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Improving Links Between Science and Coastal Management: Results of a Survey to Assess U.S. State Coastal Management Science and Technology Needs

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IMPROVING LINKS BETWEEN SCIENCE AND COASTAL MANAGEMENT

Results of a Survey To Assess U.S. State Coastal Management Science and Technology Needs

October 2004

COASTAL STATES ORGANIZATION

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APPENDICES are provided under separate cover.

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. 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.

Two hundred thirty (230) respondents completed the survey from 33 states, territories and Commonwealths. 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).

While some analysis of the data and recommendations how on the report should be used are provided, this report is not intended to offer specific interpretations of the results. Rather it is intended to raise awareness on those topics, research, information, and technology needs that are important to coastal resource managers for the purpose of initiating further dialogue on what exactly this data means and how it can best be applied to improve our future efforts.

Key Findings

Finding 1

The two top-ranked management topics identified to be very important or important at the national-level are *land use* (97%) and *habitat change* (94%).

Finding 2

There are common national-level research, information and technology needs that can be identified when viewed across the management topics. For research, several of the top-ranked needs fall into two categories of *cumulative effects* and *source identification/tracking*. *Trends/change analysis* is a common category of top-ranked information needs, and *remote sensing* and *improved models* are two common categories for technology needs.

Finding 3

At the national-level, *cumulative effects* (research needs), *trends/change analysis* (information needs), and *remote sensing* (technology needs) are all associated with the top-ranked categories of land use and habitat change. This is an important connection because it indicates that by addressing these top-ranked needs, it will speak to both the most important management topics that coastal managers are facing, as well as have the broadest application of needs across the management topics.

Finding 4

At the regional-level, *land use* and *habitat change* generally are identified as very important or import management issues. Greater variations in the top-ranked management issues occur at the program and state-levels, likely a reflection of the differences in program goals and state specific circumstances.

Next Steps

Conducting the national survey of state coastal resource managers and presenting the results in this report represents only the first of several important steps that need to be taken to make this effort meaningful and successful. There is a wealth of data that has been generated through the survey (see Appendices) that can be further analyzed in many ways. The presentation of the results in this report only represents a first order synthesis of the data and should be considered a beginning, not an end, of effectively using the survey results. The following recommendations are critical steps that need to be taken in order to make sure the survey data and report are used to effect a positive change in better defining coastal resource managers science and technology needs, and concurrently, how those needs are being addressed by the science community.

Recommendation 1

The Coastal States Organization should assume the responsibility of promoting the availability of this report. At a minimum, this should include making sure copies are provided to each representative of their organization, to each of the participating organizations, representatives of the key Federal coastal science agencies including, NOAA, EPA, USGS, USDA and NSF, each coastal member of Congress, and the staff members of relevant Congressional committees. Other opportunities include posting a PowerPoint presentation to the CSO website for others to use, encouraging associations to highlight the results in their publications and newsletters, working with regional science organizations to secure the support of the research community, and requesting survey partners to make presentations to their boards and membership. Twelve months from the date of this report CSO, should assess the collective progress in distributing the survey and recommit to making people aware of the results.

Recommendation 2

The Coastal States Organization, in partnership with the states and pertinent Federal agencies, should convene regional focus group sessions to further refine the science and technology needs of selected priorities. These intense sessions would bring together coastal managers and scientists to enhance their shared understanding of the priority, to explore what science currently exists that addresses the priority, and to identify a course of scientific inquiry responsive to managers needs.

Recommendation 3

The key Federal coastal science agencies such as NOAA, EPA, USGS, USDA and NSF should assess the alignment of their strategic and annual operating plans and research priorities to address the science needs of the coastal management community, as identified through the results of this survey report. CSO should commence this work by identifying the science funding programs most consistent with the priorities, including state research programs.

Recommendation 4

The Coastal States Organization should work with its survey partners to educate members of Congress as to the science and technology needs of state coastal resource managers. Examples of how this might be accomplished include a 1-2 page national and/or regional priorities statement suitable for a Hill staff briefing, Ocean Week presentations, and meetings with key members of Congress. A 1-year strategy to accomplish this should be jointly prepared by the survey partners.

2 INTRODUCTION

2-1 Background

Since 1970, the Coastal States Organization (CSO) has represented the Governors of U.S. 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 state coastal resource managers to better understand their science and technology needs. The results of this survey form the basis for this report. The web-based survey was funded 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. The results of this survey will be used by CICEET and other science sponsors to strategically plan future funding programs and to select projects. In addition, the information obtained from this survey benefits all members of the coastal management community (see Table 2-1).

Table 2-1. Survey Goals

- ✓ Provide a current understanding of coastal management needs so that federal agency technical assistance efforts can be targeted more effectively.
- ✓ Enhance researchers ability to share, learn, and leverage resources across multiple coastal and estuarine management programs.
- ✓ Assist Congress in understanding the issues and in shaping policy responses including program funding and reauthorization.

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).

While some analysis of the data and recommendations how on the report should be used are provided, this report is not intended to offer specific interpretations of the results. Rather it is intended to raise awareness on those topics, research, information, and technology needs that are important to coastal resource managers for the purpose of initiating further dialogue on what exactly this data means and how it can best be applied to improve our future efforts.

2-2   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 2-2).

Table 2-2. 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 2-3).

Table 2-3. Scale of Importance of Issues

1. *Very important*
2. *Important*
3. *Not very important*
4. *Not important at all*
5. *Not relevant*

If the topic was ranked either *Very Important* or *Important*, respondents were asked a series of follow-up questions. The first follow-up questions 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 broad management topic.

Survey respondents included the coastal members or delegates from each of the seven program associations, as well as certain staff members deemed most 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. Follow-up reminders were made to potential respondents to encourage broad participation in the survey.

2-3   Results Reporting

The remaining sections of this report present survey responses cross-tabulated by national, regional, state, and program association. 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. *It should be noted that some state programs or agencies opted to distribute the survey to several individuals, and then consolidate answers into a single response.* 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 from that state. For example, if state X has 8 respondents, each respondent counted as 1/8 of a response.

Respondents were asked to identify their current program position or responsibility. As shown by Table 2-4, the two top-ranked responses were from Program Managers (76) and Technical Staff (66).

Table 2-4. 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 2-5. Respondents Identified by Program or Association

Coastal States Organization (State Coastal Management Programs)	106
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

3-1   Introduction

This section discusses the highlights of the results of the survey from a *national perspective*, reporting responses from all 230 respondents. A complete set of responses cross-tabulated for the *national perspective* is included in the appendices of this report. Using the top-ranked responses of the *national perspective* provides an indication of the relative level of importance of a management issue and/or the science and technology needs they may share. This information can then be used to strategically project future coastal management needs and how products and services can be delivered most effectively.

Survey respondents were asked to indicate the importance of nine separate coastal resource management topics over the next five years (see Figure 3-1). Table 3-1 shows the percentage of all respondents who found the issues of habitat change, land use, nutrient enrichment, environmental contamination, nonindigenous species, coastal hazards, sediment management, ocean management, and marine debris either *very important* or *important* to their programs over the next five years. Table 3-1 also identifies the top-ranked research, information, and technology needs for each.

The discussions following Table 3-1 highlight views expressed by the respondents based on the top-ranked responses. With regards to the responses from the surveys related to continuous observation and monitoring variables, respondents were not asked to select from the list those variables they considered most important, but rather to select all variables that they considered necessary to address a particular issue. Because there was no prioritization of these variables, they are not discussed in the body of this report, and instead can be found in the tables in the appendices.
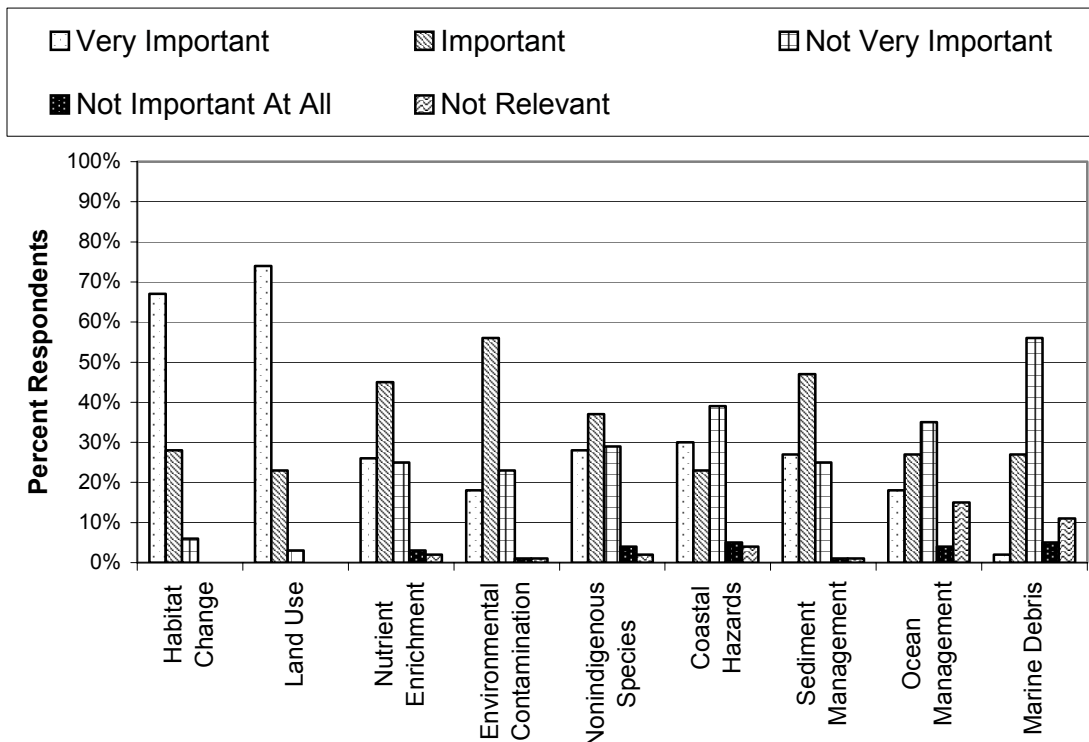
Figure 3-1. National Importance of Coastal Management Issues.

3-2   National Priorities

The two top-ranked management topics (Table 3-1) that all respondents considered to be important or very important were closely related, *land use (97%)* and *habitat change (95%)*. These two management topics ranked well above the next pair of topics, *environmental contamination (74%)* and *sediment management (74%)*. The fact that *land use* and *habitat change* are ranked so high reflects the day-to-day level of effort state coastal resource mangers must invest to address continuing development pressures in coastal areas. It is also interesting to note that the top-ranked research needs for the land use and habitat change topics both involve cumulative effects/impacts. This is an import fact for the science community to pay attention to and try to work together more to better understand the interplay of multiple stressors.

Although each of the management topics have associated with them unique top-ranked needs for research, information and technology, when viewed across the management topics there are some common needs that can be identified. For research, several of the top-ranked needs fall into two categories of *cumulative effects* and *source identification/tracking. Trends/change analysis* is a common category of top-ranked information needs, and *remote sensing* and *improved models* are two common categories for technology needs.

It is also noted that *cumulative effects* (research), *trends/change analysis* (information), and *remote sensing* (technology) needs are all associated with the top-ranked categories of *land use* and *habitat change*. This is an important connection because it indicates that by addressing these top-ranked needs, it will speak to both the most important management topics that coastal managers are facing, as well as have the broadest application of needs across the management topics.

Table 3-1. Responses by All Respondents (National)

Management Topic Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
LAND USE	97%	Identify cumulative effects of development	61%	Land use change analysis	59%	Affordable remote sensing	65%
HABITAT	95%	Cumulative impact assessments	70%	Trends analysis (rate of loss/gain, success of restoration, etc.)	81%	High resolution remote sensing	46%
						Low cost remote sensing platforms to measure change	46%
ENVIRONMENTAL CONTAMINATION	74%	Identification of sources	68%	Remediation options	53%	Improved treatment or removal technologies	57%
SEDIMENT MANAGEMENT	74%	Analysis of impacts of engineering solutions (e.g., jetties)	48%	Sediment transport patterns	65%	Improved models that simulate and/or predict	63%
NUTRIENT ENRICHMENT	71%	Source identification/tracking	80%	BMP effectiveness or cost/benefit analysis	73%	Cost effective long-term monitoring/sampling equipment	58%
NONINDIGENOUS SPECIES	65%	Early detection of species	60%	Ecosystem inventory	79%	Rapid detection and monitoring	76%
COASTAL HAZARDS	53%	Risk and vulnerability assessments	74%	Design standards for shoreline management technologies	59%	Improved models that simulate and predict	74%
						Alternative shoreline protection technologies	74%
OCEAN MANAGEMENT	45%	Cumulative impact assessments	54%	More geospatial data for GIS (benthic maps, jurisdictions, etc.)	79%	Mapping and other data acquisition	51%
MARINE DEBRIS	29%	Source tracking	58%	Public outreach and education	94%	Debris removal technology	65%

4   SURVEY RESULTS BY REGIONS

4-1   Introduction

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

Survey respondents were asked to indicate the importance of nine separate coastal resource management issues over the next five years. Tables 4-2 to 4-8 show the percentage of respondents in each of the seven *regions* who found the issues of habitat change, land use, nutrient enrichment, environmental contamination, nonindigenous species, coastal hazards, sediment management, ocean management, and marine debris to be either *very important* or *important* to their programs over the next five years. These tables also identify the top-ranked research, information, and technology needs for each.

The discussions accompanying each table highlight views expressed by the respondents based on the top-ranked responses. With regards to the responses from the surveys related to *continuous observation and monitoring variables*, respondents were not asked to select from the list those variables they considered most important, but rather to select all variables that they considered necessary to address a particular issue. Because there was no prioritization of these variables, they are not discussed in the body of this report, and instead can be found in the tables in the appendices.

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

4-2   Great Lakes Region Priorities

The top-ranked management topics that the Great Lakes region (Table 4-2) considered to be very important or important were *land use* (100%), *habitat change* (100%) and *environmental contamination* (100%), followed closely by *sediment management* (96%) and *nonindigenous species* (88%). Land use and habitat change match the national top-ranked topics.

The top-ranked research, information and technology needs identified for habitat change were *cumulative impact assessments* (71%), *trends analysis* (67%) and *habitat restoration BMPs* (75%).

Land use top-ranked research, information and technology needs were *socioeconomic cost/benefit analysis of various land use options* (63%), *more geospatial data for GIS* (58%) and *customized GIS* (79%).

The top-ranked research, information and technology needs identified for *environmental contamination* were *identification of sources* (67%), *remediation options* (54%) and *improved treatment or removal technologies* (75%).

Table 4-2. Top-ranked Responses from Great Lakes Region

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat	100%	Cumulative impact assessments	71%	Trends analysis	67%	Habitat restoration BMPs	75%
Land use	100%	Provide socioeconomic cost/benefit analysis of various land use options	63%	More geospatial data for GIS	58%	Customized GIS	79%
Environmental contamination	100%	Identification of sources	67%	Remediation options	54%	Improved treatment or removal technologies	75%
Sediment management	96%	Analysis of impacts of engineering solutions	91%	Improved methods and models for quantifying sediment budgets	74%	Methods for quantifying sediment budgets	61%
Nonindigenous species	88%	Effectiveness of BMPs	86%	Ecosystem inventory	76%	Prevention techniques	76%
Nutrient enrichment	79%	Cumulative impact assessments	74%	BMP effectiveness or cost/benefit analysis	89%	Improved treatment technologies	53%
		Source identification/ tracking	74%			Enhanced remote sensing	53%
Coastal hazards	58%	Shoreline characterizations	79%	Design standards for shoreline management technologies	93%	Alternative shoreline protection technologies	93%
Ocean management	30%	Ecological characterizations	86%	More geospatial data for GIS	71%	Energy technology	57%
				Access, retrieval and analysis of data	71%	Other	57%
				State-of-knowledge reports	71%		
Marine debris	25%	Public education effectiveness	100%	Public outreach and education	100%	Debris removal technology	67%
						Disposal or reuse technologies	67%

4-3   Northeast Region Priorities

The two top-ranked management topics that the Northeast region (Table 4-3) considered to be very important or important were *habitat change* (98%) and *land use* (96%), followed by *nutrient enrichment* (82%), *nonindigenous species* (70%) and *environmental contamination* (68%). Land use and habitat change match the national top-ranked topics.

The top-ranked research, information and technology needs identified for habitat change were *cumulative impact assessments* (60%), *trends analysis* (81%) and *high resolution remote sensing* (53%).

Land use top-ranked research, information, and technology needs were to *quantify impacts of land use on water quality* (74%), *land use change analysis* (71%) and *affordable remote sensing* (77%).

Table 4-3. Top-ranked Responses from Northeast Region

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat	98%	Cumulative impact assessments	60%	Trends analysis	81%	High resolution remote sensing	53%
Land use	96%	Quantify impact of land use on water quality	74%	Land use change analysis	71%	Affordable remote sensing	77%
Nutrient enrichment	82%	Source identification/tracking	73%	Land use analysis	60%	Cost effective long-term monitoring/sampling equipment	68%
Nonindigenous species	70%	Early detection of species	63%	Ecosystem inventory	72%	Rapid detecting and monitoring	71%
Environmental contamination	68%	Cumulative impact assessments	59%	Remediation options	49%	Cost effective long-term monitoring/sampling equipment	51%
						Improved remote sensing/ sampling technologies	51%
Sediment management	52%	Effects of dredging	66%	Sediment transport patterns	65%	Improved models that simulate or predict	64%
Ocean management	44%	Cumulative impact assessments	69%	Access, retrieval and analysis of data	81%	Mapping and data acquisition	77%
Coastal hazards	26%	Trends analysis	58%	Access, retrieval and analysis of data	58%	Improved models that simulate and predict	73%
Marine debris	13%	Source tracking Public education effectiveness	52% 52%	Public outreach and education	100%	Gear modifications to make less harmful to non-target species and habitat	52%

4-4   Mid-Atlantic Region Priorities

The two top-ranked management topics that the Mid Atlantic region (Table 4-4) considered to be very important or important were *land use (97%) and habitat change (94%)* match the national top-ranked topics.

The top-ranked land use research, information and technology needs were to *identify cumulative effects of development* (60%), *land use change analysis* (61%) and *improved models that simulate or predict* (77%).

The top-ranked research, information and technology needs identified for habitat change were *cumulative impact assessments* (78%), *trends analysis* (88%) and *habitat restoration BMPs* (54%)

Table 4-4. Top-ranked Responses from Mid-Atlantic Region

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	97%	Identify cumulative effects of development	60%	Land use change analysis	61%	Improved models that simulate or predict	77%
Habitat	94%	Cumulative impact assessments	78%	Trends analysis	88%	Habitat restoration BMPs	54%
Sediment management	72%	Prioritize restoration/protection based on max benefit for cost	55%	Sediment transport patterns	62%	Improved models that simulate or predict	61%
Nutrient enrichment	61%	Source identification/tracking	75%	BMP effectiveness or cost/benefit analysis	81%	Cost effective long-term monitoring/sampling equipment	59%
Nonindigenous species	57%	Early detection of species	78%	Ecosystem inventory	74%	Rapid detecting and monitoring	82%
Environmental contamination	56%	Identification of sources	62%	Remediation options	48%	Cost effective long-term monitoring/sampling equipment	53%
Coastal hazards	54%	Shoreline characterizations	67%	Design standards for shoreline management technologies	74%	Alternative shoreline protection technologies	87%
Ocean management	43%	Cumulative impact assessments	68%	More geospatial data for GIS	66%	Improved models that simulate or predict	66%
Marine debris	12%	Public education effectiveness	73%	Public outreach and education	86%	Debris removal technology	100%

4-5   Southeast Region Priorities

The two top-ranked management topics that the Southeast region (Table 4-5) considered to be very important or important were *land use* (97%) and *habitat change* (89%). The third top-ranked topic was *nutrient enrichment* (73%). Land use and habitat change match the national top-ranked topics.

Land use top-ranked research, information and technology needs were *develop indicators that link land use with ecosystem health* (74%), *land use change analysis* (80%) and *improved models that simulate or predict* (74%).

The top-ranked research, information and technology needs identified for habitat change were *cumulative impact assessments* (78%), *trends analysis* (86%) and *high resolution remote sensing* (54%).

Table 4-5. Top-ranked Responses from Southeast Region

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	97%	Develop indicators that link land use with ecosystem impact	74%	Land use change analysis	80%	Improved models that predict or simulate	74%
Habitat	89%	Cumulative impact assessments	78%	Trends analysis	86%	High resolution remote sensing	54%
Nutrient enrichment	73%	Source identification/tracking	82%	BMP effectiveness or cost/benefit analysis	70%	Cost effective long-term monitoring/sampling equipment	63%
Sediment management	63%	Effects of dredging	61%	Sediment transport patterns	71%	Methods for quantifying sediment budgets	70%
Environmental contamination	58%	Identification of sources	87%	Economic impact evaluations	59%	Rapid/real time detection	57%
Coastal hazards	50%	Risk and vulnerability assessments	84%	Design standards for shoreline management technologies	61%	Improved models that simulate and predict	82%
Nonindigenous species	48%	Early detection of species	78%	Ecosystem inventory	79%	Treatment and removal techniques	84%
Marine debris	45%	Perceptions and behaviors linked to sources	76%	Public outreach and education	96%	GPS tracking systems for potential sources of debris	66%
Ocean management	40%	Cumulative impact assessments	56%	State-of-knowledge reports	81%	Improved models that simulate or predict	69%

4-6   Gulf Region Priorities

The two top-ranked management topics that the Gulf region (Table 4-6) considered to be very important or important were *land use* (94%) and *habitat change* (91%). The next closely top-ranked topics were *environmental contamination* (79%) and sediment management (78%). Land use and habitat change match the national top-ranked topics.

Land use top-ranked research, information and technology needs were *develop indicators that link land use with ecosystem health* (70%), *land use change analysis* (62%) and *affordable remote sensing* (69%).

The top-ranked research, information and technology needs identified for habitat change were *cumulative impact assessments* (67%), *trends analysis* (81%) and *models that predict or simulate* (60%).

Table 4-6. Top-ranked Responses from Gulf Region

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	94%	Develop indicators that link land use with ecosystem impact	70%	Land use change analysis	62%	Affordable remote sensing	69%
Habitat	91%	Cumulative impact assessments	67%	Trends analysis	81%	Models that predict or simulate	60%
Environmental contamination	79%	Identification of sources	59%	Explanation of interactions among contaminants	49%	Reliable DNA fingerprinting	65%
Sediment management	78%	Improved beneficial use	70%	Shoreline characterizations	64%	Improved models that simulate or predict	75%
Coastal hazards	70%	Risk and vulnerability assessments	79%	Design standards for shoreline management technologies	75%	Improved models that simulate and predict	91%
Nutrient enrichment	67%	Source identification/tracking	73%	BMP effectiveness or cost/benefit analysis	77%	Cost effective long-term monitoring/sampling equipment	69%
Nonindigenous species	62%	Susceptibility factors for coastal invasive introduction	56%	Ecosystem inventory	85%	Treatment and removal techniques	91%
Ocean management	51%	Cumulative impact assessments	88%	Access, retrieval and analysis of data	87%	Improved models that simulate or predict	61%
Marine debris	47%	Biodegradable products	63%	Public outreach and education	100%	Debris removal technology	94%

4-7   Pacific Region Priorities

The two top-ranked management topics that the Pacific region (Table 4-7) considered to be very important or important were *land use* (93%) and *habitat change* (90%). Land use and habitat change match the national top-ranked topics.

Land use top-ranked research, information and technology needs were *quantify impacts of land use on water quality* (60%), *land use change analysis* (60%) and *affordable remote sensing* (61%).

The top-ranked research, information and technology needs identified for habitat change were *evaluate effectiveness of restoration/protection techniques* (70%), *ecological and physical baselines and inventories* (86%) and *low cost remote sensing platforms to measure change* (50%).

Table 4-7. Top-ranked Responses from Pacific Region

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	93%	Quantify impact of land use on water quality	60%	Land use change analysis	60%	Affordable remote sensing	61%
Habitat	90%	Evaluate effectiveness of restoration/ protection techniques	70%	Ecological and physical baselines and inventories	86%	Low cost remote sensing platforms to measure change	50%
Sediment management	65%	Prioritize restoration/protect ion based on max benefit for cost	43%	Sediment transport patterns	55%	Methods for quantifying sediment budgets	69%
Environmental contamination	59%	Identification of sources	68%	Remediation options	51%	Rapid/real time detection	66%
Nonindigenous species	56%	Effectiveness of BMPs	66%	Ecosystem inventory	85%	Rapid detecting and monitoring	92%
Nutrient enrichment	51%	Source identification/ tracking	89%	BMP effectiveness or cost/benefit analysis	74%	Effective mitigation strategies	60%
Coastal hazards	50%	Risk and vulnerability assessments	52%	More geospatial data for GIS	72%	Improved models that simulate and predict	69%
Ocean management	44%	Marine managed area effectiveness	60%	More geospatial data for GIS	87%	Nondestructive bottom fishing gear	69%
Marine debris	24%	Ecological impacts	78%	Public outreach and education	57%	Debris removal technology	59%

4-8   Islands Region Priorities

The top-ranked responses for the Islands region resulted in the highest variation from other regions. The top-ranked management topic that the Islands region (Table 4-8) considered to be very important or important was *land use* (100%). Land use was followed by *habitat change* (90%) and *environmental contamination* (90%).

Land use top-ranked research, information and technology needs were to *identify cumulative effects of development* (70%), *land use change analysis* (53%) and *customized GIS* (80%).

Table 3-8. Top-ranked Responses from Islands Region

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Identify cumulative effects of development	70%	Land use change analysis	53%	Customized GIS	80%
Habitat change	90%	Cumulative impact assessment	89%	Trends analysis	100%	High resolution remote sensing	59%
Environmental contamination	90%	Identification of sources	78%	Remediation options	78%	Improved treatment or removal technologies	70%
Sediment management	82%	Effectiveness of confinement techniques	64%	Sediment transport patterns	88%	Containment and stabilization technologies	88%
Nutrient enrichment	70%	Source identification/tracking	100%	BMP effectiveness or cost/benefit analysis	71%	Improved treatment technologies	67%
Ocean management	70%	Economic assessments	52%	More geospatial data for GIS	90%	Mapping and data acquisition	52%
		Marine managed area effectiveness	52%				
Coastal hazards	70%	Risk and vulnerability assessments	100%	More geospatial data for GIS	81%	Improved models that simulate and predict	71%
						Advanced detection and/or warning technologies	71%
Nonindigenous species	57%	Effectiveness of BMPs	53%	Ecosystem inventory	88%	Treatment and removal techniques	100%
Marine debris	40%	Source tracking	100%	Public outreach and education	100%	GPS tracking systems for potential sources of debris	67%

4-9   Comparison of Top-ranked Habitat Change Responses Across Regions

Importance of Issues Related To Habitat Change
The top-ranked responses (by percentages) for six of the seven regions indicate that issues related to habitat change are *very important* (see Figure 4-1)*.* The top-ranked response for the Pacific region indicates that issues related to habitat change is *important*.
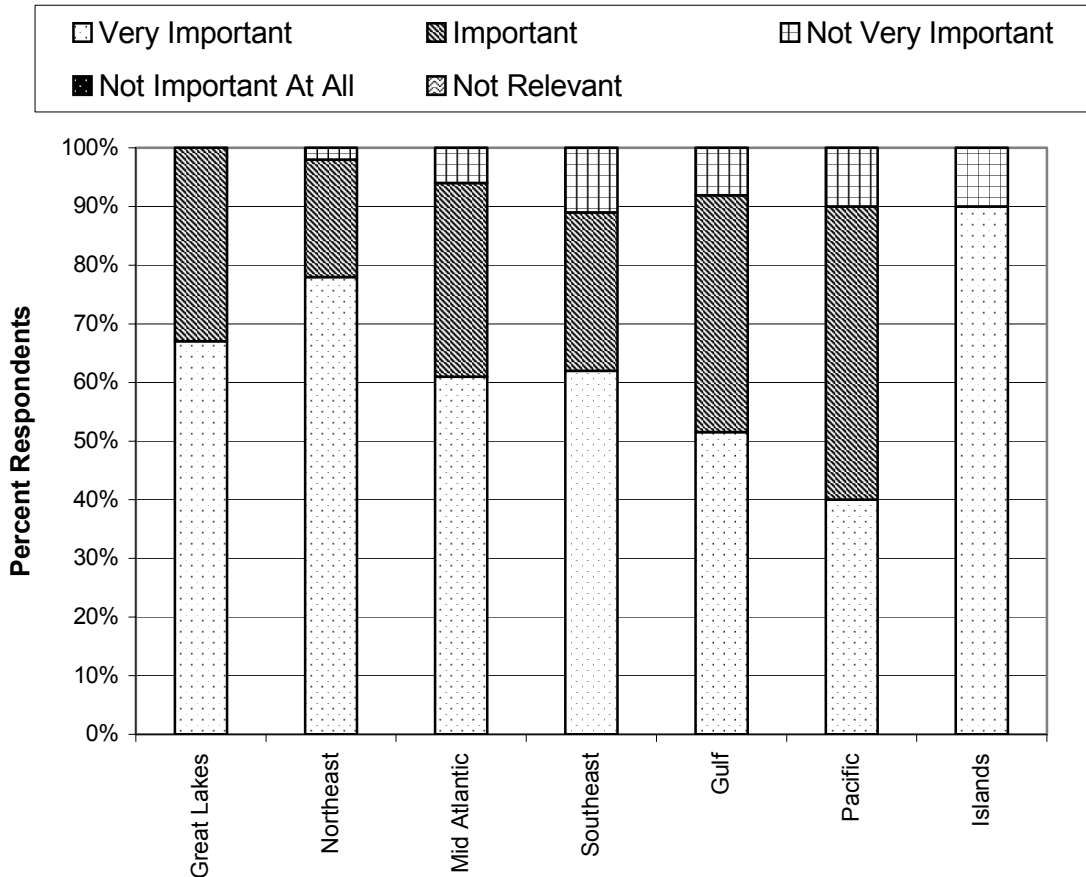
Figure 4-1. Importance of Habitat Change Across Regions

Important Habitat Types
The top-ranked responses of habitat types important to a particular program for the Mid-Atlantic (78%) and Pacific (73%) regions were *uplands (including riparian/special habitats)*. The top-ranked response for the Islands (100%) was *coral*. *Salt marsh* received the top-ranked response for the Northeast (81%), Southeast (70%) and Gulf (80%).

Habitat Change Research Needs
The top-ranked response of research needs to address habitat change for the Great Lakes (71%), Northeast (60%), Mid-Atlantic (78%), Southeast (78%), Gulf (67%) and Islands (89%) were for *cumulative impact assessments*. The Pacific Region identified to *evaluate effectiveness of restoration/protection techniques* as their top-ranked response (70%).

Types of Information Needed To Address Habitat Change
Trends analysis (e.g., rate of loss/gain, success of restoration, etc.) was the top-ranked response for the Great Lakes (67%), Northeast (81%), Mid-Atlantic (88%), Southeast (86%) Gulf (81%) and the Islands (100%). The Pacific Region identified *ecological and physical baselines and inventories* as their top-ranked response (86%).

Improved Technologies To Address Habitat Change
The top-ranked responses of technology needs related to habitat change for the Northeast (54%), Southeast (54%), and Islands (59%) were for *high resolution remote sensing.* The Great Lakes (75%) and Mid-Atlantic (54%) identified *habitat restoration BMPs* as their top-ranked responses. The Gulf region identified *models that predict or simulate* as their top-ranked responses (60%) and the Pacific region top-ranked responses (50%) were for low *cost remote sensing platforms to measure change.*

4-10   Comparison of Top-ranked Land Use Responses Across Regions

Importance of Land Use
The top-ranked responses (by percentages) for all seven regions indicate that land use issues are *very important* (see Figure 4-2).
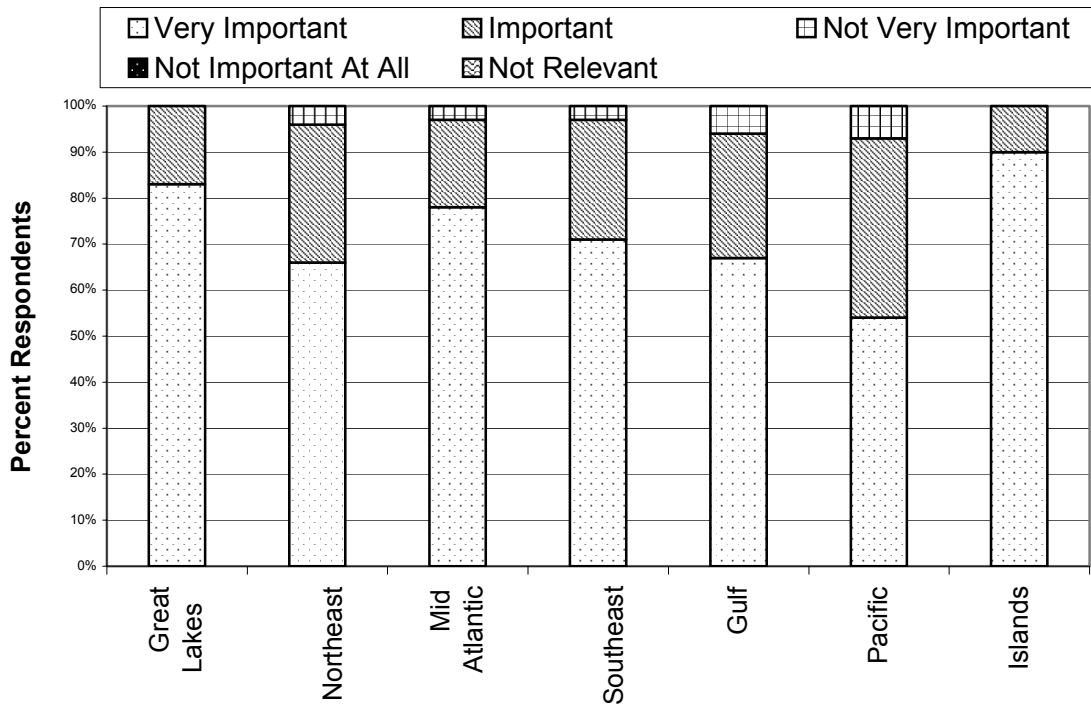
Figure 4-2 Importance of Land Use Across Regions

Important Land Use Issues
The top-ranked land use issue considered to be most important over the next five years for the Great Lakes (75%), Northeast (71%), Southeast (91%), and Pacific (72%) regions was *to manage the effects of coastal development*. The Northeast (71%) actually had a tie for top-ranked issue that also included *open space conservation and/or natural resource protection*. The Mid

Atlantic (84%) response favored *open space conservation and/or natural resource protection*. The Gulf region's (77%) top issue was *to integrate watershed/ecosystem planning at the state and local level*; the Islands region's (100%) was *to reduce the inputs of nonpoint source pollutants*.

Land Use Research Needs
The top-ranked responses of research activities to address the most important land use issues over the next five years were varied, with Great Lakes region (63%) identifying research *to provide socioeconomic cost/benefit analysis of various land use options* as the top need; the Mid Atlantic (60%) and Islands regions (70%) would prefer *to identify cumulative effects of development*; the Southeast (74%) and Gulf (70%) regions would like to see research *to develop indicators that link land use with ecosystem impact*; and the Northeast (74%) and Pacific (60%) regions *to quantify the impact of land use on water quality*.

Information Needed To Address Land Use Issues
Six of the seven regions identified *land use change analysis* as their top-ranked information need to address land use issues over the next five years, which is consistent with the need for trends analysis identified for habitat change: Northeast (71%), Mid Atlantic (61%), Southeast (80%), Gulf (62%), Pacific (60%), and Islands (53%). The Great Lakes (58%) region was in favor of *more geospatial data for GIS*.

Improved Technologies To Address Land Use Issues
The Northeast (77%), Gulf (69%), and Pacific (61%) found *more affordable remote sensing* to be the greatest technology need to address land use issues over the next five years. The Great Lakes (79%) and Islands (80%) regions identified *customized GIS*, and the Mid Atlantic (77%) and Southeast (74%) would like to see *improved models that predict and simulate* the impacts of land use.

4-11   Comparison of Top-ranked Nutrient Enrichment Responses Across Regions

Importance of Nutrient Enrichment
Six of the seven regions top-ranked responses found nutrient enrichment issues to be *important* or *very important* (see Figure 4-3), with the exception of the Pacific region whose top-ranked response found nutrient enrichment to be *not very impo*rtant (41%)

Important Nutrient Enrichment Sources
The top-ranked sources causing nutrient enrichment for the Northeast (89%) and Southeast (77%) was *stormwater sources*. The Great Lakes (84%) and Islands (71%) regions identified *urban runoff*, although the Islands had tie for top-ranked sources that also included *agricultural sources* (71%). The Mid Atlantic also identified agricultural sources to be the greatest source; the Gulf (74%)and Pacific (61%) identified *onsite disposal systems*.

Nutrient Enrichment Research Needs
All seven states identified *pollutant source tracking/identification* as the top priority research need for issues related to nutrient enrichment. The Great Lakes region had a tie for top-ranked research need that also identified *cumulative impact assessment* (e.g., the factors that lead to eutrophication) as an additional research need.
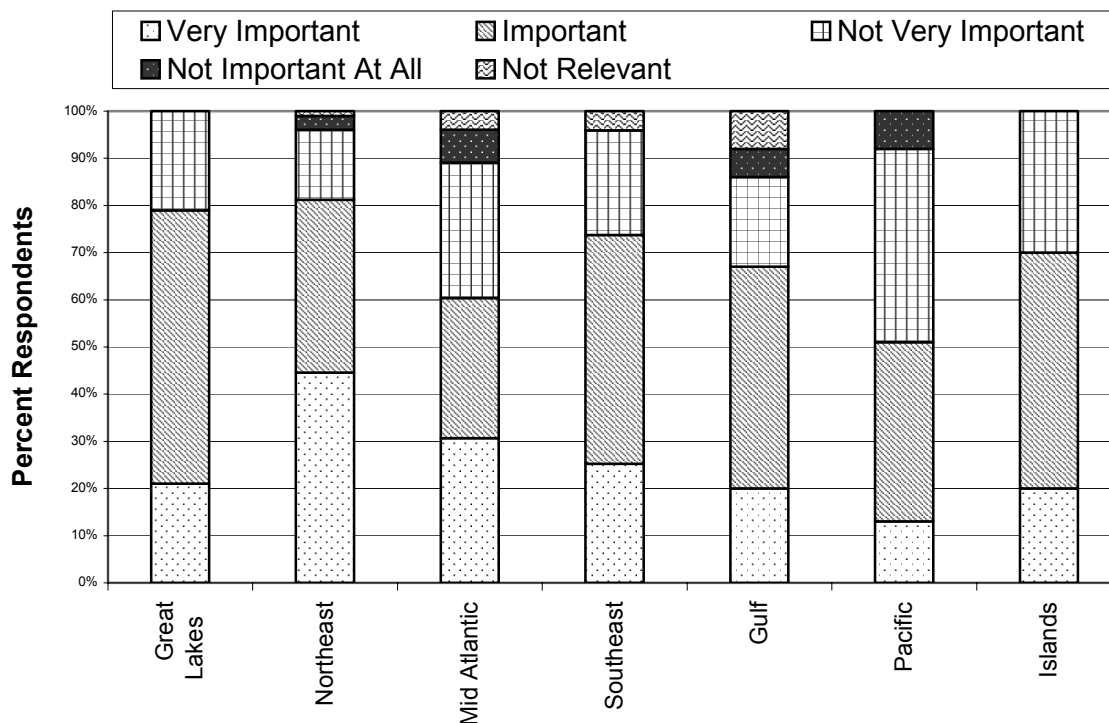
Figure 4-3. Importance of Nutrient Enrichment Across Regions

Nutrient Enrichment Information Needs

There was consensus among most regions that to address nutrient enrichment issues there is a need for better information regarding *best management practices (BMPs) effectiveness and/or BMP cost/benefit analysis*: Great Lakes (89%), Mid Atlantic (81%), Southeast (70%), Gulf (77%), Pacific (74%), and Islands (71%). The Northeast (60%) was the exception, identifying *land use analysis* as a more pressing information need.

Nutrient Enrichment Technology Needs

The Northeast (68%), Mid Atlantic (59%), Southeast (63%), and Gulf (69%) regions identified the top technology need to address nutrient enrichment issues as the need for more *cost-effective, long-term monitoring and sampling equipment*. The Great Lakes (53%) had a tie for top-ranked technology need between *enhanced remote sensing* and *improved treatment technologies*; the Islands (67%) also identified improved treatment technologies. The Pacific (60%) region was alone in its selection of *effective mitigation strategies* as it top technology need.

4-12   Comparison of Top-ranked Environmental Contamination Responses Across Regions

Importance of Environmental Contamination Issues

Six of the seven regions' top-ranked responses identified environmental contamination as an *important* issue (see Figure 4-4): Great Lakes (92%), Northeast (53%), Mid Atlantic (36%), Gulf (59%), Pacific (39%), and Islands (63%). The majority of respondents in the Southeast (38%) do not consider environmental contamination to be a very important issue.

Important Types of Environmental Contamination
The Great Lakes (83%) and Southeast (79%) identified *mercury* as the leading contaminant in their regions; the Northeast (56%) and Mid Atlantic (66%) identified *excess nitrogen*; the Gulf (54%), *sewage*; the Pacific (43%), *pathogens*; and the Islands (78%), *biocides*.

Environmental Contamination Research Needs
The majority of respondents in six of the seven regions indicated that *source identification* was the top research need to address issues related to environmental contamination over the next five years: Great Lakes (67%), Mid Atlantic (62%), Southeast (87%) Gulf (59%), Pacific (68%), and Islands (78%). The majority of respondents in the Northeast (59%) region identified *cumulative impact assessments* as the research priority, although *source identification* was a close second in the Northeast (56%).

Environmental Contamination Information Needs
The Great Lakes (54%), Northeast (49%), Mid Atlantic (48%), Pacific (51%), and Islands (78%) regions identified the top information need to address environmental contamination issues over the next five years to be *remediation options*. The Southeast (59%) selected *economic impact evaluations*, and the Gulf (49%), would like to see better *explanation of the interactions among contaminants*.
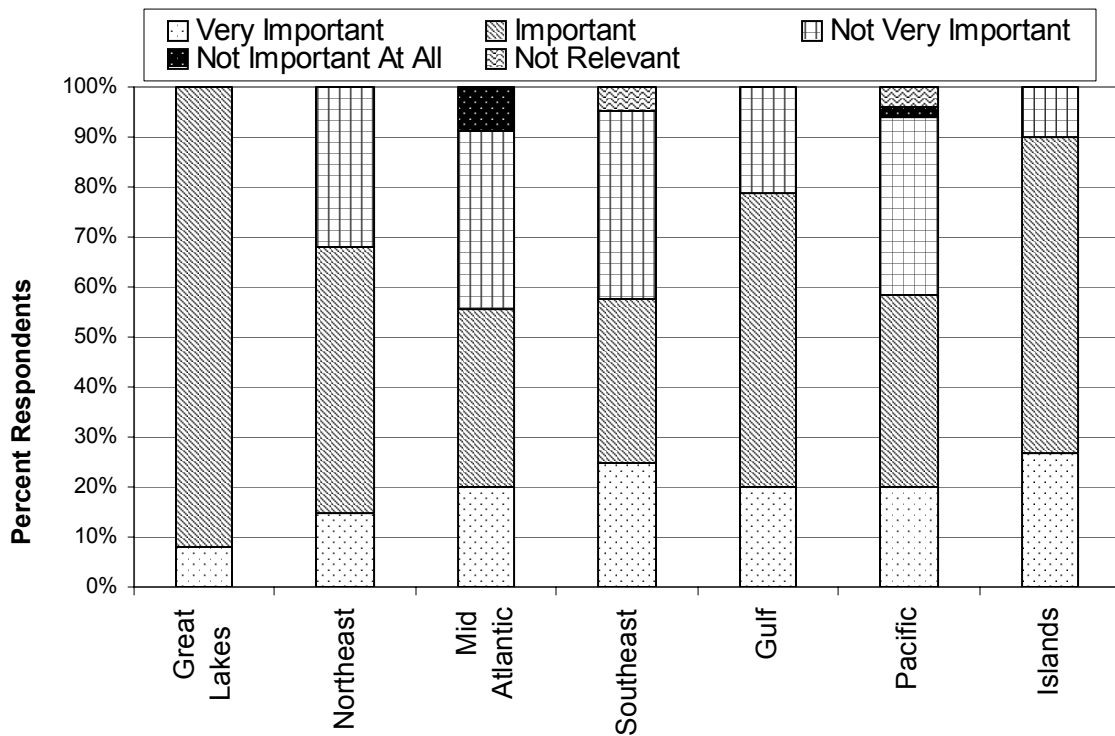
4-4. Importance of Environmental Contamination Across Regions

Environmental Contamination Technology Needs
The Northeast (51%) and Mid Atlantic (53%) identified the greatest technology need with respect to environmental contamination to be more *cost effective long-term monitoring equipment*. The Northeast (51%) had a tie for top choice that also included *improved remote sensing/sampling technologies*; the Islands (70%) region also made this their top selection. The Southeast (57%)

and Pacific (66%) regions would like to see better *rapid real time detection technologies*; the Gulf (65%) region identified the need for more *reliable DNA fingerprinting*.

4-13   Comparison of Top-ranked Nonindigenous Species Responses Across Regions

Importance of Nonindigenous Species Issues
The Great Lakes (63%) region's top-ranked response identified nonindigenous species as *very important* (see Figure 4-5). The Northeast (42%), Mid Atlantic (41%), Gulf (44%), and Islands (37%) regions' top-ranked responses were that nonindigenous species were *important*, while the Southeast (45%) and Pacific (40%) regions' top-ranked responses thought they were *not very important* to their regions.
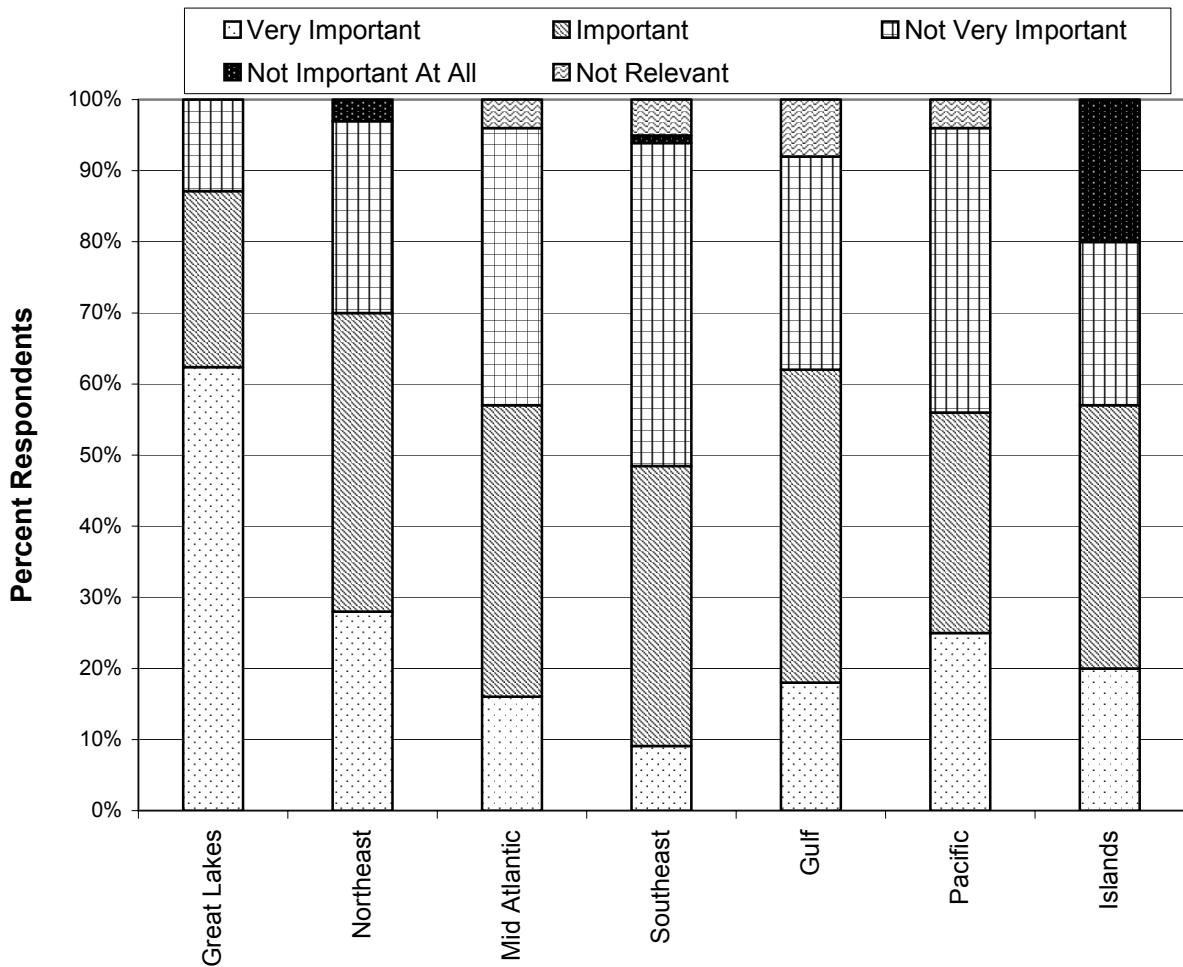
Figure 4-5. Importance of Nonindigenous Species Issues Across Regions

Important Nonindigenous Species Issues
The Great Lakes (90%), Northeast (81%), Mid Atlantic (79%), and Pacific (77%) regions identified that the *effects of nonindigenous species on native species and communities* as the most important nonindigenous species issue. The Gulf (76%) and Islands (65%) identified *eradicating or controlling species and communities* as most important, and the Southeast (88%) identified *preventing introduction*.

Nonindigenous Species Research Needs
The Northeast (63%), Mid Atlantic (78%), and Southeast (78%) identified *early detection of species* as the most important research need to address nonindigenous species issues over the next five years. The Great Lakes (86%), Pacific (66%), and Islands (53%) identified the *effectiveness of best management practices* as most important, and the Gulf (56%) was alone in selecting *susceptibility factors for coastal invasive introduction*.

Nonindigenous Species Information Needs
All seven regions selected *ecosystem inventory* as the most important information need to address nonindigenous species issues over the next five years: Great Lakes (76%), Northeast (72%), Mid Atlantic (74%), Southeast (79%), Gulf (85%), Pacific (85%), and Islands (88%).

Nonindigenous Species Technology Needs
The Southeast (84%), Gulf (91%), and Islands (100%) identified *treatment and removal technologies* as the top technology needed to address nonindigenous species issues over the next five years. The Northeast (71%) Mid Atlantic (82%), and the Pacific (92%) preferred a focus on *rapid detection and monitoring*, and the Great Lakes (76%) on *prevention techniques*.

4-14   Comparison of Top-ranked Coastal Hazards Reponses Across Regions

Importance of Coastal Hazards Issues
The top-ranked response of Islands (70%) respondents identified coastal hazards issues as *very important* (see Figure 4-6). The Mid Atlantic (42%) and Gulf (41%) regions' top-ranked response identified coastal hazards issues as *important*, and the Great Lakes (33%), Northeast (58%), Southeast (41%), and Pacific (41%) top responses found these issues to be *not very important*.

Important Coastal Hazards Issues
All seven regions identified *managing areas subject to erosion* as the most important coastal hazard issue over the next five years: Great Lakes (93%), Notheast (100%), Mid Atlantic (83%), Southeast (79%), Gulf (92%), Pacific (77%), and Islands (90%).

Research Needs for Coastal Hazards
The Southeast (84%), Gulf (79%), Pacific (52%), and Islands (100%) selected *risk and vulnerability assessments* as the top research activity to address coastal hazards over the next five years. The Great Lakes (79%) and Mid Atlantic (67%) selected *shoreline characterizations*, and the Northeast (58%) selected *trends analysis* as the priority research need.

Information Needs for Coastal Hazards
The Great Lakes (93%), Mid Atlantic (74%), Southeast (61%), and Gulf (75%) regions identified the most important information need to address coastal hazards issues over the next five years to be *design standards for shoreline management technologies*. The Pacific (72%) and the Islands (81%) identified *spatial and temporal demographics*, and the Northeast (58%) identified *access, retrieval, and analysis of data*.
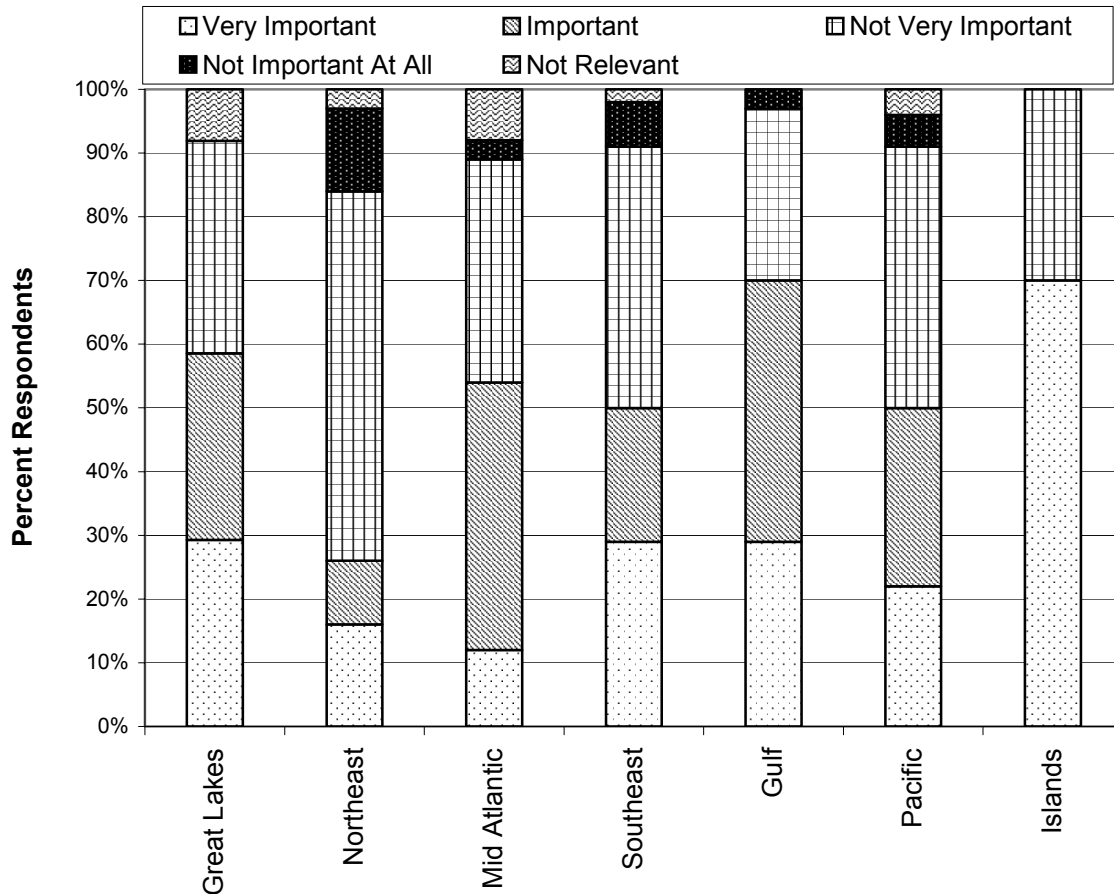
Figure 4-6. Importance of Coastal Hazards Across Regions

Technology Needs for Coastal Hazards
The Northeast (73%), Southeast (82%), Gulf (91%), Pacific (69%), and Islands (71%) selected *improved models to simulate and predict* as the priority technology need to address coastal hazards issues over the next five years; the Islands (71%) also selected *advanced detection and warning technologies* in a tie for their top-ranked technology need. The Great Lakes (93%) and Mid Atlantic (87%) selected *alternative shoreline protection technologies*.

4-15   Comparison of Top-ranked Sediment Management Responses Across Regions

Importance of Sediment Management
The Great Lakes (63%), Mid Atlantic (55%), Southeast (42%), Gulf (46%), Pacific (37%), and Islands (50%) regions identified sediment management as *important*, and the Northeast (47%) considered it to be *not very important* (see Figure 4-6).

Important Sediment Management Issues
The Great Lakes (57%), Pacific (57%), and Islands (88%) identified *identifying sediment transport patters* as the most important sediment management issue over the next five years. The Northeast (70%) and Gulf (53%) identified *managing the reuse of material*; the Southeast (61%), *identifying disposal options*; and the Mid Atlantic (60%), *developing regional management of sediment resources*.
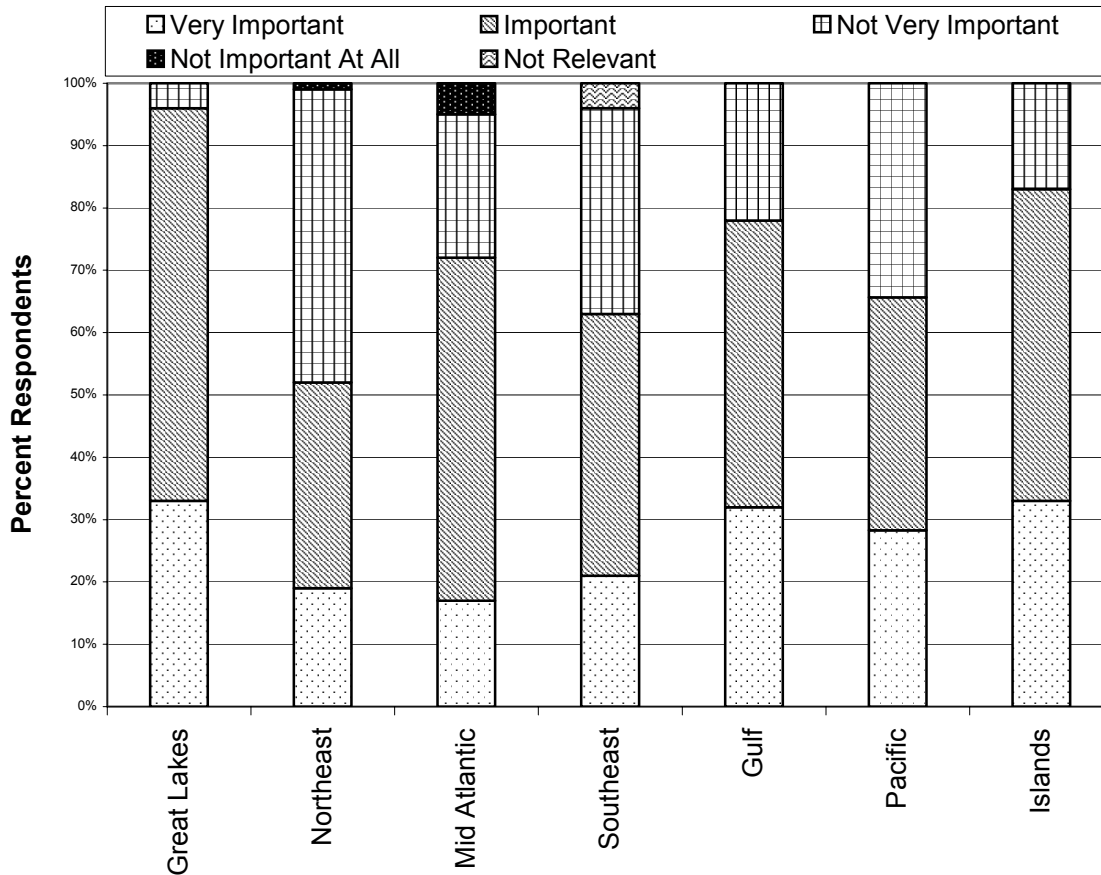
Figure 4-7. Importance of Sediment Management Across Regions

Research Needs for Sediment Management
The Northeast (66%) and Southeast (61%) identified the most needed research activity to address sediment management issues over the next five years is to *study the effects from dredging*. The Mid Atlantic (55%) and Pacific (43%) identified the need to *prioritize restoration and protection based on the most the maximum benefit for cost*; the Great Lakes (91%) identified the need to *analyze the impacts of engineering solutions*; the Gulf (70%), *improved beneficial uses*; and the Islands (64%), *effectiveness of confinement techniques*.

Information Needs for Sediment Management
The Northeast (65%), Mid Atlantic (62%), Southeast (71%), Pacific (55%), and Islands (88%) identified the top information need to address sediment management issues over the next five years to be *sediment transport patterns*. The Great Lakes (74%) identified *improved methods and models for quantifying sediment budgets*; while the Gulf (64%) identified *shoreline characterizations*.

Technology Needs for Sediment Management
The Great Lakes (61%), Southeast (70%), and Pacific (69%) regions identified the most important technological need to address sediment management issues over the next five years to be *improved methods for quantifying sediment budgets*. The Northeast (64%), Mid Atlantic (61%), and Gulf (75%) *identified improved models that simulate and predict*; and the Islands (88%), *containment and stabilization technologies*.

4-16 Comparison of Top-ranked Ocean Management Responses Across Regions

Importance of Ocean Management Issues
The Islands (40%) was the only region where the top-ranked response was that ocean management issues were *very important* (see Figure 4-8), and the Gulf (45%) was the only region whose top-ranked response found ocean management to be *important*. The top-ranked response was *not very important* in the Northeast (42%), Mid Atlantic (38%), Southeast (52%), and Pacific (39%) regions, and not relevant among the majority of Great Lakes respondents (54%).
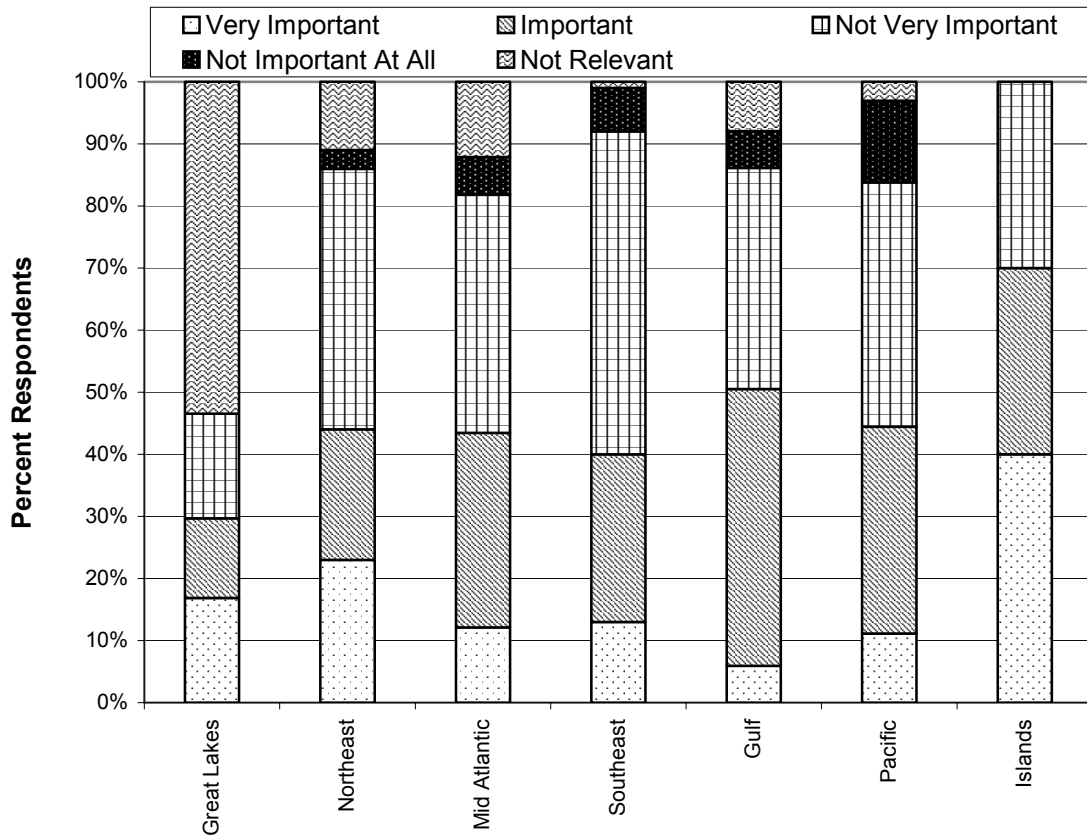
Figure 4-8. Importance of Ocean Management Across Regions

Important Ocean Management Issues
The Great Lakes (86%), Northeast (78%), Southeast (74%), and Gulf (81%) regions identified *loss of habitat or biodiversity* as the top ocean management issue to address over the next five years. The Mid Atlantic (82%) and Islands (71%) identified *reconciling conflicting uses*, and the Pacific (70%) identified the *use of Marine Management Areas* as the priority issue.

Research Needs for Ocean Management
The Northeast (69%), Mid Atlantic (68%), Southeast (56%), and Gulf (88%) regions think that *cumulative impact assessments* are the most important research activity to address ocean management issues over the next five years. The Pacific (60%) and Islands (52%) thought that research addressing *Marine Managed Area effectiveness* was most important, although the Islands (52%) had a tie for top choice and also identified *economic assessments* as most important. The Great Lakes (86%) identified *ecological characterizations*.

Information Needs for Ocean Management
The Great Lakes (71%) had a three-way tie for top information needs to address ocean management over the next five years that included *more geospatial data for GIS, access retrieval, and analysis of data*, and *state of knowledge and case studies*. The Mid Atlantic (66%), Pacific (87%), and Islands (90%) selected *more geospatial data for GIS* as the top priority information need; the Northeast (81%) and the Gulf (87%) selected *access, retrieval, and analysis of data*; and the Southeast (81%) selected *state of knowledge reports and case studies*.

Technology Needs for Ocean Management
The Mid Atlantic (66%), Southeast (69%), and Gulf (61%) identified the top technology need to address ocean management issues over the next five years to be *improved models that simulate and predict*. The Northeast (77%) and Islands (52%) identified *mapping and data acquisition* as top priority; the Pacific (69%) identified *nondestructive bottom fishing gear*; and the Great Lakes (57%) region selected energy technology.

4-17   Comparison of Top-ranked Marine Debris Responses Across Regions

Importance of Marine Debris Issues
The top-ranked response from the Gulf (47%) identified marine debris as an *important* issue (see Figure 4-9). The Great Lakes (38%), Northeast (69%), Mid Atlantic (72%), Southeast (53%), Pacific (60%), and Islands (60%) regions' top-ranked responses thought marine debris was *not very important*. The Great Lakes (38%) region also had an equal number of respondents who did not think the issue was relevant.
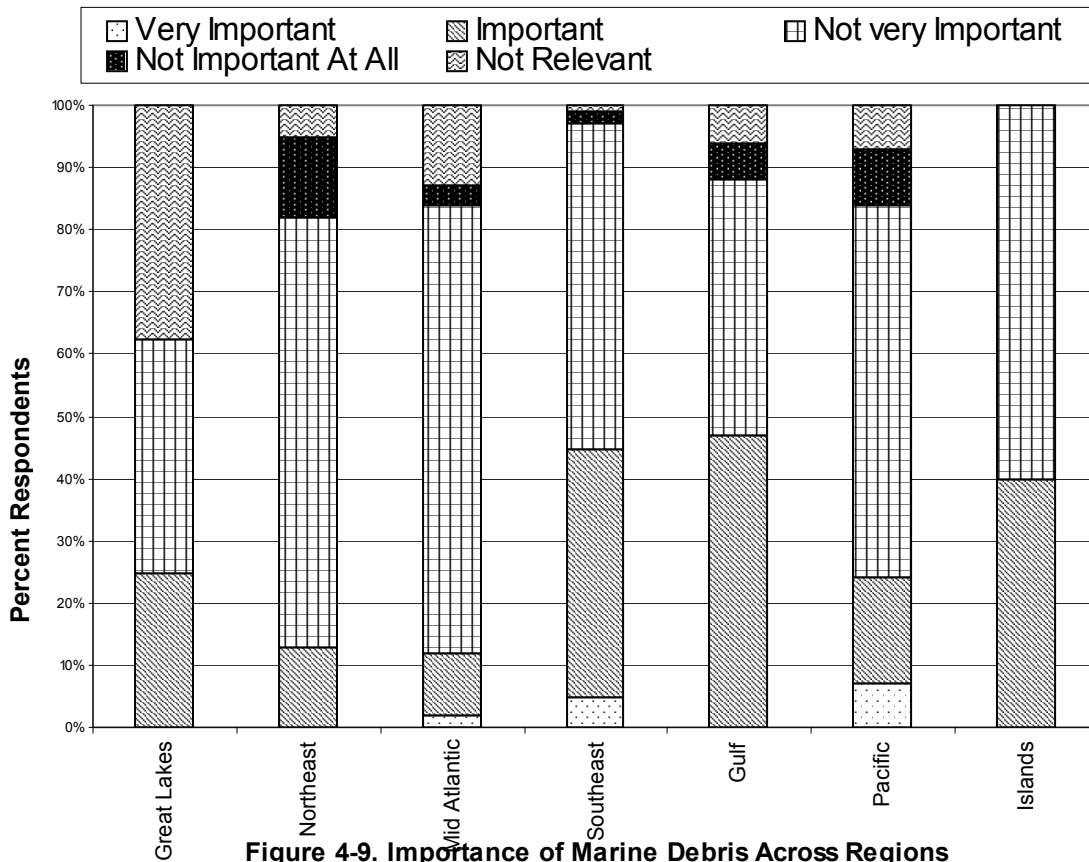
Figure 4-9. Importance of Marine Debris Across Regions

Important Marine Debris Issues
The top-ranked marine debris issue over the next five years was identified to be *source identification* by the Great Lakes (100%), Mid Atlantic (57%), Southeast (79%), and Islands (100%). The Great Lakes (100%), Northeast (70%), Pacific (65%), and Islands (100%) identified *aesthetic/habitat degradation* as the top issue. The Gulf (76%) found that *removal and disposal of retrieved debris* was a pressing issue.

Research Needs for Marine Debris
In the Great Lakes (100%), Northeast (52%), and Mid Atlantic (73%), *public education effectiveness* is the most important research need to address marine debris issues over the next five years; in the Northeast (52%), *source tracking* is also a top priority as it is in the Islands (100%) region. In the Southeast (76%), *perceptions and behaviors linked to sources* is top priority; in the Gulf (63%), *biodegradable products*; and in the Pacific (78%), *ecological impacts* is top.

Information Needs for Marine Debris
All seven regions identified the top information need to address marine debris issues over the next five years to be *public outreach and education*: Great Lakes (100%), Northeast (100%), Mid Atlantic (86%), Southeast (96%), Gulf (100%), Pacific (57%), and Islands (100%).

Technology Needs for Marine Debris
In the Great Lakes (67%), Mid Atlantic (100%), Gulf (94%), and Pacific (59%) regions, the most important technology need to address marine debris issues over the next five years is *debris removal technology*; there is also a second top priority in the Great Lakes (67%), which is marine debris *disposal or reuse technologies*. In the Southeast (66%) and Islands (67%), *GPS tracking systems for potential sources of debris* (e.g., containers, nets) is most important; and in the Northeast (52%), *gear modifications to make less harmful to non-target species and habitat*.

5   SURVEY RESULTS BY PROGRAMS

5-1   Introduction

This section discusses the results of the survey from a *program perspective*, grouped by program association as defined in Table 5-1.

Survey respondents were asked to indicate the importance of nine separate coastal resource management issues over the next five years. Tables 5-2 to 5-9 show the percentage of respondents in each of the seven *programs* who found the issues of habitat change, land use, nutrient enrichment, environmental contamination, nonindigenous species, coastal hazards, sediment management, ocean management, and marine debris to be either *very important* or *important* to their programs over the next five years. These tables also identify the top-ranked research, information, and technology needs for each.

The discussions accompanying each table highlight views expressed by the respondents based on the top-ranked responses. With regards to the responses from the surveys related to *continuous observation and monitoring variables*, respondents were not asked to select from the list those variables they considered most important, but rather to select all variables that they considered necessary to address a particular issue. Because there was no prioritization of these variables, they are not discussed in the body of this report, and instead can be found in the tables in the appendices.

Table 5-1. Associations and Program Interest

Association	Program Interest
Coastal States Organization (Coastal Zone Management Programs)	Coastal Management
National Estuarine Research Reserve Association	National Estuarine Research Reserve System
Association of National Estuary Programs	National Estuary Programs
Association of State Wetland Managers	State Wetland Programs
Association of State Floodplain Managers	State Floodplain Management Programs
Association of State and Interstate Water Pollution Control Administrators	State Water Quality Programs
Atlantic States Marine Fisheries Commission	State Fisheries Programs
Other	Varied by program

5-2   Coastal Zone Management Program Priorities

The two top-ranked management topics that the Coastal Management Program (Table 5-2) considered to be very important or important were *habitat change* (99%) and *land use* (97%). Land use and habitat change match the national top-ranked topics.

The top-ranked research, information and technology needs identified for habitat change were *cumulative impact assessments* (74%), *trends analysis-rate of loss/gain, success of restoration, etc* (79%) and *low cost remote sensing platforms to measure change* (48%).

Land use top-ranked research, information and technology needs were to *identify cumulative effects of development* (64%), *more geospatial data for GIS* (60%) and *customized GIS* (75%).

Table 5-2. Top-ranked Responses from Coastal Management Programs

Management Topic Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
HABITAT	99%	Cumulative impact assessments	74%	Trends analysis (rate of loss/gain, success of restoration, etc.)	79%	Low cost remote sensing platforms to measure change	48%
LAND USE	97%	Identify cumulative effects of development	64%	More geospatial data for GIS	60%	Customized GIS	75%
NUTRIENT ENRICHMENT	97%	Source identification/tracking	86%	BMP effectiveness or cost/benefit analysis	76%	Cost effective long-term monitoring/sampling equipment	55%
SEDIMENT MANAGEMENT	80%	Improved beneficial uses Analysis of impacts of engineered solutions	51% 51%	Sediment transport patterns	62%	Containment and stabilization technologies	63%
ENVIRONMENTAL CONTAMINATION	76%	Identification of sources	75%	Remediation options	54%	Improved treatment or removal technologies	58%
NONINDIGENOUS SPECIES	71%	Effectiveness of BMPs (e.g., ballast water treatment)	58%	Ecosystem inventory	79%	Treatment or removal technologies	73%
COASTAL HAZARDS	68%	Risk and vulnerability assessments	73%	More geospatial data for GIS (elevation maps, land cover and use, etc.)	68%	Alternative shoreline protection technologies	75%
OCEAN MANAGEMENT	55%	Cumulative impact assessments	57%	More geospatial data for GIS (benthic maps, jurisdictions, etc.)	81%	Mapping and data acquisition	50%
MARINE DEBRIS	32%	Source tracking	69%	Public outreach and education	96%	Disposal or reuse technologies	59%

5-3 National Estuarine Research Reserve Priorities

The two top-ranked management topics that the National Estuarine Research Reserves (Table 5-3) considered to be very important or important were *land use* (96%) and *habitat change* (93%). Land use and habitat change match the national top-ranked topics.

Land use top-ranked research, information and technology needs were *develop indicators that link land use with ecosystem impacts* (84%), *land use change analysis* (64%) and *improved models that predict and/or simulate* (89%).

The top-ranked research, information and technology needs identified for habitat change were *cumulative impact assessments* (67%), *trends analysis-rate of loss/gain, success of restoration, etc* (85%) and *improved models that predict and/or simulate* (62%).

Table 5-3. Top-ranked Responses from the National Estuarine Research Reserve Association

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
LAND USE	96%	Develop indicators that link land use with ecosystem impact	84%	Land use change analysis	64%	Improved models that predict and/or simulate	89%
HABITAT	93%	Cumulative impact assessments	67%	Trends analysis (rate of loss/gain, success of restoration, etc.)	85%	Models that predict and simulate	62%
ENVIRONMENTAL CONTAMINATION	77%	Identification of sources	53%	Explanation of interactions among contaminants	69%	Improved models that predict and/or simulate	61%
NONINDIGENOUS SPECIES	68%	Early detection of species	79%	Ecosystem inventory	80%	Rapid detection and monitoring	89%
SEDIMENT MANAGEMENT	68%	Prioritize restoration/protection based on max benefit for cost	55%	Sediment transport patterns	78%	Methods for quantifying sediment budgets	78%
NUTRIENT ENRICHMENT	65%	Source identification/tracking	66%	Land use analysis	75%	Improved models that predict and/or simulate	51%
OCEAN MANAGEMENT	41%	Ecological characterizations	65%	More geospatial data for GIS	61%	Improved models that predict and/or simulate	75%
COASTAL HAZARDS	37%	Shoreline characterizations Risk & vulnerability assessments	64% 64%	Design standards for shoreline management technologies	70%	Improved models that predict and/or simulate	81%
MARINE DEBRIS	10%	Biodegradable products (e.g., packing materials)	56%	Public outreach and education	94%	Debris removal technology	89%

5-4   National Estuary Program Priorities

The two top-ranked management topics that the National Estuary Program (Table 5-4) considered to be very important or important were *nutrient enrichment* (100%) and *land use* (100%).

The top-ranked research, information and technology needs identified for nutrient enrichment were *source identification/tracking* (73%), *bmp effectiveness or cost/benefit analysis* (68%) and *effectiveness of mitigation strategies* (58%).

Land use top-ranked research, information and technology needs were *to Quantify impacts of land use on water quality* (76%), *land use change analysis* (63%) and *affordable remote sensing* (75%).

Table 5-4. Top-ranked Responses from the Association of National Estuary Programs

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
NUTRIENT ENRICHMENT	100%	Source identification/tracking	73%	BMP effectiveness or cost/benefit analysis	68%	Effectiveness mitigation strategies	58%
LAND USE	100%	Quantify impact of land use on water quality	76%	Land use change analysis	63%	Affordable remote sensing	75%
HABITAT CHANGE	95%	Valuation of social, ecological, economic factors	60%	Trends analysis	84%	High resolution remote sensing	71%
ENVIRONMENTAL CONTAMINATION	80%	Effectiveness of remediation techniques	69%	Remediation options	75%	Improved treatment or removal technologies	75%
NONINDIGENOUS SPECIES	72%	Early detection of species	68%	Ecosystem inventory	90%	Rapid detection and monitoring	90%
SEDIMENT MANAGEMENT	56%	Improved beneficial uses	61%	Improved methods and models for quantifying sediment budgets	60%	Improved models that simulate and/or predict	65%
MARINE DEBRIS	35%	Public education effectiveness	59%	Public outreach and education	79%	Disposal or reuse technologies	87%
COASTAL HAZARDS	32%	Risk and vulnerability assessments	64%	Geomorphologic studies Design standards for shoreline management technologies	64% 64%	Alternative shoreline protection technologies	65%
OCEAN MANAGEMENT	30%	Ecological characterizations	57%	More geospatial data for GIS	78%	No-impact aquaculture techniques	66%

5-5   Association of State Floodplain Managers Priorities

The two top-ranked management topics that the State Floodplain Managers (Table 5-5) considered to be very important or important were *land use* (100%) and *nutrient enrichment* (100%).

The top-ranked research, information and technology needs identified for land use were *identify cumulative effects of development* (86%), *land use change analysis* (72%) and *customized GIS* (85%).

Nutrient enrichment top-ranked research, information and technology needs were *cumulative impact assessments* (100%), *BMP effectiveness or cost/benefit analysis* (100%) and *cost-effective long-term monitoring/sampling equipment* (100%).

Table 5-5. Top-ranked Responses from the Association of State Floodplain Managers

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
LAND USE	100%	Identify cumulative effects of development	86%	Land use change analysis	72%	Customized GIS	85%
NUTRIENT ENRICHMENT	100%	Cumulative impact assessments	100%	BMP effectiveness or cost/benefit analysis	100%	Cost effective long-term monitoring/sampling equipment	100%
COASTAL HAZARDS	93%	Risk and vulnerability assessments	100%	More geospatial data for GIS	73%	Improved models that simulate and predict	100%
MARINE DEBRIS	65%	Public education effectiveness	66%	Public outreach and education	100%	Debris removal technology	81%
SEDIMENT MANAGEMENT	52%	Cost/benefit analysis Analysis of impacts of engineering solutions	81% 81%	Shoreline characterizations	70%	Methods for quantifying sediment budgets Improved models that simulate and/or predict	87% 87%
HABITAT	45%	Cumulative impact assessments Evaluate effectiveness of restoration/protection techniques	84% 84%	Trends analysis (rate of loss/gain, success of restoration, etc.)	100%	Long-term monitoring/equipment	48%
ENVIRONMENTAL CONTAMINATION	43%	Cumulative impact assessments	70%	Economic impact evaluation	87%	Improved models that simulate and predict	70%
OCEAN MANAGEMENT	38%	Cumulative impact assessments	74%	More geospatial data for GIS	100%	Improved models that simulate and predict	90%
NONINDIGENOUS SPECIES	26%	Cumulative impact assessments Early detection of species	74% 74%	Land use assessment	74%	Rapid detection and monitoring	100%

5-6   Association of State Wetland Managers Priorities

The two top-ranked management topics that the State Wetland Managers (Table 5-6) considered to be very important or important were *habitat change* (100%) and *land use* (100%). Land use and habitat change match the national top-ranked topics.

The top-ranked research, information and technology needs identified for habitat change were *cumulative impact assessments (*82%), *trends analysis-rate of loss/gain, success of restoration, etc.* (96%) and *high resolution remote sensing* (61%).

Land use top-ranked research, information and technology needs were to *identify cumulative effects of development* (78%), more *geospatial data for GIS* (67%) and improved *models that simulate and/or predict* (85%).

Table 5-6. Top-ranked Responses from the Association of State Wetland Managers

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
HABITAT	100%	Cumulative impact assessment	82%	Trends analysis (rate of loss/gain, success of restoration)	96%	High resolution remote sensing	61%
LAND USE	100%	Identify cumulative effects of development	78%	More geospatial data for GIS	67%	Improved models that simulate and/or predict	85%
SEDIMENT MANAGEMENT	78%	Effects from dredging	89%	Sediment transport pattern	95%	Containment and stabilization technologies	79%
NONINDIGENOUS SPECIES	52%	Early detection of species	76%	Ecosystem inventory	94%	Treatment or removal technologies	100%
NUTRIENT ENRICHMENT	42%	Source identification/tracking	100%	Land use analysis	64%	Cost effective long-term monitoring/sampling equipment	100%
ENVIRONMENTAL CONTAMINATION	59%	Identification of sources	100%	More geospatial data for GIS	87%	Reliable DNA fingerprinting	87%
				Explanation of interactions among contaminants	87%		
COASTAL HAZARDS	11%	Shorelines characterization	100%	Design standards for shoreline management technology	100%	Improved models that simulate and/or predict	100%
						Alternative shoreline protection technologies	100%
OCEAN MANAGEMENT	11%	Ecological characterization	100%	State of knowledge reports/case studies	100%	Improved models that simulate and/or predict	100%
		Marine managed area effectiveness	100%			Nondestructive bottom fishing gear	100%
		Feasibility of alternative energy sources	100%			Energy technology	100%
MARINE DEBRIS	7%	No information		No information		No information	

5-7 Association of State and Interstate Water Pollution Control Administrators

The two top-ranked management topics that the State Water Quality Programs (Table 5-7) considered to be very important or important were *land use* (100%) and *environmental contamination* (92%). Land use matches the national top-ranked topic.

The top-ranked research, information and technology needs identified for land use were *quantify impacts of land use on water quality (*65%), *land use change analysis* (97%) and *customized GIS* (60%).

Environmental contamination top-ranked research, information and technology needs were *identification of sources* (86%), *explanation of interactions among contaminants* (71%) and *improved remote sensing/sampling technologies* (56%).

Table 5-7. Top-ranked Responses from the Association of State and Interstate Water Pollution Control Administrators

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
LAND USE	100%	Quantify impact of land use on water quality (e.g., nutrients and bacteria)	65%	Land use change analysis	97%	Customized GIS	60%
ENVIRONMENTAL CONTAMINATION	92%	Identification of sources	86%	Explanation of interactions among contaminants	71%	Improved remote sensing/sampling technologies	56%
SEDIMENT MANAGEMENT	85%	Prioritize restoration/protection based on max benefit for cost	54%	Sediment transport patterns	59%	Improved models that simulate and/or predict	75%
HABITAT	71%	Cumulative impact assessments	81%	Trends analysis (rate of loss/gain, success of restoration)	72%	Models that simulate or predict	65%
NUTRIENT ENRICHMENT	69%	Source identification/tracking	94%	BMP effectiveness or cost/benefit analysis	100%	Improved models that simulate and/or predict	69%
MARINE DEBRIS	36%	Source tracking	100%	Public outreach and education	100%	Debris removal technology	68%
OCEAN MANAGEMENT	32%	Cumulative impact assessments	74%	More geospatial data for GIS Access, retrieval, analysis of data	100% 100%	Improved models that simulate and/or predict	100%
COASTAL HAZARDS	28%	Shoreline characterization	90%	State of knowledge reports/case studies Design standards for shoreline management technologies	90% 90%	Improved models that simulate and/or predict	100%
NONINDIGENOUS SPECIES	26%	Susceptible factors for coastal invasive introduction	78%	Land use assessment	78%	Rapid detection and monitoring	100%

5-8   Atlantic States Marine Fisheries Commission Priorities

The two top-ranked management topics that the Atlantic States Marine Fisheries Commission (Table 5-8) considered to be very important or important were *habitat change* (100%) and *nonindigenous species* (91%). Habitat change matches the national top-ranked topics.

The top-ranked research, information, and technology needs identified for habitat change were *cumulative impact assessments (*89%), *ecological and physical baselines and inventories* (82%), and *high resolution remote sensing* (68%).

Nonindigenous species top-ranked research, information and technology needs were to understand *human behaviors leading to introductions* (59%), *access, retrieval and analysis of data* (75%) and *prevention technology* (85%).

Table 5-8. Top-ranked Responses from the Atlantic States Marine Fisheries Commission

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
HABITAT CHANGE	100%	Cumulative impact assessments	89%	Ecological and physical baselines and inventories	82%	High resolution remote sensing	68%
NONINDIGENOUS SPECIES	91%	Human behaviors leading to introductions	59%	Access, retrieval, and analysis of data	75%	Prevention technology (e.g., irradiation)	85%
LAND USE	78%	Identify cumulative effects of development	93%	Access, retrieval and analysis of data	70%	Affordable remote sensing	93%
ENVIRONMENTAL CONTAMINATION	77%	Cumulative impact assessments	93%	Economic impact evaluations	77%	Improved models that simulate and/or predict	77%
OCEAN MANAGEMENT	75%	Cumulative impact assessments	67%	Access, retrieval, and analysis of data	93%	Nondestructive bottom fishing gear	65%
NUTRIENT ENRICHMENT	75%	Effects on species/communities	100%	Access, retrieval, and analysis of data	78%	Cost effective long-term monitoring/sampling equipment	85%
SEDIMENT MANAGEMENT	72%	Cost/benefit analysis	62%	Improved methods and models for quantifying sediment budgets	72%	Improved models that simulate and/or predict	83%
COASTAL HAZARDS	35%	Risk and vulnerability assessments	100% 64% 64%	Geomorphologial studies Spatial and temporal demographics Design standards for shoreline management technologies	64% 64%	Impact zone identification Alternative shoreline protection technologies	100% 100%
MARINE DEBRIS	27%	Biodegradable gear	100%	Public outreach and education	100%	Gear modifications to make less harmful to non-target species and habitat	100%

5-9   Others Priorities

The top-ranked management topics that Other Respondents (Table 5-9) considered to be very important or important was *land use* (100%) and *environmental contamination* (63%). Land use matches the national top-ranked topic.

The top-ranked research, information and technology needs identified for land use were *to provide socioeconomic cost/benefit analysis of various land use options (84*%), *land suitability analysis* (100%) and *affordable remote sensing* (100%).

The top-ranked research, information and technology needs identified for environmental contamination were *toxicity analysis* (100%), *explanations of interactions among contaminants* (100%), and *rapid/real-time detection* (100%).

Table 5-9. Top-ranked Responses from Others

Management Issues Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
LAND USE	100%	Provide socioeconomic cost/benefit analysis of various land use options	84%	Land suitability analysis	100%	Affordable remote sensing	100%
ENVIRONMENTAL CONTAMINATION	63%	Toxicity analysis	100%	Explanation of interactions among contaminants	100%	Rapid/real time detection	100%
SEDIMENT MANAGEMENT	61%	Cost/benefit analysis	100%	Sediment transport patterns	100%	Engineered solutions	100%
				Improved methods and models for quantifying sediment budgets	100%		
NUTRIENT ENRICHMENT	55%	Source identification/tracking	100%	Short term forecasts of nutrient loading	100%	Improved models that simulate and predict	71%
						Cost effective long-term monitoring/sampling equipment	71%
						Enhanced remote sensing	71%
HABITAT CHANGE	55%	Identify causes of loss/gain	100%	Trends analysis	100%	Low cost remote sensing platforms to measure change	100%
				Ecological and physical baselines and inventories	100%		
COASTAL HAZARDS	45%	Littoral cell inventories	100%	Socioeconomic impact assessments	100%	Impact zone identification	100%
		Risk and vulnerability assessments	100%	State of knowledge reports/case studies	100%	Improved models that simulate and/or predict	100%
		Trends analysis	100%	More geospatial data for GIS	100%	Alternative shoreline protection technologies	100%
OCEAN MANAGEMENT	45%	Economic assessments	100%	More geospatial data for GIS	100%	No impact aquaculture techniques	100%
		State of knowledge reports/case studies	100%	Access, retrieval, analysis of data	100%	Mapping and data acquisition	100%
		Risk assessments	100%	State of knowledge reports/case studies	100%	Improved models that simulate and/or predict	100%
NONINDIGENOUS SPECIES	0%	N/A		N/A		N/A	
MARINE DEBRIS	0%	N/A		N/A		N/A	

5-10   Comparison of Top-ranked Habitat Change Issues Across Programs

Importance of Issues Related To Habitat Change
Top-ranked responses from CZM (72%), NERR (61%), NEP (85%), ASWM (82%), and AFMC (69%) found issues related to habitat change were *very important*. Top-ranked responses from ASIWPCA (67%) selected *important*, and ASFPM (55%) and Others (45%) believed they were *not very important* (see Figure 5-1).
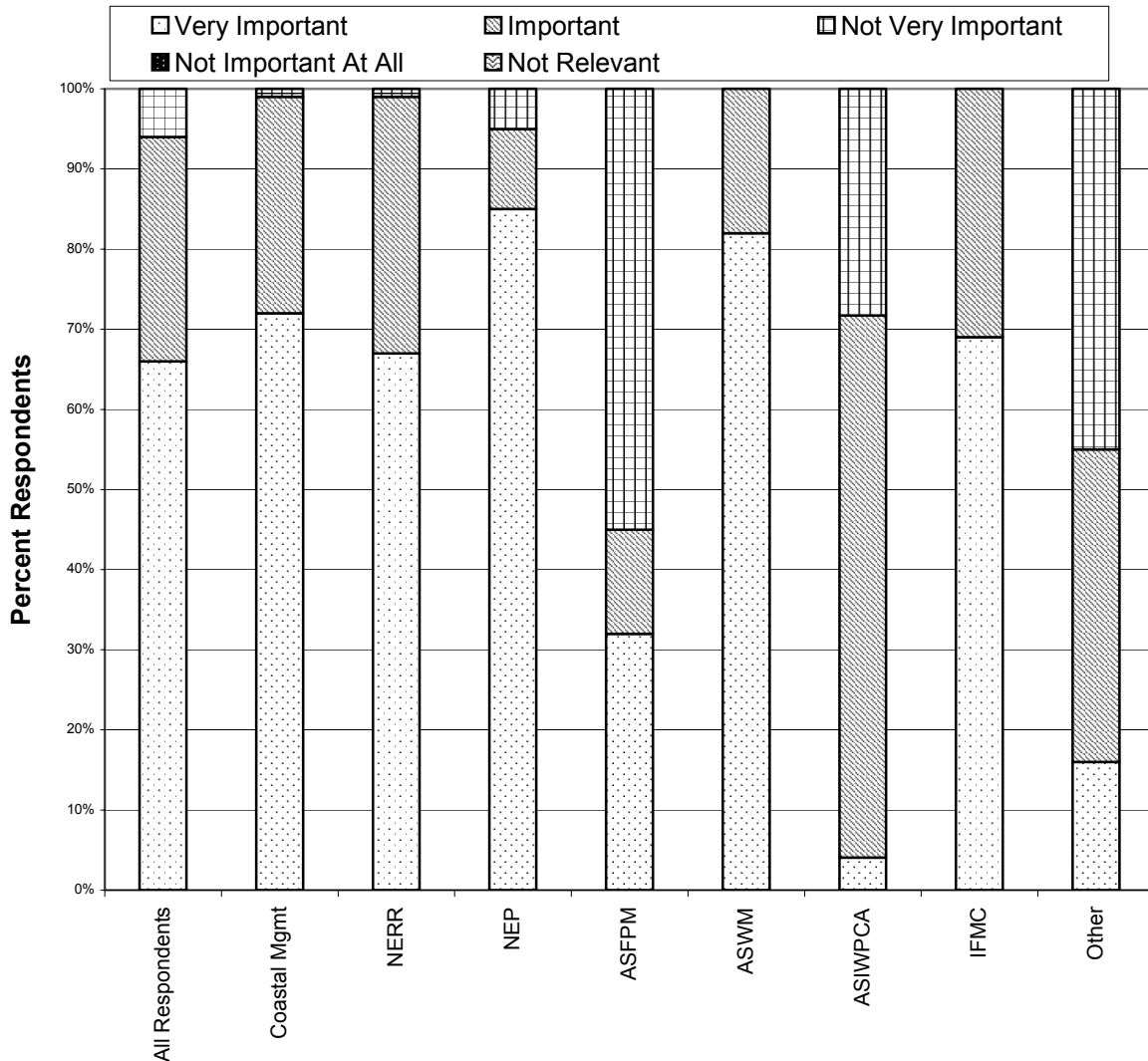
Figure 5-1. Comparison of Habitat Change Across Programs

Important Habitat Types
The top-ranked habitat type important to CZM (69%), NERR (72%), and ASIWPCA (87%) was *uplands*. ASWM (86%) found *freshwater wetlands* to be most important; NEP (76%) and Others (100%), salt marshes; ASFPM (65%), *engineered shorelines*; and AFMC (58%) identified both *shellfish beds/reefs* and *seagrass beds*.

Habitat Change Research Needs
Six of the eight programs ranked *cumulative impact assessment* as the top research needs to address habitat change: CZM (74%), NERR (67%), ASFPM (84%), ASWM (82%), ASIWPCA

(81%), and AFMC (89%). ASFPM (84%) also selected *evaluation of the effectiveness of restoration/protection techniques* as a priority research need. NEP (60%) selected the *valuation of social, ecological, and economic factors*, and Others (100%) selected *identification of causes of loss/gain*.

Types of Information Needed To Address Habitat Change
Trends analysis was selected as the top information need by seven of the eight program groups surveyed: CZM (79%), NERR (85%), NEP (84%), ASFPM (100%), ASWM (96%), ASIWPCA (72%), and Others (100%). AFMC (82%) and Others (100%) selected *ecological and physical baselines and inventories*.

Improved Technologies To Address Habitat Change
The top-ranked responses of technology needs to address habitat change for NEP (71%), ASWM (61%), and AFMC (68%) was *high resolution remote sensing*. CZM (48%) and Others (100%) selected *low cost remote sensing platforms to measure change*. ASFPM (48%) selected *long term monitoring equipment* and ASIWPCA (65%) selected *models that predict and simulate*.

5-11   Comparison of Top-ranked Land Use Responses Across Programs

Importance of Land Use
Five of the eight program groups' top ranked response selected land use as a *very important* coastal management issue: CZM (82%), NERR (69%), NEP (68%), ASFPM (86%), ASIWPCA (66%), and Other (55%). ASWM (54%), and AFMC (49%) agreed it was an *important* issue.
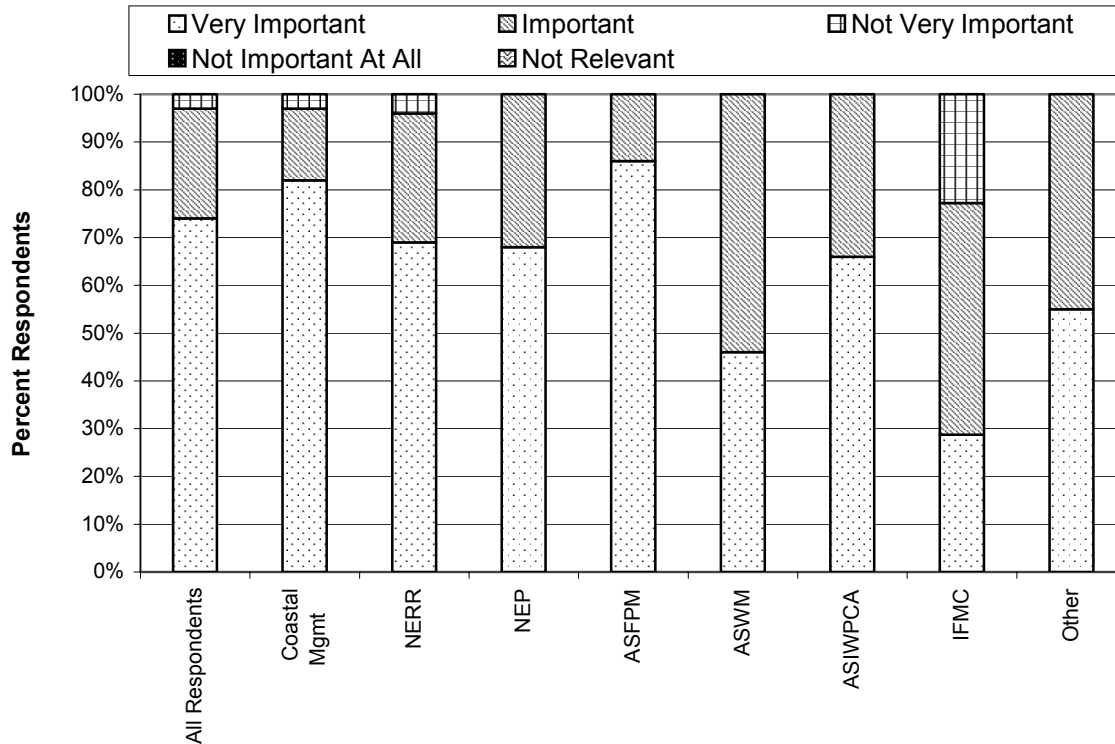
Figure 5-2. Comparison of Land Use Issues by Program

Important Land Use Issues
The top-ranked land use issue for the CZM (78%), ASFPM (100%), AFMC (82%), and Others (100%) was *managing the effects of coastal development*. NERR (84%) and ASWM (96%) identified *integrating watershed/ecosystem planning at the state and local level*; NEP (78%) and ASIWPCA (89%) identified *reducing the impacts of nonpoint source pollution*.

Land Use Research Needs
CZM (64%), ASFPM (86%), ASWM (78%), and AFMC (93%) selected the top-priority research need to address land use issues over the next five years was *to identify cumulative effects of development*. NEP (76%) and ASIWPCA (65%) would like to see research *to quantify impacts of land use on water quality*; NERR (84%) identified that *developing indicators that link land use with ecosystem impact* was a top research priority; Others (84%) top research priority was to *provide socioeconomic cost/benefit analysis of various land use options*.

Information Needed To Address Land Use Issues
NERR (64%), NEP (63%), ASFPM (72%), and ASIWPCA (97%) selected *land use change analysis* as the top information need to address land use issues over the next five years. CZM (60%) and ASWM (67%) selected *more geospatial data for GIS*; AFMC (70%) selected *access, retrieval, and analysis of data*; and Others (100%) selected *land suitability analysis*.

Improved Technologies To Address Land Use Issues
CZM (75%), ASFPM (85%), and ASIWPCA (60%) selected *customized GIS* as the top-ranked research activity to address land use change issues over the next five years. NEP (75%), AFMC (93%), and Others (100%) found *affordable remote sensing* to be a priority technology for their land use issues, and NERR (89%) and ASWM (85%) identified *improved models that simulate or predict*.

5-12   Comparison of Top-ranked Nutrient Enrichment Responses Across Programs

Importance of Nutrient Enrichment
Top-ranked responses from CZM (82%), NEP (68%), ASFPM (86%), and ASIWPCA (53%) identified nutrient enrichment issues as *very important* (see Figure 5-3). NERR (39%) and AFMC (43%) found it was *important*; ASWM (58%) and Others (45%) agreed nutrient enrichment was *not very important*.

Important Nutrient Enrichment Sources
The top-ranked nutrient enrichment source for NERR (59%), NEP (71%), ASFPM (100%), ASIWPCA (98%), and Others (100%) is *stormwater sources*. CZM (78%), ASWM (73%), AFMC (69%), and Others (100%) agreed the top source is *urban runoff*.

Nutrient Enrichment Research Needs
Six of the eight programs identified *source identification/tracking* as the top research need for nutrient enrichment issues: CZM (86%), NERR (66%), NEP (73%), ASWM (100%), ASIWPCA (94%), and Others (100%). ASFPM (100%) identified *cumulative impact assessments*, and AFMC (100%) identified research on the *effects of nutrient enrichment on species/communities* as top priority.

Nutrient Enrichment Information Needs
CZM (76%), NEP (68%), ASFPM (100%), and ASIWPCA (100%) agreed that more *information on BMP effectiveness or BMP cost/benefit analysis* is a top priority. NERR (75%) and ASWM (64%) found *information on land use analysis* to be priority; AFMC (78%) thought *access, retrieval and analysis of data* to be priority for nutrient enrichment issues, and Others identified *short-term forecasts of nutrient loading*.
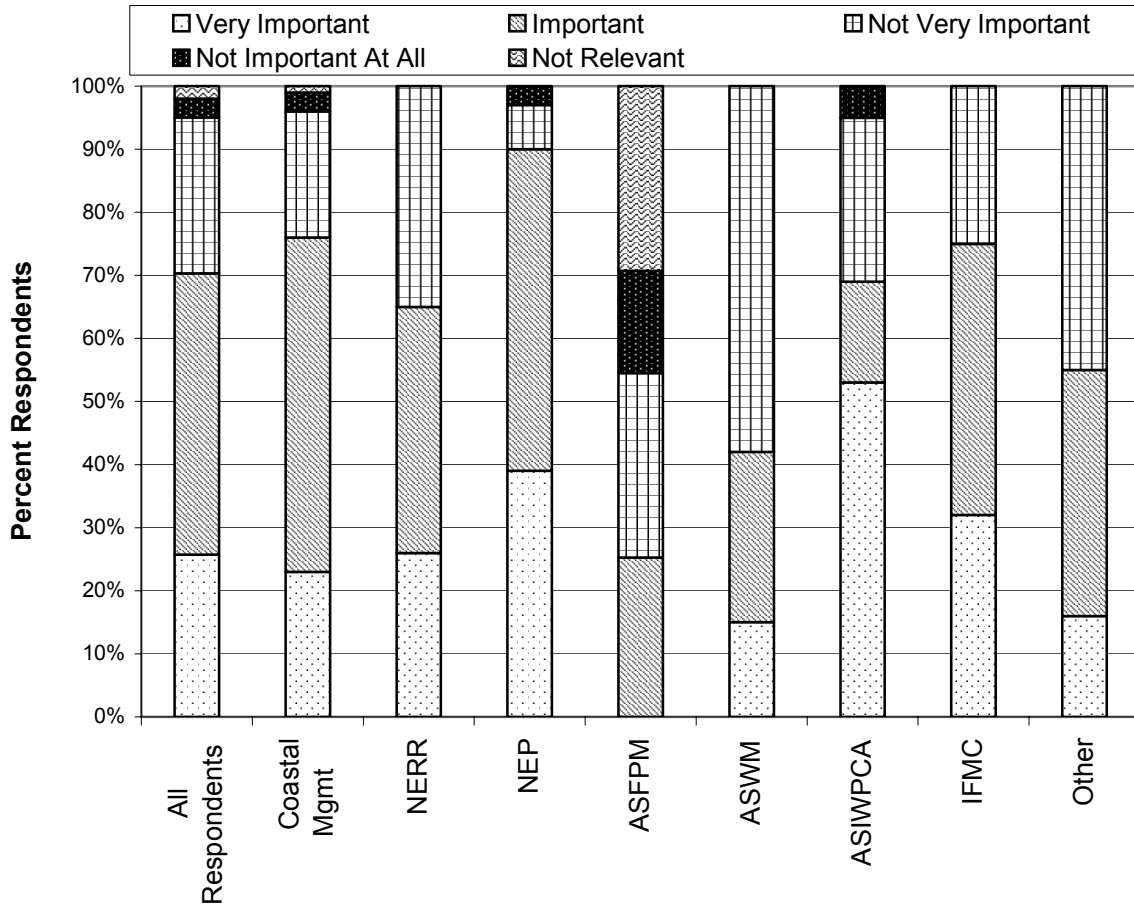
Figure 5-3. Nutrients Issues Across Programs

Nutrient Enrichment Technology Needs
CZM (55%), ASFPM (100%), ASWM (100%), AFMC (85%), and Others (71%) identified *cost effective long-term monitoring/sampling equipment* to be a priority technology need. NERR (51%) ASIWPCA (69%), and Others (71%) identified *improved models to simulate and predict*; NEP (58%) identified more *effective mitigation strategies* as the top technology need; and Others (71%) identified *enhanced remote sensing*.

5-13   Comparison of Top-ranked Environmental Contamination Responses Across Programs

Importance of Environmental Contamination Issues
Six of the eight programs' top-ranked responses identified environmental contamination as an *important* issue: CZM (60%), NERR (61%), NEP (57%), ASWM (44%), ASIWPCA (48%), AFMC (47%), and Others (47%) (see Figure 5-4). ASFPM (40%) found it to be *not very important.*

Important Types of Environmental Contamination
NEP (66%), ASIWPCA (68%), and AFMC (68%) identified *pathogens* as the most important type of environmental contamination. *Sewage* was identified as most important by NERR (61%) and ASFPM (100%). CZM (51%) and ASWM (76%) identified *mercury*, and Others (100%) identified *other* types.

Environmental Contamination Research Needs
Respondents from CZM (75%), NERR (53%), ASWM (100%), and ASIWPCA (86%) selected *identification of sources* as the top research need to address issues related to environmental contamination over the next five years. NEP (69%) selected *effectiveness of remediation techniques*, ASFPM (70%) and AFMC (93%) selected *cumulative impact assessments*, and Others (84%) selected *toxicity analysis*.

Environmental Contamination Information Needs
NERR (69%), ASWM (87%), ASIWPCA (71%), and Other (100%) identified *explanations of interactions among contaminants* as a top information need to address environmental contamination issues over the next five years. CZM (54%) and NEP (75%) identified the top need to be *more remediation options*; ASFPM (87%) and AFMC (77%), *economic impact evaluations*, and ASWM (87%) identified *more geospatial data for GIS* in a tie for their top information need.

Environmental Contamination Technology Needs
CZM (58%) and NEP (75%) selected *improved remote sensing/sampling technologies* as the top technology needed to address environmental contamination issues over the next five years. NERR (61%), ASFPM (70%), and AFMC (77%) identified *improved models that simulate and predict*; ASWM (87%) identified *reliable DNA fingerprinting*; ASIWPCA (56%) identified *improved remote sensing/sampling technologies*; and Others (63%) identified *rapid/real time detection*.
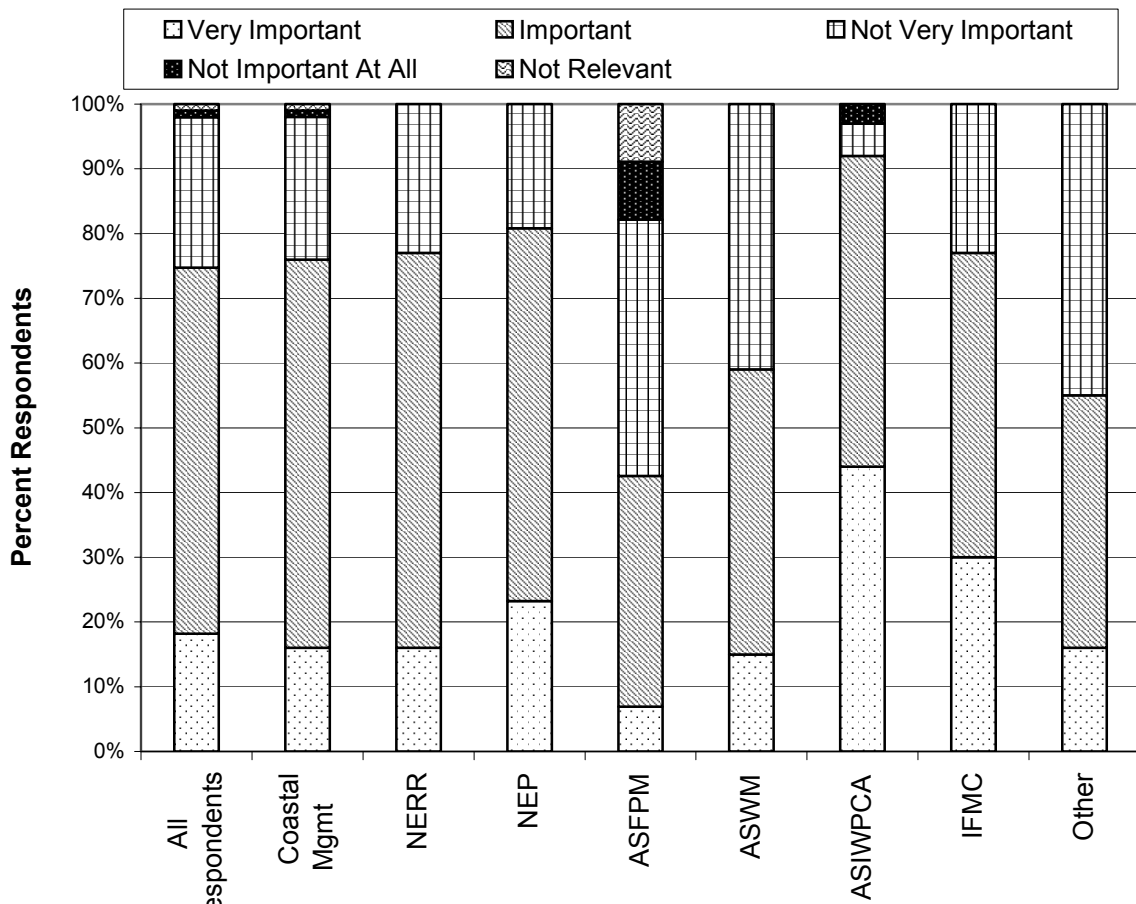
Figure 5-4. Importance of Environmental Contamination by Program

5-14   Comparison of Top-ranked Nonindigenous Species Responses Across Programs

Importance of Nonindigenous Species Issues
Top-ranked responses from CZM (37%), NEP (55%), and AFMC (61%) identified nonindigenous species issues as *important* to coastal management (see Figure 5-5). NERR (38%) identified it as *very important*; ASWM (49%), ASIWPCA (74%) and Others (100%), *not very important*; and ASFPM (38%) as *not relevant*.

Important Nonindigenous Species Issues
Five of the eight programs identified the top nonindigenous species issue over the next five years to be *effects on native species and communities*: CZM (74%), NERR (88%), ASFPM (100%), ASIWPCA (100%), and AFMC (97%). NEP (82%) identified *preventing introductions* as an important issue, and ASWM (90%) identified *eradicating or controlling species*.

Nonindigenous Species Research Needs
NERR (79%), NEP (68%), ASFPM (74%), and ASWM (76%) selected *early detection of species* as the top research activity for nonindigenous species issues over the next five years. CZM (58%) identified the top research need to be effectiveness of BMPs; ASIWPCA (78%) identified susceptibility factors for coastal invasive introductions; and Others (59%), identified the need to understand *human behaviors leading to introductions,* as a priority research need.
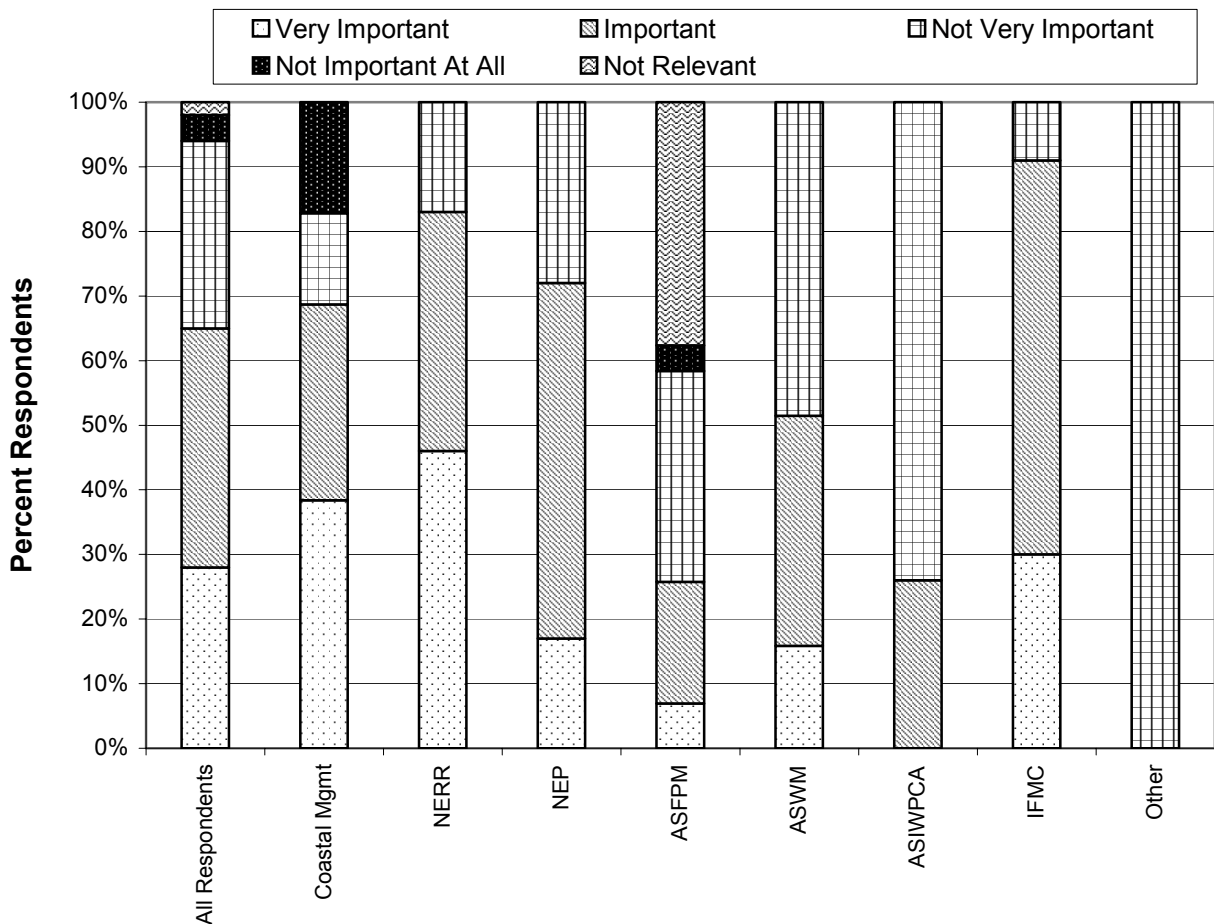
Figure 5-5. Importance of Nonindigenous Species Across Programs

Nonindigenous Species Information Needs
CZM (79%), NERR (80%), NEP (90%), and ASWM (94%) selected *ecosystem inventory* as the
top information need for nonindigenous species issues over the next five years. ASFPM (74%)
and ASIWPCA (78%) selected *land use assessment*. AFMC (75%) identified *access, retrieval
and analysis of data* as a top priority.

Nonindigenous Species Technology Needs
Rapid detection and monitoring was the most important technology need over the next five years
identified by NERR (89%), NEP (90%), ASFPM (100%), and ASIWPCA (100%). CZM (73%) and
ASWM (100%) selected *treatment or removal technologies*; and AFMC (85%) selected
prevention techniques, as a priority technology need.

5-15   Comparison of Top-ranked Coastal Hazards Responses Across Programs

Importance of Coastal Hazard Issues
Top-ranked responses from CZM (44%) and ASFPM (74%) considered coastal hazards issues to
be *very important* (see Figure 5-6). Top-ranked responses were *not very important* by NERR
(52%), NEP (51%), ASIWPCA (66%), AFMC (66%), and by the Other programs (55%). The top-
ranked response from ASWM (40%) considered coastal hazard issues *not relevant* to their work.
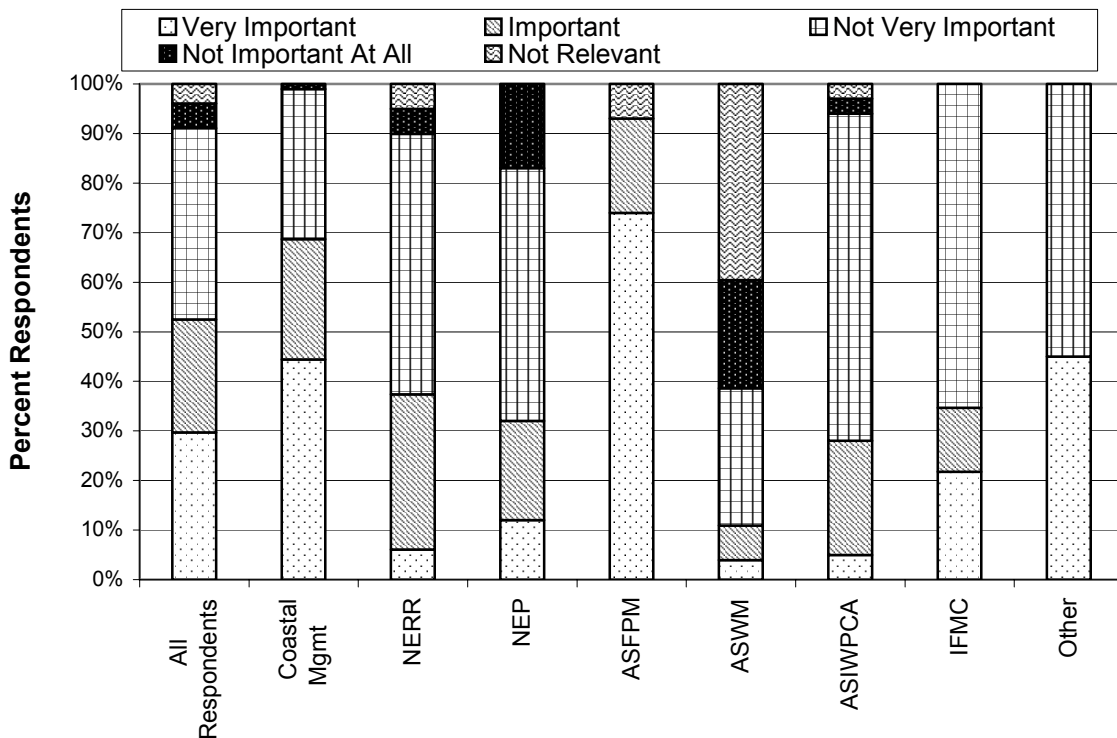
Figure 5-6. Importance of Coastal Hazards Across Programs

Important Coastal Hazard Issues
Managing areas subject to erosion was identified as the most important coastal issue by CZM
(93%), NERR (84%), NEP (65%), ASWM (100%), and by the Other programs (100%). ASFPM
(100%), ASIWPCA (82%), and Other programs (100%) ranked *managing areas subject to
flooding* (100%) as its priority issue. *Managing for effects of shoreline stabilization* was top ranked
by ASWM (100%), AFMC (64%), and Other programs (100%). AFMC (64%) also identified as a
priority, *understanding economic impacts*.

Research Needs for Coastal Hazards
Risk and vulnerability assessments were identified by CZM (73%), NERR (64%), NEP (64%), ASFPM (100%), AFMC (100%), and Other programs (100%) as the highest priority research need to address coastal hazards issues over the next five years. NERR (64%) also identified *shoreline characterizations* as a top need, as did ASWM (100%) and ASIWPCA (90%).

Information Needs for Coastal Hazards
Design standards for shoreline management technologies was identified by NERR (70%), NEP (64%), ASWM (100%), ASIWPCA (90%), and AFMC (64%) as the highest priority information need to address coastal hazard issues over the next five years. NEP (64%) and AFMC (64%) also *identified geomorphologic studies.* CZM (68%), ASFPM (73%), and Other programs (100%) desire *more geospatial data for GIS*. The top priority for ASIWPCA (90%) and Other programs (100%) was *state of knowledge reports/case studies*. AFMC (64%) also identified information on *spatial and temporal demographics*; and Other programs (100%) also would like to see *socioeconomic impact assessments*.

Technology Needs for Coastal Hazards
NERR (81%), ASFPM (100%), ASWM (100%), ASIWPCA (100%), and the Other (100%) programs identified *Improved models that simulate and predict* as a priority technology need to address issues related to coastal hazards over the next five years. *Alternative shoreline protection technologies* was identified by CZM (75%), NEP (65%), ASWM (100%), AFMC (100%), and Others (100%) as an important technology need. Both AFMC (100%) and the Other programs (100%) also selected *Impact zone identification,* as a priority need.

5-16   Comparison of Top-ranked Sediment Management Responses Across Programs

Importance of Sediment Management Issues
Top-ranked responses from CZM (49%), NERR (49%), ASWM (51%), ASIWPCA (55%), and AFMC (57%) identified sediment management issues as *important* (see Figure 5-7). NEP (44%) and ASFPM (48%) ranked these issues as *not very important*. Top-ranked responses from Other programs (45%) identified sediment issues as *very important*.

Important Sediment Management Issues
Managing the reuse of material was ranked as the most important sediment management issue over the next five years by AFMC (100%). CZM (58%), NERR (80%), NEP (55%), ASFPM (83%), and ASWM (58%) identified *identifying sediment transport patterns* as the most important sediment management issue. *Identifying disposal options* was priority for ASIWPCA (60%); and Other programs (100%) prioritized *managing sediment resources regionally*.

Research Needs for Sediment Management
ASFPM (81%), AFMC (100%), and Other (100%) programs think that c*ost benefit analysis* would best address the most important sediment management issues over the next five years. *Improved beneficial uses* was identified by CZM (51%) and NEP (61%) as the most important research activity. ASWM (89%) identified e*ffects from dredging* as their priority. *Analysis of impacts of engineering solutions* was also selected by CZM (51%) and ASFPM (81%) in addition to other activities as the primary research activity. NERR (55%) and ASIWPCA (54%) identified *prioritize restoration/protection based on max benefits for cost,* as their top research need

Information Needs for Sediment Management
Sediment transport patterns were identified as the primary information need to address sediment management issues over the next five years by CZM (62%), NERR (78%), ASWM (95%), ASIWPCA (59%), and Other programs (100%). NEP (60%), AFMC (72%) and Others (100%) selected *improved methods and models for quantifying sediment budgets* as their primary information need. ASFPM (70%) identified *shoreline characterizations* as their priority information need.

Technology Needs for Sediment Management
Top-ranked responses from NEP (65%), ASFPM (87%), ASIWPCA (75%), and AFMC (83%) identified *improved models that simulate and/or predict* as their priority technology need to address sediment management issues over the next five years. *Methods for quantifying sediment budgets* were selected by both NERR (78%) and ASFPM (87%) as their primary need. CZM (63%) and ASWM (79%) identified *treatment technologies*, and Other programs (100%) identified *engineering solutions,* as their most important technology need.
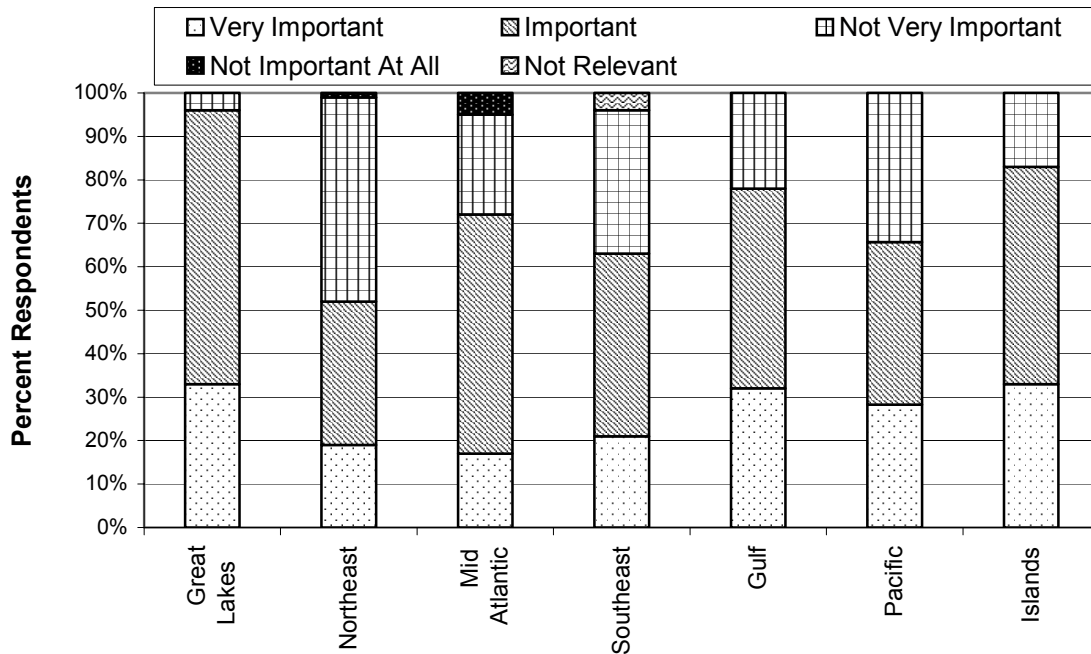
Figure 5-7. Importance of Sediment Management Across Regions

5-17   Comparison of Top-ranked Ocean Management Responses Across Programs

Importance of Ocean Management Issues
The top-ranked response from AFMC (52%) identified ocean management issues as v*ery important* (see Figure 5-8). Top-ranked responses from CZM (28%) and NERR (35%) found them to be *important*; NEP (61%), ASFPM (33%), ASIWPCA (63%), and Other programs (55%) identified ocean management issues to be n*ot very important*; and ASWM (42%) ranked them as n*ot relevant*.

Important Ocean Management Issues
Six of the eight programs selected *loss of habitat or biodiversity* as the most pressing ocean management issue over the next five years: CZM (65%), NERR (86%), NEP (84%), ASIWPCA (100%), AFMC (93%), and Other programs (100%). ASWM (100%) and Other programs (100%) identified *reconciling conflicting uses* to be the most important issue. ASFPM (100%) and ASWM (100%) respondents think that permitting of emerging uses such as transportation/transmission corridors, aquaculture, energy production, etc. is most important; ASWM (100%) also identified *design and implementation of marine managed areas*, and Other programs (100%) think that *accommodating compatible economic activities* is a priority issue.

Research Needs for Ocean Management
CZM (57%), ASFPM (74%), ASIWPCA (74%), and AFMC (67%) selected *cumulative impact assessments* as their priority research need in ocean management over the next five years. *Ecological characterizations* was selected as the most important research need by NERR (65%), NEP (57%), and ASWM (100%). ASWM also selected *Marine Managed Area effectiveness* (100%) and *feasibility of alternative energy sources* (100%) as priorities. Other programs (100%) selected *risk assessments*, *state of knowledge reports/case studies* and *economic assessments* as the most important ocean management research needs.
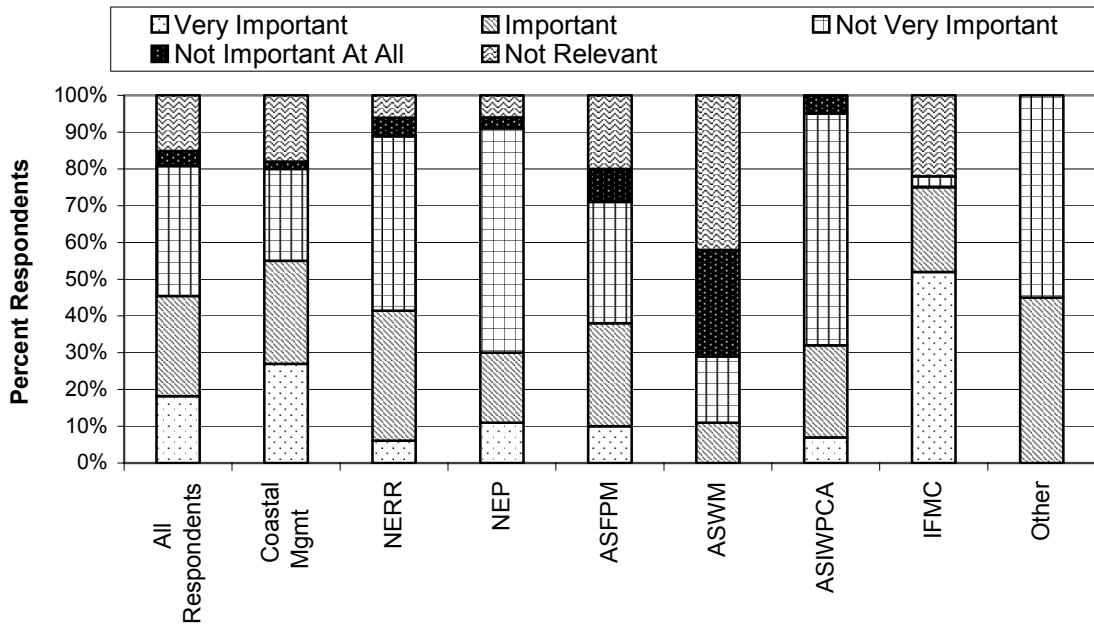
Figure 5-8. Importance of Ocean Management Across Programs

Information Needs for Ocean Management
More geospatial data for GIS was selected by CZM (81%), NERR (61%), NEP (78%), ASFPM (100%), ASIWPCA (100%), and Other (100%) as their most important information need to address ocean management issues over the next five years. ASIWPCA (100%) and Other programs (100%) additionally selected a*ccess, retrieval and analysis of data* as a priority along with AFMC (93%). ASWM (100%) and Other programs (100%) identified *state of knowledge reports/case studies* as its most important information need for ocean management.

Technology Needs for Ocean Management
Improved models that simulate and/or predict was selected by NERR (75%), ASFPM (90%), ASWM (100%), ASIWPCA (100%) and Other programs (100%) as the most important technology need to address ocean management issues over the next five years. ASWM (100%) additionally selected n*ondestructive bottom fishing gear* (100%) and *energy technology* (100%). AFMC also selected *nondestructive bottom fishing gear* (65%) as its priority. Both CZM (50%) and Other programs (100%) selected *mapping and data acquisition,* as their primary technology need. *No impact aquaculture techniques* were the priority technology need for NEP (66%) and Other programs (100%) to address ocean management.

5-18   Comparison of Top-ranked Marine Debris Responses Across Programs

Importance of Marine Debris Issues
ASFPM's (65%) top-ranked response considered issues related to marine debris to be *important* whereas ASWM's (52%) top-ranked responses considered them to be n*ot relevant*. The top responses from CZM (52%), NERR (75%), NEP (64%), ASIWPCA (54%), AFMC (51%), and Other programs (100%) considered marine debris issues to be *not very important* (see Figure 5-9).
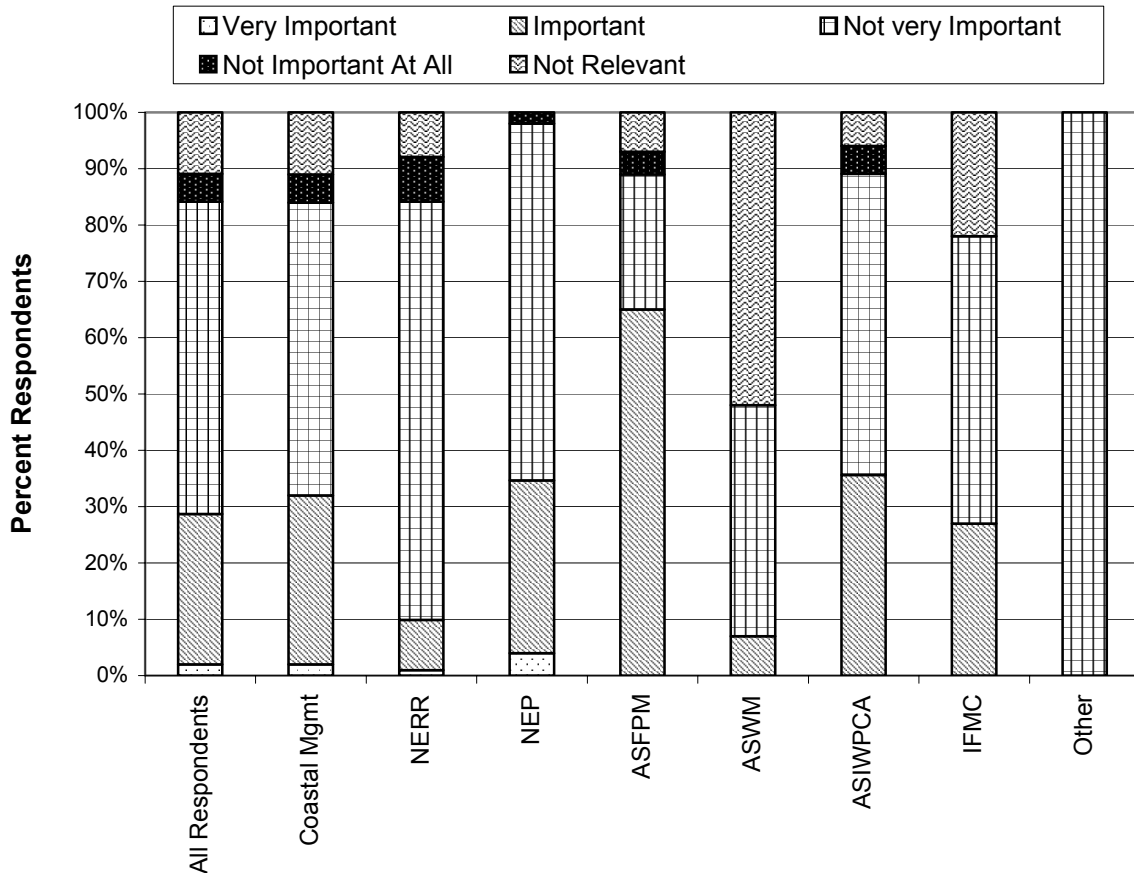
Figure 5-9. Importance of Marine Debris Across Programs

Important Marine Debris Issues
Source identification was considered the most important marine debris issue over the next five years by ASFPM (37%) and AFMC (100%). AFMC (100%) also considered *wildlife entanglement or ingestion* to be a priority issue., and ASFPM (37%) also considered o*ther* issues a priority. CZM (88%), NERR (81%), and NEP (75%) consider the most important issue to be *aesthetic/habitat degradation*. In addition, ASFPM (37%) identified *other* issues as the most important. ASIWPCA (59%) selected *public health impacts* as the most important issue related to marine debris.

Research Needs for Marine Debris
CZM (69%) and ASIWPCA (100%) consider *source tracking* to be the primary research need to address marine debris issues over the next five years. NEP (59%) and ASFPM (66%) identify *public education effectiveness* as a priority. *Biodegradable products (e.g., packing materials)* is

selected by NERR (56%), and *biodegradable gear* by AFMC (100%), as the most pressing research needs.

Information Needs for Marine Debris
Public outreach and education is the information need identified by all of the programs including CZM (96%), NERR (94%), NEP (79%), ASFPM (100%), ASIWPCA (100%), and AFMC (100%).

Technology Needs for Marine Debris
Debris removal technology is selected by NERR (89%), ASFPM (81%), and ASIWPCA (68%) as the most pressing technology need to address marine debris issues over the next five years. *Disposal or reuse technologies* was also selected by CZM (59%) and NEP (87%). AFMC (100%) selected *gear modifications to make less harmful to non target species and habitat* as its priority technology need.

6   SURVEY RESULTS BY STATE

6-1   Introduction

This section presents the results of the survey on a state-by-state basis. Those states that participated in the survey, and the number of responses from each state, are listed in Table 6-1. *It is noted that some state programs or agencies opted to distribute the survey to several individuals, and then consolidate answers into a single response.* The state results that follow are arranged by region, beginning with the Great Lakes.

Survey respondents were asked to indicate the importance of nine separate coastal resource management issues over the next five years. Tables 5-2 to 5-9 show the percentage of respondents in each of the seven *programs* who found the issues of habitat change, land use, nutrient enrichment, environmental contamination, nonindigenous species, coastal hazards, sediment management, ocean management, and marine debris to be either *very important* or *important* to their programs over the next five years. These tables also identify the top-ranked research, information, and technology needs for each.

The discussions accompanying each table highlight views expressed by the respondents based on the top-ranked responses. With regards to the responses from the surveys related to *continuous observation and monitoring variables*, respondents were not asked to select from the list those variables they considered most important, but rather to select all variables that they considered necessary to address a particular issue. Because there was no prioritization of these variables, they are not discussed in the body of this report, and instead can be found in the tables in the appendices.

Table 6-1. States and Territories that Participated in Survey

Region	States and Territories with number of responses shown in ( ).	
Great Lakes[1]	Indiana (2) Michigan (2) Minnesota (2)	Ohio (2) Wisconsin (4) Pennsylvania (1)
Northeast	Connecticut (6) Massachusetts (16) Maine (17)	New Hampshire (5) New York (10) Rhode Island (6)
Mid-Atlantic	Delaware (15) Maryland (5)	New Jersey (7) Virginia (9)
Southeast	Florida (16) Georgia (4)	North Carolina (6) South Carolina (29)
Gulf	Alabama (9) Louisiana (4)	Mississippi (3) Texas (8)
Pacific	Alaska (7) California (16)	Oregon (6) Washington (5)
Islands[2]	American Samoa (1) Commonwealth of Northern Marianas Islands (3)	Guam (1) Hawaii (2) Puerto Rico (1)

[1] Illinois does not participate in the National Coastal Management Program
[2] The US Virgin Islands did not respond to the survey

6-2   Indiana's Priorities

The top-ranked management topics that Indiana (Table 6-2) considers to be very important or important over the next five years are *habitat change* and *land use* (100%).

The top-ranked research and information needs identified for habitat change are *effects of human values and choices* and *more geospatial data for GIS* (100%). *Habitat restoration BMPs* is the priority technology need.

Land use top-ranked research need is to *identify growth patterns/land use conversion patterns* (100%). Both *land use classification* and *more geospatial data for GIS* rank as the top information needs (100%). I*mproved models is* the highest ranked technology needs (100%).

Table 6-2. Top-ranked Responses from Indiana

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Effects of human values and choices	100%	More geospatial data for GIS	100%	Habitat restoration BMPs	100%
Land use	100%	Identify growth patterns/land use conversion patterns	100%	Land use classification More geospatial data for GIS	100% 100%	Improved models	100%
Environmental contamination	100%	Bioindicators	100%	TMDL guidelines More geospatial data for GIS	100% 100%	Reliable DNA fingerprinting Improved treatment or removal technologies	100% 100%
Sediment management	100%	Analysis of impacts of engineering solutions	100%	Beach profile data Quantification of sediment budgets	100% 100%	Improved models Engineering solutions Containment and stabilization technologies Treatment technologies Remote sampling	50% 50% 50% 50% 50%
Nutrient enrichment	50%	Bioindicators Efficacy of education and outreach efforts	100% 100%	Data access/analysis BMP effectiveness or CBA	100% 100%	Cost effective long term monitoring/sampling Improved treatment technologies Enhanced remote sensing	100% 100% 100%
Nonindigenous species	50%	Cumulative impact assessment Effectiveness of BMPs	100% 100%	Ecosystem inventory More geospatial data for GIS	100% 100%	Rapid detection and monitoring Treatment or removal technologies	100% 100%

6-3   Michigan's Priorities

The six top-ranked management topics that Michigan (Table 6-3) considers to be very important or important over the next five years are *land use, habitat change, nutrient enrichment, sediment management, nonindigenous species,* and *environmental contamination* (100%). Land use and habitat change match the national top-ranked topics.

The top-ranked research and information needs identified for land use change are *socioeconomic cost-benefit analyses of land use options, developing indicators that link land use with ecosystem impact,* and *more geospatial data for GIS* (100%). The technology needs are *change detection sensors, affordable remote sensing,* and *customized GIS* (100%).

The top-ranked research and information needs for habitat change are *identification of habitat health indicators, identification of causes of loss/gain, evaluation of the effectiveness of restoration/protection technique, provision of ecological characterizations, valuation of socioeconomic and ecological factors, determining effects of human values and choices* (50%)*, development of ecological baselines and inventories,* and *more geospatial data for GIS* (100%). The technology need is *low cost remote sensing platforms* (100%).

Table 6-3. Top-ranked Responses from Michigan

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Socioeconomic cost benefit analysis of land use options	100%	More geospatial data for GIS	100%	Change detection sensors	100%
		Develop indicators that link land use with ecosystem impact	100%			Affordable remote sensing	100%
						Customized GIS	100%
Habitat change	100%	Identify indicators of habitat health	50%	Baselines and inventories	100%	Low cost remote sensing platforms	100%
		Identify causes of loss/gain	50%	More geospatial data for GIS	100%		
		Evaluate effectiveness of restoration/protection technique	50%				
		Provide ecological characterization	50%				
		Valuation of socioeconomic and ecological factors	50%				
		Effects of human values and choices	50%				
Nutrient enrichment	100%	Source identification	100%	Data access/analysis	100%	Cost effective long term monitoring	100%
Sediment management	100%	Improved beneficial uses	100%	Beach profile data	100%	Methods for quantification of sediment budgets	100%
				Quantification of sediment budgets	100%	Containment and stabilization technologies	100%

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Nonindigenous species	100%	Early detection of species	100%	Ecosystem inventory	100%	Rapid response techniques	100%
		Susceptibility factors	100%	More geospatial data for GIS	100%	Treatment or removal technologies	100%
		Effectiveness of BMPs	100%				
Environmental contamination	100%	Source ID	100%	Economic impact evaluations	100%	Rapid/real time detection	100%
		Public health risk assessment	100%	Remediation options	100%		
Coastal hazards	50%	Shoreline characterizations	100%	Design standards for shoreline management technologies	100%	Impact zone identification	100%
		Risk and vulnerability assessments	100%	Geomorphologic studies	100%	Alternative shoreline protection technologies	100%
		Effects of climate change	100%	More geospatial data for GIS	100%		

6-4   Minnesota's Priorities

Minnesota ranks *habitat change, land use, environmental contamination, sediment management,* and *nonindigenous species* (100%) as the top management topics (Table 6-4).

The most important research needs for habitat change are *cumulative impact assessments* (100%). The information need is *standardized methodologies and reporting* (100%). The major technological need is identified as *habitat restoration BMPs* (100%).

The top-ranked research, information and technology needs identified for land use change are the *development of indicators that link land use with ecosystem impacts* (100%), *data access/analysis* (100%) and *customized GIS* (100%).

Table 6-4. Top-ranked Responses from Minnesota

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessment	100%	Standardized methodologies and reporting	100%	Habitat restoration BMPs	100%
Land use	100%	Develop indicators that link land use with ecosystem impact	100%	Data access/analysis	100%	Customized GIS	100%
Environmental contamination	100%	Cumulative impact assessments	100%	Interactions among contaminants	50%	Improved treatment or removal technologies	100%
				Economic impact evaluations	50%		
				Remediation options	50%		
				More geospatial data for GIS	50%		
				Cost/benefit analysis of remediation	50%		
Sediment management	100%	Effectiveness of confinement techniques	100%	Geospatial data for GIS	100%	Engineering solutions	100%
		Analysis of impacts of engineering solutions	100%			Containment and stabilization technologies	100%
Nonindigenous species	100%	Cumulative impact assessment	100%	Data access/analysis	100%	Prevention techniques	100%
		Effectiveness of BMPs	100%	More geospatial data for GIS	100%		
		Human behaviors leading to introductions	100%				
Nutrient enrichment	50%	Cumulative impact assessments	100%	Data access/analysis	100%	Improved treatment technologies	100%
		Source ID	100%	BMP effectiveness or CBA	100%	Effective mitigation strategies	100%
		Efficacy of education and outreach efforts	100%	More geospatial data for GIS	100%		

6-5   Ohio's Priorities

The six top-ranked management topics that the Ohio (Table 6-5) considers to be very important or important over the next five years are *habitat change, land use, nonindigenous species, nutrient enrichment, coastal hazards,* and *sediment management* (100%). Habitat and land use match the national top-ranked responses.

The top-ranked research need identified for habitat change is *cumulative impact assessments* (100%). The information and technology needs are *trends analysis, baselines and inventories* (100%) *habitat restoration BMPs* and *new restoration techniques* (100%).

The top-ranked research needs to address land use change are to *identify the cumulative impacts of development*, *develop indicators that link land use with ecosystem impacts* and *quantifying the impacts of land use change on water quality, socioeconomic cost-benefit analyses of land use options, calculation of pollutant removal efficiencies,* and *identification of growth/land conversion patterns* (50%). The information needs are *land use change analyses* (100%). The top technology need is *improved prediction or simulation models* (100%).

Table 6-5. Top-ranked Responses from Ohio

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessments	100%	Trends analysis	100%	New restoration techniques	100%
				Baselines and inventories	100%	Habitat restoration BMPs	100%
Land use	100%	Identify cumulative impacts of development	50%	Land use change analysis	100%	Improved models	100%
		Socioeconomic CBA of land use options	50%				
		Indicators that link land use with ecosystem impact	50%				
		Quantify impact of land use on water quality	50%				
		Calculate pollutant removal efficiencies	50%				
		Identify growth/land conversion patterns	50%				
Nonindigenous species	100%	Susceptibility factors	100%	Ecosystem inventory	100%	Rapid detection and monitoring	100%
						Treatment or removal technologies	100%
Nutrient enrichment	100%	Cumulative impact assessments	100%	BMP effectiveness or CBA	100%	Effective mitigation strategies	100%
		Effects on species/communities	100%	Land use analysis	100%		
Coastal hazards	100%	Risk and vulnerability assessments	100%	Design standards for shoreline management	100%	Alternative shoreline protection technologies	100%
		Trends analysis	100%				

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Sediment management	100%	Analysis of impact of engineering solutions	100%	Data access/analysis	50%	Methods for quantifying sediment budgets	100%
				Sediment transport patterns	50%		
				Shoreline characterizations	50%		
				Case studies	50%		
				Quantification of sediment budgets	50%		
				Geospatial data for GIS	50%		
Environmental contamination	100%	Source ID	100%	Remediation options	100%	Improved models	100%
		Test and validate assessment techniques	100%				
Ocean management	50%	Economic assessments	100%	Other	100%	Improved models	100%
		Ecological characterizations	100%				
		Other	100%				
Marine debris	50%	Public education effectiveness	100%	Geospatial data for GIS	100%	Debris removal technology	100%
		Transport of debris	100%	Public outreach and education	100%	Disposal or reuse technologies	100%

6-6   Pennsylvania's Priorities

The nine top-ranked management topics that Pennsylvania (Table 6-6) considered to be very important or important over the next five years are *habitat change, land use, environmental contamination, nutrient enrichment, nonindigenous species, sediment management, ocean management, coastal hazards,* and *marine debris* (100%). Land use and habitat change match the national top-ranked topics.

The top-ranked research needs identified for habitat change are *cumulative impact assessments, rate of freshwater inflow,* and *effects of human values and choices* (100%). The information and technology needs are *trends analysis, baselines and inventories, success stories* (100%), *habitat restoration BMPs, low cost remote sensing* and *long term monitoring equipment* (100%).

The top-ranked research needs to address land use change are to *Other* (100%). The information needs are *build out/infill analyses* and *land suitability analysis* (100%). The top technology needs are *affordable remote sensing, customized GIS,* and *QA/QC of existing technology* (100%).

Table 6-6. Top-ranked Responses from Pennsylvania

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessment	100%	Trends analysis	100%	Low cost remote sensing platforms	100%
		Rate of freshwater inflow	100%	Baselines and inventories	100%		
		Effects of human values and choices	100%	Success stories	100%	Habitat restoration BMPs	100%
						Long term monitoring equipment	100%
Land Use	100%	Cumulative effects of development	100%	Build out/infill analysis	100%	Affordable remote sensing	100%
		Socioeconomic CBA of land use options	100%	Land suitability analysis	100%	Customized GIS	100%
		Other	100%			QA/QC of existing technology	100%
Environmental contamination	100%	Source ID	100%	Epidemiology of contaminants	100%	Rapid/real time detection	100%
		Bioindicators	100%				
		Toxicity analysis	100%	Explanation of interaction among contaminants	100%	Improved remote sensing/sampling techniques	100%
				CBA of remediation	100%	Improved treatment or removal technologies	100%
Nutrient enrichment	100%	Cumulative impact assessments	100%	Data access/analysis	100%	Improved models	100%
		Source ID	100%	BMP effectiveness or CBA	100%	Improved treatment technologies	100%
		Efficacy of education and outreach efforts	100%	Land use analysis	100%	Enhanced remote sensing	100%
Nonindigenous species	100%	Early detection of species	100%	Ecosystem inventory	100%	Rapid detection and monitoring	100%
		Effectiveness of BMPs	100%	Success stories	100%	Rapid response techniques	100%
						Prevention techniques	100%
Sediment management	100%	CBA	100%	Sediment transport patters	100%	Improved models	100%
		Improved beneficial uses	100%	Beach profile data	100%	Engineering solutions	100%
		Analysis of impacts of engineering solutions	100%	Quantification of sediment budgets methods	100%	Methods for quantifying sediment budgets	100%

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Ocean management	100%	Cumulative impact assessments	100%	More geospatial data for GIS	100%	Energy technology	100%
		Ecological characterizations	100%	Data access/analysis	100%	Other	100%
		Risk assessments	100%	Case studies	100%		
Coastal hazards	100%	Shoreline characterizations	100%	Design standards for shoreline management technologies	100%	Improved models	100%
		Trends analysis	100%			Alternative shoreline protection technologies	100%
		Risk attitudes, values, and perceptions	100%	Geomorphologic studies	100%	Advanced detection or warning technologies	100%
				More geospatial data for GIS	100%		
Marine debris	100%	Source tracking	100%	Debris inventory	100%	Gear modifications	50%
		Public education effectiveness	100%	Public outreach and education	100%	Disposal or reuse technologies	50%
		Biodegradable products	100%			Other	50%

6-7 Wisconsin's Priorities

The top-ranked management topics that Wisconsin (Table 6-7) considers to be very important or important over the next five years are *habitat change*, *land use, environmental contamination, and coastal hazards* (100%).

Habitat change top-ranked research needs are *cumulative impact assessments, effectiveness of restoration/protection techniques,* and *valuation of socioeconomic and ecological factors* (75%). The top information needs are *standardized methodologies and reporting,* and *ecological baselines and inventories* (75%). The top technology needs are *high resolution remote sensing, rapid ecological assessment and evaluation, habitat restoration BMPs,* and *long-term monitoring equipment* (50%).

Table 6-7. Top-ranked Responses from Wisconsin

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessment	75%	Standardized methodologies and reporting	75%	High resolution remote sensing	50%
		Evaluate effectiveness of restoration/protection technique	75%	Baselines and inventories	75%	Rapid ecological assessment and evaluation technology	50%
		Valuation of socioeconomic and ecological factors	75%			Habitat restoration BMPs	50%
						Long term monitoring equipment	50%
Land Use	100%	Socioeconomic CBA of land use options	75%	Standardized methodologies	75%	Improved models	75%
						Customized GIS	75%
Environmental contamination	100%	Cumulative impact assessments	75%	Remediation options	75%	Improved models	75%
		Public health risk assessment	75%				
Coastal hazards	100%	Risk and vulnerability assessments	100%	Design standards for shoreline management technologies	75%	Improved models	100%
				Socioeconomic impact assessments	75%		
Sediment management	75%	Analysis of impacts of engineering solutions	100%	Shoreline characterizations	100%	Improved models	100%
Nonindigenous species	75%	Human behaviors leading to introductions	100%	Ecosystem inventory	67%	Rapid detection and monitoring	67%
				Success stories	67%	Prevention techniques	67%
Nutrient enrichment	75%	Cumulative impact assessments	67%	BMP effectiveness or CBA	100%	Effective mitigation strategies	100%
		Source ID	67%				
		Efficacy of education and outreach efforts	67%				
Ocean management	25%	Changes in community composition	100%	Geospatial data for GIS	100%	Improved models	100%
				Data access, retrieval, analysis	100%	No impact aquaculture	100%
		Cumulative impact assessment	100%	Case Studies	100%	Mapping and data acquisition	100%
		Case Studies	100%				

6-8   Connecticut's Priorities

The top-ranked management topics that Connecticut (Table 6-8) considered to be very important or important over the next five years are *habitat change* (100%), *land use* (100%) and *nutrient enrichment* (100%).

The top-ranked research and information needs identified for habitat change are the *identification of the causes of loss or gain* (83%) and *trends analysis* (100%). Both *high resolution remote sensing and low cost remote sensing platforms* are rated the highest in terms of the technology needed to address habitat change (67%)

Land use change top-ranked research need was to *quantify the impact of land use change on water quality* (83%). Both *land use change* analysis and *build out analysis* rate as the top information needs (80%) and *affordable remote sensing* is the highest ranked technology need (100%)

Table 6-8. Top-ranked Responses from Connecticut

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Identify causes of loss/gain	83%	Trends analysis	100%	High resolution remote sensing	67%
						Low cost remote sensing	67%
Land use	100%	Quantify impact of land use on water quality	83%	Land use change analysis Build out analysis	80% 80%	Affordable remote sensing	100%
Nutrient enrichment	100%	Cumulative impact assessments Source ID	83% 83%	Short term forecasts of nutrient loading	83%	Cost effective monitoring equipment	67%
Environmental contamination	67%	Cumulative impact assessments Source ID Bioindicators Toxicity analysis	50% 50% 50% 50%	Cost/benefit analysis	75%	Improved models Real time detection Cost effective equipment Treatment technologies	67% 67% 67% 67%
Nonindigenous species	66%	Early detection of species	75%	Ecosystem inventory	100%	Rapid detection and monitoring	100%
Sediment management	66%	Effective confinement techniques Improved beneficial uses Effects from dredging	50% 50% 50%	Data access / retrieval Shoreline character	67% 67%	Treatment technologies	100%
Coastal hazards	34%	Effects of climate change/global warming	100%	More geospatial data for GIS	100%	Improved models Impact zone identification Alternative protection technologies Other	50% 50% 50% 50%
Marine debris	17%	Perceptions linked to sources Public education effectiveness	100% 100%	Public outreach and education Other	100% 100%	NO RESPONSE	
Ocean management	17%	Cumulative impact assessments Ecological character State of knowledge	100% 100% 100%	More geospatial data for GIS Data access / retrieval State of knowledge	100% 100% 100%	No impact aquaculture techniques Energy technology Mapping and data acquisition	100% 100% 100%

6-9   Massachusetts' Priorities

The two top-ranked management topics that Massachusetts (Table 6-9) considers being very important or important over the next five years are *land use* (100%) and *habitat change* (94%). Land use and habitat change match the national top-ranked topics.

The top-ranked research and information needs identified for land use change are *quantifying the impact of land use change on water quality* (73%) and *land use change analysis* (80%). The technology needs are *improved modeling* (60%) and *customized GIS* (60%).

The top-ranked research and information needs for habitat change are *cumulative impact assessments* (73%), and *trends analysis* and *ecological and physical baselines and inventories* (73%). The technology needs are *high resolution remote sensing* (53%) and *rapid ecological assessment and evaluation technology* (53%).

Table 6-9. Top-ranked Responses from Massachusetts

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Quantify impact of land use on water quality	73%	Land use change analysis	80%	Improved models	60%
						Customized GIS	60%
Habitat change	94%	Cumulative Impact Assessment	73%	Trends analysis	73%	High resolution remote sensing	53%
				Baselines and inventories	73%	Rapid ecological assessment	53%
Nutrient enrichment	88%	Cumulative impact assessments	92%	Land use analysis	62%	Improved models	62%
						Cost effective monitoring equipment	62%
Ocean management	82%	Ecological characterizations	100%	More geospatial data for GIS	77%	Nondestructive bottom fishing gear	62%
						Mapping and data acquisition	62%
Nonindigenous species	69%	Early detection of species	73%	Ecosystem inventory	73%	Rapid detection and monitoring	73%
						Rapid response techniques	73%
						Treatment technologies	73%
Environmental contamination	63%	Identification of sources	78%	TMDL guidelines	67%	Rapid/real time detection	88%
				Remediation options	67%		
Coastal hazards	50%	Trends analysis	71%	Design standards for shoreline management technologies.	57%	Improved models	86%
Sediment management	50%	Effects from dredging	57%	Sediment transport patterns	57%	Containment and stabilization technologies	71%
				Beach profile data	57%		
				Shoreline characterizations	57%		
Marine Debris	6%	Source tracking	100%	State of knowledge	100%	Debris removal technology	100%
		Perceptions linked to sources	100%	Debris inventory			
		Public education effectiveness	100%	Public outreach and education	100% 100%		

6-10   Maine's Priorities

Maine ranked both *land use* and *habitat change* (94%) as the top management topics over the next five years (Table 6-10).

The most important research needs for habitat change are *cumulative impact assessments*, to *identify indicators of habitat health* and to *identify causes of loss/gain* (50%). The information needs are *trends analysis* and *ecological and physical baselines and inventories* (75%). The major technological needs are identified as *models that predict or simulate*, *high resolution remote sensing* and *low cost remote sensing* (50%).

The top-ranked research, information and technology needs identified for land use change are the *development of indicators that link land use with ecosystem impacts* (75%), *land use change analysis* (69%) and *customized GIS* (88%).

Table 6-10. Top-ranked Responses from Maine

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	94%	Cumulative impact assessment	50%	Trends analysis	75%	Models that predict	50%
		Identify indicators of habitat health	50%	Baselines and inventories	75%	High resolution remote sensing	50%
		Identify causes of loss/gain	50%			Low cost remote sensing	50%
Land use	94%	Develop indicators that link land use with ecosystem impact	75%	Land use change analysis	69%	Customized GIS	88%
Environmental contamination	65%	Cumulative impact assessments	58%	Explanation of interactions among contaminants	58%	Improved remote sensing/ sampling	75%
		Source identification	58%				
		Bioindicators	58%	Remediation options	58%		
Nutrient enrichment	59%	Effects on species/communities	80%	Land use analysis	70%	Cost effective monitoring equipment	60%
Nonindigenous species	53%	Early detection of species	60%	More geospatial data for GIS	60%	Prevention techniques	90%
Ocean management	53%	Effects of changes in community composition	56%	More geospatial data for GIS	100%	Mapping and data acquisition	78%
		Ecological characterizations	56%				
Sediment management	47%	Effects from dredging	63%	Sediment transport patterns	75%	Improved models	63%
		Analysis of impacts of engineering solutions	63%			Quantifying sediment budgets	63%
Coastal hazards	30%	Shoreline characterizations	80%	More geospatial data for GIS	100%	Alternative shoreline protection technologies	100%
		Risk and vulnerability assessments	80%				
Marine debris	12%	Biodegradable gear	50%	Geospatial data for GIS	100%	Debris removal technology	100%
		Ecological impacts	50%				
		Perceptions and behaviors linked to sources	50%	Debris inventory	100%	Disposal or reuse technologies	100%
				Public outreach and education	100%		
		Biodegradable products	50%				

6-11   New Hampshire's Priorities

The two top-ranked management topics that the New Hampshire (Table 6-11) considers to be very important or important over the next five years are *land use* and *habitat change* (100%).

The top-ranked research needs identified for habitat change are *cumulative impact assessments*, the *identification of indicators of habitat health* and the *evaluation of restoration techniques* (80%). The information and technology needs are *trends analysis* (100%) and *new restoration techniques* (80%).

The top-ranked research needs to address land use change are to *identify the cumulative effects of development*, *develop indicators that link land use with ecosystem impacts* and *quantifying the impacts of land use change on water quality* (80%). The information needs are *land use change analysis*, *state-of-knowledge reports or success stories* and *more geospatial data for GIS* (60%). The top technology needs are *prediction and simulation models* and *affordable remote sensing* (80%).

Table 6-11. Top-ranked Responses from New Hampshire

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative Impact Assessment	80%	Trends analysis	100%	New restoration techniques	80%
		Identify indicators of habitat health	80%				
		Evaluate restoration techniques	80%				
Land use	100%	Identify cumulative effects of development	80%	Land use change analysis	60%	Improved models	80%
				State of knowledge	60%	Affordable remote sensing	80%
		Develop indicators	80%	More geospatial data for GIS	60%		
		Quantify impact of land use	80%				
Nonindigenous species	60%	Cumulative impact assessment	67%	State-of-knowledge	100%	Treatment technologies	100%
		Susceptibility factors	67%			Prevention techniques	100%
		Rapid assessment techniques	67%			Improved remote sensing/ sampling	100%
Nutrient enrichment	60%	Cumulative impact assessments	100%	BMP effectiveness	67%	Cost-effective long-term monitoring	100%
		Effects on species	100%	State of knowledge	67%		
				Land use analysis	67%	Effective mitigation	100%
Environmental contamination	40%	Cumulative impact assessments	100%	BMP effectiveness or cost/benefit analysis	67%	Cost effective monitoring equipment	100%
		Effects on species/	100%	State of knowledge	67%		
				Land use analysis	67%	Effective mitigation strategies	100%
Sediment management	40%	Effects from dredging	100%	Sediment transport patterns	100%	Improved models	100%
		Analysis of impacts of engineering solutions	100%	Models for quantifying sediment budgets	100%	Engineering solutions	100%
				Geospatial data for GIS	100%		

6-12 New York's Priorities

The two top-ranked management topics that the New York (Table 6-12) considers to be very important or important over the next five years are *habitat change* (100%) and *land use* (100%). Land use and habitat change match the national top-ranked topics.

The top-ranked research and information needs identified for habitat change are *identifying the causes of loss/gain* (70%) and *ecological and physical baselines and inventories* (90%). The top-ranked technology needs are identified as *high resolution remote sensing* and *habitat restoration best management practices* (60%).

Land use top-ranked research, information and technology needs are to *develop indicators that link land use with ecosystem health* (80%), *land use change analysis* (60%) and *affordable remote sensing* (100%).

Table 6-12. Top-ranked Responses from New York

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Identify causes of loss/gain	70%	Baselines and inventories	90%	High resolution remote sensing	60%
						Habitat restoration BMPs	60%
Land Use	100%	Develop indicators	80%	Land use change analysis	60%	Affordable remote sensing	100%
Environmental contamination	90%	Cumulative impact assessments	67%	Remediation options	56%	Improved treatment technologies	75%
				Cost/benefit analysis	56%		
Nutrient enrichment	80%	Effects on species	88%	BMP effectiveness or cost/benefit analysis	63%	Rapid community assessment	63%
						Cost effective monitoring equipment	63%
Nonindigenous species	70%	Early detection of species	71%	Ecosystem inventory	57%	Rapid detection	83%
				State-of-knowledge	57%	Rapid response techniques	83%
						Prevention techniques	83%
Sediment management	60%	Prioritize restoration	67%	Sediment transport patterns	83%	Quantifying sediment budgets	67%
Ocean management	30%	Changes in community composition	67%	Data access / retrieval	100%	Mapping and data acquisition	100%
		Cumulative impact assessments	67%				
		Ecological characterizations	67%				
Coastal hazards	10%	Risk assessments	100%	Socio economic impact assessments	100%	Improved models	100%
		Trends analysis	100%			Impact zone identification	100%
		Attitudes, values and perceptions of risk	100%	Spatial and temporal demographics	100%	Other	100%
				Other	100%		
Marine debris	10%	Source tracking	100%	Debris inventory	100%	GPS tracking systems	100%
		Perceptions linked to sources	100%	Public outreach and education	100%		
		Public education effectiveness	100%				

6-13   Rhode Island's Priorities

The top-ranked management topics that Rhode Island (Table 6-13) considers to be very important or important over the next five years are *habitat change* (100%), *nonindigenous species* (100%) and *nutrient enrichment* (100%).

Habitat change top-ranked research need is the *effectiveness of restoration techniques* (83%). The top information needs are *trends analysis, ecological and physical baselines and inventories* and *more geospatial data for GIS* (67%). The top technology needs are *habitat restoration BMPs* and *long term monitoring equipment* (67%).

The top research needs to address nonindigenous species are *early detection of species* and *cumulative impact assessments* (60%). The most important information need is *ecosystem inventories* (83%) and the top technology needs are *rapid detection, rapid response techniques* and *treatment or removal techniques* (67%).

Table 6-13 Top-ranked Responses from Rhode Island

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Effectiveness of restoration techniques	83%	Trends analysis Baselines and inventories. More geospatial data for GIS	67%	Habitat restoration BMPs Monitoring equipment	67% 67%
Nonindigenous species	100%	Early detection of species Cumulative impact assessment	60% 60%	Ecosystem inventory	83%	Rapid detection Rapid response techniques Treatment technologies	67%
Nutrient enrichment	100%	Cumulative impact assessments Source identification	67%	Data access / retrieval	67%	Cost effective monitoring equipment	67%
Environmental contamination	84%	Source ID Public health risk assessment	60% 60%	Epidemiology of contaminants Economic impact evaluations	60% 60%	Reliable DNA fingerprinting Cost-effective long-term monitoring	60% 60%
Land Use	83%	Quantify impact of land use on water quality	100%	Land use change analysis	80%	Customized GIS	80%
Ocean management	83%	Cumulative impact assessments	100%	Data access / retrieval	100%	Nondestructive fishing gear Mapping and data acquisition	80%
Sediment management	50%	Effects from dredging	100%	Transport patterns Beach profile data Shoreline characterizations GIS geospatial data	50% 50% 50% 50%	Improved models	75%
Coastal hazards	33%	Shoreline characterizations Trends analysis Effects of climate change/global warming	67% 67% 67%	Data access / retrieval	100%	Improved models Alternative shoreline protection technologies	67% 67%

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Marine debris	33%	Source tracking	67%	State of knowledge	100%	Debris removal technology	93%
				Public outreach and education	100%		

6-14   Delaware's Priorities

The top-ranked management topics that Delaware (Table 6-14) considers to be very important or important over the next five years are *land use* and *habitat change* (60%).

The top-ranked research and information needs identified for land use are the *identification of cumulative effects of development* (67%), *developing indicators* (67%), *land use change analysis* (53%) and *more geospatial data for GIS* (53%). *Improved models that simulate and predict* are rated the highest in terms of the technology needed to address land use (79%).

For habitat change, cumulative impact assessment (73%) and trends analysis are identified as the top-ranked research and information needs, respectively. The top technology need is *habitat restoration BMPs* (87%).

Table 6-14. Top-ranked Responses from Delaware

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Identify cumulative effects of development	67%	Land use change analysis	53%	Improved models that simulate and predict	79%
		Develop indicators that link land use with ecosystem impact	67%	More geospatial data for GIS	53%		
Habitat change	100%	Cumulative impact assessment	73%	Trends analysis	73%	Habitat restoration BMPs	87%
Nutrient enrichment	73%	Source ID	73%	BMP effectiveness or CBA	73%	Cost effective monitoring equipment	64%
Nonindigenous species	67%	Human behaviors leading to introductions	60%	Ecosystem inventory	100%	Treatment or removal technologies	90%
Sediment management	60%	Effects from dredging	78%	Data access / retrieval	44%	Improved models that simulate or predict	67%
Ocean management	54%	Cumulative impact assessments	62%	More geospatial data for GIS	62%	Energy technology	75%
Environmental contamination	53%	Cumulative impact assessment	50%	Interactions among contaminants	50%	Cost-effective long-term monitoring equipment	62%
				Economic impact evaluation	50%	Improved treatment or removal	62%
Coastal hazards	46%	Shoreline characterization	86%	Socioeconomic impact assessments	71%	Alternative shoreline protection	71%
		Risk attitudes, values, perceptions	86%				
Marine debris	20%	Ecological impacts	67%	Debris inventory	67%	GPS tracking	100%
		Perceptions and behaviors linked to sources	67%	Public outreach and education	67%		

6-15   Maryland's Priorities

The two top-ranked management topics that Maryland (Table 6-15) considers to be very important or important over the next five years are habitat change and *land use* (100%).

The top-ranked research and information needs for habitat change are *cumulative impact assessment*, *effectiveness of restoration/protection techniques* (80%), and *trends analysis* (80%). The technology need is *habitat restoration BMPs* (80%).

The top-ranked research and information needs identified for land use change are *identifying cumulative effects of development* (60%), *quantifying the impact of land use change on water quality* (60%) and *data access, retrieval, and analysis* (80%). The technology need is *improved modeling* (60%).

Table 6-15. Top-ranked Responses from Maryland

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative Impact Assessment	80%	Trends analysis	80%	Habitat restoration BMPs	80%
		Evaluate effectiveness of restoration/protection technique	80%				
Land use	100%	Identify cumulative effects of development	60%	Data access, retrieval, and analysis	80%	Improved models	100%
		Quantify impact of land use on water quality	60%				
Sediment management	80%	Prioritize restoration/ protection based on max benefit for cost	75%	Sediment transport patterns	75%	Improved models	75%
						Containment and stabilization technologies	75%
Nonindigenous species	60%	Early detection of species	100%	Ecosystem inventory	67%	Treatment technologies	100%
		Human behaviors leading to introductions	100%	Success stories	67%	Prevention techniques	100%
Nutrient enrichment	60%	Cumulative impact assessments	67%	BMP effectiveness or CBA	100%	Improved treatment technologies	100%
		Spatial and temporal trends analysis	67%				
Nonindigenous species	40%	Early detection of species	100%	Ecosystem inventory	67%	Treatment technologies	100%
		Human behaviors leading to introductions	100%	Success stories	67%	Prevention techniques	100%
Coastal hazards	40%	Risk and valuation assessment	100%	Design standards	100%	Alternative shoreline protection technologies	100%
				State of knowledge reports	100%		
Environmental contamination	20%	Cumulative impact assessment	100%	Epidemiology of contaminants	100%	Improved models	100%
		ID sources	100%	TMDL guidelines	100%	Cost-effective long-term monitoring equipment	100%
		Public health risk assessment	100%	Economic impact evaluations	100%		
						Improved treatment or removal tech	100%

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Ocean management	20%	Cumulative impact assessment	62%	Geospatial data for GIS	100%	Models than simulate and predict	100%
				State of knowledge reports	100%	Low-cost remote vessel tracking	100%

6-16   New Jersey's Priorities

New Jersey ranks *land use* (100%) as the top management topic to address over the next five years (Table 6-16). *Habitat change* is ranked the next highest (86%).

The most important research needs for land use are *to identify the cumulative effects of development* and socioeconomic cost benefit analysis of land use options (71%). The information needs are *land use change analysis and build out/infill analysis* (57%). The major technological need is identified as *affordable remote sensing* (71%).

The top research and information needs for habitat change are *cumulative impact assessment* (83%) and *trends analysis* (100%), respectively. *High resolution remote sensing*, *low cost remote sensing*, and *long-term monitoring equipment* (67%) are the top technology needs.

Table 6-16. Top-ranked Responses from New Jersey

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Identify cumulative effects of development	71%	Land use change analysis	57%	Affordable remote sensing	71%
		Socioeconomic CBA of land use options	71%	Build out/infill analysis	57%		
Habitat change	86%	Cumulative impact assessment	83%	Trends analysis	100%	High resolution remote sensing	67%
						Low cost remote sensing	67%
						Long term monitoring equipment	67%
Coastal hazards	71%	Risk and vulnerability assessments	80%	Design standards	60%	Alternative shoreline protection technologies	80%
				Geomorphologic studies	60%		
Environmental contamination	72%	Cumulative impact assessments	60%	Explanation of interactions among contaminants	60%	Rapid/real time detection	60%
		Source identification	60%			Cost effective long term monitoring equipment	60%
				Remediation options	60%	Improved remote sensing technologies	60%
Nonindigenous species	57%	Early detection of species	100%	Ecosystem inventory	50%	Rapid detection and monitoring	100%
		Human behaviors leading to introductions	100%	Land use assessment	50%	Prevention techniques	100%
				Success stories	50%		
Ocean management	57%	Cumulative impact assessments	75%	Case studies	100%	Improved models	75%
						Mapping and data acquisition	75%
Sediment management	62%	Improved beneficial uses	60%	Improved methods and models for quantifying sediment budgets	100%	Methods for quantifying sediment budgets	80%
		Effects from dredging	60%				
Nutrient enrichment	43%	Cumulative impact assessment	100%	Short-term forecasts of nutrient loading	100%	Long-term monitoring/ sampling	100%
		Source ID	100%				

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
						equipment	
Marine debris	29%	Public education effectiveness	100%	Public outreach and education	100%	Debris removal technology	100%

6-17   Virginia's Priorities

The three top-ranked management topics that Virginia (Table 6-17) considers to be very important or important over the next five years are *habitat change, land use, and environmental contamination* (89%).

The top-ranked research need identified for habitat change is *cumulative impact assessments* (75%). The information and technology needs are *trends analysis* (100%) and *low cost remote sensing platforms* (63%).

The top-ranked research need to address land use change is to *quantify the impacts of land use change on water quality* (88%). The information need is *land use change analysis* (75%). The top technology needs are *improved models* and *affordable remote sensing* (75%).

Table 6-17. Top-ranked Responses from Virginia

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	89%	Cumulative Impact Assessment	75%	Trends analysis	100%	Low cost remote sensing platforms	63%
Land use	89%	Quantify impact of land use	88%	Land use change analysis	75%	Improved models Affordable remote sensing	75% 75%
Environmental contamination	78%	Identification of sources	71%	Bioassay numeric guidelines Remediation options	57% 57%	Real time/rapid detection	71%
Sediment management	77%	Improved beneficial uses Prioritize restoration	67% 67%	Sediment transport patterns	71%	Containment and stabilization technologies	86%
Coastal hazards	56%	Shoreline characterizations	100%	Design standards	100%	Improved models Alternative shoreline protection technologies	100% 100%
Nutrient enrichment	67%	Source identification	100%	BMP effectiveness of CBA	83%	Improved models Improved treatment technologies	83% 83%
Nonindigenous species	44%	Early detection of species Susceptibility factors	100% 100%	Success stories	100%	Rapid detection	100%
Ocean management	44%	Ecological characterizations	75%	More geospatial data for GIS Case studies	75% 75%	Improved models	75%

6-18   Florida's Priorities

Florida's priority coastal management issue areas are *habitat change* (100%) and *land use* (94%), which match the national results.

The top-ranked research, information, and technology needs for habitat change are *cumulative impact assessment* (69%), *trends analysis* (81%), and *high resolution remote sensing* (81%).

For land use, the top-ranked research, information, and technology needs are to *quantify the impact of land use on water quality* (73%), *land use change analysis* and *land suitability analysis* (53%), and *affordable remote sensing* (86%).

Table 6-18. Top-ranked Responses from Florida

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessments	69%	Trends analysis	81%	High resolution remote sensing	81%
Land use	94%	Quantify impact of land use on water quality	73%	Land use change analysis	53%	Affordable remote sensing	86%
				Land suitability analysis	53%		
Nonindigenous species	76%	Early detection of species	75%	Ecosystem inventory	90%	Rapid detecting and monitoring	92%
Nutrient enrichment	75%	Source identification/ tracking	75%	BMP effectiveness or cost/ benefit analysis	75%	Improved models that simulate and predict	58%
						Cost effective long-term monitoring/sampling equipment	58%
Sediment management	57%	Improved beneficial uses	67%	Improved methods and models for quantifying sediment budgets	67%	Improved models that simulate or predict	67%
						Methods for quantifying sediment budgets	67%
Environmental contamination	50%	Identification of sources	75%	Economic impact evaluations	63%	Rapid/real time detection	75%
							51%
Ocean management	44%	Economic assessments	100%	More geospatial data for GIS	100%	Mapping and data acquisition	71%
Coastal hazards	38%	Shoreline characterizations	67%	More geospatial data for GIS	100%	Improved models that simulate and predict	83%
Marine debris	31%	Ecological impacts	100%	Public outreach and education	100%	Debris removal technology	100%
						GPS tracking systems for potential sources of debris	100%
						Disposal or reuse technologies	100%

6-19   Georgia's Priorities

Georgia's priority coastal management issue areas over the next five years are *habitat change* (100%) and *land use* (100%), which match the national results, and also nutrient enrichment (100%) and environmental contamination (100%).

The top-ranked research, information, and technology needs for habitat change are *cumulative impact assessment* (75%), *trends analysis* (100%), and *models that simulate and predict* along with *high resolution remote sensing* and *long-term monitoring equipment* (50%).

For land use, the top-ranked research, information, and technology needs are *cumulative impact assessments* (75%) along with *indicators that link land use with ecosystem impact* (100%), *land use change analysis* (100%), and *models that predict and simulate* (100%).

Table 6-19. Top-ranked Responses from Georgia

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessments	75%	Trends analysis	100%	Models that simulate and predict	50%
						High resolution remote sensing	50%
						Long-term monitoring equipment	50%
Land use	100%	Cumulative impact assessments	100%	Land use change analysis	100%	Improved models that predict and simulate	100%
		Indicators that link land use with ecosystem impact	100%				
Nutrient enrichment	100%	Source identification	100%	Land use analysis	75%	Cost effective long-term monitoring/sampling equipment	75%
Environmental contamination	100%	Identification of sources	100%	Economic impact evaluations	75%	Reliable DNA fingerprinting	75%
Sediment management	75%	Cost/benefit analysis	67%	Sediment transport patterns	67%	Improved models that simulate or predict	67%
		Effectiveness of confinement techniques	67%	Geospatial data for GIS	67%	Methods for quantifying sediment budgets	67%
		Effects from dredging	67%				
Marine debris	50%	Perceptions and behaviors linked to sources	100%	Public outreach and education	100%	Debris removal technology	100%
						GPS tracking systems for potential sources of debris	100%
						Gear modifications to make less harmful to non-target species	100%
Nonindigenous species	25%	Early detection of species	100%	Ecosystem inventory	100%	Rapid detecting and monitoring	100%
		Cumulative impact assessments	100%	State-of-knowledge reports	100%	Treatment or removal technologies	100%
Coastal hazards	25%	Shoreline characterizations	100%	Design standards for shoreline management technologies	100%	Improved models that simulate and predict	100%
		Risk and vulnerability assessments	100%			Impact zone identification	100%
		Effects of climate	100%			Alternative shoreline protection technologies	100%

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
		change/global warming					
Ocean management	25%	Cumulative impact assessments	100%	State of knowledge reports/case studies	100%	Improved models that simulate and predict	100%
		Identifying migration routes	100%			No impact aquaculture techniques	100%
		State of knowledge reports/case studies	100%			Other	100%

6-20   North Carolina's Priorities

North Carolina's priority coastal management issue areas over the next five years are *land use* (100%) and *coastal hazards* (84%).

The top-ranked research, information, and technology needs for habitat change are to identify the *cumulative effects of development* (83%), *land use change analysis* (100%), and *customized GIS* (83%).

For coastal hazards, the top-ranked research need is *risk and vulnerability assessments* (100%). The priority information needs are *design standards for shoreline management technologies* along with *state of knowledge reports/case studies* and *geospatial data for GIS* (60%). *Improved models that predict and simulate*, *impact zone identification*, and *alternative shoreline protection technologies* (80%) are the top-ranked technology needs over the next five years.

Table 6-20. Top-ranked Responses from North Carolina

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Identify cumulative effects of development	83%	Land use change analysis	100%	Customized GIS	83%
Coastal hazards	84%	Risk and vulnerability assessments	100%	Design standards for shoreline management technologies	60%	Improved models that simulate and predict	80%
						Impact zone identification	80%
						Alternative shoreline protection technologies	80%
				State of knowledge reports	60%		
				Geospatial data for GIS	60%		
Habitat change	66%	Cumulative impact assessments	100%	Trends analysis	100%	Habitat restoration BMPs	75%
		Evaluate effectiveness of restoration/ protection	100%				
Nonindigenous species	50%	Early detection of species	67%	Ecosystem inventory	67%	Treatment or removal technologies	100%
		Susceptibility factors for coastal invasive introductions	67%	Geospatial data for GIS	67%		
		Effectiveness of BMPs	67%				
Nutrient enrichment	50%	Source identification	100%	Short-term forecasts of nutrient loading	67%	Rapid benthic/pelagic community assessment	67%
				BMP effectiveness or cost/ benefit analysis	67%	Cost effective long-term monitoring/sampling equipment	67%
				Land use analysis	67%		
				More geospatial data for GIS	67%		

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Ocean management	50%	Economic assessments	67%	Geospatial data for GIS	100%	Improved models that simulate and predict	67%
		State of knowledge reports/case studies	67%	State of knowledge reports/ case studies	100%	Mapping and data acquisition	67%
Marine debris	50%	Perceptions and behaviors linked to sources	100%	Public outreach and education	100%	Debris removal technology	100%
Sediment management	33%	Cost benefit analysis Improved beneficial uses	50%	Sediment transport patterns	100%	Improved models that simulate or predict	100%
		Prioritize restoration/protection based on max benefit for cost	50%	Beach profile data	100%	Methods for quantifying sediment budgets	100%
		Effects from dredging Analysis of impacts of engineering solutions	50% 50%				
		Other	50%				
Environmental contamination	17%	Identification of sources	100%	Explanation of interactions among contaminants	100%	Cost effective long term monitoring equipment	100%
		Bioindicators	100%			Improved remote sensing/ sampling technologies	100%
				Economic impact evaluations	100%	Improved treatment or removal technologies	100%
				Geospatial data for GIS	100%		

6-21   South Carolina's Priorities

South Carolina's priority coastal management issue areas over the next five years are *land use* (93%) and *habitat change* (90%), which are similar to the national results.

For land use, the top-ranked research, information, and technology needs are to *quantify the impact of land use on water quality* (74%), *land use change analysis* (62%), and *improved models that simulate and predict* (80%).

The top-ranked research, information, and technology needs for habitat change are *cumulative impact assessment* (77%), *trends analysis* (64%) along with *ecological and physical baselines and inventories* (64%), and *models that predict and simulate* (58%).

Table 6-21. Top-ranked Responses from South Carolina

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	93%	Quantify impact of land use on water quality	74%	Land use change analysis	62%	Improved models that simulate and predict	80%
Habitat change	90%	Cumulative impact assessments	77%	Trends analysis	64%	Models that predict and simulate	58%
				Ecological and physical baselines and inventories	64%		
Sediment management	86%	Effects from dredging	72%	Sediment transport patterns	75%	Methods for quantifying sediment budgets	64%
Nutrient enrichment	69%	Cumulative impact assessment	70%	BMP effectiveness or cost/ benefit analysis	95%	Effective mitigation strategies	75%
Environmental contamination	62%	Identification of sources	74%	Remediation options	63%	Rapid/real time detection	68%
Coastal hazards	55%	Risk and vulnerability assessments	87%	Access retrieval and analysis of data	63%	Improved models that simulate and predict	75%
				Design standards for shoreline management technologies	63%	Impact zone identification	75%
Marine debris	48%	Public education effectiveness	79%	Debris inventory	100%	Debris removal technology	100%
						Disposal or reuse technologies	100%
Nonindigenous species	45%	Early detection of species	69%	Access, retrieval and analysis of data	69%	Treatment or removal technologies	77%
		Human behaviors leading to introductions	69%				
Ocean management	41%	Cumulative impact assessments	69%	More geospatial data for GIS	58%	Mapping and data acquisition	82%
				Access, retrieval and analysis of data	58%		
				State of knowledge reports/studies	58%		

6-22   Alabama's Priorities

Alabama's top two priority coastal management issues over the next five years are *habitat change* (100%) and *land use* (100%), which match the national results.

The top-ranked research, information, and technology needs for habitat change are *cumulative impact assessment* (78%), *trends analysis* (100%), and *models that simulate and predict* (67%).

For land use, the top-ranked research needs are to *develop indicators that link land use with ecosystem impacts* (78%) and *quantify impact of land use on water quality* (78%). Priority information needs include *land use change analysis* (67%) and *geospatial data for GIS* (67%). Top-ranked technology needs are *improved models that simulate and predict* (89%).

Table 6-22. Top-ranked Responses from Alabama

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessments	78%	Trends analysis	100%	Models that simulate and predict	67%
Land use	100%	Develop indicators that link land use with ecosystem impact	78%	Land use change analysis	67%	Improved models that predict or simulate	89%
		Quantify impact of land use on water quality	78%	Geospatial data for GIS	67%		
Nutrient enrichment	78%	Cumulative impact assessments	86%	BMP effectiveness or cost/ benefit analysis	86%	Improved models that simulate and predict	86%
Sediment management	77%	Effects of dredging	71%	Sediment transport patterns	57%	Improved models that simulate or predict	86%
				Improved methods and models for quantifying sediment budgets	57%		
Environmental contamination	66%	Identification of sources	100%	Epidemiology of contaminant	50%	Reliable DNA fingerprinting	67%
				Interactions among contami-nants	50%		
				Remediation options	50%		
Coastal hazards	66%	Shoreline characterization	83%	Design standards for shoreline management tech.	100%	Improved models that simulate and predict	100%
Nonindigenous species	55%	Early detection of species	60%	Access, retrieval and analysis of	100%	Rapid detecting and monitoring	100%
		Cumulative impact	60%				

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
		assessment		data			
Ocean management	55%	Ecological characterizations	80%	Access, retrieval and analysis of data	100%	Improved models that simulate and predict	80%
Marine debris	22%	Source tracking	67%	Debris inventory	100%	Debris removal technology	67%
		Perceptions and behaviors linked to sources	67%	Public outreach and education	100%	GPS tracking systems for potential sources of debris	67%
		Biodegradable products	67%			Gear modifications to make less harmful to non-target species	67%
						Disposal or reuse technologies	67%

6-23   Louisiana's Priorities

Louisiana's priority coastal management issue areas over the next five years are *habitat change* (100%) and *sediment management* (100%).

The top-ranked research needs for habitat change are to *evaluate the effectiveness of restoration/protection techniques* (75%) and the *valuation of social, ecological, and economic factors* (75%). *Trends analysis* (75%) and *state of knowledge reports/case studies* (75%) were the priority information needs for habitat change. The top-ranked technology need is *new restoration techniques* (75%).

For sediment management, the top-ranked research, information, and technology needs are *improved beneficial uses* (100%), *sediment transport patterns* (75%) along with *improved methods and models for quantifying sediment budget*s (75%), and *engineering solutions* (75%).

Table 6-23. Top-ranked Responses from Louisiana

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Evaluate effectiveness of restoration/protection techniques	75%	Trends analysis	75%	New restoration techniques	75%
		Valuation of social, ecological, and economic factors	75%	State of knowledge reports/case studies	75%		
Sediment management	100%	Improved beneficial uses	100%	Sediment transport patterns	75%	Engineering solutions	75%
				Improved methods and models for quantifying sediment budgets	75%		
Land use	75%	Provide socioeconomic c/b analysis of various land use options	67%	Land suitability analysis	67%	Affordable remote sensing	67%
		Develop indicators that link land use with ecosystem impact	67%			Customized GIS	67%
		Quantify impact of land use on water quality	67%				
Ocean management	75%	Cumulative impact assessments	100%	Geospatial data for GIS	67%	Energy technology	100%
		Economic assessments	100%	Data access, retrieval and analysis	67%		
				State of knowledge reports	67%		
Nonindigenous species	50%	Early detection of species	50%	State of knowledge reports/ success stories	100%	Rapid detecting and monitoring	100%
		Cumulative impact assessment	50%			Treatment and removal technologies	100%
		Effects of climate	50%				

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
		change		Geospatial data for GIS	100%		
		Rapid assessment techniques and analysis	50%				
		Effectiveness of BMPs	50%				
		Human behaviors leading to introductions	50%				
Environmental contamination	50%	Effectiveness of remediation techniques	100%	Remediation options	100%	Rapid/real time detection	100%
				C/B analysis of remediation	100%	Improved treatment or removal technologies	100%
Coastal hazards	50%	Effects of climate change	100%	Geomorph. studies	100%	Alternative shoreline protection technologies	100%
Nutrient enrichment	25%	Source identification/tracking	100%	State of knowledge reports	100%	Cost effective long term monitoring and sampling equipment	100%
		Understanding factors that trigger HABs	100%	Land use analysis	100%	Improved treatment technologies	100%
		Efficacy of education and outreach	100%	Geospatial data for GIS	100%	Effective mitigation strategies	100%
Marine debris	25%	Source tracking	100%	State of knowledge reports/ case studies	100%	GPS tracking systems for potential sources of debris	100%
		Perceptions and behaviors linked to sources	100%			Gear modifications to make less harmful to non-target species	100%
		Biodegradable products	100%	Public outreach and education	100%	Disposal or reuse technologies	100%

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6-24   Mississippi's Priorities

Mississippi's priority coastal management issue areas are *land use* (100%), *environmental contamination* (100%), and *coastal hazards* (100%).

For land use, the top-ranked research needs are to *identify the cumulative effects of development* (67%) and *quantify impact of land use on water quality* (67%). The top information needs are *access, retrieval and analysis of data* (67%), *land use change analysis* (67%), and *land suitability index* (67%). Technology needs include *improved models that simulate and predict* (67%), *affordable remote sensing* (67%), and *customized GIS* (67%).

The top-ranked research needs for environmental contamination are *cumulative impact assessments* and *toxicity analysis* (67%). *Explanations of interactions among contaminants* (67%) was the top information need. The top-ranked technology needs are *improved models that simulate and predict*, *reliable DNA fingerprinting*, and *improved remote sensing/sampling technologies* (67%).

Table 6-24. Top-ranked Responses from Mississippi

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Identify cumulative effects of development	67%	Access, retrieval and analysis of data	67%	Improved models that predict and/or simulate	67%
		Quantify impact of land use on water quality	67%	Land use change analysis	67%	Affordable remote sensing	67%
				Land suitability index	67%	Customized GIS	67%
Environmental contamination	100%	Cumulative impact assessment	67%	Explanation of interactions among contaminants	67%	Improved models that simulate and predict	67%
		Toxicity analysis	67%			Reliable DNA fingerprinting	67%
						Improved remote sensing/sampling technologies	67%
Coastal hazards	100%	Shoreline characterizations	100%	Design standards for shoreline management technologies	67%	Improved models that simulate and predict	100%
		Risk and vulnerability assessments	100%				
Habitat change	67%	Cumulative impact assessments	100%	Geospatial data for GIS	100%	Models that predict and simulate	100%
		Identify causes of loss/gain	100%				
Marine debris	67%	Source tracking	50%	Public outreach and education	100%	GPS tracking systems for potential sources of debris	167%
		Perceptions and behaviors linked to sources	50%			Gear modifications to make less harmful to non-target species	67%
		Public education effectiveness	50%			Disposal or reuse technologies	67%
		Biodegradable products	50%				
Nonindigenous species	67%	Susceptibility factors for coastal invasive introduction	100%	Ecosystem inventory	100%	Rapid detection and monitoring	100%
						Treatment or removal technologies	100%

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Nutrient enrichment	66%	Source identification/ tracking	100%	Short term forecasts of nutrient loading	100%	Improved models that simulate and predict	100%
				BMP effectiveness or cost/ benefit analysis	100%	Cost effective long term monitoring and sampling	100%
Sediment management	33%	Test and validate assessment techniques	100%	Access, retrieval and analysis of data	100%	Improved models that simulate and predict	100%
		Effectiveness of confinement techniques	100%	Sediment transport patterns	100%	Containment and stabilization technologies	100%
		Effects from dredging	100%	Shoreline characteriza-tions	100%	Remote sampling	100%
Ocean management	33%	Effects of changes in community composition on historic use and values	100%	More geospatial data for GIS	100%	Improved models that simulate and predict	100%
		Cumulative impact assessments	100%	Access, retrieval and analysis of data	100%	Nondestructive bottom fishing gear	100%
		Marine managed area effectiveness	100%			No impact aquaculture techniques	100%

6-25 Texas' Priorities

Texas' priority coastal management issue areas over the next five years are *habitat change* (100%), *land use* (100%), *sediment management* (100%), *environmental contamination* (100%), and *nutrient enrichment* (100%).

The top-ranked research needs for habitat change are to *identify causes of loss/gain* (63%) and the *rate of freshwater inflow* (63%). *Trends analysis* (88%) is the priority information needs for habitat change. The top-ranked technology needs are *models that simulate and predict* (63%) and *high resolution remote sensing* (63%).

For land use, the top-ranked research, information, and technology needs are to *develop indicators that link land use with ecosystem impac*t (100%), *land use change analysis* (75%), and *change detection sensors* along with *affordable remote sensing technology* (75%).

Table 6-25. Top-ranked Responses from Texas

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Identify causes of loss/gain	63%	Trends analysis	88%	Models that simulate and predict	63%
		Rate of freshwater inflow	63%			High resolution remote sensing	63%
Land use	100%	Develop indicators that link land use with ecosystem impact	100%	Land use change analysis	75%	Change detection sensors	75%
						Affordable remote sensing	75%
Sediment management	100%	Improved beneficial uses	86%	Sediment transport patterns	86%	Improved models that simulate and predict	86%
Environmental contamination	100%	Identification of sources	63%	Explanation of interactions among contami-nants	57%	Reliable DNA fingerprinting	71%
				C/B analysis of remediation	57%		
Nutrient enrichment	100%	Source identification/ tracking	50%	BMP effectiveness or C/B analysis	75%	Improved treatment technologies	63%
		Effects on species/ communities	50%	Land use analysis	75%		
		Bioindicators	50%				
		Efficacy of education and outreach efforts	50%				
Nonindigenous species	76%	Early detection of species	100%	Ecosystem inventory	100%	Treatment and removal technologies	100%
Marine debris	75%	Ecological impacts	60%	Public outreach and education	100%	Disposal or reuse technologies	100%
		Public education effectiveness	60%				
		Biodegradable products	60%				
Coastal hazards	63%	Risks and vulnerability	80%	Design standards for	80%	Improved models that simulate and predict	100%

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
		assessments		shoreline management tech.		Alternative shoreline protection technologies	100%
		Effects of climate change	80%				
Ocean management	38%	Cumulative impact assessments s	100%	Access, retrieval and analysis of data	100%	Improved models that simulate and predict	50%
						Nondestructive bottom fishing gear	50%
						No impact aquaculture techniques	50%
						Energy technology	50%
						Mapping and data acquisition	50%

6-26   Alaska's Priorities

Alaska's priority coastal management issue areas over the next five years are *land use* (86%) and *habitat change* (85%).

The top-ranked research needs for land use are to *identify cumulative effects of development* and to *develop indicators that link land use with ecosystem impacts* (67%). *Land use change analysis* (67%) and *geospatial data for GIS* (67%) are the priority information needs for land use. The top-ranked technology need is *models that simulate and predict* (67%).

For habitat change, the top-ranked research needs are *cumulative impact assessment* (57%) and to *evaluate the effectiveness of restoration/protection techniques* (67%). The priority information needs are *trends analysis* and *ecological and physical baselines and inventories* (86%). *Low cost remote sensing and habitat restoration BMPs* (57%) are the top-ranked technology needs.

Table 6-26. Top-ranked Responses from Alaska

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	86%	Identify cumulative effects of development	67%	Land use change analysis	67%	Improved models that simulate and predict	67%
		Develop indicators that link land use with ecosystem impact	67%	Geospatial data for GIS	67%		
Habitat change	85%	Cumulative impact assessment	57%	Trends analysis	86%	Low cost remote sensing platforms to measure change	57%
		Evaluate the effectiveness of restoration/protection techniques	57%	Ecological and physical baselines and inventories	86%	Habitat restoration BMPs	57%
Coastal hazards	72%	Risks and vulnerability assessments	60%	Geospatial data for GIS	80%	Improved models that simulate and predict	80%
		Shoreline characterizations	60%			Alternative shoreline protection technologies	80%
						Impact zone ID	80%
Environmental contamination	71%	Identification of sources	83%	TMDL guidelines	40%	Rapid/real time detection	83%
				Economic impact evaluation	40%		
				Remediation options	40%		
Sediment management	58%	Cost benefit analysis	50%	Beach profile data	75%	Improved models that simulate and predict	75%
		Test and validate assessment techniques	50%	Shoreline characteri-zations	75%	Methods for quantifying sediment budgets	75%
		Prioritize restoration/ protection based on C/B analysis	50%				
		Analysis of impacts of engineering solutions	50%				
Ocean management	57%	Effects of changes in community composition on historic use and values	80%	Geospatial data for GIS	75%	Mapping and data acquisition	75%
				Anecdotal/ traditional data	75%		

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Nutrient enrichment	28%	Source identification/ tracking	100%	Access, retrieval and analysis of data	67%	Improved models that simulate and predict	67%
						Rapid community assessment	67%
				Short term forecasts of nutrient loading	67%	Cost-effective long-term monitoring/ sampling	67%
				BMP effectiveness or C/B analysis	67%		
Nonindigenous species	28%	Early detection of species	100%	Ecosystem inventory	79%	Rapid detection and monitoring	100%
		Effectiveness of BMPs	100%			Prevention techniques	100%
Marine debris	28%	Ecological impacts	50%	Debris inventory	50%	Debris removal technology	100%
		Transport of debris	50%				
		Other	50%	Public outreach and education	50%		

6-27   California's Priorities

California's priority coastal management issue areas are *habitat change* (94%), *land use* (88%), and *nonindigenous species* (88%).

The top-ranked research, information, and technology needs for habitat change are to *evaluate the effectiveness of restoration/protection techniques* (80%), *ecological and physical baselines and inventories* (80%), and *rapid ecological assessment and evaluation technology* (57%).

For land use, the top-ranked research, information, and technology needs are to *quantify the impact of land use on water quality* (79%), *geospatial data for GIS* (64%), and *customized GIS* (58%).

Table 6-27. Top-ranked Responses from California

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	94%	Evaluate effectiveness of restoration/ protection techniques	80%	Ecological and physical baselines and inventories	80%	Rapid ecological assessment and evaluation technology	57%
Land use	88%	Quantify impact of land use on water quality	79%	Geospatial data for GIS	64%	Customized GIS	58%
Nonindigenous species	88%	Early detection of species	50%	Ecosystem inventory	79%	Treatment or removal technologies	86%
		Effectiveness of BMPs	50%				
Environmental contamination	69%	Cumulative impact assessments	82%	TMDL guidelines	55%	Cost effective long term monitoring equipment	73%
				Explanation of interactions among contaminants	55%		
Nutrient enrichment	63%	Source identification/ tracking	60%	BMP effectiveness or cost/ benefit analysis	90%	Effective mitigation strategies	60%
		Effects on species/ communities	60%				
Sediment management	62%	Effects from dredging	70%	Sediment transport patterns	80%	Methods for quantifying sediment budgets	75%
Coastal hazards	44%	Trends analysis	57%	Design standards for shoreline management technologies	57%	Improved models that simulate and predict	67%
						Alternative shoreline protection technologies	67%
Ocean management	31%	Marine Managed Area effectiveness	80%	Geospatial data for GIS	80%	Improved models that simulate and predict	60%
						Nondestructive bottom fishing gear	60%
						Low cost remote vessel tracking	60%
Marine debris	26%	Source tracking	75%	Debris inventory	100%	Debris removal technology	100%
		Ecological impacts	75%				
		Public education effectiveness	75%				

6-28   Oregon's Priorities

Oregon's priority coastal management issue areas are *habitat change* (100%) and *land use* (100%), which match the national top-ranked results.

The top-ranked research, information, and technology needs for habitat change are *valuation of social, ecological, and economic factors* (83%), *ecological and physical baselines and inventories* (100%), and *high resolution remote sensing* (67%).

For land use, the top-ranked research, information, and technology needs are to *identify cumulative effects of development* (50%), *land use change analysis* (83%), and *affordable remote sensing* (60%) along with *others* (60%).

Table 6-28. Top-ranked Responses from Oregon

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Valuation of social, ecological, and economic factors	83%	Ecological and physical baselines and inventories	100%	High resolution remote sensing	67%
Land use	100%	Identify cumulative effects of development	50%	Land use change analysis	83%	Affordable remote sensing	60%
						Other	60%
Sediment management	83%	Prioritize restoration/ protection based on max. benefit for cost	60%	Improved methods and models for quantifying sediment budgets	80%	Methods for quantifying sediment budgets	100%
Coastal hazards	66%	Risk and vulnerability assessments	75%	Geomorph. studies	100%	Impact zone identification	75%
Nonindigenous species	50%	Early detection of species	67%	Ecosystem inventory	100%	Rapid detecting and monitoring	100%
		Susceptibility factors for coastal invasive introductions	67%	State of knowledge reports and success stories	100%		
Ocean management	50%	Marine Managed Area effectiveness	100%	Geospatial data for GIS	100%	Nondestructive bottom fishing gear	100%
				Anecdotal/ traditional data	100%		
				Access, retrieval and analysis of data	100%		
Nutrient enrichment	33%	Source identification/trackin g	100%	Short term forecasts of nutrient loading	100%	Improved models that simulate and predict	50%
						Cost effective long-term monitoring/sampling equipment	50%
						Rapid measurements of concentration	50%
						Enhanced remote sensing	50%

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Environmental contamination	17%	Identification of sources	100%	Epidemiology of contaminants	100%	Improved models that simulate and predict	100%
		Public health risk assessment	100%			Rapid/real time detection	100%
		Test and validate assessment techniques	100%	Explanation of interactions among contaminants	100%	Improved remote sensing/ sampling technologies	100%
				Other	100%		

6-29   Washington's Priorities

Washington's priority coastal management issue areas are *land use* (100%) and *habitat change* (80%), which match the national top-ranked results, along with nutrient enrichment (80%), environmental contamination (80%).

The top-ranked research, information, and technology needs for land use are to *quantify the impact of land use on water quality* (80%), *geospatial data for GIS* (60%), and *improved models that simulate and predict* along with *affordable remote sensing* (80%).

For habitat change, the top-ranked research, information, and technology needs are to *evaluate the effectiveness of restoration/protection techniques* (100%), *ecological and physical baselines and inventories* (75%), and *high resolution remote sensing* (75%).

Table 6-29. Top-ranked Responses from Washington

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Quantify impact of land use on water quality	80%	Geospatial data for GIS	60%	Improved models that predict and simulate	80%
						Affordable remote sensing	80%
Habitat change	80%	Evaluate the effectiveness of restoration/ protection techniques	100%	Ecological and physical baselines and inventories	75%	High resolution remote sensing	75%
						Habitat restoration BMPs	75%
Nutrient enrichment	80%	Source identification/tracking	100%	Short term forecasts of nutrient loading	75%	Effective mitigation strategies	100%
				BMP effectiveness of C/B analysis	75%		
Environmental contamination	80%	Public health risk assessment	75%	Economic impact evaluations	63%	Improved remote sensing/ sampling	75%
		Effectiveness of remediation techniques	75%			Improved treatment or removal	75%
		Remediation options	75%				
Nonindigenous species	60%	Effectiveness of BMPs	100%	Ecosystem inventory	100%	Rapid detecting and monitoring	100%
				State of knowledge report/ success stories	100%	Treatment or removal	100%
Sediment management	60%	Effectiveness of confinement techniques	100%	State of knowledge report and case studies	100%	Engineering solutions	100%
						Treatment technologies	100%
Ocean management	40%	Marine Managed Area effectiveness	100%	More geospatial data for GIS	100%	Nondestructive bottom fishing gear	100%
				State of knowledge reports and case studies	100%		

Management Issue Ranked Very Important or Important		Top-Ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Marine debris	40%	Ecological impacts	100%	State of knowledge reports and success studies	100%	GPS tracking systems for potential sources of debris	100%
						Gear modifications to make less harmful to non-target species and habitat	100%
Coastal hazards	20%	Littoral cell inventories	100%	Design standards	100%	Improved models that simulate and predict	100%
		Shoreline characterizations	100%	Geomorph. Studies	100%	Alternative shoreline protection	100%
		Effects of climate change	100%	Geospatial data for GIS	100%		

6-30 American Samoa's Priorities

The nine top-ranked management topics that American Samoa (Table 6-30) considers to be very important or important are *habitat change, land use, nutrient enrichment, nonindigenous species, environmental contamination, coastal hazards, ocean management, sediment management, and marine debris* (100%). Land use and habitat change match the national top-ranked topics.

The top-ranked research needs identified for land use are *to understand demographic changes and cultural influences on development, to calculate pollutant removal efficiencies, and to identify growth patterns and land use conversion patterns* (100%). The top information needs are *land use classification*, *land use change an*alysis, and *geospatial data for GIS* (100%). Technology to address land use issues includes *change detection sensors*, *affordable remote sensing*, and *customized GIS* (100%).

Habitat change top-ranked research needs are *cumulative impact assessment*, *ecological characterizations*, and *valuation of social, ecological and economic factors* (100%). Information needs include *trends analysis*, *ecological and physical baselines and inventories*, and *geospatial data for GIS* (100%). Top-ranked technology needs are *high resolution remote sensing*, *new restoration techniques*, and *rapid ecological assessment and evaluation technology* (100%).

Table 6-30. Top-ranked Responses from American Samoa

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land Use	100%	Understand demographic changes and/or cultural influences on development patterns	100%	Land use classification	100%	Change detection sensors	100%
				Land use change analysis	100%	Affordable remote sensing	100%
				Geospatial data for GIS	100%	Customized GIS	100%
		Develop methodologies to calculate pollutant removal efficiencies	100%				
		Identify growth patterns/ land use conversion patterns	100%				
Habitat change	100%	Cumulative impact assessment	100%	Trends analysis	100%	High resolution remote sensing	100%
		Provide ecological characterization	100%	Ecological and physical baselines and inventories	100%	New restoration techniques	100%
		Valuation of social, ecological, economic factors	100%	Geospatial data for GIS	100%	Rapid ecological assessment and evaluation technology	100%
Nutrient enrichment	100%	Cumulative impact assessments	100%	Short term forecasts of nutrient loading	100%	NO RESPONSE	
		Source tracking/ identification	100%	Land use analysis	100%		
		Spatial and temporal trends analysis	100%	Geospatial data for GIS	100%		
Environmental contamination	100%	Cumulative impact assessments	100%	Economic impact evaluations	100%	Cost effective long term monitoring equipment	100%
		Identification of Sources	100%	Geospatial data for GIS	100%	Improved remote sensing/ sampling technologies	100%
		Public health risk assessment	100%			Reliable public health testing	100%

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Nonindigenous species	100%	Cumulative impact assessment	100%	Ecosystem inventory	100%	Treatment or removal technologies	100%
		Vector identification	100%	Land use assessment	100%		
				Geospatial data for GIS	100%		
Coastal hazards	100%	Shoreline characterizations	100%	Spatial and temporal demographics	100%	Improved models	100%
		Risk assessments	100%			Impact zone identification	100%
		Trends analysis	100%	Geospatial data for GIS	100%	Advanced detection	100%
Sediment management	100%	Effectiveness of confinement techniques	100%	Sediment transport patterns	100%	Engineering solutions	100%
		Prioritize restoration	100%	Shoreline characterizations	100%	Methods for quantifying sediment budgets	100%
				Geospatial data for GIS	100%	Containment and stabilization technologies	100%
Ocean management	100%	Changes in community composition	100%	Geospatial data for GIS	100%	Improved models	100%
		Ecological characterizations	100%	Anecdotal/traditional data	100%	Mapping and data acquisition	100%
		Marine Managed Area effectiveness	100%				
Marine debris	100%	Source tracking	100%	Geospatial data for GIS	100%	Gear modifications	75%
		Ecological impacts	100%	Debris inventory	100%		
				Public outreach and education	100%		

6-31   Commonwealth of the Northern Marianas Islands' Priorities

The top-ranked management topics that Northern Marianas Islands (Table 6-31) considered to be very important or important are *habitat change*, *land use*, *nutrient enrichment*, *coastal hazards*, *ocean management*, and *marine debris* (100%).

The top-ranked research and information needs identified for habitat change are *cumulative impact assessment, effectiveness of restoration techniques, valuation of socioeconomic* and *ecological factors, and trends analysis* (100%). *Models that simulate and predict, high resolution remote sensing,* and *habitat restoration BMPs* are rated the highest in terms of the technologies needed to address habitat change (100%)

Land use change's top-ranked research need is to *identify cumulative effects of development* (100%). *Access and analysis of data*, *land use classification*, and *land use change analysis* ranks as the top information need (67%), and *customized GIS* is the highest ranked technology need (100%)

Table 6-31. Top-ranked Responses from Northern Marianas Islands

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessment	100%	Trends analysis	100%	Models that simulate and predict	67%
		Effectiveness of restoration techniques	100%			High resolution remote sensing	67%
		Valuation of socioeconomic and ecological factors	100%			Habitat restoration BMPs	67%
Land use	100%	Identify cumulative effects of development	100%	Access and analysis of data	67%	Customized GIS	100%
				Land use classification	67%		
				Land use change analysis	67%		
Nutrient enrichment	100%	Source ID Bioindicators	100% 100%	Access and analysis of data	100%	Rapid community assessment	100%
				BMP effectiveness or CBA	100%	Rapid measurements of concentration	100%
Coastal hazards	100%	Risk and vulnerability assessments	100%	Design standards for shoreline management technologies	100%	Impact zone identification	100%
Ocean management	100%	Cumulative impact assessments	100%	Access, retrieval, and analysis of data	100%	Improved models to simulate and predict	33%
						Low-cost vessel tracking	33%
						Mapping/data acquisition	33%
Marine Debris	100%	Source tracking Biodegradable products	100% 100%	Public outreach and education	100%	Debris removal technology	100%
Environmental contamination	100%	Identification of sources	100%	Economic impact evaluations	100%	Reliable DNA fingerprinting	67%
		Effectiveness of remediation techniques	100%	Remediation options	100%	Improved treatment or removal technologies	67%
Sediment management	67%	Effectiveness of confinement techniques	100%	Sediment transport patterns	100%	Containment and stabilization techniques	100%
		Effects from dredging	100%				

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Nonindigenous species	33%	Early detection Susceptibility factors	100%	Other	100%	Rapid detection	100%
						Treatment or removal	100%
						Prevention techniques	100%
		Human behaviors leading to introductions	100%				

6-32   Guam's Priorities

The eight top-ranked management topics that Guam (Table 6-32) considers to be very important or important are *land use, habitat change, nutrient enrichment, ocean management, nonindigenous species, environmental contamination, coastal hazards,* and *sediment management* (100%).

The top-ranked research and information needs identified for land use change are *identifying cumulative effects of development* (100%)*, success stories, more geospatial data for GIS, and other* (100%). The technology needs are *change detection sensors, affordable remote sensing, and customized GIS* (100%).

The top-ranked research and information needs for habitat change are *cumulative impact assessments*, *evaluation of the effectiveness of restoration techniques*, *valuation of socioeconomic and ecological factors, trends analysis, baselines and inventories, and more geospatial data for GIS* (100%). The technology needs are *high resolution remote sensing, low cost remote sensing platforms,* and *long term monitoring equipment* (100%).

Table 6-32. Top-ranked Responses from Guam

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	Identify cumulative effects of development	100%	Success stories More geospatial data for GIS Other	100% 100% 100%	Change detection sensors Affordable remote sensing Customized GIS	100% 100% 100%
Habitat change	100%	Cumulative Impact Assessment Evaluate the effectiveness of restoration techniques Valuation of socioeconomic and ecological factors	100% 100% 100%	Trends analysis Baselines and inventories More geospatial data for GIS	100% 100% 100%	High resolution remote sensing Low cost remote sensing platforms Long term monitoring equipment	100% 100% 100%
Nutrient enrichment	100%	Source ID Effects on species or communities Trends analysis	100% 100% 100%	BMP effectiveness or CBA Success stories Other	100% 100% 100%	Cost effective long term monitoring equipment Improved treatment technologies Effective mitigation strategies	100% 100% 100%
Ocean management	100%	Economic assessments Feasibility of alternative energy sources Other	100% 100% 100%	More geospatial data for GIS Data access/analysis Case studies	100% 100% 100%	No impact aquaculture techniques Low cost remote vessel tracking Energy technology	100% 100% 100%
Nonindigenous species	100%	Early detection of species Susceptibility factors Effectiveness of BMPs	100% 100% 100%	Ecosystem inventory Success stories Other	100% 100% 100%	Rapid detection and monitoring Treatment technologies Prevention techniques	100% 100% 100%
Environmental contamination	100%	Source ID Bioindicators Public health risk assessment	100% 100% 100%	TMDL guidelines Remediation options CBA of remediation	100% 100% 100%	Rapid/real time detection Improved remote sensing Improved	100% 100% 100%

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
						treatment or removal technologies	
Coastal hazards	100%	Risk and vulnerability assessments	100%	Data access/analysis	100%	Improved models	100%
				Socioeconomic impact assessments	100%	Alternative shoreline protection technologies	100%
		Effects of climate change	100%				
		Other	100%	More geospatial data for GIS	100%	Advanced detection	100%
Sediment management	100%	Cost benefit analysis	100%	Sediment transport patterns	100%	Improved models	100%
		Effects from dredging	100%	Quantification of sediment budgets	100%	Containment and stabilization technologies	100%
		Analysis of impacts of engineered solutions	100%	Other	100%	Treatment technologies	100%

6-33   Hawaii's Priorities

Hawaii ranks *land use* (100%) as the top priority issue to address over the next five years followed by *habitat change*, *environmental contamination, nutrient enrichment, nonindigenous species, ocean management, sediment management* and *coastal hazards* (50%) as the top management topics (Table 6-33).

The most important research needs for land use are *identifying cumulative effects of development, develop indicators that link land use with ecosystem impact, determining the impact of land use on water quality, calculating pollutant removal efficiencies,* and *identifying growth or land use pattern change* (50%). The most important information need is *land use change analysis* (100%). The major technological need is identified as *customized GIS* (100%).

The most important research needs for habitat change are *identification of indicators of habitat health*, *valuation of socioeconomic and ecological factors,* and *determining the effects of scale on data and analysis* (100%). The most important information needs are *data access/analysis, trends analysis,* and *developing baselines and inventories* (100%). The major technological needs are identified as *improved models that simulate and predict*, *rapid assessment and evaluation technology* and *long term monitoring equipment* (100%).

Table 6-33. Top-ranked Responses from Hawaii

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Land use	100%	ID cumulative effects of development	50%	Land use change analysis	100%	Customized GIS	100%
		Indicators that link land use with ecosystem impact	50%				
		Impact of land use with water quality	50%				
		Calculate pollutant removal efficiencies	50%				
		Identify growth or land use patters	50%				
Habitat change	50%	Identify indicators of habitat health	100%	Data access/analysis	100%	Improved models	100%
		Valuation of socioeconomic and ecological factors	100%	Trends analysis	100%	Rapid assessment and evaluation technology	100%
				Baselines and inventories	100%		
		Effects of scale on data and analysis	100%				
						Long term monitoring equipment	100%
Environmental contamination	50%	Source ID	100%	Epidemiology of contaminants	100%	Improved remote sensing	100%
		Toxicity analysis	100%				
		Public health risk assessment	100%	Explanation of interactions among contaminants	100%	Improved treatment or removal technologies	100%
				Remediation options	100%		
						Reliable public health testing	100%
Nutrient enrichment	50%	Cumulative impact assessments	100%	Data access/analysis	100%	Improved models	100%
		Source ID	100%	BMP effectiveness or CBA	100%	Cost effective long term monitoring equipment	100%
		Efficacy of education and outreach efforts	100%	Land use analysis	100%		

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
						Effective mitigation strategies	100%
Nonindigenous species	50%	Rapid assessment and analysis	100%	Data access/analysis	100%	Rapid detection and monitoring	100%
		Effectiveness of BMPs	100%	Ecosystem inventory	100%		
		Human behaviors leading to introductions	100%	More geospatial data for GIS	100%	Rapid response techniques	100%
						Treatment or removal technologies	100%
Ocean management	50%	Economic assessments	100%	More geospatial data for GIS	100%	Mapping and data acquisition	100%
		Marine Managed Area effectiveness	100%	Anecdotal/traditional use data	100%	Other	100%
		Risk assessments	100%	Data access/analysis	100%		
Sediment management	50%	Improved beneficial uses	100%	Beach profile data	100%	Improved models	100%
		Prioritization of restoration/protection based on max benefit for cost	100%	Shoreline characterizations	100%	Engineering solutions	100%
		Analysis of impacts of engineering solutions	100%			Remote sampling	100%
Coastal hazards	50%	Shoreline characterizations	100%	Data access/analysis	100%	Improved models	100%
		Risk and vulnerability assessments	100%	Socioeconomic impact assessments	100%	Alternative shoreline protection technologies	100%
		Trends analysis	100%	More geospatial data for GIS	100%	Advanced detection or warning	100%

6-34   Puerto Rico's Priorities

The top-ranked management topics that the Puerto Rico (Table 6-34) considers to be very important or important are *habitat change*, *land use*, *environmental contamination,* and *sediment management* (100%).

The top-ranked research needs identified for habitat change are *cumulative impact assessments*, *rate of freshwater inflow, and effects of human values and choices* (100%). The information and technology needs are *trends analysis* and *more geospatial data for GIS* (100%) and *improved models, low cost remote sensing platforms, and habitat restoration BMPs* (100%).

The top-ranked research needs to address land use change are to *identify the cumulative effects of development*, *develop indicators that link land use with ecosystem impacts,* and *socioeconomic cost-benefit analyses of land use options* (100%). The information needs are *build out/infill analysis* and *land suitability analysis* (100%). The top technology needs are *improved prediction or simulation models* and *change detection sensors* (100%).

Table 6-34. Top-ranked Responses from Puerto Rico

Management Issue Ranked Very Important or Important		Top-ranked Research Need		Top-ranked Information Need		Top-ranked Technology Need	
Habitat change	100%	Cumulative impact assessments	100%	Trends analysis	100%	Improved models	100%
		Rate of freshwater inflow	100%	More geospatial data for GIS	100%	Low cost remote sensing platforms	100%
		Effects of human values and choices	100%			Habitat restoration BMPs	100%
Land use	100%	Identify cumulative effects of development	100%	Build out/infill analysis	100%	Improved models	100%
		Socioeconomic CBA of land use options	100%	Land suitability analysis	100%	Change detection sensors	100%
		Develop indicators that link land use with ecosystem impact	100%				
Environmental contamination	100%	Bioindicators	100%	Explanation of interactions among contaminants	100%	Improved models	100%
		Toxicity analysis	100%			Cost effective long term monitoring equipment	100%
		Rate of freshwater inflow	100%	More geospatial data for GIS	100%	Improved treatment or removal technologies	100%
				CBA of remediation	100%		
Sediment management	100%	Test and validate assessment techniques	100%	Sediment transport patterns	100%	Improved models	100%
		Effectiveness of confinement techniques	100%	Shoreline characterizations	100%	Quantification of sediment budgets	100%
		Prioritize restoration/protection based on max benefit for cost	100%	Quantification of sediment budgets	100%	Containment and stabilization technologies	100%

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