MARINE PROTECTED AREAS: GATHERING STAKEHOLDER INPUT VIA AN INTERNET-BASED SURVEY

by

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Conservation efforts have been increasing in recent years to help preserve threatened coastal and ocean resources. Marine protected areas (MPAs) are an important tool to protect and conserve ocean resources. The MPA Center was established to take the lead in developing a framework for a national system of MPAs. The Natural Science Research Strategy (NSRS) for MPAs is a document being created to provide common ground among MPAs and MPA managers across the U.S. It will be a general document discussing the natural science considerations for establishing MPAs e.g., larval dispersal, critical habitat, proximity to land (runoff), etc.

The MPA Center wants to engage stakeholders in the process of identifying regional design criteria and research needs for MPAs. An online survey has been chosen to gather this stakeholder input. Hypothetical draft questions regarding MPA design criteria and research needs were developed, survey methodologies were reviewed emphasizing web-based strategies, and a prototype survey developed online. This report outlines the work described above and suggests ways that the MPA Center can move forward with this process.
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INTRODUCTION

Properly functioning marine ecosystems (ocean and coastal) provide important goods and services to society. These services can be divided into five main categories: food, ecosystem services (i.e. cleansing water and air, regulating climate, maintaining gaseous composition of the atmosphere) medicines, chemicals and minerals (e.g. fossil fuels, manganese), and recreation and ecotourism (Norse, 1993; Daily, 1997; Costanza, 1999; Moberg and Folke, 1999 in Hixon et al., 2001; CBD and UNEP, 2004). However, despite their tremendous value, ocean and coastal environments and many species that depend on them are in decline. Many are calling for new approaches to protect and restore these ecosystems so vital to human society.

The reports of two recent ocean panels—the Pew Oceans Commission (2003) and the US Commission on Ocean Policy (2004)—document the multiple crises facing ocean and coastal ecosystems in great detail. Nonpoint source pollution, invasive species, overfishing, habitat alteration, and other human-caused and natural changes are transforming the chemistry, structure, and ecological functioning of marine ecosystems and adversely affecting the economic benefits they provide to society. The reports agree that traditional single-sector management approaches have not worked and in some cases have actually accelerated the ecological crises. Addressing these crises will require major national policy changes, new governance structures, increased research, monitoring, building of public awareness, and strong bottom-up conservation efforts that bring communities and stakeholders together to address national problems at a local scale. Recommendations in the two reports identify a series of policy changes that need to be implemented to begin the process of restoring our ocean and coastal ecosystems.
Along with Pew and US ocean commissioners, scientists, conservationists, and some resource managers are recommending new principles and approaches to managing our oceans and coasts that are precautionary, ecosystem-based, and adaptive as we learn more about these vital ecosystems. The establishment of marine protected areas (MPAs) is one tool being promoted as a key feature of a new, area-based strategy for protecting and restoring marine ecosystems. An MPA is “an area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein” (E.O. 13158, 2000). MPAs are not a new idea, but their recent ascendance as a management approach was given new emphasis in the U.S. when President Clinton signed Executive Order 13158 in 2000. That order established the NOAA Marine Protected Area Center with a mandate to establish a national network of MPAs.

Worldwide, MPAs are an extremely controversial management strategy for certain marine resource users, primarily due to the area-based limitations they impose on various uses and activities. The National Research Council (2000) noted in its recent report that it is difficult to change the perception among many resource users that open access to marine resources is a right, because the open-access doctrine has deep roots in the United States, as well as other countries. Stakeholders in the MPA debate include commercial and recreational fishers, divers, boaters, coastal residents, the tourism industry, environmentalists, as well as the concerned public. These groups cherish their right to use the marine environment and its resources with minimal restrictions placed on them. A particularly controversial type of MPA is a ‘no-take’ marine reserve (MR). These are areas that are protected from all destructive and extractive activities.
(Lubchenco et al., 2003). Given the present severity of management restrictions that some fisheries face, the exclusion of commercial and recreational fishing in MRs is of special concern to the fishing industry. A more general problem with establishing MPAs is the limited scientific information we have available to knowledgeably design them and monitor their effectiveness.

This problem—the limitations of our scientific understanding of marine ecosystems for purposes of designing effective MPAs—is one of the chief issues being addressed by the MPA Center and is the impetus behind my Summer 2003 internship and subsequent work with the MPA Center’s Science Institute in Santa Cruz, California. At the outset of the internship, the assignment was to use a draft of the MPA Natural Science Research Strategy (NSRS) as a basis for outreach to the ocean community to identify regional criteria and research needs to effectively design and implement networks of protected areas. An internet-based survey approach was anticipated to gather this information due to the internet’s capability of transcending geographical barriers and accelerating communication efforts. Unfortunately, the draft NSRS was not completed when I began my internship (and still is not), so the internship experience focused on several other projects in preparation for an eventual survey of stakeholders.

For this project, then, hypothetical draft questions for stakeholders regarding MPA design criteria and research needs were developed, survey methodologies were reviewed emphasizing web-based strategies, and a prototype survey developed online. This report outlines the work described above and suggests ways that the MPA Center can move forward with this process.
Following this introduction, background material is provided on the relatively recent ascendance of MPAs, past legislation supporting MPAs, current efforts to establish MPAs, the science of MPAs and MRVs, the internet and internet based surveys. This is followed by a brief outline of project objectives and methods, and then a discussion of the project. Finally, recommendations are provided for implementing the survey once the Natural Science Research Strategy for MPAs is completed by the MPA Center.
BACKGROUND & LITERATURE REVIEW

Marine Protected Areas as a Management Tool

The coastal areas of the world serve as important regions for the human population. Nearly "two-thirds of the world’s population lives near the coast" (Klee, 1999). In the United States alone, half of the population lives within fifty miles of the coastline. This overcrowding of coastlines, accompanied by the numerous destructive practices that occur daily (e.g. agricultural practices, land-use, nutrient runoff, destructive and unsustainable fishing practices, etc.) are degrading the marine environment and all of its inhabitants. As a result the ocean is beginning to show signs of depletion and damage. Beach closures due to high levels of pollutants in the water, marine mammal strandings, coral bleaching, the filling of wetlands and estuaries, and the depletion of fish stocks have been increasing over the past three decades.

Considering just the impacts from fishing practices, we are depleting the oceans of fish, causing habitat degradation, and altering numerous marine ecosystems. Currently, fisheries managers only know the status of 30% of the 959 commercially fished stocks in U.S. waters. Out of the 304 stocks whose status is known, 30% are experiencing overfishing or are overfished (Pew Oceans Commission, 2003). A fish stock experiences overfishing when too many individuals are removed such that breeding stocks are reduced to levels that cannot replenish the population. The numbers above do not include the numerous non-targeted species of fish that make it into fishing nets or get entangled in fishing gear each year. This is called “bycatch” and accounts for 25% of the catch worldwide (Pew Oceans Commission, 2003). By focusing on only one stock at a time, in our management efforts, the significance of serial depletion of individual stocks
and fishing grounds is masked, a phenomenon illustrated by fisheries in all parts of the world (Pauly, 1988; Dugan and Davis, 1993; Orensanz et al., 1998 in Sumaila et al., 2000). There clearly is a dire need for a different approach to managing marine resources. Fisheries managers have long recognized that exploited stocks are part of a larger ecosystem and interact with other species to maintain the health of the overall marine ecosystem. Especially in recent years, this realization has compelled them to try to manage their stocks more sustainably taking an ecosystem approach (U.R. Sumaila et al., 2000).

The cumulative effects of these human impacts on the marine environment have attracted increasing public attention and concern that the current management of marine resources and habitats is insufficient (NRC, 2001). Due to the rapid depletion of marine resources, ecosystem-based management has been receiving more attention among marine resource managers and scientists. Ecosystem-based management aims to maintain the health of the whole as well as the parts of an ecosystem and acknowledges the interdependency among things (Pew Oceans Commission, 2003). Throughout the past century, the public has grown accustomed to and supportive of ecosystem-based management in terrestrial environments. The rapid loss of wilderness lands and biodiversity triggered the creation of protected areas, reserves, and parks where human activities are restricted. The public now accepts and cherishes these parks. This approach to protecting resources and ecosystems has not yet crossed over to the marine environment (NRC, 2001). Currently, four percent of the land area in the United States is preserved as wilderness, yet the area of the ocean under U.S. jurisdiction that is protected is just one percent (Pew Oceans Commission, 2003).
The one percent of the marine environment under protection is encompassed in MPAs – sanctuaries, reserves, national parks, and seashores. MPAs of sufficient size and diversity have the potential to lessen many of the problems that human uses and the resulting adverse impacts have created. The foremost examples of MPAs in the U.S. are the thirteen National Marine Sanctuaries, for example Monterey Bay NMS and Stellwagen Banks NMS to name a few. They are a tool that can aid in conserving, protecting, and restoring marine species and habitats to help achieve a variety of goals; among them being biodiversity conservation, fisheries enhancement and recovery, and sustainable recreation and tourism. The highest level of protection in the marine environment is provided by marine reserves or MRs. As mentioned earlier, the restrictive nature of MRs has created a high level of controversy among marine resource users. Despite this, MR initiatives have been successful in the Florida Keys and Channel Islands National Marine Sanctuaries (FKNMS and CINMS respectively). Each process to establish these reserves required the extensive involvement of local stakeholders, along with scientists and politicians. The State of Oregon is currently planning to establish an experimental system of marine reserves in coastal waters.

**The Science of MPAs and MRs**

Along with the increased use of MPAs over the past few decades, scientific research on the effects of MPAs inside and outside of their boundaries has also been on the rise. The scientific research and literature on MPAs in general is sparse, but there is an emerging body of research and literature that is focused on marine reserve design, implementation, and impacts.
In locations where marine reserves have been strategically planned, gained the support of its opponents, and have been fully protected for a number of years, MRs are reportedly successful. The key findings in research reviewed by the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) are that in marine reserves, “animals and plants usually increase in their biomass, abundance, number of species, and body size” (PISCO, 2002). These results are important because they all show increasing ecosystem biodiversity and productivity. Species that are not fished also respond positively to the protection of their ecosystem within the marine reserve boundaries (PISCO, 2002).

An example of a successful marine reserve is the waters surrounding Anacapa Island off the coast of Southern California. Prior to establishing the reserve, the ecosystem was out of balance. The lobster population was being heavily fished, which left urchins, their prey, to flourish and consume vast amounts of kelp. Not only was the kelp decreasing, but the entire ecosystem which depends on the kelp forest was in decline. Removing the lobster through fishing caused harmful effects on the ecosystem due to the interactions and interdependence among different species in the environment (PISCO, 2002).

In 1978, the National Park Service declared a ban on all fishing within the waters of the Anacapa Island Ecological Reserve. This was an effort to protect lobsters, sea urchins, fish, and other organisms that live within the kelp forest. Two years later, scientists collected data from within the reserve and from areas outside of the reserve to test its effectiveness. They found that red urchins were almost twice as large in the reserve waters. Lobster and sheephead fish were more abundant in the reserve, six and
three times more numerous, respectively. Kelp plants grew five times more dense, thus creating more habitat for other creatures of the kelp forest (PISCO, 2002). The populations within the reserve were able to reestablish a more natural balance in the ecosystem.

It has also been well documented by other scientists, that marine reserves have beneficial affects on plants and animals that exist within their enforced boundaries (Roberts, 1995; Russ and Alcala, 1996; Halpern 2003). Halpern (2002) has reviewed the results of 89 separate studies on marine reserves worldwide and found that on average, the diversity of communities and average size of the organisms are between 20-30% greater compared to unprotected areas. The density and biomass of organisms within marine reserves doubled and tripled, respectively, compared to unprotected waters (Halpern, 2002). Roberts and Hawkins (2000) examined previous research on 30 marine reserves and had similar findings to Halpern. It is because of studies like Halpern and Roberts and Hawkin that marine reserves are gaining support for their ability to protect habitat, increase species abundance, size, and biomass, as well as species diversity.

There are fewer data to support marine reserves as beneficial tools for fisheries management, but there is growing evidence of promising results. One of the theories behind marine reserves is that as populations recover from the effects of overharvesting within reserve boundaries, the increasing size, density, and fecundity of fish and other organisms will act as a source of larvae, juvenile, and adult organisms for populations outside of the reserve. The export of adults and young recruits to fishing areas outside the reserve determines the effectiveness of marine reserves for replenishing fish stocks. It is expected that the contribution of reserves will be highest for heavily fished, non-
migratory stocks (NRC, 2001). Direct evidence of the “spillover” effect on fisheries is sparse (PISCO, 2002). A few examples of this include a study by Roberts et al. (2001) where a reserve in the Philippines was re-opened to fishing and catches in nearby areas collapsed. Catches rose again, when the marine reserve was re-established. This finding could be interpreted that the reserve had previously supported the surrounding fisheries. Other observations include fishing boats in the United States, Kenya, Japan, and elsewhere that have been known to fish along the perimeter of marine reserves, called “fishing the line.” This is where they have their highest catches. In addition, marine reserves in both Florida and St. Lucia have been shown to enhance adjacent fisheries (Roberts et al., 2001).

“Export” is another process believed to occur as a result of marine reserves. This process is the “seeding” of surrounding unprotected areas with the larvae and propagules of marine reserve organisms through ocean currents (PISCO, 2002). According to Palumbi (2002), the fecundity of fish increases greatly with weight. Both Thorrold et al. (2002) and Bohnsack (1996) have demonstrated this through studies of red snapper. Warner et al. (2000) demonstrated that a single 60cm red snapper weighing 12.5kg produces 9,300,000 eggs. It would require 212 red snappers of 1.1kg in weight and 40cm long to create the same amount of eggs. Since marine reserves have proven to increase the size and weight of fish within its boundaries, more larvae will be produced. The dispersal of these larvae is complex. A number of modeling studies have been conducted to illustrate the potential patterns of the larval dispersal but further research is needed. In the Murawski et al. (2000) study of George’s Bank, it was determined that scallop populations more than doubled outside and down-current from the closed area. Over $34
million in fishing revenues were gained from sea scallops beyond the reserve. Both spillover and export have been found in some studies to increase populations of plants and animals outside of reserve waters. Despite the lack of overwhelming data on fisheries benefits, it has been demonstrated that marine reserves, in conjunction with other fisheries management strategies outside of reserve waters, can be great tools to help protect habitat and biodiversity within the marine environment.

There is also increasing evidence that networks of reserves can serve as a buffer against environmental variability and provide greater protection than just a single reserve (NCEAS, 2001). The effectiveness of these networks requires further research, according to NCEAS. To be successful, these reserves need to encompass a diverse set of habitats and have an arrangement spatially that coincides with larval dispersal and/or feeding and breeding grounds. Current research is looking to increase understanding of larval dispersal, life histories, and habitat use of the various species within reserves. Once a better understanding exists, networks of reserves can be spatially arranged to maximize their conservation and biodiversity benefits to the marine environment (NCEAS, 2001).

It is important to remember that despite the biological effects of MPAs and marine reserves discussed above, there are other factors that must be considered in determining their success. Ultimately, the complex interactions between biological, economical, political, and institutional factors are all important in the evaluation of success.
Past Legislation Supporting MPAs

Despite the controversial nature of establishing MPAs and MRVs with certain stakeholders, there is legislation in place that supports their use in the United States. Two of these grew out of the recommendations of the Stratton Commission, which was charged by Congress to take a comprehensive look at how the nation could improve its use of the ocean and its resources. The Commission presented Congress with more than one-hundred recommendations in its 1969 report, “Our Nation and the Sea.”

One key piece of legislation the Stratton Commission passed in 1972 was the Coastal Zone Management Act (CZMA). The CZMA provided incentives to coastal states to use their various authorities to protect coastal and offshore resources. Section 315 of the CZMA established the National Estuarine Research Reserve System to provide protection of representative estuarine ecosystems and a place for research and education. Over the past 30yrs, 28 of these estuarine MPAs have been established.

Also in 1972, Congress passed the Marine Protection, Research, and Sanctuaries Act, which called for the creation of a national system of marine sanctuaries to protect ocean resources of ecological, cultural, historical, economic, and aesthetic value. Sanctuary establishment got off to a slow start, but today there are thirteen national marine sanctuaries. They range in size from the Monterey Bay NMS (California) encompassing 5,328 nautical square miles, to Fagatele Bay NMS (American Somoa), just 0.25 nautical square miles. All sanctuaries prohibit oil and gas drilling, and each sanctuary has its own plan, but generally, there are still many other activities that occur within sanctuary boundaries that harm ocean resources. Examples of these activities can include commercial and recreational fishing, motor boat/jet ski use, coral blasting. In
addition to allowing harmful activities, sanctuaries also lack adequate funding for scientific monitoring, evaluation, and enforcement (NRC, 2001). It is becoming increasingly evident that new strategies and enhanced funding are needed to protect sanctuaries and conserve the marine environment generally.

Recent U.S. Coastal and Ocean Management MPA Efforts

Legislation for conserving marine resources, habitat, and biodiversity that was implemented over thirty years ago has proved inadequate to sustain marine ecosystems, in part because they continue to permit many uses that have resulted in pollution, habitat destruction, and overfishing. As a result, fishery closures are increasing, as are the number of endangered species, and degraded marine habitats.

In 1996, the Sustainable Fisheries Act (SFA), amended to the Magnuson-Stevens Fishery Conservation and Management Act of 1976, brings a new focus to reducing the harmful effects of commercial fishing on the marine environment. The eight regional fisheries management councils set up by the 1976 act now have new authority under the SFA to help rebuild overfished stocks and adopt more stringent regulations to reduce both bycatch and habitat degradation. Councils can now open and close areas for fishing to protect specific stocks of fish and set aside essential fish habitat as “no-take” areas (Pew Commission, 2003). In this manner, Councils can use MPAs as fishery management tools.

Not only has the fishing industry realized the importance of MPAs in fishery management, but others have as well. Concerned members of Congress, scientists, and advocacy groups drafted recommendations for President Bill Clinton and Vice President
Al Gore called "Safeguarding America's Seas: Establishing a National System of Marine Protected Areas." Among their recommendations was the need for an Executive Order to establish a national system of MPAs that by 2015 would protect 20% of the U.S. exclusive economic zone, the 3 to 200 nautical mile offshore zone under federal jurisdiction (www.mcbi.org/marineprotected/Marine.htm). An Oceans Act to create a new national commission, similar to the Stratton Commission, was also recommended.

In May of 2000, President Clinton signed Executive Order 13158, stating that the nation must:

"protect the significant natural and cultural resources within the marine environment for the benefit of present and future generations by strengthening and expanding the Nation's system of marine protected areas" (Executive Order 13158).

Federal agencies, including the Department of State, Department of Transportation, Department of Commerce, Department of Interior, the Environmental Protection Agency, the National Science Foundation, and others, are mandated under the E.O. to coordinate and share information, strategies, and tools to support its purpose. Another directive of E.O. 13158 is that NOAA establish a Marine Protected Area Center (MPA Center). The overall mission of the MPA Center is to work in cooperation with the Department of Interior to create a framework and support for a national system of MPAs. NOAA is also tasked to provide information, strategies, and technologies to support local, tribal, territorial, State, and other Federal agency efforts to establish and implement MPAs.

Research and coordination is another major responsibility. The MPA Center works with governmental and nongovernmental agencies to:

1. Create a science-based identification and prioritization of natural and cultural resources for additional protection.
2. Integrate assessments of ecological linkages among MPAs.

3. Conduct a biological assessment of the minimum area where consumptive uses would be prohibited that is necessary to preserve representative habitats in different geographic areas of the marine environment.

4. Conduct an assessment of threats and gaps in levels of protection currently afforded to natural and cultural resources.

5. Create practical, science-based criteria and protocols for monitoring and evaluating the effectiveness of MPAs.

6. Identify emerging threats and user conflicts affecting MPAs and appropriate, practical, and equitable management solutions.

7. Assess the economic effects of the preferred management solutions.

8. Identify opportunities to improve linkages with, and technical assistance to, international marine protected area programs.

(E.O. 13158, 2000)

The MPA Center has made good progress towards many of the directives in E.O. 13158. One current project is the creation of a Natural Science Research Strategy (NSRS) for MPAs. The NSRS will be a general and conceptual framework for the science needed to establish an effective network of MPAs. Currently the NSRS exists only in outline form, but some of the main issues to be addressed include:

- researching the anthropogenic impacts to marine resources in a region i.e., invasive species, habitat degradation, fishing practices, and pollution
- ecosystem structure and function including spatial distribution of biodiversity, ecological connectivity of a region, and ecosystem function
- the effects of MPAs on marine ecosystems both inside and outside of their boundaries
- siting, size, and design of MPAs for both biodiversity and fisheries objectives
- restoration and monitoring efforts.
The MPA Center realizes that marine resource managers, stakeholders, and the marine environment will not benefit much from a broad strategy that covers all U.S. waters. To make the NSRS more useful, the Center wants to involve marine resource stakeholders in the process of establishing design criteria and research priorities for MPAs on a regional basis. The principle goal of this project is to develop a mechanism for gathering stakeholder input on appropriate scientific criteria and research needs for establishing MPAs in different regions of the U.S..

The Missing Link: Ocean Community Input

With limited scientific information on how to best design MPAs, it becomes quite easy to see the challenges that are posed when trying to get the ocean community to support their implementation. The MPA Center recognizes the diminished state of our marine resources and the potential of MPAs to help improve their status. It also realizes the wealth of knowledge that stakeholders may have about ocean resources and ecosystems and how vital their input and support is to the establishment of successful MPAs. Multiple researchers have found that MPAs have a greater chance of being successful when stakeholders have input in the process of why and how they are developed and managed (Kritzer, 2004; Lourie et al., 2004). Methods such as working groups have been utilized in the Channel Islands National Marine Sanctuary (NMS) and the Florida Keys NMS, but these are small scale focusing on just one geographical area. For the MPA Center to foster the creation of a national system of MPAs, another method of gathering stakeholder input is necessary. An internet-based survey has the potential to
involve a great number of stakeholders from regions throughout the country, and is the focus of this project.

**The Internet & Internet-Based Surveys**

The Internet is a global communications network consisting of thousands of networks connected by satellites and fiber optic cabling. Numerous servers and workstations are connected that support multiple users in accessing networked resources. The U.S. Department of Defense created the internet in the early 1960's as a strategy for advanced communication in the event of a nuclear attack (Kristula, 1997). Soon thereafter, the internet was extended to the technically skilled and university communities. The launching of the World Wide Web (WWW) in 1990 and the free distribution of Netscape in 1994 expanded the internet as a user-friendly vehicle for the general public to communicate and gather information (World Bank, 1999). Since the 1990's, the WWW has been constantly evolving. It has shrunk the world of communication making interaction and the sharing of information possible from a distance in real time (World Bank, 1999). In addition to increasing the exchange of ideas and information, the internet provides a medium for collaboration and interaction between people without regard for geographic location.

The World Wide Web and electronic mail are ubiquitous and the most recent platforms for survey research. Even though the use of internet-based surveys is relatively new, they are increasing in popularity because many believe “they are faster, better, cheaper, and easier to conduct than surveys that use more traditional telephone or postal mail methods” (Schonlau et al., 2001). Internet-based surveys have been fielded successfully in as little as ten days, while their counterparts often take a minimum of
three months to obtain a sufficient response rate (Schonlau et al., 2001). Communication and transcription are the areas where the most time can be saved. Online communication is instantaneous and responses on web-based surveys are immediately downloaded into a database for analysis. This not only saves time, but also reduces the chance for human transcription errors of respondent information into the database.

Internet-based surveys have been hailed as better and cheaper than other survey platforms. They are better in the sense that they eliminate transcription error, allow for the use of skip pattern logic (skipping to different questions based on responses to a prior question), can add more visual and auditory stimuli for respondents, and allow for wide geographic coverage. In terms of cost, "the calculations are based on the trade-off from the expected savings in postage, printing, and labor costs to prepare survey mailing packages and code the subsequent survey returns against the expected additional costs of programming, additional management effort, and maintaining a telephone help line for the web survey" (Schonlau et al., 2001). Additionally with internet surveys, the sample size can increase with minimal to no additional costs and can span across states, countries, and the globe with ease.

While using the internet as a survey platform has numerous strengths, it also has limitations. Some key challenges to internet-based surveys include security and confidentiality, respondent computer skills, sampling coverage (digital/social divide), lack of uniform access by respondents (computer operating systems), and screen configurations (Bourque and Fielder, 2003; Dillman et al., 1994; Gunn, 2002). Inputting personal information on the internet raises issues of security and confidentiality for respondents and therefore must be addressed. Respondents should be advised as to
the security of their information and whether or not they will remain anonymous and/or their information kept confidential. Other issues to keep in mind are that not all of the sample population may have access to the internet nor will they have the same screen configuration, access speed, and computer skills. These challenges will reduce survey response rates if they are not addressed appropriately. As you can see, the strengths of internet surveys are counter-balanced by their limitations. This is why it is imperative to address each situation individually to assess whether using an internet-based approach is the optimal platform for a particular survey.

When planning a survey whether internet-based or traditional, it is also important to recognize that the success depends on the quality of the entire process, not just the survey instrument itself. Dillman (1978 and 2000) has created the Total (or Tailored) Design Method (TDM) which has proven to be successful for mail and telephone surveys. Although a formal survey-process framework is lacking for internet-based surveys, the basic tenets should be the same regardless of the survey medium. This holistic approach includes defining the survey objectives, determining the sample, creating and testing the survey instrument, contacting respondents, and conducting the appropriate analyses (Schonlau et al., 2001). (Refer to “A Guidebook to Internet-Based Surveys” in Appendix A for more details).

As of 2004, there have only been a handful of internet-based surveys conducted about the marine environment and related issues. Most have been geared towards the general public and their knowledge about the oceans. What is needed in the present case is a survey that directly involves “active” marine resource stakeholders (those who are involved with the ocean on a daily or regular basis) for management of these resources.
This project serves to fill this void by soliciting input from active stakeholders on one of the most, if not the most, controversial topics in marine resource management today, MPAs. In addition, this project is the first effort by the MPA Center to establish priorities for regional science-based siting and design criteria and research needed to establishing effective MPAs. This project also has the potential to revolutionize the way in which stakeholder input is gathered in the management of marine resources, as well as aid in the process of establishing regional design and research priorities for MPAs across the U.S.
METHODOLOGY

In support of the MPA Center Science Institute, the goal of this internship project was to design an internet-based survey to solicit feedback from the ocean community on the natural science information needed to establish regional priorities and research needs for the design of MPAs. The specific project objectives were to (1) identify a preliminary set of design criteria and research needs vital to MPAs, (2) create an internet survey guidebook and evaluate potential web survey hosts, and (3) develop a prototype survey using the best web host that is effective in characterizing stakeholder perspectives on MPA design criteria and research needs.

Identification of Natural Science Design Criteria and Research Needs of MPAs

When the internship was established, it was anticipated that the draft of the MPA Natural Science Research Strategy would be available to identify the natural science design criteria and research needs for use as a basis for survey question development. Because it was not completed and available to guide survey question development, it was necessary to conduct a literature review on MPAs to identify possible scientific design criteria and research needs of MPAs. From a comprehensive examination of the MPA literature published over the past couple of decades, numerous design criteria and research needs have been identified by researchers. These are outlined in the Discussion and served as the basis for the design of the prototype survey.
Creating the survey guidebook required obtaining knowledge in social science methods of research, particularly conducting surveys. This began with enrolling in a course focused on the science of conducting surveys in general; mail and telephone surveys predominantly. Utilizing the knowledge and experience gained in the course in addition to conducting a literature review on internet-based surveys helped guide the creation of the internet survey guidebook. From these multiple resources, survey information was condensed into major topics such as target population, sampling techniques, question development and order, and survey design; therefore, enabling a researcher who has little to no survey experience to successfully conduct an internet-based survey.

There are numerous online survey web hosts to choose from when conducting a survey. My guidelines from the MPA Center were to compare Zoomerang.com with SurveyMonkey.com and choose the web host that is the least expensive, but is easy to use, respects confidentiality, and is secure. From here, comparisons between the hosts were made in the areas of cost, security, confidentiality, user-friendliness, and help center support. The survey web host that fit these criteria most accurately was selected to host the prototype survey for the project.

Creating the Prototype Survey

After completing the two objectives discussed above, creating the prototype survey was possible. This step is the culmination of the knowledge I acquired from both the MPA and survey literature reviews. I have taken the critical natural science design
criteria and research needs behind MPAs and translated them into questions for marine resource stakeholders to address. Creating effective questions on these sensitive issues is a source of contention and will continue to be a work in progress for the MPA Center as it reaches the point of designing the actual survey from the prototype.
DISCUSSION

Identification of Natural Science Design Criteria and Research Needs for MPAs

Many researchers have noted that in order to create networks of MPAs and marine reserves, four main questions need to be addressed that are fundamental to their design and function: 1) How much of the coastline should be encompassed in protected areas? 2) What should the size and shape be of the MPAs? 3) How many should there be? and 4) Where should they be placed? (Lubchenco, 2003; Carr et al., 2003; Agardy, 2000). The answers to these questions depend on the goals of the network of protected areas and on many ecological factors. Despite the fact that the science of MPAs is still in its infancy and relatively little of a technical nature has been written about design criteria (Agardy, 2000), there is emerging literature that highlights the ecological factors and processes that are critical to designing scientifically successful networks of MPAs.

To begin with, defining the goal(s) of a particular MPA or network of MPAs is a first step in determining the scientific factors that will help in their design and placement. According to Airame et al. (2003), goals for networks of MPAs usually fall within five categories: sustainable fisheries, ecosystem biodiversity, economic variability, natural and cultural heritage, and education. Networks of MPAs often have multiple objectives that may include some or all of the categories above. This paper will focus on designing MPAs with goals that fall under the first two categories, sustainable fisheries and ecosystem biodiversity.

Scientific Research Needs for MPAs with Fishery Enhancement Goals

Fisheries receive their maximum benefit from MPAs, in terms of sustainability and yield, when MPAs are small enough to allow for emigration of species outside of the
protected areas thus increasing the benefits of export and spillover of juveniles and adults into fishable waters (NRC, 2001). If protected areas are too large, they can decrease the amount of movement between protected areas and fished areas of certain species (Kramer and Chapman, 1999). Some fisheries models suggest that less area would have to be protected in reserves as management outside reserves improves (NRC, 2001). It should be noted that reducing fishing effort is not equivalent to setting areas aside in marine reserves or MPAs. Many fishing practices result in bycatch of non-target species and habitat destruction that will continue to affect these fished areas long after fishing effort has been reduced (Halpern, 2003). Most theoretical and empirical studies indicate that to minimize the risk of fishery collapse and maximize long term sustainable catches, 20-50% of fishing grounds will need to be protected (NRC, 2001; Halpern, 2003). Scientists recommend that the size, shape, and location of the protected areas should depend on potential larval dispersal distance, recruitment dynamics, population growth rate, fishing pressure on species of concern, trophic interactions, critical habitat, and unpredictable environmental variation (Halpern, 2003; Allison et al, 2003; Agardy, 2000). In addition, plant and animal species that depend on other distant populations for recruitment will require networks of reserves with high connectivity (NRC, 2001). Individual reserves may also be smaller when they are part of a network that is connected through dispersal of larvae and adults (Hastings and Botsford, 1999).

**Scientific Research Needs for MPAs with Conservation Goals**

For networks of MPAs with conservation of biodiversity as their goal, the benefits increase with an increase in reserve size (Dayton et al., 2000; Roberts and Hawkins,
Larger reserves protect more species and habitats which can provide a buffer against losses from environmental fluctuations or other natural fluctuations that may alter mortality and growth rates (Roberts and Hawkins, 2000; Airame et al., 2003). In terms of how much area to protect, theoretical studies and limited empirical data show that at a minimum, protecting 10-40% of all marine habitats will help conserve ecosystem biodiversity (NRC, 2001). (Executive Order 13158 mandates that 20% of the EEZ be protected in MPAs by the year 2015). It has also been noted that with less effective management outside of reserves, large reserves will be needed to achieve conservation goals (Halpern, 2003). The size, shape, and location of MPAs for biodiversity and ecosystem conservation depends on many of the same ecological processes as those established for fisheries benefits; i.e., trophic interactions, population growth rate, critical habitat, recruitment and dispersal dynamics, and unpredictable environmental variation. In addition, MPAs for ecosystem and biodiversity conservation require knowledge about unique habitats and representative habitat types.

Scientific Research Needed

Given the above scientific criteria that influence the design of MPAs, it is critical to research the ecological factors and processes that affect these scientific criteria. Understanding trophic interactions, larval dispersal dynamics, migration patterns, life histories, environmental features (i.e. geomorphological features and hydrographic patterns), etc., requires a tremendous amount of research. Despite this need for understanding through research, empirical studies are difficult to conduct in the marine environment. The marine environment presents numerous challenges to researchers. It is
time-consuming and costly to conduct ocean studies and at times treacherous. Often it is
difficult to study numerous species or parts of a habitat due to decreased visibility in the
oceans and the mobile nature of so many species of interest. Important topics such as
larval dispersal dynamics and life histories are difficult to track because of the limited
time researchers can spend out at sea, limited budgets, and equipment capabilities.

Acknowledging our limitations in understanding marine ecosystems, it would seem that
a precautionary approach in creating a network of marine reserves would be
advisable (U.R. Sumaila et al., 2000). This approach requires resource managers to err on
the side of caution. Using a precautionary approach, a recommended strategy for
placement of a network of MPAs is over representative marine habitats instead of
protecting individual species (Agardy, 1997; Dayton et al., 2000). Modeling efforts have
been increasingly used to design MPAs as well (Palumbi, 2003).

The key scientific needs identified above (i.e. larval dispersal, natural variability,
etc.) now need to be prioritized due to limited resources (i.e. time, money, researchers,
equipment), priorities among ocean community members, and relative need. In the
"Creating the Prototype Survey" below, I have developed a series of questions that aim to
prioritize the MPA design criteria and research needs among regional stakeholders.

Creating an Internet Survey Guidebook & Selecting the Survey Web Host

Creating an Internet Survey Guidebook

The guidebook in Appendix 2 shares many commonalities with other survey
guidebooks, but emphasizes specifics that only pertain to internet-based surveys. It is an
attempt to synthesize and condense the large literature that exists on survey design and
implementation with the more limited literature on internet surveys. The manual was created to assist employees, with little to no survey experience or knowledge, in conducting an internet-based survey.

The guidebook begins with an overview of the strengths and limitations of internet surveys as well as the multiple methods for conducting an internet-based survey. Internet-based surveys can be broken down into two main categories, email or web page surveys. There are three methods under each of these categories for conducting a survey and each method's strengths and limitations are discussed briefly in the guidebook.

Defining the survey's objectives, target population, and sampling technique are critical steps to conducting and implementing a successful survey. Defining the survey's objectives can be determined by answering the following questions:

- Why are you conducting the survey?
- What is the information gap you are trying to fill with this survey?
- What problem are you trying to solve?
- What new information do you need to solve it?

Once the objectives are clear, the surveyor must decide which people will be able to help reach the survey objectives/goals. This is referred to as the target population. When the target population has been determined, it is important to decide whether the sampling technique(s) employed will be probability or non-probability based. The sampling technique is critical in the analysis and interpretation of survey results. For example, if non-probability based sampling is employed, results can only be generalized to those who took the survey and not to a broader population.

Next, the surveyor needs to understand survey and question design. The physical and visual representation of a survey influences survey response rates. Survey design
involves both the layout of the survey (i.e., colors, images, radio boxes, how many pages, time to complete, scrolling, etc.) and the actual questions (i.e., types of questions, wording, content, etc.). Overall, minimizing respondent frustration is extremely important to conducting a successful survey. The less frustrated a respondent is, the more likely they will complete the survey which will help you attain your survey objectives. Reducing frustration most commonly is done by two methods: minimizing the time it takes to complete the survey and creating a user-friendly survey. Please refer to Appendix 2 for more details on survey and question design.

The next step in the survey process is communication with respondents. Communication is vital to the success of a survey as well. There is a protocol that has been found to be successful in paper surveys which includes the initial invitation, reminder letters throughout the survey period, and thank you letters. The initial invitation email establishes the tone for the survey. Aside from including the URL to the actual survey, the email invitation needs to give the respondent a tremendous amount of information. To begin with, the invitation email should state the purpose of the study, who the sponsors are, how and why the individual was selected, and the dates that they can participate in the survey. Respondent’s should also be informed as to why their participation is important, what to expect on the survey, how long the survey will take to complete, and be given contact information if they need help or have questions. In general, you should not expect people to commit more than 15-20 minutes to complete the survey. Confidentiality issues need to be addressed. Will the respondents remain anonymous or just their information kept confidential? In addition, some surveys offer incentives to get more responses, such as a copy of the survey results, money, coupons,
or a t-shirt (Bourque and Fielder, 2003). Personalizing each email is also known to increase response rates and many internet-based survey providers make this easy to accomplish (Porter and Whitcomb, 2003).

One of the main benefits of an internet survey once it is employed is that data collection is done instantaneously. This saves the surveyor time and reduces transcription errors. Depending on the web host that is chosen, answer choices are either recorded into a database as soon as they are selected or when the respondent completes the entire survey. Most companies do some simple statistics on the data, but you can often download the data into a spreadsheet such as Microsoft Excel or a statistical package such as Statistical Package for the Social Sciences (SPSS) for further analysis. Do not forget to follow through with any promises you made to respondents for completing the survey, e.g., sending survey results, a t-shirt, etc.

Selecting the Web Survey Host

The main criteria used to compare the two web survey hosts SurveyMonkey.com and Zoomerang.com were cost, user-friendliness, website security and confidentiality, and help desk support. Overall, SurveyMonkey.com meets each of these criteria well and is inexpensive compared to the Zoomerang.com. Both SurveyMonkey and Zoomerang are user-friendly survey hosts and offer security and confidentiality to participants in the survey as well as the people/organization conducting the survey. In terms of help desk support, SurveyMonkey was fast in their responses and very personable. Zoomerang was days slower and not as detailed or personable in their responses. The cost differential is the biggest distinguishing factor. SurveyMonkey charges $19.95/month while
Zoomerang charges $75/month (rates as of November 2004). Using SurveyMonkey as the web host is the best option to help the MPA Center best achieve its goals. See Table 1 for web survey host comparison.

Table 1: Web survey host comparison.

<table>
<thead>
<tr>
<th>Comparison Criteria</th>
<th>SurveyMonkey.com</th>
<th>Zoomerang.com</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost</strong></td>
<td>$19.95/month</td>
<td>$75.00/month</td>
</tr>
<tr>
<td><strong>User-friendliness</strong></td>
<td>Easy to use and navigate the site</td>
<td>Easy to use and navigate the site</td>
</tr>
<tr>
<td><strong>Confidentiality &amp; Security Issues</strong></td>
<td>Website is secure and participant information kept confidential</td>
<td>Website is secure and participant information kept confidential</td>
</tr>
<tr>
<td><strong>Help Desk Support</strong></td>
<td>Excellent support and in a timely manner; personable responses as well</td>
<td>Decent support, but slower response rate and less personable responses</td>
</tr>
</tbody>
</table>

Creating the Prototype Survey

Structure of the Survey

As mentioned above, SurveyMonkey provides a great user-friendly site to host the NSRS survey. I integrated the various parts of this project discussed previously into an initial prototype survey for the MPA Center using SurveyMonkey. I have included the actual prototype survey in Appendix 3 for reference. The screens of questions are in the order that a participant will encounter them except that each page is displayed on a separate screen in the online survey. Participants will use a combination of scrolling down a screen as well as clicking “NEXT” to navigate through the survey. Combining
these navigational methods has been found to decrease survey time and increase response rates.

The survey is divided into four sections, the Introduction, Marine Ecosystems, Marine Protected Areas, and Individual Information. The fourth section is the only section containing skip logic. Although it is not apparent in the printout of the survey in Appendix B, respondents will be taken to different screens of questions based on their answer to the question “What is your primary occupation?” Other than this section, all respondents answer the same questions.

There is a strategic aspect to the sequence of the four sections of the survey and the order of questions within each section. Questions on similar topics are grouped together and within each group they are arranged by their structure (Dillman and Salant, 1994). To begin with, a general rule of surveys is to order the questions so that the most interesting and topic-oriented ones are at the beginning while the more objectionable and sensitive issues are raised later in the survey (Dillman and Salant, 1994). This will help keep respondents engaged and interested versus feeling like the survey is not worth their time. The first question in a survey is critical and therefore it is important that it relates to the survey’s purpose (Gaddis, 1998; Burgess, 2001; Dillman, 2000). The first question in the prototype survey is “How often do you visit or use coastal areas and/or resources?” This question relates to the topic of the survey and is benign in the sense that it should not offend respondents or create bias. An opening question such as, “Marine resources and coastal areas are in serious decline. How often do you visit or use these areas and/or resources?” would introduce bias into the question. This bias may cause respondents to minimize how often they visit and use coastal resources leading to inaccurate survey
responses. You also want to build a rapport with respondents before you ask them any real personal questions such as age, race, and income. This is why the Individual Information is the concluding section of this survey.

Arranging questions with other similar structured questions is less demanding on respondents because they do not have to switch how they respond as often. For example, questions that ask for rankings should be placed next to each other in each section. This is demonstrated in the Marine Protected Areas section of the survey where questions four, five, six, and seven require respondents to rank scientific research needs/criteria. Spreading these four questions out in that section of the survey would require respondents to change their response style usually increasing the time spent responding to the survey.

In examining the prototype survey, the Introduction to the survey is brief and reiterates some of the important information that is included in the email invitation. In this example, the goal of the survey is addressed along with the importance of the respondents input, confidentiality issues, how long the survey should take, and whom the sponsors are. Finally, respondents are thanked for participating.

In the second section on Marine Ecosystems, the foundation is laid for answering the questions on MPAs in the following section. Understanding where stakeholders are coming from in terms of their connection to the marine environment as well as their opinions on the status of marine resources and ecosystems, are important precursors to asking the more sensitive questions involving MPAs.

The Marine Protected Areas section really hones in on the goals of the survey. Respondents are directly asked whether or not they support MPAs and MRVs and what
they feel are the scientific criteria and research needs for establishing MPAs in waters nearest to them. It is extremely important in this section as well as the previous one on Marine Ecosystems, to pay close attention to the wording of the questions. This will be addressed later in this discussion section.

To change from one section to the next throughout a survey it is important to use transitional words. This can be accomplished by saying “Next we would like to know…” or “Finally, we would like to ask…” (Salant and Dillman, 1994). At the beginning of each section, you will find a few transitional sentences for the respondent to read. These sentences can also be used to inform respondents how much of the survey they have completed or have left to complete.

**Wording of Questions**

Writing good questions often takes time and many attempts because so many things have to be taken into consideration – how to structure questions, deciding what information is needed, and avoiding a variety of wording problems that may result in inaccurate responses or no response at all. Although there is no perfect list of rules for how to word or not word questions, researchers suggest that you:

- be specific
- use simple words
- don’t be vague
- keep it short
- don’t talk down to people
- don’t be too specific

Some of these suggestions may seem contradictory, but I have included some sample questions below on the marine environment to illustrate a few of these common wording problems.
Example 1: Vaguely worded questions and responses

Would you actively support, support, or not support the establishment of marine protected areas (MPAs) in waters nearest your location?

1. ACTIVELY SUPPORT
2. SUPPORT
3. NOT SUPPORT

The vaguely worded question and responses above produce useless information for researchers. What does “support” mean? Here is a possible revision below.

If a network of marine protected areas (areas that limit extractive and harmful activities) were established in waters nearest your location, would you be willing to have some of your activities (e.g. fishing, jet skiing, etc.) restricted?

1. WILLING
2. NOT WILLING
3. UNDECIDED

Example 2: Too much knowledge is assumed of the respondent

Do you support President Clinton’s Executive Order 13158?

1. ACTIVELY SUPPORT
2. SUPPORT
3. DO NOT SUPPORT
4. UNSURE OR UNDECIDED

It is important not to assume respondents know enough to answer the question. It is best to verify first what they know or provide information and then proceed from there as demonstrated in the revision below.

In 2000, President Clinton issued Executive Order 13158 which mandates that the U.S. establish a National System of Marine Protected Areas. These are areas of the ocean where human use and activities may be restricted. Is limiting human uses and activities for ecosystem and fisheries enhancement acceptable or not acceptable to you, personally?

1. ACCEPTABLE
2. NOT ACCEPTABLE
3. UNSURE OR UNDECIDED

Example 3: Bias

Many marine resource managers in the U.S. support ecosystem-based management tools such as marine protected areas (MPAs). Do you support MPAs?

1. SUPPORT
2. DO NOT SUPPORT
3. UNDECIDED

Bias enters a question when respondents are made to think that everyone engages in a particular activity and therefore they should as well. As mentioned previously, there is no set way to word questions, but there are some general guidelines and tips that can be useful like the examples above. If surveys shared the same content and objectives, it would be much easier to come up with set rules. Please refer to the works cited page for further references on this topic (Salant and Dillman, 1994).
CONCLUSIONS AND RECOMMENDATIONS

Conserving and protecting threatened marine resources and ecosystems in United States waters is a critical need. One of the first steps in meeting this need is to gather information from those most affected by conservation and protection decisions—marine resource stakeholders. This project outlines a process an efficient and relatively inexpensive approach for gathering information from these stakeholders on national and regional-level research priorities for establishing marine protected areas (MPAs). The prototype survey presented here is a starting point for identifying the natural science research priorities in the absence of NOAA’s Natural Science Research Strategy (NSRS) for MPAs. Once the NSRS is created, the prototype survey questions can be modified to compliment the specific priorities addressed in the NSRS. An alternative for the MPA Center to consider is conducting the internet survey first and then create the NSRS based on the information gathered from the survey. This would help create an NSRS for MPAs that is focused on each region’s priorities and research needs.

This project can serve as a springboard for the MPA Center’s mandate in E.O. 13158 to create a national system of MPAs. As many researchers have noted, stakeholder input is critical to the success of MPAs. Gathering this input should be one of the first priorities for creating this system of MPAs. Establishing a national network of MPAs will be a lengthy process. The sooner the information-gathering process begins, the sooner our oceans and marine resources will get the protection they warrant.

Recommendations

The results of this project suggest a number of actions that need to be undertaken by the MPA Center. First and foremost is that the MPA Center needs to complete a draft
of the research strategy. Second, the MPA Center needs to engage survey professionals with design and data analysis experience to follow through with this report’s recommendations. Also important is that the organization selected to conduct the survey be one that is viewed as unbiased. The Communication Partnership for Science and the Sea (COMPASS) was originally a partner with the MPA Center on this survey, but has since pulled its funds. A possible replacement partner could be a university from each region of the U.S. being surveyed, perhaps institutions with Sea Grant extension programs, such as Oregon State University, University of Rhode Island, University of Alaska at Fairbanks, University of Hawaii, University of Puerto Rico, and so on. Additional recommendations are addressed below for conducting this internet-based survey.

Survey Objectives

At the time this document was written, the goals of the survey were two-fold: to identify regional science criteria and research needs for MPAs throughout the United States. If the objectives of the survey remain the same when the draft NSRS is completed, then the recommendations below apply. However, if survey objectives change, then some of the following recommendations may need to change as well. Having clear, well-defined survey objectives will allow for the design of more focused and useful questions in the survey instrument.

Target Population

The population of interest needs to be defined as well as the type of data to be collected and the desired precision of the results. Currently, the population of interest for the NSRS Survey is marine resource stakeholders. (It is important to note that
“stakeholders” is a politically charged word for some audiences and a possible replacement term should be considered for use in the survey and the findings of the survey. Since there are many different types and degrees of marine resource stakeholders, it will be important to decide what information is most important to obtain and who has that information. For purpose of this survey, the sample should include those who are most active in the marine environment, including those who are researching, earning their livelihood, or trying to protect it (Table 2 provides examples). Individuals from these groups are likely to provide the kinds of information the survey seeks, such as opinions on data needs and rankings of scientific criteria. The desired precision of the results is on a regional level in order to establish regional priorities.

Table 2: Marine resource stakeholder populations of interest for NSRS survey.

<table>
<thead>
<tr>
<th>General Categories</th>
<th>Specific Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishermen</td>
<td>commercial, recreational</td>
</tr>
<tr>
<td>Non-profit/non-government organizations</td>
<td>environmental, trade/industry, user groups</td>
</tr>
<tr>
<td>Tourism/non-consumptive recreation</td>
<td>diving, boating, nature-based tours</td>
</tr>
<tr>
<td>Marine Resource Managers</td>
<td>state, federal, tribal</td>
</tr>
<tr>
<td>Scientists</td>
<td>academic, government</td>
</tr>
<tr>
<td>Maritime Industry</td>
<td>shipping, ports and harbors, military/Coast Guard, marine suppliers, weather services</td>
</tr>
<tr>
<td>Other Maritime Industry</td>
<td>oil/gas/mineral extraction, underwater cables, dredging, engineering and construction, alternative energy</td>
</tr>
</tbody>
</table>

Sampling

For the NSRS Survey, a type of sampling that is both probability-based and purposive will be most applicable. The population of interest is marine resource
stakeholders and specifically the ones listed in Table 2. Obtaining membership email lists and organizational email lists that are comprised of these stakeholders (ex. fishermen associations, conservation groups, etc.) is one of the first steps. This is known as a closed population or creating a sample frame because the population is well defined and does not include anyone from outside of the selected groups and associations. It is a purposive sample as well because these particular groups are being targeted for a reason. They are a chosen subpopulation of the general population of interest, marine resource stakeholders. These lists will need to be obtained for all coastal areas of the U.S. including commonwealths and territories. Coastal areas are grouped into Large Marine Ecosystems or LMEs (Table 3 and Figures 1 and 2). LMEs are defined as large geographic regions of ocean and coastal space characterized by distinct hydrography, bathymetry, productivity, and trophically-dependant populations and have been identified to aid in the implementation of ecosystem-based assessment and management (NOAA, 2004).

Unless everyone on the membership lists is surveyed, the probability-based portion of the sampling occurs when a sample is selected from the membership lists. A systematic random sample of the lists is a great option. This is when every “nth” person on the list will receive the survey invitation email and URL link. By conducting a systematic random sample of the lists, the survey results can be generalized to the group, organization, or association that is surveyed. This will become important when analyzing the data. For example, a comparison could be made between the different organizations within a region as well as across regions.
Table 3: Large Marine Ecosystems in U.S. or partial US jurisdiction (NOAA 2004).

<table>
<thead>
<tr>
<th>Large Marine Ecosystems</th>
<th>States/Territories Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaufort Sea</td>
<td>North side of AK</td>
</tr>
<tr>
<td>Eastern Bering Sea</td>
<td>West side of AK</td>
</tr>
<tr>
<td>Gulf Of Alaska</td>
<td>South side of AK</td>
</tr>
<tr>
<td>California Current</td>
<td>WA, OR, CA</td>
</tr>
<tr>
<td>Insular Pacific Hawaiian</td>
<td>HI</td>
</tr>
<tr>
<td>Insular Pacific Johnston Island</td>
<td>Johnston Island</td>
</tr>
<tr>
<td>Insular Pacific Wake Island</td>
<td>Wake Island</td>
</tr>
<tr>
<td>Insular Pacific Samoa</td>
<td>American Samoa</td>
</tr>
<tr>
<td>Insular Pacific Marianas</td>
<td>Northern Marianas Islands, Guam</td>
</tr>
<tr>
<td>Insular Pacific Palmyra Atoll</td>
<td>Palmyra Atoll Kingman Reef</td>
</tr>
<tr>
<td>Insular Pacific Jarvis Island</td>
<td>Jarvis Island</td>
</tr>
<tr>
<td>Insular Pacific Howland &amp; Baker Islands</td>
<td>Howland and Baker Islands</td>
</tr>
<tr>
<td>Gulf Of Mexico</td>
<td>TX, LA, MS, AL, western FL, FL. Keys</td>
</tr>
<tr>
<td>Caribbean Sea</td>
<td>Puerto Rico, U.S. Virgin Islands</td>
</tr>
<tr>
<td>South East U.S. Continental Shelf</td>
<td>eastern FL, GA, SC</td>
</tr>
<tr>
<td>North East U.S. Continental Shelf</td>
<td>NC, VA, MD, DE, NJ, NY, CT, RI, MA, NH, ME</td>
</tr>
</tbody>
</table>

Web Survey Host and Questionnaire Design

The MPA Center should utilize SurveyMonkey© as the survey’s web host. It is the least expensive user-friendly and efficient web host for this survey’s needs.

For survey and question design, refer to the “Guidebook to Internet-Based Surveys” (Appendix A) for detailed recommendations. One example is that the use of
Figure 1: Large Marine Ecosystems in U.S. jurisdiction (Source: NOAA Regional Ecosystem Delineation Workshop Proceedings, 2004).

Figure 2: Insular Pacific Exclusive Economic Zone boundaries, corresponding generally to Insular Pacific large marine ecosystems (Source: NOAA Regional Ecosystem Delineation Workshop Proceedings, 2004).
open-ended questions should be minimized and if used, should generally be follow-ups to
the previous question. A simple example is:

1. Do you agree or disagree with efforts to establish marine protected areas for
   conservation of biodiversity?
   a. STRONGLY AGREE
   b. AGREE
   c. NEUTRAL
   d. DISAGREE
   e. STRONGLY DISAGREE

2. Briefly explain your response to question 1.

In addition to the suggestion above, it will be important to include partially close-
ended questions so that respondents are not limited to just the answers you have supplied.
They can check “OTHER” and write in their own response. In terms of survey layout
and wording of questions, there are numerous suggestions that are supplied in the
guidebook (Appendix A).

Pre-Testing the Survey

Once the survey has been designed, it will need to be put it through a preliminary
test or pre-test. A tremendous amount of energy goes into a survey up to this point, and
pre-testing is another vital step to creating a successful survey. Pre-testing will help
catch any mistakes in grammar, wording of questions, skip logic, etc. It is helpful to
select pre-testers with similar knowledge levels/backgrounds as those who will be in the
actual sample. It is also important to include pre-testers without experience or knowledge
in the subject area. They can provide a mechanism for checking errors and
incompatibilities. It is also a good idea to test the survey using different computing
platforms (MAC, PC) and with different hardware configurations. Multiple browsers such as Internet Explorer, AOL, Netscape, etc. and different connection speeds should be included in the pre-testing as well.

**Contacting Respondents**

Once the survey is ready to be administered, the next step will be to contact and communicate with respondents. As mentioned in the guidebook, it is important that the initial email invitation include a cover letter and a link to the survey. The cover letter needs to inform participants of the “who, what, when, where, and why” of the survey. It is critical to be honest and straightforward about confidentiality as well. Another key will be to avoid conducting your survey near or around holidays or major vacation times, such as Thanksgiving, Hanukah, spring break, etc. Conducting a survey and trying to communicate with respondents over holidays and breaks, often leads to a low survey response rate. It will also be beneficial to include links to information on MPAs, so that respondents who choose to can read more about MPAs before taking the survey.

It is recommended that the schedule/timeline for administering the survey take a total of 15 days. Some research shows that internet surveys can be fielded successfully in less than 10 days, but this paper recommends the timeline displayed in Table 4. For more details on conducting internet surveys, please refer to Appendix 2 “A Guidebook to Internet-Based Surveys.”

Marine and coastal management is largely about information sharing, communicating, monitoring, and evaluating; therefore, the potential benefits from an information management and communication tool such as the internet are tremendous (Kay and Christie, 1999). As access to the internet continues to expand, it is
Table 4: Recommended NSRS Survey Timeline

<table>
<thead>
<tr>
<th>Day</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Send the initial email invite with cover letter and URL link to the survey</td>
</tr>
<tr>
<td>Day 5</td>
<td>Send the first thank you/reminder email with the URL embedded</td>
</tr>
<tr>
<td>Day 10</td>
<td>Send out the second thank you/reminder email with the URL embedded</td>
</tr>
<tr>
<td>Day 15</td>
<td>At midnight, close access to the survey and begin analyzing data</td>
</tr>
</tbody>
</table>

recommended that the MPA Center conduct more research on utilizing other capabilities of the internet to solicit stakeholder input. In particular, online chat rooms and virtual communities could provide another opportunity to interact with stakeholders on the scientific design and implementation of MPAs. In addition to transcending geographic barriers, online chat rooms and internet surveys also make it possible to hear more opinions instead of the few opinions that may dominate face-to-face interaction.

Nevertheless, it is still important to weigh the strengths and limitations of using the internet to communicate and gather input from stakeholders. While some strengths include its relative low cost and transcendence of geographic barriers, some limitations to consider are the access of stakeholders to the internet and their ability to interact using a computer and its software. These limitations can create a significant of bias in the survey results. This bias should be carefully considered in deciding to conduct an internet survey. Methods that can be employed to reduce this bias are offering a variety of survey response modes, i.e. internet, postal, telephone, etc. These options need to be presented to the organizations/associations when first asking for email lists.

Even with a variety of response modes to choose from, some stakeholders may not want to participate in the survey for various reasons. If this happens, it is important
for the surveyor to reach out to these groups and ask them what they would prefer. It may be necessary to conduct an in-person meeting with these organizations to make sure their voices are heard and that their opinions are included in the design of this national system of MPAs.
REFERENCES


APPENDIX 1: EXECUTIVE ORDER 13158

Executive Order 13158

Marine Protected Areas


Section 1. Purpose. This Executive Order will help protect the significant natural and cultural resources within the marine environment for the benefit of present and future generations by strengthening and expanding the Nation's system of marine protected areas (MPAs). An expanded and strengthened comprehensive system of marine protected areas throughout the marine environment would enhance the conservation of our Nation's natural and cultural marine heritage and the ecologically and economically sustainable use of the marine environment for future generations. To this end, the purpose of this order is to, consistent with domestic and international law: (a) strengthen the management, protection, and conservation of existing marine protected areas and establish new or expanded MPAs; (b) develop a scientifically based, comprehensive national system of MPAs representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources; and (c) avoid causing harm to MPAs through federally conducted, approved, or funded activities.

Sec. 2. Definitions. For the purposes of this order:

a. "Marine protected area" means any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.

b. "Marine environment" means those areas of coastal and ocean waters, the Great Lakes and their connecting waters, and submerged lands thereunder, over which the United States exercises jurisdiction, consistent with international law.

c. The term "United States" includes the several States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands of the United States, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands.

Sec. 3. MPA Establishment, Protection, and Management. Each Federal agency whose authorities provide for the establishment or management of MPAs shall take appropriate actions to enhance or expand protection of existing MPAs and establish or recommend, as appropriate, new MPAs. Agencies implementing this section shall consult with the agencies identified in subsection 4(a) of this order, consistent with existing requirements.

Sec. 4. National System of MPAs. (a) To the extent permitted by law and subject to the availability of appropriations, the Department of Commerce and the Department of the Interior, in
consultation with the Department of Defense, the Department of State, the United States Agency for International Development, the Department of Transportation, the Environmental Protection Agency, the National Science Foundation, and other pertinent Federal agencies shall develop a national system of MPAs. They shall coordinate and share information, tools, and strategies, and provide guidance to enable and encourage the use of the following in the exercise of each agency’s respective authorities to further enhance and expand protection of existing MPAs and to establish or recommend new MPAs, as appropriate:

1. science-based identification and prioritization of natural and cultural resources for additional protection;
2. integrated assessments of ecological linkages among MPAs, including ecological reserves in which consumptive uses of resources are prohibited, to provide synergistic benefits;
3. a biological assessment of the minimum area where consumptive uses would be prohibited that is necessary to preserve representative habitats in different geographic areas of the marine environment;
4. an assessment of threats and gaps in levels of protection currently afforded to natural and cultural resources, as appropriate;
5. practical, science-based criteria and protocols for monitoring and evaluating the effectiveness of MPAs;
6. identification of emerging threats and user conflicts affecting MPAs and appropriate, practical, and equitable management solutions, including effective enforcement strategies, to eliminate or reduce such threats and conflicts;
7. assessment of the economic effects of the preferred management solutions; and
8. identification of opportunities to improve linkages with, and technical assistance to, international marine protected area programs.

b. In carrying out the requirements of section 4 of this order, the Department of Commerce and the Department of the Interior shall consult with those States that contain portions of the marine environment, the Commonwealth of Puerto Rico, the Virgin Islands of the United States, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands, tribes, Regional Fishery Management Councils, and other entities, as appropriate, to promote coordination of Federal, State, territorial, and tribal actions to establish and manage MPAs.

c. In carrying out the requirements of this section, the Department of Commerce and the Department of the Interior shall seek the expert advice and recommendations of non-Federal scientists, resource managers, and other interested persons and organizations through a Marine Protected Area Federal Advisory Committee. The Committee shall be established by the Department of Commerce.

d. The Secretary of Commerce and the Secretary of the Interior shall establish and jointly manage a website for information on MPAs and Federal agency reports required by this order. They shall also publish and maintain a list of MPAs that meet the definition of MPA for the purposes of this order.

e. The Department of Commerce’s National Oceanic and Atmospheric Administration shall establish a Marine Protected Area Center to carry out, in cooperation with the Department of the Interior, the requirements of subsection 4(a) of this order, coordinate the website established pursuant to subsection 4(d) of this order, and partner with governmental and nongovernmental entities to conduct necessary research, analysis, and exploration. The goal of the MPA Center shall be, in cooperation with the Department of the Interior, to develop a framework for a national system of MPAs, and to provide Federal, State, territorial, tribal, and local governments with the information, technologies, and strategies to support the system. This national system framework and the work of the MPA Center is intended to support, not interfere with, agencies' independent exercise of their own existing authorities.
f. To better protect beaches, coasts, and the marine environment from pollution, the Environmental Protection Agency (EPA), relying upon existing Clean Water Act authorities, shall expeditiously propose new science-based regulations, as necessary, to ensure appropriate levels of protection for the marine environment. Such regulations may include the identification of areas that warrant additional pollution protections and the enhancement of marine water quality standards. The EPA shall consult with the Federal agencies identified in subsection 4(a) of this order, States, territories, tribes, and the public in the development of such new regulations.

Sec. 5. Agency Responsibilities. Each Federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions. To the extent permitted by law and to the maximum extent practicable, each Federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA. In implementing this section, each Federal agency shall refer to the MPAs identified under subsection 4(d) of this order.

Sec. 6. Accountability. Each Federal agency that is required to take actions under this order shall prepare and make public annually a concise description of actions taken by it in the previous year to implement the order, including a description of written comments by any person or organization stating that the agency has not complied with this order and a response to such comments by the agency.

Sec. 7. International Law. Federal agencies taking actions pursuant to this Executive Order must act in accordance with international law and with Presidential Proclamation 5928 of December 27, 1988, on the Territorial Sea of the United States of America, Presidential Proclamation 5030 of March 10, 1983, on the Exclusive Economic Zone of the United States of America, and Presidential Proclamation 7219 of September 2, 1999, on the Contiguous Zone of the United States.

Sec. 8. General.

a. Nothing in this order shall be construed as altering existing authorities regarding the establishment of Federal MPAs in areas of the marine environment subject to the jurisdiction and control of States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands of the United States, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and Indian tribes.

b. This order does not diminish, affect, or abrogate Indian treaty rights or United States trust responsibilities to Indian tribes.

c. This order does not create any right or benefit, substantive or procedural, enforceable in law or equity by a party against the United States, its agencies, its officers, or any person.

(Presidential Sig.)<Clinton1><Clinton2>

THE WHITE HOUSE,

This guidebook will address the strengths and weaknesses of internet-based surveys as well as their design and implementation. If at any point while reading the information you need more detail, please refer to the literature cited and annotated bibliography in the back.
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INTRODUCTION

The World Wide Web and electronic mail are ubiquitous and the most recent platforms for survey research. Even though internet-based surveys are still in their infancy, they are increasing in popularity because many believe “they are faster, better, cheaper, and easier to conduct than surveys that use more traditional telephone or postal mail methods” (Schonlau et al., 2001). Internet-based surveys have been fielded successfully in as little as ten days, while their counterparts often take a minimum of three months to obtain a sufficient response rate (Schonlau et al., 2001). Communication and transcription are the areas where time can be saved. On-line communication is instantaneous and responses on web-based surveys are immediately downloaded into a database for analysis. This not only saves time, but also reduces the chance for human transcription errors of respondent information into the database.

Internet-based surveys have been hailed as better and cheaper than other survey platforms. They are better in the sense that they eliminate transcription error, allow for the use of skip pattern logic (skipping to different questions based on responses to a prior question), can add more visual and auditory stimuli for respondents, and allow for wide geographic coverage. In terms of cost, “the calculations are based on the trade-off from the expected savings in postage, printing, and labor costs to prepare survey mailing packages and code the subsequent survey returns against the expected additional costs of programming, additional management effort, and maintaining a telephone help line for the web survey” (Schonlau et al., 2001). Additionally, the sample size can increase with minimal to no additional costs with these types of surveys and can span across states, countries, and the globe with ease.

While using the internet as a survey platform has numerous strengths, it does not go without limitations. Some key challenges to internet-based surveys include security and confidentiality, respondent computer skills, sampling coverage (digital/social divide), lack of uniform access by respondents (computer operating systems), and screen configurations (Bourque and Fielder, 2003; Dillman et al., 1994; Gunn, 2002). Inputting personal information on the internet raises issues of security and confidentiality for respondents and therefore must be addressed. Respondents should be advised as to
the security of their information and whether or not they will remain anonymous and/or their information kept confidential. Other issues to keep in mind are that not all of the sample population may have access to the internet nor will they have the same screen configuration, access speed, and computer skills. These challenges will reduce survey response rates if they are not addressed appropriately. As you can see, the strengths of internet surveys are counter-balanced by their limitations. This is why it is imperative to address each situation individually to assess whether using an internet-based approach is the optimal platform for a particular survey.

When planning a survey whether internet-based or traditional, it is also important to recognize that there is an entire process which needs to be focused on in order to be successful, not just the survey instrument itself. Dillman (1978 and 2000) has created the Total (or Tailored) Design Method (TDM) which has proven to be successful for mail and telephone surveys. Although a formal survey-process framework is lacking for internet-based surveys, the basic tenets should be the same regardless of the survey medium. This holistic approach includes defining the survey objectives, determining the sample, creating and testing the survey instrument, contacting respondents, and conducting the appropriate analyses (Schonlau et al., 2001).

The following pages will first address the different types of internet-based surveys and each of the above stages in depth, followed by recommendations for the Natural Science Research Strategy for Marine Protected Areas Survey (NSRS Survey).

**INTERNET-BASED APPROACHES**

Internet-based survey platforms can be broken down into two main categories, email and web page surveys. Within email surveys there are three types. The first type is an email that includes a cover letter and the survey within it. Respondents are only required to reply to the email. The second type is an email with a cover letter and an attached survey. Respondents in this situation need to open the attachment, respond, and then attach their responses in another email to the survey collector. The third type is an email with a cover letter and URL embedded within, leading respondents to a web-based survey. In this situation, respondents click on the URL and fill out the survey. They do
not need to send an email back to the survey collector. Their responses are then automatically entered into a database from the web-page (Bradley, 1999).

It is important to address confidentiality and anonymity with email surveys. In the first two types of email surveys, the respondents are not anonymous because the return email indicates their email address. The email that includes a URL is also not anonymous because you can tell who has responded and who has not from the survey host’s email database. However, you can offer the respondent confidentiality by concealing any information regarding their participation in the survey in all three of these survey types.

Aside from email, web page surveys are an additional internet-based platform for surveys. There are three different methods that differ in how the sample of participants is selected. The three options are open web, closed web, and hidden web (Bradley, 1999). Open web uses a banner invitation which allows anyone on the web to enter the survey. Closed web invites respondents to a site which may be password protected. Hidden web is when a survey invitation appears on the screen after being triggered by some sort of mechanism i.e., date, visitor number, interest in a specific page, etc. Each of these is described briefly because it is important to know that they are options which can be fast and produce “clean data.” However, due to their sampling method, these methods do not provide data with much scientific value. If you are interested in pursuing one of these web page options, it’s highly recommend that you revisit your survey objectives and consult some of the listed references. Refer to Table 1 for a synopsis of internet-based survey types.
Table 1: Types of Internet-Based Surveys and Anonymity

<table>
<thead>
<tr>
<th>INTERNET-BASED SURVEYS</th>
<th>ANONYMOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-MAIL</td>
<td></td>
</tr>
<tr>
<td>E-mail</td>
<td>No</td>
</tr>
<tr>
<td>E-mail with survey attachment</td>
<td>No</td>
</tr>
<tr>
<td>E-mail with URL embedded</td>
<td>No</td>
</tr>
<tr>
<td>WEB-PAGE</td>
<td></td>
</tr>
<tr>
<td>Open-web</td>
<td>Yes</td>
</tr>
<tr>
<td>Closed-web</td>
<td>Yes</td>
</tr>
<tr>
<td>Hidden-web</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Out of the above internet-based approaches to surveys, I recommend using the email with a URL embedded inside. Some advantages to this survey type are that once respondents answer the questions, their data is instantaneously entered into a database for analysis. There is no time required for the survey collectors to input data thus creating “clean data.” This also reduces the amount of time to analyze the data.

There are numerous organizations that can host a survey online and that offer other useful services to conduct a successful survey. I recommend using SurveyMonkey.com. They are inexpensive ($19.95/mo), allow for any sample size, are easy to use, and prompt at responding to help desk or technical support inquiries. I have created a sample survey through SurveyMonkey.com which may be useful to refer to when beginning your own survey and could serve as an initial attempt at the NSRS Survey. Feel free to contact me for access to the sample survey.

DEFINING SURVEY OBJECTIVES

Defining survey objectives is a critical step in the process of creating and implementing a successful survey. Here are some questions to ask yourself.

- Why are you conducting the survey?
- What is the information gap you are trying to fill with this survey?
- What problem are you trying to solve?
• What new information do you need to solve it?

For example, the NSRS Survey has two main objectives: to develop regional design criteria and research needs for MPAs. Having clear and defined survey objectives allows for the design of more focused and useful questions in the actual survey instrument. You do not want to appear to be wasting the respondents’ time with insignificant questions. This can often lead to fewer survey responses.

The population of interest needs to be defined as well as the type of data to be collected and the desired precision of the results. The population of interest for the NSRS Survey is marine resource stakeholders. Since there are many different types and degrees of marine resource stakeholders, it is key to decide whose information you are most interested in obtaining. For our purposes, the sample will include those who are most active in the marine environment whether they are studying, earning their livelihood from, or trying to protect it. Table 2 categorizes these marine resource stakeholders first in a broad general sense, but then provides more specific examples in the second column. This population is more likely to give us the information we are seeking in our survey objectives. The type of data that needs to be collected from the sample are opinions and rankings of criteria. The precision of the results is on a regional level in order to establish regional priorities.

Table 2: Population of Interest for NSRS Survey

<table>
<thead>
<tr>
<th>Marine Resource Stakeholders</th>
<th>Specific</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td><strong>Specific</strong></td>
</tr>
<tr>
<td>1. Fishermen</td>
<td>commercial, recreational</td>
</tr>
<tr>
<td>2. Non-profit/non-government organizations</td>
<td>environmental, trade/industry, user groups</td>
</tr>
<tr>
<td>3. Tourism/non-consumptive recreation</td>
<td>diving, boating, nature-based tours</td>
</tr>
<tr>
<td>4. Marine Resource Managers</td>
<td>state, federal, tribal</td>
</tr>
<tr>
<td>5. Scientists</td>
<td>academic, government</td>
</tr>
<tr>
<td>6. Maritime Industry</td>
<td>shipping, ports and harbors, military/Coast Guard, marine suppliers, weather services</td>
</tr>
<tr>
<td>7. Other Maritime Industry</td>
<td>oil/gas/mineral extraction, underwater cables, dredging, engineering/construction, alternative energy</td>
</tr>
</tbody>
</table>
DETERMINING THE SURVEY SAMPLE

Now that you have defined the survey's objectives, you need to determine how to sample the population of interest. Sampling a population can be either probability-based or non-probability based. Probability-based samples are when the probability that an individual is selected into a sample can be computed. This method of sampling assumes that the sample is representative of a larger population; thus, researchers only need to survey a part of the population. They can then use statistical inference in the analyses of the data to relate the results to the greater population. While this method allows for the use of statistical inference, it is a more timely process than non-probability-based sampling (Schonlau et al., 2001).

Depending on your needs, a non-probability based sample may be adequate. This method often requires less time and effort. In this type of sample the probability of an individual selected into the sample cannot be computed. Convenience-based and purposive samplings are two examples of non-probability based sampling. Convenience-based means whoever you can get to take the survey while purposive sampling is targeting people you want to participate in the survey. Purposive sampling can be great for exploratory research, yet it is important to remember that these two types of sampling do not yield results that can be extrapolated onto the larger population. Since the sample you selected is not representative of the general population, your results are only representative of those you sampled, not any larger population (Schonlau et al., 2001).

For the NSRS Survey, I suggest a type of sampling that is both probability-based and purposive. The population of interest is marine resource stakeholders and specifically the ones listed in Table 2. I recommend obtaining membership email lists and organizational email lists that are comprised of these stakeholders (ex. fishermen associations, conservation groups, etc). This is known as a closed population or creating a sample frame because the population is well defined and does not include anyone from outside of the selected groups and associations. It is a purposive sample as well because these particular groups are being targeted for a reason. They are basically a chosen subpopulation of the general population of interest, marine resource stakeholders. These lists will need to be obtained for all coastal areas of the U.S. including commonwealths.
and territories. These coastal areas are grouped into Large Marine Ecosystems or LMEs. LMEs are defined as large geographic regions of ocean and coastal space characterized by distinct hydrography, bathymetry, productivity, and trophically dependant populations. NOAA has identified LMEs to aid in the implementation of ecosystem based assessment and management practices (NOAA, 2004). Refer to Table 3 for a list of these LMEs and to Figures 1 and 2 for their geographical locations.

Unless you decide to survey everyone on the membership lists, the probability based portion of the sampling comes when you select a sample from the membership lists. I recommend performing a systematic random sample of the lists. This is when every “nth” person on the list will receive the survey invitation email and URL link. By conducting a systematic random sample of the lists, your survey results can be generalized to the group, organization, or association you are surveying. This will become important when you analyze your data and try to create regional priorities for MPAs. For example, you could compare the different organizations within a region as well as across regions.

Table 3: Large Marine Ecosystems in U.S. jurisdiction

<table>
<thead>
<tr>
<th>Large Marine Ecosystems</th>
<th>States/Territories Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEAUFORT SEA</td>
<td>North side of AK</td>
</tr>
<tr>
<td>EASTERN BERING SEA</td>
<td>West side of AK</td>
</tr>
<tr>
<td>GULF OF ALASKA</td>
<td>South side of AK</td>
</tr>
<tr>
<td>CALIFORNIA CURRENT</td>
<td>WA, OR, CA</td>
</tr>
<tr>
<td>INSULAR PACIFIC HAWAIIAN</td>
<td>HI</td>
</tr>
<tr>
<td>INSULAR PACIFIC JOHNSTON ISLAND</td>
<td>Johnston Island</td>
</tr>
<tr>
<td>INSULAR PACIFIC WAKE ISLAND</td>
<td>Wake Island</td>
</tr>
<tr>
<td>INSULAR PACIFIC SAMOA</td>
<td>American Samoa</td>
</tr>
<tr>
<td>INSULAR PACIFIC MARIANAS</td>
<td>Northern Marianas Islands, Guam</td>
</tr>
<tr>
<td>INSULAR PACIFIC PALMYRA ATOLL</td>
<td>Palmyra Atoll Kingman Reef</td>
</tr>
<tr>
<td>INSULAR PACIFIC JARVIS ISLAND</td>
<td>Jarvis Island</td>
</tr>
<tr>
<td>INSULAR PACIFIC HOWLAND &amp; BAKER ISLANDS</td>
<td>Howland and Baker Islands</td>
</tr>
<tr>
<td>GULF OF MEXICO</td>
<td>TX, LA, MS, AL, western FL, FL. Keys</td>
</tr>
<tr>
<td>CARIBBEAN SEA</td>
<td>Puerto Rico, U.S. Virgin Islands</td>
</tr>
<tr>
<td>SOUTH EAST U.S. CONTINENTAL SHELF</td>
<td>eastern FL, GA, SC</td>
</tr>
<tr>
<td>NORTH EAST U.S. CONTINENTAL SHELF</td>
<td>NC, VA, MD, DE, NJ, NY, CT, RI, MA, NH, ME</td>
</tr>
</tbody>
</table>
SURVEY AND QUESTION DESIGN

Survey Design

It is imperative to place the respondent and the survey’s objectives at the forefront when creating a survey. With the graphic and multimedia capabilities of the World Wide Web regarding survey design, both the physical and visual presentation of a survey can notably affect survey responses (Dillman, 2000; Gunn, 2002). Survey design involves both the layout of the survey (i.e., colors, images, radio boxes, how many pages, time to complete, scrolling, etc.) and the actual questions (i.e., types of questions, wording, content, etc.). Overall, minimizing respondent frustration is extremely important to conducting a successful survey. The less frustrated a respondent is, the more likely they will complete the survey which will help you attain your survey objectives. Reducing frustration most commonly is done by two methods; minimizing the time it takes to complete the survey and making a user-friendly survey.

Minimizing the time required to participate in the survey can be accomplished in numerous ways. One way is to keep the survey both brief and concise by only including questions that directly relate to the survey objectives (Frary, 1996; Dillman et. al, 1998). Numerous researchers have found that even though the web has many graphic and multimedia capabilities for enhancing the look of a survey, a simple design is best (Dillman, 2000; Gunn, 2002). Including graphics and images not only requires more time to download the web page, but they can affect respondents interpretations of questions as well (Schonlau et. al, 2001). It has also been found that placing questions on separate pages in an internet-based survey increases downloading time and the option of placing them all on one page for respondents to scroll through increases frustration levels. Researchers advise to include a mixture of both methods, multiple web-pages containing multiple questions for respondents to scroll through per web-page (Dillman, 2000; Gunn, 2002).

Creating a user-friendly survey is another key component to minimizing respondent frustration. One way to accomplish this is by using a conventional format similar to paper surveys; vertical layout with numbered questions and distinct spaces between questions (Dillman et. al, 1998 ;Gunn, 2002). In addition, radio boxes should be used for questions that have a few answer choice, while drop-down menus should be used
where there are a lot (~15 or more) (Schonlau et al., 2001). Respondents also should not be required to answer questions before moving to the next question or subsequent page. This has been found to increase frustration levels and decrease response rates (Dillman et al., 1998; Schonlau et al., 2001). It is important as well to decrease browser incompatibilities and security issues. To do this, try only using HTML without any plugins, i.e. Java, JavaScript, or ActiveX (Schleyer and Forrest, 2000).

Lastly, it is important to relay to the respondent where they are in the survey. You can do this one of two ways; either include some sort of progress bar or time bar, or use descriptive words and phrases such as “Lastly, we would like to ask you questions concerning...” It may be easier to use descriptive words because a time bar may increase the time it takes to download each page of the survey.

Creating the Questions

Drafting questions for a survey can be a challenging task, but I have included some key ideas and guidelines below to help get you started on your way. Questions are classified into asking for one of two types of information – behavior/attribute and attitudes/beliefs (Salant and Dillman, 1994). An example of a behavior/attribute is asking if the respondent exercises or has been employed over the last six months. An example of an attitude/belief is whether the respondent favors increasing the number of trash bins on the beach or they believe that smiling at people brings good karma back to them.

Knowing which type of information you are seeking with each question will help in their design and the answer choices given. In general there are four main types of questions – open-ended, close-ended with ordered response choices, close-ended with unordered response choices, and partially close-ended (Salant and Dillman, 1994).

Open-ended questions are the most difficult to answer and analyze, yet are the easiest to write. Open-ended questions are good for when a precise piece of information is needed such as “What year were you born?” or “What state do you live in?” These types of questions can also be useful when they follow a close-ended question (to ask respondents why they selected a particular answer) or to give the respondents a chance to express strong opinions, vent frustrations, and let the researcher know if any information has been overlooked. In many cases though these types of questions are more demanding of the respondent because there are no answer choices. They must think of and type their
own original answer. Open-ended questions also produce many different responses which make it difficult to analyze information across the entire sample and to guide decision making if that is an objective (Salant and Dillman, 1994).

Close-ended questions with ordered choices tend to be very specific, less demanding on the respondent, and easy to analyze. Each answer choice represents a scale for a single concept; therefore, a complete range of possible answers is provided for the respondent to choose from (Salant and Dillman, 1994). An example of this type of question is below:

1. How do you feel about this statement? “This community needs more trash receptacles.”
   a. STRONGLY DISAGREE
   b. MILDLY DISAGREE
   c. NEITHER AGREE NOR DISAGREE
   d. MILDLY AGREE
   e. STRONGLY AGREE

Close-ended questions with unordered response choices are when the answer choices do not fall on a continuum. Respondents are required to evaluate each distinct answer choice and select the one that best reflects their behavior, attitude, or belief. An example is:

2. Out of the fruits listed below, which one do you like most?
   a. STRAWBERRIES
   b. APPLES
   c. BLACKBERRIES
   d. CHERRIES
   e. BLUEBERRIES

As you can see, this question requires a little more effort from respondents because they need to evaluate each choice separately. The choices do not fall on a continuum describing one concept as the answer choices do in question one. These types of questions can often be used to have respondents rank answer choices. These should be used sparingly because they are more demanding and time consuming for respondents to answer. In addition, these questions are susceptible to the “category order effect.”
Researchers have noted that respondents in paper surveys tend to only read the first few answer choices and select an answer, whereas in telephone surveys, respondents only remember the latter responses and choose from them (Salant and Dillman, 1994). There is no full-proof solution to the problem, but it can be somewhat remedied by keeping your list of answer choices short.

Partially close-ended questions are those that give unordered answer choice, but add an “OTHER (PLEASE SPECIFY)” category. In a sense, they are a cross between open and closed-ended questions. These types of questions do not force respondents into a particular answer if the options do not suit their situation, but they still may induce the “category order effect” mentioned above. They can also generate new information for researchers (Salant and Dillman, 1994). Please refer to Table 4 for a detailed description of the advantages and disadvantages of each type of question.

Table 4: Advantages and disadvantages for each type of question.

<table>
<thead>
<tr>
<th>QUESTION TYPE</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Open-ended</td>
<td>- easy to write</td>
<td>- difficult to analyze</td>
</tr>
<tr>
<td></td>
<td>- good for precise information</td>
<td>- demanding on respondent</td>
</tr>
<tr>
<td></td>
<td>- follow-up close-ended questions</td>
<td></td>
</tr>
<tr>
<td>2. Close-ended with ordered responses</td>
<td>- very specific</td>
<td>- may be too specific for needs</td>
</tr>
<tr>
<td></td>
<td>- easy to analyze</td>
<td>- limit respondents to answers given</td>
</tr>
<tr>
<td></td>
<td>- not demanding on respondent</td>
<td></td>
</tr>
<tr>
<td>3. Close-ended with unordered responses</td>
<td>- easy to analyze</td>
<td>- demanding on respondents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- limit respondents to answers given</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- category order effect</td>
</tr>
<tr>
<td>4. Partially close-ended</td>
<td>- may generate new information</td>
<td>- category order effect</td>
</tr>
<tr>
<td></td>
<td>- somewhat easy to analyze</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- does not limit respondents</td>
<td></td>
</tr>
</tbody>
</table>

**It is important to note here that none of the four question structures above is inherently better than another. Each has its advantages and disadvantages for a particular type of information.**

67
Arranging the Questions

Now that we have discussed the four basic question structures, it is important to discuss what order questions should be arranged in on the survey. The order of questions is influenced by both their content and structure. To begin with, a general rule of surveys is to order the questions so that the most interesting and topic oriented ones are at the beginning while the more objectionable and sensitive issues are raised later in the survey (Salant and Dillman, 1994). This will help keep respondents engaged and interested versus feeling like the survey is a waste of their time. You also want to build up a rapport with respondents before you ask them any real personal questions such as age, race, and income. The first question in a survey is critical and therefore it is important that it relates to the survey's purpose (Gaddis, 1998; Burgess, 2001; Dillman, 2000). Within the survey, questions on the same topic should be grouped together and within each group they should be arranged according by their structure (Salant and Dillman, 1994). Arranging questions with other similar structured questions is less demanding on respondents because they do not have to switch gears as often. For example, questions that ask for rankings should be placed next to each other. Questions of similar structure can also be shaped into matrices to take up less space and they actually take less time for respondents to complete, but use them sparingly because it is difficult to predict how a matrix will appear on the respondent's computer. This may make it difficult or confusing to answer so it is best to use these sparingly (Schonlau et. al, 2001). To change from one topic to the next throughout a survey, it is important to use transitional words when moving from section to section. This can be accomplished by saying "Next we would like to know..." or "Finally, we would like to ask..." (Salant and Dillman, 1994).

Wording of the Questions

Writing good questions often takes time and many attempts because so many things have to be taken into consideration – how to structure questions, deciding what information is needed, and avoiding a variety of wording problems that may result in inaccurate responses. Although there is no perfect list of rules for how to word or not word questions, researchers suggest that you;

- be specific
- use simple words
- keep it short
- don't talk down to people
- don’t be vague
- don’t be too specific

Some of these suggestions may seem contradictory at times, but there is a limit to each of them. Below are a few example questions from Salant and Dillman (1994) to illustrate common wording problems and possible revisions. Refer to their book for further details and examples on these issues.

Example 1: Vaguely worded questions and responses

Do you actively support, support, or not support expanded public transportation services in your community?

4. ACTIVELY SUPPORT
5. SUPPORT
6. NOT SUPPORT

The vaguely worded question and responses above produce useless information for researchers. What does “support” mean? Here is a possible revision below.

A proposal has been made to increase the number of public bus routes so that residents will not have to travel as far to catch a bus. Would you be willing or not willing to pay an increase of 1 percent in the city gas tax to finance more bus routes?

4. WILLING
5. NOT WILLING
6. UNDECIDED

Example 2: Too much knowledge is assumed of the respondent

Do you tend to agree or disagree with the U.S. Department of Agriculture’s new regulations on labeling criteria for organic produce?

5. AGREE
6. DISAGREE
7. UNSURE OR UNDECIDED

It is important not to assume respondents know enough to answer the question. It is best to verify first what they know and proceed from there as demonstrated in the revision below.
The Department of Agriculture has recently issued new regulations regarding criteria for using the "Organic" label on fresh produce. Were you aware or not aware that the agency had issued new regulations?

1. AWARE
2. NOT AWARE

If aware, please describe these regulations in your own words.


Are these regulations acceptable or not acceptable to you, personally?

4. ACCEPTABLE
5. NOT ACCEPTABLE
6. UNSURE OR UNDECIDED

In this third example, see if you can figure out the problem with the wording.

Example 3

More Americans exercise regularly now than they did 10 years ago. Do you exercise—such as bike, walk, or swim—regularly, or do you not exercise regularly?

4. DO EXERCISE REGULARLY
5. DO NOT EXERCISE REGULARLY

If you guessed that there is bias in this question you are correct. Bias enters a question when respondents are made to think that everyone engages in a particular activity and therefore they should as well. As mentioned previously, there is no set way to word questions, but there are some general guidelines and tips that can be useful like the examples above. If surveys shared the same content and objectives, it would be much easier to come up with set rules. Please refer to the works cited page for further references on this topic (Salant and Dillman, 1994).
**Pre-testing the Survey**

Once you have completed the survey, it is important to pre-test it before sending out the official invitations to respondents. Pre-testing will allow you to catch any mistakes in grammar, wording of questions, skip logic, etc. It is helpful to have people with similar knowledge levels/backgrounds as those who will be in your sample pre-test the survey, but it is still useful to have others without experience or knowledge in the area take the survey and check for errors or incompatibilities. It is also a good idea to test the survey using different computing platforms (MAC, PC) and with different hardware configurations. Multiple browsers such as Internet Explorer, AOL, Netscape, etc. and different connection speeds should be included in the pre-testing as well. Please do not underestimate the importance of pre-testing your survey. You have expended a tremendous amount of energy into the survey so far and pre-testing is another vital step to making your survey more successful.

**CONTACT AND COMMUNICATION WITH RESPONDENTS**

The next step in the survey process is communication with respondents. Communication is vital to the success of a survey as well. There is a protocol that has been found to be successful in paper surveys which includes the initial invitation, reminder letters throughout the survey period, and thank you letters. The initial invitation email establishes the tone for the survey. Aside from including the URL to the actual survey, the email invitation needs to give the respondent a tremendous amount of information. To begin with, the invitation email should state the purpose of the study, who the sponsors are, how and why the individual was selected, and the dates that they can participate in the survey. Respondent’s should also be informed as to why their participation is important, what to expect on the survey, how long the survey will take to complete, and be given contact information if they need help or have questions. In general, you should not expect people to commit more than 15-20 minutes to complete the survey. Confidentiality issues need to be addressed. Will the respondents remain anonymous or just their information kept confidential? In addition, some surveys offer incentives to get more responses (Bourque and Fielder, 2003). I recommend offering
respondents a copy of the results unless there is more you can offer them such as money or a t-shirt, etc. Personalizing each email is also known to increase response rates and many internet-based survey providers make this easy to accomplish (Porter and Whitcomb, 2003).

If using SurveyMonkey.com, participants will click on the link at the bottom of their invitational email and be connected to the survey. From there, they will scroll and click their way through the survey, their results being instantaneously written to a database for later analysis. Once they reach the end, a concluding page will thank them for their participation and ask them for any additional comments they feel will benefit the study. The results of the survey (thus far) will be displayed on the screen for them to view. You will be able to set certain limitations on what they can view and how they can interact with the results pages.

Since the survey is in motion now, your job from here is to monitor who has and has not responded to the email invitation and give them a gentle reminder. Multiple contacts with respondents are to be expected and research has found that anywhere from one to four contacts in email surveys can increase response rates (Dillman and Schaefer, 1998). You can do this by sending a reminder email with the URL link that thanks them if they have already completed the survey and reminds them they still have time to participate if they have not. SurveyMonkey.com records who has and has not participated in the survey and makes the process of contacting recipients easy. I recommend sending out two of these emails before the survey closes. The first one should be sent four to five days after the invitational email and the second thank you/reminder email should be sent four to five days after the first one. Allow the participants another four or five days to complete the survey from the last thank you/reminder email. In total, the fielding of the survey should take fifteen to twenty days.

DATA COLLECTION AND ANALYSIS

As mentioned before, when using companies such as SurveyMonkey.com to host a survey online, data collection is done instantaneously. This is one of the many benefits
of performing a survey online because you can save time and reduce transcription errors. Depending on the company you choose, answer choices are either recorded into a database as soon as they are selected or when the respondent completes the entire survey. Most companies do some simple statistics on your data, but you can often download the data into a spreadsheet such as Microsoft Excel or a statistical package such as Statistical Package for the Social Sciences (SPSS) for further analysis.

Now that you have almost completed the survey, it is crucial to not draw any conclusions from your data that are misleading or inaccurate. You will need to constantly recall your sampling technique so that you stay within the bounds of your objectives. If you used a non-probability sampling approach, you cannot make generalizations to a larger population. You would only be able to discuss the results in terms of those people or groups that took the survey. This is important in the NSRS Survey analysis because you will be analyzing data from membership lists of selected organizations to create regional priorities. Make sure to emphasize the point that these regional priorities are based on specific groups. When your analysis and conclusions are complete, make sure you send a copy to all of the respondents thanking them for their participation.

**Accurate Survey Results**

Inevitably while conducting a survey, many potential sources of error are present that will affect the accuracy of the survey results. At the very best, surveys can produce close estimates of people’s thoughts, feelings, and actions. There are four main sources of error that affect the accuracy of survey results that anyone conducting a survey needs to be aware of and make efforts to minimize. These are coverage, sampling, measurement, and non-response errors. I will briefly introduce you to these concepts, but while creating your own survey, I suggest you consult a text on survey errors.

Coverage error occurs when a discrepancy exists between the target population and survey population. The target population is just the subset of people that are the focus of the survey while the survey population is the subset of the target population that actually receives the survey. The amount of coverage error is dependent on how different those in the survey population are from those in the target population. Having accurate and up-to-date lists that do not contain duplicate entries can help reduce coverage error.
Whenever researchers survey a sample of a population, sampling error is introduced automatically. Sampling error is the basic idea that there are discrepancies among those surveyed in a sample and that the fewer people you survey, the less accurate your results will be. The more people you survey, the more accurate your results will portray your survey population. This type of error therefore can be somewhat minimized by increasing the sample size so that more of the population is being surveyed. Sampling error can only be avoided by conducting a census of a population.

Measurement error is a factor when data is being collected. There are many different sources of it including the questionnaire that you have so carefully designed. An example is when a respondent who attends church once a month answers "OCCASSIONALLY" to a question asking "How often do you attend church?" while another respondent who attends church once a year checks "OCCASSIONALLY" as well. The information that the researcher is trying to collect is not accurately measuring the respondent's actions.

The fourth source of error is non-response error. This type of error occurs when a significant amount of people in the survey sample do not respond to the survey and when those non-responders are different from those who do respond in a way that is important to the survey. In a sense this type of error is similar to sampling error except this occurs within the survey population.

In general, paper surveys should aim to have response rates around 60-70%. While internet-based surveys do not have an acceptable response rate documented, I would suggest trying to achieve a response rate of at least 45%. Overall, it is important to weigh these four sources of error equally while creating and conducting a survey.
CONCLUSIONS & SUMMARY OF RECOMMENDATIONS FOR NSRS SURVEY

Conserving and protecting threatened marine resources and ecosystems in United States waters is a critical need. One of the first steps in meeting this need is to gather information from those most affected by conservation and protection decisions—marine resource stakeholders. This project outlines a process an efficient and relatively inexpensive approach for gathering information from these stakeholders on national and regional-level research priorities for establishing marine protected areas (MPAs). The prototype survey presented here is a starting point for identifying the natural science research priorities in the absence of NOAA’s Natural Science Research Strategy (NSRS) for MPAs. Once the NSRS is created, the prototype survey questions can be modified to compliment the specific priorities addressed in the NSRS. An alternative for the MPA Center to consider is conducting the internet survey first and then create the NSRS based on the information gathered from the survey. This would help create an NSRS for MPAs that is focused on each region’s priorities and research needs.

This project can serve as a springboard for the MPA Center’s mandate in E.O. 13158 to create a national system of MPAs. As many researchers have noted, stakeholder input is critical to the success of MPAs. Gathering this input should be one of the first priorities for creating this system of MPAs. Establishing a national network of MPAs will be a lengthy process. The sooner the information-gathering process begins, the sooner our oceans and marine resources will get the protection they warrant.

Recommendations

The results of this project suggest a number of actions that need to be undertaken by the MPA Center. First and foremost is that the MPA Center needs to complete a draft of the research strategy. Second, the MPA Center needs to engage survey professionals with design and data analysis experience to follow through with this report’s recommendations. Also important is that the organization selected to conduct the survey be one that is viewed as unbiased. The Communication Partnership for Science and the Sea (COMPASS) was originally a partner with the MPA Center on this survey, but has since pulled its funds. A possible replacement partner could be a university from each
region of the U.S. being surveyed, perhaps institutions with Sea Grant extension programs, such as Oregon State University, University of Rhode Island, University of Alaska at Fairbanks, University of Hawaii, University of Puerto Rico, and so on. Additional recommendations are addressed below for conducting this internet-based survey.

**Survey Objectives**

At the time this document was written, the goals of the survey were two-fold: to identify regional science criteria and research needs for MPAs throughout the United States. If the objectives of the survey remain the same when the draft NSRS is completed, then the recommendations below apply. However, if survey objectives change, then some of the following recommendations may need to change as well. Having clear, well-defined survey objectives will allow for the design of more focused and useful questions in the survey instrument.

**Target Population**

The population of interest needs to be defined as well as the type of data to be collected and the desired precision of the results. Currently, the population of interest for the NSRS Survey is marine resource stakeholders. (It is important to note that “stakeholders” is a politically charged word for some audiences and a possible replacement term should be considered for use in the survey and the findings of the survey). Since there are many different types and degrees of marine resource stakeholders, it will be important to decide what information is most important to obtain and who has that information. For purpose of this survey, the sample should include those who are most active in the marine environment, including those who are researching, earning their livelihood, or trying to protect it (Table 2 provides examples). Individuals from these groups are likely to provide the kinds of information the survey seeks, such as opinions on data needs and rankings of scientific criteria. The desired precision of the results is on a regional level in order to establish regional priorities.
Table 2: Marine resource stakeholder populations of interest for NSRS survey.

<table>
<thead>
<tr>
<th>General Categories</th>
<th>Specific Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishermen</td>
<td>commercial, recreational</td>
</tr>
<tr>
<td>Non-profit/non-government organizations</td>
<td>environmental, trade/industry, user groups</td>
</tr>
<tr>
<td>Tourism/non-consumptive recreation</td>
<td>diving, boating, nature-based tours</td>
</tr>
<tr>
<td>Marine Resource Managers</td>
<td>state, federal, tribal</td>
</tr>
<tr>
<td>Scientists</td>
<td>academic, government</td>
</tr>
<tr>
<td>Maritime Industry</td>
<td>shipping, ports and harbors, military/Coast Guard, marine suppliers, weather services</td>
</tr>
<tr>
<td>Other Maritime Industry</td>
<td>oil/gas/mineral extraction, underwater cables, dredging, engineering and construction, alternative energy</td>
</tr>
</tbody>
</table>

**Sampling**

For the NSRS Survey, a type of sampling that is both probability-based and purposive will be most applicable. The population of interest is marine resource stakeholders and specifically the ones listed in Table 2. Obtaining membership email lists and organizational email lists that are comprised of these stakeholders (ex. fishermen associations, conservation groups, etc.) is one of the first steps. This is known as a closed population or creating a sample frame because the population is well defined and does not include anyone from outside of the selected groups and associations. It is a purposive sample as well because these particular groups are being targeted for a reason. They are a chosen subpopulation of the general population of interest, marine resource stakeholders. These lists will need to be obtained for all coastal areas of the U.S. including commonwealths and territories. Coastal areas are grouped into Large Marine
Ecosystems or LMEs (Table 3 and Figures 1 and 2). LMEs are defined as large geographic regions of ocean and coastal space characterized by distinct hydrography, bathymetry, productivity, and trophically-dependant populations and have been identified to aid in the implementation of ecosystem-based assessment and management (NOAA, 2004).

Unless everyone on the membership lists is surveyed, the probability-based portion of the sampling occurs when a sample is selected from the membership lists. A systematic random sample of the lists is a great option. This is when every “nth” person on the list will receive the survey invitation email and URL link. By conducting a systematic random sample of the lists, the survey results can be generalized to the group, organization, or association that is surveyed. This will become important when analyzing the data. For example, a comparison could be made between the different organizations within a region as well as across regions.

Web Survey Host and Questionnaire Design

The MPA Center should utilize SurveyMonkey® as the survey’s web host. It is the least expensive user-friendly and efficient web host for this survey’s needs.

For survey and question design, refer to the “Guidebook to Internet-Based Surveys” (Appendix A) for detailed recommendations. One example is that the use of open-ended questions should be minimized and if used, should generally be follow-ups to the previous question. A simple example is:

2. Do you agree or disagree with efforts to establish marine protected areas for conservation of biodiversity?
   a. STRONGLY AGREE
   b. AGREE
   c. NEUTRAL
   d. DISAGREE
   e. STRONGLY DISAGREE
2. Briefly explain your response to question 1.

In addition to the suggestion above, it will be important to include partially close-ended questions so that respondents are not limited to just the answers you have supplied. They can check “OTHER” and write in their own response. In terms of survey layout and wording of questions, there are numerous suggestions that are supplied in the previous sections of this guidebook.

Table 3: Large Marine Ecosystems in U.S. or partial US jurisdiction (NOAA 2004).

<table>
<thead>
<tr>
<th>Large Marine Ecosystems</th>
<th>States/Territories Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaufort Sea</td>
<td>North side of AK</td>
</tr>
<tr>
<td>Eastern Bering Sea</td>
<td>West side of AK</td>
</tr>
<tr>
<td>Gulf Of Alaska</td>
<td>South side of AK</td>
</tr>
<tr>
<td>California Current</td>
<td>WA, OR, CA</td>
</tr>
<tr>
<td>Insular Pacific Hawaiian</td>
<td>HI</td>
</tr>
<tr>
<td>Insular Pacific Johnston Island</td>
<td>Johnston Island</td>
</tr>
<tr>
<td>Insular Pacific Wake Island</td>
<td>Wake Island</td>
</tr>
<tr>
<td>Insular Pacific Samoa</td>
<td>American Samoa</td>
</tr>
<tr>
<td>Insular Pacific Marianas</td>
<td>Northern Marianas Islands, Guam</td>
</tr>
<tr>
<td>Insular Pacific Palmyra Atoll</td>
<td>Palmyra Atoll Kingman Reef</td>
</tr>
<tr>
<td>Insular Pacific Jarvis Island</td>
<td>Jarvis Island</td>
</tr>
<tr>
<td>Insular Pacific Howland &amp; Baker Islands</td>
<td>Howland and Baker Islands</td>
</tr>
<tr>
<td>Gulf Of Mexico</td>
<td>TX, LA, MS, AL, western FL, FL. Keys</td>
</tr>
<tr>
<td>Caribbean Sea</td>
<td>Puerto Rico, U.S. Virgin Islands</td>
</tr>
<tr>
<td>South East U.S. Continental Shelf</td>
<td>eastern FL, GA, SC</td>
</tr>
<tr>
<td>North East U.S. Continental Shelf</td>
<td>NC, VA, MD, DE, NJ, NY, CT, RI, MA, NH, ME</td>
</tr>
</tbody>
</table>
Figure 1: Large Marine Ecosystems in U.S. jurisdiction (Source: NOAA Regional Ecosystem Delineation Workshop Proceedings, 2004).

Figure 2: Insular Pacific Exclusive Economic Zone boundaries, corresponding generally to Insular Pacific large marine ecosystems (Source: NOAA Regional Ecosystem Delineation Workshop Proceedings, 2004).
Pre-Testing the Survey

Once the survey has been designed, it will need to be put it through a preliminary test or pre-test. A tremendous amount of energy goes into a survey up to this point, and pre-testing is another vital step to creating a successful survey. Pre-testing will help catch any mistakes in grammar, wording of questions, skip logic, etc. It is helpful to select pre-testers with similar knowledge levels/backgrounds as those who will be in the actual sample. It is also important to include pre-testers without experience or knowledge in the subject area. They can provide a mechanism for checking errors and incompatibilities. It is also a good idea to test the survey using different computing platforms (MAC, PC) and with different hardware configurations. Multiple browsers such as Internet Explorer, AOL, Netscape, etc. and different connection speeds should be included in the pre-testing as well.

Contacting Respondents

Once the survey is ready to be administered, the next step will be to contact and communicate with respondents. As mentioned in the guidebook, it is important that the initial email invitation include a cover letter and a link to the survey. The cover letter needs to inform participants of the “who, what, when, where, and why” of the survey. It is critical to be honest and straightforward about confidentiality as well. Another key will be to avoid conducting your survey near or around holidays or major vacation times, such as Thanksgiving, Hanukah, spring break, etc. Conducting a survey and trying to communicate with respondents over holidays and breaks, often leads to a low survey response rate. It will also be beneficial to include links to information on MPAs, so that respondents who choose to can read more about MPAs before taking the survey.

It is recommended that the schedule/timeline for administering the survey take a total of 15 days. Some research shows that internet surveys can be fielded successfully in less than 10 days, but this paper recommends the timeline displayed in Table 4.

Marine and coastal management is largely about information sharing, communicating, monitoring, and evaluating; therefore, the potential benefits from an information management and communication tool such as the internet are tremendous (Kay and Christie, 1999). As access to the internet continues to expand, it is
Table 4: Recommended NSRS Survey Timeline

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Send the initial email invite with cover letter and URL link to the survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 5</td>
<td>Send the first thank you/reminder email with the URL embedded</td>
</tr>
<tr>
<td>Day 10</td>
<td>Send out the second thank you/reminder email with the URL embedded</td>
</tr>
<tr>
<td>Day 15</td>
<td>At midnight, close access to the survey and begin analyzing data</td>
</tr>
</tbody>
</table>

recommended that the MPA Center conduct more research on utilizing other capabilities of the internet to solicit stakeholder input. In particular, online chat rooms and virtual communities could provide another opportunity to interact with stakeholders on the scientific design and implementation of MPAs. In addition to transcending geographic barriers, online chat rooms and internet surveys also make it possible to hear more opinions instead of the few opinions that may dominate face-to-face interaction.

Nevertheless, it is still important to weigh the strengths and limitations of using the internet to communicate and gather input from stakeholders. While some strengths include its relative low cost and transcendence of geographic barriers, some limitations to consider are the access of stakeholders to the internet and their ability to interact using a computer and its software. These limitations can create a significant of bias in the survey results. This bias should be carefully considered in deciding to conduct an internet survey. Methods that can be employed to reduce this bias are offering a variety of survey response modes, i.e. internet, postal, telephone, etc. These options need to be presented to the organizations/associations when first asking for email lists.

Even with a variety of response modes to choose from, some stakeholders may not want to participate in the survey for various reasons. If this happens, it is important for the surveyor to reach out to these groups and ask them what they would prefer. It may be necessary to conduct an in-person meeting with these organizations to make sure their voices are heard and that their opinions are included in the design of this national system of MPAs.
REFERENCES


Although the focus of this book is not on internet surveys, it does discuss them briefly in different chapters. (This synopsis of the book will only focus on the information regarding internet surveys.) Online surveys have multiple advantages and challenges to their implementation and success. Some advantages include that they allow for a wide geographic coverage; could add auditory stimuli to the visual questionnaire; provide clean data with no end-stage processing; can increase the sample size with little or no additional costs; and decrease the amount of time needed to conduct the survey. For all of these advantages there are definitely some important challenges worth noting. The surveyor needs appropriate computer equipment and survey software plus a programmer or technician skilled in the application of this software to conduct an online survey. Responses to email and internet surveys may be confidential but not anonymous. The survey programming needs to control for multiple entries of the survey by the same respondent. Along these same lines, the survey needs to control for the targeted sample population which is difficult given the digital divide/social divide of using the internet as the survey medium. There are also issues with downloading the survey. The more complex the survey (i.e. pictures, skip logic questions, coding, progress bars) the slower the download time. This will increase respondent frustration and lower the response rates.

Probability and non-probability sampling selection are applicable when conducting Internet surveys. From a sampling viewpoint, the self-completion method of data collection over the Internet is very important because a survey is only as representative as the sample of people chosen to partake in the survey. This article highlights possible sample sources for internet surveys (pop-up surveys, web-site directories, e-mail directories, subscribers, etc.) as well as six options for designing an internet survey. Three are web-page style surveys (open, closed, hidden) and three are e-mail style surveys (simple e-mail, e-mail attachment, e-mail URL embedded). In addition, thirteen types of computer users are defined based on their “user capability” and “equipment capability.” Each type of computer user poses challenges for sampling techniques.
Internet surveys can provide significant research benefits to scientists who are interested in researching people that are normally difficult to reach and/or research issues that are particularly sensitive. Coomber’s study involves drug dealers from around the world and the practice of “cutting drugs with other substances to increase profit margins on drugs sold.” Drug dealers were solicited on drug related newsgroup websites such as alt.drugs.hard and rec.drugs.misc. Eighty reliable responses were received spanning 14 countries and 4 continents. Respondents ranged from drug users to drug dealers (street, wholesale, and friend-only dealers) and had various levels of involvement in terms of their income from drugs. Although this study’s population sample was not a probability sample, useful information was able to be gathered through the survey on the practice of “cutting” drugs for profit. This information, in conjunction with data from interviews with drug users and dealers in a prison, helped this researcher suggest that “cutting” drugs does not happen as often as we may think and it may be more of a “street myth.”


Couper points out that web surveys represent a “double-edged sword” for the survey industry. While web surveys provide quick data and can cover a large sample size, they may bring the survey industry down by the bombardment of survey requests that is already occurring from other industries such as marketing and entertainment. In addition, web surveys need to address the major sources of error that occur in all surveys (sampling, coverage, nonresponse, and measurement error). There are both nonprobability methods and probability-based methods in web surveys. It is important that reports/conclusions resulting from data collected through web surveys accurately reflect the type of methods used.


This article assesses the effects of web survey design on resulting data quality. Three experiments on design approaches were added to a survey of university students. Among the design approaches tested were a progress bar versus no awareness of progress, multiple items per screen versus one question per screen, and radio buttons to enter responses versus entering numerical responses in a box provided. The results showed that the presence of a progress bar did not affect response rates. Having multiple questions per screen resulted in less time to complete the survey as well as more substantive answers. The radio button
version of the survey took less time to complete and having entry boxes for respondents to enter numbers resulted in more missing data.


This research set out to achieve response rates in email surveys that are consistent to mail surveys (60%-75%). They created a case study where the survey population was divided into four groups which received different treatments of the survey. Three criteria were used to assess the success of the email survey treatments compared to the standard mail group. Response rates, quality of the data (nonresponse and length of response to open-ended questions), and speed of response were compared across the survey treatments. Results showed that for the sample population, comparable response rates can be achieved for mail surveys and e-mail surveys (57.5% and 58% respectively). The e-mail mode obtained more returned completed questionnaires; less nonresponse to questions; open ended questions contained more words in their response (avg. = 10 words for mail and 40 words for email); and the average time to complete the email survey was 9 days versus 14 days for the paper mail surveys. The authors note that using a multiple mode design for email surveys will continue to be necessary to decrease coverage error, but that internet based surveys will be even more effective overall than email surveys.


This paper identifies 11 design principles for designing a respondent-friendly web survey, which is defined as a survey constructed to increase responses and the accuracy of responses from those surveyed. The three main criterion that these design principles are based on are: 1) the survey should take into account that advanced programming may not be received or easily responded to because of transmission, browser, and equipment limitations of those being surveyed; 2) the design needs to operate logically from both a computer and human standpoint; 3) web surveys need to account for the likelihood of being used in a mixed-mode survey.


Web survey designers have access to sophisticated software and a variety of other design options for their surveys. A study comparing two different designs, fancy and plain, of the same web survey was conducted to assess the impact of survey
design on response rates and data quality. The results of the study suggest that using a plain questionnaire (one without color and html tables) takes less time to download, has a higher response rate, and is more likely to be fully completed (last page seen, number of pages completed, write-in boxes completed). It also took respondents less time to complete the survey. These results could have large implications for the design of web surveys.


This book covers several important aspects of email and internet surveys. This brief summary will focus on the advantages and disadvantages of using email and internet surveys. Advantages include that they overcome international boundaries to conducting surveys; eliminate paper, postage, mail-out, data entry costs, and dramatically lowers costs related to sample size and survey costs. Usually with other methods, telephone, paper, and interviews, the cost increases the more people you survey, but for electronic and internet surveys this is not necessarily the case. Disadvantages of email and internet surveys are that they raise concerns about security and confidentiality (therefore trust as well), people’s computer skills, computer operating systems, screen configurations, and sampling coverage. Dillman also describes some tactics for the design of email and web surveys.


The author of this paper examines different types of web-based surveys, the advantages and challenges of them, possible design options, and issues of validity, error, and non-response. Noted advantages of web-based surveys include reduced cost, faster response rate, error checking capability, faster processing of data, and ease of sending reminders to participants. Concerns with web-based surveys are security issues, sampling methods, lack of computer expertise in respondents, and lack of uniform access by respondents.


Web surveys are becoming increasingly popular. This study investigates the impact of changing the email contact notice to analyze the effects of sponsorship, personalization, and scarcity. After surveying 12,000 high school students on the web, it was found that personalization of the email and sponsorship of the survey was of no consequence for increasing response rate. This is opposite of what is found in mail surveys. Including a statement informing the respondent that they have been selected as part of a small group to complete the survey and mentioning of a deadline when the survey website will shut down, increased response rates by 8%. Due to the increase in junk mail to people’s email accounts, survey
researchers that use the web, will have to continually alter their methods to attain higher response rates.


This case study describes a non-probability web-based survey of dentists. The results show that when compared with mail surveys, web surveys have potentially lower costs and collect data more quickly and efficiently. However, this case study also confirms that survey usability, the computer literacy of participants, and program defects all affect survey response and measurement accuracy.


This book addresses three main questions for researchers who are contemplating using internet surveys to collect data. These questions are: 1) When should an internet survey be considered? 2) What type of internet survey is appropriate for the study? and 3) How should the internet survey be designed and implemented? There is an emphasis on convenience versus probability sampling techniques and making sure that research results are analyzed to the level that the sampling technique permits. Shonlau et al. also addresses claims that internet surveys are faster, better, and cheaper than traditional methods (mail, telephone, interview).


In the past few decades, organizational researchers have been assessing the effectiveness of using email, the web, and a combination of the two for conducting surveys. These researchers have discovered major issues to be aware of when determining whether using an internet tool for survey data collection is appropriate and how to go about it. The major issues addressed in the article are: confidentiality and security issues, response rates, response completeness and quality, response options, survey design, non-respondent follow up, response speed, sample selection, restricted access, and technical issues.
APPENDIX B: SAMPLE INVITATIONAL EMAIL

March 15, 2004

Dear ____________________,

You have been selected to take part in a study concerning citizen attitudes and opinions on marine resources and marine resource conservation issues. The survey will cover topics such as anthropogenic threats to marine resources, marine ecosystem dynamics, and marine protected area design and function. The survey is sponsored by ______________ and responses to the survey will provide government and non-governmental organizations with local community perspectives and input on marine resource conservation issues. Only a small group of marine resource constituents will receive the questionnaire so your participation is integral to the study. The survey should take between 15 and 20 minutes to complete.

The answers you provide will be kept confidential to the extent permitted by law. Special precautions have been established to protect the confidentiality of your responses. There are no foreseeable risks to you as a participant in this project. All participants in the project will receive a copy of the compiled results by email upon completion of the project.

If you have any questions about the survey, please contact me at (541)908-2764 or by email at rdemirdj@coas.oregonstate.edu. In the event that I am not available when you call, please leave a message and I will return your call.

Please click on the following URL to enter the survey ____________________.

We appreciate your cooperation and thank you for your help.

Sincerely,

Renee Demirdjian
Candidate, M.S. Marine Resource Management
College of Oceanic & Atmospheric Sciences
Oregon State University
APPENDIX C: SAMPLE THANK YOU/REMINDER EMAIL

March 20, 2004

Dear ____________,

A few weeks ago a survey was sent to your household concerning citizen attitudes and opinions on marine resources and marine resource conservation issues. The survey covered topics such as anthropogenic threats to marine resources, marine ecosystem dynamics, and marine protected area design and function. The survey is sponsored by ____________ and responses to the survey will provide government and non-governmental organizations with local community perspectives and input on marine resource conservation issues. Only a small group of marine resource constituents will receive the questionnaire so your participation is integral to the study. The survey should take between 15 and 20 minutes to complete.

The answers you provide will be kept confidential to the extent permitted by law. Special precautions have been established to protect the confidentiality of your responses. There are no foreseeable risks to you as a participant in this project. All participants in the project will receive a copy of the compiled results by email upon completion of the project.

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We appreciate your cooperation and thank you for your help.

Sincerely,

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Candidate, M.S. Marine Resource Management
College of Oceanic & Atmospheric Sciences
Oregon State University
APPENDIX 3: PROTOTYPE SURVEY

Natural Science of Marine Protected Areas

1. Introduction

There are increasing efforts to protect marine resources for present and future use, consumption, and enjoyment. Protecting marine resources requires social, cultural, scientific, and economic information. This study strictly looks at the natural science considerations to siting and designing marine protected areas (MPAs). This survey is an initial attempt to gather marine resource stakeholder input on regional scientific design criteria and research needs for establishing a national system of MPAs.

Your input on these issues will be extremely valuable to decision-makers and the marine environment. Your answers and comments are strictly confidential throughout this survey. The survey should take approximately 15 minutes to complete.

Thank you in advance for your time assisting us with this survey.

Sponsors -
Communication Partnerships for Science and the Sea (COMPASS) & the National Marine Protected Areas Center, Science Institute

2. Marine Ecosystems

This section of the survey asks you some general questions about your interests, activities, and knowledge of marine resources in your region. Please mark only one response per question.
1. How often do you visit or use coastal areas and/or resources?

- Never
- Rarely - no more than once or twice a year
- Occasionally - several times a year
- Somewhat frequently - at least once a month
- Very frequently - at least once a week

2. What is your primary connection to the ocean and its resources?

- Recreation
- Leisure
- Basis of employment
- Cultural
- Conservation
- Spiritual
- Exploration and discovery
- Other (please specify)
3. Which human threat do you think is most relevant to the marine region nearest your location? Please select only one.

- Ocean dumping
- Nutrient enrichment from runoff
- Climate change
- Destructive fishing techniques
- Mining/dredging
- Invasive species
- Natural disaster (hurricane, etc.)
- Overexploitation of fisheries
- Erosion
- Don't know
- Other (please specify)
4. Which human threat do you think is the least relevant to the marine region nearest your location?

- Ocean dumping
- Nutrient enrichment from runoff
- Climate change
- Destructive fishing techniques
- Mining/dredging
- Invasive species
- Natural disaster (hurricane, etc.)
- Overexploitation of fisheries
- Erosion
- Don’t know
- Other (please specify)

5. What is your primary source for information on marine resource issues?

- Radio programs
- Newspapers
- Internet
- Television programs
- Magazines
- Peer reviewed scientific research
- Other (please specify)
6. Please describe your opinion to the following statements by choosing one of the options to the right of each statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall health of the oceans worldwide is</td>
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<tr>
<td>Health of oceans in your region is</td>
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<td>Health and abundance of marine life in your region is</td>
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<tr>
<td>Condition of marine habitats in your region is</td>
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3. Marine Protected Areas

This section of the survey concerns your attitudes and opinions on marine protected areas (MPAs). All responses are confidential.

1. Marine protected areas (MPAs) are a type of fisheries and marine conservation management tool that restrict the use of designated areas and/or resources in the ocean. (Examples of MPAs include sanctuaries and wildlife refuges.) Would you support the establishment of MPAs in U.S. waters near your location?

- Strongly support
- Somewhat support
- Neutral
- Somewhat unsupportive
- Strongly unsupportive
2. In a marine reserve (a fully protected area of the ocean) all extractive activities are prohibited, including drilling, mining, and all commercial and recreational fishing. Swimming, diving, boating, and various research activities may still be allowed. Do you favor or oppose having marine reserves in U.S. waters near your location?

- Strongly favor
- Somewhat favor
- Neutral
- Somewhat oppose
- Strongly oppose

3. In 2000, President Clinton issued Executive Order 13158 which mandates the Marine Protected Areas Center to develop a framework for a National System of MPAs. Considering this executive order, what do you feel is the most important goal for a system of MPAs in the waters nearest your location?

- Sustainable fisheries - recovery of depleted fish stocks
- Economic sustainability - tourism
- Ecosystem biodiversity - protection of marine species and habitats
- Cultural heritage - protection cultural and historic resources
- Education - increasing ocean awareness and knowledge
- Other (please specify)
4. If MPAs were to be established in the coastal waters nearest your location with the goal of recovering depleted fish stocks, how important are each of the following criteria for siting and designing these MPAs? Please select only one answer per row.

<table>
<thead>
<tr>
<th>Least Important</th>
<th>Somewhat Important</th>
<th>Important</th>
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<tr>
<td>Critical habitat - spawning and nursery habitats</td>
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<td>Species diversity - number of species inhabiting an area (plants and animals)</td>
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<tr>
<td>Natural disaster frequency</td>
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<tr>
<td>Proximity to land</td>
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</tbody>
</table>
5. Rank the following scientific criteria, for MPAs with the goal of recovering depleted fish stocks, in terms of the level of existing knowledge.

<table>
<thead>
<tr>
<th></th>
<th>No Knowledge</th>
<th>Some Knowledge but Insufficient</th>
<th>Some Knowledge but Sufficient</th>
<th>Abundant Knowledge</th>
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<tr>
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<tr>
<td>Trophic interactions - interdependence among organisms and plants</td>
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<td>Migration patterns - adult movement in the marine environment</td>
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<td>Life histories of</td>
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6. If MPAs were to be established in the coastal waters nearest your location with the goal of protecting marine species and habitats in the area, how important are each of the following criteria in siting and designing these MPAs? Please select only one.

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</table>
Trophic interactions - interdependence among organisms and plants

Migration patterns - adult movement in the marine environment

Life histories of species - maturation and reproductive rates

Hydrographic patterns - ocean currents and conditions

4. Individual Information

We now have a few concluding questions to ensure the survey is representative of our targeted population. Answers are completely confidential.

1. What year were you born? (ex. "19__")

2. Zip Code - of primary residence
3. Which marine region are you referring to in answering this survey?

- Beaufort Sea (North AK)
- Eastern Bering Sea (West AK)
- Gulf of Alaska (South AK)
- California Current (WA, OR, CA)
- Insular Pacific Hawaii
- Insular Pacific Johnston Island
- Insular Pacific Wake Island
- Insular Pacific Samoa (American Samoa)
- Insular Pacific Marianas (Northern Marianas Islands, Guam)
- Insular Pacific Palmyra Atoll (Palmyra Atoll Kingman Reef)
- Insular Pacific Jarvis Island
- Insular Pacific Howland and Baker Islands
- Gulf of Mexico (TX, LA, MS, AL, Western FL, FL Keys)
- Caribbean Sea (Puerto Rico, U.S. Virgin Islands)
- South Eastern U.S. Continental Shelf (Eastern FL, GA, SC)
- North Eastern U.S. Continental Shelf (NC, VA, MD, DE, NJ, NY, CT, RI, MA, NH, ME)
4. Highest Level of Education
- Grade School
- Middle School
- High School
- Vocational School
- Some College
- Associate's Degree
- Bachelor's Degree
- Master's Degree
- Doctorate Degree
- Other (please specify)

5. What is your primary occupation?
- Maritime
- Fishing Industry
- Non-Profit/Non-Governmental Organization
- Resource Manager
- Academic
- Tourism and/or Non-Consumptive Recreation
- Other Marine Industry
- Other (please specify)
1. Primary area of work?

- Biophysical
- Social
- Other (please specify)

2. Primary approach to work?

- Theoretical
- Empirical
- Other (please specify)

6. Non-Profit NGO

1. Type of NGO?

- Environmental
- Trade/Industry
- User Groups
- Other (please specify)
2. What is your role?

- Scientist
- Educator
- Program Manager
- Advocate
- Other (please specify)

7. Fishing Industry

1. Type

- Commercial Industry
- Recreational Charter
- Other (please specify)

2. If in the commercial fishing industry, are you a...

- Fisherman(woman)
- Processor/Distributor
- Other (please specify)
3. If you are a fisherman/woman, what is the main gear type you use?

- bottom trawl
- hook and line
- spearfishing
- hand plucking
- Other (please specify)

8. Resource Management

1. What is the scope of your resource management responsibility?

- Fisheries
- MPA
- Non-living resources (mineral, energy)
- Water quality
- Other (please specify)

2. What level is your management position?
3. What is your role?

- Educator
- Management
- Enforcement
- Scientist
- Other (please specify)

9. Maritime

1. What type of maritime industry do you work for?

- Shipping
- Ports & Harbors
- Military/Coast Guard
- Marine Supplier
- Weather Service
- Other (please specify)
1. Type-

- Diving
- Professional media (photography, video, film, etc.)
- Wildlife/Nature-based tours (whalewatching, birdwatching, etc.)
- Boating (usage & rentals)
- Hotel/Restaurant
- Marine Retail
- Other (please specify)
12. Occupation

1. How many years of experience do you have in marine related occupations?
   - less than 1yr
   - 1-5yrs
   - 6-10yrs
   - 11-15yrs
   - 16-20yrs
   - 21yrs+

13. Conclusion

This concludes our survey. If you have additional comments, please make them in the space provided below. After this page, you will be automatically taken to the summary results of the survey thus far.

Thank you for your time.