SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON STATUS OF MARINE RESE4RVES PROPOSALS FOR CHANNEL ISLAND NATIONAL MARINE SANCTUARY

Draft Scientific and Statistical Committee (SSC) Statement on the October 1-2, 2001 Meeting of the SSC Ad Hoc Marine Reserves Committee and the CINMS Science Advisory Panel

Introduction

In April 2001, Mr. Matt Pickett, Mr. Sean Hastings, and Dr. Satie Airame of the Channel Islands National Marine Sanctuary (CINMS) made a presentation to the SSC in which they described the process being used to consider marine reserves at CINMS. They described the roles of the Sanctuary Advisory Council, the Marine Reserves Working Group (MRWG), the Science Advisory Panel and the Socioeconomic Panel in that process. They also described work conducted by the Science Panel to map and characterize habitats within the CINMS and the algorithm used to ensure that each habitat type would be adequately represented within reserve areas. The SSC was impressed by the site selection algorithm developed by the Science Panel.

At the April meeting, the CINMS also informed the SSC of the Science Panel's recommendation for a reserve size of 30%-50% for all CINMS waters and, in justification, provided a table listing references from the marine reserve literature. However, the conclusions that could be drawn from the citations in the table and the Science Panel's size recommendation were not fully persuasive to the SSC. The SSC therefore requested that the CINMS provide written documentation of the rationale underlying the Science Panel's 30%-50% size recommendation. The CINMS subsequently provided the SSC with a draft document dated May 23, 2001 and entitled "How large should marine reserves be?" The CINMS also provided the SSC with copies of many of the references cited in that document.

At the June 2001 Council meeting, the SSC offered to create an SSC Ad-Hoc Marine Reserve Committee to meet with CINMS and the Science Panel to further review the reserve size recommendation and its potential relevance to the Council's future consideration of marine reserves, particularly for the groundfish fishery. The Council accepted the offer. The meeting was held on October 1-2, 2001 in Santa Barbara, California. The meeting itself was devoted to three specific discussion points: (1) the analytical basis for the Science Panel's 30-50% reserve size recommendation, (2) the relationship between the reserve size recommendation and existing management controls, and (3) the extent to which the approach underlying the Science Panel's reserve size recommendation can be generalized to the west coast groundfish fishery. The SSC appreciates the participation of the Science Panel and CINMS staff at that meeting.

After the meeting in Santa Barbara, the CINMS provided the SSC with a slightly revised version of their draft report entitled "How large should marine reserves be?" (dated October 17, 2001). The purpose of this statement is to summarize SSC's conclusions derived from the new Science Panel draft report and the discussions that occurred at the Santa Barbara meeting. This statement to the Council constitutes an independent peer review of one aspect of the marine reserve deliberations conducted at CINMS, namely the Science Panel's recommendation regarding reserve size. The SSC notes that this statement should not be interpreted as a comprehensive review of marine reserve deliberations at the CINMS.

In order to evaluate the Science Panel's size recommendation, it is important to first understand their specific charge. The Science Panel was asked by the MRWG to evaluate the size of marine reserves at CINMS needed to achieve two goals: (1) to protect representative and unique marine habitats, ecological processes, and populations of interest (hereafter referred to in this statement as the "biodiversity" goal), and (2) to achieve sustainable fisheries by integrating marine reserves into fisheries management (hereafter referred to in this statement as the "sustainable fisheries" goal). To facilitate their consideration of these goals, the Science Panel was provided with a list of 119 plant, invertebrate, fish, mammal and bird species of particular concern in the CINMS. The list included: (1) economically and/or recreationally important species, (2) keystone or dominant species, (3) species listed or proposed for listing under the Endangered Species Act, (4) species that have shown long term declines in harvest and/or size structure, (5) habitat-forming species, (6) indicator or sensitive species, and (7) important prey species.

Specific Comments

Given this background, the SSC has the following comments relative to the three specific discussion topics at the Santa Barbara meeting.

Topic 1. What is the analytical basis for the Science Panel's 30-50% reserve size recommendation?

The Science Panel provided the SSC with various types of evidence (i.e., factors) relating to their 30-50% reserve size recommendation, including (1) the Council's default harvest rate policy for rockfish, (2) dispersal rates of macro-algae, invertebrates and fish, (3) concerns about emerging fisheries, and (4) a general review of the marine reserve literature. While factor (4) represents the major driving force behind the Panel's size recommendation, a brief discussion of factors (1)-(3) is warranted before addressing factor (4).

Factor (1): At the Santa Barbara meeting, a Science Panel member made a presentation asserting that the 30%-50% reserve size recommendation is consistent with the Council's default harvest rate policy for rockfish (i.e., $F_{50\%}$ with 40:10 precautionary adjustment). The SSC notes the following regarding that assertion: (a) The Council's harvest rate policy seeks to maintain groundfish populations at a level equal to 40% of the unfished level ($B_{40\%}$) by reducing the exploitation rate when biomass drops below the target. If 40% of the available habitat were set aside in no-take reserves, that alone might be expected to provide long term protection to 40% of the stock, which would nominally satisfy the Council's spawning stock preservation requirements. The stock within reserves, combined with the portion of the stock residing outside of reserves would then represent an aggregate level of abundance in excess of $B_{40\%}$. (b) With respect to harvest rate, $F_{50\%}$ is the mortality rate that reduces spawning per recruit to 50% of that expected in the absence of fishing. Unless recruitment is completely independent of stock size, reductions in recruitment due to the effects of fishing at an $F_{50\%}$ rate will reduce the total spawning potential of the stock to a level lower than 50% of virgin conditions, often substantially lower. Given both these considerations, the SSC does not view a 30%-50% area set aside for marine reserves as equivalent to the Council's default harvest policy.

Factor (2): The Science Panel provided information showing that dispersal distances of fishes, in contrast to macro-algae, are relatively large (i.e., 10-1,000 km). Thus, to ensure that reserves replenish themselves, and do not simply export their larvae to unproductive areas, reserves for fishes must be large and/or highly networked. Recognizing there is little assurance that reserves within CINMS will be self-sustaining for species with large dispersal distances, such as groundfish, the Science Panel felt that large reserves within CINMS would at least enhance the self-sustainability of species with lesser dispersal ranges.

Factor (3): The Science Panel noted that emerging fisheries frequently require management attention to remedy inadequate controls on fishing during fishery development. Thus the benefits of marine reserves could extend to species that may become targeted in emerging fisheries. The SSC agrees with this point.

Factor (4): The Science Panel and CINMS staff provided the SSC with a histogram that depicted the distribution of optimal marine reserve sizes indicated by studies from the literature. The resulting distribution was very broad, ranging from 5-80% of available habitat. Most of the studies that were cited indicated a minimum of 10-40% of marine habitats would need to be protected to conserve ecosystem biodiversity, and that 20-50% of fishing grounds would need to be protected for fishery sustainability. The central tendency of the two distributions occurred in the range of 30-50%. It was this result that provided the primary impetus for the Panel's reserve size recommendation. The SSC notes the following regarding the Science Panel's rationale under Factor (4):

- In addressing the biodiversity goal, the Science Panel operated under the premise that the inclusion of habitats in proportion to their occurrence within the reserve could be expected to provide broad ecosystem protections. In terms of protecting populations of interest, which were defined to include 119 diverse plant and animal species, the Panel assumed that the best way to ensure protection of those populations was to protect representative habitats. The SSC considers the Panel's approach to addressing the biodiversity goal to be reasonable, particularly given the large number and diversity of species that the Panel was asked to consider and the limited information available regarding the life history and current status of many of those species.

- While many of the studies from the literature cited by the Science Panel indicated that a minimum 10-40% of habitat would be needed to conserve biodiversity, the Panel noted that biodiversity benefits increase continuously with reserve size. Biodiversity *per se* cannot be used to establish an upper bound on reserve size. In other words, the upper bound on reserve size is driven more by the sustainable fisheries goal than the biodiversity goal.

- The reserve size recommendations made in the studies cited by the Science Panel depend critically on assumptions about how well fisheries are managed prior to the establishment of reserves and/or how well they are managed in the open areas once reserves are in place. Significantly, many of these studies assume negligible or loose effort controls in the open area, which predisposes them to conclude that large reserves are required to achieve fishery sustainability.

- The Science Panel identified the existence of an emerging body of spatial meta-population literature which suggests that effort controls alone are incapable of matching sustainable yields that are, in theory, possible when using a combination of methods. Beyond noting the existence of such a literature, they did not specifically link this literature to their reserve size recommendation.

Topic 2. What is the relationship between the Science Panel's reserve size recommendation and existing management controls?

As indicated under Topic 1, the Science Panel's size recommendation was based on results from studies that largely assumed that existing management measures are ineffective or non-existent. The Panel felt that this assumption applied to many of the species in CINMS. Their conclusion was not based on systematic analytical assessments of populations within the CINMS but on a variety of trend indices and other types of information for a limited number of species. The SSC was unable to evaluate the general validity of this conclusion, given the limited documentation provided regarding State fishery management practices and the status of stocks within CINMS. Clearly some resources are in jeopardy (e.g., abalone), while others (e.g., market squid) are considered to be robust.

The Science Panel was instructed to consider the 119 populations of interest identified at CINMS to be circumscribed by the boundaries of the CINMS, thus invoking a non-biological definition of the term "population". This was done in recognition of the fact that the CINMS has no authority over areas outside its boundaries. Even so, because the biological populations of virtually all species within the Sanctuary extend well beyond its boundaries, this is an oversimplification. Consistent with this narrow geographic focus, the Panel's reserve size recommendation was not tempered by any explicit consideration of fishery regulations outside of the CINMS and the conservation benefits that such regulations might provide to resources dwelling within the CINMS.

According to the Science Panel's October 17 draft report, "To enhance conservation benefits and the potential for fisheries to be sustainable over the long-term, the science advisory panel recommended either limiting catch outside of the reserves to current levels or reducing catch if current levels are insufficient to achieve sustainability". Given that the Panel's 30-50% size recommendation is based on studies that generally justify large reserves as a substitute for management using more traditional measures (effort/catch controls), a reserve size of 30-50% should reduce the need for strict controls in the open area. A number of studies cited by the Panel suggest that the same sustainable fisheries benefit can be achieved (1) with controls on fishing effort alone, (2) with marine reserves and no restrictions on effort in the open area, or (3) with some combination of these approaches. The Panel's recommendation regarding the need for catch restriction outside a 30-50% reserve appears to ignore the trade-off between reserves and traditional fishery management.

Topic 3. To what extent can the approach underlying the Science Panel's reserve size recommendation be generalized to the west coast groundfish fishery?

Because the Council will be considering marine reserves under the auspices of the Magnuson-Stevens Act, a biodiversity conservation goal is not likely to be equally weighted with a sustainable fisheries goal, as it was

by the Science Panel. Moreover, because of data limitations, the habitat inventory developed for CINMS to address the biodiversity goal by protecting habitats in proportion to their occurrence will be difficult for the Council to replicate with similar resolution on a coastwide basis.

As indicated earlier, the Science Panel's reserve size recommendation is derived largely from studies that assume poor to nonexistent fishery management. As such, the Panel's size recommendation is not broadly applicable to situations where traditional fishery management measures contribute significantly to sustainable fishery management. In conducting its own deliberations regarding reserve size for the groundfish fishery, the SSC recommends that the Council be selective in terms of focusing on empirical studies that are most relevant to west coast groundfish and on theoretical models that are based on assumptions that realistically reflect conditions in the groundfish fishery, where restrictive management measures have been implemented.

The marine reserve papers from the literature that were pivotal to the Science Panel's size recommendation consist largely of theoretical studies and a limited number of empirical studies; very few pertained to the U.S. west coast. Any assertions that marine reserves provide similar benefits on the west coast as they do elsewhere should be viewed with caution and subject to verification.

The Science Panel was not asked merely to provide scientific advice regarding the ecological/biological implications of alternative reserve sizes for achieving the separate goals of biodiversity conservation and sustainable fisheries. They were asked to provide a single reserve size recommendation by balancing the two goals, a task that was complicated by the fact that biodiversity benefits were thought to increase with increasing reserve size. The difficulties associated with achieving a balance in these goals may have been minimized and masked by results from the literature suggesting that similar reserve sizes might be appropriate to achieve fishery sustainability and meet minimum biodiversity requirements. Nevertheless, the balancing of goals done by the Science Panel essentially makes their size recommendation a policy rather than a scientific recommendation.

In the context of Council groundfish management, an attempt is usually made to distinguish "risk-neutral" recommendations from "precautionary adjustments" when technical information is presented to the Council, with an accompanying decision table that allows the Council to assess the implications of uncertain decision making on its part. This procedure clearly separates science from management, as levying precautionary adjustments in the face of uncertainty is ultimately a policy decision, not a scientific one. Some of the studies cited by the Science Panel, however, incorporate insurance against management uncertainty as a factor influencing optimal reserve size. Thus size recommendations derived from such studies should be interpreted in the Council context as precautionary rather than risk neutral.

Because socioeconomic issues were considered in a separate and independent process at CINMS, the Science Panel did not include members with socioeconomic expertise, nor were they provided access to socioeconomic information. It was therefore inevitable that their policy recommendation regarding reserve size would exclude any explicit consideration of socioeconomic factors. In the Council context, policy guidance of the type provided by the Panel would need to be informed by information on short-term transition costs, long-term benefits and costs, and other relevant socioeconomic information in order to meet the requirements of the National Environmental Policy Act.

General Conclusions

Given the mandate of the Science Panel and the constraints under which they conducted their deliberations, the SSC is generally supportive of their reserve size recommendation as it relates to the biodiversity and sustainable fisheries goals as defined in the specific context of CINMS. Beyond that context, however, the methodology used by the Science Panel will require substantial modifications and extensions to be more broadly useful to the Council in considering marine reserves for the groundfish fishery and other resources under its authority. The SSC recognizes the many benefits of marine reserves and endorses their use as a valid fishery management tool. For example, reserves are a potentially useful way for the Council to protect essential fish habitat and to address other requirements of the Magnuson-Stevens Act. However, just as it is important to recognize the uncertainties inherent in traditional fishery management, it is also important to recognize the uncertainties associated with reserves as a management tool. Integration of reserves with traditional fishery management will require innovative thinking and careful consideration of costs and benefits.

Next year the SSC will be reviewing its Research and Data Needs and Economic Data Plan, which will provide a good opportunity to revisit and perhaps expand on our previous consideration of information gaps as they relate to marine reserves.

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