Robert R. Treanor
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California Fish and Game Commission
1416 Ninth Street
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Agenda item F.1
June 2002

April 26, 2002

Dear Mr. Treanor,

I recently reviewed the "The Economic Effects of Sportfishing Closures in Marine Protected Areas: The Channel Islands Example" by Robert Southwick. I find this report to be seriously flawed; it overstates the impact of proposed marine closures in the Channel Islands by as much as 86%. I attach my brief review.

By way of disclaimer, please note that I am an assistant professor of international relations and environmental studies at the University of Southern California. My doctoral degree is in Natural Resource and Environmental Economics from Yale University. I work closely with commercial fishermen from Southern California and I have received funding from the National Oceanic and Atmospheric Administration for my research on beach water quality. To avoid bias, I have not read Dr. Leeworthy's rebuttal to Mr. Southwick's report.

I would be happy to provide additional feedback beyond that included in the attached review.

Sincerely,

Linwood H. Pendleton

A Brief Critique of "The Economic Effects of Sportfishing Closures in Marine Protected Areas: The Channel Islands Example."

Average vs. Marginal Impacts

The proposed closures of recreational fishing areas in the Channel Islands Marine Sanctuary will undoubtedly impact the economic well being of sportsfishers that use party/charter boats and private sportsfishing boats to fish the waters of the Channel Islands. Mr Southwick, following Leeworthy and Wiley (2001) reports that somewhere between 21,770 and 155,152 fishing trips (days) may be lost due to these proposed closures. It is important, however, to remember that while these fishing trips may be lost from the areas associated with the Channel Islands Marine Sanctuary, it is likely that many of these fishers will choose to fish elsewhere. As a result, the impacts of closures in the Channel Islands Marine Sanctuary ought to be considered marginal impacts – these closures may effect where anglers choose to fish and possibly the total number of trips taken by individual anglers, but these closures are not likely to prevent most anglers from fishing altogether. These closures will impact local expenditures associated with trips to the area, but are unlikely to significantly impact expenditures that are not made on a per trip basis – e.g. expenditures made on durable items (equipment) or items that are purchased on an annual basis (licenses, subscriptions, etc.).

The report by Southwick is seriously flawed in that it attempts to estimate the loss of average total expenditures per trip for a situation (a marine closure) in which only marginal (per trip variable) expenditures ought to be considered. Mr. Southwick combines per trip expenditures (marginal expenditures) with average annual expenditures per trip to arrive at estimates for the impacts of proposed closures in the Channel Islands. By doing so, Mr. Southwick estimates impacts that are greater than 7 times what ought to be considered reasonable for this analysis.

Needed Increase in Non-Fishing Recreation Days

Mr. Southwick writes that non-fishing recreation days would need to increase by 3.5 times to overcome the loss of fishing days due to closures. This calculus is false – recreation days and fishing days cannot be compared directly from an economic perspective. Instead, the value of non-fishing recreation days gained needs to be compared against the value of fishing days lost. Further, non-fishing recreation includes non-market values that are likely to be significant. While Mr. Southwick attempts to include these non-market values in his discussion of the valuation of lost fishing days, he does not include these values in his discussion of non-fishing recreation.

Preference of Fishing Compared to Other Activities

The data Mr. Southwick provides regarding the preferences of Americans for fishing activities compared to other activities shed little light on the marine closures debate. Figures given for participants involved in fishing include freshwater fishing. Further, participation in any one activity does not preclude participation in other activities.

Non-market Values of Fishing

Mr. Southwick writes that consumer surplus, option values, bequest values, and existence values ought to be added to current expenditures attributed to fishing. Consumer surplus values are important, but are not part and parcel of an analysis on expenditures. Mr. Southwick is correct in his assertion that other non-market values are important, but he incorrectly defines option values, bequest values, and existence values in his report. What Mr. Southwick calls option value is in fact option price – an amount that includes expected use values. Bequest values are also expected use values, only for future progeny and not today's anglers. Finally, the existence values described by Mr. Southwick are really more appropriately termed altruistic values. Existence values would be better ascribed to the willingness of anglers to pay for the existence of fish rather than the existence of fishers.

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.

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