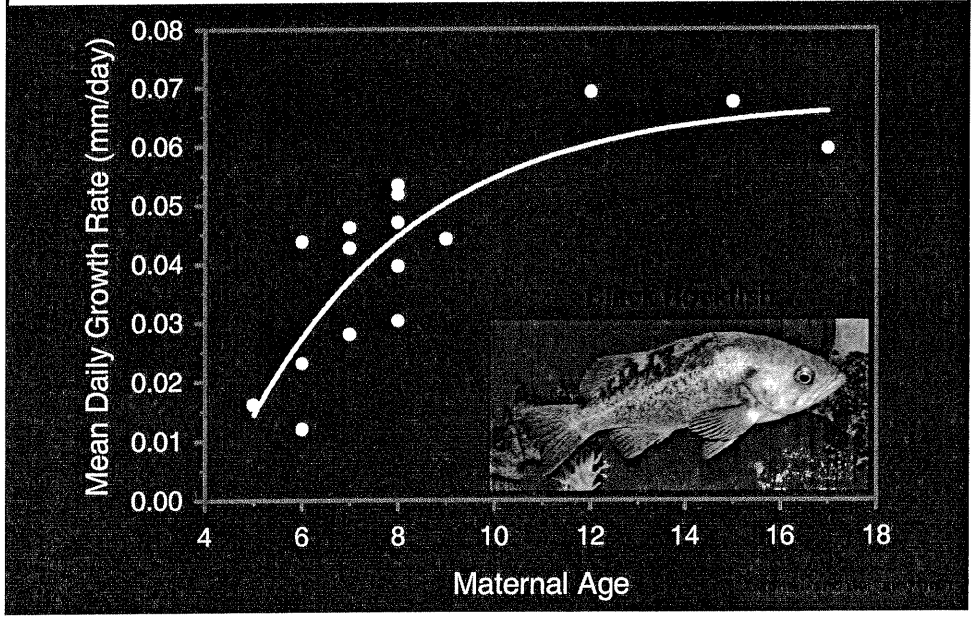
- **15 of 17 comparisons (88%)**
- **3-25x more eggs produced in reserves**

2 exceptions:

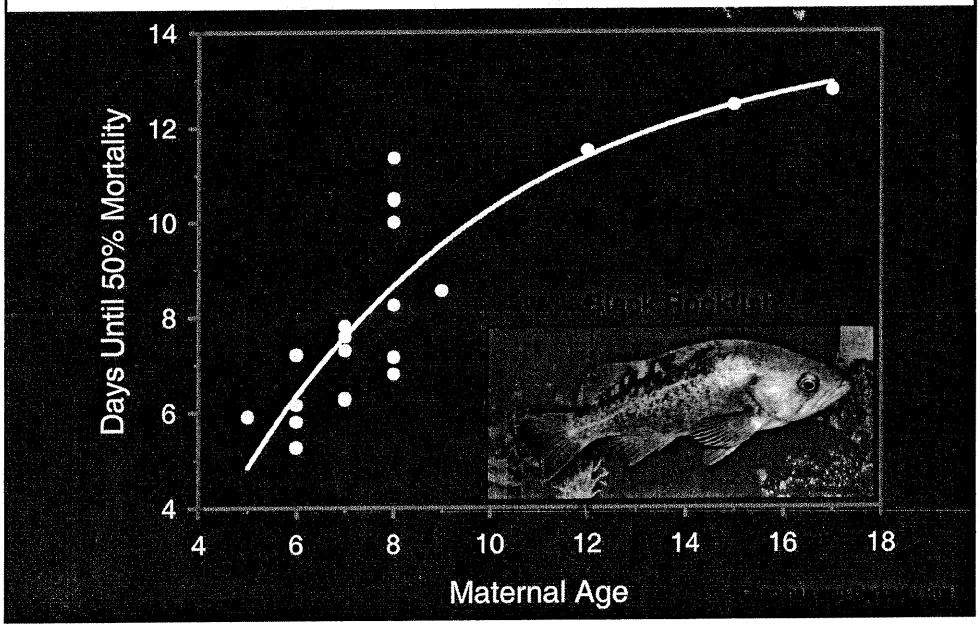
quillback rockfish in Puget Sound, WA

cabezon in no. CA (Pt. Lobos)

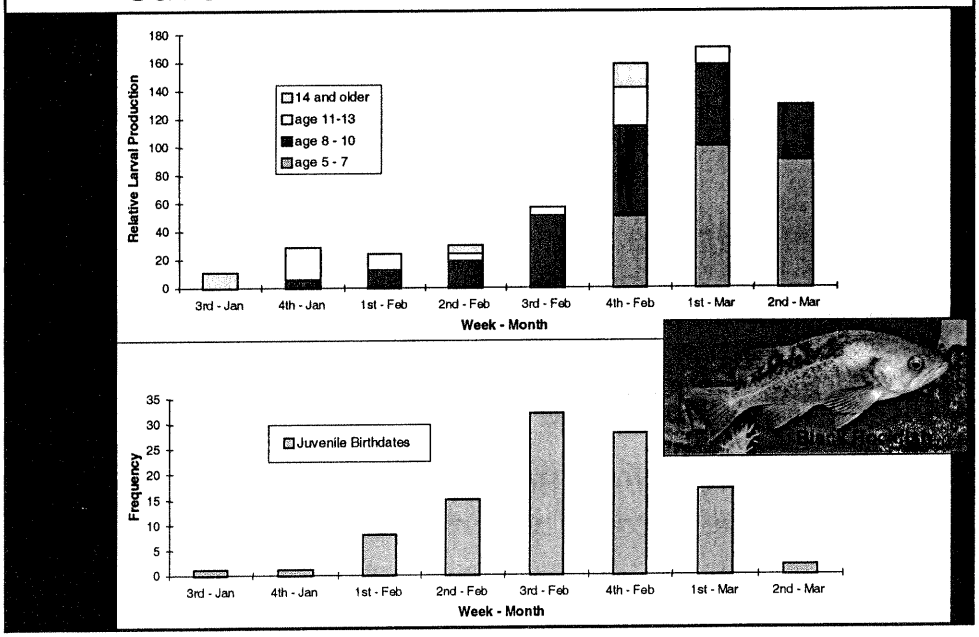
Value of Big Old Fat Females:
Larvae from older fish grow faster



Value of Big Old Fat Females:
Larvae from older survive better



Value of Big Old Fat Females:
Juvenile survivors are from older fish



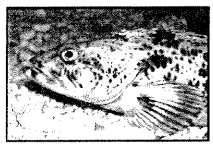
Spillover Effect?
Are movements of West Coast groundfish sufficient?

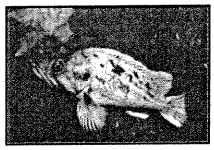
YES

Tagging studies show that various rockfishes, flatfishes, and others move 10s of nautical miles as they grow, sufficient distances for spillover to occur.

Spillover Effect?
Movements of West Coast Groundfish

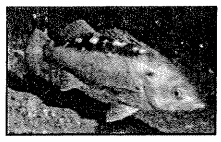
Lingcod (Strait of Georgia, BC):
- 95% of males move up to 9 nmi / yr
- 95% of females move up to 18 nmi / yr





Brown rockfish (San Francisco to CA coast):
- juveniles migrate up to 27 nmi

Yellowtail rockfish (Puget Sound to WA coast):
- juveniles migrate up to 195 nmi



Yellowtail rockfish (Heceta Bank, OR):
- adults move up to 0.7 nmi / mo

Conclusions Regarding West Coast Marine Reserves

Inside Reserves:

- Are there more fish?
  Yes—with few exceptions
- Are there larger fish?
  Yes—with few exceptions

Outside Reserves:

- Is there "seeding" of larvae?
  Probably—increased egg production
- Is there "spillover" of adults?
  Probably—sufficient movement of fish

Conclusions Regarding West Coast Marine Reserves

"Catch-22"

There is no way to fully test the predicted fishery benefits of marine reserves without implementation on a larger scale than presently exists.

For a copy of the full report, e-mail:

hixonm@science.oregonstate.edu

and for info on big, old, fat females:

stevenab@cats.ucsc.edu

Exhibit D.1.c
Supplemental HC Report
March 2003

HABITAT COMMITTEE COMMENTS ON CONSIDERATIONS FOR INTEGRATING MARINE RESERVES WITH EFFECTIVE FISHERY MANAGEMENT

The Habitat Committee (HC) would like to thank Drs. Lubchenco, Hixon, and Fluharty for making this presentation. The HC looks forward to further discussion of these issues at the April Council meeting.

PFMC
03/11/03

Exhibit D.1.c
Supplemental SAS Report
March 2003

SALMON ADVISORY SUBPANEL STATEMENT ON CONSIDERATIONS FOR INTEGRATING MARINE RESERVES WITH EFFECTIVE FISHERY MANAGEMENT

The Salmon Advisory Subpanel (SAS) had a general discussion regarding marine reserves. The SAS has one question, "What new tools do marine reserves offer that traditional fishery management does not offer?"

PFMC
03/11/03

Alliance of Communities for Sustainable Fisheries
P O Box 1309, Carmel Valley, CA 93924 (831) 659-2838

January 6, 2003

PISCO
UCSB
Marine Science Institute
Santa Barbara, CA 93106-6150

PISCO
UCSC
Long Marine Laboratory
100 Shaffer Road
Santa Cruz, CA 95060

PISCO
Stanford University
Hopkins Marine Station
Oceanview Boulevard
Pacific Grove, CA 93950

PISCO
Oregon State University
Department of Zoology
3029 Cordley Hall
Corvallis, OR 97331

To Whom It May Concern:

We are writing to express our concern over several recent actions by the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO). We now wonder if PISCO is moving away from being a science-based organization, and becoming, at least on the topic of Marine Reserves, an advocacy group. We wonder if PISCO realizes the impressions that certain recent actions on its part have created among the public who have been following the debate over Marine Reserves. Society expects science to be objective, fair and impartial. We therefore point out that advocacy for a theory that results from or causes a loss of objectivity on a topic that affects so many people and resources can have serious consequences, such as:

1. Social and economic damage
2. Fail to deliver intended benefits
3. Lead to actionable abuse of due process by government and advisory groups that rush into such MPA policies at a time when the scientific rationale for them has fallen into serious question
4. Cause unintended harm to fishery resources, which diminishes a basic food supply for our country

We hope that PISCO and the greater science community understands the weight of responsibility for its role in providing objective information in the Marine Reserves decision-making process.

Our first area of concern lies in the publication of "The Science of Marine Reserves", which purports to present the latest and most complete science on this topic. We have been following the science well enough to know that the wave of support for the widespread use of Marine Reserves and MPAs generally to solve a host of ocean ills has already passed. The next wave that is building is of more critical thinking as to: cautions and limitations that result from their use as a fishery management tool; for their ability, or lack of, to successfully restore a native biodiversity; their potential harmful impacts on neighboring areas; and, the need for more research to be done regarding unintended or unexpected consequences. This is not just the opinion of a bunch of fishermen; we know respected members of the science community are beginning to challenge some of the claims made about the benefits of Marine Reserves. There is, however, very little discussion of criticism or competing theories regarding the effectiveness of Marine Reserves in "The Science of Marine Reserves." These omissions are obvious to informed readers, and we fear that PISCO not only loses credibility, but will be seen as rushing to judgement before its case falls apart under critical peer review.

Of particular concern is the credit given to Dr. Ray Hilborn, of the School of Aquatic and Fishery Sciences at the University of Washington, for his review and comments on this PISCO report. We know that Dr. Hilborn does support the use of Marine Reserves in certain circumstances. However, he has also been one of the scientists who is of the second wave, offering critical evaluations of Marine Reserves, particularly as to their benefit and costs in fishery management regimens and impacts on neighboring areas. He has also challenged many of the case studies cited by Marine Reserves supporters as not really being on-target to substantiate actual benefits. We have since learned that Dr. Hilborn's comments, solicited by PISCO, were in fact received, but not incorporated in the PISCO document. PISCO should consider that it can seem misleading to issue a statement that thanks Dr. Hilborn and credits his comments, leading to the impression that he supports this report, when in fact he expressed concerns. A copy of a statement issued by Dr. Hilborn is attached for your review. It suggests that he is among the informed readers who view the PISCO report as an advocacy instead of a science-based document.

Also not included, even by mention or in the bibliography of resource materials, is the study done by Dr. Robert Shipp, Chair of the Marine Sciences Department at the University of Southern Alabama. Dr. Shipp has also served for nine years on the Gulf of Mexico Fishery Management Council, including two terms as Chair. His study is of approximately 350 species of fish, including most West Coast fished species. He concludes that Marine Reserves are of no benefit, and may even be of negative benefit, for approximately 98% of these fish stocks as a fishery management tool. The fact that this study, which is well known in the science community, was not even mentioned in the PISCO report, also makes informed readers wonder if the PISCO authors are interested in presenting the full array of critical thinking. Again, we do not think that this bewilderment is limited to fishermen; other members of the science community will be lead to wonder about PISCO's objectivity as well. For your information, the Shipp Report has been peer reviewed and will be reissued by the author early in 2003.

Possibly the most surprising activity on the part of PISCO that made many wonder about PISCO's objectivity, lies in the format of its three "media workshops on the science of Marine Reserves" on the West Coast. Apparently these workshops were put on in Corvalis, Oregon, and La Jolla, California prior to our learning of an upcoming workshop to be held at the National Marine Fisheries Lab in Santa Cruz. At the workshops in Oregon and in La Jolla, and as was proposed for Santa Cruz, the public was excluded from the workshops and only selected media representatives invited. Specifically excluded were journalists writing for major fishing publications – puzzling for an interdisciplinary partnership.

Additionally, the topics at the workshops were not merely the science of Marine Reserves, but also the results of a public opinion poll. This public opinion poll is so biased in its construction that it is truly laughable. We don't understand what opinion poll results have to do with science. PISCO should consider the impression given that it was to lead journalists to a particular conclusion. With regards to the Santa Cruz media workshop, after representatives from the fishing community learned of the workshop and strongly objected, two fishing representatives were finally able to get an invitation after much initial resistance on the part of PISCO. However, representatives from the fishing publications, including major national fishing magazines such as Pacific Fishing, were still excluded, and the fishing representatives were not allowed to speak or ask questions. Please consider the message that these events conveyed, that PISCO did not want to have anyone participate in these media workshops who might ask critical questions or challenge the information being presented in any way. No critical thinking on a University campus?

We hope that PISCO will reflect on the impressions that have been created. The Alliance of Communities for Sustainable Fisheries expects PISCO to be objective and strongly science-based. We are so concerned that we will be requesting of the California Department of Fish & Game that they not represent the PISCO report as it is currently written as the best and most complete science on Marine Reserves, as they recently did by providing a copy of "The Science of Marine Reserves" to each MLPA panel member in our area. We will ask the Department of Fish & Game to provide a copy of Dr. Ray Hilborn's statement and also provide a copy of the Shipp Report when it is republished early in 2003. We will also request the same of the National Marine Sanctuary Program.

The Alliance of Communities for Sustainable Fisheries and people who fish generally, want to have a constructive and mutually educational relationship with the science community on a topic as important as the sustainability of our ocean resources. We are very willing to work with PISCO and the science community at large in developing what truly is the best available science on these important topics. Indeed, we have been offering for some time the experience of our on-the-water observations. Our at-sea experience (in some cases 200 plus days a year for 30-40 years) will add to the empirical base needed to develop valid data and tested scientific hypothesis. We want to help! PISCO, however, also needs to reflect on the impressions which its actions

have given, and on its objectivity. We need PISCO to do good science, and to be watchful of dismissing evidence that contradicts (or at least greatly constrains) the far-reaching conclusions PISCO appears to want to implement.

Sincerely,

Mike Ricketts
Co-Chair, ACSF

Kathy Fosmark
Co-Chair, ACSF

Supporting Associations & Organizations

Pacific Coast Federation of Fishermen's Association
Port San Luis Commercial Fishermen's Association
Morro Bay Commercial Fishermen's Association
Monterey Commercial Fishermen's Association
Fishermen's Association of Moss Landing
Santa Cruz Commercial Fishermen's Association
Half Moon Bay Fishermen's Marketing Association
Fishermen's Alliance
Western Fish Boat Owners Association
Ventura County Commercial Fishermen's Association
Federation of Independent Seafood Harvesters
Golden Gate Fishermen's Association
Port San Luis Harbor District
City of Morro Bay Harbor
City of Monterey Harbor
Moss Landing Harbor District
Santa Cruz Port District
Pillar Pt. Harbor, San Mateo County Harbor District

C: The Honorable Sam Farr
The David & Lucile Packard Foundation
The Leon & Sylvia Panetta Institute for Public Policy
National Science Foundation
Michael Flores, President, CFG Commission
Robert Hight, Director, CDFG
Bill Douros, Superintendent, MBNMS
Stephanie Harlan, Chair, MBNMSAC

Enclosure

"The Science of Marine Reserves" a comment

Ray Hilborn
School of Aquatic and Fishery Sciences
University of Washington

The combination of the video and pamphlet "The Science of Marine Reserves" is now widely circulated and being used in a number of public forums with proponents claiming it summarizes the state of the scientific knowledge regarding marine reserves. I was asked to review an original draft, and did provide comments, and am listed as a reviewer in the document. However, as none of my comments seem to have had any impact on the final draft, I thought I would circulate some of my criticisms of the document.

Let me state that I am broadly in favor of Marine Reserves, and believe they are a valuable tool for protection of biodiversity, and in some cases may be an important tool in fisheries management. However, I feel that the public consideration of Marine Reserves should look at all aspects of the available evidence and not be based on selective presentation of evidence.

The document is clearly not a scientific document nor would I say that it has been peer reviewed in the normal sense. It is not "scientific" in that it does not critically review the state of scientific knowledge, presents competing hypotheses and evidence for and against the hypothesis. It is an advocacy document that selectively chooses which data to present, and in no cases does it present any of the alternative interpretations of the "evidence" included in the document.

I don't believe it has been "peer reviewed" in the sense of scientific journal articles, because there was no independent editor, rather than authors simply solicited comments which may or may not have been incorporated depending upon the authors judgment.

Several examples of how evidence has been selectively chosen alternative interpretations not considered are given below/

The Merritt island and St. Lucia examples were both published in a paper by Roberts et al. in Science. Science also published critiques of these examples. None of the elements of the critiques was mentioned in the document. The New England scallop example fails to mention that the Canadian scallop fishery rebuilt before the American fishery, without the use of any protected areas. The Canadians simply reduced fishing effort, a traditional fisheries management tool. Any increase in abundance outside of the reserves in the US due to larval transport as likely to be from the Canadian scallop stocks as the US stocks inside the reserves. Further the major benefit to fishermen from the Georges Bank scallop example is that they were allowed to fish inside the area that had been closed – not exactly an outcome fishermen could expect in Marine Reserves.

Regarding the current debate in the US, there are almost certainly significant biodiversity benefits of establishing Marine Reserves, but there will likely be short term and in many cases long term costs to fishermen. Further there are potential negative biodiversity impacts in areas that will receive effort displaced from reserves. Neither the video nor the brochure address these potential costs.

Some Observations on the Pew Commission Report
By John Lagrange

Having read the Pew Commission Report I am left with the impression that it was prepared with a rather narrow pre-conceived conclusion in mind. Those of us in the fishing industry are not surprised that the report paints a bleak picture of the nations fisheries and proposes drastic changes in fisheries management. Unfortunately any information that goes counter to that conclusion has been conveniently left out of the report. An uninformed reader would come away from the report without any idea that a large number of our fisheries are in good condition. Nor would he know anything about the many stocks that have been, or are being, rebuilt, using traditional fisheries management methods. I cannot help but think that an equal amount of money and time given to an equally qualified group of professionals of a slightly different mind-set would have produced quite a different report.

Of course there are real problems in our fisheries. There always have been and probably always will be. But this does not justify excluding any mention of the successes that are out there. There is scant mention of fish stocks that have been fished sustainably for many years, such as; Halibut, Black Cod, Salmon and Pollack in Alaska, squid, anchovies, mackerel, lobster, crab, herring, tuna and swordfish here on the west coast. Nor is there much discussion of stocks that have recovered or are currently increasing such as sardines and white sea bass on the west coast or striped bass, scallops and the ground fish species off New England. In fact, the number of overfished stocks in U.S. fisheries is currently declining . One of the stocks recently classified as recovered is scup in the Atlantic. The report, choosing to ignore this fact, uses scup as an example of the failure of current fisheries management.

When an exercise such as this report ignores such a large part of the picture, one must question not only the validity of the conclusions but also the motivation behind it. Convincing the American public that commercial fishing has caused a crisis in the oceans is a long term goal of the Pew trust. Most of us in the fishing industry will view this report as just another chapter in that campaign.

UPDATE ON MARINE RESERVES ACTIVITIES

Situation: This update on ongoing marine reserves activities covers the following areas:

1. Central California National Marine Sanctuary Activities
2. Phase 2 of the Council's Marine Reserves Considerations
3. Marine Reserves Science Developments
4. The Federal Advisory Committee on Marine Protected Areas

The National Marine Sanctuary Act requires that sanctuaries review their management plans at least once every five years. There are 15 workgroups actively updating the joint management plan for central California National Marine Sanctuaries (Cordell Bans, Gulf of the Farallones, and Monterey Bay). These groups are considering a wide array of issues for these sanctuaries including marine reserves. The target for release of a final joint management plan is the summer of 2004. Additionally, one of the working groups is considering an action plan that would ban krill harvest in the Monterey Bay National Marine Sanctuary. Krill are not covered under Council fishery management plans, and the group considering the ban has questions about the degree to which the Council would like to be involved in consideration of the ban and when consultation should occur.

Phase 2 of the Council's process for considering marine reserves has stalled due to a lack of funding and staff time. Dr. Richard Parrish, NMFS, has provided for the Council a paper intended to advance progress on Phase 2 of the Council process for federal waters off California. His paper provides specific examples of various arrays of potential Marine Protected Area (MPA) networks covering the range recommended in the Groundfish Strategic Plan (5% to 20% of the area). Individual reserves in the networks generally provide continuous coverage from 20 fathoms to 500 fathoms, were located in areas distant from fishing ports and covered areas representing an array of habitat depths and bottom types. The specific locations in his proposal also draw on results from the Channel Islands National Marine Sanctuary (CINMS) and California Marine Life Protection Act planning processes. His report is provided here as information for the Council family (Exhibit D.2.a, Attachment 1).

There continues to be controversy over the fishery science associated with marine reserves. Last fall, the Council was provided with an American Sport Fishing Report on marine reserves, commonly referenced as "The Shipp Report." The Shipp Report questioned fishery benefits that might be associated with marine reserves. Attached is a rebuttal to the Shipp report which Drs. Lubchenco and Hixon requested be provided to the Council (Exhibit D.2.a, Attachment 2). This attachment includes both the rebuttal and the original report.

In response to the ongoing controversy over the fishery science associated with marine reserves, the National Fisheries Conservation Center (NFCC) is proposing a workshop to bring marine reserve and fishery scientists together to resolve differences of basic assumptions about ecological process, the conceptual and mathematical models used to make predictions and analyze data, and the interpretation of available evidence. NFCC is seeking endorsements for this exercise and the funds necessary to support the workshop. Their proposal is provided as Exhibit D.2.a, Attachment 3).

A National Marine Protected Area Federal Advisory Committee (Exhibit D.2.a, Attachment 4) has been appointed to advise the Secretaries of Commerce and Interior on implementation aspects of the MPA Executive Order (Executive Order 13158). The committee will be supported by the National Marine Protected Areas Center. The MPA Center is charged with providing federal, state, territorial, tribal and local governments with the information, technologies, training, and strategies to coordinate federal activities related to MPAs. At the Winter Council Chairmen's meeting in Washington, DC, Councils were invited and advised to make recommendations on marine protected areas to this new committee.

Council Task:

1. Discussion and direction to staff, as appropriate.

Reference Materials:

1. "Marine Reserves to Supplement Management of West Coast Groundfish Resources, Phase 2-Draft Concepts for California Waters," Richard H. Parrish (Exhibit D.2.a, Attachment 1).
2. “Comments on ASA report entitled "No take marine protected areas (nMPAs) as a fishery management tool, a pragmatic perspective" by Robert L. Shipp, Ph.D.” Carr *et. al.* (Exhibit D.2.a, Attachment 2).
3. "Integrating Marine Reserves Science into the Fisheries Management System," NFCC (Exhibit D.2.a, Attachment 3).
4. Press Release: Commerce and Interior Departments Select Candidates for National Marine Protected Area Federal Advisory Committee (Exhibit D.2.a, Attachment 4).
5. Public Comment.

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

The GFSP calls for the Council to "use marine reserves as a fishery management tool that contributes to groundfish conservation and management goals, has measurable effects, and is integrated with other fishery management approaches."

a. Agendum Overview — Jim Seger
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Discussion

PFMC
02/24/03

MARINE RESERVES TO SUPPLEMENT MANAGEMENT OF WEST COAST GROUNDFISH RESOURCES

PHASE 2 - DRAFT CONCEPTS FOR CALIFORNIA WATERS

PREPARED BY

Richard H. Parrish
National Marine Fisheries Service
Southwest Fisheries Science Center
Pacific Fisheries Environmental Laboratory

January 29, 2003

MARINE RESERVES TO SUPPLEMENT MANAGEMENT OF WEST COAST GROUNDFISH RESOURCES

Phase 2 - Draft Concepts for California Waters

INTRODUCTION

Due to funding constraints the Pacific Fishery Management Council has not made progress towards the development of a network of marine protected areas (MPAs) to supplement the management of west coast groundfish resources, or any other resource managed by the Council. In contrast, the Council's actions have far outweighed its words, as huge areas have recently been closed, albeit temporarily, to fishing for groundfishes. These areas include the cowcod closures in Southern California, the California Rockfish Conservation Area between Cape Mendocino and the Mexican Border and additional area closures enacted to the north of Point Reyes and to the north of Cape Mendocino. Presently as much as 90% of the adult habitat of some groundfish species is closed to fishing. This includes both overfished and healthy species (i.e. bocaccio and chilipepper rockfish). In contrast other species have area closures in almost none of their adult habitat.

In addition the Council's actions on closed seasons, reduced daily bag limits, size limits and total prohibition on the recreational take for some species will greatly reduce the take of many nearshore groundfishes. To a large degree the Council's actions have taken the urgency out of the marine protected area issue as much of California's waters are presently closed to fishing for the groundfishes that are most in need of protection. Slope species are the principal exception and in these species the situation is geographically quite mixed. The 2003 groundfish closures provide some protection in the area north of Point Reyes (i.e. out to 250 fathoms) and in Southern California the deepwater portions of the cowcod closures provide considerable protection to the slope species. This leaves the Point Conception to Point Reyes region as the only area in California with no area closures deeper than 150 fathoms.

Eventually fishery management will progress to the point that environmental variation will be incorporated in management decisions. Eventually fishery management will progress beyond single species concepts and get to the point that ecosystem based management strategies will be enacted. Eventually fishery management will evaluate the direct effect of fishing on non-target species and the indirect effects of fishing on both economically important and non-target species. All of the above will require the use of reference/research sites that contain assemblages of fishes and invertebrates that are unfished and can therefore be used to distinguish between ecological responses caused by environmental variation versus those caused by fishing. Unfortunately, based on the life history rates and the current sizes of many groundfish stocks it will take at least a decade and possibly as much as five decades before the closed reference sites approximate the unfished state. Clearly from both research and stock status points of view we would be in a much better situation today if 30 years ago some visionary had managed to get a geographical array of closed 'research' MPAs established in the California Current System.

In addition to their importance for research MPAs can be used for two other major purposes, heritage sites (i.e., preservation of typical habitat and its associated flora and fauna for future generations) and fishery management (either as a supplemental tool or as the principal fishery management strategy). Research and heritage purposes are quite compatible and a good system or network of research MPAs will most likely also be a good network for heritage purposes; particularly if both research and heritage goals are used in the planning process. Use of MPAs for supplemental or primary fishery management may, or may not, be adequate for research and heritage purposes. For example, geographical rotation of closed areas could be a desirable fishery management technique but it clearly would not satisfy heritage purposes. It would be useful for some research roles (i.e. the determination of the recover rate of heavily exploited stocks) and not for others (i.e., those requiring unfished age structures and population densities). It is possible to design a good heritage and research MPA network that contains less than 10% of the habitat. However, due to the limited productivity of the West Coast groundfishes, a network that is intended to play a significant supplemental fishery management role will require a minimum of about 10% of the habitat and one that plays a primary role would have to be considerably larger. It is important to note that the Pacific Fishery Management Council Groundfish Fishery Strategic Plan does not include the use of MPAs as a primary fishery management tool.

Two major proposals for MPAs have recently been made for California waters and Phase 1 of the Channel Islands proposal has been enacted by the California Fish and Game Commission. It is apparent that those developing these proposals have restricted their attention to the particular piece of water for which they were given political jurisdiction and neither area will provide a good representation of the habitats or organisms in the California Current Region. A well-designed coast-wide MPA network will require careful integration of nearshore, continental shelf and slope habitats as well as a good geographical array of MPAs. In this report I have also restricted the geographical area to the area, California, in which I have political jurisdiction; and more importantly experience. A coast-wide MPA network would have to include Oregon and Washington and the optimum network for the California Current System would include Canadian and Mexican waters as well.

Given the present situation I feel that a proposal for a MPA network for Federal waters is overdue. This report examines a wide range of potential MPA networks covering the array of networks recommended in the Groundfish Strategic Plan (i.e. MPA networks occupying 5% to 20% of the area). I have developed MPA concepts that are primarily for research and heritage purposes as well as concepts that may effectively be used to supplement fishery management. To show the range of options that can be made with a constant habitat percentage three concepts are proposed with the same percentage of habitat (10%).

My hope is that these concepts will convince the Pacific Council that it should move immediately to develop a MPA network designed for research, preservation and heritage purposes. I believe that the array of concepts presented will demonstrate that a network designed to supplement the management of West Coast groundfishes cannot be determined simply by examining a range of options. Instead it is time for the Council to put some resources into a modeling effort designed to assess the supplemental role that MPAs could play in the management of the West Coast groundfish resource. Hopefully a decision will be made on the

objectives and magnitude of the MPA network before the Council launches the major effort that will be necessary to design, site and enact an MPA system that is intended to supplement the management of groundfishes.

THE CINMS AND MLPA PROPOSALS

The two principal proposals for MPAs in California are the Channel Islands National Marine Sanctuary (CINMS) proposal and the Marine Life Protection Act (MLPA) proposal. The CINMS proposal refers to a 1,133 sq. nm area within the 1,252 sq. nm Sanctuary; note that the Sanctuary extends to about 6 nm offshore of the Channel Islands. The planning for this proposal was carried out by the Marine Reserve Working Group (MRWG), which had a mixture of agency and public representatives. This process also had a separate Science Panel. The terms of reference for the Science Panel reportedly limited their considerations to 'no take' reserves that were intended to minimize the possibility of population declines under the assumption that no other fishery management regulations were in effect. The MRWG Science Panel reported that under these conditions 30-50% of the sanctuary area should be placed in 'no take' marine reserves. The Marine Reserve Working Group did not reach a consensus and the final 'preferred' reserve option was prepared by staff from the Channel Islands National Marine Sanctuary and the California Department of Fish and Game. This option consists of 25% of the area within the proposal area and it is divided into Phase 1, which is limited to State waters, and Phase 2 that includes both State and Federal waters. The preferred option includes 11 'no take' reserves, 1 conservation area (where the only allowed take is for lobster taken in the recreational fishery) and 1 conservation area (where recreational and commercial take of lobster and recreational take of pelagic finfish is allowed). Phase 1 of the CINMS proposal, was enacted by the California Fish and Game Commission and could go into effect as early as March, 2003. Phase 1 includes about 19% (114 sq. nm) of the State waters within the Sanctuary. The total area within the proposed project and subsequent federal waters phase is approximately 279 square nautical miles. Although the stated percentage is 25% actually only 22.3% of the Sanctuary would be protected as the 'project area' does not include 119 sq. nm of the Sanctuary. Further complicating the percentage issue, 4 of the marine reserves extend beyond the boundaries of the Sanctuary. The average size of the 13 MPAs is about 23 sq. nm; 4 are less than 10 sq. nm and 5 are larger than 20 sq. nm.

The California Legislature enacted the Marine Life Protection Act in 1999 and it requires the establishment of a MPA network for California State waters (3,974 sq. nm). The goals for this network are primarily based on ecosystem preservation and heritage considerations; but include commercial and recreational resource utilization and other economic, social and cultural factors. The initial draft concept was proposed in July 2001 and it describes an extremely complicated plan. The proposal has 82 MPAs with an average size of 9.1 sq. nm; 15 sites are less than 1 sq. nm and only 5 are more than 20 sq. nm. It includes 665 sq. nm, or about 16.7% of state waters. Marine reserves occupy 259 sq. nm (6.5%), marine parks 86 sq. nm (2.2%) and marine conservation areas 320 sq. nm (8.1%). There is a wide array of proposed regulations on the marine parks and conservation areas ranging from nearly 'no take' to no additional protection. Some areas (i.e. Santa Monica Bay) were considered to be conservation areas simply due to the large amount of current restrictions on fishing. I was one of the 8 Master Team members that developed the draft MLPA proposal. This proposal was 'scrapped' by the California

Department of Fish and Game and the Department is now engaged in the development of a MPA network utilizing 7 regional stakeholder committees. Each committee includes 14-17 stakeholders and the meetings are being professionally facilitated.

DIFFERENCES BETWEEN NEARSHORE AND OFFSHORE GROUNDFISH STOCKS THAT WILL INFLUENCE THE DESIGN OF CLOSED AREAS.

Many of the important exploited organisms that inhabit the nearshore area have limited mobility or are sessile (i.e. bivalves, abalone, sea urchins and marine algae) and many of the nearshore fishes are territorial and/or make very limited movements as adults (i.e. copper, quillback, gopher and brown rockfishes). Small MPAs (1 sq. nm) will therefore provide local protection for some nearshore species and moderate sized MPAs (10 sq. nm) will provide local protection for species with limited to moderate movement as adults (i.e. blue and olive rockfishes). Presently there are four California MPAs larger than 1 sq. nm that have no fishing for groundfishes; Vandenberg Marine Resources Ecological Reserve (1.8 sq. nm) being the largest. MPAs of this size may allow some species to achieve local population densities and age structures that approximate the unfished state.

In contrast, many of the important exploited offshore organisms form aggregations that are relatively mobile (i.e. Pacific Ocean perch, bocaccio, chilipepper and widow rockfishes). Some offshore species settle on the shelf as juveniles and gradually move to deeper water as they grow (Dover and English soles, sablefish, and canary rockfish) and others make seasonal inshore-offshore movements for feeding and spawning (Petrale sole and lingcod). The species with the largest groundfish stock on the west coast (Pacific hake) is highly migratory with adults moving from summer feeding grounds in the Pacific Northwest to winter spawning grounds off Southern California. Even the important exploited offshore invertebrates have considerable movement. Tagged Dungeness crab have been recovered as much as 100 miles from their release site (although most tag recoveries are made with 10 miles), Pacific Ocean shrimp make extensive but relatively short distance movements and market squid are highly mobile. Clearly small (1 sq. nm) and moderate sized (10 sq. nm) closed areas are not large enough to allow many, and probably most, of the exploited offshore species to attain age compositions and population densities within the closed areas that approach those that existed prior to fishing.

One of the major purposes of MPAs will be to provide reference sites that have populations similar to those that would occur in the absence of fishing. This type of site will be critical in future assessments of the relative effects of environmental fluctuation vs. the effects of fishing. To be effective these sites will have to be large enough to allow a broad range of species to achieve population densities and age compositions that are close to those that would occur with no fishing. MPAs intended for heritage and preservation purposes have this same requirement. Therefore, in this proposal, I have used large (100-500 sq. nm) MPAs; however, it is likely that even this size of closed area is not large enough to produce local population densities and age compositions that are close to the unfished state for some species. For example, it is obvious that these protected areas will have virtually no affect on the local age composition and densities of migratory species such as Pacific hake.

I note that that the rockfish conservation areas presently utilized by the Pacific Council for rebuilding the cowcod, bocaccio and other depressed groundfish populations in California are an order of magnitude larger than the largest closed areas utilized in this proposal. The cowcod closures (about 3,600 sq. nm) is much larger than the total area considered by the CINMS proposal (1,133 sq. nm) and about the same size as the total area of California State Waters (i.e. the 3,974 sq. nm area in the MLPA proposal). The area off California in the 2003 rockfish closures is about 8,300 sq. nm and the combined cowcod and 2003 rockfish closures are about 10,700 sq nm. Note that some of the locations in of the Cowcod Conservation Areas are also in of the California Rockfish Conservation Area.

PRACTICAL CONSIDERATIONS

In all of the MPA concepts presented here I have attempted to maintain roughly equal percentages of area in the regions north and south of Point Conception. My calculations of area are not particularly accurate because area was calculated with simple geometry and measurements taken from nautical charts using a computer program called Digital ChartKit. Final concepts should use a geographical information system (GIS) to obtain more accuracy.

There are several problems associated with the determination of the percentage of habitat included in the MPA concepts. The principal problem is that the Groundfish Strategic Plan does not define the depth range of the habitat to be included in the MPA network. Based on the cowcod closures and the 2003 groundfish closures I took the inner depth to be 20 fathoms. I somewhat arbitrarily chose 500 fathoms to be the outer depth. Without a geographical information system (GIS) and a database for depth contours I was unable to accurately determine how much area occurs between 20 and 500 fathoms off California. To estimate the area in the region north of Point Conception, I noted that the 500 fathoms line lies at an average distance from shore of about 20 nautical miles. The north-south distance between the Oregon Border and Point Conception is 453 nautical miles. I therefore used 9,060 sq. nm as the habitat area for this region (453 x 20). The Southern California region has extremely complicated topography. My calculations of habitat area for this region (12,500 sq. nm) are very rough; they included a large amount of area deeper than 500 fathoms and omitted a large amount of area shallower than 500 fathoms (Figure 1). The total area, including the area shallower than 20 fathoms, is 21,560 sq. nm.

For most MPAs I attempted to attain a continuous coverage from 20 fathoms to approximately 500 fathoms. I have exclusively used north-south and east-west boundaries for the MPAs and, for the most part, I have used round latitude and longitude numbers rather than geographical boundaries. This was primarily based on recommendations from NMFS and CDF&G enforcement personnel. I realize that boundaries based on geographical features may be superior for small, nearshore MPAs. However, the availability and low cost of GPS instruments (that give longitude and latitude) and the difficulty of identifying geographical features at night, in fog or when 10-20 miles from shore clearly indicate that simple latitude and longitude boundaries are superior for large offshore groundfish MPAs.

The use of 'square boundaries' resulted in a considerable amount of area deeper than 500 fathoms being included in the MPAs. Where submarine canyons were present I extended the MPAs into water deeper than 500 fathoms in an attempt to provide some deeper water protection and where the continental shelf was particularly wide I did not always extend the MPAs all the way to 500 fathoms. The areas deeper than 500 fathoms were included in the MPA area computations and percentages of habitat for the concepts presented, but the areas shallower than 20 fathoms were not included as I followed recent Council precedent and did not include waters shallower than 20 fathoms in the MPAs.

Application of a GIS to calculate area will provide more accurate estimates of area; however these calculations will not necessarily be more meaningful as the choice of the depth range will still be largely an arbitrary decision. Probably the best solution will be to stratify the area by meaningful depth strata and then attempt to get roughly proportional coverage by depth strata. In my opinion tailoring a MPA network to precisely fit some pre-arranged percentage of habitat will not have much biological significance, and I do not see this as an important consideration for the present draft concepts.

DESIGN ELEMENTS

DEGREE OF PROTECTION

The State of California uses three MPA classifications:

1. Marine Reserves do not allow any take of any species for commercial or recreational purposes.
2. Marine Parks do not allow any take of any species for commercial purposes; but recreational take of some species is allowed.
3. Marine Conservation Areas allow some species to be taken for commercial purposes and some species may be taken for recreational purposes.

The Pacific Council has adopted the use of the conservation area term in its recent groundfish closures; it has prohibited the take of groundfishes within the closed areas but has allowed the continued take of finfish managed under the Salmon, Coastal Pelagic Species and Highly Migratory Species Management Plans. Although the Council does not manage invertebrate fisheries it has also prohibited the use of shrimp and prawn trawls in the groundfish conservation areas because this gear takes groundfish species.

In the concepts presented here I have followed the same regulations as those in the current groundfish closures. However, it may be desirable for some or all of the MPAs to have additional species closures; for example, it may be desirable to protect coastal pelagic species in MPAs. It may be desirable to prohibit trap and pot fisheries that target invertebrates in some or all of the MPAs. The Council may also have to address the merits of establishing joint Federal/State marine reserves that extend into Federal waters.

SIZE, SHAPE AND SPACING

Determination of the optimum size and spacing of individual MPAs is dependent upon the range of larval dispersal and the amount of movement, migration or dispersal of the juveniles and adults of the affected species. Unfortunately these factors are largely unknown for most West Coast groundfish species. It is clear that the optimum MPA spacing and size for one species could provide little protection to another species. A multitude of combinations of size vs. distance between MPAs is possible and I have little insight as to what the optimum size and spacing may be. In the following draft concepts I have placed the bulk of the MPAs into three size classes, 100-130, 200-300 and 400-500 sq. nm. As I have placed the average offshore edge of the MPAs at about 500 fathoms, and this depth occurs at an average of about 20 nm offshore, this results in MPAs that are about 5-6, 10-12, and 20-25 nm on their alongshore axis. Obviously with a given percentage area the size of the MPAs determines both the number of MPAs and the average distance between them. Smaller MPAs result in more MPAs with the average distance between MPAs being smaller.

The 400+ sq. nm MPAs have roughly equal alongshore and offshore dimensions, the 200-300 sq. nm MPAs have alongshore dimensions roughly half their offshore dimensions and the 100-125 sq. nm MPAs have alongshore dimensions roughly one quarter of their offshore dimensions. Species that are relatively mobile and make alongshore movements are much more likely to move in or out of the narrow than the squarish MPAs. A permutation that I have not used, because I have attempted to achieve a full 20-500 fm depth range in each MPA, would be to make all of the MPAs squarish. However, the shape should depend upon the purpose of the individual MPA or MPA network. If the purpose is to provide a research or heritage MPA that will achieve near pristine population densities and age structures then large, squarish MPAs should be used. If the intention is to provide trophy fish for recreational anglers then smaller, elongated MPAs with a high boundary to area ratio should be used to achieve high spillover of adults. If the intention is to provide recruitment to the areas open to fishing the MPAs should be regularly spaced along the coast with relatively close spacing between MPAs.

LOCATION

The strategy I used to determine where MPAs were located relied primarily upon three factors. The dominant factor was my decision to concentrate MPAs in areas distant from fishing ports. The bulk of the MPAs to the north of Point Conception are located approximately midway between fishing ports and the majority of the MPAs south of Point Conception are located away from the mainland. The principal reason for this placement is to reduce the economic, safety and social consequences that would result from closing areas near to fishing ports. However, other things being equal, this also tends to locate MPAs in areas that currently have relatively high densities of groundfishes. This is because these areas generally have a history of lower fishing mortality than the areas closer to the ports.

The second factor was topography. I have attempted to get a representative array of habitats, depths and bottom types. Nautical charts were the major source of this information.

The third factor was the results from the CINMS and MLPA planning processes described above. Anyone familiar with the draft concepts developed during these exercises will recognize

many of the locations in the draft concepts presented here. In addition as a member of the MLPA science team I have extensively used the input gained from the 10 public hearings, 70+ small group meetings and hundreds of letters that were part of the MLPA process. I note that my exposure to the public input to the MLPA process was much greater north of Point Conception than it was south of Point Conception.

NETWORK CONSIDERATIONS

There is no single location where even a very large MPA (i.e. 1,000 sq. nm) can protect the diversity of organisms found in the California Current; therefore a system or network of MPAs will be necessary. The network would be expected to differ depending upon the purposes for which the MPA network is intended. If the major purpose of the network is to provide research and preservation sites the minimum network would be a series of MPAs that had at least one MPA in each region with a distinct faunal composition. In addition the MPA(s) for each faunal region should contain a wide range of depths, bottom types and oceanographic settings. For groundfishes a minimum California network would have an MPA near the Mexican Border for protection of sub-tropical species, an MPA in the Northern Channel Islands area where the sea surface temperature gradient is the most intense, one in Central California where historical bocaccio and chilipepper rockfish stocks were the largest and one in Northern California for the protection of the Oregonian fauna.

If the major purpose is to supplement fishery management by providing spillover of larval, juvenile and/or adult fishes from the closed areas to the areas open to fishing the network should contain a fairly large percentage of the habitat (i.e. 10-20%). Also the distance between MPAs should be small enough to insure some minimum recruitment in the areas open to fishing. If the purpose of the network is to provide the bulk of the protection in a management strategy (i.e. few traditional fishery regulations are to be utilized) a large percentage of the habitat will be required (i.e. more than 20%). Otherwise stock sizes near 40% of the virgin biomass, in accordance with the 40-10 management strategy used by the Pacific Council, are unlikely to be maintained.

HOW LARGE SHOULD THE MPA NETWORK BE?

There is little doubt that MPAs can be beneficial for protecting overexploited and poorly regulated stocks, and the Pacific Council is presently utilizing very large closed areas to rebuild depressed populations of groundfish. In addition MPAs are well suited to help manage recreational fisheries where management by limited access is undesirable. There are many situations where it may be desirable to use MPAs in a mix of management measures, for example as a trade off to closed seasons, size limits and reduced bag limits or to avoid bycatch. MPAs may also be valuable in situations where a stock has low productivity but high availability and vulnerability to fishing. However, these general observations offer little guidance for the determination of what proportion of the habitat should be protected. Clearly the principal problem associated with the development of an MPA system is the determination of how much area, or what percentage of the habitat, should be protected. There is little field evidence available to make this determination and therefore we will be forced to largely rely upon models. Proper evaluation of this question would require, at a minimum, a multi-species model and it

would preferably utilize an ecosystem model. Unfortunately it appears that at present we only have the capability to use single species models to evaluate this critical and contentious question.

The vast majority of published papers dealing with fishery management and MPAs have not addressed the role of MPAs in assisting in the management of a highly regulated fishery such as the West Coast groundfish fishery. The bulk of the published MPA models do not specify the management regime that exists outside of the MPAs. To date none of the reserve models that I have seen utilize simulations with a fishery regulated by complex rules similar to those used by the Pacific Council for groundfish. That is management by quotas that establish annual yield with a state-of-the-art control rule based on stock biomass and the 40-10 rule. In addition very few 'reserve' models have analyzed the changes in the age composition and fishing mortality exerted on the area that remains open to fishing. This is a very important consideration that should be addressed before the Council invests the resources that will be necessary to design a MPA network of the size necessary to supplement the management of West Coast groundfishes. However, it is of much lesser concern with a MPA network in the size range needed for research and heritage purposes.

To demonstrate the problems associated with the determination of the magnitude of a MPA network intended to supplement the management of groundfishes consider a stock that is at 40% of its virgin biomass and at this biomass its control rule would produce a 1,000-ton quota. The first order affect on population size is the removal of 1,000 tons of fish. This removal would be the same if the percentage of habitat in MPAs were 0%, 10% or 30%. However, after a decade the biomass and age composition in the area open to exploitation and the fishing effort required to take a 1,000-ton quota would be quite different under each of the above scenarios. Models based on information from data rich West Coast groundfishes should be developed to assess the differences between the yields, costs of fishing and stock sizes under various percentages of closed area. These models should use harvest rates based on the current control rules for the species modeled.

Even without models it is obvious that the first order population effect will be determined by the control rule. The differences in productivity due to the sizes, shapes and locations of individual MPA networks will be secondary. These secondary differences will primarily be dependent upon two factors, geographical variations in life history rates and density-dependence in life history rates. If there are significant geographical variations in life history rates there are likely to be areas that are population sources and others that are sinks. If a large proportion of the sources of recruitment are inside of MPAs and if most of the sinks are outside the MPA network there will be a positive effect both inside and outside of the MPAs. The reverse is also true. Unfortunately we have virtually no information on the geographical variation in recruitment or most other life history rates. This implies that modeling will necessarily focus on density-dependent variations in life history rates; primarily egg production, recruitment, juvenile survival and growth. If the density-dependence of some these rates are large, MPAs could produce significant changes in the productivity of the stock. However, in spite of extensive information on the population dynamics of West Coast groundfishes no one has noticed significant density-dependence in egg production, or in the survival rates or growth rates of juveniles or adults. In addition for most West Coast groundfishes both recruitment and surplus production have proven to have little density-dependence. In fact this is the primary reason for our present dilemma.

DRAFT CONCEPTS

Eight draft concepts with a range of area percentages (4.5-20%), number of MPAs (4-20) and MPA sizes (75-504 sq. nm.) are included in this analysis (Figures 2-9, Tables 1-2). I have included some concepts designed for research and heritage purposes and others primarily intended to supplement traditional fishery management strategies. The intention is not to suggest that any of these concepts is preferable to another; rather the purpose is to show what a range of options looks like with different sized MPAs and different percentage protection. In addition, I have used the concepts to discuss the strengths and weakness of different MPA configurations with respect to their use for research and heritage networks or for supplemental fishery management networks. The chart for each concept includes the current Cowcod, and California Rockfish Conservation Areas and the other 2003 groundfish closures. This will allow the present situation to be directly compared with each draft concept. The MPAs boundary lines, as drawn, extend to the shore; however, the areas inside of the 20-fathom line are not included in the MPAs.

RESEARCH AND HERITAGE MPA NETWORKS

Three research concepts with 4.5%, 6% and 7.5% of the total habitat area in MPAs are presented. The principal purpose of MPA networks of this general size is to provide areas where many species should be able to attain near pristine population densities and natural age structures. Reference sites of this type will be necessary in the determination of the relative effects of fishing vs. environmental change (i.e. global climate change, climatic regime effects and pollution) and for assessment of the effects of fishing on no-target organisms.

An increasing proportion of the public is becoming aware of the advantages of MPAs in resource protection for heritage and preservation purposes and this size of MPA network should also be effective for these purposes. MPA networks that occupy this percentage of the total habitat are being developed in a number of other countries primarily because it is thought that this size of MPA networks are large enough to preserve heritage and research sites with near-pristine conditions for future generations. However, the relatively remote locations and the fact that the proposed MPAs do not include depths less than 20 fathoms makes them poor candidates for use as wild parks where the public will be have access to view or use the resources protected by the networks. MPAs that the public can actually use will primarily be in water that is shallow enough for the use of scuba gear and they will receive more use if they are near ports or other sites with public access to the ocean.

The size of these research and heritage concepts are too small to provide much assistance in maintaining stock size or recruitment to sustain fisheries and they should therefore not be relied upon to provide much assistance in maintaining viable fisheries. Their role in supplementing traditional fishery management will primarily be to guard against management errors or adverse climatic events. However, MPA networks of this size will provide insurance, as they are large enough to prevent the populations of many species from declining to the level where they would become candidates for the Endangered Species Act.

The 4.5% Concept

The 4.5% concept has 9 MPAs with 4 north of Point Conception (Figure 2). The size of MPAs averages 108 sq. nm and the MPAs average about 6 nm in the along shore dimension and 18 nm in the offshore dimension. This configuration is good at providing spillover of large fishes that can be taken in the adjacent fished areas and it could be used to evaluate the potential of MPAs for assisting in fishery management. Due to the larger number of MPAs this network has a wide range of habitat types and the spacing between MPAs is 40-70 nm in Southern California and 85-150 nm North of Point Conception. This should allow relatively wide dispersal of pelagic larvae to the entire region; however, the larval production from this size of a network will be only a small percentage (i.e. 4.5 to 7.5%) of that that occurred prior to fishing and it certainly is not large enough to maintain healthy populations outside of the MPAs

MPAs of the size and shape used in this concept are likely to be on the small size for achieving near-pristine densities and age structures of relatively mobile fishes and invertebrates. Specifically the MPAs in this concept have quite narrow alongshore dimensions and it is likely that species with even minor alongshore movements will have significant numbers leaving and the entering the closed areas. This implies that this concept will have some drawbacks if its principal purpose is to provide preservation areas and sites for ecological research. Enforcement costs would be relatively high for a research and heritage network with this configuration due to the relatively large number of MPAs and the increased distance in boundaries caused by the elongated shapes of the MPAs.

The 6% Concept

The 6% concept (Figure 3) has fewer (4) and larger (average 320 sq. nm) MPAs than the 4.5% concept. This concept was an attempt to achieve a network with larger MPAs that should have a better chance to attain near pristine conditions. The trade off for increased size of individual MPAs is achieved by a substantial increase in the spacing between MPAs; the distance between MPAs in this concept varies between 100 and 250 nm. This concept has the minimum number of sites that could be considered to provide a research network as sites are so widely spaced that each site contains a different assemblage of organisms. Each of the sites is located in areas that have high wind and current speeds; dispersal of pelagic early life history stages will be near the maximum possible with a small number of sites. However, the Punta Gorda, Point Sur and Richardson Rock MPAs also contain areas with considerable protection from wind and offshore currents where larval retention would be expected to be high. When this factor is combined with the large size of the MPAs it is likely that local recruitment may allow these MPAs to maintain relatively high recruitment rates even if the stock sizes outside of the MPAs is quite low.

An MPA network with this configuration would be intended primarily for preservation and heritage purposes. It also has high potential for ecological research and evaluation of the relative effects of fishing and environmental conditions. However the remote locations and high energy oceanographic conditions of the MPA sites will make the costs and difficulty of carrying out research relatively high.

The 7.5% Concept

The 7.5% concept (Figure 4) has 6 MPAs with an average size of 270 sq. nm. This network is an attempt to attain a research and heritage network that has relatively large MPAs, moderate spacing between MPAs (between 70 and 150 nm) and a broad range of habitat types and oceanographic settings. Thus it becomes the largest of the research MPA networks. The three sites not present in the 6% concept are less remote and more easily studied than those in the 7.5% concept and a MPA network with this configuration should be very good for research and heritage purposes and it is approaching the size where it may provide some assistance in maintaining populations outside of the network. With the configuration in this concept the assistance would be expected to be based on larval production and recruitment rather than spillover of adult animals

MPA NETWORKS TO SUPPLEMENT MANAGEMENT

Before designing a MPA network to supplement fishery management specific objectives of the network should be established. One way to proceed with this determination is to establish a network core that achieves research and heritage goals and then add to this core to achieve the specific supplemental protection intended to assist with the management of the fishery. For example, the core could look like one of the three previously described research and heritage networks. The core MPAs would be intended to be permanent whereas MPAs intended to supplement fishery management may, or may not, be permanent and they may, or may not, be established at the same time as the network core. Also MPAs intended to supplement fishery management should be designed to be part of a total management strategy, not simply an additional layer of management. For example, a management strategy based on individual transferable quotas and MPAs could produce an efficient management regime that would completely do away with trip limits and other temporal catch limits.

The research and heritage core should have a representative array of habitats providing a good mix of the depth, geographical and oceanographic settings. The fishery management part of the network could have this same mix of habitats; however, it may be preferable to design this part to protect the specific habitats of individual species. It is possible that the fishery management part of the network could be based on system of rotating, rather than permanent, area closures. It is clear that the use of MPAs to supplement the management of groundfishes will be an exercise in adaptive management. This is why it will be important to identify the individual MPAs that are intended for research and heritage goals and those that are intended for supplementing fishery management. The research and heritage MPAs should be considered to be quasi-permanent whereas the fishery management MPAs will be expected to evolve if they prove to be successful or disappear if they prove to be an ineffective management tool.

Concepts with permanent and temporary MPAs

Although not designed as a formal MPA network, in fact California presently has an extremely large network of groundfish conservation areas (i.e. about 10,700 sq. nm, or 49.6% of the total 21,650 sq. nm area considered in this report). The major objective of this MPA network is to

insure that seriously overfished species will be allowed to recover to healthy biomass levels. Of course, the amount of area in the temporary MPAs would be expected to vary over time as the depressed stocks recover and the value of closed areas for fishery management becomes better understood.

Establishment of a research and heritage core similar the three previously described concepts (Figures 2, 3, and 4) would produce a MPA network with about 1,000 to 1,600 sq nm in permanent research and heritage MPAs; note that more than half of the area of the three research MPA networks is already in existing conservation areas. The combination of these permanent MPAs with the existing rockfish conservation areas would result in a MPA network with 4.5-7.5% of the area in permanent conservation areas and about 46-48% of the area in temporary conservation areas. The permanent MPAs would include a wide range of species and a diverse range of habitats; whereas the temporary conservation areas are focused on the habitats of individual depressed species.

The 10% Concepts

Three concepts with 10% of the habitat in MPAs were developed. This was done to show the large amount of variation that can be achieved by manipulating the size and number of MPAs without changing the percentage of habitat in the network. The concepts have 20 MPAs with an average size of 108 sq. nm, 10 MPAs with an average size of 217 sq. nm and 5 MPAs with an average size of 435 sq. nm. Note that I have attempted to maintain roughly equal size and shapes of MPAs within each of the 10% concepts; obviously it may be desirable to have a 10% concept that includes several sizes of MPAs.

The 10% concept with 20 MPAs (Figure 5) has the maximum number of MPAs of all 8 concepts and the average size and shape of MPAs is similar to that in the 4.5% concept (108 sq. nm). This 10% concept has the smallest distances between MPAs of any of the networks presented and it has the maximum distance in boundaries. This suggests that this network would have the maximum exchange or spillover of organisms between protected and unprotected areas. Due to the large number of sites this concept has the maximum range of habitat and oceanographic conditions and this configuration also allows the maximum dispersal of pelagic larvae produced within the protected area. There is also considerable scope for replicate sites for research purposes. In addition many sites are closer to ports, which allows the benefits of protected areas to be available to the maximum number of people and it also would allow the network to be more easily studied. This combination implies that it would also be the most expensive to enforce. The principal weakness of the configuration is that the relatively small size and elongate shapes of most of the MPAs reduce their value for heritage and preservation purposes.

The 10% network with 10 MPAs (Figure 6) is based on MPAs that vary is size from 205-254 sq. nm with the exceptions of the Santa Cruz Island MPA (130 sq. nm) and Encinitas MPA (150 sq. nm). Offshore MPAs have squarish shapes and MPAs adjacent to the mainland have an alongshore axis with about half the length of the offshore axis. This network could be considered to be the moderate or mid-point of the 8 concepts presented; because, it is has mid-sized MPAs and also is in the middle of the range of percentages and spacing for the concepts.

The 10% network with 5 MPAs (Figure 7) has two large (477 and 441 sq. nm) MPAs to the north of Point Conception and one 254 sq. nm and two near 500 sq. nm MPAs in Southern California. Due to the large size of individual MPAs this network should be one of the best at attaining near pristine densities and age structures of organisms. It therefore is a good configuration for heritage and preservation purposes and for ecological research. However, like the 7.5% concept it has quite wide spacing between MPAs and it may therefore be among the worst at assuring a wide and even distribution of larvae. Networks of this type would appear to be best suited to a management regime that does not allow the spawning biomass of individual species to fall to low levels in the areas open to fishing. Also due primarily to the small number of MPAs and its high area to boundary ratio it would be among the easiest to enforce.

The 15% Concept

The 15% Concept has 10 MPAs with 5 north and 5 south of Point Conception and it includes both 200+ and 400+ sq. nm MPAs (Figure 8). The average size of MPAs is somewhat smaller north of Conception to reduce the distance between MPAs in this region. This type of network is approaching the size that may offer considerable assistance in maintaining population size and recruitment in heavily exploited species as well as providing large replicate MPAs for research purposes. This concept has a representative array of habitat types and theoretically, once a system of this type has been in place for a decade or more, it should prevent stock sizes of a wide range of species from reaching the level (10% of virgin stock size) that requires rebuilding under the 40-10 management provision.

The 20% Concept

The 20% concept has 9 MPAs and it is primarily composed of 400+ sq. nm MPAs (Figure 9). MPA networks of this magnitude would be large enough to be used to assist in the recovery of depleted stocks and, after they had been in place for a decade or so, would probably provide considerable insurance against stock declines associated with overexploitation and/or unfavorable regime scale environmental changes. MPA networks of this size may be approaching the size where increases in size would come at the expense of decreased long-term economic yield. The principal reasons for this is that it has yet to be demonstrated that 100% of MSY can be obtained from fishing only 80% of the habitat. Also fishing effort (costs) will have to increase to catch a given quota due to decreased fish density in the area open to fishing. Of course if a large proportion of recruitment comes from the spawners in a relatively small proportion of a given species habitat it is possible that proper placement of MPAs could result in increased yield from that species. However, the geographical reproductive sources would have to be common to a wide variety of species before it would be likely that the total yield of groundfish could be increased.

DISCUSSION

In effect the Pacific Council has already established extremely large, temporary MPAs and these MPAs are the most significant management measure currently being used to rebuild several depleted rockfish stocks. As the depleted stocks begin to rebuild it is likely that it will be desirable to phase out the closed areas rather than reopen the entire area all at once. This is

definitely not the situation that was expected when the Groundfish Strategic Plan was developed. In fact most people would have thought that the Council would be in the position where it was phasing in a MPA network; not waiting for favorable environmental conditions that will allow the depleted stocks to rebuild to the state where the Council can start phasing out area closures.

It is possible that problems with other species (i.e. deep slope species) will result in area closures with different geographical and depth boundaries designed to assist in their recovery. It is possible that that the Council will be phasing in area closures for some species at the same time that it is phasing out area closures for others. Area closures are definitely a tool that will be used for West Coast groundfish management for the foreseeable future.

To date the Council has put very limited resources into assessment of temporary area closures or permanent MPAs. It is clear that both temporary and permanent MPAs need to be assessed as management tools and the Council needs to broaden its analytical research capabilities to include simulation models with geographical resolution. In particular analyses need to be carried out to assess the response of stocks to different sized MPA percentages when these stocks are managed with state of the art control rules.

Marine protected areas are presently very popular with the public; undoubtedly this is partially due to the perception that fish stocks are in decline worldwide. An increasing number of people believe that the only way we will be able to preserve natural marine populations is to remove substantial areas from exploitation. Given the present situation with West Coast groundfishes there appears to be little downside that would be realized if the Council was to immediately establish an MPA network similar to the research and heritage networks described here; as little additional area would have to be closed to fishing. However, MPA networks of the size necessary to supplement fishery management (i.e. 10-25% of the habitat) need to be assessed with models based on data rich West Coast groundfishes before this type of permanent MPA network should be developed.

RECOMMENDATIONS

1. The Pacific Council should quickly proceed with the development of a reference, or research, MPA network for groundfishes. This network should be based on, or at least include portions of, the present groundfish closures and it should be designed to provide significant areas for heritage and preservation purposes. Action on a Federal MPA network at this time would foster the coordinated development of an integrated network for both State and Federal waters.

2. The first order of business, in developing a marine protected area network to supplement the management of west coast groundfishes, should be to carry out model simulations designed to provide the information necessary to determine the approximate percentage of the habitat that should be included in this type of MPA network.

3. The modeling effort should focus on the age composition and population densities inside and outside of MPAs as well as the yield and fishing effort that will result from different sized

MPA networks. This modeling should be carried out for several important data rich species and the models should be run with the existing control rules applicable to the individual species. Models should include scenarios with healthy stock size as well as stocks that are in a rebuilding status. This type of analysis should result in information that will assist the Council in making the critical decision regarding the percentage of area that should be included in an MPA network designed to supplement the management of West Coast groundfishes.

4. In addition to permanent MPAs the Council should put a priority on analyses designed to evaluate the use of temporary MPAs to assist in rebuilding depleted stocks. Specifically it should examine how and when to scale back the present very large area closures as the overfished bocaccio, cow cod, canary, yelloweye and dark-blotched rockfishes begin to recover.

Table 1. Information on MPA concepts.

Concept	4.5%	6%	7.5%	10%	10%	10%	15%	20%
Text Figure	2	3	4	5	6	7	8	9
No. of MPAs	9	4	6	20	10	5	10	9
Area (sq. nm)	973	1282	1618	2158	2173	2176	3226	4278
Average MPA size	108	320	270	108	217	435	323	475
% Total area	4.5	5.9	7.5	10.0	10.1	10.1	15.0	19.8
% North of P. Conception	4.5	5.8	7.6	9.9	9.9	10.1	15.3	19.9
% South of P. Conception	4.5	6.1	7.4	10.1	10.2	10.1	14.7	19.8

Area north of Point Conception - 9060 sq. nm
Area south of Point Conception – 12500 sq. nm

Table 2. Boundaries and sizes (sq. nm) of conservation areas in MPA concepts.

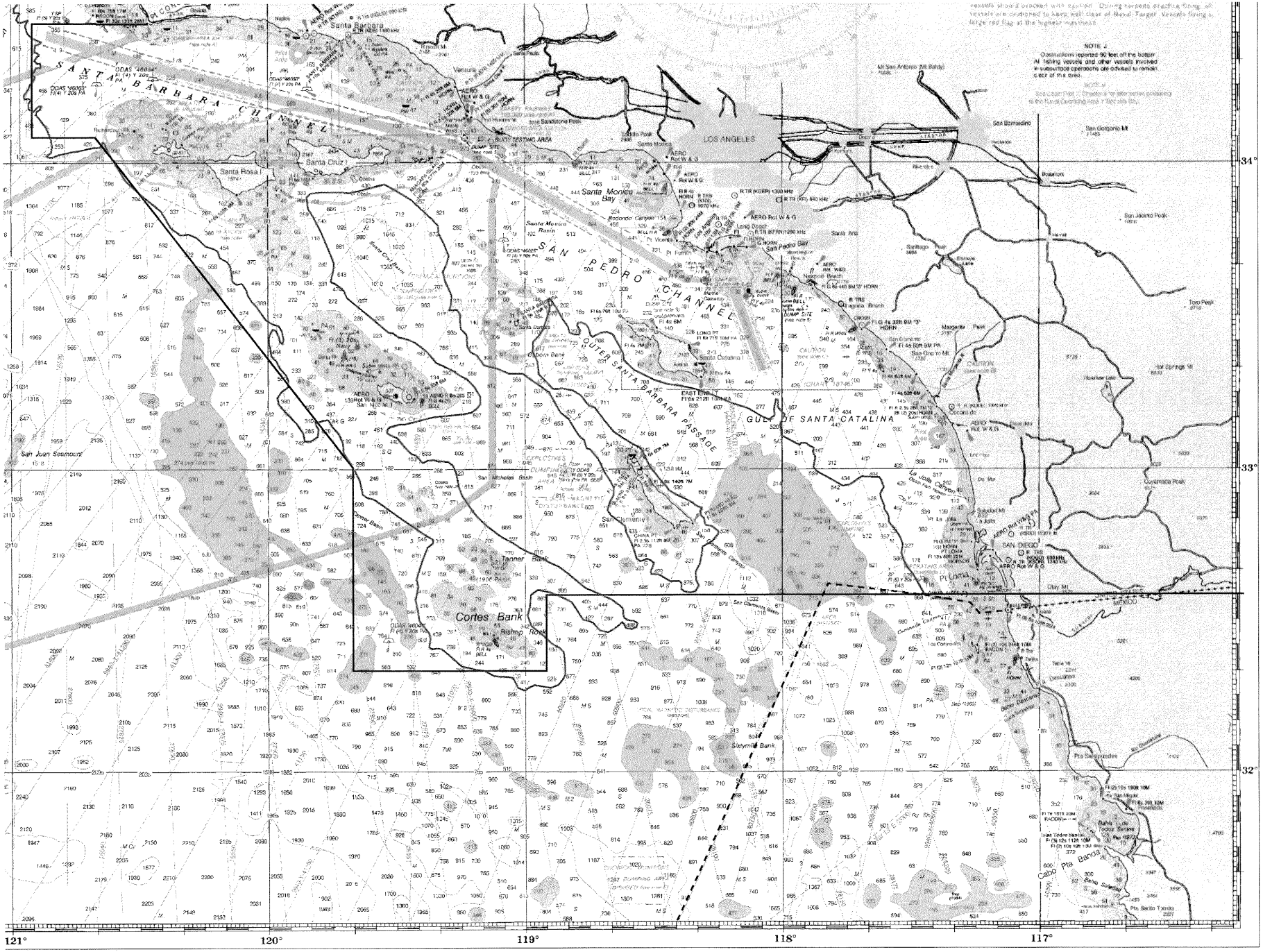
MPAs	Boundaries North n lat.	South n lat.	West w long.	East w long.	Figure Area	2 4.5%	3 6%	4 7.5%	5 10%	6 10%	7 10%	8 15%	9 20%
Pelican Point	42 0	41 53	124 40		120				120				
Klamath	41 37	41 31	124 35		109	109							
Klamath	41 37	41 25	124 35		226			226		226		226	
Reading Rock	41 37	41 15	124 35		424								424
False Cape	40 34	40 27	124 50		127				127				
Punta Gorda	40 25	40 0	124 42	124 13	477						477	477	
Punta Gorda	40 20	40 0	124 35	124 13	276		276						
Elk	39 9	39 4	124 10		95	95			95				
Black Point	38 50	38 30	123 55		443								443
Black Point	38 46	38 34	123 50		220			220		220			
Farallones	37 45	37 35	122 55	123 25	233							233	
Farallones	37 44	37 38	122 58	123 20	100				100				
Ano Nuevo	37 9	37 4	122 48		115	115			115				
Big Sur	36 17	36 12	122 15		100				100				
Big Sur	36 15	36 4	122 10		245		245	245		245		245	
Big Creek	36 15	35 55	122 5		441						441		441
Cambria	35 35	35 30	121 30		93	93			93				
Point Sal	34 54	34 45	121 10		205					205		205	
Point Arguello	34 54	34 34.7	121 10		494								494
Point Arguello	34 42	34 34.7	121 5		147				147				

Table 2. Continued

MPAs	Boundaries North n lat.	South n lat.	West w long.	East w long.	Figure Area	2 4.5%	3 6%	4 7.5%	5 10%	6 10%	7 10%	8 15%	9 20%
Richardson Rock	34 15	34 0	120 50	120 30	247					247			
Richardson Rock	34 14	34 2	120 50	120 18.4	294			294				294	
Richardson Rock	34 14	34 58	120 50	120 18.4	393		393						
Richardson Rock	34 13	34 6	120 40	120 18.4	124	124			124				
San Miguel	34 10	33 43	120 45	120 17	502						502		502
Santa Cruz	34 10	34 2	119 40	119 20	130				130	130			
Big Sycamore		33 48	119 3	118 55	110	110			110				
Gull Island	33 55.2	33 45	119 55	119 45	85				85				
Cow Cod North	33 50	33 30	119 30	119 0	498							498	498
Santa Barbara Is	33 28.5	33 13	119 10	118 50	254					254	254		
Santa Barbara Is	33 27.5	33 15	119 5	118 55	105				105				
Catalina Is	33 20	33 14	118 22	118 0	104				104				
San Nicolas Is	33 15	33 2	119 40	119 30	104	104			104				
San Nicolas Is	33 15	33 0	119 50	119 30	246					246		246	
Cow Cod Central	33 15	33 0	119 50	119 10	486								486
Encinitas	33 8	32 58	117 55		296			296				296	
Encinitas	33 8	32 52	117 50		488								488
Encinitas	33 5	33 0	117 42		108	108			108				
Encinitas	33 5	32 58	117 45		150					150			
San Clemente Is W	32 58	32 53	118 57		100				100				
San Clemente Is E	32 58	32 53		118 5	100				100				
Cortez Bank	32 40	32 20	119 30	119 10	337			337					
Cow Cod South	32 40	32 20	119 30	119 8	368		368						

Cow Cod South	32 40	32 20	119 30	119 0	504						504	504	504
43 Fathom Spot	32 40	32 30	118 0	117 50	75			75					
Cortez Bank	32 35	32 20	119 10	118 50	251				251				
Cortez Bank	32 30	32 20	119 14	119 0	117	117		117					

Figure 1. Area used to calculate area in Southern California (i.e. the area inshore of the black line). Green contour lines show basins deeper t , 500 fathoms and solid green areas show banks shallower than 500 fathoms.



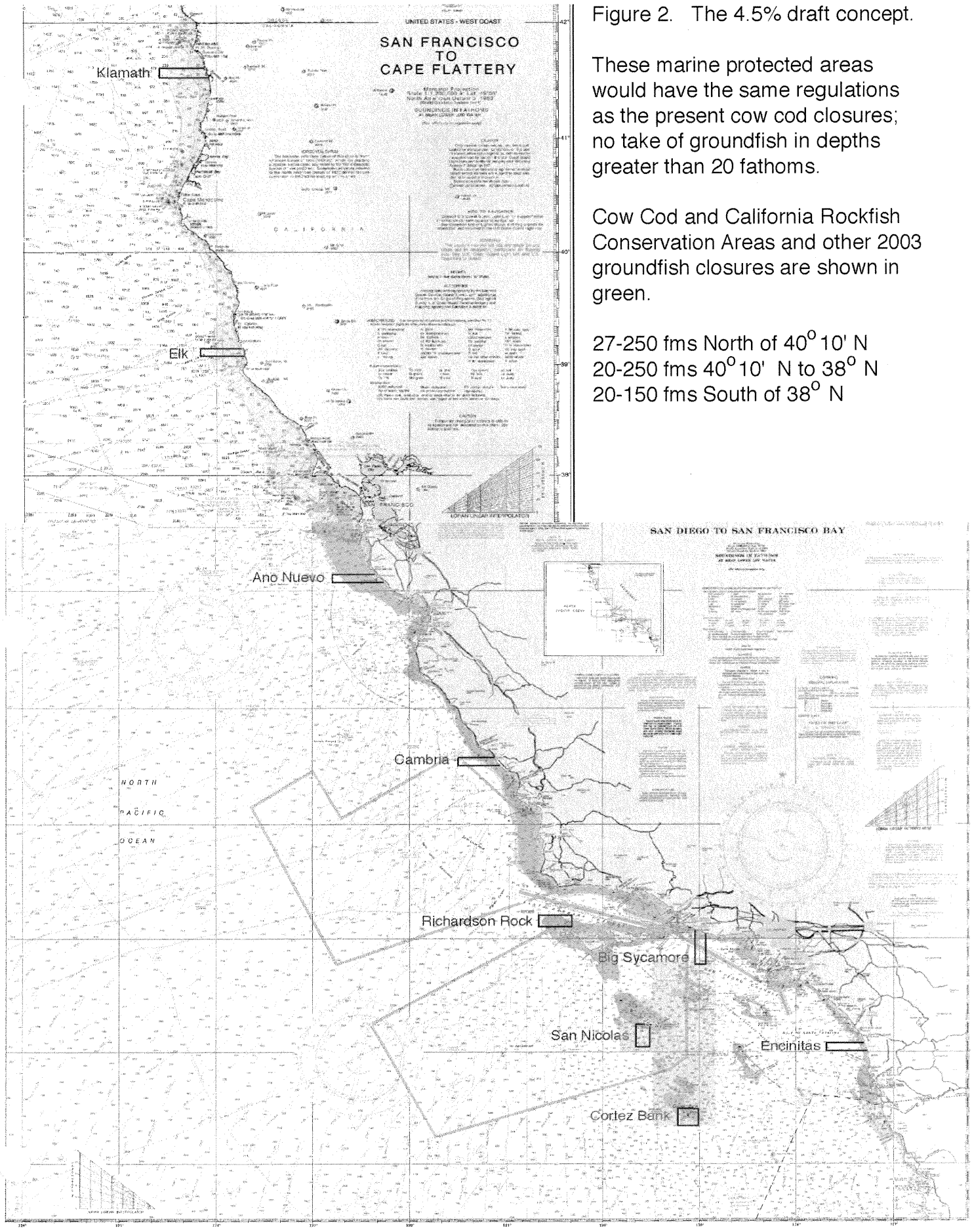


Figure 2. The 4.5% draft concept.

These marine protected areas would have the same regulations as the present cow cod closures; no take of groundfish in depths greater than 20 fathoms.

Cow Cod and California Rockfish Conservation Areas and other 2003 groundfish closures are shown in green.

27-250 fms North of 40° 10' N
20-250 fms 40° 10' N to 38° N
20-150 fms South of 38° N

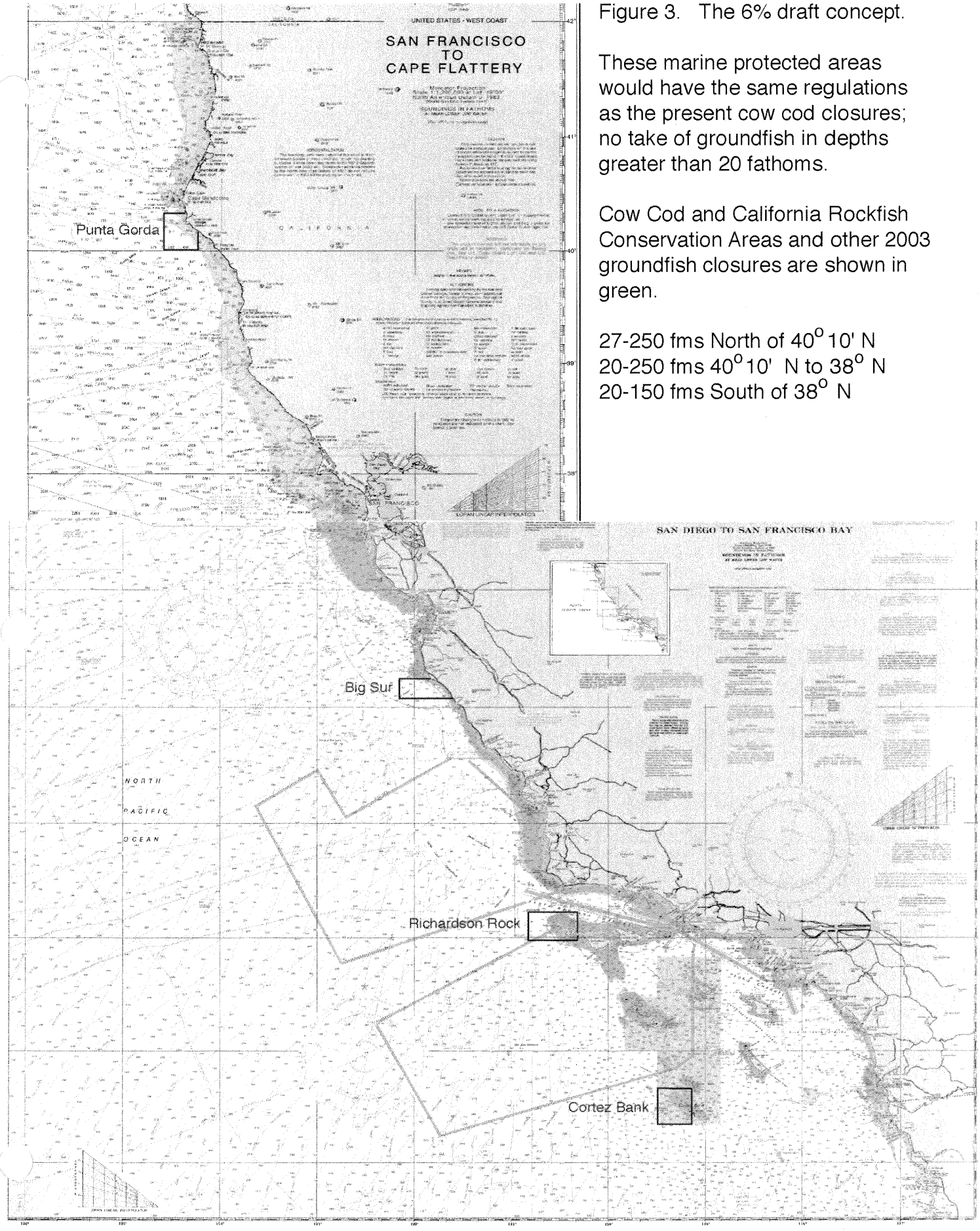


Figure 3. The 6% draft concept.

These marine protected areas would have the same regulations as the present cow cod closures; no take of groundfish in depths greater than 20 fathoms.

Cow Cod and California Rockfish Conservation Areas and other 2003 groundfish closures are shown in green.

27-250 fms North of 40° 10' N
20-250 fms 40° 10' N to 38° N
20-150 fms South of 38° N

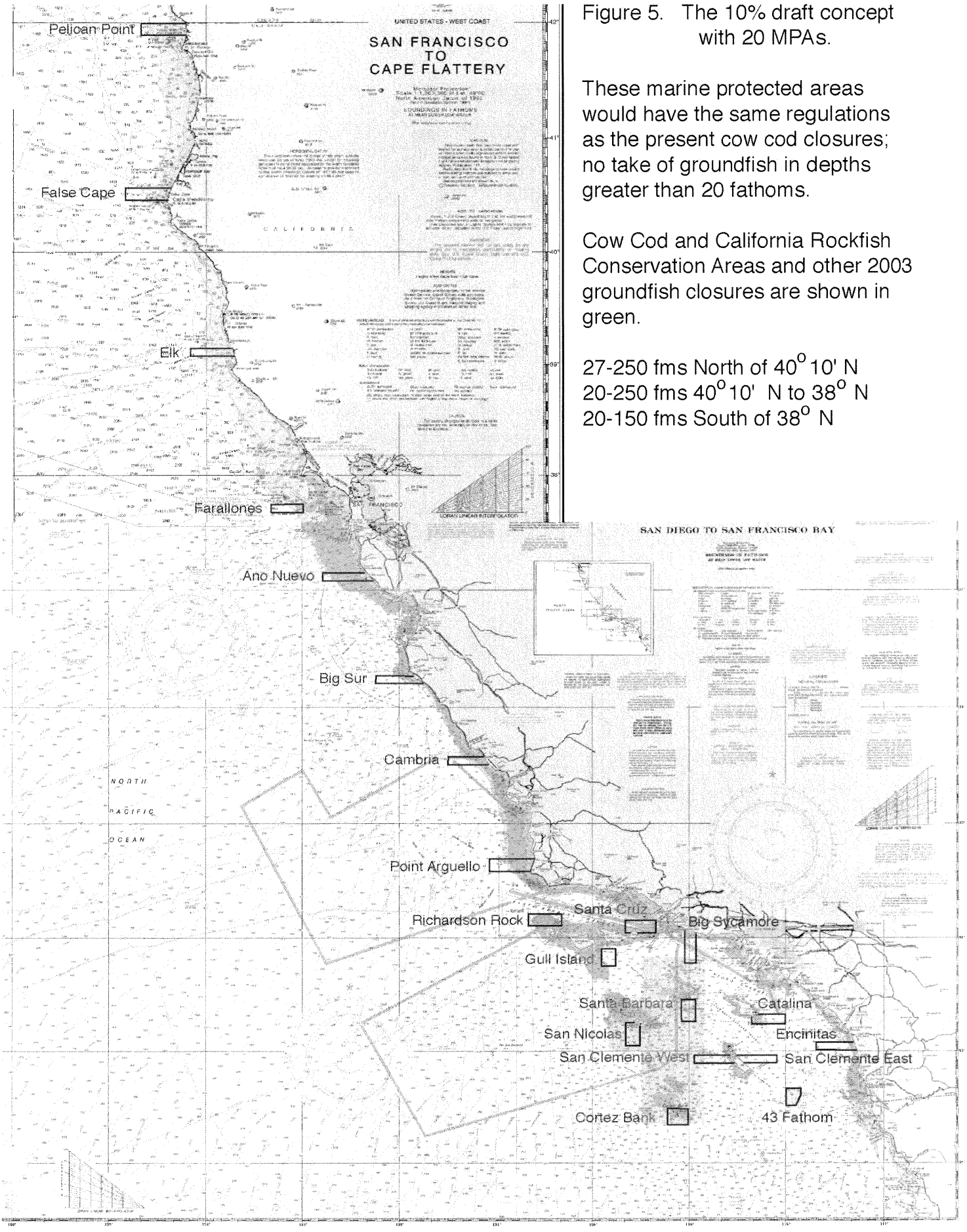


Figure 5. The 10% draft concept with 20 MPAs.

These marine protected areas would have the same regulations as the present cow cod closures; no take of groundfish in depths greater than 20 fathoms.

Cow Cod and California Rockfish Conservation Areas and other 2003 groundfish closures are shown in green.

27-250 fms North of 40° 10' N
20-250 fms 40° 10' N to 38° N
20-150 fms South of 38° N

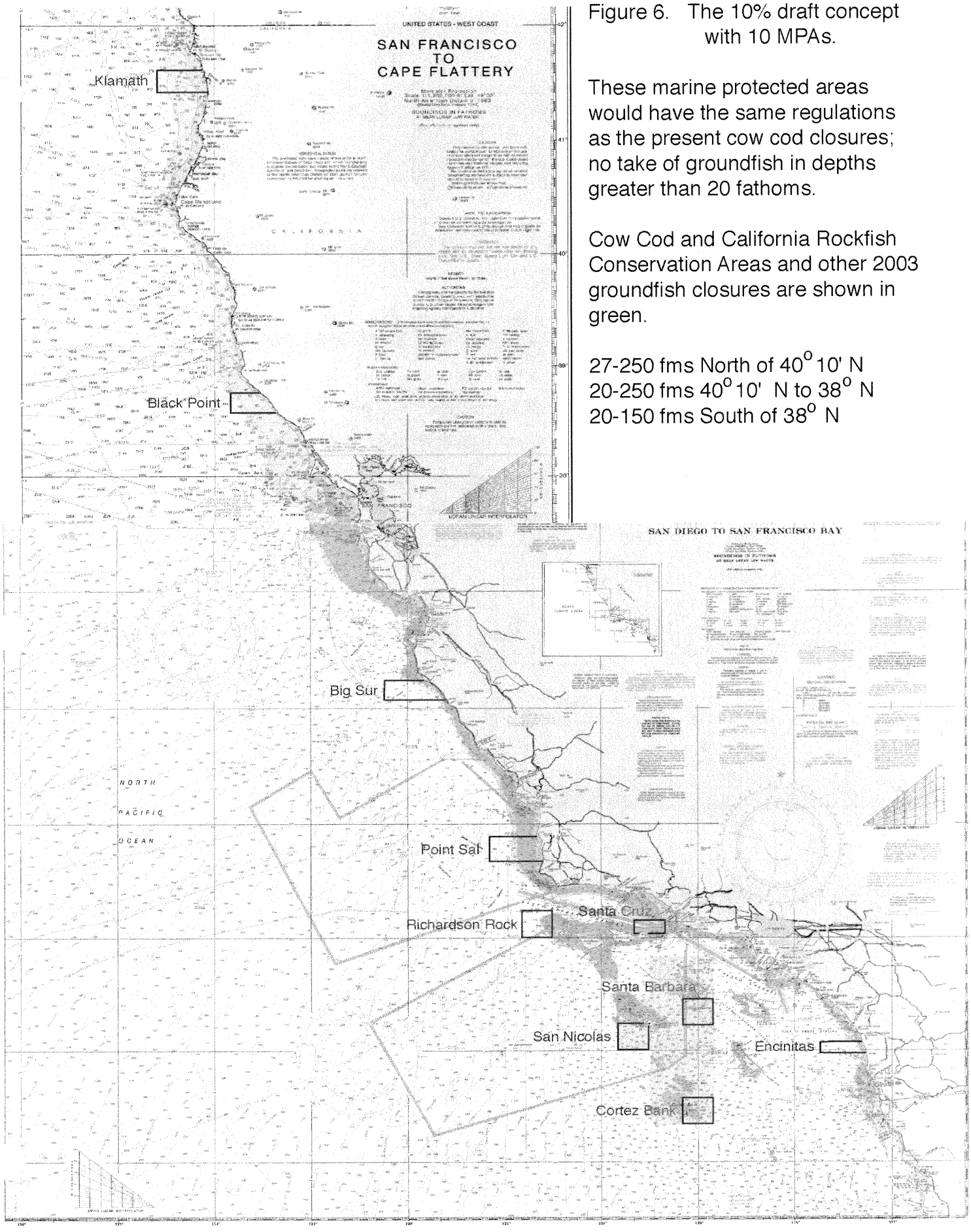


Figure 6. The 10% draft concept with 10 MPAs.

These marine protected areas would have the same regulations as the present cow cod closures; no take of groundfish in depths greater than 20 fathoms.

Cow Cod and California Rockfish Conservation Areas and other 2003 groundfish closures are shown in green.

27-250 fms North of 40° 10' N
20-250 fms 40° 10' N to 38° N
20-150 fms South of 38° N

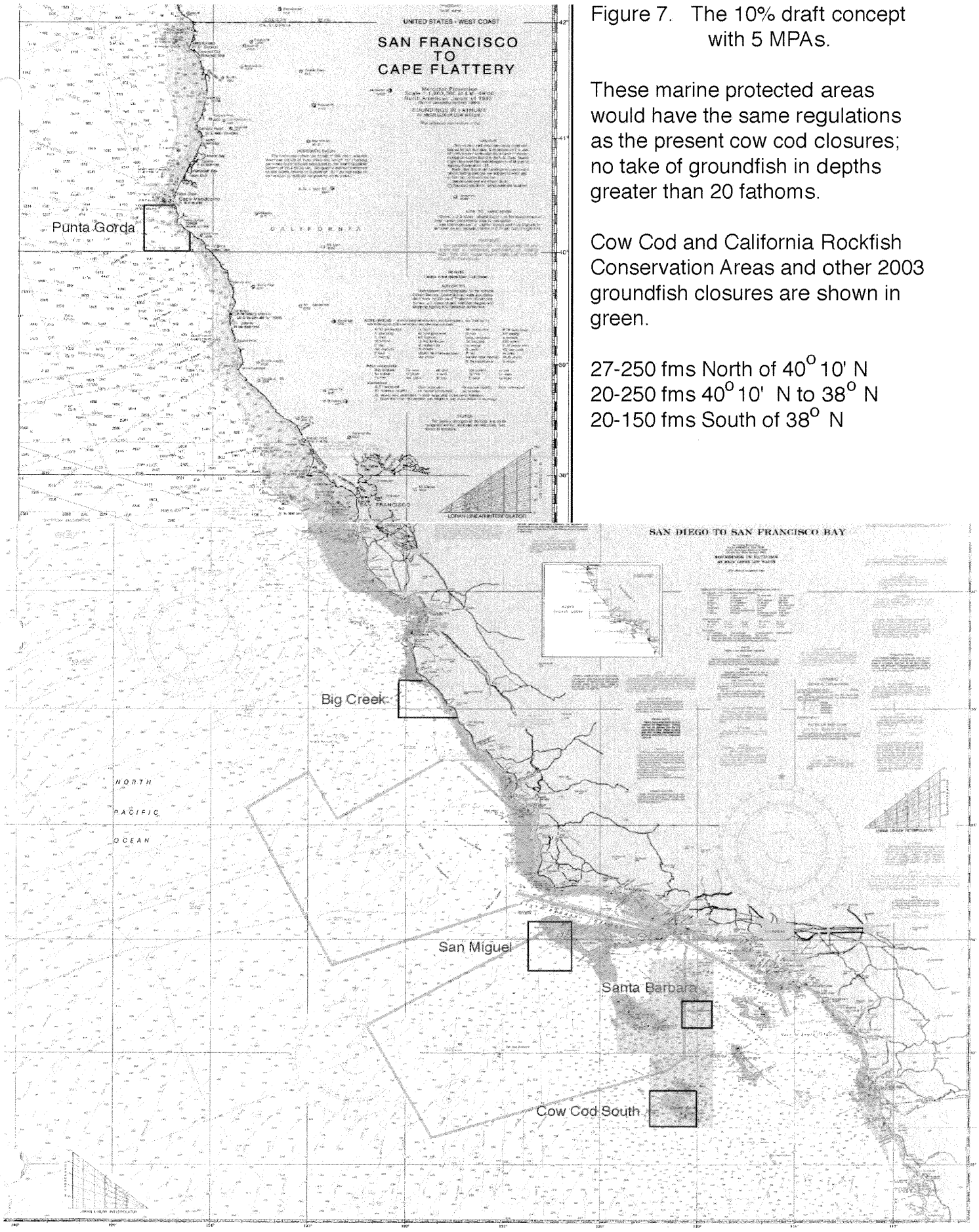


Figure 7. The 10% draft concept with 5 MPAs.

These marine protected areas would have the same regulations as the present cow cod closures; no take of groundfish in depths greater than 20 fathoms.

Cow Cod and California Rockfish Conservation Areas and other 2003 groundfish closures are shown in green.

27-250 fms North of 40^{o} 10' N
20-250 fms 40^{o} 10' N to 38^{o} N
20-150 fms South of 38^{o} N

Comments on ASA report entitled "No take marine protected areas (nMPAs) as a fishery management tool, a pragmatic perspective" by Robert L. Shipp, Ph.D.

By

Drs. Mark Carr, Paul Dayton, Steven Gaines, Mark Hixon, George Leonard,
Stephen Palumbi, and Robert Warner
(authors listed alphabetically)
June 7, 2002

As members of the academic science community with research experience on marine reserves and marine protected areas, we wish to provide comments on a report released on March 7, 2002 by the American Sportfishing Association (ASA) that reportedly evaluates the potential role of marine reserves as a fishery management tool. An examination of the peer-reviewed scientific literature and other existing data suggest that the ASA report seriously underestimates the important role marine reserves (referred to as nMPAs in the report) could play in sustaining both fisheries and marine ecosystems in general. The ASA report is misleading because it:

- underestimates the scope of the fisheries problem,
- biases the analysis in favor of traditional fisheries management,
- ignores the important contribution of marine reserves to the protection of habitats and intact, functional ecosystems,
- takes an incomplete view of how marine reserves may function within a fisheries context, and
- employs faulty logic regarding the presumed costs to fisheries should marine reserves fail to provide fishery benefits.

1) The scope of the problem

The ASA report maintains that data from NMFS (2001) show that only 10% of U.S. fish stocks are overfished and that only 6.3% are both overfished and still subject to overfishing. It uses these figures to argue that U.S. fish stocks are generally healthy and that very few are in need of new, more restrictive management measures. These figures, however, are extremely misleading (a point admitted to but downplayed in the report), because the status of the majority of U.S. fish stocks is unknown. The scope of fishery problems is better understood by considering the percentage of assessed stocks that are overfished. Of the 959 U.S. stocks, about 307 have been assessed. Of those, 33% (rather than the 10%, above) are currently classified as overfished (NMFS, 2002) and very few of these are recovering in any substantial way. Along the U.S. west coast the situation is far worse. Of the 82 species of groundfish in the Pacific Fishery Management Council management plan, only 19 (23%) have been reliably assessed. Of these, 9 species (nearly 50%) are classified as overfished (Stephen Ralston, NMFS, personal communication).

In discussing 60 species of reef fishes in the South Atlantic and Gulf of Mexico, where stock assessments for "the vast majority...have not been performed and life history data, including movement patterns, are also unknown", the ASA report posits "any considerations of nMPA benefits for these species is premature." In so doing, the ASA report tacitly assumes that all unassessed stocks are in pristine condition but there is no scientific basis for the assumption that unassessed stocks are any healthier than assessed stocks. A more realistic approach is to apply the percentage of overfished stocks in the known sample to the unknown stocks. In this case, using data from NMFS' most recent report (2002), nearly 316 of the 959 U.S. fish stocks are estimated as overfished. Clearly, the scope of the problem (and the need for new management measures) in U.S. fisheries is substantially greater than that stated in the ASA report. Because many of these are coastal species, near-shore marine reserves could play an important role in their restoration, conservation and sustainable use.

2) Achieving multiple fishery and ecosystem goals with marine reserves

The critical and overlooked goal of habitat and ecosystem protection

Marine reserves are fundamentally an ecosystem-based management tool whose goal is to protect habitats and intact ecosystems against a variety of threats, including overfishing. It has been well established that many types of ecosystems can dramatically recover when protected from overfishing (e.g., Babcock et al. 1999). Reserves have the potential to conserve and replenish marine ecosystems in ways that may strengthen their resilience in the face of other impacts, such as climate change. They address the needs of thousands of species at the same time, species that humans eat as well as the numerous species that serve as food for the species that humans eat. By protecting habitats, reserves protect the underlying structure of coastal ecosystems and in so doing are critical to maintaining the other non-fishery "goods and services" on which humans depend (Dailey 1997, Costanza 1999).

As an ecosystem management tool, marine reserves can achieve fishery goals that are difficult to accomplish using standard practices such as gear restrictions, seasonal closures, etc. The most important of these is the protection of habitat critical to juvenile and adult survival. Trawling is known to damage bottom habitats and the recovery times for these sensitive habitats in many cases can be far longer than the frequency with which they are trawled (NRC 2002). Although gear restrictions reduce bottom damage, the most effective way to eliminate such impacts entirely is with the use of marine reserves. The scientific literature is replete with examples of the importance of habitat to various aspects of finfish and shellfish life history (e.g.,. Lindholm et al. 1999; Domeier and Colin 1997; Koenig et al. 2000). The ASA report, too, acknowledges "habitat preservation is an important feature of future management of many fish species" but does not state how such protection for the numerous species being harvested will be accomplished. Because marine reserves protect intact ecosystems, they prevent bottom disruption from mining, oil development, or destructive fishing methods. By preserving entire natural ecosystems, including biological habitats like kelp forests and oyster reefs, they simultaneously protect the species on which many commercial and recreational fisheries depend.

The precautionary approach and overfishing

The ASA report defines a fishery management tool as "one that *sustains* and/or increases through time the yield of a fish stock" (italics added). This includes precautionary management tools that prevent declines before they occur. The report then contradicts itself by stating only stocks in serious trouble should be managed: if "stocks are healthy, and projected to remain so ... the need for nMPAs as a management tool is nil." Although yield is an important goal of fishery management, it should not be the only goal and overfishing should not be a prerequisite for the use of marine reserves. By emphasizing a precautionary approach, marine reserves can help reduce the probability that both healthy stocks and those of unknown status become overfished in the first place. Hence, marine reserves can play an important role long before a crisis is reached and long before data are available on the many stocks currently being landed.

The alternative to using marine reserves and a framework of ecosystem management is to rely on multiple, overlapping, single species management plans that become cumbersome and difficult to implement and enforce. Today's fisheries increasingly exploit a plethora of species from finfish to sedentary invertebrates to seaweeds. Managing all these species, one at a time, is the current fisheries paradigm and the mandate of the Magnuson-Stevens Fishery Conservation and Management Act, but this paradigm was generated when fisheries were dominated by a few, high-value finfish. Simultaneously managing all the present day species for optimum yield, as currently demanded by federal law, is a coordination challenge that no fishery agency has yet been able to meet. In contrast to the current approach, marine reserves and an ecosystem approach provide management value for hundreds of species at the same time and provide a unique mechanism for the management of many of the species currently mandated. Sustainable fisheries will only be achieved through a combination of protecting a portion of the stock from fishing mortality and by protecting the habitat on which these and other species depend. Marine reserves can achieve both these goals simultaneously while traditional effort control cannot.

Insurance against the unknowns of natural variability

An additional fishery benefit is that marine reserves provide insurance against the variability inherent in marine ecosystems. By protecting a proportion of the population (especially large, reproductive females), the resultant larger population will offer more resistance to and resilience from both natural and manmade disturbances, which themselves are highly variable and difficult to predict. This added resistance and resilience will directly benefit the long-term sustainability of fish stocks by reducing the probability of population crashes. In addition, marine reserves provide insurance against our own ignorance in the face of the immense complexity of ocean ecosystems. Although scientists and fishermen have considerable knowledge about fish and their habitats, there is clearly much to be learned. Failures in traditional fishery management are due, in part, to our poor ability to precisely quantify fish stocks and the patterns and consequences of human induced and natural mortality. It is unlikely that the perfect knowledge needed for effective traditional management will ever be achieved. By protecting sections of ecosystems within their borders, marine reserves offer an elegant solution to the problems inherent in single species management highlighted above and the difficulties of limited information. It should be stressed that marine reserves are not an excuse for our limited knowledge. Rather, they

illustrate what new information is needed to manage marine ecosystems effectively and to provide critical baselines for understanding human impacts on marine ecosystems.

Marine reserves as a supplement to traditional management practices

We emphasize that marine reserves should not replace traditional management, but should be an additional tool that is compatible with existing approaches. The tenor of the ASA report implies that marine reserves would completely replace traditional fishery management. The academic community has continually argued that marine reserves are not a panacea for the ocean's problems. Like others, we suggest that a combination of traditional management and place-based approaches such as marine reserves can substantially improve the long-term viability of fisheries and the fish stocks on which they depend.

3) How reserves function in a fisheries context

The role of animal movement

The ASA report is founded on a misunderstanding of marine reserve function and design. The report maintains that marine reserves "are predicated on two fundamental components: keeping harvesters out and keeping the species in." Although effective enforcement is critical to the success of marine reserves (as it is for *any* management measure), movement of animals and their offspring does not doom marine reserves to failure. On the contrary, marine reserves have the potential to benefit fisheries only if adult fish move and/or their larvae disperse on ocean currents. The ASA report concludes that because nearly all fish move to some extent, that marine reserves cannot possibly work as a management tool. Presenting fish simply as either sedentary or mobile ignores the subtleties in life history and behavior that make many species good candidates for marine reserves. For example, recent data for red drum near Merritt Island in Florida (Roberts et al. 2001) clearly demonstrate reserve effectiveness for this mobile species.

In addition, although the ASA report acknowledges that rocky reefs act as natural refuges for west coast rockfish (and hence, are an effective form of 'natural' marine reserve), it maintains that additional marine reserves would not work. This is especially perplexing because numerous well-respected scientists believe the life history characteristics of rockfish make them some of the best candidates for the habitat protection afforded by marine reserves (Yoklavich 1998). One source of confusion in the ASA report is equating a species range with mobility or range of an individual. Many species are wide ranging (that is, have large geographic ranges) yet do not exhibit wide movement as individuals (that is, individuals themselves do not travel over large distances). Some rockfish are good examples of species with wide ranges yet limited movement. The substantial movement that does occur is part of the life history of the individual, where young rockfish gradually move into deeper water as they grow. Thus, marine reserves could be effectively situated to protect immature rockfish in shallower water and/or large spawning adults in deeper water. In general, the conclusion that marine reserves will not work for many species is simply at odds with the increasing body of empirical evidence that shows that, despite fish movement, marine reserves consistently increase fish abundance, size and reproductive capacity within their borders (e.g.

Halpern, in press). If marine reserves were bound for failure, as the ASA report maintains, then this wealth of scientific data showing strong effects could simply not exist.

Non-fish fisheries

In concentrating on finfish, the ASA report ignores the growing number of invertebrates that make up U.S. fisheries. Among others, these include lobster, sea urchin, abalone, squid, crab, shrimp and oysters. As finfish landings decline, these "non-fish fisheries" are expanding and now account for over 50% of the gross landings (in dollars) along the U.S. west coast (data available at http://www.st.nmfs.gov/st1/commercial/landings/annual_landings.html). Many of these species are *less* mobile as adults than most of the finfish examined in the ASA report and hence are very strong candidates for the successful use of marine reserves in their management. For example, spatial management has been argued to be a critical component to the management of non-Dungeness crabs (Orensanz et al., 1998) and sea cucumbers (Schroeter and Reed 2001). Because many invertebrates (and some fish) form dense aggregations during mating (Dayton et al. 2000; Tegner et al. 1996; Stokesbury and Himmelman 1993), marine reserves can play a critical role in ensuring densities are large enough to result in successful reproduction. Without the explicit spatial protection afforded by marine reserves, this is unlikely. Even using the faulty logic in the ASA report, if invertebrate fisheries were included, then a substantially larger proportion of fisheries stocks would have been found to benefit from marine reserves.

Evidence and importance of adult spillover and larval seeding

The ASA report claims that there is no evidence that spillover of adult fish from reserves to surrounding areas occurs. Although empirical studies of spillover are still limited, this important effect of marine reserves has occurred consistently when it has been examined. As the density and size of fish increase within a reserve, individuals move outside the reserve boundaries because of density-dependent effects or ontogenetic habitat shifts. Evidence for adult spillover exists from both the fish (e.g. Roberts et al., 2001) and the fishermen themselves. "Fishing the line" is now a commonplace phenomenon where fishermen congregate at reserve boundaries to capture the large fish as they move outside the reserve borders (McClanahan and Mangi 2000). A recent example includes lobster fisherman setting traps outside the border of the Sambos Ecological Reserve in the Florida Keys (Jim Bohnsack, NMFS, personal communication).

Much more important, however, are the increasing number of observations that marine reserves also export larvae beyond their borders and can act to replenish fisheries via the enhancement of recruitment. For example, when areas of George's Bank in the Gulf of Maine were closed to groundfishing (Murawski et al. 2000), they subsequently supported a profitable scallop fishery in areas near reserves (Fogarty et al., 2000).

By ignoring that the depletion of breeding adults occurs, the ASA report dismisses the potential of marine reserves to contribute to stock restoration via larval replenishment. It is true that there is often little relationship between stock biomass and recruitment in natural populations because larval production far exceeds recruitment. However, many fished stocks are at such depleted levels that low recruitment clearly limits their ability to recover (Myers and Barrowman 1996). Marine reserves often result in the build up of large numbers of big

fish, including females (Murray et al. 1999). Larger females produce a disproportionately large number of eggs and larvae than smaller fish (Wootton 1990) and thus they play an important potential role in restoring fisheries. Moreover, larger females produce young that are more fit than those produced by smaller individuals (Berkeley et al. submitted). Developing a fishery to protect large females is nearly impossible without using marine reserves. In short, larval dispersal is much more important to enhancing fisheries than is adult spillover and the build up of biomass and reproductive potential increasingly evident within marine reserves could go a long way toward helping to reverse our current crisis in fisheries.

Optimal yield

The ASA report argues that the yield under a marine reserve scenario is always less than that for a perfectly managed fishery. This argument is predicated on the assumption of an optimally managed fishery, a goal that has rarely (if ever) been achieved using traditional management approaches. Under more realistic conditions, the yield disparity between marine reserves and traditional measure disappears. New modeling results suggest that marine reserves can actually provide an equivalent (Hastings and Botsford 1999) or in some cases greater yield (Gaines et al. in press) when one incorporates our growing knowledge of spatial variation in marine habitats and larval dispersal.

The ASA report cites Murray et al. (1999) and their recommended guidelines for developing marine reserves. We are in total agreement with the report that reserves (and other management measures) should have clear goals, objectives and expectations. For fishery management, we also agree that marine reserves should be evaluated specifically with regard to fishery benefits while not losing sight of their important habitat and ecosystem benefits. We freely admit that data are limited on marine reserve performance for fisheries. Only by establishing a significant network of marine reserves, however, will scientists finally accumulate the empirical data industry seeks illustrating their true potential as a supplemental fishery management tool. There is clearly more to learn, but the evidence available today suggests that marine reserves can contribute to healthy fish stocks.

4) Are there costs of "unsuccessful" reserves to fisheries?

Finally, the ASA report employs faulty logic on the potential costs to fisheries should marine reserves fail to provide fishery benefits. It argues strongly that marine reserves should not be used because they cause significant financial hardship while providing few fishery benefits. As discussed above, the ASA report expects reserves to fail frequently because fish move and consequently will not stay within reserve boundaries. The great irony of this argument is that if reserves provide no benefit (because fish leave protected areas too frequently) then reserves also have little or no cost to fishermen. If the fish are still being caught when they leave the reserve, the only effect on the fishery will be that fish will be caught in different places. Carefully designed and placed reserves could minimize these costs to fishermen. The primary tenet of the report's analysis is that most species will continue to be caught by fishermen since they are too mobile to be protected in reserves. For every species where this is true, reserves should do no harm. As a result, reserves could achieve all of their other non-fishery goals (e.g., conservation of biodiversity, benchmarks for scientific understanding, etc.) while only

changing the location of fishing. In this sense, by arguing against reserves because they will not provide protection from fishing, the ASA report has developed an untenable argument. If these management tools are truly as ineffective as the ASA report would have you believe, then the fishing industry is likely to neither experience the costs and hardship that they maintain nor the fishery benefits that many scientists and conservationists have proposed. Should this be true, reserves could then be established without regard to their effect on fisheries issues.

References

Babcock, R. C. and S. Kelly, N. T. Shears, J. W. Walker and T. J. Willis (1999). Changes in community structure in temperate marine reserves. Marine Ecology Progress Series 189: 125-134.

Berkeley, S. A., C. Chapman, S. J. Bobko, and S. M. Sogard. (Submitted). Longevity and population stability in marine fishes. Science.

Costanza, R. (1999). The ecological, economic, and social importance of the oceans. Ecological Economics. 31(2): 199-213.

Daily, G. C., editor (1997). Nature's services: societal dependence on natural ecosystems. Island Press. 416 pp.

Dayton, P. K., E. Sala, M. J. Tegner and S. Thrush (2000). Marine reserves: parks, baselines and fishery enhancement. Bulletin of Marine Science 66 (3): 617-634.

Domeier, M.L. and P.L. Colin. 1997. Tropical reef fish spawning aggregations: defined and reviewed. Bulletin of Marine Science 60: 698-726.

Fogarty, M. J., J. A. Bohnsack and P. K. Dayton (2000). Marine reserves and resource management. In Seas at the Millennium: An Environmental Evaluation. Volume III. Global issues and processes. Charles C. Sheppard, ed. Pp. 375 - 392.

Gaines, S. D., B. Gaylord, and J. Largier. (2002 – in press). Avoiding current oversights in marine reserve design. Ecological Applications.

Halpern, B. (2002 – in press). The impact of marine reserves: does reserve size matter? Ecological Applications

Hastings, A. and L. W. Botsford (1999). Equivalence in yield from marine reserves and traditional fisheries management. Science 284: 1537 – 1538.

Koenig, C. C., F. C. Coleman, C. B Grimes, G. R. Fitzhugh, K. M. Scanlon, C. T. Gledhill and M. Grace (2000). Protection of fish spawning habitat for the conservation of warm-

temperate reef-fish fisheries of shelf-edge reefs in Florida. Bulletin of Marine Science 66(3): 593-616.

Lindholm, J. B., P. J. Auster and L. S. Kaufman (1999). Habitat-mediated survivorship of juvenile (C-year) Atlantic cod, *Gadus morhua*. Marine Ecology Progress Series 180: 247 – 257.

McClanahan, T. R. and S. Mangi (2000). Spillover of exploitable fishes from a marine park and its effect on the adjacent fishery. Ecological Applications 10: 1792-1805.

Meyers, R. A. and N. J. Barrowman (1996). Is fish recruitment related to spawner abundance? Fishery Bulletin 94: 707-724.

Murawski, S. A. and R. Brown, H. L. Lai, P. J. Rago and L. Hendrickson (2000). Large-scale closed areas as a fishery-management tool in temperate marine systems: the George's Bank experience. Bulletin of Marine Science 66: 775-798.

Murray, S. N., R. F. Ambrose, J. A. Bohnsack, L. W. Botsford, M. H. Carr, G. E. Davis, P. K. Dayton, D. Gotshall, D. R. Gunderson, M. A. Hixon, J. Lubchenco, M. Mangel, A. MacCall, D. A. McCardle, J. C. Ogden, J. Roughgarden, R. M. Starr, M. J. Tegner, M. M. Yoklavich (1999). No-take marine reserve networks: sustaining fishery populations and marine ecosystems. Fisheries 24 (11): 11-25.

NMFS (2001). Report to Congress. Status of fisheries of the United States. Silver Spring Maryland. 119 pp.

NMFS (2002). Annual Report to Congress on the status of U.S. fisheries – 2001. U.S. Dep. Commerce, NOAA, Natl. Mar. Fish. Serv., Silver Spring, MD 142pp.

National Research Council (2002). Effects of trawling and dredging on seafloor habitats. National Academy Press, Washington, DC. 174 pp.

Orensanz, J.M., J. Armstrong, D. Armstrong and R. Hilborn. 1998. Crustacean resources are vulnerable to serial depletion - The multifaceted decline of shrimp and fisheries in greater Gulf of Alaska. Reviews in Fish Biology and Fisheries 8: 117-176.

Roberts, C. M., J. A. Bohnsack, F. Gell, J. P. Hawkins and R. Goodridge (2001). Effects of marine reserves on adjacent fisheries. Science 294: 1920-1923.

Schroeter, S. C and D. C. Reed (2001). The use of marine reserves in evaluating the dive fishery for the warty sea cucumber (*Parastichopus parvimensis*) in California, USA. Canadian Journal of Fisheries and Aquatic Sciences 58: 1773 – 1781.

Stokesbury, K. D. E. and J. H. Himmelman (1993). Spatial distribution of the giant scallop, *Placopectin magellanicus*, in unharvested beds in the Baie des Chaleurs, Quebec. Marine Ecology Progress Series 96: 159-168.

Tegner, M. J., L. V. Basch and P. K. Dayton (1996). Near extinction of an exploited marine invertebrate. Trends in Ecology and Evolution 11(7): 278-280.

Wootton, R. J. 1990. Ecology of teleost fishes. Chapman and Hall, London, England.

Yoklavich, M. M. (1998). Marine harvest refugia for west coast rockfish: a workshop. NOAA Technical Memorandum NMFS-SWFSC-225, 162pp.

No Take Marine Protected Areas (nMPAs) as a fishery management tool, a pragmatic perspective

A Report to the FishAmerica Foundation

By Robert L. Shipp, Ph.D.

Executive Summary

Marine Protected Areas (MPAs) are portions of the marine environment which are protected from some or all human activity. Often these are proposed as a safeguard against collapse of fish stocks, although there are numerous other suggested purposes for their establishment. "No take" MPAs (hereafter referenced as nMPAs) are those from which no harvest is allowed. Other types include those where certain types of harvest are prohibited, which are reserved for certain user groups, or which are protected from other human activities such as drilling or dredging.

Establishment of nMPAs may have numerous beneficial purposes. However, as a tool for fisheries management, where optimal and/or maximum sustainable yield is the objective, nMPAs are generally not as effective as traditional management measures, and are not appropriate for the vast majority of marine species. This is because most marine species are far too mobile to remain within an nMPA and/or are not overfished. For those few species that could receive benefit, creation of nMPAs would have an adverse effect on optimal management of sympatric forms.

Eight percent of US fish stocks of the Exclusive Economic Zone (EEZ) are reported to be experiencing overfishing. The finfish stocks included in this number are primarily pelagic or highly mobile species, movement patterns that don't lend themselves to benefit from nMPAs. Thus a very small percentage, something less than 2 %, depending on mobility potentials, is likely to benefit from creation of these no-take zones. However, many of these species have come under management within the last decade, employing more traditional fishery management measures, and are experiencing recovery.

MPAs (both "no take" and other types) can serve a positive function as a management tool in protecting breeding aggregations, in helping recovery of severely overfished and unmanaged insular fish populations with little connectivity to adjacent stocks, and in protecting critical habitat which can be damaged by certain fishing methods.

Introduction

Concept of MPAs

In recent years, a great deal of interest has been expressed in the establishment of Marine Protected Areas (MPAs), marine "no take" areas, or marine sanctuaries (e.g. National Research Council: "Marine Protected Areas: Tools for Sustaining Ocean Ecosystems, 2001; National Resource Defense Council: "Keeping Oceans Wild: How marine reserves protect our living seas, 2001") This interest has been spurred by the frequent references to depleted fish stocks, and continued decline in marine fishery resources.

Proponents of so called "no take" Marine Protected Areas (nMPAs) have described the benefits to include potential as a fishery management tool as well as several other related advantages, specifically, conserving biodiversity, protecting (coastal) ecosystem integrity, preserving cultural heritage, providing educational and recreational opportunities, and establishing sites for scientific research (Houde et al., 2001). In addition, other benefits suggested include enhancing ecotourism, and reducing user group conflict (e.g. divers and harvesters).

The concept of nMPAs is initially attractive, and will no doubt elicit a great deal of support and discussion among various groups interested in protecting marine habitats. However, the many offered benefits described above often overlap, and become intertwined in the discussions that ensue. A fishery management tool is one that sustains and/or increases through time the yield of a fish stock, or several sympatric stocks of an ecosystem. If nMPAs are to be considered as a management tool, then that goal or objective, sustained and/or increased yield, needs to be clearly stated, and distinguished from other, more theoretical goals.

Traditional Management Tools

Traditional management tools generally focus on reducing effort, enhancing stocks from hatchery operations, and protecting critical habitat. Effort reduction includes bag and size limits (including sometimes slot limits), quotas, seasonal and/or areal closures, gear restrictions, and by-catch reduction. These have been successful for more than a century in freshwater environments. Their use in marine habitats has only become widespread in the United States in recent decades, especially since passage of the Fishery Conservation and Management Act in 1976. Hatchery operations and stocking have also been primarily a freshwater endeavor, although recent efforts to stock some marine species have been attempted and yet to be evaluated over the long term. Protection of critical marine habitats has become an issue of extreme concern and is the focus of current efforts on the part of all Fishery Management Councils, as required in the most recent reauthorization of the Sustainable Fisheries Act. Use of MPAs for this purpose is discussed later in this paper.

Purposes of MPAs

In order for nMPAs to function as a management tool for marine fisheries, there needs to be an examination in specific instances and with specific stocks to determine the potential benefits. This is especially true when stakeholders are currently so involved in management decisions that impact their livelihood. In their work on no-take reserves (Murray et al., 1999), the authors list guidelines for these reserves, including first:

1. Reserves should have clearly identified goals, objectives, and expectations.

a) Clearly identify and describe the purposes of each reserve.
b) Clearly identify the species, communities, and habitats to be protected.
c) Clearly identify the projected role and contribution of each reserve to the network.

I am in total agreement with these guidelines. For this reason, a systematic approach, detailing the potential benefits or lack thereof of nMPAs on managed stocks is justified, and is the intent of this paper. It is not the intent of this paper to pass judgment on the benefits of MPAs ("no take" or MPAs of other design) on any of the other stated objectives (e.g. conserving biodiversity, study sites for ecosystem research, ecotourism sites, protection of habitat from destructive fishing methods, protection of habitats from other harmful anthropogenic activities such as drilling, coastal development etc.). These are socioeconomic or scientific questions that may have socioeconomic and/or scientific consequences, but are distinct from evaluating scientifically nMPAs as a fishery management tool.

Methodology

The procedure followed here is to develop a comprehensive list of economically (commercial and recreational) important finfish from the mid to south Atlantic, the Gulf of Mexico, and Pacific US coasts (shellfish are excluded here because of the radical differences in their life history, harvest methods, etc.). For each species in the list, determine the status of the stocks (underutilized, fully utilized, over utilized, unknown). Then review their life histories, especially movement and/or migratory patterns, and make a judgment as to the possible benefits that may be conferred by establishment of an nMPA.

Determination of nMPA impacts

NMPAs are predicated on two fundamental components: keeping harvesters out and keeping the species in. The first of these is primarily an enforcement, compliance, and education issue and not to be discussed herein. The second is wholly a scientific issue, that is, whether the biology of the species is such that they will remain within an nMPA for a period of their life long enough to accrue the protection desired.

Studies assessing the management potentials of nMPAs recognize this, and the "keeping species in" component is critical in modeling efforts. For example, Nowlis and Roberts (1998) state that their models "**included the key assumptions that adults did not cross reserve boundaries and that larvae mixed thoroughly across the boundary but were retained sufficiently to produce a stock-recruitment relationship for the management area.**"

In addition, for an nMPA to be an effective management tool, the clear implication is that management is needed. Thus, the stocks must be overfished, or overfishing is occurring or likely to occur, and the stocks may be approaching an overfished condition. There are formal and legal definitions for these terms, but briefly, an "overfished stock" is one whose current biomass is below that needed to maintain current harvest rates, and "overfishing" refers to a **rate** of fishing pressure that will lead to the overfished condition, even though current biomass of that stock is adequate to sustain maximum sustainable yield (MSY) if properly managed.

If the stocks are healthy, and projected to remain so, that is they are neither overfished nor is overfishing occurring, the need for nMPAs as a management tool is nil. This is also true if the preferred but complex ecosystem management strategy is employed, and no species within the complex is overfished or experiencing overfishing. In fact the literature is clear on this point, that if the stocks are healthy, nMPAs at best are yield neutral or will reduce harvest in some ratio to the size of the nMPAs (e.g. Polachek, 1990; DeMartini, 1993; Holland and Brazee, 1996; Sladik and Roberts, 1997; Botsford et al., 1999; Hastings and Botsford, 1999; R. Hilborn, U. of Wash. pers. com.).

Current status of fisheries

So it is first important to gain some perspective on the extent of overfishing in U.S. waters before we can assess the possible benefits of nMPAs. In the latest Report to Congress (NMFS 2001), 905 fish stocks in the EEZ were addressed, including both finfish and shellfish. Ninety-two stocks (10%) were determined to be overfished; seventy-two stocks (8%) were found to have overfishing occurring. Of these, 57 stocks (6.3%) were found to be both overfished and are experiencing overfishing. These percentages are somewhat misleading in that there were a large number of stocks for which the stock status was undetermined. However most of these were economically less important and less targeted species.

Determination of Potential Benefits

In determining possible benefits for each species, while movement patterns and stock condition are primary considerations, additional parameters include any that may impact the management of the species. Examples include utility and effectiveness of alternative management measures, presence of critical habitat, by-catch mortality, release mortality, and recruitment (i.e. larval dispersal) characteristics.

The species movement patterns of course relate to the proposed dimensions of an nMPA, but in most discussions, vast area nMPAs, covering extents within which a migratory species or all life history stages of sedentary species would be contained, are not proposed. Exceptions exist in dire cases, such as the major areas established off the upper western North Atlantic shelf, where an attempt is being made to recover the depleted ground fish stocks (NOAA, 1999). In fact, these can also be interpreted as a proxy for effort reduction on a collapsed fishery.

There have been suggestions that certain areas which serve as major migratory pathways or important spawning areas for pelagic species be considered as nMPAs (e.g. NOAA, 1999). These in fact will be discussed as critical habitat parameters, but are not what are generally considered as an nMPA, as these may be seasonal, or even variable in locale, depending on certain physical conditions.

The basic document employed for this list determination is the aforementioned "Report on the Status of US Living Resources" published by the US Dept of Commerce for the year 1999 (NOAA, 1999) and "The Report to Congress. Status of Fisheries of the United States" (NMFS, 2001). These reports provide species lists for each of the coasts, and their current stock status. This is supplemented by including additional species that may fall under individual state management, or have some economic importance external to the parameters of the federal documents. Where these species have been added, a brief commentary on the rationale to do so is included.

Thus the concern often expressed is for troubled species, and the purpose of this report is to determine if those species are potential beneficiaries of nMPAs.

Mid to south Atlantic species

Anadromous Species

NOAA (1999) lists five managed anadromous species of the Atlantic Coast: Striped bass, American shad, alewife/blueback, sturgeons, and Atlantic salmon. All these stocks are considered overfished except striped bass.

Striped bass (*Morone saxatilis*) suffered severe recruitment failures in the 1970s, but restrictive management measures implemented in the 1980s and some good recruitment levels have restored the stocks. For the other species, agricultural and industrial development and damming of rivers are cited as the major impediments to rebuilding. And while improvements of these riverine habitats may be necessary for recovery of these stocks, none of these species can be considered as potential beneficiaries of an nMPA.

Atlantic Highly Migratory Species.

NOAA (1999) lists 10 categories of highly migratory fish stocks: yellowfin tuna, bigeye tuna, albacore, skipjack tuna, bluefin tuna, "other" tunas, swordfish, blue marlin, white marlin and sailfish. Of these, all are considered over exploited, except yellowfin (fully exploited), skipjack (possibly fully exploited) and other tunas (unknown). While there is grave concern for the future of these severely overfished stocks, their highly migratory nature and requirements for international quota regulations preclude them from receiving significant benefit from an nMPA. However, identification of critical spawning areas may justify seasonal/areal closures in the future.

Atlantic Shark Fishery.

There are thirty-four species of sharks listed in the Atlantic shark fishery by NOAA (1999), however these are grouped into only three categories: large coastal, small coastal, and pelagic. The large coastal species as a group are considered overfished, although lack of knowledge of the individual species status is a concern. Small coastal sharks are thought to be fully utilized, and their stock levels above that necessary to maintain a long-term potential maximum yield. The exploitation status of the highly pelagic grouping is unknown. But practically all shark species for which tagging studies have been implemented show extensive movement patterns, and as a result, are unlikely to benefit from nMPAs. However, recent information on critical nursery areas for some species may warrant seasonal/areal closures or other measures to protect critical habitat of juveniles.

Summer Flounder.

Along the New England and mid Atlantic coast, summer flounder (*Paralichthys dentatus*) of the mid Atlantic states is a heavily exploited species, both commercially and recreationally. The species undergoes an offshore spawning migration from late summer to mid-winter, and the larvae and post-larvae drift inshore, where metamorphosis is completed, and the juveniles utilize eelgrass beds or similar habitats. The extensive migratory patterns minimize potential benefit to the species by nMPAs, however, consideration should be given to protection and even expansion of the required juvenile habitat.

Other south Atlantic and Gulf of Mexico stocks

Atlantic and Gulf of Mexico Migratory Pelagic Fisheries.

Because of their migratory patterns which ingress between both the Gulf and south Atlantic, Gulf and Atlantic migratory species are included together. The species listed include dolphinfish, king mackerel, Spanish mackerel, cobia, and cero mackerel. To this list is added wahoo, because both Management Councils (the South Atlantic Fishery Management Council [SAFMC] and the Gulf of Mexico Fishery Management Council [GOMFMC]) have recently begun an assessment and management plan for this species.

Of these seven species, only the Gulf stock king mackerel have been considered overfished, although the most recent stock assessment has concluded that this stock has now recovered to the fully utilized level (Dr. Will Patterson, chair GOMFMC Coastal Migratory Stock Assessment Panel, pers. com). Dolphinfish, cobia, cero, and wahoo fishery utilization levels are unknown. But in any case, these species are so migratory that none could be considered to benefit by an nMPA.

Atlantic and Gulf of Mexico Reef Fisheries.

About 60 species of reef fishes are managed in the South Atlantic and Gulf EEZ. For the vast majority of these, stock assessments have not been performed and life history data, including movement patterns, are also unknown. Thus any consideration of nMPA benefits for these species is pre mature. However, in recent decades, great concern has been expressed for several of the more valuable species, and more is known of their stocks and life history than the lesser known forms. These will form the analytical basis for the potential benefits of nMPAs, and for the present, can be considered as reasonable proxies for the other less studied species.

The species included in this discussion are: jewfish (= goliath grouper), Nassau grouper, gag grouper, red grouper, red snapper, vermilion snapper, mutton snapper, greater amberjack, red porgy, and gray triggerfish. Each of these is treated individually in regard to their stock status and current trends, life history parameters, and potential benefits of nMPAs.

Goliath grouper (*Epinephelus itajara*) has been a species of great concern for more than a decade. In fact, a total harvest prohibition was placed on this species in the late 1980s. Since then, the population has experienced significant recovery (A. E. Eklund, NMFS, pers.comm.), and has led many commercial and recreational fishermen to express concern that its predatory behavior may negatively impact populations of sympatric reef species, especially spiny lobsters. At the recent (January 2002) meeting of the Reef Fish Advisory Panel (RFAP) of the GOMFMC,

several members noted that these stocks have rebounded so strongly and are impacting their prey species so heavily that the Panel voted unanimously to request that the Council consider a controlled harvest to determine the status of the stocks.

Nassau groupers (*Epinephelus striatus*) are found only in the most extreme southern US, primarily the Florida Keys (Sadovy and Eklund, 1999). The status of their stocks has also been of great concern, especially because of their well-documented spawning aggregations (Colin, 1992) that make them vulnerable to intense harvest at that time. For this reason, protection of these sites during spawning is certainly a positive function of an nMPA. Whether these sites should be so designated permanently would require additional studies to determine if habitat requirements were threatened by harvest activities during other times. In addition, designation of areas other than the spawning sites as nMPAs for protection of Nassau would not be beneficial, since they would leave those areas during spawning, and thus become vulnerable to capture (Bolden, 2000).

Gag grouper (*Mycteroperca microlepis*) is an extremely important commercial and recreational species, occurring along the entire mid- Atlantic and Gulf coasts. There has been a great deal of study on this species (see Turner et al., 2001) because of its economic importance, fears for the condition of the stock, the formation of spawning aggregations, its protogynous life cycle, and the possibility of a major shift in sex ratios (fewer males) due to overfishing and the extremely aggressive habits of the males during this period (Coleman et al., 1996). Several regions off the big bend area of Florida were proposed as nMPAs by the GOMFMC for this species during the spawning period (late winter-early spring), but prevented from implementation by subsequent litigation. However, the occurrence of spawning aggregations and concern over sex ratios does argue for protection in those areas well documented as spawning sites. Although the current stock assessment indicates that the stocks are not overfished (GOMFMC, Stock Assessment Panel [SAP], 2001), gag is definitely a potential candidate for protection at aggregate spawning sites and during spawning periods.

Red grouper (*Epinephelus morio*) range from Massachusetts to Brazil, and are most abundant on the west Florida and Yucatan shelves. They're found from coastal estuaries to the outer continental shelf (Robins et al., 1986; Shipp, 2000) and will likely be declared overfished during the year 2002 (Dr. Jim Cowan, chair, GOMFMC, SAP), although there continues to be a great deal of uncertainty regarding the status of the stocks, due in large part to historical catch by the Cuban fleet through the 1960s. In addition, little is known about the migratory patterns of this species. But there is no indication that they are any more sedentary than other groupers, and the juveniles occur in nearshore waters, moving offshore as they approach maturity. It is possible that adults form small breeding aggregations (Coleman et al., 1996), but whether these occur in well-defined areas is not known. If such areas are located, they could possibly be designated as an nMPA during spawning periods.

Red snapper (*Lutjanus campechanus*) has doubtlessly become the most controversial finfish species in the Gulf of Mexico, less so in the south Atlantic. It's high market value, favor by recreational fisherman, and the vulnerability of juveniles to shrimp trawls, has resulted in stakeholder conflicts on many fronts. The species was declared as severely overfished in the late 1980s and early 1990s (Goodyear, 1995; Schirripa and Legault, 1999). This resulted in numerous harvest restrictions, including minimum size limits, seasonal closures, trip limits for commercial fishermen, bag limits for recreational fishermen, and mandates for by-catch reduction devices by the shrimp fleet.

Because of these factors, and the fact that it's a reef species thought to have relatively sedentary habits, several recent papers on red snapper have cited the species as one that might be benefited by nMPAs (Bohnsack, 1996; Fogarty et al. 2000, Houde, 2001). However, on closer examination, red snapper would likely not benefit. Recent papers describing results of tagging studies (Watterson et al., 1998; Patterson et al. 2001) demonstrate that while strongly reef associated, red snappers exhibit slow movement away from tagging sites under normal conditions, and extensive movement as a result of tropical cyclones, a very frequent occurrence throughout the entire range of the species Figure 1). Thus, a "permanent" red snapper stock in an nMPA would be largely relocated to other areas with each of these events.

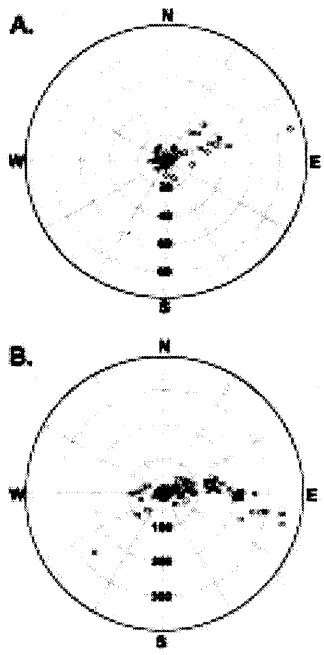


Figure 1. Polar diagrams of red snapper movement for (A) fish not at liberty during Hurricanes Opal and Georges and (B) fish at liberty during those hurricanes. Note scaler differences, in kilometers. From Patterson et al, 2001

In addition, recent model projections of snapper recovery (Goodyear, 1995; Schirripa and Legault, 1999) cite the need for very substantial (40%-80%) shrimp trawl by-catch reduction of age 0 and 1 juveniles. Red snapper larvae remain in the plankton for two weeks or more. Thus any potential contribution of larvae to the overall population from and nMPA stock would be subjected to the same mortality over most of its range. But despite the stresses experienced by the stock, red snapper appear to have begun to recover. With the implementation of the traditional management measures described above, quotas and CPUE have increased consistently during the last decade.

Vermilion snapper (*Rhomboplites aurorubens*) is a moderately important reef species of the Gulf and south Atlantic. The stock assessment panels have not been able with certainty to evaluate stock status. However, in the Gulf, it is likely that this species may be heading toward an overfished condition (J. Cowan, chair, GOMFMC Stock Assessment Panel, pers. comm.), although the most recent assessment contained so many uncertainties that the GOMFMC Reef Fish Advisory Panel in 2002 recommended "status quo" on setting a quota until a more reliable assessment could be developed. The species has been managed primarily by a minimum size limitation. There is little information as to its migratory or movement patterns, so the benefits of an nMPA for this species cannot be determined.

Mutton snapper (*Lutjanus analis*) is known to form distinct spawning aggregations. One of the best known is the Riley's hump area near the Dry Tortugas in the Florida Keys. This area is protected during the spawning season, and except for some occasional violations and attendant enforcement problems, the protection will likely benefit the species.

Greater amberjack (*Seriola dumerili*), though listed as a reef species, is better considered a coastal pelagic. Although frequenting reef areas, this active species is very mobile, and its movements, though not extensive long range migrations, do traverse hundreds of kilometers on a regular basis (Ingram, et al., in press), and thus is an unlikely candidate to benefit from any but the most expansive nMPAs.

Red porgy (*Pagrus pagrus*) ranges on both sides of the Atlantic in temperate and tropical seas. It favors live bottom habitats. It is a species of some concern regarding the health of the stocks, especially in the south Atlantic US coast. Recent increases in fishing pressure have resulted in a greatly reduced stock, and a call for reduced fishing mortality. Earlier tagging studies did not indicate extensive migrations. The species is currently under management by the SAFMC, and effort restrictions have been put in place to reduce harvest. Contingent on the results of this management and additional data on population movements, the red porgy is a species that could possibly benefit from an nMPA until stocks are returned to a level more manageable by traditional fishery methods. However, the population appears to be experiencing a substantial rebound (Dr. Robert Mahood, Exec. Dir. SAFMC, pers. com.), and a new stock assessment will be completed in June of 2002.

Gray triggerfish (*Balistes capriscus*) is a temperate-tropical species found on both sides of the Atlantic. The species has received additional fishing pressure in recent years, probably resulting from more stringent management regulations on co-occurring species, especially red snappers and groupers. However, the stocks are not considered overfished, but as a precautionary move, a 12" minimum TL size limit has been implemented by most management agencies. Recent studies (Ingram, 2001) suggest that gray triggerfish are more sedentary than previously thought, more so than red snapper, but nevertheless do display some limited movement. Should future fishing pressures indicate additional limitations on harvest, this species might be the best candidate among the fishes discussed here to benefit from an nMPA, especially given that recent stock assessment data indicate that gray triggerfish may be experiencing local overfishing in some locations in the Gulf of Mexico (J. Cowan, chair, GOMFMC Stock Assessment Panel, pers. comm.).

Other Snapper/Grouper Species.

In the south Atlantic, there are nine species of snappers and groupers (gag grouper, red snapper, speckled hind, snowy grouper, Warsaw grouper, golden tilefish, yellowtail snapper, red grouper, and black grouper) that are considered overfished and overfishing is occurring. The SAFMC has initiated rebuilding plans by imposing catch restrictions on all these species. These plans are generally 10-15 year plans, and most are about five years away from completion. If these traditional management measures fail, nMPAs might be appropriate for some or all of these species. However, migratory patterns of these forms are at present poorly understood. Therefore, establishment of nMPAs at this time is pre mature.

There are an additional 19 snapper/grouper species in the South Atlantic, as well as scores of sympatric species under management (e.g. grunts, porgies), for which the stock status is unknown.

Southeast Drum and Croaker Fisheries.

Black drum, Atlantic croaker, spot, red drum, seatrouts, and kingfishes (whitings) are included in this grouping. Atlantic croaker and red drum are considered overfished, while the other species' status is considered unknown. All these species spawn in higher salinity waters or offshore, and the young enter estuaries where they reside until reaching sexual maturity.

Of the two overfished stocks, management plans are in place for the recovery of both. Croaker (*Micropogonias undulatus*) stocks suffer greatly from by-catch discards, which include about 7.5 billion individuals killed annually (NOAA 1999). Improvement in gear designs will likely reduce this mortality and lead to recovery of the species.

A total harvest ban in federal waters by the South Atlantic and Gulf of Mexico Councils has been put in place for red drum (*Sciaenops ocellatus*). In addition, the states have implemented various restrictive harvest measures. The results suggest that these conservation measures have substantially increased the escapement of juveniles, and the offshore adult stocks are increasing.

Thus there appears no benefit of nMPAs as a management tool for the southeast drum and croaker fisheries.

Other Gulf and south Atlantic species under some form of management include striped mullet, tarpon, and snook. Only regional assessments exist for these species, but none is considered overfished on a range-wide basis, and all have moderate to long range migratory patterns, and would not benefit from traditional nMPAs. However, the juvenile phase of tarpon may benefit from some nursery area protection (Shipp, 1986).

Pacific Coast fisheries (excluding Alaska)

Pacific Coast Pelagic Species.

There are five species included within the Pacific pelagic group (northern anchovy, Pacific sardine, jack mackerel, chub mackerel, and Pacific herring, NOAA, 1999). All are listed as under or fully utilized, none overfished. Therefore, because of their healthy stock conditions and pelagic life history, they would receive no benefits from creation of nMPAs.

Pacific Coast Groundfish Fisheries.

The Pacific groundfish assemblage is a diverse group of species, principally flatfishes and rockfishes. These are mainly long-lived, slow growing species, subject to harvest by both commercial and recreational fishers. Included are about 60 species of rockfishes, principally *Sebastes* and several species of thornyheads (Genus *Sebastolobus*), several cods, the sablefish (*Anolopoma fimbria*) and the lingcod (*Ophiodon elongatus*). Recently, life history data were provided to the Pacific States Marine Fisheries Commission of the nearshore fishes of California (Cailliet, 2000). This, along with several supplementary references, and combined with the NOAA document (1999) and the Report to Congress NMFS 2001) provide the background for determination of the possible impacts of nMPAs on these species.

The Pacific whiting (=Pacific hake, *Merluccius productus*), is a mid to moderate depth species, with relatively extensive movement patterns. It is considered fully but not over exploited, and with extremely variable year class strengths. Because of these factors the species is not likely to benefit from establishment of an nMPA.

The sablefish (*Anaplopoma fimbria*) is an important commercial species, ranging from Japan and the Bering Sea to Baja. The stock status is considered fully exploited, and stock levels are below optimum. However, it is a deep water, often migratory species, thus not likely to benefit from an nMPA.

The lingcod (*Ophiodon elongatus*) is a large member of the greenling family, ranging from Kodiak Island to southern California, but is most abundant in the northern part of its range. It is an extremely important recreational and commercial species, with a high food value, although representing only about 2 % of the Pacific Coast groundfish catch. This species is considered to be over exploited, with stock levels well below that necessary to maintain the long-term projected yield. The species is relatively sedentary, usually in rocky reefs at depths of 10 to 100 m. It is a nest building species, and the males become extremely aggressive during this time, particularly vulnerable to attack by marine mammals. The species is also cannibalistic.

The life history and stock condition indicate that this species could benefit by an nMPA in the more northern part of its range. However, other management measures have been put in place, including protection of spawning and nesting sites during spawning season, minimum size requirements to ensure at least one spawn before subject to harvest, and restricted catch limits through recreational bag limits and commercial quotas. Though recovery is likely to be slow because this is a long-lived species (up to 25 years), these measures are thought to be sufficient to effect recovery (Alaska Dept. of Fish and Game, 1994).

Pacific cod (*Gadus macrocephalus)* is a wide ranging, highly migratory species of commercial importance in the North Pacific. It is considered underutilized, although stock status and long term potential yield are unknown. Therefore, the species would not benefit from establishment of an nMPA.

Pacific Flatfishes.

Pacific halibut (*Hippoglossus stenolepis*) is a carefully managed species, with its center of abundance in the Gulf of Alaska. Landings from the US Pacific Coast (excluding Alaska) average about 570 metric tons, representing a little more than 1% of the total harvest (NOAA, 1999). The species is well managed throughout its range by traditional methods, and recent harvest has been near record. Thus the species would not likely benefit from establishment of an nMPA.

The status of four other US Pacific Coast flatfish species (arrowtooth flounder [*Atheresthes stomias*], Dover sole [*Microstomas pacificus*] , English sole [*Pleuronectes vetulus*] , and petrale sole [*Eopsetta jordani*]) are considered individually while the many additional flatfishes are grouped together (NOAA, 1999). Of these four, none is listed as overfished, and all are wide ranging with extensive offshore movement patterns. For this reason, none would benefit from nMPAs. For the many remaining flatfish species, their stock status is unknown.

Rockfishes.

There are about 65 species of rockfishes endemic to the US Pacific coast, most in the genus *Sebastes*. They live in a diversity of habitats, from clean bays, to depths greater than 400 M. They are long-lived species, with some living well over 50 years. Thus, annual exploitation to attain the management goals of 35-40% spawning biomass per recruit is often as low as about 5-10%. In recent years, the surplus present in most of these stocks has been fished down, resulting in reductions in recommended annual harvest (NOAA, 1999).

In its report to Congress, NMFS (2001) lists 52 species of rockfish. For four species (Pacific ocean perch [*Sebastes alutus*], bocaccio [S. *paucispinus*], canary rockfish [*S. pinniger*], and cowcod [*S. levis*], all but the latter are major stocks) the stocks are overfished but overfishing is not presently occurring and rebuilding programs are in place or under development. These species are all wide ranging forms with extensive portions of their populations in very deep water. Thus for fishery management purposes, nMPAs are likely not needed Only nMPAs of impractical extent both longitudinally and bathymetrically would have any impact on the stocks as a whole.

For three species (darkblotched rockfish [*Sebastes crameri*], silvergrey rockfish [*S. brevispinis*], and yelloweye rockfish [*S. ruberrimus*], all major stocks) overfishing is occurring, but for the former species the stocks are not currently overfished, and for the latter two stock conditions are unknown. Reduced mortality will be required, but currently, rebuilding plans are not yet in place. These three are also very wide ranging, from the Bering Sea to southern California, and out to depths of well more than 500 M, thus nMPAs would be impractical as a management tool. And in fact, due to the bathymetry of the eastern North Pacific coast, many of the areas inhabited by rockfishes are such as to prevent extensive fishing effort, or create a "natural refuge" (see Yolklavich et al. below).

For eight species (seven of which are major stocks) for which assessments exist the stocks are not overfished, nor is overfishing occurring. For the remaining species, most of which are minor stocks, their status and rate of fishing mortality is unknown. Therefore, particular management measures are premature.

The Pacific Fishery Management Council has implemented limits for individual vessels, as well as other measures in an attempt to maintain a year round harvest for most rockfish species.

Life history data and stock assessments for most species are not yet determined. Cailliat (2000) lists data on about 30 species, and about half are known to be resident species. Of the overfished or species experiencing overfishing, movement data are available only for the canary rockfish which is considered transient/resident, with tagged movements of over 259 km documented, and the yelloweye, which is considered a resident species.

General Life History Comments Regarding Rockfish.

In their study of the Soquel Submarine Canyon, off Monterey California, (Yoklavich et al., 2000) suggested that "**rock outcrops of high relief interspersed with mud in deep water of narrow submarine canyons are less accessible to fishing activities and thereby can provide natural refuge for economically important fishes.**" Their study was represented by 52 fish species, of which rockfishes were represented by a minimum of 24 species. In addition, they concluded that "**There was remarkable concordance between some of the guilds identified in Soquel Canyon and the results of other habitat-specific assessments of fishes along the west coast of the United States from central California to Alaska.**" Certainly this suggests that there is an inherent control of fishing effort in these habitats and consideration of more extensive areas designated as nMPAs is pre-mature and likely unnecessary.

Soh et al. (2001) studied the role of marine reserves on Alaskan rockfishes. Although Alaska is beyond the scope of this report, the findings are likely applicable. While predicting that harvest refugia (=MPA) can be used to greatly reduce discards and serial overfishing, they state that the effectiveness of marine refugia "**in fisheries management is poorly understood and concepts regarding their use are largely untested.**"

Discussion

NMPAs may serve many purposes, as described above. But when intended to serve as a fishery management tool, there are several situations for which they may be extremely beneficial, and many others for which more traditional methods are much preferred. These are reviewed briefly as follows.

Benefits of nMPAs as management tools

NMPAs can have a strong beneficial impact for fishery management during periods of active spawning by aggregations, when species may be especially vulnerable to harvest, and when certain components of the stock (e.g. large male gag grouper) may be disproportionately liable to capture. This can lead to imbalanced sex ratios that can further jeopardize a stressed stock. The utility of these is likely to be seasonal, and normally would not require year around catch restrictions.

In instances where a stock is severely overfished and subject to little or no management, an nMPA can be used along with other measures to more rapidly replenish populations. This is especially true in isolated, insular populations (e.g. Roberts et al., 2001, for St Lucia) that are not strongly connected to proximal populations for replenishment.

Where habitats are damaged by fishing practices, establishment of nMPAs may help ensure habitat recovery. This is useful when these habitats, such as submerged aquatic vegetation, reef structures or other hard bottom habitat, are critical for vulnerable life stages. Oftentimes, however, gear restrictions can be enacted to lessen the social impact that would result in declaration of a total no-take zone.

NMPAs may also be beneficial where ecosystem management is employed in fisheries (primarily of near sedentary species) where by-catch of non-targeted species has become excessive, or conversely, where a protected species has reached population levels which increase natural mortality rates of targeted species, preventing a reasonable harvest (see comments on Goliath grouper, above). An nMPA will allow some version of dynamic equilibrium to return. When the equilibrium has been reestablished, then alternate, more traditional management actions may be desirable to allow yield from the system. However, ecosystem based management is still in its infancy, and much research needs to be done before tested management principles can be established.

Liabilities and "non benefits"of nMPAs as management tools

When establishment of an nMPA is intended as a near proxy for a virgin stock, several factors need to be kept in mind. And it might be helpful, in gaining perspective, to recall that some of these principles have been well known for decades or longer, though sometimes forgotten. **First, by definition, a virgin stock provides no yield.** Therefore a perfect proxy would be a negative in terms of management goals to produce an MSY or OY. However, proponents of nMPA usage for management purposes refer to a "spillover effect" of harvestable adults to adjacent areas. The impact of this spillover will always be less than that of a properly managed stock, which generates the optimal yield-per-recruit, again, by definition. These models are discussed in numerous classical and modern texts (e.g. Rounsefell, 1975; Iverson, 1996),

The issue of spillover is addressed briefly by Houde et al. (2001). The authors describe the difficulty of direct confirmation of spillover effects, and suggest models may be more useful in understanding how marine reserves function in a regional context. But they also note that those conclusions are limited by underlying assumptions on which the model is based. For species with low mobility, the spillover is minimal, yet these sedentary species are the very ones for which an nMPA is supposedly most effective.

Another claim is that larvae from an nMPA will be a significant addition to the overall stocks. This may be beneficial, but only for a very seriously depleted stock. In other cases, larval production, always in excess of the carrying capacity of the habitat, does not normally relate to year class strength. Rather density dependent factors usually control ultimate recruitment to the harvestable stock. While this principle has been the subject of scores of books and probably thousands of publications, it was espoused nearly 150 years ago by Darwin and restated frequently in most every fishery text (e.g. Gulland, 1977; Rothschild 1986).

And much more recently, data presented by the GOMFMC Coastal Pelagic Stock Assessment Panel (January 2002) re emphasizes for very practical management purposes, such as in the case of Gulf king mackerel, that egg production does not correlate to an increase in stock size, the panel stating: **" recruitment is assumed to increase to some level of spawning stock, and then to remain at the average recruitment for higher spawning stock values (Figure 2)."**

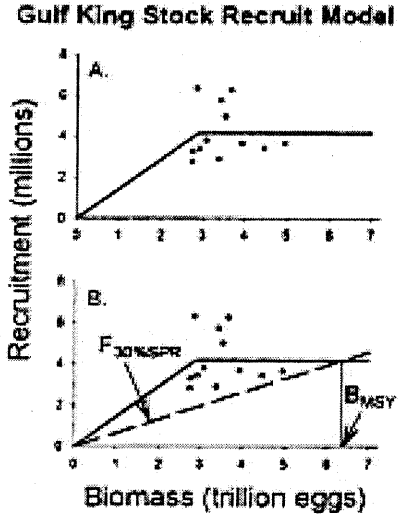


Figure 2. A) Spawner recruit model estimated for Gulf king mackerel. B) Bmsy is estimated at the intersection of the spawner recruit model and F30%SPR replacement line.

Stocks within an nMPA

There are numerous examples in the literature of stock increases within an nMPA (e.g. Johnson et al., 1999; Roberts et al., 2001). However, one must not forget what the point is here in regard to yield. While effective nMPAs may support a stock with relatively greater biomass, perhaps larger individuals, and a higher spawning potential ratio (SPR), **this portion of the stock has been removed from harvest**. Therefore, the overall yield is reduced by whatever fraction could be contributed to overall harvest from this protected stock, and mitigated only by the possibility of spillover or larval contribution, as discussed above.

Pragmatic perspective

Examination of the scores of coastal species from the mid to south Atlantic, Gulf, and US Pacific coasts reveals that very few species are known to be both overfished and/or experiencing overfishing, and are sedentary. Those candidates that are in both categories, and may possibly benefit from and nMPA, are found in widely differing geographic ranges, with optimal potential nMPA sites far apart (e.g. lingcod and surf perch in the Pacific, red porgy in the Atlantic and gray triggerfish in the Gulf). To establish an nMPA for the benefit of those few species would remove harvest potential of the scores of sympatric forms, most of which are not overfished. And while this may not reduce the overall harvest of these species, it would definitely reduce efficiency and increase fishing effort in other, adjacent areas.

Far better would be to impose more traditional methods to restore the overfished stocks, as has been done for many species. This becomes more and more successful as we adopt more precautionary harvest levels, improve our methods of stock assessment, stock/recruit relationships, and life history information.

Current plans or suggestions regarding closure of large areas of the US mainland continental shelf to harvest are simply not scientifically supportable from a fishery management perspective. The suggestion, for example, that as much as 40 % of the Southern California shelf should be designated an nMPA is totally without merit from a fishery harvest perspective. Though there may be other aesthetic benefits, such a closure would severely reduce harvest potentials, shift effort to other areas, and likely have a substantial negative economic impact on both the commercial and recreational fishing industries.

Literature Cited

Bohnsack, J.A. 1996. Marine Reserves, Zoning, and the Future of Management. *Fisheries* 21(9): 14-16.

Bolden, S. K. 2000. Long-distance Movement of Nassau Grouper (*Epinephelus striatus*) to a Spawning Aggregation in the Central Bahamas. *Fish. Bull.* 98:642-645.

Botsford, L. W., L. E. Morgan, D. R. Lockwood, and J. E. Wilen. 1999. Marine Reserves and Management of the Northern California Red Sea Urchin Fishery. *Cal. Coop. Oceanic Fish. Invest. Rep.* 40:87-93.

Cailliet, G.M. 2000. Biological Characteristics of Nearshore Fishes of California: A Review of Existing Knowledge and Proposed Additional Studies. Final Report to the Pacific states Marine fisheries Commission. 103 p.

Coleman, F. C., C. C. Koenig, and L. A. Collins. 1996. Reproductive Styles of the Shallow-water Groupers (Pisces: Serranidae) in the Eastern Gulf of Mexico and the Consequences of Spawning Aggregations. *Env. Bio. of Fishes* 47:129-141.

Colin, P. L. 1992. Reproduction of the Nassau Grouper, *Epinephelus striatus*, (Pisces: Serranidae) and its Relationship to Environmental Conditions. *Env. Bio. of Fishes.* 34:357-377.

DeMartini, E. E., 1993. Modeling the Potential of Fishery Reserves for Managing Pacific Coral Reef Fishes. *Fish. Bull.* 91:414-427.

Fogarty, M.J., J. A. Bohnsack, and P. K. Dayton. 2000. Marine Reserves and Resource Management. In: Sheppard, C (ed.) Seas at the Millennium. Elsevier Science Ltd. London.

Goodyear, C. P. 1995. Red Snapper in U.S. Waters of the Gulf of Mexico: 1992 Assessment Update. NMFS-SEFSC, MIA-92/93-76.

Gulland, J. A. 1977. Fish Population Dynamics. John Wiley and Sons. New York, 372 p.

Hastings, A. and L. Botsford. 1999. Equivalence in Yield from Marine Reserves and Traditional Fisheries Management. *Science* 284:11-2.

Holland, D. S. and R. J. Brazee. 1996. Marine Reserves for Fisheries Management. *Marine Resource Economics* 11:157-171.

Houde, Ed, chair, Committee on the Evaluation, Design, and Monitoring of Marine Reserves and Protected Areas in the United States. Marine Protected Areas, Tools for Sustaining Ocean Ecosystems. 2001. National Academy of Sciences. Washington, DC.

Ingram, G. W. 2001. Movement, Growth, Maturity Schedules and Fecundity of Gray Triggerfish (*Balsites capriscus*) from the North-central Gulf of Mexico. Ph.D. diss. Univ. of South Alabama.

Iverson, E. S. 1996. Living Marine Resources, their Utilization and Management. Chapman and Hall, New York. 403p.

Johnson, D.R., N. A. Funicelli, and J. A. Bohnsack. 1999. Effectiveness of an Existing Estuarine No-take Fish Sanctuary within the Kennedy Space Center, Florida. *N. Amer. J. of Fish. Manag.* 19(2):436-453.

MacCall, D., A. McArdle, J.C. Ogden, J. Roughgarden, R.M. Starr, M.J.Tegner, and M. M. Yoklavich. 1999. No-Take Reserve Networks: Sustaining Fishery Populations and Marine Ecosystems. *Fisheries* 24 (11): 11-25.

Manooch, C.S.,III and W.W. Hassler. 1978. Synopsis of Biological Data on the Red Porgy (*Pagrus pagrus*) Linnaeus. NOAA Tech. Rep. NMFS Circ. 412, 19 p.).

Murray, S.N., R.F. Ambrose, J. A. Bohnsack, L. W. Botsford, M.H. Carr, G.E. Davis, P.K. Dayton, D. Gotshall, D.R. Gunderson, M.A. Hixon, J. Lubchenco, M. Mangel, A. MacCall, D. A. McArdle, J. C. Ogden, J. Roughgarden, R. M. Starr, M. J. Tegner, and M. M. Yoklavich. 1999. No-Take Reserve Networks: Sustaining Fishery Populations and Marine Ecosystems. *Fisheries* 24 (11): 11-25.

National Marine Fisheries Service. 2001. Report to Congress. Status of Fisheries of the United States. Silver Spring Maryland. 119p.

National Oceanic and Atmospheric Administration (NOAA). 1999. Our Living Oceans: Report on the Status of U. S. Living Marine Resources, 1999. NOAA Technical Memorandum NMFS-F/SPO-41. Silbver Spring, MD.

National Resources Defense Council. 2001. Keeping Oceans Wild. April 2001 report.

Nowlis, J. S. and C. M. Roberts. 1999. Fisheries Benefits and Optimal Design of Marine Reserves. *Fish. Bull.* 97:604-616.

Patterson III, W. F., J. C. Watterson, R. L. Shipp, and J. H. Cowan. 2001. Movement of Tagged Red Snapper in the Northern Gulf of Mexico. *Trans. Amer. Fish. Soc.* 130:533-545.

Polacheck, T. 1990. Year Around Closed Areas as a Management Tool. *Natural Resource Modeling* 4:327-354.

Roberts, C. M., J. A. Bohnsack, F. Gell, J. P. Hawkins, and R. Goodridge. 2001. Effects of Marine Reserves on Adjacent Fisheries. *Science* 294:1920-1923.

Robins, C.R., C. G. Ray, and J. Douglass. 1986. A Field Guide to Atlantic Coast Fishes. The Peterson Field Guide Series. Houghton Mifflin, Boston.

Rothschild, B. J. 1986. Dynamics of Marine Fish Populations. Harvard Univ. Press, Cambridge, MA. 272p.

Rounsefell, G. A. 1975. Ecology, Utilization, and Management of Marine Fisheries. C. V. Mosby, St. Louis. 516p.

Sadovy, Y., and A. E. Eklund. 2000. Synopsis of Biological Data on the Nassau Grouper, *Epinephelus striatus* (Bloch, 1792) and the Jewfish, *E. itajara* (Lichtenstein, 1822). NOAA Tech. Rep. NMFS 146. FAO Fisheries Synopsis 157.

Schirripa, M.J, and C.M. Legault. 1999. Status of the Red Snapper Stock in U.S. Waters of the Gulf of Mexico: updated through 1998. NOAA/NMFS, SFD-99/00-75.

Shipp, R. L. 1986. Dr. Bob Shipp's Guide to the Fishes of the Gulf of Mexico. KME Seabooks, Mobile, AL. 186p.

Shipp, R.L. 1999. Status of exploited fish stocks in the Gulf of Mexico, 196-204. *In*: The Gulf of Mexico Large Marine Ecosystem, H. Kumpf, K. Steidinger, and K. Sherman, eds. Blackwell Science, Malden, MA.

Soh, S., D.R. Gunderson, and D. H. Ito. 2001. The Potential Role of Marine Reserves in the Management of Shortraker Rockfish (*Sebastes borealis*) and rougheye rockfish (S. aleutianus) in the Gulf of Alaska. *Fish. Bull.* 99:168-179.

Turner, S.C., C.E. Porch, D. Heinmann, G. P. Scott, and M.Ortiz. 2001. Status of the Gag Grouper Stocks of the Gulf of Mexico: assessment 3.0. NMFS/SEFSC contri. SFD-01/02-134.

Vaughan, D.S., G. R. Huntsman, C.S. Manooch, III, F.C. Rohde, and G.F. Ulrich. 1992. Population Characteristics of the Red Porgy, *Pagrus pagrus,* Stock off the Carolinas. *Bull. Mar. Sci.* 50 (1): 1-20.

Watterson, J. C., W. F. Patterson III, R. L. Shipp, and J. H. Cowan, Jr. 1998. Movement of Red Snapper, *Lutjanus campechanus*, in the North Central Gulf of Mexico: Potential Effects of Hurricanes. *Gulf of Mexico Science* 1998(1):92-104.

Yoklacich, M.M., H. G. Greene, G. G. Cailliet, D. E. Sullivan, R. N. Lea, and M. S. Love. 2000. Habitat Associations of Deep-water Rockfishes in a Submarine Canyon; an Example of a Natural Refuge. *Fish. Bull.* 98:625-641.

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Integrating Marine Reserves Science into the Fisheries Management System

A proposal from:

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Introduction

Marine protected areas (MPAs), or marine reserves, are in use throughout the world for a variety of purposes. In the U.S., MPAs have been established by numerous agencies to achieve a variety of objectives. Their sizes, shapes, and purposes are as diverse as their designations. National marine sanctuaries, fishery management zones, national seashores, national parks, national monuments, critical habitats, national wildlife refuges, national estuarine research reserves, state conservation areas, state reserves, and local parks perform as sites for research and education, as biodiversity reserves, as tools to conserve historic or cultural marine resources, as designations to reduce user conflicts, and to manage natural resources.

The federal government's MPA program defines marine protected areas as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein" (E.O. 13158, Federal Register, 2000). Conservation advocates and others have defined them as protected or reserved areas where there is no consumptive use, no removal of marine resources, and where little if any use or human disturbance is permitted. The World Conservation Union defines a marine protected area as "any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment" (IUCN, 1988; Kelleher, 1999). One fishery management council has defined marine reserves as "specific areas of marine environment managed for the primary purpose of aiding in the recovery of overfished stocks and to insure the persistence of healthy fish stocks, fisheries, and habitats" (South Atlantic Fishery Management Council, 2000).

Ocean resource managers at a variety of levels in the U.S. are considering marine protected areas to accomplish targeted objectives, particularly recovery of depleted fish populations. Fishery management councils in the Gulf of Mexico, South Atlantic, and Pacific are examining and debating the use of MPAs as fishery management tools, but there is no clear consensus about their efficacy in different regions, for variously managed fisheries, and for populations of fish with diverse life histories. As program managers in National Marine Sanctuaries perform their periodic reviews and evaluations, MPAs are being suggested as proposed management measures in sanctuary management plans. State managers in Florida and Oregon are grappling with the effects of such designations on activities they manage in state waters, and in California managers are proposing more designations within their waters.

Each proposed line on a chart, every suggested change or curtailment of human activity in the marine environment engages user groups, managers, and scientists in the debate over the purpose, effectiveness, and evaluation of marine protected areas as a resource management tool. This in turn highlights the need for improved knowledge of the effectiveness of marine reserves for different purposes and more concrete criteria for their design and implementation. This proposal offers a methodology to focus specifically on a thorough and systematic examination of how marine reserves should best be integrated with traditional fisheries management approaches.

Project Objectives

The National Fisheries Conservation Center, as part of a larger consortium of interested parties (see Appendix), proposes a 2-day workshop to improve the integration of marine reserves science

and traditional fisheries management. A consensus statement by 161 scientists, released at the February 2001 annual meeting of the American Association for the Advancement of Science (AAAS), and subsequent important review articles clarified the potential benefits of marine reserves. In particular, they found that reserves can lead to larger and more numerous fish, along with higher diversity, within reserve boundaries, and the spillover of fish beyond reserve boundaries. However, these studies did not assess the relationship of reserve effects to existing fisheries management practices, nor did they suggest how reserves should be integrated with, or traded off against, traditional fisheries management tools.

As a result, several recent discussions involving stakeholders and interested scientists have made clear that there remain important differences between fisheries scientists and managers on the one hand and marine reserves ecologists on the other in terms of basic assumptions about ecological processes, the conceptual and mathematical models used to make predictions and analyze data, and the interpretation of available evidence. These differences affect, for example, conclusions and judgments about:

- Whether marine reserves will increase yields in ways that existing management tools cannot
- Whether marine reserves and existing management tools are equivalent in terms of controlling fishing effort
- The extent to which larvae and/or adults will spill over reserve boundaries and the impact of such spillover on fishery yields
- The means for accounting for existing management constraints on fishing efforts in the design of marine reserves
- Methods for dealing with congestion externalities.

While fishery scientists and managers, marine reserves ecologists, conservation organizations, and fishing industry representatives have almost universally agreed on the need for resolving such issues, there has been little systematic effort focused in this area. As a result, the consideration of whether and how marine reserves should be used in fishery management remains mired in conflict.

NFCC and its cosponsors believe that for marine reserves to receive a fair trial, and to be fully integrated into the fishery management system, such issues must be addressed in an open and objective manner. We believe that a structured discussion of these issues, in a moderated public format, would have several important benefits. It would significantly improve:

- Stakeholders' understanding of key scientific issues
- Managers' appreciation of the uncertainties involved in reserve design and implementation
- Attempts to better integrate reserve design with existing fishery management tools
- Stakeholders' awareness of the tradeoffs involved in decisions about how to integrate marine reserves into the management process
- The focus and effectiveness of the debate about the role of marine reserves in fisheries management.

Methods

We propose a 2-day workshop with the goals of:

- Identifying and exploring key differences in scientific points of view about the use of marine reserves in fisheries management
- Defining the implications of these differences for decision making

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- Identifying where scientific uncertainty is greatest (i.e., what key questions should be answered)
- Describing a set of studies needed to resolve these uncertainties (i.e., how to answer these questions).

We are basing the format of this proposed workshop on that used for the National Institutes of Health's (NIH) Consensus Development Conferences and their companion State of the Science Conferences. A detailed description of the planning and format of such conferences can be found at: http://consensus.nih.gov/about/process.htm. In summary, the process includes the following steps (adapted from the above website):

1. A conference planning committee is assembled to select the review panel, prepare the literature review, and craft the questions the review panel will consider.
2. A broad-based, nonadvocacy review panel is assembled to give balanced, objective, and knowledgeable attention to the topic. Panel members are carefully screened to exclude anyone with scientific or commercial conflicts of interest.
3. Invited experts present data to the panel in public sessions, followed by inquiry and discussion. The panel then meets in executive session to prepare the consensus statement.
4. A number of specific advance questions determine the scope and direction of the conference. These questions are widely circulated and are known to all conference participants. The principal job of the review panel is to develop responses to them.
5. A systematic literature review is prepared for use by the review panel in addressing the questions.
6. Near the end of the conference a draft consensus statement is prepared by the review panel in executive session and is then presented in plenary session. Following public discussion and any revisions deemed appropriate by the review panel, the statement is adopted formally and stands as the record of the conference.
7. The consensus statement is widely disseminated to achieve maximum impact on policy development and/or the direction of future research initiatives.

As described on the NIH website, these conferences are usually held over a 2-day period. The first day and a half consists of a plenary session in which invited speakers present evidence, followed by open discussion among speakers, panelists, and the audience. On the evening of the first day, the panel meets in executive session to begin to draft the consensus statement, which is a response to the conference questions. On the afternoon of the second day, the panel again meets in executive session and completes a draft of the consensus statement. The following morning the draft statement is presented in a public session for audience comment. On the basis of these comments the statement is modified by the panel in a final executive session held the same day.

Appendix 1 shows that several scientists who have been prominent in the discussion of marine reserves as a management tool have expressed an interest in presenting evidence or serving on the review panel. We have also begun discussions with a few preeminent ecologists, who are neutral on the marine reserves issue, who would be candidates to chair the review panel. In addition, the Aquarium of the Pacific, in Long Beach, CA, has offered to host the conference and to provide staff time to assist with planning and logistics.

We emphasize that we do not believe that a single conference can completely resolve the outstanding issues related to the design and implementation of marine reserves and their successful integration into the fisheries management system. Rather, we think that such a

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conference can effectively identify and prioritize the key scientific issues and reach agreement on the data and studies needed to resolve them.

Products

This process will produce a combination of several tangible and intangible benefits and products, including:

- A framework for continued discussion of the science and policy surrounding marine reserves
- Concise statements of the major questions facing marine reserves policy making
- Responses to these questions, based on the best available current knowledge
- Prioritized recommendations for additional research needed to improve decision making related to marine reserves.

In an October 2002 action, the California Fish and Game Commission set aside 175 square miles of ocean around the Channel Islands as a permanent, no-fishing marine reserve. Scientific advice about the potential for rebuilding diminished rockfish populations in the area fueled the decision. Not only was the vote controversial because it has the potential to create economic hardship on some recreational fishing operations, some scientific controversy remains about the assumptions behind the arguments for the reserve. Future action on a much larger reserve in federal waters adjoining the state protected area will consider more than 400 additional square miles for protection. The debate on the larger area will include scientists, fishermen, reserve advocates, federal and state managers and the interested public.

Moreover, both state and federal fishery managers from the Caribbean to Alaska have been examining marine protected areas as a tool for recovering depleted fish populations. Protection of essential fish habitat has been the subject of litigation and ongoing discussion under federal fishery law. About half of the 13 national marine sanctuaries have begun required periodic reviews of their management plans, and use of MPAs is high on the list of priority issues.

It is crucial that during these discussions managers, decision-makers and stakeholders have a sound basis for deliberation. Ongoing decision processes to conserve and sustain ocean and coastal resources can only benefit from good scientific advice about the use of reserves, including recommendations for needed research, direction on intelligent experimentation, and strategic tools to shape the debate and lower the temperature of the rhetoric. Participation and support for this conference from a broad range of interests and co-sponsors could provide the basis for a more cohesive approach to policy making.

Qualifications

The National Fisheries Conservation Center (NFCC), and its cosponsors (see Appendix), have a long and substantial record of direct involvement in the science and policy of marine reserves. They represent the broadest possible cross section of involved interests, from fisheries and marine reserves scientists, to leaders of fishing industry and conservation advocacy organizations, to agencies responsible for developing and implementing fisheries and reserves policies. Thus, the sponsors of this effort have direct experience with all aspects of the marine reserves issue and its relationship to fisheries management.

The NFCC is ideally suited to act as lead sponsor for this effort. Its board contains a broad range of science, industry, and conservation interests whose experience and points of view assure a balanced approach. NFCC's basic mission is to find fisheries conservation and management approaches that work, both for the oceans and the people who depend on them (www.nfcc-fisheries.org). We believe that there is a common ground and that it can be found. We believe that there is a shared goal and that it can be reached.

In addition to facilitation and mediation, NFCC has a track record of serving as a fact finder and a trusted resource for unbiased and accurate information on fisheries issues. A moderated scientific discussion of MPAs is in keeping with our history of contributing to informed discussions that lead to the collaborative resolution of common problems. On numerous topics, including marine reserves, NFCC has provided factual, reliable, and objective information that includes the full range of perspectives held by fishery interest groups, thus helping to cut through the rhetoric and misinformation that often polarizes discussions between these groups.

In one of three topic areas on our website, MPAs were the focus of information in different forms:

1. Informative background papers that detail the facts and key issues associated with each topic;
2. A series of opinion papers solicited from leaders in the field that present the range of views on key issues; and
3. An electronic dialogue center that highlights current developments in each topical area, as well as questions and comments advanced by others who are interested in the successful resolution of key issues associated with these topics.
4. A live, on-line chat with decision-makers and experts on marine reserves.

In addition, the NFCC has a well-deserved reputation for thoroughness, scientific rigor, and procedural fairness and objectivity, along with a history, extending over the past several years, of organizing and facilitating a wide variety of discussions, forums, workshops, and problem-solving efforts directly related to marine reserves.

Budget and Schedule

Task	Background Materials	Committee Meetings	Logistics & Publicity	Conference	Publish Results	Project Management
Labor						
NFCC lead analyst(s)	7,500	10,000	1,250	5,000	2,000	2,500
Committee members		15,000		15,000	3,000	
Researcher	5,000	1,000			4,000	
Logistics support		1,000	4,000	1,200		
Technical writer/editor				1,000	1,000	
Labor subtotal	12,500	27,000	5,250	22,200	10,000	2,500
Direct costs						
Airfare		8,000		5,000		
Lodging		2,000		2,000		
Meals		1,080		18,950		
Phone, postage	100		50	500		50
Conference materials						
Publication costs					500	
Fisherman stipend				24,000		
Direct costs subtotal	100	11,080	50	50,450		
Task totals	12,600	37,080	5,300	72,650	10,500	2,550
PROJECT TOTAL	$141,680					

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Labor cost justification

Labor hours will be billed as follows:

NFCC lead analysts:	$125/hr
Committee members:	$125/hr
Researcher:	$50/hr
Logistics support:	$50/hr
Technical writer:	$100/hr

We assume that the background research must include a comprehensive review of current research findings on the effects of marine reserves, as well as a description of how this science has been used in various policy arenas.

We assume that the review committee will consist of six scientists and that two one-day meetings of the committee will be needed prior to the conference. Ten hours are budgeted for each meeting to include some allowance for travel time. In addition, we assume that the researcher will need to prepare materials specifically for the two meetings.

While the Aquarium of the Pacific has offered to contribute on-site logistical support, additional effort will be required to identify and contact potential participants; arrange travel, lodging, and meeting sites for the committee meetings; publicize the conference; and handle off-site aspects of the conference.

We assume that the conference will involve two ten-hour days for NFCC analysts, the committee members, and the writer, who should attend the conference to ensure he/she understands the material. We assume the logistics support person will spend 24 hours related to conference arrangements and direct support of the committee's work.

We have allocated 40 hours for the writer to prepare the summary workshop documents, four hours each for the committee members to review a draft, and 16 hours for NFCC analysts to assist in preparing the workshop summary. In addition, we have budgeted 20 hours for the researcher to fill any last-minute holes in the documents.

We have budgeted 20 hours for project management, which will involve tracking schedules and budgets, contracting with project staff, and interacting with sponsors and funding sources.

Direct cost justification

We assume that airfare will average $500 per round-trip ticket, and that airfare will be required for 8 persons (6 committee members and 2 NFCC analysts) to the committee meetings, and for ten persons (6 committee members, 2 NFCC analysts, writer, logistics support) to the conference.

We assume that lodging will cost $125 per night and that lodging will be required for one night for each committee meeting and for two nights for the conference.

Meals are budgeted at $45 per day. We assume that each committee meeting will involve 1 ½ day. Meals for the conference will include continental breakfast and lunch on the first day, and a

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308 Raymond St., Ojai, CA
(805) 646-8369; (805) 646-3849 fax
brockbernstein@sbcglobal.net

continental breakfast on the second day, all estimated at $15 per person for 200 people. In addition, we have budgeted for a seafood reception at the end of the second day, estimated at $25 per person for 200 people. Finally, we have budgeted $45 for each of the ten project staff to cover food expenses while traveling to and from the conference.

The fisherman stipend is a large item and we recognize that is a relatively unique request. It includes funds for 40 fishermen to cover two days of time (at $125/day), travel costs of $100 per fisherman, and lodging for two nights at $125 per night. The rationale for this item is that fishermen assert, with justification, that they are not paid to attend conferences such as this, although the outcome may directly affect their livelihood. Unlike other stakeholder groups (e.g., management agencies, environmental advocacy groups), they have no source of funds, other than their personal savings, to pay for travel and other related expenses and to compensate for lost income. Therefore, in order to create as level a playing field as possible, we are budgeting for a stipend to fund the attendance of 40 fishermen at the conference.

Appendix: Cosponsors

The following have expressed an interest in helping to sponsor a conference on the science of integrating marine reserves with the fisheries management system. "Cosponsorship" may mean anything from an agreement to lend financial and/or in-kind support, to participation in presenting evidence or as a member of the review panel, or simply to adding an individual's or organization's name in support of this effort. Some of the individuals below indicated support as individuals and others for their organization. We're still sorting that out at this point. In addition, this list will be expanded as we continue contacting interested parties.

Contact	**Organization**
Bob Bailey	Oregon Ocean Management Program
Jennifer Bloeser	Pacific Marine Conservation Council
Loo Botsford	University of California, Davis
Mark Carr	University of California, Santa Cruz
Steve Gaines	University of California, Santa Barbara
Paul MacGregor	At-Sea Processors Association
Chris Harrold	Monterey Bay Aquarium
Marc Hershman	University of Washington
Ray Hilborn	University of Washington
George Leonard	COMPASS Program, Monterey Bay Aquarium
Marc Mangel	University of California, Santa Cruz
Steve Murawski	National Marine Fisheries Service
Vicki Nichols	Save Our Shores
Robin O'Malley	H. John Heinz Center for Science, Economics, and the Environment
Holly Price	Monterey Bay National Marine Sanctuary
Steve Ralston	National Marine Fisheries Service
Mike Ricketts	Alliance of Communities for Sustainable Fisheries
Steve Schroeter	California Coastal Commission
Jerry Schubel	Aquarium of the Pacific
Peter Shelley	Conservation Law Foundation
Rick Starr	California Sea Grant
Charlie Wahle	NOAA's MPA Science Center
Bob Warner	University of California, Santa Barbara
Brad Warren	Pacific Fishing Magazine

NOAA 2003-001
FOR IMMEDIATE RELEASE
Contact: Glenda Tyson
1/3/03

COMMERCE AND INTERIOR DEPARTMENTS SELECT CANDIDATES FOR NATIONAL MARINE PROTECTED AREA FEDERAL ADVISORY COMMITTEE

Today, the Department of Commerce, with assistance from the Department of the Interior, named final candidates for the National Oceanic and Atmospheric Administration (NOAA) National Marine Protected Area Federal Advisory Committee. Required as part of Presidential Executive Order 13158 dealing with Marine Protected Areas (MPAs), the 30-person committee represents a broad stakeholder community, including scientists, academia, commercial and recreational fishermen, resource users and managers, and environmentalists.

The advisory committee's duties include providing advice and recommendations to the Secretaries of Commerce and the Interior on implementation of aspects of the MPA Executive Order. The members may establish working groups, subcommittees, or task forces as needed to fulfill the committee's goals. They also will create a scientific working group of experts in marine and ocean science fields, which will assess the conditions of natural and submerged cultural resources within the nation's MPAs. The members will serve for two or three-year terms, and will elect a chairperson from the group.

"Marine protected areas are important resource management tools," said Commerce Secretary Don Evans. "We look forward to strong leadership from these individuals in helping us determine how best to continue our efforts, balancing conservation needs with commercial and recreational interests as we move forward to protect the marine environment for present and future generations."

The committee will be supported by the National Marine Protected Areas Center, established by NOAA in cooperation with the Department of the Interior, as required by Executive Order. The MPA Center is charged with providing federal, state, territorial, tribal and local governments with the information, technologies, training and strategies to coordinate federal activities related to MPAs.

Final candidates for the MPA Federal Advisory Committee are:

- Dr. Tundi Agardy, Sound Seas; Bethesda, Md.
- Mr. Robert Bendick, Jr., The Nature Conservancy; Altamonte Springs, Fla.
- Mr. David Benton, North Pacific Fishery Management Council; Anchorage, Alaska
- Dr. Daniel Bromley, University of Wisconsin; Madison, Wis.
- Dr. Anthony Chatwin, Conservation Law Foundation; Boston, Mass.
- Dr. Michael Cruickshank, Marine Minerals, Technology Center Associates; Honolulu, Hawaii
- Mr. Ernesto Diaz, Puerto Rico Coastal Zone Mgmt. Program; San Juan, Puerto Rico
- Ms. Carol Dinkins, Vinson & Elkins Attorneys At Law; Houston, Texas
- Dr. Rodney Fujita, Environmental Defense; Oakland, Calif.
- Dr. Dolores Garza, University of Alaska; Ketchikan, Alaska
- Mr. Eric Gilman, National Audubon Society; Honolulu, Hawaii

- Dr. Mark Hixon, Oregon State University; Corvallis, Ore.
- Mr. George Lapointe, Maine Department of Marine Resources; Augusta, Maine
- Dr. Bonnie McCay, Rutgers University; New Brunswick, N.J.
- Mr. Melvin E. Moon, Jr., Quileute Natural Resources Department; LaPush, Wash.
- Mr. Robert Moran, American Petroleum Institute, Washington, D.C.
- Dr. Steven Murray, California State University; Fullerton, Calif.
- Mr. Michael Nussman, American Sportfishing Association; Alexandria, Va.
- Dr. John Ogden, Florida Institute of Oceanography; St. Petersburg, Fla.
- Mr. Terry O'Halloran, hulaRez Inc.; Kalaheo, Hawaii
- Mr. Lelei Peau, Dept. of Commerce of American Samoa Pago Pago; American Samoa
- Dr. Walter Pereyra, Arctic Storm Management Group, Inc.; Seattle, Wash.
- Mr. Max Peterson, International Assoc. of Fish and Wildlife Agencies; Washington, D.C.
- Mr. Gilbert Radonski, Sport Fishing Institute; Cape Carteret, N.C.
- Mr. James Ray, Environmental Ecology and Response Shell Global Solutions (U.S.)Inc.; Houston, Texas
- Ms. Barbara Stevenson, Portland Fish Exchange; Portland, Maine
- Dr. Daniel Suman, University of Miami; Miami, Fla.
- Capt. Thomas E. Thompson, USCG (Ret.), International Council of Cruise Lines; Arlington, Va.
- Ms. H. Kay Williams, Gulf of Mexico Fishery Management Council; Vancleave, Miss.
- Mr. Robert Zales, II, Bob Zales Charters; Panama City, Fla.

Committee members were nominated by organizations and individuals. Potential members are offered membership into the committee and then must undergo a background check. These candidates were selected by a panel of experts from both agencies seeking to ensure that the committee's membership represented the broad spectrum of interested parties throughout the nation.

NOAA is dedicated to exploring, understanding, conserving and restoring the nation's coasts and oceans. NOAA Ocean Service balances environmental protection with economic prosperity in fulfilling its mission of promoting safe navigation, supporting coastal communities, sustaining coastal habitats and mitigating coastal hazards. NOAA Fisheries ensures the sustainable use of marine fishery resources, protects marine mammal and sea turtle populations, and promotes the health of coastal and offshore marine habitats.

Marine protected areas are one of several management tools NOAA Fisheries uses to prevent decline and promote recovery of marine fish, mammal and sea turtle species that fall under the agency's stewardship responsibilities. In partnership with the eight regional fishery management councils, NOAA Ocean Service, states, fishermen, and coastal communities, NOAA Fisheries combines protected areas with other marine resource management tools to ensure a healthy and bountiful ocean for all Americans.

The Department of the Interior is the nation's principal conservation agency. Interior serves as the steward for approximately 426 million acres of America's public land, representing about 19 percent of the U.S. land surface and 66 percent of all federally owned land. Interior also manages mineral development on the 1.48 billion acre U.S. outer continental shelf. Interior's National Park Service currently manages 385 parks and serves about 285 million visitors. Interior's Fish and Wildlife Service is the primary federal agency responsible for the protection, conservation, and renewal of fish, wildlife, plants and their habitats, and manages 538 refuges and 37 wetland management

districts throughout the U.S.

For more information online:
Department of Commerce - http://www.commerce.gov
NOAA - http://www.noaa.gov
NOAA Ocean Service - http://www.nos.noaa.gov
NOAA Fisheries - http://www.nmfs.noaa.gov
National Marine Protected Areas Center - http://www.mpa.gov
Department of the Interior - http://www.doi.gov
National Park Service - http://www.nps.gov
U.S. Fish and Wildlife Service - http://www.fws.gov
Minerals Management Service - http://www.mms.gov

Regulatory Coordination Between the National Marine Sanctuaries Program and Fishery Management Agencies

Under the National Marine Sanctuaries Act (NMSA), NOAA, on behalf of the Secretary of Commerce, is responsible for protecting sanctuary resources and facilitating within the sanctuaries multiple uses that are compatible with resource protection. The NMSA provides sufficient regulatory authority to accomplish these management objectives, including authority to regulate fisheries and fishing activities as necessary to address specific issues at a particular sanctuary. Any such regulation would be developed in cooperation with appropriate state and federal authorities and fishery management councils, as required by section 304 (a)(5) of the NMSA.

The regulation of fishery resources in national marine sanctuaries is a collaborative process, where sanctuary managers work with other fishery managers in the region to ensure that these important resources are protected. When appropriate, the sanctuary manager may request that the relevant fishery management agency address sanctuary concerns within that agency's own statutory and regulatory context. However, sanctuaries may manage fishery resources within their boundaries by imposing specific sanctuary regulations on certain fishing methods and gear or preventing the taking of fish when it is determined to be necessary to protect cultural sites, to protect important natural resources or to maintain biodiversity or the health and balance of the sanctuary ecosystem. NOAA has adopted such regulations under the NMSA in the Monitor, Florida Keys, Fagatele Bay, Flower Garden Banks, and Gray's Reef Sanctuaries. Where the regulatory measures taken by state and the fishery management councils and NMFS are found to afford appropriate protection to sanctuary resources and meet sanctuary management objectives, the sanctuary achieves its objectives by working with these entities to ensure that the appropriate level of protection is maintained.

It may be determined that additional fishing regulations should be imposed in the sanctuary to achieve management objectives under the NMSA or for the goals and objectives of the particular sanctuary. In such a situation, the sanctuary would consult with the appropriate fishery management council, NMFS, any affected state (if applicable), and the public. In state waters, the sanctuary will work with state fishery agencies to implement necessary regulations. In federal waters, if the fishery management council or the sanctuary determine that the regulations should be implemented, pursuant to subsection 304 (a)(5) of the NMSA the appropriate fishery management council would be given the opportunity to prepare draft sanctuary fishing regulations for that portion of the sanctuary. If the council decides to prepare such draft regulations it is to use as guidance the national standards of section 301(a) of the Magnuson-Stevens Act to the extent those standards are consistent and compatible with the goals and objectives of the sanctuary. If the draft regulations are found by NOAA to meet the goals and objectives of the sanctuary and the purposes and policies of the NMSA, they will be published as sanctuary regulations. If, however, the council declines to make a determination as to the need for fishing regulations in the sanctuary, makes a determination that is rejected by NOAA, requests that NOAA prepare the draft

regulations, or does not prepare the draft regulations in a timely manner, NOAA will prepare the fishing regulations. Regardless of whether the council or NOAA drafts the sanctuary fishing regulations, NOAA will be responsible for compliance with the NMSA, National Environmental Policy Act, Administrative Procedure Act, and other applicable requirements.

Exhibit D.2.b
Supplemental HC Report
March 2003

HABITAT COMMITTEE COMMENTS ON UPDATE ON MARINE RESERVES ACTIVITIES

The Habitat Committee plans to review the report by Dr. Richard Parrish before the April Council meeting, and will have comments at that time.

Second, the HC has some concerns with the report by Dr. Shipp, specifically that there may be some misleading statements concerning West Coast species.

Third, the HC reviewed the proposal by the National Fisheries Conservation Center. Members were concerned the questions raised in the proposal didn't fully capture the scope and breadth of the issues. The HC will discuss this further at the April meeting.

Fourth, the HC heard a report that Monterey Bay National Marine Sanctuary is considering prohibiting krill harvest within the Sanctuary. Krill are used as a colorant for farmed Atlantic salmon. There is no current krill fishery in this area, but the Council should be aware there may be interest in developing such a fishery.

Finally, the HC urges the Council to continue to follow marine reserve issues. Marine reserves have considerable support outside the Council process, and it would behoove the Council to stay involved and consider taking a leadership role. Marine reserves should be considered as a tool during the programmatic and essential fish habitat environmental impact statement processes.

PFMC
03/12/03

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON UPDATE ON MARINE RESERVES ACTIVITIES

The Scientific and Statistical Committee (SSC) did not have access to all of the content of the presentations made by Drs. Lubchenco, Hixon, and Fluharty under agenda item D.1. However, the committee is pleased with the Council's efforts to engage these individuals in a discussion of the "effects of marine reserves on system productivity and yield in the presence of an effective fishery management program" (Exhibit D.1.a, Attachment 1, March 2003). As indicated in a previous SSC statement, the SSC considers it critically important that the Council's marine reserve deliberations focus on "empirical studies and theoretical models that most closely reflect conditions on the Pacific Coast, where highly restrictive management measures have been implemented" (Exhibit F.1.c, Supplemental SSC Report, November 2001). The SSC encourages an objective scientific dialogue on this important topic.

The SSC discussed the proposal by the National Fisheries Conservation Center (NFCC) to hold a workshop to improve the integration of marine reserves science and traditional fisheries management (Exhibit D.2.a, Attachment 3, March 2003). The SSC considers the questions that the NFCC intends to address at the workshop (Exhibit D.2.c, Public Comment, March 2003) to be important aspects of this issue. While the workshop will focus on these questions generically rather than in the specific context of fisheries managed by the Council, workshop output may be useful in terms of informing the Council's discussions of marine reserves. The SSC has a number of questions regarding workshop process (e.g., types of expertise to be represented on the review panel, terms of reference, workshop products). Given the importance of process to the outcome of the workshop, the SSC would like to encourage a representative of the NFCC to make a presentation to the SSC at the next available date to clarify these process questions.

To help the Council deal with the reserve issues before it (Exhibit D.2., Situation Summary, March 2003), the SSC proposes that its Marine Reserves Subcommittee meet some time this summer to prepare a white paper on marine reserves that could be presented at the Council's September or November meeting. The objective of the white paper would be to assist the Council in setting the technical ground rules for discussion of marine reserve initiatives generated within and outside of the Council family. The white paper would focus on issues of specific relevance to the Council. These would include (1) guidance for determining what constitutes "best available science" in terms of the applicability of the marine reserves literature to use reserves as a management tool, (2) the essential role of natural and social sciences in evaluating ecosystem and fishery effects associated with reserves, and (3) implications of marine reserves for stock assessments.

PFMC
03/12/03

Statement to the Pacific Fisheries Management Council from the National Fisheries Conservation Center*

The policy debate over the use of marine reserves as a fishery management tool has generated more than its share of conflict. In addition, the role played by science and scientists in this debate has sometimes blurred the lines between science, advocacy, and policy making in ways that have both helped and hindered decision making about reserves.

While there is broad agreement that marine reserves lead to more and bigger fish, and a more diverse fish community, within the boundaries of a reserve, there are important scientific differences of opinion about the implications of such changes. Much of this debate focuses on the question of whether and how reserves, and the changes they lead to, should be used as a fishery management tool. We think there are five more specific questions (at least) embedded here:

- Will marine reserves increase yields in ways that existing management tools cannot?
- Are marine reserves and existing management tools equivalent in terms of controlling fishing effort?
- What is the extent to which larvae and/or adults will spill over reserve boundaries and what are the impacts of such spillover on fishery yields?
- How should existing management constraints on fishing efforts be accounted for in the design of marine reserves?
- How should managers deal with congestion externalities?

While there are any number of opinions about these five questions, there is no clear scientific consensus available to guide management, nor is there an available process for developing one.

Fortunately, the fisheries management community is not alone in wrestling with the problem of how to use scientific knowledge, and the scientific process, to help make tough management and policy decisions. Of the many approaches available, we think that one, developed by the National Institutes of Health (NIH), is particularly applicable to the marine reserves problem. NIH uses formally structured consensus conferences, and state of the science conferences (http://consensus.nih.gov/about/process.htm), to develop national policy on the management of specific health issues. It uses these conferences in cases where there are scientific differences of opinion about the interpretation of scientific evidence and their implications for medical practice, situations directly analogous to the situation we now face with marine reserves.

The National Fisheries Conservation Center (NFCC) is planning to use this process to convene a group of fisheries scientists and marine ecologists to wrestle with the five questions, the controversy they raise, and explore plausible avenues for answering them. We have garnered some enthusiastic partners for the endeavour, and welcome more. We hope that the Council would agree to provide a statement of support for this effort.

We don't expect science and technology to provide all the answers to questions about marine reserves. But science gives us a means to ask and vigorously probe questions to which our colleagues in the policy community may not already have the answer – at least not an answer in which we can all be confident. And confidence in scientific findings which we can clearly communicate to those who will be affected by the policies our science informs is one of the most critical tasks we face. Because at the end of the day, policy making on MPAs should stand on a firm foundation of thoughtfully considered, well communicated, and critically examined science.

* The National Fisheries Conservation Center is a non-profit organization dedicated to promoting effective discourse on fisheries issues and helping to develop solutions that work for the oceans and the fishermen who depend on them.

PLANNING FOR FEDERAL WATERS PORTION OF THE CHANNEL ISLANDS NATIONAL MARINE SANCTUARY

Situation: On October 23, 2002, the California Fish and Game Commission (CFGC) voted to prohibit fishing in 132 square nautical miles (175 square miles) of state water areas within the Channel Islands National Marine Sanctuary (CINMS), creating a system composed of twelve separate no-take marine reserves. The next phase of this project is to consider expanding the network of reserves into federal waters--those lying beyond the three-mile boundary of state water that encircle each island. The full system of marine reserves would cover 322 nautical miles (426 square miles), based on existing boundaries of the CINMS.

Under the National Marine Sanctuaries Act (NMSA), expansion of the marine reserves into federal waters requires consultation with the Council, including provision of an opportunity for the Council to draft the needed regulations. Current federal fishery regulations that apply to federal waters of the CINMS are implemented under Magnuson-Stevens Fishery Conservation and Management Act authority (regulations implemented by NMFS) and apply only to species under the scope of an approved fishery management plan. The federal regulations which would create no-take marine reserves would be implemented under NMSA authority (regulations implemented by the National Ocean Service [NOS]) and apply to all marine species. Organizationally, the sanctuary programs are part of the NOS. Both NOS and NMFS are part of the Department of Commerce. If the Council were to choose to not participate in the process, not participate in a timely manner, or recommend regulations that are determined by the Secretary of Commerce to be inconsistent with the goals and objectives of the CINMS, the Secretary could then prepare the needed regulations.

We anticipate a letter from the CINMS staff outlining proposed steps for the consideration of marine reserves in federal waters of the CINMS. At the time of the briefing book deadline, the letter was still in the preparation stage. These reserves would be implemented within CINMS boundaries under the authorities of the National Marine Sanctuaries Act (NMSA). The Council will need to determine how it wishes to participate in this process.

The Council received a letter from Vice Admiral Lautenbacher, Under Secretary of Commerce for Oceans and Atmosphere responding to Council concerns about NOAA recommendations to CFGC regarding CFGC's then pending decision on marine reserves for the CINMS (Exhibit D.3.a, Attachment 1). The Council had expressed concerns, because NOAA comments appeared to pre-empt Council efforts to develop recommendations on the matter (Exhibit D.3.a, Attachment 2). In his response, the Under Secretary stated, "NOAA fully encourages meaningful participation by the Council as we begin the process to implement marine reserves in the federal waters portion of the Sanctuary."

Closely related to the designation of CINMS marine reserves is action the sanctuary is considering which would extend the boundaries of the sanctuary.

Council Action:

1. **If appropriate, adopt process for consideration of marine reserves in federal waters in or near the CINMS.**

Reference Materials:

1. Letter from Vice Admiral Lautenbacher (Exhibit D.3.a, Attachment 1).
2. Letter to Vice Admiral Lautenbacher from Dr. Donald McIsaac (Exhibit D.3.a, Attachment 2).
3. Public Comment (Exhibit D.3.c, Public Comment).
4. Letter from the CINMS regarding a proposed process and schedule (Exhibit D.3.a, Supplemental Attachment 3).

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

The GFSP calls for the Council to "use marine reserves as a fishery management tool that contributes to groundfish conservation and management goals, has measurable effects, and is integrated with other fishery management approaches."

a. Agendum Overview — Jim Seger
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Discussion
e. **Council Action:** If appropriate, adopt process for consideration of marine reserves in federal waters in or near the CINMS

PFMC
02/25/03

Exhibit D.3.a
Attachment 1
March 2003

UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary of Commerce
for Oceans and Atmosphere
Washington, D.C. 20230

OCT 25 2002

RECEIVED
NOV 04 2002
PFMC

Dr. Donald O. McIsaac
Executive Director
Pacific Fishery Management Council
7700 N.E. Ambassador Place
Portland, Oregon 97220-1384

Dear Dr. McIsaac:

Thank you for your letter regarding the Pacific Fishery Management Council's (Council) concerns about the establishment of marine reserves within the Channel Islands National Marine Sanctuary (Sanctuary). You refer to an August 29, 2002, letter from the National Oceanic and Atmospheric Administration (NOAA) to the California Department of Fish and Game (CDFG) that provided NOAA comments on the CDFG draft environmental document for the establishment of marine reserves in the state waters of the Sanctuary. That letter conveys NOAA's support for the establishment of a network of state-water sites where commercial and recreational fishing would be prohibited or limited. It was prepared jointly by field staff from both the National Marine Fisheries Service and the National Ocean Service, reviewed through both line offices, and reflects NOAA's position on the state's proposal. The procedure used is typical of how NOAA works together on issues that may affect multiple offices within our organization.

I am concerned that you and the Council feel that your efforts in providing input into the consideration of marine reserves within the Sanctuary may have been preempted by our comments on the state proposal. The Council has been a leader in marine conservation efforts on the west coast, as your recent recommendation on the emergency groundfish closure demonstrates, and I believe that NOAA's position in no way diminishes your efforts. NOAA fully encourages meaningful participation by the Council as we begin the process to implement marine reserves in the federal waters portion of the Sanctuary.

I have asked William Hogarth, Assistant Administrator for Fisheries, to look into your concerns and report back to me on how we might improve coordination in the future. I appreciate your comments, and I hope that we can address them to our mutual satisfaction in advancing the management of marine resources off the west coast.

Sincerely,

C. Lautenbacher Jr.

Conrad C. Lautenbacher, Jr.
Vice Admiral, U.S. Navy (Ret.)
Under Secretary of Commerce for
Oceans and Atmosphere

Exhibit D.3.a
Attachment 2
March 2003

PACIFIC FISHERY MANAGEMENT COUNCIL

7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

CHAIRMAN
Hans Radtke

EXECUTIVE DIRECTOR
Donald O. McIsaac

Telephone: 503-820-2280
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Fax: 503-820-2299
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October 23, 2002

VADM Conrad C. Lautenbacher
U.S. Navy Retired
Under Secretary of Commerce for Oceans and Atmosphere
Department of Commerce
14th and Constitution Avenues
Washington, DC 20230

RE: Improved coordination in National Oceanic and Atmospheric Administration (NOAA) consideration of Marine Protected Areas on the West Coast

Dear VADM Lautenbacher:

We would like to bring to your attention a matter of concern that occurred recently which detracts from the spirit of teamwork and orderliness you have been cultivating within the NOAA organization. The incident involves an August 29, 2002 letter from the Office of the Assistant Secretary for Oceans and Atmosphere sent to the California Department of Fish and Game (CDFG) that compromises and may pre-empt the extensive efforts of the Pacific Fishery Management Council (Council) to provide input into the ongoing consideration for marine reserves in areas in and near the Channel Islands National Marine Sanctuary (CINMS).

Over the past 18 months, the Council has worked closely with the CINMS, CDFG, and California Fish and Game Commission staff in considering marine reserves in the Channel Islands area. The Council's role in this matter was based on the effect the state action would have in limiting the reasonable range of alternatives available to the Council for the implementation of complementary reserves in federal waters of the CINMS, a role designated for the Council under the National Marine Sanctuaries Act (NMSA). Since the beginning, all parties have been up-front and collaborative towards the goal of providing each other's input such that all parties are aware of each other's positions prior to any party formally acting to establish a marine reserve. The Council spent considerable time and resources reviewing the basis for marine reserve alternatives and the California Environmental Quality Act (CEQA) impact analysis document, and was in the final stage of formulating a recommendation on eight alternatives being considered; at each step the Council heard from expert advisory bodies and took public comment on the record.

Then to our surprise, we received without notice or expectation, and conspicuously on the eve of the Council meeting scheduled to adopt a final recommendation, a copy of the aforementioned letter. It contained three elements we considered surprises, (1) a NOAA recommendation for one of the eight alternatives, (2) language inconsistent with a socioeconomic analysis concern we believe to be a significant problem, and (3) it was noticeably omissive of any reference to the role of the Council in the process of establishing marine reserves in this area. The existing bureaucratic chain of command whereby the Council is advisory to the National Marine Fisheries Service, which organizationally reports to the NOAA administration, left the Council with the feeling that our extensive efforts may have been

rendered irrelevant. In that the Regional Fishery Management Councils represent the federal government public interface for offshore fishery management matters with the fishing industry, conservation groups, the general public, and regional state governments, tribal governments, and local governments, the Council is concerned all of these groups participating in our input process were also procedurally neutralized. The Council questioned the NOAA process that lead to the letter in question. Further, the Council was left with a question of whether the sequence of relative policy development designated in the Magnuson-Stevens Act and the NMSA for such matters remains intact.

The Council went ahead with their scheduled deliberations on this matter, and have submitted comments that are not consistent with the position in the NOAA letter as to recommended alternative and certain other matters. After the vote on this matter, the Council members tasked me with providing this letter to you.

An important goal of the current NOAA Strategic Plan is to "Improve NOAA's abilities to serve its customers and forge stronger ties with its partners and stakeholders" (page 1 of the Executive Summary). The Council is in a unique partnership with NOAA under the Magnuson-Stevens Act; many stakeholders interact with federal fishery management primarily through the Council. Prior to the August 29, 2002 letter, the process for mutual consideration of marine reserves on the West Coast between NOAA entities had worked relatively well; the CINMS staff have been very professional and responsible during the Channel Islands marine reserves process, National Ocean Service staff have been a pleasure to work with on various issues since the Council Chairmen's meeting in Sitka, Alaska earlier this year, and managers from other West Coast National Marine Sanctuaries have been cordial in their desire for an open discussion of upcoming matters of mutual concern. However, from the Council's perspective, the August 29, 2002 letter did not further the stated NOAA strategic goal for improved working relationships.

Achieving needed marine reserves is a common goal in both the Pacific Groundfish Strategic Plan "Transition to Sustainability" and the NOAA Strategic Plan "A Vision for 2005." The Council offers this letter in the spirit of improving collaborative processes towards common goals and maximizing our operational efficiency. Please advise if we should alter our approach or role in developing recommendations on marine protected areas on the West Coast.

Thank you for your understanding on this matter, and please don't hesitate to contact me should you have any questions.

Sincerely,

D. O. McIsaac, Ph.D.
Executive Director

DOM:kla

c: Dr. William T. Hogarth
Council Members
Mr. Joe Urovitch
LCDR Matthew Pickett
Dr. John Coon
Council Staff Officers
Mr. James P. Burgess III

HABITAT COMMITTEE COMMENTS ON PLANNING FOR FEDERAL WATERS PORTION OF THE CHANNEL ISLANDS NATIONAL MARINE SANCTUARY

The Habitat Committee will comment on this topic when the Council receives a letter regarding marine reserves in the federal waters of the Channel Islands National Marine Sanctuary.

PFMC
03/12/03

Exhibit D.3.c
Public Comment
March 2003

110 Victoria Commons
Newark, DE 19716
December 9,2002

Executive Director Don McIsaac
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220-1384

Dear Mr.McIsaac;

I am writing to you to encourage your support for the establishment of a network of fully protected marine reserves within federal waters, in the Channel Islands National Marine Sanctuary. Once an area abundant with white abalone, rockfish, cowcod, boccacio, prawns and lobsters, these species now face the threat of extinction, due to commercial fishing diminishing the resilience of kelp forests and marine life. The need for reserve enforcement and monitoring is essential to the future existence of this fragile ecosystem.

As of late November, the California Fish and Game Commission approved a plan that will create a network of marine reserves off the coast of California. This plan will ultimately protect nearly 20 percent of state waters as no-take reserves in the Channel Islands. The importance of this marine reserve will be providing a refuge for many fish and wildlife species, which have been declining dramatically. Some species, such as Giant sea bass, sheepheads, sharks and rockfish, popular industry fish, have had populations decline as high as 90%. Protecting portions of the waters within the Channel Islands is the only option to help restore this once abundant and thriving biodiversity. Scientific studies have shown that large set aside reserves are the only way to achieve the twin goal of protecting underwater habitats and creating a spillover effect to help economically suffering fisheries to rebound. Also, studies have shown that the total weight of organisms inside reserves significantly doubles in comparison to unprotected waters. Therefore, although the islands receive necessary protection as a National Marine Sanctuary, additional measures must be enforced in order to restore declining species and kelp beds.

As a certified scuba diver who enjoys spending many hours in the ocean, I have a personal concern towards protecting this unique ecosystem. Home to an abundant amount of species and diversity, it is essential we preserve these waters within the Channel Islands for future generations to enjoy.

Please support the finalization of the marine reserve network recently approved by the California State and Fish and Game Council, by protecting remaining federal portions within this key ecosystem. This plan will ultimately provide a balance between short-term impacts on the fishing community and restoration of the sanctuary's resources over the long term. If you would be so kind, please keep me informed of your decision pertaining to this issue.

Sincerely,

Natalie Piszek

235 East Fairmount Avenue
State College, PA 16801

December 3, 2002

7700 NE Ambassador Place
Suite 200
Portland, Oregon 97220-1384
Dear Pacific Fishery Management Council,

I write to encourage your support for the establishment of a network of fully protected marine reserves within the federal waters of the Channel Islands National Marine Sanctuary. Fully protecting portions of the waters around the Channel Islands within a network of marine reserves is the only real way to help the once thriving marine life around the Islands rebound and thrive. The islands receive important protections as a National Marine Sanctuary, however new measures are needed to restore declining fisheries and preserve habitat.

We are already losing the battle to restore and preserve wildlife since President Bush lowered the restrictions upon deforesting. Former President Clinton had the right idea to set up strict guidelines to follow to deter forest cutting. However, due to our executive's and several legislatures' greediness and lack of information, a dire consequence may face our nation. Let us not make the same mistake twice.

There is now compelling scientific evidence that an appropriately designed system of marine reserves can help restore damaged rockfish and invertebrate populations. To ignore these problems at this time simply invites a more severe crisis in the future. Our Channel Islands support diverse marine habitats and a unique ocean ecosystem. I strongly urge that you support a configuration of fully protected marine reserves, which protects the Islands' many habitats, including rocky reefs, sandy seafloor, and subsea canyons. By leaving a portion of our coastal waters undisturbed, marine reserves can restore biological diversity and prevent the extinction of individual species. The resulting protected areas can also provide tangible, long-term benefits to commercial and recreational fishermen.

Please finish the marine reserve network recently approved by the California State Fish and Game Commission, by completing the federal portion of this carefully-negotiated, science-based protection for key ecosystems at the Channel Islands.

Thank you for your attention to this pressing matter.

Sincerely,

Justin Edwab

Adrian Bellomo
941 Addison Ave. , Palo Alto, California 94301

January 15, 2003 01:21 AM

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220

Subject: Support for Preferred Alternative Marine Reserve Network at the Channel Islands

Dear Pacific Fishery Management Council:

I'm a high-school student from Palo Alto, Calif. who cares abput the environment. I write to encourage your support for the establishment of a network of fully protected marine reserves within the federal waters of the Channel Islands National Marine Sanctuary. The preferred alternative is fully supported by the CEQA document and by the California Fish and Game Commission.

Fully protecting portions of the waters around the Channel Islands within a network of marine reserves is the only real way to help the once thriving marine life around the Islands rebound and thrive. The islands receive important protections as a National Marine Sanctuary, however new measures are needed to restore declining fisheries and preserve habitat.

There is now compelling scientific evidence that an appropriately designed system of marine reserves can help restore damaged rockfish and invertebrate populations. To ignore these problems at this time simply invites a more severe crisis in the future. Our Channel Islands support diverse marine habitats and a unique ocean ecosystem. I strongly urge that you support a configuration of fully protected marine reserves, which protects the Islands' many habitats, including rocky reefs, sandy seafloor, and subsea canyons. By leaving a portion of our coastal waters undisturbed, marine reserves can restore biological diversity and prevent the extinction of individual species. The resulting protected areas can also provide tangible, long-term benefits to commercial and recreational fishermen.

Please finish the marine reserve network recently approved by the California State Fish and Game Commission, by completing the federal portion of this carefully-negotiated, science-based protection for key ecosystems at the Channel Islands.

Thank you for your attention to this pressing matter.

Sincerely,

Adrian Bellomo

Thanks for your time.
-adrian

Bryan Mulvaney

5307 W Poinsettia Drive , Glendale, Arizona 85304

February 03, 2003 04:53 PM

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220

Subject: Support for Preferred Alternative Marine Reserve Network at the Channel Islands

Dear Pacific Fishery Management Council:

I write to encourage your support for the establishment of a network of fully protected marine reserves within the federal waters of the Channel Islands National Marine Sanctuary. The preferred alternative is fully supported by the CEQA document and by the California Fish and Game Commission.

Fully protecting portions of the waters around the Channel Islands within a network of marine reserves is the only real way to help the once thriving marine life around the Islands rebound and thrive. The islands receive important protections as a National Marine Sanctuary, however new measures are needed to restore declining fisheries and preserve habitat.

There is now compelling scientific evidence that an appropriately designed system of marine reserves can help restore damaged rockfish and invertebrate populations. To ignore these problems at this time simply invites a more severe crisis in the future. Our Channel Islands support diverse marine habitats and a unique ocean ecosystem. I strongly urge that you support a configuration of fully protected marine reserves, which protects the Islands' many habitats, including rocky reefs, sandy seafloor, and subsea canyons. By leaving a portion of our coastal waters undisturbed, marine reserves can restore biological diversity and prevent the extinction of individual species. The resulting protected areas can also provide tangible, long-term benefits to commercial and recreational fishermen.

Please finish the marine reserve network recently approved by the California State Fish and Game Commission, by completing the federal portion of this carefully-negotiated, science-based protection for key ecosystems at the Channel Islands.

Thank you for your attention to this pressing matter.

Sincerely,

Bryan Mulvaney

As of February 21, 2003, 26 copies of this letter were received.

Read by Kathy Fosmark under D.2.c but it should be filed under D.3.c per Chairman Radtke

Dear Kathy, March 10, 2003

I am writing to you as my representative on the Ad Hoc Marine Protected Areas Committee for the PFMC. I am writing you about the Channel Islands Marine Reserve Project. The Scientific and Statistical Committee for the PFMC reviewed the Environmental Document for the proposed CINMS reserve network prepared by CINMS and DFG to comply with the California Environmental Quality Act.

The reviewers suggested that their comments were partially designed to flag issues that needed to be addressed in the federal phase of the CINMS project under NEPA.

Currently fishermen from our region are mounting a legal challenge to the project based on the CDFG and CINMS failing to address this initial peer review along with formal comments from the fishermen on the adequacy of the range of alternatives and the lack of an adaptive management plan for the project's implementation.

Part of my experience with this project as a fisheries representative, I participated as a field researcher in the social and economic survey for this project. In this project we developed GIS maps that show the relative economic yield, by the harvested species spatially as a product of our survey. This information was developed under a system that required fishermen to sign a waiver to release their confidential fishing records from the DFG for verification. The survey was done on standard NOAA charts in a habitat-mapping format with a resolution of 1x1 square nautical miles to describe habitat value for harvest.

Unfortunately we developed a protocol for releasing the data that the scientific advisors in our project felt was too much of a constraint. We required that the Science Advisory Panel provide complete transparency in their models for reserve designs.

We were not effective in using our database as a bargaining chip to insure an open process. However that being behind us now I am asking you to request that the SSC committee review this spatial data and the methodology we used. With the goal of developing this survey and improving on it as a spatial information base that can be utilized in monitoring our reserve network. I believe that this will help to address many of the comments of the SSC review of our project and assist the PFMC in developing a collaborative approach to our project with the fishing community as a pilot adaptive management program for MPA's. In looking at the development (our reserve network), I feel the spatial database is needed for context in assessing statistical projections of economic impact.

This information has potential to be applied also in the context of essential fish habitat. As well as used as a reference for getting more specific information in stock surveys.

Sincerely,

Chris Miller, Vice-president, California Lobster and Trap Fisherman's Assn.