MarineMap and Collaborative Decision Making:

Stakeholder perceptions of MarineMap Decision Support Tool (DST) to reduce conflict and strengthen relationships.

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"MarineMap and Stakeholder Decision Making: Stakeholder perceptions of MarineMap Decision Support Tool (DST) to reduce conflict and strengthen relationships", a terminal project prepared by Derek Campbell in partial fulfillment of the requirements for the Master of Public Administration in the Department of Planning, Public Policy and Management.

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Abstract

The implementation of marine protected areas (MPAs) as part of a shift to ecosystem based management within our marine waters is gaining widespread acceptance by scientific and conservation communities. However fisherman and often the communities from which they come have expressed reservations about the implementation of MPAs for various reasons. Despite this, past work has shown that the participation and contributions of these groups are needed for effective implementation and future success of MPAs. This suggests a collaborative model be used when proposing MPAs that underscores the need for these historically conflicting stakeholder groups to work together.

This paper is an analysis of stakeholder perceptions of the MarineMap Decision Support Tool (DST) in regard to its role in reducing conflict and strengthening relationships within the South Coast Regional Stakeholder Group (SCRSG) in their efforts to draft proposals for MPAs in accordance to the Marine Life Protection Act Initiative of California. Three fundamental questions are at the heart of the analysis: Does stakeholder use of MarineMap 1) increase one's understanding of the interests of others in the group, 2) shape the views of stakeholders regarding the MPA proposal process, and 3) strengthen the working relationship between those within the group. The findings reveal that MarineMap helped shape the views of individuals within the SCRSG and in the process helped stakeholders better understand the interests of others. Because of this it is expected that the use of MarineMap in the decision making process surrounding the planning and implementation of MPAs will reduce associated conflict between the various stakeholder groups.

Table of Contents

Acknowledgments

Central to this project was the participation from members of the South Coast Regional Stakeholder Group (SCRSG) in the survey regarding stakeholder perceptions of the use of MarineMap DST in drafting marine protected areas. My thanks to those who participated and to the MarineMap Consortium for guidance in the early stages of project design.

Introduction

I. Our Oceans and Conservation

At the turn of the 20th century President Teddy Roosevelt made the astute observation that we as a nation needed an evaluation of the use and protection of our public lands. The great bison herds of the plains had collapsed, the millions of passenger pigeons that had blackened the skies were all but gone, and the landscape was fast changing under the feet of a growing nation. The Natural Conservation Commission created in 1909 confirmed the fast depletion of our natural resources. So ushered in a stirring period of land conservation efforts: The formation of National Parks and Monuments, the relentless advocacy of John Muir, the work of Gifford Pinchot, and Leopold's call for a new "land ethic". Upon entering the 21st century we are faced with a comparable need to evaluate the use and protection on our oceans. Lubchenco et al. (2002) suggests there is a need for a new "ocean ethic", a serious commitment to protect and restore life in our marine environments. It is becoming clear our ocean environments worldwide are under threat from a host of factors (Hughes et al. 2005; USCOP 2004; NRC 1999; Lubchenco et al. 1995):

- Development along our coasts continues to swallow sensitive habitat.
- Coastal rivers and bays are degraded by nutrient runoff leading to red tides and dead zones off shore.
- Many ecologically and commercially important fish species are overfished not to mention the bi-catch that threatens various turtle, mammal, and non-commercial fish species.

- Destructive fishing practices impact the environs flora and fauna depend on further changing relationships and the functioning of marine ecosystems.
- Disease, invasive species, ocean acidification, coral bleaching, and mass mortalities round out an ever expanding list of problems facing our oceans.

The increasing frequency of these ailments can be correlated to a wide variety of land and ocean based human activities compounded by a lack of understanding of marine systems and the consequential activities. "A broad spectrum of human activities is unintentionally but most definitely changing the chemistry, biology, ecology, and physical structure of oceans, especially in coastal areas." Jane Lubchenco, 2007. This in turn is affecting human society. We are not immune to the plight of the wilderness around us whether terrestrial or marine because we are a part of it. People are integral parts of ecosystems and a dynamic interaction exists between them and other parts of ecosystems, with the changing human condition driving, both directly and indirectly, changes in ecosystems and thereby causing changes in human well-being (Millennium Assessment 2007). Cumulative effects are disrupting our marine ecosystems to a point that they cannot maintain provision of the goods and services we as a society need and have come to expect (Lubchenco, 2007).

Addressing these effects means addressing the underlying problems which means defining a course of action for each problem. There is, however, a need to incorporate a holistic approach into the overall framework. Ecosystem based management (EBM) describes a management style that incorporates the whole ecosystem, considering

connectivity and the various relationships and processes involved with humans being a part of this system. This approach is preferable to the status quo of managing in a piecemeal fashion (Leslie & Mcleod 2007) because ocean management has not adequately sustained the productivity of our marine resources (POC 2003, USCOP 2004). EBM stresses the need to understand the integral relationships and processes within a marine environ and how they respond to human impacts. A management shift to EBM can address the ecological interactions vital to the health of marine systems for when they are broken the resiliency of the whole is degraded (Pain 1998, Hughes 2005, Levin & Lubchenco 2008). One tool gaining acceptance in this shift to EBM is the implementation of marine protected areas because they achieve many of the goals the conventional management cannot such as (Roberts et al. 2005). Marine protected areas represent a treatment of an eco-*system* rather than the individual piecemeal management of individual species.

II. Marine Protected Areas

Marine Protected Areas, (MPAs) are defined as: "Any area of 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" (IUNC, 1991). Historically the creation of MPAs has been limited and it was not until 1960 that an international meeting was held to reflect on their role in conservation and discuss approaches to selection and management (Jones, 2002). In 2006 world wide MPAs numbered 4,500 covering 849,000 square miles or about 0.6% of the ocean (PISCO, 2007). Only about a quarter

of these receive full protection, meaning all extractive activities are prohibited. These specific MPAs are defined as marine reserves and they cover less that 0.01% of the world's oceans (PISCO 2007, Roberts & Hawkins 2005).

Marine reserves are being recognized as an emerging tool for management and conservation and viewed as the preferred MPA. The *Science of Marine Reserves* symposium at the 2001 American Association for the Advancement of Science (AAAS) meeting reported on the findings of a two and a half year international study conducted by a team of scientists from the National Center for Ecological Analysis and Synthesis (NCEAS). Conclusions from these findings coalesced with previous work on marine reserves in a Scientific Consensus Statement signed by 161 researchers from around the world. Some of the conclusions contained in the consensus statement include:

- Reserves conserve both fisheries and biodiversity.
- Reserves must encompass the diversity of marine habitats in order to meet goals for fisheries and biodiversity conservation.
- Reserves are the best way to protect resident species and provide heritage protection to important habitats.
- Reserves must be established and operated in the context of other management tools.
- Reserves need a dedicated program to monitor and evaluate their impacts both within and outside their boundaries.
- Reserves provide a critical benchmark for the evaluation of threats to ocean communities.

- Networks of reserves will be necessary for long term fishery and conservation benefits.
- Existing scientific information justifies the immediate application of fully protected marine reserves as a central management tool.

(NCEAS 2001)

At the 2010 AAAS meeting a panel of top marine scientists convened together to confer on the most recent findings. It was again impressed upon those in attendance that: "…managers can design marine reserves that will increase overall ocean health as well as increase catch for fisheries." Steve Gains, Dean of Bren School of Environmental Science & Management, University of California, Santa Barbara (UCSB). The germane questions to those at the 2010 meeting were less to do with whether marine reserves worked but how are they to be implemented so as to 1) get the "most ecological bang for the buck", 2) help shift management towards EBM and 3) address social components of ocean use and conservation (Halprin et al. 2010 ASSS).

The subject of this paper will concentrate on the latter of these three questions, the social component. Specifically implementing networks of marine reserves in the face of conflicting values and interests and how this conflict might be reduced so groups grappling with this issue may find common ground to build consensus.

III. Conflicting Values and Spatial Decision Support Systems

The conflict that is often found in natural resource planning and that surrounds the marine reserve issue stems from the fundamentally different set of values of multiple stakeholders (Brody et al. 2003). The implementation of marine reserves is found to

generate conflicts between ocean use and preservationist values (Jones 2002, Callicott 1991).

Fishermen fear a strict preservation practice that severely restricts both commercial and recreational activity. Surveys show fishing interests are generally against the implementation of MPA networks because of the potential immediate loss of revenue and recreational opportunities (Sholtz et al. 2003, Soma 2003, Jones 2002). Compounding the negative perception fisherman tend to have towards MPAs is a history of distrust and contention surrounding marine management in general (Sholtz et al. 2003).

The reluctance to embrace MPAs is not isolated to fisherman alone, coastal communities may fear the change in social identity by the redistribution of participation in marine recreational or commercial activities caused by a change in fisheries management (Soma 2003, Sholtz et al. 2003). However it is argued that direct involvement of those most affected by the implementation of MPAS is essential if this conflict is to be transformed into a positive partnership. If user groups, most notably fisherman, are ignored and the socioeconomic effects not clearly fleshed out the process will alienate these individuals broadening the schism between them and managers (Soma, 2003).

If consensus is to be reached and implementation of marine reserves expedited it may be necessary to identify and address the values of the parties involved. The decision

making process must consider, in part, how individuals interact with the marine environment and how the changing management of that marine area may affect them (Jones, 2002). One of the major goals of identifying potential conflicts and untangling the various interdependent relationships is to understand the different environmental perspectives and how they interlock to generate conflict (Susskind and Cruikshank 1987, Susskind et al 1999). Uncovering the multiple environmental values, goals, and interests is one step in resolving a dispute and reaching an agreement (Susskind 1999, Fisher & Ury 1999).

Quality science and integration of local ecological knowledge (LEK) is prerequisite to the process (Roberts et al. 2003, Sholtz et al, 2003). Science is needed to guide and explain "where and why" marine reserves are being proposed. Using "source and sink" modeling to scientifically explain how MPA networks bolster marine populations helps to make better arguments for the potential benefit to adjacent fisheries (Crowder et al. 2000). In relation to this is the need for science guided bio-economic modeling; a more complete analysis of the economic tradeoffs associated with implementing marine reserve system and the relationship between physical environ and economy (Sanchirico 2000). LEK gleaned from user groups can be woven into this information matrix; filling gaps found during the planning process and help managers produce a more viable system. Input from fishing interests can also aid subsequent negotiations which may prove to be especially important in the initial stages to create a robust dialog with stakeholders and empower the various user groups (Sholtz et al. 2003). But the integration of information, scientific or otherwise, can be relative and as Alder (2000)

states "…parties bring to the table different kinds of knowledge: "traditional" knowledge, "cultural" knowledge, "local" knowledge, and "remembered" knowledge, all of which have a place at the table in environmental conflict resolution." The best science / information is that which is mutually agreed upon by the various and often conflicting interests within a diverse collaborative group suggesting knowledge and meaning of relevant information is a social construct (Ozawa 1991). Information is more likely to be agreed upon and trusted when it stems from joint fact finding and the methods of integrating knowledge are mutually agreed upon (Alder et al. 2000).

Spatial Decision Support Systems (SDSS) are tools developed to help groups discover and integrate information. These systems combine geographical information systems (GIS mapping) with knowledge-based systems to help individuals or groups identify problems and make decisions regarding natural resource planning. Evidence is mounting that use of such tools help reduce conflict in some negotiation processes. The visual information displayed by GIS overlay is noted to be a powerful tool in helping stakeholders reach consensus in certain disputes (Susskind 1999). GIS-based tools can be used to resolve conflicts among different stakeholders in planning problems by providing common data base that facilitates negotiation and reduces ungrounded, self-serving claims. (Godschalk et al. 1992). SDSS tools have been found useful in collaborative efforts to establish MPAs serving to get more stakeholders involved in the process, import local environmental knowledge, and delineate reserves boundaries so as to reduce economic impact while maintaining ecological benefits (Brody et al. 2003). Brody found using a SDSS based tool to map proposed MPAs within a potentially

contentious region off the coast of Texas proved to help facilitate a planning process that reduced stakeholder conflict. Integrating local knowledge and relevant scientific information allowed planners to flesh out the least contentious regions for MPAs.

IV. MarineMap

MarineMap Decision Support Tool (DST) is a SDSS being used to assist groups in the MPA proposal process in California in accordance with the Marine Life Protection Act (MLPA). MarineMap DST is an online tool that can be accessed by stakeholders involved in MLPA marine reserve proposal process. It combines an extensive catalog of GIS data, and sophisticated spatial analysis but remains fairly non-technical in function so as to be easily usable by those with limited mapping software experience. The MarineMap web site describes the tool as such:

> *MarineMap assists group members in the design of MPAs by allowing them to view oceanographic, biological, geological, chemical and human dimensions of the ocean and coastal areas. MarineMap provides easy sharing of MPA ideas, and reports on how well individual MPAs and arrays of MPAs meet various guidelines set by the Master Plan Science Advisory Team (SAT) to help meet the goals of the MLPA.*

MarineMap (DST) allows stakeholders to (**http://marinemap.org/**, 2010):

- Visualize social and ecological attributes of coastal areas
- Draw and assemble networks of prospective MPAs

- Specify types of regulations to be applied to each MPA, as well as goals and objectives fulfilled
- Generate reports that assess MPAs according to scientific guidelines as well as social and economic impacts
- Share MPA boundaries and networks with other users
- Discuss results with others in online forum
- Quickly and easily modify existing MPA concepts as the process evolves

The use of collaborative mapping models such as MarineMap provides a “joint fact finding” opportunity. Stakeholders, together, gather and disseminate knowledge and information. This in turn provides a visual representation of what is taking place in the real world making it possible for the parties involved to decide upon a set of “facts” from which informed negotiation can proceed. The principle question of this study is: Did the use of MarineMap through the collaborative effort of sharing of knowledge and information help illuminate stakeholder interests, shape personal views, and strengthen relationships during collaborative process. The answers to these questions may help uncover the ability of MarineMap to reduce conflict amongst stakeholders. Just acknowledging the interests and positions of others has been identified as a key element in overcoming conflict (Susskind 1999, Fisher & Ury 1991). “In order to facilitate common understanding, avoid conflicts and establish trust, it is recommended that stakeholders are represented and involved in decision-making in fisheries management, the “participatory process” must entail open dialogue and broadly active civic engagement” - Soma (2003).

Methodology

I. Study Group

The MLPA was passed in California in 1999 and directs the state to redesign a system of marine protected areas in order to: more effectively protect marine life and habitat, marine ecosystems, and marine natural heritage, as well as improve recreational, educational, and scientific opportunities (CA Dept. of Fish and Game). Five regional stakeholder groups were created to provide local expertise, evaluate existing MPAs, and develop alternative MPA proposals for their particular region. They were also tasked with reaching out to constituent groups and individuals in an effort to increase public participation. To achieve these and other goals in a collaborative manner, the regional stakeholder group works with a facilitation team, a science advisory team, and staff from the MLPA Initiative, California Department of Fish and Game, and California Department of Parks and Recreation.

The MLPA South Coast Regional Stakeholder Group (SCRSG) was chosen for a survey regarding their individual perceptions regarding the use of MarineMap DST in drafting proposal MPAs. This group was recommended by the MarineMap Consortium for the survey because of their extensive use of the mapping tool and the fact the group had recently completed and submitted proposals. The individuals responding to the survey represented the following stakeholder groups: commercial fishing, recreational fishing, recreation (non-consumptive), conservation, business/industry (fishing & non-fishing), academics, federal agency (non-science) and science.

II. Survey

The survey consisted of eight questions. Initial questions determined which stakeholder group the individual belonged to and to what extent they used MarineMap. The remaining questions were designed to uncover the perceptions the individual held regarding their use and the group's use of the mapping tool. The aim was to uncover whether or not MarineMap increased participants understanding of stakeholder interests, strengthened relationships, shaped personal views about proposal process, and was seen in general to be beneficial to the SCRSG.

Questions were formatted in a Likert scale fashion with the option for further elaboration if the individual chose to expand upon his or her answer. The survey was sent to 60 of the 62 member group via email. The two left out did not have a valid email address. Respondents were not required to disclose any personal information so as to maintain confidentiality and allow for candid response. The survey was sent out on 4 different occasions over a two week period ending the last week of April, 2010. The last questionnaire was received April 29th. Eighteen of the sixty members returned a completed questionnaire equating to approximately 30% response rate.

Results

Eighty percent of respondents reported having used MarineMap substantially during their work with the SCRSG. The remaining respondents reported moderate use of the mapping tool. The following sections describe perceptions of stakeholders regarding

increased understanding of interests, shaping of views of proposal process, and strengthening of working relationships.

I. Understanding of Stakeholder Interests

Stakeholders responding to the survey generally learned more about the interests of other stakeholders involved in the MLPAI because of the use of MarineMap. Thirteen of the eighteen respondents reported having substantially more understanding of others' interests because of the collaborative use of the mapping tool (see table 1). Four indicated having moderately more understanding and only one reported only a little more understanding of others' interests. Stakeholders representing commercial fishing interests all reported having substantially more understanding of the interests of others in the SCRSG. Individuals were less inclined to believe *other stakeholders* understood more about *their interests* because of MarineMap. When asked, "because of MarineMap how much more do other stakeholders understand your interests", eight reported substantially more, two reported moderately more, and seven reported only a little more was understood about their interests. Both commercial and recreational fishing interests saw the sharing of information to only slightly or moderately increase the understanding of others within the group regarding their interests.

Comments from the surveyed stakeholders reflect the ability of MarineMap to help communicate ideas and information and help create a common ground. "This is the real steel issue" said one respondent. It was stated this decision support tool helped stakeholders visualize what is being "lost /gained", and determine best location for

MPAs. The sharing of information and ideas was seen by one individual as being "…the key tool in understanding the spatial issues involved in MPA creation and identifying stakeholders' "true concerns". Of particular benefit was the ability of the stakeholders to visualize what was being proposed by the various groups However, it is also mentioned that not all stakeholders were concerned with understanding the interests of others and the issue of stakeholder interests was beyond the scope of the Regional Stakeholder Group facilitation or MarineMap.

Table 1. Increased understanding of stakeholder interests.

Because MarineMap was used during the MLPA Initiative how much more...					
	Nothing more	Little More	Moderately more	Substantially more	No opinion
--do you understand the interests of other stakeholders regarding the MLPA initiative process?	**0**	**1**	**4**	**13**	**0**
-- do other stakeholders understand your interests regarding the MLPA initiative process?	**0**	**7**	**2**	**8**	**1**

"…ability to share shapes over the web between meetings helped us resolve critical geographies" -conservationist.

II. Shaping Views of Stakeholders

MarineMap was generally seen to help shape the views of stakeholders regarding the creation of draft MPA proposals in the MLPA initiative. Nine of the respondents strongly agreed that information shared by others in the SCRSG helped shape their views of draft proposals. Eight slightly agreed with this statement while one academic

representative strongly disagreed. Two individuals had no opinion. There was less agreement among the stakeholders that the information *they* shared helped shape the views of *others* regarding the draft MPA proposals. Six of the eighteen respondents felt strongly that the views of others were influenced by information shared in MarineMap. Seven respondents slightly agreed that sharing information helped shape the views of others regarding draft MPAs and again one individual strongly disagreed while one other slightly disagreed. Fishing interests, both recreational and commercial, mostly "slightly agreed" with this statement although one individual slightly disagreed that sharing their information shaped the views of others (see table 2).

Table 2. Shaping of views regarding MPA proposal process.

How would you respond to the following statements?					
	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree	No opinion
-- The information shared by other stakeholders on MarineMap helped shape my views regarding the creation of draft MPA proposals in the MLPA initiative	**1**	**0**	**8**	**9**	**0**
-- Sharing my information on MarineMap helped shape the views of other stakeholders regarding the creation of draft MPA proposals in the MLPA initiative.	**1**	**1**	**7**	**6**	**2**

Stakeholder comments regarding the use of MarineMap noted that it helped clarify the issues and the conflicts at hand. MarineMap was said to make "decision making easier" and helped "justify objectivity", [it] "provide a set of facts for the stakeholders to work with rather than perspectives and experiences". Seen by one individual as a base where

[all] could agree. Data layers helped to visualize habitat diversity in areas and subsequently strengthened understanding of what places needed protecting. Further comments regarding the influence of shared information on participant's views reveal that while there is relative agreement that MarineMap helped shape views it was not always perceived as being positive. MarineMap may have been seen by some as a tool to manipulate others, a tool to gain leverage by generating areas of greater size than were necessary.

III. Strengthening Relationships

When asked how MarineMap changed relationships between stakeholders with conflicting interests 12 out of 18 of those surveyed believed the relationships to have been slightly strengthened (see table 3). One individual answered greatly strengthened while another felt the relationships were actually greatly weakened. The remaining two stakeholders who answered the question feel there was no change in the relationships due to the use of MarineMap. Those feeling there was no change were both representing fishing interests but other stakeholders representing fishermen and the fishing industry believed relationships to have been slightly strengthened.

Table 3. Change in stakeholder relationships.

Given the following choices, how would you say the MarineMap changed relationships between stakeholders with conflicting interests?					
Greatly weakened	Slightly weakened	No change	Slightly strengthened	Greatly strengthened	No opinion
1	**0**	**2**	**12**	**1**	**2**

Comments reflected a mixed perception of stakeholder relationships and the influence of MarineMap in shaping them. Although 12 out of the eighteen respondents agreed relationships were slightly strengthened there were no *comments* to the effect that the tool helped reshape relationships between those who came to the table with conflicting interests. It was stated again that MarineMap helped establish a common ground and helped those involved to better understand rationales but it did little to bridge the gap between individuals with very opposing views. Comments also suggested MarineMap illuminates the science at hand but several individuals did not believe opinions changed much in response to the information shared on MarineMap.

> *"MarineMap was incredibly useful. But I am not sure it did much to change the conflicts between different interests. It probably did help to clarify all the issues a little more because we could see everything laid out geographically. But the relationships aren't going to change just on the use of this tool." --Federal Agency*

IV. General Impact on MLPA Process

When asked to rate the impact of MarineMap on the MLPA initiative process stakeholders responded overwhelming (16 out of 18 respondents) that the tool was greatly beneficial (see table 4). Two believed it to be slightly beneficial and one saw MarineMap to be slightly detrimental to the process. Users appreciated speed and ease of sharing information, ideas, and concepts. Also noted as beneficial was the subsequent analysis including ability to quickly create shapes and generate reports. MarineMap was seen to be very usable by all participants

although it was noted there is a slight inequity in access and the timeliness of data integration could be improved.

Table 4. MarineMap's impact on MLPA initiative process.

Given the following choices how would you say the use of MarineMap by various stakeholders impacted the MLPA Initiative?					
Greatly detrimental	Slightly detrimental	No impact	Slightly beneficial	Greatly beneficial	No opinion
0	**1**	**0**	**1**	**16**	**0**

"My term for MarineMap is "GIS for Dummies." Anyone can use it with a modicum of computer skills. More importantly, many stakeholders--completely lacking computer savvy--became very proficient with it, proficient enough to use it in real time negotiations. This was invaluable!!"

--Commercial Fisherman

Discussion

The results of this survey show that the sharing of information and knowledge through MarineMap was seen to be beneficial to the MLPAI process for the SCRSG. The sharing of information and knowledge helped stakeholders better understand interests of others and create a common ground. This increased understanding is shown in table 1 to be substantial for some MarineMap users. This suggests MarineMap may prove valuable in providing stakeholders a basis for acknowledging the interests of others which has been identified as a key element in overcoming conflict (Fisher & Ury, 1991). Viewing MarineMap as a tool capable of reducing conflict would be consistent with the findings of Brody et al. (2003); the use of a SDSS results in less conflict during the planning and implementation of MPAs. The issue of stakeholder interest is

complex however. While respondents believed the tool helped them to understand the interests of others they were less sure it helped others understand their interests. This may expose a weakness of the tool to adequately communicate the increased understanding stakeholders gain of others interests or it may simply mean individuals feel their particular interests are too complex and nuanced to be understood well by others.

MarineMap shows potential in helping shape the views of stakeholders involved in drafting MPAs. It was said to provide an agreed upon set of “facts” from which those involved could begin a dialog. This is encouraging because, as has been stated by Alder (2000), information within a collaborative setting is best when it is agreed upon. The integration of the different kinds of knowledge is important in the collaborative process and participants of this survey echoed that point remarking MarineMap was helpful in bringing in different sources of information and provided a base from which negotiation could proceed. It helped stakeholders get beyond “personal perspectives”. Data layers provided the ability to visualize what was being discussed, a key element of the effectiveness of GIS tools to help overcome disputes (Susskind, 1999).

It remains unclear whether MarineMap helped strengthen the working relationships of stakeholders involved in drafting MPAs. There may have been a modest improvement because of the joint effort to find and share data but the statements of respondents do not reference the strengthening of relationships and it does not appear to have been a key element or outcome. Some participants may even see this tool as being a way to

manipulate others and gain leverage in the negotiation process. Fact sharing may help various stakeholders work through the process but strengthening or building relationships may require more than just a joint effort to produce an agreed upon data set. SDSSs are not explicitly designed for this function so the analysis itself may be a bit unfair.

Further study on the use of MarineMap by future collaborative groups is recommended to understand in more nuance the ability of this decision support tool to effectively aid the collaborative process. It is important to understand why this tool may be viewed as "manipulating" the process. It would also be worthwhile to discover if MarineMap can be better used to communicate interests so stakeholders feel stronger about their interests being understood by others.

Conclusion

There is currently agreement among many within the scientific community that there is worldwide need for the establishment of viable marine reserve networks. Implementation in accordance with the best available science and local knowledge has shown to help reverse ecological damage due to decades of environmental degradation and help maintain the resiliency of marine environs. It is also understood that the creation of these conservation zones should not be undertaken without the direct involvement of the people and communities it most affects. Fishermen, both commercial and recreational, are invaluable to the process but are often reluctant to collaborate with agencies and other stakeholders due to differing values and a history

of mistrust. Decision making surrounding the planning and implementation of MPAs is often obstructed because of the positional arguments over these conflicting values.

The MarineMap DST shows potential to reduce the conflict within this decision making process. It allows the sharing of mutually accepted knowledge and information, helping to shape the views of those at the table regarding potential areas of agreement and disagreement. In the process this tool may help increase the understanding of stakeholder interests by illuminating common ground from which dialog can begin. This study adds to the body of work that suggests SDSSs such as MarineMap DST may help reduce the conflict often surrounding natural resource planning. It remains unclear whether relationships can be expected to be strengthened due to the use of this tool.

> "MarineMap was well worth the investment. South Coast would have been much more difficult without it." --Federal Agency

> "Wonderful program that I hope will continue to expand for marine management purposes well beyond its MPA uses!" --Scientist

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