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State Coastal Observations and Monitoring Needs: Results of a Survey to Assess Coastal Management Needs (DRAFT REPORT)

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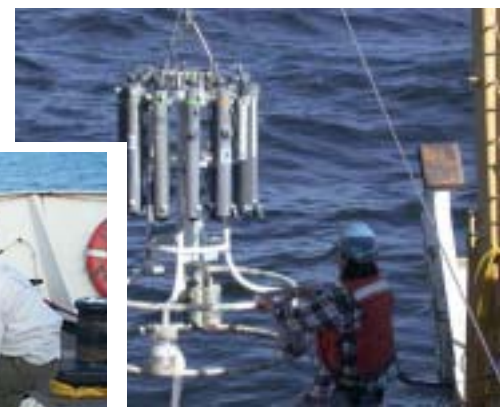
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State Coastal Observations and Monitoring Needs: Results of a Survey to Assess Coastal Management Needs

DRAFT REPORT

May 2004



Prepared for
The Coastal States Organization
and
The SEACOOS Outreach and Education Workgroup

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1 EXECUTIVE SUMMARY

In Winter 2003/2004 the Coastal States Organization (CSO) sponsored a national survey of state coastal resource managers to better understand their science and technology needs. At the request of the Southeast Atlantic Coastal Ocean Observation System (SEACOOS) Education and Outreach Workgroup, a category of questions related to coastal observation and monitoring needs was added to the survey. The continuous observation and monitoring variables selected for the survey closely align with those identified in the *Strategic Design Plan for the Coastal Component of the Global Ocean Observing System* published in 2000.

The web-based survey was sponsored by CSO with funding provided by the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) at the University of New Hampshire. This survey builds upon a previous survey conducted by CSO in 1999. CSO contracted with the Urban Harbors Institute (UHI) at UMass-Boston to prepare the survey questions and final report. The University of New Hampshire Survey Center was contracted to conduct the survey and analyze the results. Organizations participating in this survey included the Coastal States Organization (CSO), National Estuarine Research Reserve Association (NERRA), Association of National Estuary Programs (ANEP), Association of State Floodplain Managers (ASFPM), Association of State Wetland Managers (ASWM), Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), and the Atlantic States Fishery Management Commission (ASFMC).

This report presents results of two elements of the survey, the level of importance of management topics identified by the 230 respondents, and the coastal observation and monitoring needs they associate with those management topics. The results are presented for the national level and seven regions. Additional results of survey questions can be found in the report titled *Improving Links Between Science and State Coastal Management: Results of a Survey to Assess Science and Technology Needs*.

It is anticipated that this report will have extensive application in understanding and supporting the needs of coastal managers. It is particularly important for planning the U.S. Integrated Coastal Ocean Observing System to ensure that the needs of the coastal management community are being addressed. In addition, the information obtained from this survey provides benefits to all members of the coastal science and management community.

1-1 Key Findings

The success of the U.S. Coastal Ocean Observing System will be measured, in part, by how well the needs of the coastal management community are being addressed. The results of this survey indicate that the two most important management issues facing coastal programs are land use and habitat change. It is essential that the planning and implementation of the USCOOS take this fact into account and place a priority on addressing these high priority management needs. This can only be accomplished through the direct long-term involvement of the coastal management community with USCOOS efforts at the national and regional levels. By working together on this survey, SEACOOS and the coastal management community have demonstrated one way that coastal science and management can be focused on a common goal.

1-2 National Highlights

Land use (97% response) and habitat change (94% response) are the two nationally top-ranked management topics respondents considered to be important/very important.

Aerial/satellite imagery is consistently needed by more than 25% of respondents for all the management categories.

Ocean management has the most observation and monitoring variables (12) identified by more than 25% of the respondents.

1-3 Regional Highlights

Great Lakes

Land use (100% response) and habitat change (100% response) are the two top-ranked management topics respondents considered to be important/very important.

Aerial/satellite imagery is consistently needed by more than 25% of respondents for all the management categories.

Ocean management has the most observation and monitoring variables (14) identified by more than 75% of the respondents.

Northeast

Habitat change (98% response) and land use (96% response) are the two top-ranked management topics respondents considered to be important/very important.

Aerial/satellite imagery is consistently needed by more than 25% of respondents for all the management categories.

Ocean management has the most observation and monitoring variables (11) identified by more than 25% of the respondents.

Mid-Atlantic

Land use (97% response) and habitat change (94% response) are the two top-ranked management topics respondents considered to be important/very important.

Aerial/satellite imagery, phytoplankton and light penetration are most often needed variables selected by more than 25% of respondents for management categories.

Ocean management has the most observation and monitoring variables (11) identified by more than 25% of the respondents.

Southeast

Land use (97% response) and habitat change (89% response) are the two top-ranked management topics respondents considered to be important/very important.

Aerial/satellite imagery is consistently needed by more than 25% of respondents for all the management categories.

Ocean management has the most observation and monitoring variables (12) identified by more than 25% of the respondents.

Gulf

Land use (94% response) and habitat change (91% response) are the two top-ranked management topics respondents considered to be important/very important.

Aerial/satellite imagery is consistently needed by more than 25% of respondents for all the management categories.

Habitat change has the most observation and monitoring variables (12) identified by more than 25% of the respondents.

Pacific

Land use (93% response) and habitat change (90% response) are the two top-ranked management topics respondents considered to be important/very important.

Aerial/satellite imagery and surface and/or subsurface currents are the most often needed variables identified by more than 25% of respondents for all the management categories.

Ocean management has the most observation and monitoring variables (14) identified by more than 25% of the respondents.

Islands

Land use (100% response) is the top-ranked management topic respondents considered to be important/very important, followed closely by habitat change (90% response) and environmental contamination (90%).

Aerial/satellite imagery is the most often needed variable identified by more than 25% of respondents for all the management categories.

Coastal hazards and sediment management have the most observation and monitoring variables (7) identified by more than 25% of the respondents.

2 INTRODUCTION

2-1 Ocean Observation Systems Background

In May of 2000, the Chief of Naval Research, the Administrator of NOAA, and the President of the Consortium for Ocean Research and Education announced the formation of OCEAN.US, an organization dedicated to the formation of an integrated and sustainable ocean observation system. The vision for this ocean observation system requires that observing systems scattered across the country cooperate to “collect and disseminate data and data products to serve the critical and expanding needs of environmental protection, public health, industry, education, research, and recreation” (from the September 30, 2003, draft of the IOOS Executive Summary).

The U.S. Integrated Ocean Observing System (IOOS) will consist of two components: a global, open-ocean component; and a coastal component focused on observations, products, and services needed from within the estuaries to the edge of the nation's Exclusive Economic Zone (EEZ). The global component will be of primary interest to users in the climate, defense, research, and maritime commerce sectors. The coastal component will be of interest to these sectors plus many others, including resource management, public health, recreation, and energy.

The Southeast Atlantic Coastal Ocean Observing System (SEACOOS) is to be a part of this larger IOOS system and is envisioned as one of the regional systems ringing the U.S. to form the coastal component of the IOOS. The SEACOOS partnership includes five academic institutions, four Sea Grant offices (at North Carolina State University, South Carolina Sea Grant, University of Georgia and the University of Florida), a not-for-profit private firm (MCNC), and a state agency, the South Carolina Department of Natural Resources. Funding for SEACOOS is provided by the Office of Naval Research under the stipulation that the research efforts for a regional coastal ocean observing system are coupled with a vigorous outreach and education effort.

SEACOOS will enhance and expand existing observing systems, test and develop needed sensor support infrastructure such as data transmission and power systems, develop data management capabilities and develop data-assimilative model products. The user base for such a system is very large, consisting of federal, state and local governmental agencies, the private sector, non-governmental organizations, academia, and the public. The following areas have been identified as important ones for the development of useful information products:

- Marine operations (e.g. shipping, offshore operations like drilling and mining)
- Natural hazard mitigation (e.g. storm forecasting, surge prediction, tsunami warning)
- Climate change and its effects (e.g. inter-annual variability in water temperature, salinity, nutrients, storminess, plankton species and abundance, fish species and abundance)
- National security (e.g. toxin trajectories, detection of covert operations)
- Public health (e.g. unsafe biological activity, rip currents, harmful algal blooms)
- Assessing ecosystem health (e.g. changes in food web structure)
- Sustained use of marine resources (e.g. fish stock assessments)

As the lead outreach partner for SEACOOS, the Sea Grant outreach process is to promote and facilitate two-way flow of information between user groups and the research community. User groups receive useful science-based information and academic researchers are provided feedback on the emerging issues that may warrant further investigation. In this situation, the term "outreach" refers to information, which can be transferred and used by stakeholders who represent diverse interests, including shipping, natural hazards, recreational and commercial fishing interests, coastal communities, etc. The term "education" refers to information, which can be included in formal education, K-16 situations and free-choice institutions--such as museums, aquariums and science centers through contact with the educators and teachers. This separation between outreach and education audiences will have some areas of overlap.

The application of coastal ocean observing system data depends upon the target audience having access to real time, near-real time and archival information. The format in which this data appears will need to reflect the ability of the audience to understand it. Therefore, both the outreach and education components of SEACOOS will require web-based access to provide information in several formats, including imaging, visualization, and time-series flows.

Coastal managers are perceived as one of the important users of coastal ocean data. However, their specific information needs have not been objectively measured. This research project's goal is to better understand the users' information needs and how they vary by region.

2-2 Survey Background

Since 1970, the Coastal States Organization (CSO) has represented the Governors of United States coastal states and territories as an advocate for improved management of the nation's coasts, oceans and Great Lakes. The purpose of the organization is to shape and advance a national agenda that enhances the sound management of coastal and ocean resources and furthers the vision for the coasts shared by its 35 member states and territories.

One of the core principles long held by CSO is that decisions made by coastal and ocean resource managers are supported by the best science available. To this end, CSO strives to enhance the links between science and management through sustained discourse and improved information exchange between scientists and managers. In Winter 2003/2004 CSO sponsored a national survey of coastal managers to better understand the science and technology needs of state coastal resource managers. At the request of the SEACOOS Education and Outreach Workgroup a category of questions related to coastal observation and monitoring needs was added to the survey. The continuous observation and monitoring variables selected for the survey closely align with those identified in the *Strategic Design Plan for the Coastal Component of the Global Ocean Observing System* published in 2000. It should be noted that the survey variables include aerial/satellite imagery, often thought of as a "tool" rather than an observation variable. It was the consensus of the CSO Science Work Group to include aerial/satellite imagery as an observation and monitoring data source frequently used by coastal managers.

The web-based survey was sponsored by CSO with funding provided by the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) at the University of New Hampshire and builds upon a previous survey conducted by CSO in 1999. CSO contracted with the Urban Harbors Institute (UHI) at UMass-Boston to prepare the survey questions and final report. The University of New Hampshire Survey Center was contracted to conduct the survey and analyze the results.

This report presents results of two elements of the survey, the level of importance of management topics identified by respondents, and the coastal observation and monitoring needs they associate with those management topics. Additional results of the survey can be found in the report titled *Improving Links Between Science and Coastal Management: Results of a Survey to Assess Science and Technology Needs*.

It is anticipated that this report will have extensive application in understanding and supporting the needs of coastal managers. It is particularly important for planning the U.S. Integrated Coastal Ocean Observing System to ensure that the needs of the coastal management community are being addressed. In addition, the information obtained from this survey provides benefits to all members of the coastal science and management community.

Organizations participating in this survey included the Coastal States Organization (CSO), National Estuarine Research Reserve Association (NERRA), Association of National Estuary Programs (ANEP), Association of State Floodplain Managers (ASFPM), Association of State Wetland Managers (ASWM),

Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), and the Atlantic States Fishery Management Commission (ASFMC).

2-3 Survey Methodology

The survey was conducted as a web-based survey. The survey questions were prepared by the Urban Harbors Institute, through an iterative process with the CSO Science Work Group (SWG). A draft survey framework was presented to SWG at their October 2003 meeting in New Hampshire and several drafts of the questions were subsequently provided to SWG for comment. The survey was posted on the web from December 22, 2003 to February 15, 2004.

The survey consisted of nine primary categories representing broad management topics that are most common among coastal and estuarine management programs.

Table 2-1. Survey Question Categories

- | | |
|----|---|
| 1. | Habitat Change (including degradation, loss and restoration); |
| 2. | Land Use; |
| 3. | Nutrient Enrichment; |
| 4. | Environmental Contamination; |
| 5. | Nonindigenous Species; |
| 6. | Coastal Hazards; |
| 7. | Sediment Management; |
| 8. | Ocean Management; and |
| 9. | Marine Debris. |

Respondents were first asked to rank how important each broad management topic would be to their program over the next five years. Importance was considered on a five-point scale.

Table 2-2. Scale of Importance of Issues

- | | |
|----|-----------------------------|
| 1. | <i>Very important</i> |
| 2. | <i>Important</i> |
| 3. | <i>Not very important</i> |
| 4. | <i>Not important at all</i> |
| 5. | <i>Not relevant</i> |

If the topic was ranked either *Very Important* or *Important*, respondents were asked a series of follow-up questions. The first follow-up question asked respondents to identify no more than three important issues

from a list. The next four follow-up questions asked respondents to select priority *research needs, information needs, observation and monitoring needs, and technology needs* related to the management topic.

Survey respondents included the coastal members or delegates from each of the seven program associations, as well as other staff members deemed appropriate. The names and e-mail addresses of the potential participants were collected by CSO and provided to UNH and UHI. Information about the survey, and a link to the web site, were e-mailed to all of the program association staff by CSO. Follow-up reminders were made to potential respondents to encourage broad participation in the survey.

2-4 Results Reporting

The remaining sections of this report present survey responses cross-tabulated at the national and regional levels. Two hundred thirty (230) respondents completed the survey from 33 states, territories, and Commonwealths. *Unless otherwise indicated, all responses are shown as a percentage of respondents. In some cases, multiple responses were possible and percentages may sum to more than 100%.*

Data for this report were compiled by the University of New Hampshire Survey Center using the Statistical Package for the Social Sciences (SPSS). The number of respondents from each state completing the survey varied, ranging from a high of 29 respondents per state to a low of 1 respondent per state. To reduce the impact that any one state would have on the analysis, the data were weighted (or normalized) by state, so each state had equal influence. This was accomplished by representing each state respondent as a fraction of the total respondents of that state. For example, if state X has 8 respondents, each respondent counted as 1/8 of a response. *It should also be noted that some state programs or agencies opted to distribute the survey to several individuals, and then consolidate answers into a single response.*

Respondents were asked to identify their current program position or responsibility. As shown by Table 2-4, the two top-ranked responses were Program Manager (77) and Technical Staff (66).

Table 2-3. Number of Responses by Program Position or Responsibility

Program Manager	77
Technical Staff	66
Management Staff	47
Policy Staff	15
Other	25

Survey respondents were asked to identify the program or organization they were representing. Table 2-5 shows the distribution of responses. Because respondents could associate with more than one program or organization, the total in Table 2-5 is not representative of the total respondents.

Table 2-4. Respondents Identified by Program or Association

Coastal States Organization	106
-----------------------------	-----

(State Coastal Management Programs)	
National Estuarine Research Reserve Association	49
Association of National Estuary Programs	32
Association of State Floodplain Managers	11
Association of State Wetland Managers	10
Association of State and Interstate Water Pollution Control Administrators	15
Atlantic States Marine Fisheries Commission	10
Other	15

3 NATIONAL SURVEY RESULTS FOR CONTINUOUS OBSERVATION AND MONITORING NEEDS

3-1 Introduction

This section presents results from the survey cross-tabulated at the *national level*, reporting responses from all 230 respondents. Responses are presented for two of the survey questions—the level of importance of the nine management topics (Figure 3-1), and identification of the continuous observation and monitoring needs for each management topic (Table 3-1).

For management topics respondents considered to be *Very Important* or *Important*, they were then asked a follow-up question to identify any of the listed observation and monitoring variables they considered necessary to address the given management topic. Reviewing the relative level of importance of the management topics identified by respondents (Figure 3-1), together with the responses for the observation and monitoring variables (Table 3-1) can help to better establish priorities for addressing observation and monitoring needs.

Table 3-1 presents the percent of responses for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses, 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%. This provides an easy reference to identify how often each variable was identified across each management topic, as well as how often variables were selected for each management topic.

3-2 National Management Priorities

Survey respondents were asked to indicate the importance of the nine coastal resource management topics over the next five years. The results of those responses are shown in Figure 3-1.

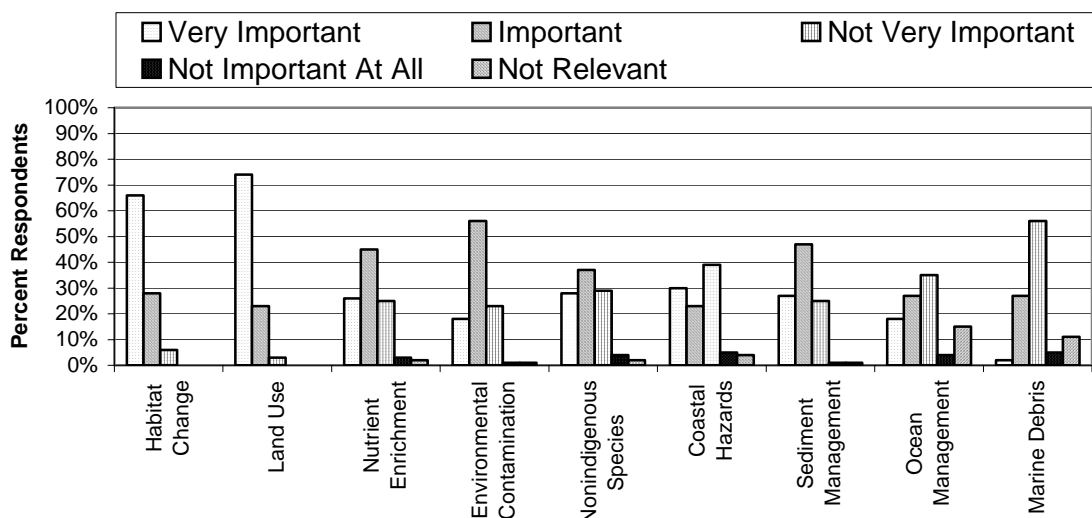


Figure 3-1. National Importance of Coastal Management Issues

The two top-ranked management topics (Table 3-1) that respondents considered to be very important and important are closely related, **land use (97%)** and **habitat change (94%)**. **Environmental contamination (74%)** and **sediment management (74%)** are tied as third-ranked, followed by **nutrient enrichment (71%)**,

nonindigenous species (65%), coastal hazards (53%), ocean management (45%) and marine debris (29%).

3-3 National Coastal Observation and Monitoring Priorities

Respondents were asked to select from a list any of the continuous observation and monitoring variables they considered necessary to help address the nine management topics over the next five years. Table 3-1 presents the results of responses for each observation and monitoring variable across management topics. The responses are also identified by shading which divides the responses into four groups of percentages: 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%. In addition to the variables listed, respondents were also provided the opportunity to identify any “other” variables that were not listed. A complete listing of those additional variables, by region, is included in the Appendices of this report

Table 3-1. National Observation and Monitoring Responses

Observation and Monitoring Variables	Habitat Change	Land Use	Nutrient Enrichment	Environmental Contamination	Nonindigenous Species	Coastal Hazards	Sediment Management	Ocean Management	Marine Debris
Sea level	43%	28%	7%	7%	10%	64%	39%	34%	9%
Surface and/or subsurface currents	21%	~	22%	24%	20%	36%	56%	43%	48%
Surface waves	19%	8%	12%	14%	3%	57%	43%	26%	26%
Surface winds	14%	6%	13%	12%	5%	43%	28%	24%	36%
Surface salinity	26%	~	11%	9%	20%	4%	3%	24%	0%
Surface temperature	23%	8%	22%	11%	19%	5%	3%	32%	3%
Light penetration	39%	~	50%	15%	18%	5%	23%	31%	3%
Bathymetry/bottom type	50%	21%	12%	22%	17%	32%	58%	58%	19%
Organic matter	27%	27%	56%	45%	12%	2%	17%	26%	6%
Dissolved inorganic nutrients	49%	46%	71%	48%	25%	3%	11%	32%	3%
Dissolved oxygen	49%	35%	74%	40%	25%	4%	7%	38%	3%
Zooplankton species	23%	8%	29%	22%	39%	2%	2%	29%	3%
Phytoplankton species	29%	16%	51%	28%	40%	2%	5%	32%	3%
Ocean color	2%	1%	7%	3%	6%	2%	1%	7%	5%
Aerial/satellite imagery	66%	76%	38%	34%	51%	71%	61%	70%	52%
Other	20%	22%	10%	23%	26%	34%	16%	11%	10%

~ Not included

☐ 0 – 24%
 ☐ 25 – 49%
 ☐ 50 – 74%
 ☐ 75 – 100%

As shown in Table 3-1, the percent of respondents identifying each observation and monitoring variable as “necessary” to address each management category ranged from a low of 0% of respondents indicating a need for surface salinity data for marine debris, to a high of 76% of the respondents indicating a need for aerial/satellite imagery for land use topics.

Table 3-1 also indicates how often respondents identified the need for each observation and monitoring variable across all the management topics, as well as how often respondents identified the need for variables within each management topic. Based on the percent of responses, aerial/satellite imagery is

consistently needed by more than 25% of respondents for all of the management topics. Ocean management has the most observation and monitoring variables (12) identified by more than 25% of respondents.

4 REGIONAL SURVEY RESULTS FOR CONTINUOUS OBSERVATION AND MONITORING NEEDS

4-1 Introduction

This section discusses the results of the survey from a *regional perspective*, with the 33 coastal, Island, territories and Great Lake states grouped by region as defined in Table 4-1.

Table 4-1. Regional Classification of States and Territories

Region	Number of Respondents	Includes the Following States and Territories	
Great Lakes ¹	13	Indiana (IN) Michigan (MI) Minnesota (MN)	Ohio (OH) Wisconsin (WI) Pennsylvania (PA)
Northeast	60	Connecticut (CT) Massachusetts (MA) Maine (ME)	New Hampshire (NH) New York (NY) Rhode Island (RI)
Mid-Atlantic	36	Delaware (DE) Maryland (MD)	New Jersey (NJ) Virginia (VA)
Southeast	55	Florida (FL) Georgia (GA)	North Carolina (NC) South Carolina (SC)
Gulf	24	Alabama (AL) Louisiana (LA)	Mississippi (MS) Texas (TX)
Pacific	34	Alaska (AK) California (CA)	Oregon (OR) Washington (WA)
Islands ²	8	American Samoa (AS) Commonwealth of Northern Marianas Islands (CNMI)	Guam (GU) Hawaii (HI) Puerto Rico (PR)

¹ Illinois does not participate in the National Coastal Management Program

² The US Virgin Islands did not respond to the survey.

Responses are presented for two sets of survey questions—the level of importance of the nine management topics (Figures 4-1 to 4-7), and identification of the continuous observation and monitoring needs for each management topic (Tables 4-2 to 4-8). Additional survey results can be found in the report titled *Improving Links Between Science and Coastal Management: Results of a Survey to Assess Science and Technology Needs*.

Survey respondents were asked to indicate the importance of the nine coastal resource management issues over the next five years. For those management topics respondents considered to be *Very Important* or *Important*, they were then asked a follow-up question to identify any of the listed observation and monitoring variables they considered necessary to address the given management topic. Tables 4-2 to 4-8 present the percent of responses, by Region, for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses, 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%. This provides an easy reference to

identify the relative frequency each variable was identified across each management topic, as well as the relative frequency variables were selected for each management topic.

Reviewing the relative level of importance of the management topics identified by respondents (Figures 4-1 to 4-7), together with the responses for the observation and monitoring needs (Tables 4-2 to 4-8), can help to better establish priorities for addressing observation and monitoring needs.

4-2 Great Lakes Region

Management Priorities

The top-ranked management topics that the Great Lakes region (Fig. 4-1) consider to be very important or important are **land use (100%)**, **habitat change (100%)** and **environmental contamination (100%)**, followed closely by **sediment management (96%)**. These priorities are followed by **nonindigenous species (88%)**, **nutrient enrichment (79%)**, **coastal hazards (58%)**, **ocean management (30%)**, and **marine debris (25%)**.

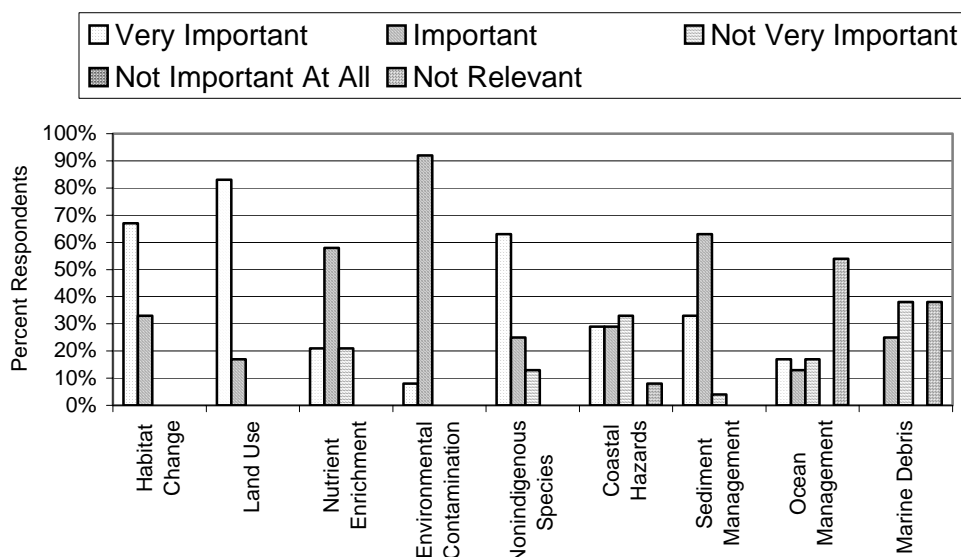


Figure 4-1 Great Lakes Importance of Management Topics

Coastal Observation and Monitoring Needs

Respondents were asked to select, from a list, any continuous observation and monitoring variables they considered necessary to help address nine specific management topic over the next five years. Table 4-2 presents the results of responses for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses, 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%.

In addition to the variables listed, respondents were also provided the opportunity to identify any “other” variables that were not listed. A complete listing of those additional variables is included in the Appendices of this report.

Table 4-2. Great Lakes Observation and Monitoring Responses

Observation and Monitoring Variables	Habitat Change	Land Use	Nutrient Enrichment	Environmental Contamination	Nonindigenous Species	Coastal Hazards	Sediment Management	Ocean Management	Marine Debris
Sea level	42%	42%	12%	0%	11%	71%	35%	100%	0%
Surface and/or subsurface currents	25%	~	47%	27%	33%	64%	70%	100%	67%
Surface waves	21%	17%	35%	32%	0%	86%	52%	100%	67%
Surface winds	8%	8%	35%	9%	0%	64%	26%	100%	67%
Surface salinity	0%	~	0%	0%	22%	0%	0%	80%	0%
Surface temperature	8%	0%	35%	9%	22%	0%	0%	80%	0%
Light penetration	33%	~	59%	18%	28%	0%	9%	80%	0%
Bathymetry/bottom type	33%	13%	6%	23%	17%	36%	61%	80%	0%
Organic matter	17%	25%	71%	50%	22%	0%	17%	80%	0%
Dissolved inorganic nutrients	42%	50%	71%	64%	56%	0%	17%	80%	0%
Dissolved oxygen	50%	33%	82%	50%	44%	0%	9%	100%	0%
Zooplankton species	0%	8%	35%	9%	61%	0%	0%	80%	0%
Phytoplankton species	17%	17%	71%	27%	56%	0%	9%	80%	0%
Ocean color	0%	0%	0%	0%	22%	0%	0%	0%	0%
Aerial/satellite imagery	63%	96%	65%	41%	56%	86%	87%	80%	33%
Other	13%	29%	0%	27%	28%	36%	35%	0%	0%

~ Not included



As shown in Table 4-2, the percent of Great Lakes respondents identifying observation and monitoring variables as “necessary” to address each management category ranged from a low of 0% for thirty variables, to a high of 100% of the respondents indicating a need for data associated with sea level, surface and/or subsurface currents, surface waves, surface winds, and dissolved oxygen all related to ocean management topics.

Table 4-2 also indicates how frequently respondents identified the need for each observation and monitoring variable across all the management topics, as well as how respondents identified the need for variables within each management topic. Based on the percent of responses, aerial/satellite imagery is consistently identified as needed by more than 25% of respondents across all of the management topics. Ocean management has the most (14) observation and monitoring variables identified by more than 75% of respondents.

4-3 Northeast Region

Management Priorities

The two top-ranked management topics that the Northeast region (Fig. 4-2) considers to be very important or important are **habitat change (98%)** and **land use (96%)**, followed by *nutrient enrichment (82%)*, *nonindigenous species (70%)*, *environmental contamination (68%)*, *sediment management (52%)*, *ocean management (44%)*, *coastal hazards (26%)* and *marine debris (13%)*.

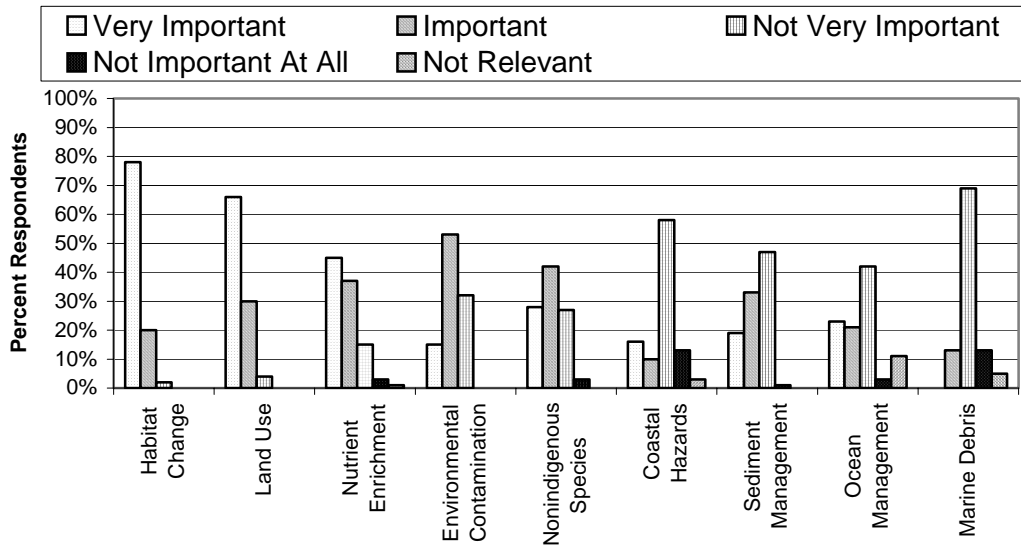


Figure 4-2. Northeast Importance of Coastal Management Issues

Coastal Observation and Monitoring Needs
Respondents were asked to select, from a list, any

continuous observation and monitoring variables they considered necessary to help address the nine management topics over the next five years. Table 4-3 presents the results of responses for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses; 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%.

In addition to the variables listed, respondents were also provided the opportunity to identify any “other” variables that were not listed. A complete listing of those additional variables is included in the Appendices of this report.

Table 4-3. Northeast Observation and Monitoring Responses

Observation and Monitoring Variables	Habitat Change	Land Use	Nutrient Enrichment	Environmental Contamination	Nonindigenous Species	Coastal Hazards	Sediment Management	Ocean Management	Marine Debris
Sea level	63%	31%	5%	2%	11%	85%	40%	25%	0%
Surface and/or subsurface currents	17%	~	15%	25%	26%	35%	63%	40%	27%
Surface waves	6%	5%	4%	4%	5%	74%	52%	24%	0%
Surface winds	9%	5%	7%	17%	7%	36%	39%	21%	0%
Surface salinity	20%	~	17%	10%	17%	0%	4%	25%	0%
Surface temperature	23%	5%	18%	9%	16%	0%	4%	31%	0%
Light penetration	40%	~	49%	15%	16%	0%	12%	35%	27%
Bathymetry/bottom type	58%	10%	12%	25%	23%	24%	65%	65%	0%
Organic matter	26%	17%	46%	50%	9%	0%	18%	23%	0%
Dissolved inorganic nutrients	51%	41%	65%	50%	24%	0%	6%	27%	0%
Dissolved oxygen	66%	48%	84%	49%	31%	0%	0%	44%	0%
Zooplankton species	30%	9%	39%	43%	40%	0%	2%	40%	0%
Phytoplankton species	38%	12%	68%	52%	44%	0%	2%	40%	0%
Ocean color	2%	2%	13%	2%	2%	0%	0%	7%	27%
Aerial/satellite imagery	72%	81%	28%	27%	39%	58%	58%	64%	46%
Other	23%	31%	11%	25%	32%	37%	18%	21%	43%

~ Not included



As shown in Table 4-3, the percent of Northeast respondents identifying observation and monitoring variable as “necessary” to address each management category ranged from a low of 0% for twenty-two variables, to a high of 85% of the respondents indicating a need for sea level data for coastal hazard topics. The need for sea level data is closely followed by dissolved oxygen (84%) for nutrient enrichment topics and aerial/satellite imagery (81%) for land use topics.

Table 4-3 also indicates how often Northeast respondents identified the need for each observation and monitoring variable across all the management topics, as well as how often respondents identified the need for variables within each management topic. Based on the percent of responses, aerial/satellite imagery is consistently needed by more than 25% of Northeast respondents across all of the management topics. Ocean management has the most (11) observation and monitoring variables identified by more than 25% of northeast respondents.

4-4 Mid-Atlantic Region

Management Priorities

The two top-ranked management topics that the Mid Atlantic region (Fig. 4-3) considers to be very important or important are **land use (97%)** and **habitat change (94%)**. These priorities are followed by *sediment management* (72%), *nutrient enrichment* (61%), *nonindigenous species* (57%), *environmental contamination* (56%), *coastal hazards* (54%), *ocean management* (43%), and *marine debris* (12%).

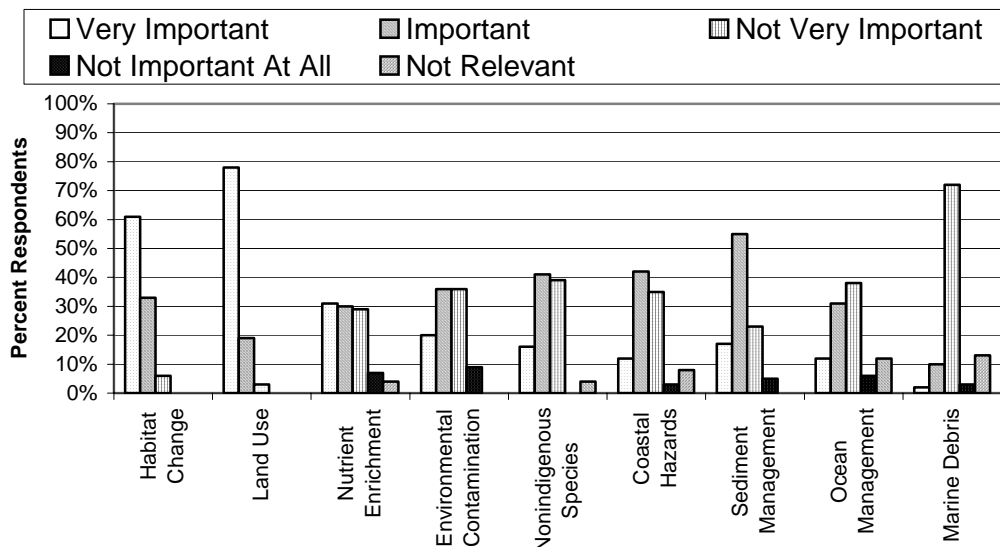


Figure 4-3. Mid-Atlantic Importance of Coastal Management Issues

Coastal Observation and Monitoring Needs

Respondents were asked to select, from a list, any continuous observation and monitoring variables they considered necessary to help address the nine management topics over the next five years. Table 4-4 presents the results of responses for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses; 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%.

In addition to the variables listed, respondents were also provided the opportunity to identify any “other” variables that were not listed. A complete listing of those additional variables is included in the Appendices of this report.

Table 4-4. Mid-Atlantic Observation and Monitoring Responses

Observation and Monitoring Variables	Habitat Change	Land Use	Nutrient Enrichment	Environmental Contamination	Nonindigenous Species	Coastal Hazards	Sediment Management	Ocean Management	Marine Debris
Sea level	41%	27%	9%	7%	22%	86%	45%	30%	0%
Surface and/or subsurface currents	12%	~	16%	14%	15%	29%	41%	31%	86%
Surface waves	24%	8%	9%	7%	10%	56%	41%	12%	43%
Surface winds	15%	8%	9%	14%	10%	39%	29%	31%	73%
Surface salinity	33%	~	20%	23%	22%	16%	16%	28%	0%
Surface temperature	15%	10%	25%	16%	16%	16%	16%	21%	0%
Light penetration	57%	~	50%	25%	29%	12%	41%	32%	0%
Bathymetry/bottom type	44%	23%	32%	23%	20%	26%	50%	55%	0%
Organic matter	27%	16%	63%	50%	13%	0%	22%	19%	14%
Dissolved inorganic nutrients	56%	49%	83%	49%	10%	0%	12%	26%	0%
Dissolved oxygen	42%	27%	65%	35%	20%	8%	17%	28%	0%
Zooplankton species	18%	6%	24%	16%	37%	8%	10%	32%	14%
Phytoplankton species	27%	26%	60%	33%	51%	8%	11%	40%	14%
Ocean color	2%	0%	8%	0%	3%	8%	2%	19%	0%
Aerial/satellite imagery	56%	54%	18%	3%	53%	28%	42%	42%	0%
Other	10%	6%	0%	29%	18%	32%	12%	24%	0%

~ Not included



As shown in Table 4-4, the percent of Mid-Atlantic respondents identifying observation and monitoring variables as “necessary” to address each management category ranged from a low of 0% for fifteen variables, to a high of 86% of the respondents indicating a need for surface and/or subsurface current data for marine debris topics, and sea level data for coastal hazard topics. The need for current and sea level data is followed closely by the need for dissolved inorganic nutrient data (83%) for nutrient enrichment topics.

Table 4-4 also indicates how often Mid-Atlantic respondents identified the need for each observation and monitoring variable across all the management topics, as well as how often respondents identified the need for variables within each management topic. Based on the percent of responses, the observation and monitoring variables most often identified by more than 25% of Mid-Atlantic respondents are aerial/satellite imagery (6), phytoplankton species (6) and light penetration (6). Ocean management has the most observation and monitoring variables (11) identified by more than 25% of Mid-Atlantic respondents.

4-5 Southeast Region

Management Priorities

The two top-ranked management topics that the Southeast region (Fig. 4-4) considers to be very important or important are **land use (97%)** and **habitat change (89%)**. The third top-ranked topic is *nutrient enrichment* (73%) followed by *sediment management* (63%), *environmental contamination* (58%), *coastal hazards* (50%), *nonindigenous species* (48%), *marine debris* (45%), and *ocean management* (40%).

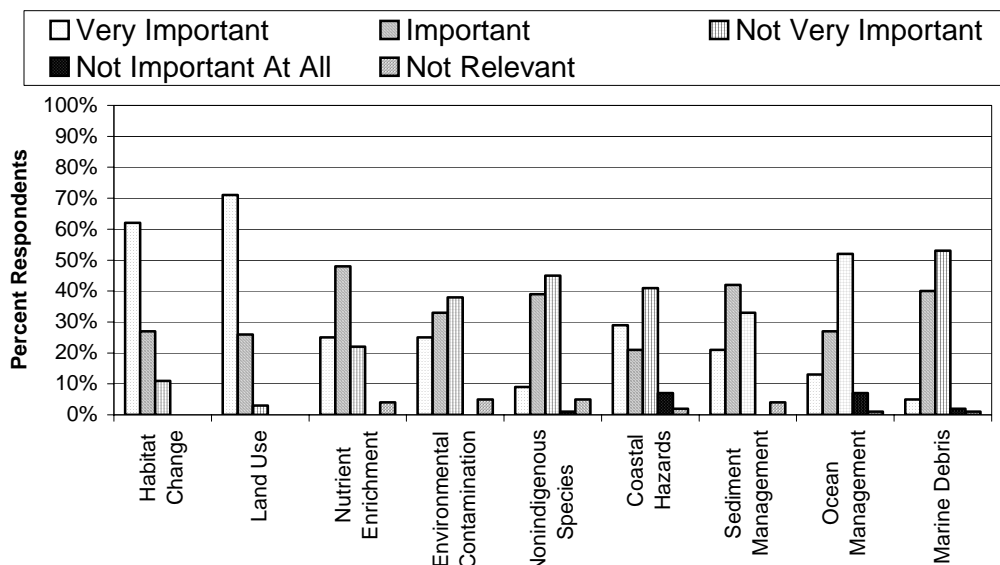


Figure 4-4. Southeast Importance of Coastal Management Issues

Coastal Observation and Monitoring Needs

Respondents were asked to select, from a list, any continuous observation and monitoring variables they considered necessary to help address the nine management topics over the next five years. Table 4-5 presents the results of responses for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses; 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%.

In addition to the variables listed, respondents were also provided the opportunity to identify any “other” variables that were not listed. A complete listing of those additional variables is included in the Appendices of this report.

Table 4-5. Southeast Observation and Monitoring Responses

Observation and Monitoring Variables	Habitat Change	Land Use	Nutrient Enrichment	Environmental Contamination	Nonindigenous Species	Coastal Hazards	Sediment Management	Ocean Management	Marine Debris
Sea level	41%	32%	11%	21%	19%	63%	40%	64%	14%
Surface and/or subsurface currents	14%	~	9%	12%	15%	17%	47%	25%	66%
Surface waves	15%	11%	2%	5%	5%	65%	48%	21%	32%
Surface winds	8%	5%	2%	8%	8%	49%	31%	21%	53%
Surface salinity	54%	~	16%	27%	23%	14%	4%	27%	2%
Surface temperature	18%	12%	15%	9%	26%	15%	3%	27%	17%
Light penetration	44%	~	47%	12%	26%	12%	11%	40%	2%
Bathymetry/bottom type	48%	29%	9%	27%	21%	49%	48%	63%	22%
Organic matter	35%	25%	53%	46%	12%	8%	24%	29%	5%
Dissolved inorganic nutrients	48%	51%	76%	55%	27%	17%	18%	44%	5%
Dissolved oxygen	47%	46%	77%	61%	24%	17%	7%	56%	2%
Zooplankton species	11%	16%	16%	27%	40%	3%	4%	31%	2%
Phytoplankton species	20%	20%	41%	27%	42%	3%	4%	29%	2%
Ocean color	2%	2%	4%	7%	3%	3%	7%	17%	0%
Aerial/satellite imagery	66%	78%	49%	56%	75%	81%	70%	83%	75%
Other	15%	12%	8%	3%	5%	8%	0%	0%	11%

~ Not included

0 – 24%
 25 – 49%
 50 – 74%
 75 – 100%

As shown in Table 4-5, the percent of Southeast respondents identifying observation and monitoring variables as “necessary” to address each management category ranged from a low of 0% for two variables, to a high of 83% of the respondents indicating a need for aerial/satellite imagery for ocean management topics. The need for aerial/satellite imagery is also identified by 81% of Southeast respondents for coastal hazard topics.

Table 4-5 also indicates how often respondents identified the need for each observation and monitoring variable across all the management topics, as well as how often respondents identified the need for variables within each management topic. Based on the percent of responses, aerial/satellite imagery is consistently needed across all the management topics by more than 25% of respondents. Ocean management has the most observation and monitoring variables (12) identified by more than 25% of respondents.

4-6 Gulf Region

Management Priorities

The two top-ranked management topics that the Gulf region (Fig. 4-5) considers to be very important or important are **land use (94%)** and **habitat change (91%)**. The third closely top-ranked topics are *environmental contamination (79%)* and *sediment management (78%)* followed by *coastal hazards (70%)*, *nutrient enrichment (67%)*, *nonindigenous species (62%)*, *ocean management (51%)*, and *marine debris (47%)*.

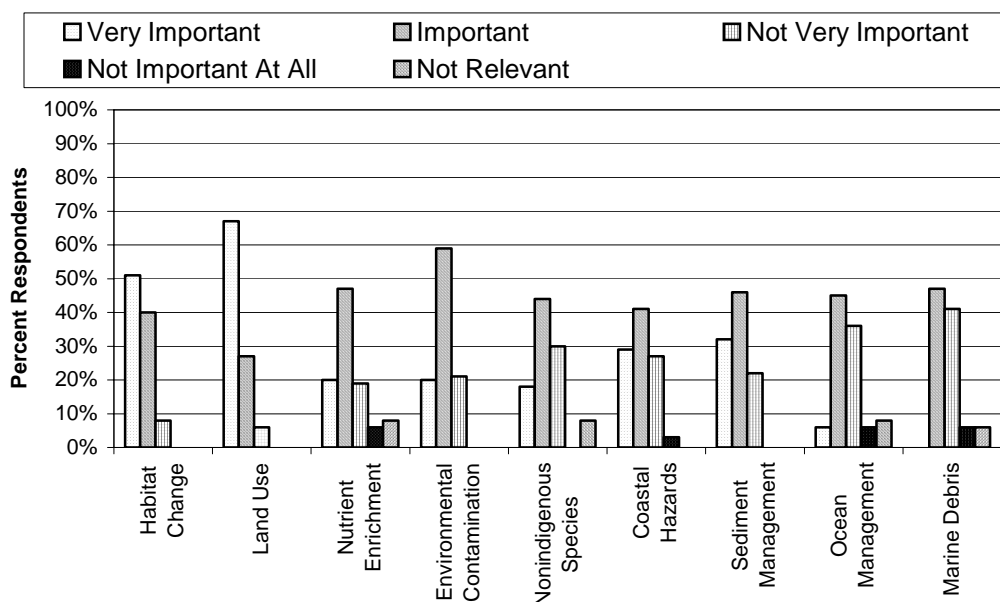


Figure 4-5. Gulf Importance of Coastal Management Issues

Coastal Observation and Monitoring Needs

Respondents were asked to select, from a list, any continuous observation and monitoring variables they considered necessary to help address the nine management topics over the next five years. Table 4-6 presents the results of responses for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses; 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%.

In addition to the variables listed, respondents were also provided the opportunity to identify any “other” variables that were not listed. A complete listing of those additional variables is included in the Appendices of this report.

Table 4-6. Gulf Observation and Monitoring Responses

Observation and Monitoring Variables	Habitat Change	Land Use	Nutrient Enrichment	Environmental Contamination	Nonindigenous Species	Coastal Hazards	Sediment Management	Ocean Management	Marine Debris
Sea level	46%	51%	5%	20%	0%	80%	34%	51%	20%
Surface and/or subsurface currents	10%	~	9%	30%	11%	13%	56%	51%	59%
Surface waves	34%	7%	21%	24%	5%	47%	34%	25%	22%
Surface winds	28%	10%	26%	24%	6%	37%	29%	13%	36%
Surface salinity	58%	~	13%	9%	48%	0%	0%	13%	0%
Surface temperature	16%	23%	39%	24%	42%	0%	0%	19%	0%
Light penetration	47%	~	61%	15%	11%	4%	24%	24%	0%
Bathymetry/bottom type	36%	17%	9%	8%	22%	21%	54%	19%	0%
Organic matter	41%	40%	78%	48%	16%	0%	17%	24%	0%
Dissolved inorganic nutrients	55%	40%	60%	55%	27%	0%	13%	43%	0%
Dissolved oxygen	48%	27%	71%	43%	27%	0%	4%	39%	0%
Zooplankton species	25%	7%	43%	44%	41%	0%	0%	24%	0%
Phytoplankton species	47%	30%	52%	31%	41%	0%	0%	24%	0%
Ocean color	0%	0%	17%	11%	0%	0%	0%	6%	8%
Aerial/satellite imagery	74%	83%	34%	31%	52%	75%	53%	55%	42%
Other	6%	13%	0%	4%	11%	0%	4%	6%	20%

~ Not included

0 – 24%
 25 – 49%
 50 – 74%
 75 – 100%

As shown in Table 4-6, the percent of Gulf respondents identifying observation and monitoring variables as “necessary” to address each management category range from a low of 0% for twenty-eight variables, to a high of 83% of the respondents indicating a need for aerial/satellite imagery for land use topics. The need for aerial/satellite imagery is followed closely by the need for sea level data for coastal hazard topics (80%).

Table 4-6 also indicates how often Gulf respondents identified the need for each observation and monitoring variable across all the management topics, as well as how often respondents identified the need for variables within each management topic. Based on the percent of responses, aerial/satellite imagery is consistently needed by more than 25% of respondents across all of the management topics. Habitat change has the most observation and monitoring variables (12) identified by more than 25% of Gulf respondents.

4-7 Pacific Region Priorities

Management Priorities

The two top-ranked management topics that the Pacific region (Fig. 4-6) considers to be very important or important are **land use (93%)** and **habitat change (90%)**. The third-ranked topic is *sediment management* (65%) followed by *environmental contamination* (59%), *nonindigenous species* (56%), *nutrient enrichment* (51%), *coastal hazards* (50%), *ocean management* (44%), and *marine debris* (24%).

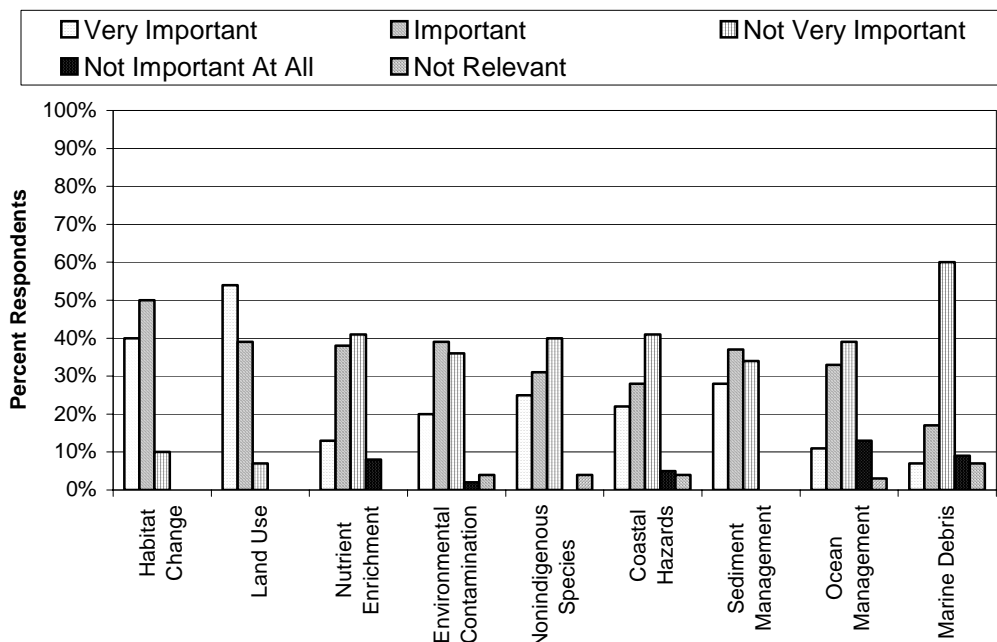


Figure 4-6. Pacific Importance of Coastal Management Issues

Coastal Observation and Monitoring Needs

Respondents were asked to select, from a list, any continuous observation and monitoring variables they considered necessary to help address the nine management topics over the next five years. Table 4-7 presents the results of responses for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses; 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%.

In addition to the variables listed, respondents were also provided the opportunity to identify any “other” variables that were not listed. A complete listing of those additional variables is included in the Appendices of this report.

Table 4-7. Pacific Observation and Monitoring Responses

Observation and Monitoring Variables	Habitat Change	Land Use	Nutrient Enrichment	Environmental Contamination	Nonindigenous Species	Coastal Hazards	Sediment Management	Ocean Management	Marine Debris
Sea level	37%	17%	7%	11%	8%	54%	30%	26%	19%
Surface and/or subsurface currents	32%	~	9%	38%	34%	40%	43%	51%	25%
Surface waves	18%	8%	7%	13%	0%	54%	36%	48%	0%
Surface winds	10%	4%	3%	17%	12%	38%	12%	30%	8%
Surface salinity	23%	~	9%	15%	7%	8%	0%	38%	0%
Surface temperature	37%	15%	12%	18%	15%	12%	0%	32%	0%
Light penetration	48%	~	41%	21%	19%	12%	32%	32%	0%
Bathymetry/bottom type	57%	27%	22%	16%	15%	39%	65%	58%	19%
Organic matter	44%	36%	54%	34%	7%	8%	21%	29%	47%
Dissolved inorganic nutrients	51%	37%	60%	40%	7%	8%	10%	32%	27%
Dissolved oxygen	42%	45%	73%	22%	12%	8%	16%	34%	27%
Zooplankton species	36%	12%	30%	27%	37%	8%	3%	37%	17%
Phytoplankton species	36%	18%	42%	27%	37%	8%	9%	52%	17%
Ocean color	14%	4%	9%	3%	0%	12%	0%	8%	8%
Aerial/satellite imagery	51%	55%	21%	34%	30%	74%	28%	60%	19%
Other	24%	39%	0%	23%	30%	17%	26%	12%	0%

~ Not included

☐ 0 – 24%
 ☐ 25 – 49%
 ☐ 50 – 74%
 ☐ 75 – 100%

As shown in Table 4-7, the percent of Pacific respondents identifying observation and monitoring variables as “necessary” to address each management category range from a low of 0% for eleven variables, to a high of 74% of the respondents indicating a need for aerial/satellite imagery for coastal hazards topics. The need for aerial/satellite imagery is followed closely by the need for dissolved oxygen data for nutrient enrichment topics (73%).

Table 4-7 also indicates how often Pacific respondents identified the need for each observation and monitoring variable across all the management topics, as well as how often respondents identified the need for variables within each management topic. Based on the percent of responses, the observation and monitoring variables most often identified by more than 25% of Pacific respondents are aerial/satellite imagery (7) and surface and/or subsurface currents (7). Ocean Management has the most observation and monitoring variables (14) identified by more than 25% of Pacific respondents.

4-8 Islands Region

Management Priorities

The top-ranked responses for the Islands region vary most from other regions. The top-ranked management topic that the Islands region (Fig. 4-7) considered to be very important or important is **land use (100%)**. The second ranked management topics are *habitat change* (90%) and *environmental contamination* (90%) followed by *sediment management* (83%), *nutrient enrichment* (70%), *coastal hazards* (70%), *ocean management* (70%), *nonindigenous species* (57%), and *marine debris* (40%).

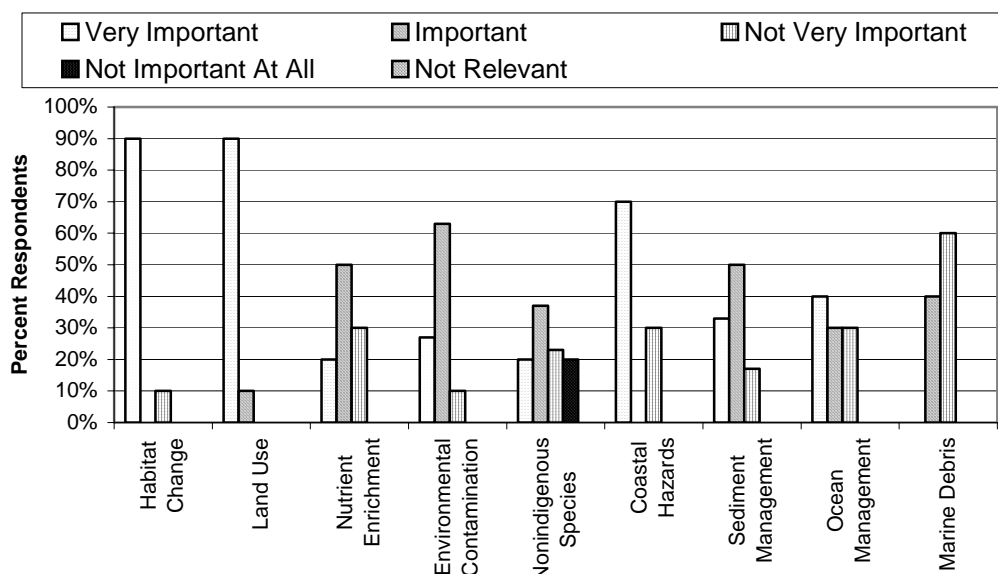


Figure 4-7. Islands Importance of Coastal Management Issues

Coastal Observation and Monitoring Needs

Respondents were asked to select, from a list, any continuous observation and monitoring variables they considered necessary to help address the nine management topics over the next five years. Table 4-8 presents the results of responses for each observation and monitoring variable across each management topic. The percentages are also identified by shading to fall within one of four groups of percent responses; 0 – 24%, 25 – 49%, 50 – 74%, and 75 – 100%.

In addition to the variables listed, respondents were also provided the opportunity to identify any “other” variables that were not listed. A complete listing of those additional variables is included in the Appendices of this report.

Table 4-8. Islands Observation and Monitoring Responses

Observation and Monitoring Variables	Habitat Change	Land Use	Nutrient Enrichment	Environmental Contamination	Nonindigenous Species	Coastal Hazards	Sediment Management	Ocean Management	Marine Debris
Sea level	22%	0%	0%	0%	0%	29%	47%	0%	0%
Surface and/or subsurface currents	37%	~	40%	19%	0%	38%	58%	29%	0%
Surface waves	22%	0%	0%	0%	0%	29%	32%	0%	0%
Surface winds	22%	0%	0%	0%	0%	29%	32%	0%	0%
Surface salinity	15%	~	0%	0%	0%	0%	0%	0%	0%
Surface temperature	48%	0%	0%	0%	0%	0%	0%	29%	0%
Light penetration	15%	~	33%	0%	0%	0%	42%	10%	0%
Bathymetry/bottom type	78%	33%	0%	29%	0%	29%	63%	67%	75%
Organic matter	11%	37%	20%	33%	0%	0%	0%	10%	0%
Dissolved inorganic nutrients	48%	53%	87%	14%	0%	0%	0%	10%	0%
Dissolved oxygen	37%	20%	47%	14%	0%	0%	0%	10%	0%
Zooplankton species	44%	0%	0%	0%	0%	0%	0%	0%	0%
Phytoplankton species	22%	0%	0%	0%	0%	0%	0%	0%	0%
Ocean color	0%	0%	0%	0%	0%	0%	0%	0%	0%
Aerial/satellite imagery	78%	70%	33%	38%	53%	76%	58%	90%	100%
Other	44%	20%	53%	38%	47%	81%	0%	10%	0%

~ Not included

0 – 24%
 25 – 49%
 50 – 74%
 75 – 100%

As shown in Table 4-8, the percent of Islands respondents identifying observation and monitoring variables as “necessary” to address each management category range from a low of 0% for seventy-eight variables, to a high of 100% of the respondents indicating a need for aerial/satellite imagery for marine debris topics. The need for aerial/satellite imagery for marine debris topics is followed closely by the need for aerial/satellite imagery for ocean management topics (73%).

Table 4-8 also indicates how often Islands respondents identified the need for each observation and monitoring variable across all the management topics, as well as how often respondents identified the need for variables within each management topic. Based on the percent of responses, aerial/satellite imagery is consistently needed by more than 25% of respondents across all of the management topics. Coastal hazards and sediment management have the most observation and monitoring variables (7) identified by more than 25% of Islands respondents.

APPENDIX

Additional Continuous Observation and Monitoring Responses Reported By Management Topics

1 Great Lakes Region

Habitat change

- Lake levels/Nutrient load (P)/Invasive Species.
- lake level change, migration patterns, food sources, nesting materials

Land Use

- Lake levels/Nutrient sediment loading
- Eddies and Currents - Surface and Subsurface
- Suspended solids
- Land cover, variables related to water quality

Nutrient Enrichment

Environmental Contamination

- Sediment transport for sediment associates
- Botulism incidence

Nonindigenous Species

- Habitat diversity
- Introduction of vectors
- Lake levels

Coastal Hazards

- Lake levels
- Great Lakes level changes

Sediment Management

- Sediment associated contaminants
- Lake level changes/predictability
- Watershed gauging stations

Ocean Management

None

Marine Debris

None

2 Northeast Region

Habitat change

- Associated vegetation & invasives
- Updated mapping of habitats and land cover
- Presence of and resurgence of invasive species
- LIDAR/SHOALS/topographic beach data
- Shoreline position
- Eelgrass distribution
- Invasive species
- Fish communities
- Tide level trends (all datum's) - especially for the growing season as
- Weather patterns
- Building permits / development / river water quality / land use change
- Biotic trends
- Underwater imagery

Land Use

- Percent of watershed that is hardened surfaces; biodiversity
- Vegetation
- Development patterns & impervious surface coverage
- Updated land use/land cover
- Percentage of buffer zones along the coastline
- Beach characteristics, storm impacts (i.e., 100 yr storm)
- Precipitation Patterns
- Sub-basin trends in impervious surface + changes in stormwater deliver
- Shoreline change and nitrogen loadings
- SAV coverage
- River water quality, riparian land use changes, building permits / dev
- Encroachments on wetlands, public lands
- USGS River Flow

Nutrient Enrichment

- Bottom temperature
- Detailed nitrogen chemistry
- Loading data from groundwater
- River and estuarine water quality
- Nutrients

Environmental Contamination

- Areas vulnerable to oil spills
- Bioindicators
- DNA analyses for determining sources of bacteria
- Cost effective, field based toxic contaminant monitoring
- Measure sediment contamination levels ~ every 5 yrs
- Organic contaminants
- MeHg, PAH's, Biocides

Nonindigenous Species

- Man-made surfaces (e.g. docks, piers, pipes); invasives monitoring
- Bottom temperature
- Vegetation
- Soil type

- Distribution Samples
- Rapid assessment surveys + any physical modeling that predicts
- Fish & invertebrate community structure changes
- Biological inventories
- Estuarine rapid assessments
- Benthic species
- Baseline information, pre and post invasive control

Coastal Hazards

- Beach profiling after major storm events
- Storm characteristics/beach response
- Shoreline position, natural protective feature position/condition
- Shoreline position
- Shoreline Definition/Change

Sediment Management

- Storms, beach characteristics
- Shoreline Change, Marsh loss/gain
- Shoreline position
- Movement of suspended solids in tidal systems
- Turbidity monitoring

Ocean Management

- Changes in biological parameters (fish, marine mammals, etc.)
- Stock assessment
- Eelgrass distribution and loss
- Fish & invertebrate communities
- Social & economic
- Aerial/satellite imagery at a finer scale for both time and space

Marine Debris

- Monitoring of debris from CSOs
- Habitat impacts or change

3 Mid-Atlantic Region

Habitat change

- Changes in vegetative communities
- Shoreline change
- Land Use
- Surface water quantity/flow
- Shoreline change

Nutrient Enrichment

None

Environmental Contamination

None

Nonindigenous Species

- Species-specific status assessments
- Tracking foreign ships
- Routine aquatic species monitoring

Coastal Hazards

- Flushing characteristics—data
- Storm surge maps
- Rainfall, tides (unless that is what sea level means)
- Shoreline change trends
- Analysis of sediment movement and effects of shore protection structure

Sediment Management

- Ambient suspended sediments
- Beach profiles

Ocean Management

- Wave swell predictors
- Abundance and distribution of exploited fish species
- Migratory bird patterns

Marine Debris

None

4 Southeast Region

Habitat change

- Chlorophyll
- Total Nutrients
- Shellfish Area Closures
- TSS, turbidity and dissolved matter
- Area Specific Tidal Data
- Fecal coliform
- Nitrogen Inputs

Land Use

- Bacteria/Pathogens
- Wetland inventories by plant community
- Shellfish Area Closures
- Light attenuation
- Effectiveness/suitability of best management practices
- Salinity and fecal coliforms by source (human, pet waste, wildlife, et
- Dissolved Organic N
- Nutrient Enrichment
- Chlorophyll
- Total nutrients
- Water discharges - quantities and rates, HAB monitoring and research
- Enhanced spatial nutrient monitoring

Environmental Contamination

- More comprehensive GIS data on impaired waters and point locations
- Freshwater flow rates

Nonindigenous Species

- GIS database of known species locations
- Nonindigenous monitoring systems

Coastal Hazards

- Ocean Hazard Erosion Rates

Sediment Management

None

Ocean Management

None

Marine Debris

- Tracking removal
- Human use patterns
- Possibly an expanded beach inventory program, standardized

5 Gulf Region

Habitat change

- Acreages, upland development practices
- Land use trends

Land Use

- Land use/land cover mapping
- Crop Surveys

Nutrient Enrichment

None

Environmental Contamination

- Sediment, benthic, fish tissue analysis

Nonindigenous Species

- Surveys
- Detection monitoring

Coastal Hazards

None

Sediment Management

- Sediment accretion/erosion patterns

Ocean Management

- Living resource assessments/fish and shellfish population status and trends

Marine Debris

- Coastal Cleanup results

6 Pacific Region

Habitat change

- Sediment flux and tidal circulation, invasive species
- Bacteria concentrations
- Mercury methylation rates
- Riparian baseline inventories
- Periodic (e.g., every 10 years) Aerial/satellite imagery
- Land use change/hydrology change

Land Use

- Storm water inputs to the estuary; bacteria linked to human health
- River levels (stage data)
- Wildlife remote assessment
- Land surface changes
- Land use/land cover mapping
- Erosion rates
- Fecal coliform levels, or improved substitute for FC
- Lidar measurements for digital elevation modeling
- Floodplain encroachment

Nutrient Enrichment

None

Environmental Contamination

- Freshwater inflows, Real time NPDS discharge data, real time storm water
- Contaminant sensors
- Toxic loadings
- Surface water quality

Nonindigenous Species

- Species appearances and disappearances
- Ongoing detection efforts
- Monitoring for new species

Coastal Hazards

- Seismic activity, tectonic deflection dynamics of coastal margins
- Sediment movement/shoaling patterns
- Shoreline position and bluff edge position

Sediment Management

- Precipitation and run off patterns
- Freshwater inflows; sediment accretion/erosion dynamics
- Sediment quality
- Movement of shoals
- Benthic organisms
- Cliff erosion rates, sediment discharge rates at river mouths

Ocean Management

- Community structure
- Fish catches

Marine Debris

None

7 Islands Region

Habitat change

- Benthic and nekton organisms
- LIDAR for topography data

Land Use

- Benthic and nekton organisms

Nutrient Enrichment

- Seagrass and algae growth
- Benthic organisms

Environmental Contamination

- Fecal coliform
- Toxics in groundwater

Nonindigenous Species

- Land cover
- Benthic organisms

Coastal Hazards

- Stormwater/streamflow
- Meteorological data
- Global/Regional Observation Systems
- LIDAR

Sediment Management

None

Ocean Management

- Use patterns by boaters, divers, recreational vehicles, etc

Marine Debris

None