Connecting the Dots: Strengthening the Communication between Researchers, Community Members, and Policy Makers in the Florida Reef Tract

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Abstract: *The Florida Reef Tract (FRT) extends along the Southeastern coast of Florida and supports vast biodiversity, as well as Florida's fishing and tourism industry. In recent years, the FRT experienced a decline in health, which can be attributed in part to anthropocentric influences. This essay argues that by strengthening communication between researchers, policy makers, and community members, FRT management schemes will become more holistic and allow the reef to recover. The model presented in this paper demonstrates how information from scientific research is used by both policy makers and the community to take action in both awareness and protection of the reef.*

Coral reefs occupy one percent of the world's oceans, yet provide habitat for twenty-five percent of all marine species (Trujillo & Thurman, 2017). The marine organisms, ranging from microscopic phytoplankton to predatory sharks, form complex ecosystems that are critical for fishing and tourism industries. The Florida Reef Tract (FRT) contributes six billion dollars to the Florida economy annually from local sales and income generated by fishing and tourism industries (National Oceanic and Atmospheric Administration [NOAA], 2011). The reef tract is the only coral reef in the continental United States, and is the third largest reef in the world. The reef is comprised of approximately 80 different species of coral, which in turn supports hundreds of species of fish and other marine organisms (Florida Department of Environmental Protection, 2019). Effective management of the reef allows for the species living on the reef as well as the industries that depend on it to flourish.. The FRT has two methods of management that inform policies dictating use, access, and protection of the reef tract. The first method is government protection via Florida Keys National Marine Sanctuary (FKNMS). This area covers 2,900

square nautical miles and is managed by the National Oceanic and Atmospheric Administration (NOAA) and the State of Florida (Gregg, 2013). However, these parks only include the lower two-thirds of the entire tract. The second method encompasses the upper 1,450 square nautical miles and is managed by stakeholders and research organizations in the Southeast Florida Coral Reef Initiative (SEFCRI). How can these management schemes maximize the economic efficiency of reef use as well as work to conserve it for years to come? More emphasis needs to be placed on the flow of information from researchers to policy makers and community members to influence individuals to take action towards informed protection through integrating research into policy, incorporating community members in decision making, and enforcing policy decisions.

Overview of Regulatory Agencies

The Florida Keys National Marine Sanctuary was established in 1990, with the first management plan implemented in 1997 under the joint management of NOAA and the state of Florida. Prior to the declaration of the lower part of the reef tract as a national marine sanctuary, this section of the reef was exploited for oil and torn apart by boats (NOAA, n.d.). In order to construct policy aimed at addressing the threats to the reef, federal and state agencies consulted research organizations, universities, and non-governmental organizations (NOAA, n.d.). This management plan is revisited every few years and revised according to new information.

The Southeast Florida Coral Reef Initiative management system consists of 70 divers, research organizations, nonprofits, and governmental agencies (Gregg, 2013). The group has over 140 projects focused on achieving their mission to "develop and support the implementation of an effective strategy to preserve and protect southeast Florida's coral reefs and associated reef resources, emphasizing balance between resource use and protection, in cooperation with all interested parties" (SEFCRI Charter, 2012). Projects are evaluated every few years to ensure progress via the implementation of actionable plans. One benefit of stakeholders comprising the main governing body is flex-

ibility in policy design: Aspects are taken into consideration, and policy can be designed to benefit not only the reef but also its various appropriators.

Factors Leading to Improved Management Practices

Ecosystem management is complex, and many people are involved in the use, care, and conservation of the reef. There are three main aspects which dictate the overall health and well-being of the reef: knowledge, awareness, and protection. Knowledge is the research that is conducted on or in regard to the health, environment, or organismal interactions of the Florida Reef Tract. Awareness is the process of getting the community involved and inspiring them to take individual steps to protect the reef, as well as pushing for better policy. Together these aspects create an interconnected web affecting the well-being of the reef. Knowledge and awareness programs work to create and implement informed protection protocols. The interconnection of knowledge, awareness, and protection tenets will be examined in the following sections.

Utilizing What We Know

The Florida Keys is the largest reef tract in the United States, and it gets a lot of attention from marine biologists and reef enthusiasts; however, this knowledge is not adequately included in government policy. According to Billing, Brennan, and Miller, policies made at the government level lack the vision and knowledge of those at the local level (2017). This local knowledge can be achieved through the use of research and guidance from experts to tailor policy to local conditions. Whether it be research on coral physiology in waters that are increasing in temperature, coral – algae symbiosis, disease, or interactions between fish species, the information gained from these studies is essential for understanding the reef as an entire ecosystem. Having foundational knowledge is important when it comes to policy making because stakeholders are often concerned with one aspect of the reef and not its entire well-being. Rehr et al. (2012) argue that the value of an ecosystem is often viewed as strictly economic and that policy ignores the environmental

and social benefits of the ecosystem. Therefore, a comprehensive decision-making framework must be in place to promote decisions that "achieve a better balance between resource use, depletion or degradation, and preservation" (Rehr et al., 2012, p. 1206). Policies informed by research are more effective at protecting the reef due to a greater understanding of the reef and the interactions between organisms.

Citizen Science

Citizen science is one method of getting the community involved and excited about conservation while also contributing to the knowledge about the reef. In these programs, people can go out into the reef and collect data on bleaching, disease, and fish counts to report back to research organizations, who then use the data. For example, the Southeast Florida Action Network Bleach Watch is a program that allows divers to document bleaching and disease events in an easy-to-submit form, and the Coral Ambassador program in the Southeast Florida Coral Reef Initiative allows individuals to pledge against unsafe reef practices. This allows for widespread data collection as well as the ability to better monitor reef conditions. When comparing the programs between the Florida Keys National Marine Sanctuary and SEFCRI, there are many similarities in goals and methodology. The main difference between the FKNMS and SEFCRI as it pertains to citizen science is that FKNMS is directed towards tourists and those actively involved in the industry, while SEFCRI is directed towards the community.

In the Florida Keys area along the FKNMS, tourists are often focused on because they are one of the main users of the reef. For example, in Key West, educational signage from Reef Relief, a grassroots effort dedicated to education and advocating for the reefs, is posted along highly populated areas. Reef Relief also has a site for tourists to learn through interaction with live corals in a building located on one of Key West's historical marinas (Reef Relief, n.d.). These educational tools are useful in helping the general public understand that reefs serve a purpose and are essential ecosystems. Programs such as Reef Relief may be the only interaction tourists have with the marine

environment on a scientific level and is a source of inspiration to take action.

The Southeast Florida Coral Reef Initiative focuses citizen science programs on community members in order to develop support in the community. This emphasis on the community is also heightened due to the relative newness of SEFCRI. Citizen science programs ensure the involvement of community members by providing hands-on experience and a first-hand look at the problems affecting the Florida Reef Tract. According to Reisewitz and Harper (2013), many of the residents in the four counties affiliated with the tract in this part of Southern Florida lack knowledge of the reefs in the area. This is attributed to the fact that when people think of coral reefs in Florida they automatically think of the Florida Keys and not their local community. SEFCRI values the ability of citizen science programs to engage and bring awareness to the community about the FRT, and to further this commitment SEFCRI made one of the four main tenets of their mission Awareness and Appreciation.

To accomplish this goal Southeast Florida Coral Reef Initiative reaches and inspires as many people as possible through a variety of media and methods (Reisewitz &Harper, 2013). SEFCRI's strategy is to inform, often pairing positive messages before the negative in order to establish that basis of hope while still providing a sense of urgency (Reisewitz & Harper, 2013). For SEFCRI, the key is for material to be simple while conveying important information. SEFCRI relies on their website, on which they post all meeting minutes, management plans past and present, as well as informational handouts. Other resources used include kits, posters, exhibits, and most importantly word of mouth. Our Florida Reefs Strategic Communications Plan 2013-2016 (produced by SEFCRI) states, "Each person has a sphere of influence, although they may lack inspiration to communicate certain messages within that sphere. If SEFCRI provides that inspiration, this network will spread the word quickly" (Reisewitz & Harper, 2013). The Southeast Florida Coral Reef Initiative's effort to provide the community with a variety of information shows their deep commitment to educating members of the community and getting people excited to

protect the reef.

Taking Action

Members of the community need to be engaged in the management process. In order to foster engagement, psychological factors must be overcome. Billing, Brennan, and Miller (2017) emphasize the need to acknowledge how people value and perceive the use of a resource differently. The authors assert that different viewpoints change how local environments should be managed, stating that academic research and the response of community members to that research operate as "agents for change" in the protection of marine environments (2017). Similarly, Campbell and Vainio-Mattila (2003) argue that communities should not be viewed as "homogenous entities" but instead must be understood as opposing forces that "determine appropriate and realistic incentives for conservation." Therefore, community members should be brought into the conversation surrounding local reef management. Identifying local needs can help government officials or stakeholders establish a management regime that meets the community where they are, providing tools and resources to educate and promote the importance of the reefs.

The local and scientific communities must work together to identify motivators that cause change in opinions, thus changing behavior. Internally, opinion is governed by attitudes and values which are often ingrained and not likely to change (Clayton, Litchfield, & Geller, 2013). According to Rietig (2018), there are three ways in which new information is received and acted upon depending on a group's preconceived opinion and strength of that opinion, as shown in Figure 1. In the first scenario, the new information aligns with the subgroup's preconceived notions, thus causing strong action in favor of the opinion. In the second scenario, the information does not match the opinion and the opinion is strongly held, in which case the information is renounced with no action taken. In the third and final scenario, new information counters opinion; however, the opinion is not strongly held so the information is taken as a learning opportunity, resulting in action taken in favor of

changed opinion.

There may be a learning curve that occurs within the community as awareness grows and the importance of reef management is understood. By determining where members in the community stand regarding these three categories, management can target specific audiences to ensure positive results.

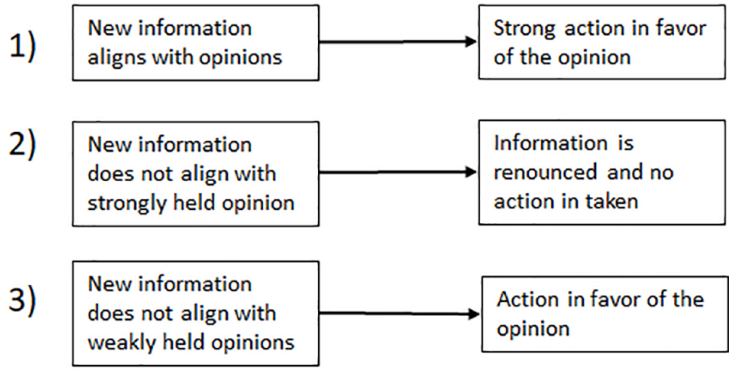

Figure 1: Representation of Rietig's model of how new information affects action.

Recommendations

If any change is going to be made, achievable steps must be taken to improve the flow of information between research organizations, community members, and policy makers. Only when a continuous flow of information exists can the reef be managed in a way that results in an outcome best for all who use it now and into the future. Based on the above discussion of how information flows, agencies should employ the model in Figure 2 to strengthen communication.

Researchers (including research organizations, academic researchers, and lay researchers) are at the top of the triangle because they are where the flow of information starts. Without research, there would be no information to pass to community members nor policy makers. The reef and its resources would be exploited without protection, as the Florida Keys National Marine Sanctuary was before it was declared a sanctuary. Re-

searchers noticed warning signs and advocated for better protection. Research organizations have a responsibility not only to learn what is happening to the ecosystem, but also to share that knowledge with the surrounding community by getting people involved in citizen science programs, participating in community events, and providing easy-to-understand, accessible documents to the public.

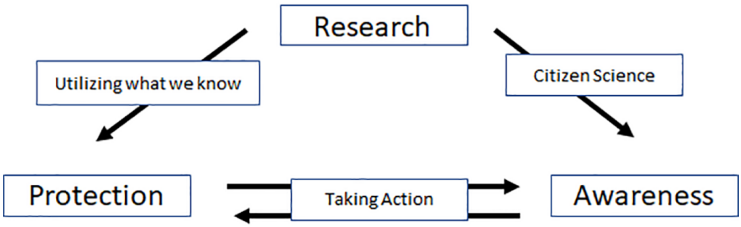

Figure 2: Representation of the relationships between research, awareness, and protection.

However, researchers themselves can only do so much, and if action is only taken at the level of research and policy, not much will be accomplished. It is the responsibility of community members to optimize their power to vote, speak at local events, advocate for better policy, and ultimately adhere to these policies set forth by decision-making agencies. While individual action has limited impact, it may inspire others to make simple changes that cumulatively create lasting change. According to Clayton, Litchfield, and Geller (2013) while individuals have the capacity to act independently, human tendency is to follow the actions of others. Therefore, if a responsive audience base grows and takes action, those opposing the ideas may become increasingly likely to follow suit. Together, individuals can take steps to increase awareness of the environmental consequences of their actions, educating themselves and others on the importance of the coral reef, and advocating for the protection of the ecosystem.

Community members share the responsibility of adhering to policy and holding each other accountable. Ostrum (2015) stresses the importance of monitoring systems within a management scheme. Monitoring systems do not need to be formal

mechanisms established within policy but do need to include a general cooperation among appropriators to establish that everyone will be held accountable for their actions (Ostrum, 2015). This is important for reef management because if one person is not adhering to the policies, others no longer have an incentive to adhere to the policies, and the reef will no longer be protected. Community members and the coral reef have a close relationship: the actions of the community members affect the reef both positively and negatively, and the reef affects the people. Therefore, it is the responsibility of the community to get involved and ensure others adhere to the policy.

The role of policy makers is to design management plans that will benefit the conservation of the reef as well as those who depend on the reef to support their livelihoods. The Florida Keys has a large tourism industry, so maintaining a pristine reef is essential. Since the reef needs to be kept in good condition, management plans need to employ science. Policy makers must listen to the community and utilize the latest science, ensuring the science is sound. When representatives from research organizations are involved on boards or councils that oversee policy design and implementation, research and the environmental implications of the policy can be better evaluated. The reef must also be able to maximize benefits to those who use it. Therefore, management plans must take into consideration the needs of the people. Williams and Stewart (1998) emphasize the importance of developing a "sense of place," or a shared set of values and beliefs about the importance of the ecosystem among community members to provide a holistic approach to management. Armitage (2015) further elaborates, stating that community involvement creates a greater share of power is given to whom the ecosystem affects. Through encouraging community participation in management, plans become well rounded, and encompass not just economic value but environmental and societal value as well. Plans should be revisited to consider new information, and as the environment within the ocean continues to change, designing proactive policy instead of reactive policy will be more important than ever.

Conclusion

Knowledge, awareness, and protection are tightly interwoven. Both knowledge and awareness are highly valued in the Florida Reef Tract as is shown by the variety of research organizations, citizen science programs, and outreach programs. However, there is a disconnect when it comes to individuals taking action. Therefore, research organizations need to design educational materials and outreach programs that target individuals who care and want to protect the reef, as well as those who may want to help but do not know how. Once a strong base of reef advocates is established within a community, those who are stubborn to change their ways may act due to the fact that it is what everyone else is doing. The power of collective action advocating for reef health should in turn influence policy makers. The time has come for coral reef conservation to be a topic of serious discussion in these communities, with the purpose of sparking curiosity and gaining public support for conservation.

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