

Rising to the Challenge



Results of the 2011 California Coastal Adaptation Needs Assessment



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We would like to thank, first and foremost, the 594 individuals who responded to this survey. The survey was initiated and developed in collaboration with 15 organizations based in California, who share an interest in the sustainable management and stewardship of the state's coastal and marine resources. We thank them for their participation, collaborative spirit, and for useful feedback on earlier drafts of the survey instrument and this analysis. We thank the six individuals who tested the 2011 survey instrument and provided critical feedback, and USC Sea Grant's intern, Marika Schulhof, who spent many hours organizing the data (stripped of personal information) in preparation for the analysis presented in this report.

REPORT IMAGES - CALIFORNIA KING TIDE INITIATIVE

Most of the photographs utilized on the cover and throughout this report are from the California King Tides Initiative. This initiative encourages members of the public to document the highest seasonal king tides that occur along the state's coast. These photos not only help identify places that are vulnerable to sea level rise, they also can be used to build public awareness and develop initiatives to help our communities become proactive in preparing for future impacts of climate change. For more information, please visit: <http://californiakingtides.org/aboutus/>

Cover image top left: Highway 1 along El Granada, CA, during a king tide on Jan. 22, 2012. Photo taken by Jack Sutton.

Cover image bottom left: Train tracks in Humboldt Bay near Manila, CA, during a king tide on Feb. 18, 2011. Photo taken by Caltrans.

Cover image bottom right: Mother's Beach, Marina del Rey, CA. Photo taken by Aaron McLendon on February 17, 2011.

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The Center for Ocean Solutions (COS) is a collaboration among Stanford University's Woods Institute for the Environment and Hopkins Marine Station, the Monterey Bay Aquarium and the Monterey Bay Aquarium Research Institute. Across these institutions, COS draws from about 80 scholars, researchers and educators who work on coastal and ocean ecosystems in the natural, physical and social sciences. COS also works with experienced conservation practitioners and policy experts. Located at Stanford and in Monterey, California, COS is uniquely positioned to leverage expertise and develop practical solutions to the most urgent and important ocean conservation problems.



A crowded beach on a summer's day in Santa Monica, CA. Photo credit: Charlotte Stevenson.

SURVEY COLLABORATIVE

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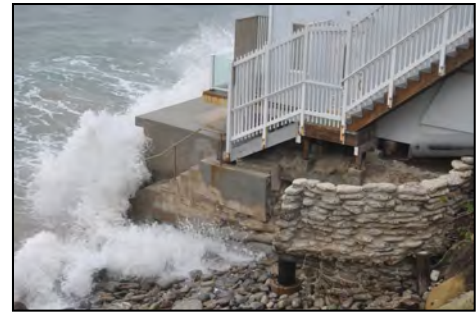
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Flooded Embarcadero in San Francisco during a king tide on Jan. 22, 2012.
Photo credit: Sergio Riuz.

EXECUTIVE SUMMARY

Sea level along most of California's coast is rising and the best science available suggests it will continue to rise at an increasing rate in the future. In addition, climate change will bring higher air and water temperatures, changes in precipitation and runoff, thus changes in water supplies and quality, and more extreme tides and storm surges that will aggravate coastal flooding and erosion. While uncertainty remains as to how these changes will unfold in any one place along the coasts and embayments of California, further change is assured.



Southern Malibu coast during a king tide on March 18, 2011. Photo credit: Amy of Malibu.

Are coastal professionals preparing for these changes? This report presents results of a survey of California coastal managers that shows that neither the state nor coastal communities are standing by until science and policy questions are settled. Communities along both the open ocean coast and along bay and estuarine shorelines are beginning to plan for climate change impacts. Despite scientific uncertainties and the economic challenges of recent years, they are rising to the challenge of coastal climate change. In light of already experienced changes, and the scientifically robust projections of additional and accelerating impacts of climate change in the future, this survey aimed to assess coastal professionals' concerns with climate change impacts, their activities to date to plan and prepare for them, and the needs and barriers they encounter in planning for climate change.

In an unprecedented collaboration of 15 organizations who share an interest in the sustainable management and stewardship of the state's coastal and marine resources, a survey was prepared. The results will inform their efforts to provide appropriate trainings and technical assistance to coastal professionals and to link them to the resources and tools that already exist.

Nearly 600 coastal professionals along California's open ocean, bay, delta, and estuarine coastlines, from a range of communities, regional, state and federal government agencies, as well as the civic and private sectors, were surveyed in the summer and fall of 2011 to understand:

- Current coastal management challenges;
- Concerns, knowledge, and actions to prepare for climate change impacts; and
- Information, technical assistance, and training needs to support adaptation planning and implementation.

Current Coastal Management Challenges

To place climate change adaptation in context, the survey asked coastal professionals to describe their communities, work responsibilities, and the coastal management challenges they already face. These already-existent coastal management challenges are a good indicator of the issues that concern coastal professionals the most, and that inform their work priorities, but they also point to near- and medium-term vulnerabilities.

- ***Current coastal management challenges are worsening.*** The top most challenging coastal management issues at present include degraded water quality, coastal/shoreline erosion, loss of native habitat and species, and sea level change. These challenges are viewed as contentious and serious; respondents view the top coastal management challenge as having worsened over the past five years, and they expect this trend to continue in the near future.

- **Top management challenges will be exacerbated by climate change.** Most of the leading management challenges (e.g., wetland loss, loss of endangered species, water quality issues, shoreline erosion, and sea level change) can be expected to worsen as climate change accelerates. Survey respondents' perception that these problems are worsening, and that they are already often rather contentious, shapes the context for adaptation planning.
- **Current management challenges make adaptation planning and decisions difficult.** Adapting to a changing climate and associated coastal impacts is a difficult prospect on its own. When coupled with the social and political implications in identifying and choosing amongst various response options, rational adaptation planning and decision-making become even more challenging.

Respondents of this survey represent coastal professionals from coastal counties across California, from a range of communities in terms of population size and local economy, across public and private sectors, and all levels of government. Thus, their concerns about current coastal management challenges provide a comprehensive picture of the current state of affairs along the state's coastline.

Climate Change Concerns, Knowledge and Actions

To understand the state of adaptation planning in coastal California, the following were assessed: coastal professionals' attitudes toward climate change; efforts to address climate change in their work; their motivations for doing so; and, barriers encountered.

- **Attitudes and knowledge about climate change are strongly supportive of adaptation action.** An overwhelming majority of survey participants accept the reality of climate change and consider it either caused by mostly human or a mix of human and natural causes. Strong majorities are concerned or very concerned about climate change, and display considerable knowledge about expected impacts on coastal areas over the next few decades. Survey findings reveal a remarkable readiness among California coastal professionals to address climate change, with both mitigation and adaptation now a high priority for all respondent groups, and adaptation the higher priority for state/regional/federal, NGO, and private sector respondents. Furthermore, many coastal professionals wish to see strong action taken to prepare for the impacts of climate change, and have either begun to do so or are about to begin. A considerable portion, however, remain unclear as to how to prepare for climate change or await authorization and direction.
- **Attention to adaptation has increased markedly over the past five years.** The survey revealed a strong increase in adaptation activity compared to the very low level observed at the time of the first coastal adaptation survey conducted in 2005/2006. That survey – conducted by researchers at the National Center for Atmospheric Research – found that among the local governments in coastal areas that were surveyed, only two counties at that time had begun considering climate change in their planning efforts, and another six cities and four counties were in the process. Five years later a marked shift is evident: today 93% of all survey respondents (including representatives from local, regional, state and federal entities) say they are in the process of understanding their climate change risks, assessing their adaptation options, or implementing a strategy.
- **Adaptation planning and implementation is still in the very early stages.** Despite clear indications of increased attention to adaptation at this time, two out of five coastal professionals (41%) are still in the very early stages of trying to understand what the climate change threats are for which they need to develop adaptation strategies, and another two out of five respondents (41%) are just beginning to brainstorm what might be done. The remaining small group of respondents (11%) states they have begun to implement some adaptation options.

- **Limited familiarity with innovative adaptation approaches.** Given the stated familiarities with different coastal adaptation approaches, it appears that most respondents may be considering techniques that are commonly used in coastal land use planning and hazard mitigation, and possibly do not know about or appropriately consider approaches with which they are less familiar at this time. These knowledge gaps are clear targets for future outreach and training activities aimed at coastal managers.

Information, Technical Assistance, and Training Needs

To help link the best available science to coastal management practice, it is important to understand which types of information and information-processing tools coastal professionals commonly use in their daily work. Results reveal important opportunities to facilitate the integration of adaptation into regular coastal management practice, and to build capacity. This may be achieved by providing training and relevant information to managers and decision makers engaged in climate adaptation planning and implementation.

- **Organizational missions, job responsibilities, and legal requirements shape common information use.** Most respondents are familiar with physical and biological information that would be useful for climate change planning, likely because this type of information is already required in ongoing practice. By contrast, they are less familiar with socioeconomic data that provide critical information on the social vulnerability of communities.
- **Ease of access to information is the overriding determinant of information use.** Given the ease of access and ubiquitous use of computer and Internet technology, respondents are turning first and most often to the Internet and to their colleagues for information, rather than to scientific journals or experts.
- **Specific information needs differ by professional group.** Specific information needs differ by respondent groups likely due to job responsibilities and mandates of different entities and, perhaps, differences in climate adaptation planning experience.
- **Critical opportunities exist to meet coastal professionals' information, technical assistance, and training needs.** There is an evident need for training on the use of socioeconomic data in conducting vulnerability assessments and adaptation planning. The survey also revealed an ongoing need to translate scientific information into forms that are more accessible to coastal professionals, and to help them discern credible from less credible information sources. While in-person training opportunities are strongly preferred by most respondents, survey participants also identify web-based trainings and webinars as particularly useful. Due to the specific needs of different respondent groups, organizations offering information products, tools and trainings should tailor their offerings to specific audiences.

If the significant progress in coastal professionals' attention to adaptation since 2005 is any indication, it is reasonable to expect continued growth in that awareness and interest among even more coastal communities and the professionals responsible for developing adaptation plans over the coming years. As other studies have found, one of the first and most important steps in preparing for climate change is to build the knowledge, skills, and capacities of managers and decision-makers. This appears to be the process California coastal professionals are in the midst of at this time. The primary task for organizations such as those partnering on this survey is thus to support this capacity-building effort, track how these needs are changing, and help ensure that coastal professionals have the assistance they need in rising to the challenge of climate change.

THE 2011 COASTAL ADAPTATION NEEDS ASSESSMENT: MOTIVATION AND OVERVIEW

Rising to the Challenge of Climate Change

Sea level along most of California's coast is already rising and the best science available suggests it will continue to rise at an increasing rate in the future (Price et al. 2011; Nicholls and Cazenave 2010; Jevrejeva et al. 2009; Nicholls et al. 2007).¹ In addition, climate change will bring higher air and water temperatures, changes in precipitation and runoff, thus changes in water supplies and quality, and more extreme tides and storm surges that will aggravate coastal flooding and erosion (Cayan et al. 2009; Bromirski et al. 2012). While uncertainty remains as to how these changes will unfold in any one place along the coasts and embayments of California, further change is assured. The state thus faces multiple environmental and societal threats to coastal areas, which will be aggravated the more people and economic activity are exposed to coastal hazards.

The State of California has recognized the urgency of these interacting trends and has developed a statewide approach to reducing the risks from climate change impacts, summarized in the California Adaptation Strategy of 2009 (currently being updated, with an anticipated completion date of December 2012). In 2010 the California Ocean Protection Council (OPC) worked in conjunction with the OPC Science Advisory Team and 16 state agencies through the Coastal and Ocean working group of the California Climate Action Team (CO-CAT) to develop the State of California Sea Level Rise Interim Guidance Document. In March of 2011, the OPC adopted a non-binding sea level rise resolution asking state agencies to incorporate consideration of sea level rise into all decisions and programs (including funding) and to follow the recommendations in the state guidance document on sea level rise. While there is no mandatory local adaptation planning at this time, the state is currently encouraging adaptation at the local level through state funding programs (e.g., State Coastal Conservancy, Strategic Growth Council, Department of Water Resources), requiring that entities applying for funds conduct sea level rise vulnerability assessments. Finally, the state also released a Climate Adaptation Policy Guide (2012) oriented especially toward local communities that is currently under public review.

Several California state agencies partnered with Oregon, Washington and three federal agencies through the West Coast Governors' Alliance for Ocean Health to fund a National Academy of Sciences expert panel to review sea level rise science for the entire West Coast. The report is expected to be released by June 2012. Meanwhile, coastal communities are not standing by until both science and policy questions are settled. Communities along both the open ocean coast and along bay and estuarine shorelines are beginning to plan for climate change impacts. Despite the range of sea level rise projections for the end of the century, scientific challenges in projecting place-specific impacts, and the economic challenges of recent years, California coastal communities are rising to the challenge of climate change.



A woman captures images of waves crashing on the Seal Beach Pier in January 2010. Photo by Michael Goulding. (Image courtesy of Orange County Register, Feb. 15, 2011 <http://sciencedude.ocregister.com/2011/02/15/king-tides-a-global-warming-preview/121567/>)

1. At the Golden Gate tide gauge, for example, sea level has risen approximately 7 inches (18 cm) over the past century (1900-2005); rates along other parts of the California coast vary.

Background on the Adaptation Needs Assessment Survey

In response to the consensus on climate science and previously identified stakeholder needs (e.g., Sea Grant Regional Information Needs Report, 2007), several California-based coastal organizations independently developed guidance documents and workshop trainings on climate adaptation planning.² In this context, the University of Southern California (USC) and California Sea Grant programs began developing a survey instrument to help characterize community-specific information needs. At the California and World Ocean Conference in September 2010, representatives from several organizations (see partner list) agreed to combine and leverage their individual efforts. The unprecedented collaboration among representatives of these organizations resulted in the development of a statewide survey of information, technical assistance and training needs, and continues to serve as a forum to avoid duplication of effort for future educational products tailored to climate change adaptation. The goal of the survey is to understand the needs and barriers coastal communities have in planning for climate change, to develop appropriate trainings and technical assistance for communities, and to determine the best way to link communities to resources and tools already available.

The collaborators are making survey results available so that interested organizations can use this information to develop user needs-focused research programs and targeted educational materials, plan workshops, offer technical assistance and develop communications programs that address the needs of coastal professionals. Already, the survey collaboration has led to unanticipated benefits, such as the partnering organizations coordinating their climate adaptation outreach efforts (e.g., USC Sea Grant and the Tijuana National Estuarine Research Reserve have co-sponsored a southern California-based workshop on conservation planning in a changing climate). It is our hope that in the future more such benefits will arise from our collaboration.

In the development of this survey, the collaborating organizations were fortunate to be able to build on a prior similar survey conducted in 2005/2006 by researchers from the National Center for Atmospheric Research (NCAR, Boulder, CO) with funding from the California Energy Commission's PIER Program (Moser and Tribbia 2006/2007; Tribbia and Moser 2008). That first survey was undertaken in response to then-Governor Arnold Schwarzenegger's Executive Order S-3-05 of June 1, 2005 to assess California's coastal communities' level of preparedness for the unavoidable impacts of climate change. The survey aimed to understand California's coastal managers' perceptions of current coastal management challenges and the added risks from climate change, their perceived vulnerability to the growing coastal problems, and the extent to which they were beginning to think about and tackle these increasingly difficult management challenges. The survey findings also identified and illustrated coastal managers' plans to cope with and adapt to the unfolding effects of climate change.³

To allow for maximum comparability between the previous and current surveys, the research team built on the 2005/2006 survey instrument, retained many questions or modified them only slightly, and added more detail to meet the information needs of survey partners. While the results from the 2011 survey are not compared in detail with the 2005/2006 survey results here, forthcoming publications will provide this longitudinal analysis. The survey results reported here provide a first look at what climate change impacts concern coastal managers and how information can best be provided to assist them in meeting the adaptation challenge.

2. For a list of guidance documents and training materials, please see Appendix V.

3. Coastal managers who responded to the 2005/2006 survey included local and county government planners, permitting officers, public works engineers, environmental specialists, development coordinators, harbor managers, water resource managers, elected officials, emergency service managers, natural resource managers and others.

SURVEY METHODOLOGY

Targeted Respondents

Coastal management in California involves local (municipal and county) governments, regional institutions, state and federal agencies, the private sector, nongovernmental organizations (NGOs) and – at the scale of individual coastal properties – home and property owners. Proactive adaptation planning, however, is typically not done by individual homeowners directly, and thus they were not targeted for this survey.

The survey instrument targeted local, state, and federal government staff, NGO representatives, private sector consultants, and elected officials whose daily work is already, or could be, affected by climate change impacts. The survey inquired about respondents': (1) location, including the resources and coastal land/water areas they manage; (2) current coastal management challenges; (3) perceptions of climate change and related impacts on coastal areas, as well as their actions to plan and prepare for those impacts; and (4) information, decision support, and related training needs to facilitate coastal adaptation. A concluding section asked basic demographic information, including geographic location of the respondent (southern, central, northern California and San Francisco Bay/Delta area).

Survey Design, Distribution, and Analysis

The survey instrument drew heavily on the survey conducted in 2005/2006 (Moser and Tribbia 2006/2007; Tribbia and Moser 2008). The research team adjusted it to meet the participating organizations' information needs and research interests. The resulting instrument consisted of 68 questions (several with sub-questions), was reviewed by all participating organizations, pilot tested by six individuals across the multiple sectors targeted, refined, and then prepared as a web-based survey.⁴ Based on the pilot tests, an estimated response time of ~45 minutes was expected of respondents.

Survey respondents were approached with a recruitment email indicating they had been selected to respond to the survey; this was then followed by an email with a unique survey response access code to ensure unique responses and confidentiality. The online survey opened on August 1, 2012, was accessible to respondents initially until September 15, 2012, and then extended two more weeks until September 30, 2012 (for a total of 60 days). Following the initial invitation to participate sent from USC Sea Grant, participating organizations sent emails to their respective constituents to encourage participation in the survey. Throughout the first six weeks, three additional reminder emails were sent from USC Sea Grant to those who had not yet responded to the survey. The last survey reminder (with the extended deadline) was sent from the California Ocean Science Trust and the California Ocean Protection Council (two of the survey partners) to encourage broader participation.

Survey responses were compiled by the web host of the survey (Qualtrics) and the data files submitted to the lead researchers for analysis. For the purposes of this summary report, descriptive statistical analyses and graphics were prepared; those findings are discussed below. The appendices contain answers to each of the survey questions – including the exact wording of each question and figures displaying the detailed results. Because the management responsibilities and/or jurisdictions among the various respondent groups can be different, some questions were slightly modified for each of these respondent categories (e.g., information delivery to elected officials is significantly different from that to local planners, see Appendix IV, Question 37). For some questions, all responses are summarized in a single figure, while for others responses are separated out by respondent categories.

4. All members of the core research team underwent human subjects research certification (on file) prior to deployment of the survey instrument.

SURVEY POPULATION AND RESPONSE RATE

The survey was sent out to 2,378 coastal professionals working along California’s open ocean, bay, delta, and estuarine coastlines. This list of individuals was generated by the participating organizations. “Coastal professionals” were defined as those individuals involved in California coastal resource management, conservation, and protection from coastal hazards. Thus the professionals approached included elected officials, planners, resource managers, public works engineers, transportation managers, emergency response managers, public health officials, harbor managers, port commissioners, representatives of environmental organizations working on coastal issues, consultants, and officials at farm bureaus. We received 594 responses, yielding a survey response rate of approximately 25%. Of those who responded, 75% completed the full survey;⁵ the remainder only answered some of the questions. Based on industry standards for online surveys of this nature, this response rates is entirely in line with common experience (Hamilton 2009), and considered adequate (Visser et al 1996; Holbrook et al. 2007). This may even be viewed as very good considering the length and scope of the survey (average actual time to complete the survey was 77 minutes) and thus required considerable time and effort on the part of respondents.

Table 1. Respondents’ Sectoral Jurisdictions

Sector	Percent Invited (n=2,378)	Percent Responded (n=557)
Municipal/City Government	46%	28%
State Government	11%	23%
County Government	17%	12%
Regional District or Association	5%	10%
Non-Governmental Organization	7%	10%
Federal Government	6%	9%
Environmental Consultant	4%	5%
Private Industry	2%	3%
Tribal Nation	1%	1%
Other	1%	1%

Table 2. Respondents’ Professions/Job Titles

Type of Position	Percentage (n=335)
Planner	33%
Environmental Specialist	26%
Wildlife/Natural Resource Manager	13%
Other ⁶	9%
Public Works Engineer	6%
Harbor, Parks, or Beach Manager	5%
Water Resources Manager	3%
Community Development Coordinator	2%
Permitting Officer	2%
Flood District Manager	1%
Emergency Services Manager	1%

5. Percentages throughout the text are rounded to the nearest full number.

6. “Other” types of positions were identified as: coastal engineer; hydraulic engineer; scientist; climatologist; chart coordinator; engineering geologist; public health manager; and, manager of aviation planning.

As Table 1 indicates,⁷ results are dominated by responses from local and state-level coastal professionals, albeit proportionally reflecting the population approached (Questions 1 & 2a-b). The majority (94%) were not elected officials (Question 1). Most of these respondents self-identify as planners and environmental specialists, with a range of other professional groups represented (Table 2; Question 3). While the majority (53%) has worked with their employers for over 10 years, respondents predominantly have held their current positions for three or more years (Question 4a-b). Fifty-six percent of respondents are male, and 38% female, and the majority (60%) range in age from 45 – 64 years of age (Question 5 & 6). Ninety-five percent of respondents have bachelor’s degrees, and 60% have higher (graduate or professional) degrees (Question 7). Together, these demographics suggest a group of survey respondents that is highly educated and relatively senior in experience and positions.

With more than 1,100 miles of open ocean coastline and another 1,000 miles of shoreline along San Francisco Bay, and hundreds more miles of embayments, the range of coastal management challenges, as well as approaches to managing coastal climate change risks, is diverse. It was thus important to determine whether the survey respondents adequately represented California’s southern, central, northern and bay regions and the different types of coasts found in the state. Forty-three percent of respondents are from southern California, including Santa Barbara, Ventura, Los Angeles, Orange and San Diego counties. Thirty-seven percent of respondents work in the Bay/Delta Region, which includes the 12 counties of Sonoma, Napa, Solano, Sacramento, Marin, San Francisco, Contra Costa, Alameda, San Joaquin, Santa Clara, San Mateo, Santa Cruz.⁸ The remaining respondents are equally divided between counties in central California (12%, Monterey and San Luis Obispo) and northern California (12%, Del Norte, Humboldt, Mendocino, Sonoma; Question 8). Notably, each coastal county is represented in the survey by at least one respondent (Map 1).



Map 1. Locations of respondents. The identity of survey respondents was kept anonymous unless they chose to provide their contact information. This map was developed using this contact information and is therefore not reflective of the respondent population as a whole. Rather, the map provides a glimpse of the geographic distribution of some of the survey respondents (n=59 of 594 survey respondents).

7. See also Appendix I, Questions 1 – 7, to review questions and a summary of responses from all demographic questions posed in the survey.

8. The map utilized to identify respondents’ geographic region included Santa Cruz County in the Bay Area/Delta region. We recognize that Santa Cruz is considered a central coast county. Because it is impossible, with anonymous data, to extract the Santa Cruz County respondents from the Bay Area/Delta region cohort, results in the remainder of this report referring to the Bay area include Santa Cruz.

The survey population captured in our survey is thus representative of all California’s major coastal regions with the most populated coastal regions of the state (southern California and the San Francisco Bay region) most strongly represented by survey respondents. In terms of respondents’ job responsibilities, nearly three-quarters of participants are planners, environmental specialists, or wildlife/natural resource managers, while engineers, water resource managers, emergency or flood district managers and others make up the remaining portion. While obviously an uneven distribution, those most directly involved in long-term planning (such as for climate change) are well represented here. Moreover, this survey – contrary to its 2005/2006 predecessor – includes individuals from all levels of government, reflecting the complex nature of coastal management and adaptation planning. The only group clearly missing is Tribal communities, and more efforts need to be made in the future to reach that particular population. Based on this review, we conclude that survey responses are adequately representative of the state of affairs in California.

The key findings of the survey are summarized below in three parts (with detailed results presented in the appendices):

- Part 1: Current coastal management challenges
- Part 2: Coastal adaptation to climate change
- Part 3: Information, training, and decision support needs.



High water over the St. Francis Yacht Club San Francisco, CA, during a king tide on Jan. 21, 2012. Photo credit: Matt Richardson.

PART 1: CURRENT COASTAL MANAGEMENT CHALLENGES IN CALIFORNIA

The first section of the survey, “Current Coastal Management Challenges in California,” sought to characterize the communities represented by respondents and to understand the challenges respondents face in the course of their daily work. These insights provide important information about the current state of coastal management across the state, and also contextualize any ongoing efforts and priorities in adaptation planning to date.⁹

Profile of California Coastal Communities

To understand current coastal management challenges, several questions asked for information about the regions in which respondents work – what part of the state they represent, how large the communities are, whether they are urban or rural, the nature of the local coastal economy, and what coastal infrastructure and assets can be found in the immediate shoreline. As noted above, the majority of respondents represents more urbanized portions of the state (southern California and the Bay/Delta region). However, the majority (74%) of respondents represents communities with populations ranging from 10,000 – 500,000, with only 16% of respondents from cities with populations greater than 1,000,000 (Question 10). Relative to the approximate number of communities in each size category, the smallest communities are somewhat underrepresented, while the largest cities are somewhat overrepresented. This could be expected since larger cities tend to have relatively more staff – and thus capacity – to respond to a survey request.

Beyond the population figures, there is considerable variation in how respondents describe their communities. About 37% of statewide respondents describe their locales as metropolitan, and another 34% as tourism/beach and recreation destinations (Figure 1). About 27% represent small towns, while 26% represent suburbs. Another 26% describe their communities as urban/mixed economies and 23% as unincorporated areas. Farming and working harbor communities, as well as communities dominated by a park or reserve and retirement communities, make up the smallest group (with 17% for the first three and 3% for the retirement community, Question 11). Respondents were asked to choose as many descriptors as they deemed useful for describing their communities, thus percentages do not add up to 100%.

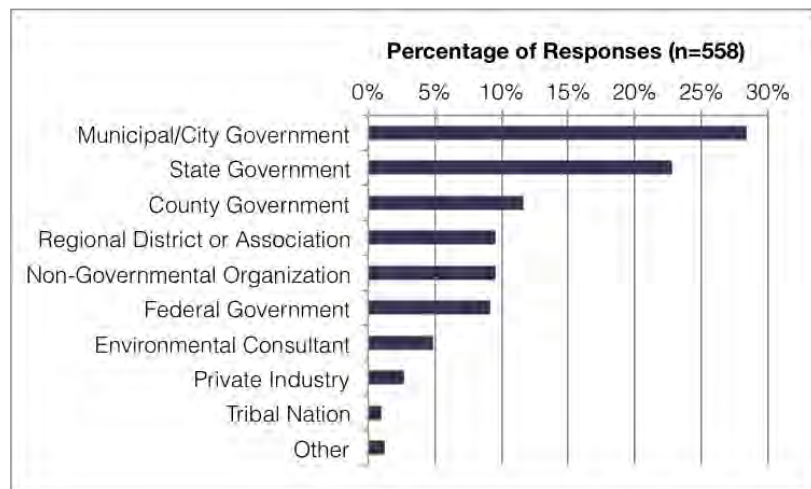


Figure 1. Respondents were asked to describe the community in which they work (see Question 2a).

9. Questions and a summary of responses from this portion of the survey can be found in Appendix II, Questions 8 – 19.

In their descriptions of predominant types of sensitive infrastructure, developments, or habitats (again with the opportunity to “choose all that apply”), more than 50% of respondents identify wetlands as one of the dominant assets located in shorefront areas (Question 12). This result is notable, considering the majority of respondents are from the more urbanized portions of the California coastline. Since a large percentage of wetlands have been lost across the state since historical times (CNRA 2010; Dahl 1990), the high level of concern expressed in the survey responses may stem from the acute need and the challenge of protecting and managing the remaining coastal wetlands as required by state and federal legislation. A high percentage of respondents also identify endangered species habitat (41%), open spaces/parks for recreation (38%) and pristine recreational beaches (35%) as dominant habitats along the coast. The high frequency of natural assets is followed by critical infrastructure in the immediate shorefront. Respondents identify highways and roads (35%), residential buildings (31%), stormwater/ wastewater infrastructure (28%), marinas/recreational fishing facilities (23%), and levees (21%) as dominant infrastructure assets located along the coast.

Nearly one-third of respondents (30%) indicate that there is currently “moderate” development and redevelopment pressure and nearly a quarter (24%) of respondents report “significant” pressure on their communities. Twenty-two percent describe this pressure as “slight” and the remaining 24% report no development pressure (Question 13). Expanding upon where the development pressure is occurring, responses differ by respondent group. City and county staff indicate that most development/redevelopment pressure is not in immediate shorefront areas, but rather elsewhere within municipal boundaries (Question 14). This may be explained by considering that most urban shorefront areas are already highly developed, with mostly infill and redevelopment taking place in many areas. Elected officials appear to perceive more pressure along the coast than elsewhere within city boundaries or than at the edge of municipal boundaries.

Current Coastal Management Challenges Along California’s Coast

Current coastal management challenges are good indicators of the issues that concern coastal professionals the most, and that inform their work priorities. As a baseline against which one could assess the additional challenges from climate change, current problems also point to near- and medium-term vulnerabilities. For example, coastal flooding or erosion issues already experienced today are likely to be exacerbated in the future as sea level continues to rise.

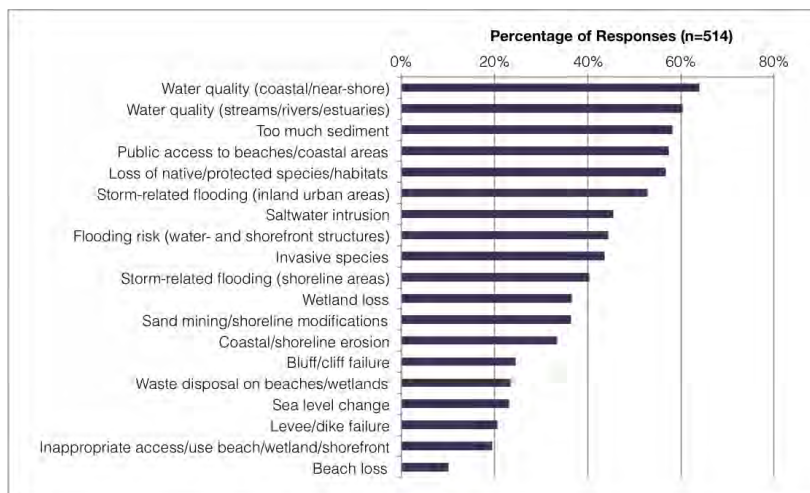


Figure 2. Respondents were asked to identify their current coastal management challenges (see Questions 15 &16).

The majority of respondents identify water quality in coastal/near-shore waters and in coastal streams, rivers, and estuaries; too much sediment; public access to beaches and coastal areas; and, loss of native, protected species habitats in coastal areas as current coastal management challenges (Figure 2; Question 15). Respondents were then asked to choose their top five management challenges (from all that applied in their communities). The responses reveal slight differences depending on their sectors/ jurisdictions (Question 16).

For instance, city/county respondents identify water quality in coastal/near-shore waters as their top concern; state, regional, and federal respondents as well as NGO respondents identify loss of native or protected species and coastal habitats as their top concerns; and elected officials and private industry/consultants identify sea level change as their top concern.

Across all sectors, the majority of respondents indicate that the identified top coastal management challenge is either serious or very serious (68%) at present, that the severity increased over the past five years (63%), and that they expect it to continue to worsen over the next five years (72%; Question 17 & 18a-b). Notably, at this point in the survey, respondents had not yet been primed to think about climate change and its impacts. Thus, these responses may serve as a first indication that climate change impacts have emerged as daily concerns for at least some of California's coastal professionals. Most respondents (56%) also identify the political atmosphere around their top coastal management challenge as either contentious or very contentious (Question 19a). Respondents, however, are divided in whether they perceive that top challenge as having worsened (31%), improved (35%) or not changed at all (35%) over the past five years (Question 19b).

Respondents identify local governments, state agencies/commissions, and federal agencies as well as environmental advocacy groups as the stakeholder groups most involved in the top coastal management challenges, with slight differences depending upon the respondent group. Scientists and engineers are not among the top three of the stakeholder groups, but are ranked in the top five stakeholder groups involved in the management of coastal challenges (Question 18c).

Summary

Respondents of this survey represent coastal professionals from coastal counties across California, from a range of communities in terms of population size and local economy, across public and private sectors, and all levels of government. Thus, their concerns about current coastal management challenges provide a comprehensive picture of the current state of affairs along California's coastline. Development and redevelopment pressure at this time is primarily categorized as moderate. The cumulative impact of past and current human development and use of coastal areas, however, is clearly apparent in the most pressing management challenges identified. The most challenging coastal management issues include degraded water quality, coastal/shoreline erosion, loss of native habitat and species, and sea level change. Local, regional, and state governments as well as environmental advocacy groups are the main stakeholders involved in these coastal management challenges. All assert that these challenges are contentious and serious, that the top coastal management challenge has worsened over the past five years, and that they expect this trend to continue in the near future. Perceptions of changes (or lack thereof) in the political atmosphere around the most serious management challenge, however, are mixed, with some seeing improvements, others little if any change, and yet others deterioration. In two-thirds of responses, however, coastal professionals perceive that the already-contentious situation has either not changed (stayed contentious) or has become more contentious in recent years.

The responses in this part of the survey clearly show that current management challenges are significant "as is." Most of the top five current management challenges (e.g., wetland loss, loss of endangered species, water quality issues, shoreline erosion, and sea level change) can be expected to worsen as climate change accelerates. Survey respondents' perceptions – that these problems are worsening and are contentious – shape the context for adaptation planning. Adapting to a changing climate and associated coastal impacts is a difficult prospect on its own. When coupled with the social and political implications associated with identifying and choosing amongst various response options, rational adaptation planning and decision-making become even more challenging.

PART 2: COASTAL ADAPTATION TO CLIMATE CHANGE

The second section of the survey, “Coastal Adaptation to Climate Change,” assessed coastal professionals’ attitudes toward climate change, and whether or not they are currently addressing climate change in their work. To the extent they had begun thinking about or planning for climate change adaptation, the questions in this part of the survey also tried to uncover what had motivated adaptation-related work, and what barriers the respondents had encountered. Together with the more specific answers to information and training needs (Part 3), the responses help inform how best to support coastal professionals in their work as they address climate change impacts.¹⁰

Attitudes Toward Climate Change

To elicit coastal professionals’ attitudes toward climate change, a variety of indicator questions were used. Respondents were randomly assigned surveys that used the term “climate change” (n=247, 52%) or “global warming” (n=229, 48%) throughout. By randomly assigning the two terms in the 2011 survey, several important insights could be gained. First, it is possible to determine if the different terms elicit different responses from respondents, which can inform language preferences in outreach and educational efforts; and second, since the phrase “global warming” was used in the 2005/2006 survey, it is possible to conduct an adequate longitudinal analysis of survey results over time.

Respondents were first asked to indicate their opinions about the causes of climate change (mostly natural, mostly human, or a mix of human and natural cause – all implicitly assuming that climate change is occurring), and one option that climate change (regardless of cause) is not occurring (Question 20). Results indicate that just over 50% of all California coastal professionals believe it is caused by a mix of natural and human causes, about 44% believe it is caused mostly by human causes, about 5% believe that global warming is caused mostly by natural causes, and less than half of one percent believe it is not occurring (Figure 3).

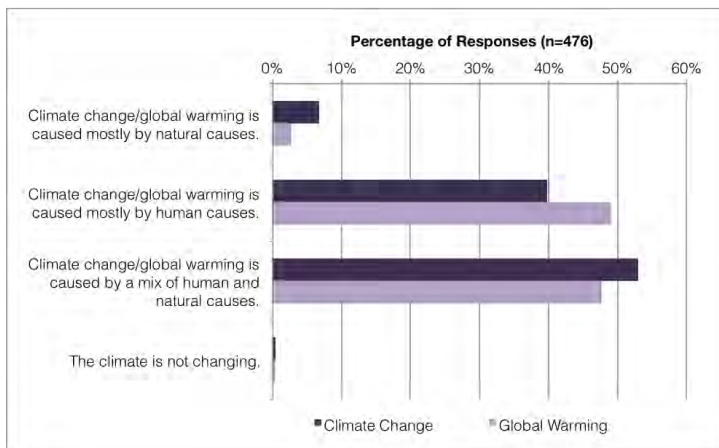


Figure 3. Respondents were asked to identify what they believe causes climate change/global warming or if they do not believe the climate is changing (see Question 20).

When results were compared for the segment of respondents that were asked this question using the term “climate change” versus “global warming,” small percentage differences were found (Question 21). These differences were determined to be not statistically significant at the 95% confidence level. Thus, using a stringent statistical significance threshold, respondents’ answers to climate change/global warming related questions did not depend on the use of either term.¹¹ For the purposes of this report then, answers are combined in the remainder of this discussion, using only the term “climate change.”

10. Questions and a summary of responses from this portion of the survey can be found in Appendix III, Questions 20 - 33.

When survey participants were asked about their personal levels of concern about climate change, a consistent pattern was found across respondent groups: in each group, the vast majority of respondents (at least 80%) says they are *concerned* or *very concerned* about climate change, with the remainder being either *neutral* (typically less than 10%) or *not (very) concerned* (typically less than 5%) (Figure 4; Question 21). The only exceptions to this general pattern are (a) elected officials, where a smaller majority (about 60% compared to the more than 80% in other respondent categories) indicate they are *concerned/very concerned*, and a larger proportion (20% compared to about 5% for others) say they are *not (very) concerned* about climate change; and (b) environmental NGOs, where no respondent is in the *not (very) concerned* group and nearly 100% are *concerned/very concerned* about it.

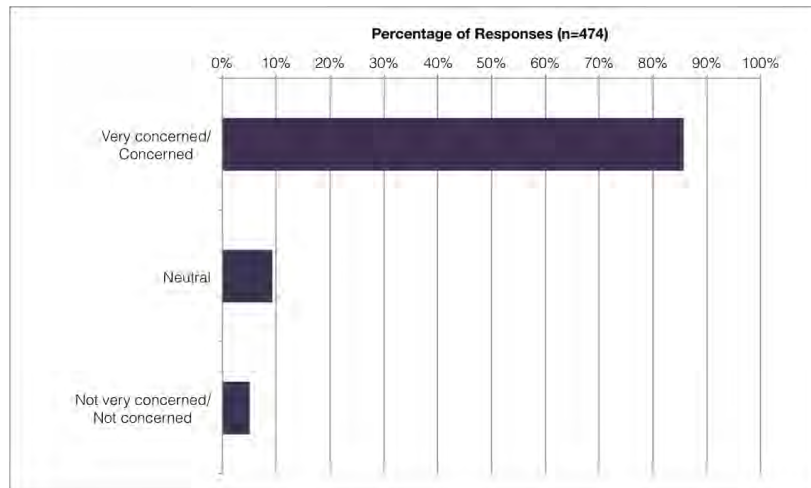


Figure 4. Respondents were asked about their level of concern about climate change (see Question 21).

Another indication of coastal professionals' engagement with climate change is their response to the question whether they have considered the potential impacts of climate change in their personal lives, their work, in both, or not at all (Question 22a). Again, the vast majority of respondents (76%) say they have done so in both their work and personal lives and only a very small segment (4%) says they have not considered them at all. Of those who have considered them, the majority says they have done so for more than three years (44%); another 43% says they have done so for 1-3 years; and the remainder is relatively new to the issue (no more than one year, 13%; Question 22b).

When asked more specifically about their attitudes toward preparing for the changes in coastal areas that one might expect from climate change, most respondents favor one of two statements: either "we should prepare for climate changes based on the best available science" (58% overall, and the preferred option particularly for local respondents, private industry/environmental consultants, and state/federal/regional respondents, or "we should prepare for changes in climate in all our decisions" (32% overall, but preferred particularly by NGOs and, notably, elected officials; Question 23). A significantly smaller segment of respondents (typically in the single digits per response option) state that "we should not take any action because climate change is not happening," "we should not make any changes until we have better information," or "we don't have enough information so we should only take actions that benefit us regardless of climate change." The only exception are elected officials, 12% of whom feel that "we don't have enough information so we should only take actions that benefit us regardless of climate change."

11. Less stringent significance thresholds (e.g., 90% confidence level) suggest there may be a slight difference in the two respondent groups' answers. Future analyses will explore this in more detail. For now, we note that a finding of no statistical significance between respondent groups is in and of itself interesting, and lends weight to recent scientific findings that the terms "global warming" and "climate change" may no longer predicate attitudes toward the topic as strongly as it once seemed to do (Villar and Krosnik 2011; Akerlof and Maibach 2011).

Knowledge About Climate Change and Adaptation

Respondents were also asked to self-assess their knowledge about climate change and its impacts in coastal California (Questions 24 and 25). In general, city/county and state/federal/regional respondents feel – by a strong margin – *moderately well informed* (66% and 58%, respectively), followed by a smaller group (30% and 36%, respectively) saying they feel *well informed* about climate change. Very small percentages (less than 5%) say they feel *not well informed*, and only a few respondents in the private industry/environmental consultants segment and state/federal/regional segment acknowledge they feel *not at all informed*.

When followed up with a question about respondents' knowledge of climate change impacts in coastal California over the next three to four decades, the relatively high ratings in the self-assessment were largely consistent with respondents' factual knowledge. Respondents' answers to this question were logged as being either consistent or inconsistent with prevailing scientific consensus on each item (those items with no clear scientific consensus were excluded from analysis). Using an arbitrary threshold of at least 80% of responses being consistent with the scientific consensus, it becomes clear that:

- State/federal/regional respondents (who rate themselves predominantly as only *moderately well informed*) are correct in their assessment for 12 out of 13 impacts;
- Elected officials and NGO respondents (who both rate themselves primarily as *well* or *moderately well informed*) are each correct in 11 out of 13 cases;
- City/county respondents (who rate themselves predominantly as *moderately well informed*) are correct in their expectations for eight out of 13 identified impacts; and,
- Private sector/environmental consultants who self-assess themselves predominantly as *well informed* are consistent with the scientific consensus for only four out of 13 impacts.

Thus, it appears that city/county officials and NGO representatives self-assess their knowledge quite consistently with what it factually appears to be, whereas private industry/environmental consultants may be overconfident and state/federal/regional respondents seem to understand the issues better than they give themselves credit for.

A final question in this section about climate change knowledge and attitudes inquired about respondents' sense of how climate change may affect their work (Figure 5; Question 26). A strong plurality (49%) states that "it is clear that climate change does already or will affect my work and I have begun preparing for it in a number of ways." The second and third most frequently chosen responses reflect less certainty, but still an awareness of the potential of climate change to affect their daily work. Nearly 18% say that they expect "climate changes may well affect the things I manage but I don't know how to prepare for them," while 17% say they could "see the connection and are about to prepare for climate change." Another 10% of respondents indicate that they "see the link but have not yet been directed or allowed to begin work on adaptation." Very small minorities have "not yet thought about that connection" (3%), feel they "won't worry about it until ... told to do so" (2%) or "could not see how this global problem was relevant to my work" (1%).

These numbers strongly affirm the findings summarized above about coastal professionals' level of personal concern, knowledge, and readiness to act on climate change. At the same time, these results suggest that there is a large subset of coastal professionals (nearly a quarter) who could benefit from learning more about how climate change might affect their job responsibilities. They have either thought about that connection but do not know what to do, or they have not yet thought about that link. They could also benefit from help with preparing for these impacts once the connection is clearer.

Those respondents who have not been directed or allowed to start working on adaptation or who wait for such authorization may be ready to do so if given the go-ahead. This suggests a key target audience for outreach and climate change education, namely those in leadership positions, as they can provide direction, affect work plans, job descriptions, and budgets.

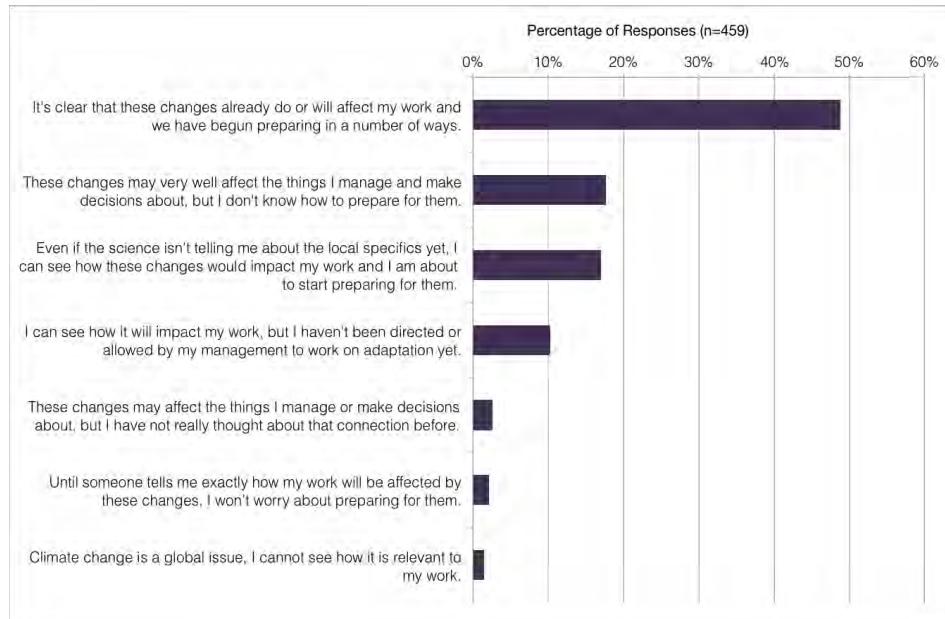


Figure 5. Respondents were asked to identify how climate change could impact their work (see Question 26).

Adaptation Activity Underway in Coastal California

The next set of questions in the survey asked respondents to indicate what activities related to climate change are underway in their organization, what motivated them, and what obstacles – if any – respondents have encountered in addressing adaptation.

First, respondents were asked to indicate how high a priority both mitigation (efforts to reduce greenhouse gas emissions from energy and land use) and adaptation (efforts to plan and prepare for the projected impacts of climate change) are in their work (Question 27). Both climate change responses are considered – by a wide margin and for all respondent groups – as high-priority issues. For city/county respondents and elected officials mitigation is the higher priority of the two, whereas adaptation is the higher priority for NGOs, private industry/environmental consultants and state/federal/regional respondents. This finding may well reflect the fact that California's Global Warming Act (AB32) and related bills (e.g., CA State Senate Bill 375) give a legislative mandate to take mitigation actions, whereas no comparable law exists to date that obligates communities to take adaptation actions. The state does, however, encourage adaptation at the local level through state funding programs which require that entities applying for funds conduct sea level rise vulnerability assessments. The above mentioned non-binding resolution adopted by the Ocean Protection Council also calls on non-state entities that are implementing projects funded by the state or on state lands to follow the current state guidance document on sea level rise. Moreover, the 2009 California Adaptation Strategy was primarily oriented toward state agencies and required them but not local governments to take adaptation action.¹²

12. The updated 2012 California Adaptation Strategy will include more consideration and support for local government actions.

To ascertain what prompted respondents to begin adaptation planning specifically, coastal professionals could choose as many options as they wished. The five leading motivations or initiatory events (for at least 50% of respondents) are regionally/locally-specific information, personal motivation, the California Adaptation Strategy (2009), a state or federal legislative mandate, or the occasion of the local general plan or local coastal plan being updated. Notably, recent extreme events are the least-frequently selected motivation to start adaptation planning (Figure 6; Question 28). Again, there are some differences among respondent groups. City and county respondents indicate that developing or updating a climate action plan, a general plan and regionally specific information initiated their adaptation planning efforts, while state/federal/regional respondents are most often motivated by the 2009 California Adaptation Strategy, personal motivation, or legislative mandate. The leading motivation for NGO, private sector or elected office respondents is personal motivation, followed by regionally-specific information. In the absence of a mandate (law) or directive (such as the state-level adaptation strategy), being better able to visualize what could happen locally (through regionally relevant information) and the driver of personal motivation appear to emerge as critical factors in the response seen to date.

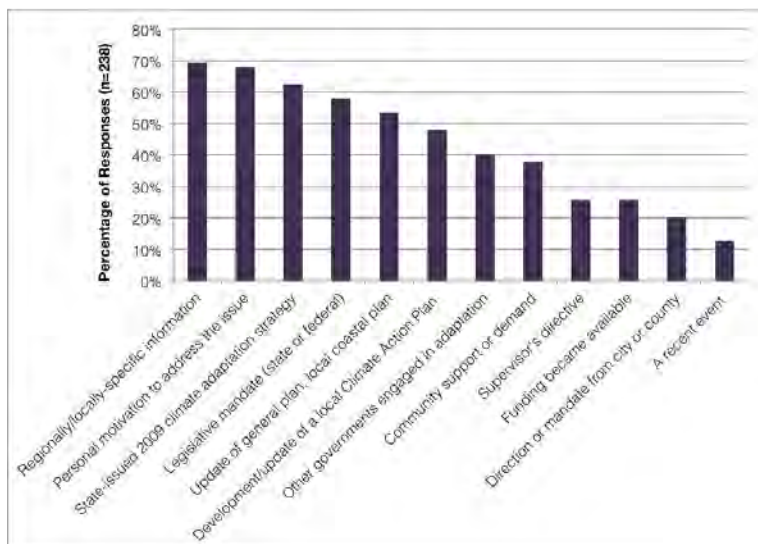


Figure 6. If already planning for climate change, respondents were asked to identify what motivated them to begin. Responses are presented by respondent type in Appendix III (see Question 28).

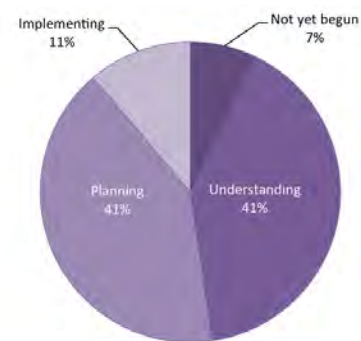


Figure 7. Respondents were asked to identify where they are in the adaptation planning and decision-making cycle (Moser and Ekstrom 2010, see Questions 29a-b).

To better understand how far along coastal communities are at this time in their adaptation efforts, respondents were asked to indicate the phase that best describes their current efforts (Figure 7; Question 29a and b). The response options offered to respondents here followed a stylized planning and decision-making cycle (Moser and Ekstrom 2010), wherein individuals have either not yet begun to think about climate change and related adaptation needs, started to understand and assess the problem (“Understanding”), begun to plan for and assess adaptation options (“Planning”), or initiated implementation, monitoring and assessment of selected options (“Managing”).

Only 7% of respondents say they have “not yet begun” with adaptation efforts at all. Forty-one percent say they are in the process of “understanding” what climate change might mean for them; another 41% indicates that they are “planning” their adaptive responses, and a final small group (11%) says they are already in the process of “implementing” some adaptive actions. When probed for further detail, it becomes clear that of the 41% currently in the “understanding” phase, three-quarters have

“started to gather some information to better understand the issue” but have not yet completed any type of assessment. Of the other large segment in the “planning” phase, 60% say they are “brainstorming a range of options to prepare for and manage climate change risks” but only 27% have completed an options assessment and only 13% have gotten as far as selecting a preferred set of actions. And finally, the majority of those who are already implementing adaptive actions, have just begun to do so, with far fewer monitoring how well implemented actions are faring or even reassessing their approaches. In total, these figures indicate that whereas there is now significant awareness of the need for adaptation, California coastal communities are by and large still very early in their adaptation efforts. Most are still trying to understand the threats, some have advanced to trying to assess their response options, but very few have taken adaptive actions on the ground.

Barriers to Adaptation

The obvious question then arises: what prevents communities from moving adaptation along faster – even though coastal professionals express high concern and understanding of climate change, see how it matters to their work, and have strong preferences for being proactive? Respondents were thus asked to indicate which of 19 issues (plus one write-in option) are experienced as *big hurdles*, *small hurdles*, or *not as hurdles* in their adaptation efforts to date (Figure 8; Question 30). Looking, first, at the response patterns for all survey participants, the four most frequently mentioned *big hurdles* for coastal professionals in California are insufficient staff resources, lack of funding to implement an adaptation plan, current pressing issues are all-consuming, and lack of funding to prepare an adaptation plan. All other issues (e.g., public opposition, lack of public demand, the science being too uncertain, or lack of technical assistance) appear to be less problematic.

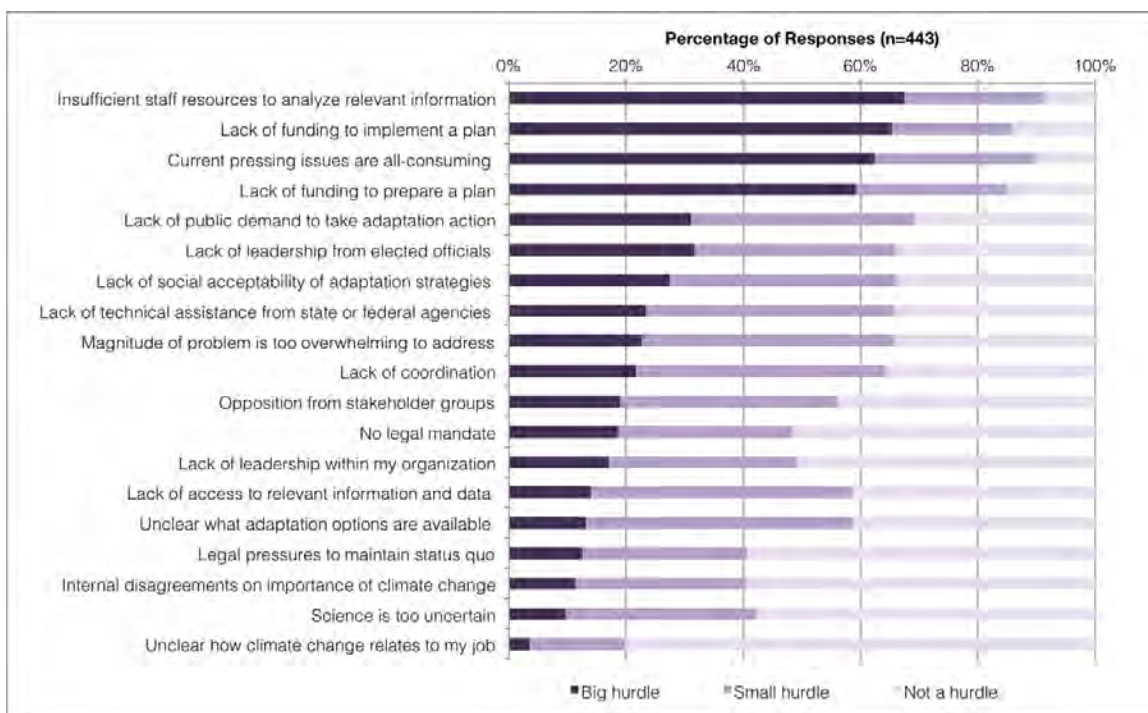


Figure 8. Respondents were asked to identify the hurdles they face in planning. Responses are presented by respondent type in Appendix III (see Question 30).

There are some notable differences among respondent groups, however. First, it is interesting that for local, state/regional/federal respondents, and elected officials, the top four *big hurdles* are the same, and mentioned by at least 60% in those groups: foremost the lack of funding to develop and implement an adaptation plan; current issues being all-consuming; and insufficient staff resources. For NGO respondents, insufficient staff resources dominate (the only issue mentioned by at least 60% in that group), followed to a lesser degree by a lack of leadership from elected officials, competing issues, and lack of funding. Finally, for private industry/environmental consultants the range of barriers are generally perceived to be *big hurdles* by a much smaller proportion of respondents in that group. For example, no more than 40-50% of private sector respondents find lack of funding for preparing or implementing a plan to be a big issue, followed by lack of public demand for adaptation, and current pressing issues being all-consuming.

A final question asked respondents to state their familiarity with specific coastal adaptation approaches, with a set of choices focused particularly on adapting to sea level rise and related impacts (i.e., flooding, erosion, wetland inundation; Figure 9; Question 31). Overall, California coastal professionals are most familiar with shoreline hardening, followed by beach sand replenishment, low-impact development, and land acquisition. The notions of living shorelines, managed retreat, and rolling easements are considerably less familiar to the respondents. Respondents’ degree of familiarity with different sets of approaches confirms how much they are already in use or are known from experience in other locations. For example, almost all respondent groups are similarly familiar with sand replenishment and shoreline hardening, and almost all respondents are similarly unfamiliar with managed retreat. Particular job responsibilities and agency foci are also likely to affect familiarity with different adaptation approaches. The wide variance in familiarity among groups with land acquisition, living shorelines, and flood-proofing may reflect that some professional groups deal with those on a daily basis while others do not have functional authority over them.

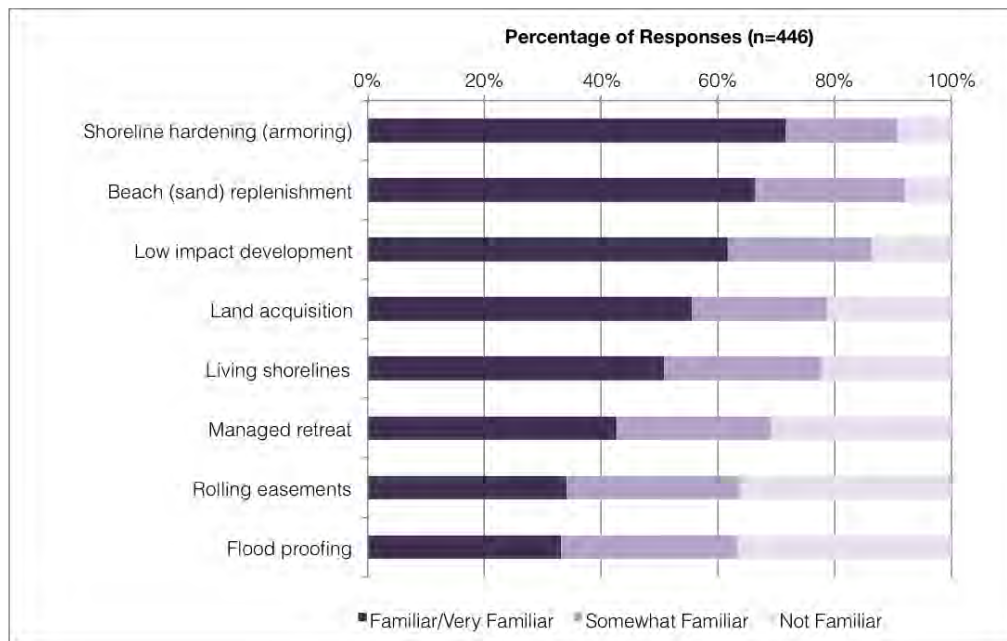


Figure 9. Respondents were asked to identify how familiar they are with the listed adaptation options. Responses are presented by respondent type in Appendix III (see Question 31).

Summary

The findings from this section of the survey reveal a remarkable readiness among California coastal professionals to address climate change, with both mitigation and adaptation now being a high priority for all respondent groups, and adaptation the higher priority for state/regional/federal, NGO, and private sector respondents. This may reflect the self-selection by those who chose to respond to the survey, but even so suggests a remarkable increase in adaptation activity compared to the very low level observed at the time of the first coastal adaptation survey conducted in 2005/2006.

An overwhelming majority of survey participants accept the reality of climate change and see it as either caused by mostly human or a mix of human and natural causes. Strong majorities are also concerned or very concerned about climate change, and display considerable knowledge about the expected impacts on coastal areas over the next few decades. Furthermore, many coastal professionals wish to see strong action being taken to prepare for the impacts of climate change and state that they have either begun to do so or are about to begin. A significant portion, however, remain unclear as to how to prepare for climate change or await authorization and direction.

Despite these clear indications of increased attention to adaptation at this time, the reality is that about two out of five coastal professionals (41%) are still in the very early stages of trying to understand what the climate change threats are for which they need to develop adaptation strategies, and another two out of five respondents (41%) are just beginning to brainstorm what might be done. A far smaller group (11%) stated they have begun to implement some adaptation options.

Given the stated familiarities with different coastal adaptation approaches, it appears as if most respondents may be considering techniques that are commonly used in coastal land use planning and hazard mitigation, and possibly not know about or appropriately consider approaches with which they are less familiar at this time. These knowledge gaps are clear targets for future outreach and training activities aimed at coastal managers.



A structure surrounded by water during a king tide (looking north from Humboldt Bay Bridge on Route 255.) Photo taken by Caltrans on February 18, 2011.

PART 3: INFORMATION, TRAINING, AND DECISION SUPPORT NEEDS

The final section of the survey, “Information, Training, and Decision Support Needs,” ascertained what kinds of information and technical assistance are available to, and valued by, respondents, and what other kinds of support may be desirable for coastal professionals in their efforts to plan for and implement adaptation actions. The information gathered in this part of the survey is meant to inform the efforts of participating organizations and others in providing useful resources, technical assistance and professional development opportunities to community leaders and coastal managers.

Information Used in Coastal Management at Present

Survey respondents were asked to identify the types of information they consult regularly in the course of their daily work in order to identify opportunities to bring new and relevant climate information into the hands of practitioners such that they can easily integrate it into ongoing planning, assessment, and decision processes. For this survey, commonly used data and information were divided into the following categories:

- environmental resource information (such as habitat or land cover maps or biological assessment studies);
- geological or geomorphological information (such as coastal geology maps, erosion rate information, or flood risk maps and/or flood frequency information);
- weather, climate, and hydrologic information (such as sea level rise projections, water quality and supply information, or climate information);
- socioeconomic data (such as land use plans or surveys, demographic or tax information);
- other types of information (such as topographic maps).

Of these, the most commonly used types of information – while dependent on respondents’ professional focus – include habitat or land cover maps and studies (76%), land use plans or surveys (75%), topographic maps (74%), flood risk maps and/or flood frequency information (64%), sea level rise projections (58%), and water quality information (57%). In this question, respondents were able to choose all that applied (Figure 10; Question 34).

Consistent with the strong concern of respondents in coastal wetland issues, over 60% of them identify environmental resource information (habitat or land cover maps, biological assessments, and endangered species maps or studies) as data and information that they regularly consult. In contrast, water quality information is less used at present, even though water quality issues ranked among the biggest coastal management challenges at present. Further research is needed to better understand this discrepancy (e.g., unavailability of water quality information, lack of technical expertise, or simply a disconnect between concern and actual use of information in the respondent’s work). In addition, socioeconomic information, such as demographic data, information on recreation, and property tax information is among the least utilized types of information identified by respondents. Socioeconomic information is generally most useful for understanding the social and economic vulnerabilities of communities. This finding may indicate that more attention is currently focused on the environmental impacts of management challenges than on the socioeconomic impacts, possibly due to environmental legislation requiring such assessments. To fully understand the vulnerabilities of communities to climate change, and thus adapt in a way that strategically reduces these vulnerabilities, however, social aspects also need to be assessed.

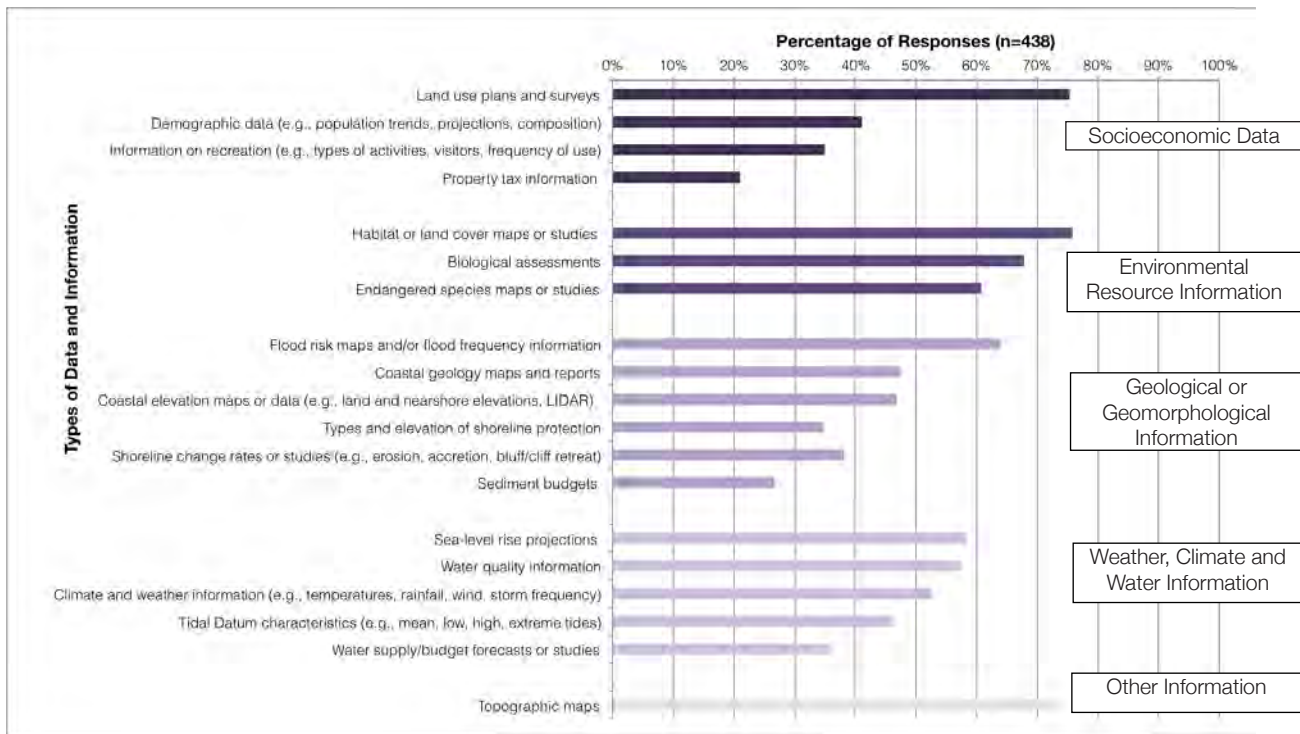


Figure 10. Respondents were asked to identify which sources of information they consult regularly in their daily work (see Question 32).

Identified Information Needs for Climate Change Planning

This section sought to identify perceived and real information gaps among the respondents. Knowledge of these gaps can provide guidance for research to address information needs, or for education opportunities, when that information already exists. Respondents were therefore questioned about the potential usefulness of information that would help them specifically to assess the risks of climate change to local coastal resources. Respondents were asked to rank each information type as either *very useful*, *fairly useful* or *not at all useful*. Regarding weather and climate information, all respondents identify regionally specific projections of climate change (for the next two to three decades or for the rest of the century) and climate change projections for California (for the next two to three decades or for the rest of the century) as the most useful types of information. Weather forecasts and seasonal climate predictions, by contrast, are judged to be the least useful types of information (Question 35a). These results indicate that respondents understand the differences in information about weather versus climate – an important distinction in climate adaptation planning.

The most useful information about the physical environment identified by government and NGO respondents includes: sea level rise information for their specific region or community; predictions of changes in flooding or erosion; shoreline change data currently and under different sea level rise scenarios; tidal change information; information on changes about future water quality and availability of freshwater. Information on ocean acidification is ranked consistently as the least useful type of physical information (identified by only 27–37% as *very useful*), possibly because the respondents’ management responsibilities do not include concerns about ocean acidification or because respondents cannot see the link between their work and this climate change impact (Question 35b).

Respondents also identified the usefulness of different types of biological information in planning for climate change. Identification of critical habitats and corridors for species migration; past, present and future wetland extent; and spread of new or existing invasive species are identified as the most useful types of information in this category by all respondents. While most respondents (85-90%) indicate that all types of biological information are either *very useful* or *fairly useful*, NGO (80%) and regional/state/federal respondents (77%) feel most strongly so – possibly because their management and advocacy foci fall squarely into this arena. By comparison slightly less than 60% (but still the majority) of city/county respondents and private industry/environmental consultants find biological information *very useful* – possibly because their responsibilities, while they include environmental issues, are generally more broad (Question 35c).

The last type of information respondents were asked to rank in terms of usefulness were socioeconomic data sets. Among the governmental respondents, information on potential trade-offs among adaptation options, cost of different adaptation options, and information on how to communicate climate change to various stakeholders are identified as the most useful types of information. Interestingly, information on vulnerability assessments ranks relatively lower in usefulness, even though most discussions of adaptation refer to vulnerability assessment as a critical first step in identifying appropriate adaptation measures and their economic/political impacts and/or benefits (NOAA 2012; Russell and Griggs 2012; Moser and Ekstrom 2011; UKICP 2011; Moser 2010; USAID 2009; Snover et al. 2007), (Question 35d). This may reflect a lack of capacity and understanding of how to conduct socioeconomic vulnerability assessments and lack of knowledge of how to use the resulting insights in policy- and decision-making. Moreover, formal consideration of social vulnerability – while maybe socio-politically expedient – is not yet a legal requirement in coastal management.

By contrast, as communities are beginning to better understand local climate change challenges and are in the process of assessing their adaptation options, it is not surprising that they wish for more information about these options, their respective costs and trade-offs, and how to engage communities on climate change adaptation. On-the-ground experience confirms that communities often consider only a limited set of adaptation measures, particularly for sea level rise impacts, and are concerned about how to garner the necessary political will and community support for economically and politically costly measures.

A notable contrast is what private industry/environmental consultants most wish for: information on how to communicate about climate change with stakeholders and how to effectively engage these stakeholders – challenges they are often tasked with in their daily work. By comparison, information about the costs of different adaptation options and potential trade-offs are ranked as the least useful types of information to them – maybe because their own capacities and strengths allow them to generate that information in any given case (e.g., when they work with a particular community).

Trusted Sources of Information and Analytic Capacity

This section sought to understand where respondents get the information for their work, the format in which they prefer it, and the tools they use. When asked to identify where respondents find the information they use in their work, the majority identify the Internet (worldwide web) as a source of information they use *all the time* or *frequently* (76%). Colleagues at work are the next most frequently utilized resource (75%), followed by state and federal agencies (61% for both) and consultants (41%, Question 34). Scientific journals are among the least commonly used sources, with only 30% indicating that they use these *all the time* or *frequently*. Respondents are more likely to turn to academic experts, but not by much (37% turn to them *all the time* or *frequently*). This may be due to

the difficulty non-academics have in accessing scientific journal articles as many are copyright-protected, journal subscriptions are very costly, and scientific papers themselves are often more challenging to understand due to jargon and the often highly specialized knowledge they require for appropriate interpretation (Figure 11).

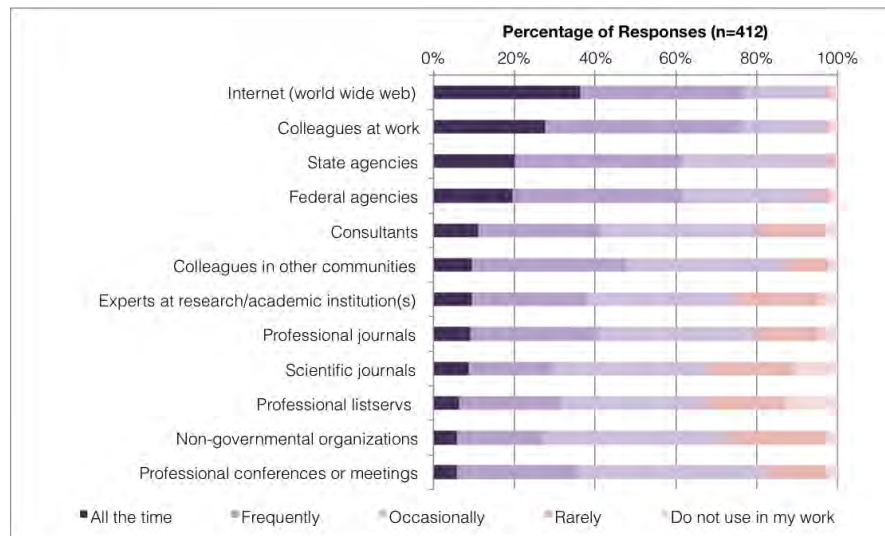


Figure 11. Respondents were asked to identify the sources of information they most commonly utilize (see Question 34).

Respondents were also asked to identify which information processing tools and analytic tools they already use in their daily work – either themselves or someone else in their office – or whether they turned to outside sources for such expertise. The majority of respondents identify paper maps and overlays (81%) as well as computerized geographic information systems (GIS, 82%) as tools the respondents themselves use and/or others within their department or organization use. Internal GIS capacity is supplemented by hiring consultants when there is limited in-house capacity. Visualization tools as well as database compilation and management tools are also commonly used in-house tools. By contrast, in-house capacity for the use of more complex analytic tools such as decision analysis tools and scenario planning – commonly used for long-term, multi-objective adaptation planning and decisions – is low (32% and 27%, respectively). Respondents indicate that they draw upon external experts for such assistance or do not currently use or need such tools (Question 35).

Training Needs

An important component of this survey was to better understand how best to provide needed information and knowledge to different sets of coastal professionals. A majority of respondents (60%) indicate that they have not attended any formal climate adaptation training to date (Question 36). For those who had attended trainings, when asked to identify who led the trainings, the majority says the trainings were conducted by federal agencies, state agencies, or local NGOs. Federal trainings are mainly provided by the National Oceanic and Atmospheric Administration’s (NOAA) Coastal Services Center and the National Estuarine Research Reserve Coastal Training Programs, as well as the United States Geological Service (USGS) and Environmental Protection Agency (EPA). State agency-led trainings are mainly conducted by the San Francisco Bay Conservation and Development Commission (BCDC), the California Coastal Commission, or the California Energy Commission. NGO trainings are most often offered by the Center for Ocean Solutions and ICLEI–Local Governments for Sustainability.¹³ All but two of these listed organizations (USGS and EPA) are partners on this survey. By far,

13. Full listing of identified trainings is available upon request.

respondents identify in-person training opportunities (quite possibly reflecting the desired depth and direct engagement they afford), as well as web-based trainings or webinars (likely reflecting the need for easy access and flexibility) as the most useful forms of future trainings. Elected officials identify training for staff and invitation of speakers to attend hearings as the most useful way in which they want to learn about the state of scientific understanding and useful tools to support planning for climate change (Figure 12a-b; Question 37).

These findings have important implications for providers of information and skill development opportunities. Coastal professionals – at this stage in adaptation planning and implementation – want a greater emphasis on hands-on trainings rather than just the delivery of information or data packages, guidebooks, and handbooks. The particular focus of trainings may change over time as coastal professionals move through the adaptation planning cycle (i.e., from brainstorming options, to planning, to implementation). Organizations providing information and trainings are well advised to track rapidly shifting needs among key stakeholder groups. The immediate need and opportunity, however, is to build the capacity of coastal managers so they can advance the state of their communities’ preparedness, with the longer term outcome of applying research to decision-making and making better informed decision-making to improve coastal stewardship.

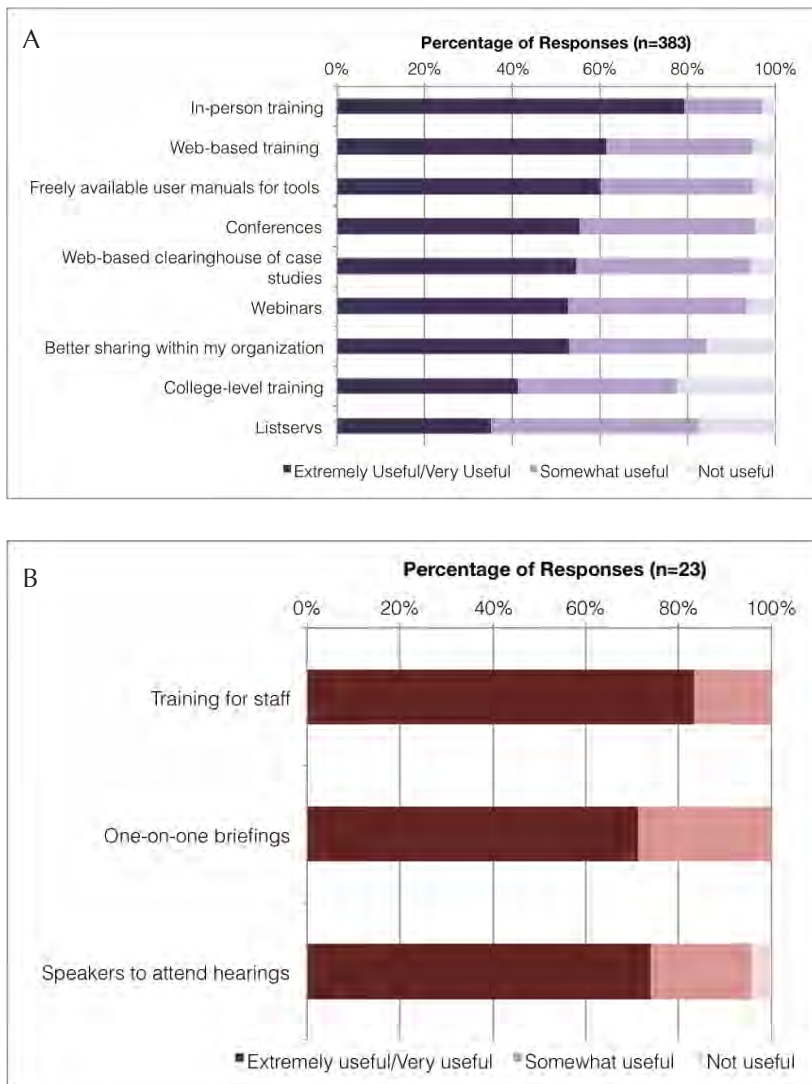


Figure 12. Respondents were asked to identify the usefulness of various learning opportunities: A) responses of city/county, regional/state/federal, NGOs, environmental consultants/private industry and B) responses of elected officials (see Questions 37a-b).

Summary

The data collected in this section provide critical insights for governmental and coastal organizations that help link the best available science to practice by providing training and relevant information to policy- and decision-makers engaged in climate adaptation planning and implementation. While most respondents indicate they commonly use physical and biological information, they are less familiar with the usefulness of socioeconomic data, which provide critical information on the social vulnerability of their communities. There is an evident need for training on conducting such vulnerability assessments and adaptation planning, giving more balanced attention to both environmental and human dimensions of adaptation planning.

Not surprisingly, given the ease of access and ubiquitous use of computer and Internet technology, respondents are turning first and most often to the Internet and to their colleagues for information, rather than to scientific journals or experts. As such, there continues to be the need to translate scientific information into forms that are more accessible to coastal professionals, and to help them discern credible from less credible information sources. While in-person training opportunities are strongly preferred by most respondents, survey participants also identify web-based trainings and webinars as particularly useful. Given this, there is a clear opportunity to provide trainings and scientific information in cost-effective and Internet-friendly formats and to augment them with easily accessible and affordable local trainings. Some trainings, such as on communication and stakeholder engagement, are far more effective in person as they afford greater interactive practice opportunities and easier exchange of experiences. Thus the pros and cons of delivery formats should be carefully weighed.

There are subtle differences in the information needs of the different respondent types, likely based on both the job responsibilities and mandates of different respondent groups and – perhaps – differences in climate adaptation planning experience. Thus, before specific trainings are developed, understanding the specific needs of potential participants will help organizations develop more fine-tuned and effective tools and trainings.



Seawater floods public Pier 14 on San Francisco's Embarcadero, just north of the San Francisco-Oakland Bay Bridge during a king tide on Feb. 17, 2011. Photo credit: Mike Schweizer.

CONCLUSIONS

This survey aimed to assess coastal professionals' concerns with current and future climate change impacts and their activities to date to plan and prepare for them. In light of the scientifically robust projections of additional and accelerating changes in the future, adaptation is an increasingly central concern for coastal managers at all levels of government and in the private sector. The goal of the survey thus was to understand the needs and barriers coastal managers have in planning for climate change, so that appropriate trainings and technical assistance could be developed for communities and to link them to resources and tools that are already available.

To place climate change adaptation in context, the survey asked coastal professionals to describe their communities, work responsibilities, and the coastal management challenges they already face. These already-existent coastal management challenges are a good indicator of the issues that concern coastal professionals the most, and that inform their work priorities, but they also point to near- and medium-term vulnerabilities.

The survey found that current management challenges are significant "as is." The top management challenges at present (e.g., wetland loss, loss of endangered species, water quality issues, shoreline erosion, and sea level change) can be expected to worsen as climate change accelerates. Survey respondents' perception that these problems are worsening and are already contentious shape the context for adaptation planning. Adapting to a changing climate and associated coastal impacts is a difficult prospect on its own. When coupled with the social and political implications associated with identifying and choosing amongst various response options, rational adaptation planning and decision-making become even more challenging.

Encouragingly, the overwhelming majority of California survey participants accepts the reality of climate change, and the role humans play in its rapid trajectory, along with exacerbating its impacts through other pressures on the coastal environment. The majority of coastal professionals also understand the need to plan ahead and have begun doing so. In fact, compared to five years ago, the findings from this survey suggest a distinct uptick in awareness and planning for adaptation. The 2005/2006 survey found that – among the local coastal governments that were surveyed – only two counties had begun considering climate change in their planning efforts at that time, and another six cities and four counties were in the process.

Five years later a marked shift is evident: today 93% of all survey respondents (including representatives from local, regional, state and federal entities) say they are in the process of understanding their climate change risks, assessing their adaptation options, or implementing a strategy. Yet, despite these clear indications of increased attention to adaptation, efforts are still in the very early stages: two out of five coastal professionals (41%) say they are trying to understand what the climate change threats are for which they need to develop adaptation strategies, and another two out of five respondents (41%) are brainstorming about what might be done. A far smaller group (11%) states they have begun to implement some adaptation options.



High tide flooding sign in Marin City/Sausalito, CA, during a king tide on Dec. 23, 2011. Photo credit: Iblash.

Barriers to adaptation planning and implementation are dominated by the lack of resources for planning and implementing adaptation strategies, lack of staff resources, and current pressing issues being all-consuming, and not necessarily due to a lack of information about climate change or the science being perceived as too uncertain. Moreover, the fact that many find other issues more pressing and that they have not been given clear directives to fully engage in adaptation planning may be due to a lack of a legislative mandate similar to California’s Global Warming Act (AB32) and related bills (e.g., CA State Senate Bill 375) which give clear direction to take mitigation action at the local level. No comparable law exists to date that obligates communities to take adaptation actions.

Coastal professionals are quite knowledgeable about expected climate change impacts and indicate familiarity with some adaptation strategies (especially those that are commonly used coastal hazard and natural resource management approaches). They are less familiar with some of the more innovative tools and approaches. For the organizations that have partnered on this survey, there is a clear directive to:

- Educate coastal professionals about adaptation options pertinent to their job responsibilities;
- Develop technical assistance and tools that help resource-limited local governments take advantage of the wealth of scientific information available, in a manner that is easily accessible and ready to use; and
- Offer hands-on and web-based trainings for “soft” skills, such as community engagement, communication, managing and resolving conflict, and facilitating public meetings.



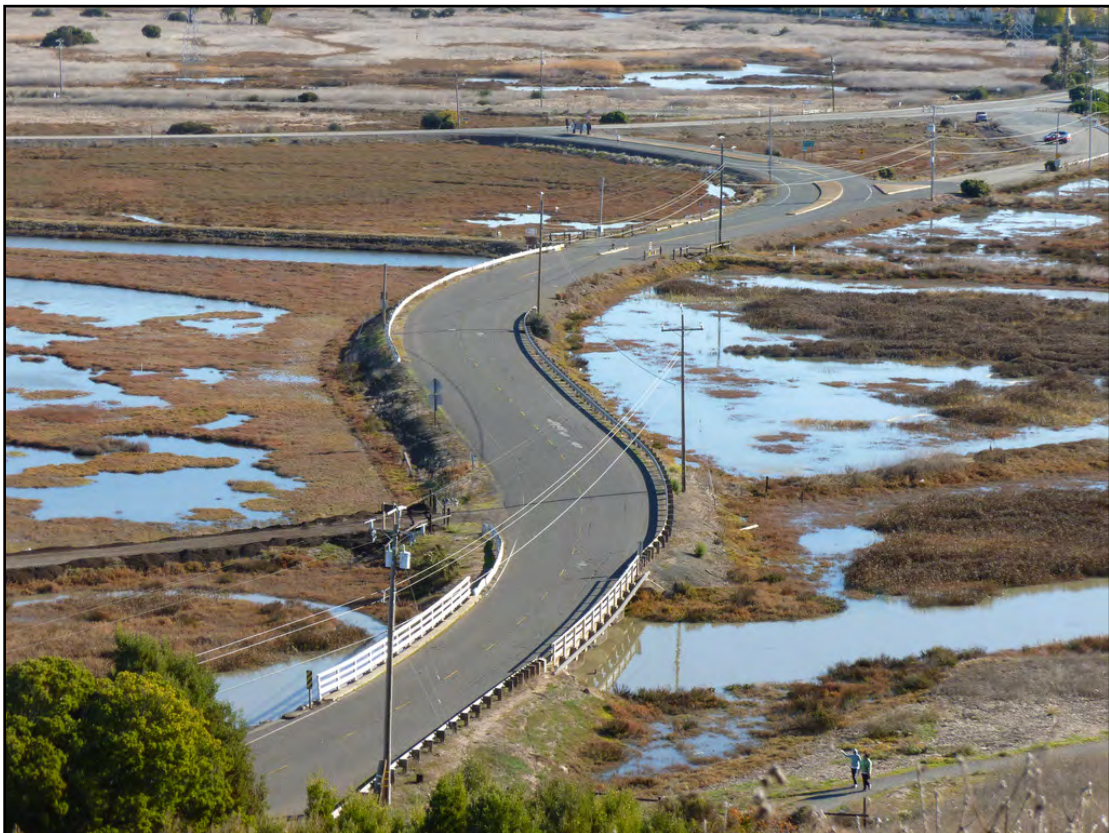
Pedestrian/Disabled ramp in the Marina District, San Francisco, CA, during a king tide on Jan. 21, 2012. Photo credit: Matt Richardson

Various organizations at the state and federal government levels are working on integrated data sets and tools that allow for better climate adaptation planning. Yet these data sets, such as those available on NOAA’s Digital Coast and Cal-Adapt, and tools (e.g., visualization tools, vulnerability assessment guides, legal instrument primers) are still complex. Communities often need assistance in learning to utilize them appropriately and efficiently. Thus, while there has been movement forward in advancing the tools necessary to help communities in their planning, there is still the need to train and build capacity within local governments and among other professionals to use these tools and data.

The survey identifies some important synergies between the work respondents already do and the need for developing and implementing adaptation strategies. For instance, the identification of protecting coastal wetlands as a top management challenge for a majority of respondents provides an opportunity for climate adaptation planning generally, and sea level rise planning more specifically. Planning and allowing for “living shorelines,” for example, where wetlands are both protected and able to shift landward in response to rising sea level and shifting flood zones, is generally recognized as one of the adaptation measures in adaptation planning with multiple co-benefits (Gregg et al. 2011; USEPA 2009; IUCN 2008). The example illustrates the need for adaptation strategy-specific information and how to assess co-benefits and potential trade-offs, so as to comprehensively inform coastal professionals’ efforts in adaptation planning, implementation, and evaluation over time.

Survey respondents also identified the types of information and data-processing tools they already use. Those offer important entry points for mainstreaming climate adaptation planning and implementation in common practices and procedures. Indeed, many of the challenges coastal communities will face more of with climate change, are challenges they already face (e.g., flooding and erosion of coastal infrastructure, water quality declines, threats to coastal habitat). Thus, developing tools that build on these commonly used sources of information has the two-fold advantage of incorporating climate adaptation planning into coastal professionals daily toolbox and eliminating the need to train coastal professionals on an entirely new set of tools.

If the significant progress in coastal professionals' attention to adaptation since 2005 is any indication, it is reasonable to expect continued growth in that awareness and interest among even more coastal communities and the professionals' tasks with developing adaptation over the coming years. As other studies have found, one of the first and most important tasks in preparing for climate change is for managers and decision-makers to build their own knowledge, skills, and capacities (Armitage and Plummer 2010; Glaas et al. 2010; Gupta et al. 2010). This appears to be the process in which California coastal professionals are engaged at this time. The primary task for organizations such as those partnering on this survey is thus to support this capacity-building movement, track how these needs are changing, and thus help ensure that coastal professionals have the assistance they need in rising to the challenge of climate change.



A meandering road rises above the wetlands at Don Edwards San Francisco Bay National Wildlife Refuge. Photo taken during a king tide on Dec. 22, 2011 by ee.refuge.

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APPENDICES

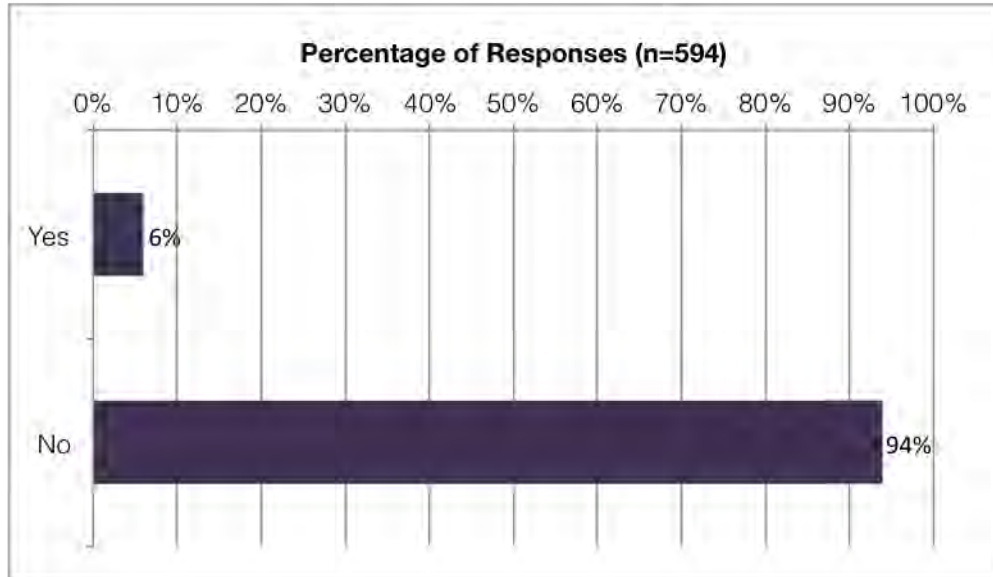
These appendices include all the questions asked in the survey, along with a figure for each question that best displays the responses. In most cases, responses are reported in a single figure. In some cases, however, responses are separated out by respondent categories: city/county; regional/state/federal; elected officials; non-governmental organizations; and, private industry/environmental consultants. Because the responsibilities and/or jurisdictions among the various respondents can be different, some questions were modified and phrased slightly differently for each of these respondent categories (e.g., 'location managed by a respondent' does not easily apply to state or federal agency respondents whose responsibility covers a larger region or the entire state coastline; information delivery to elected officials is significantly different from that to local planners).

As noted above, most survey respondents completed the entire survey, but some may have skipped questions as they progressed through the survey. Thus, the number of respondents (n) is included on each figure.

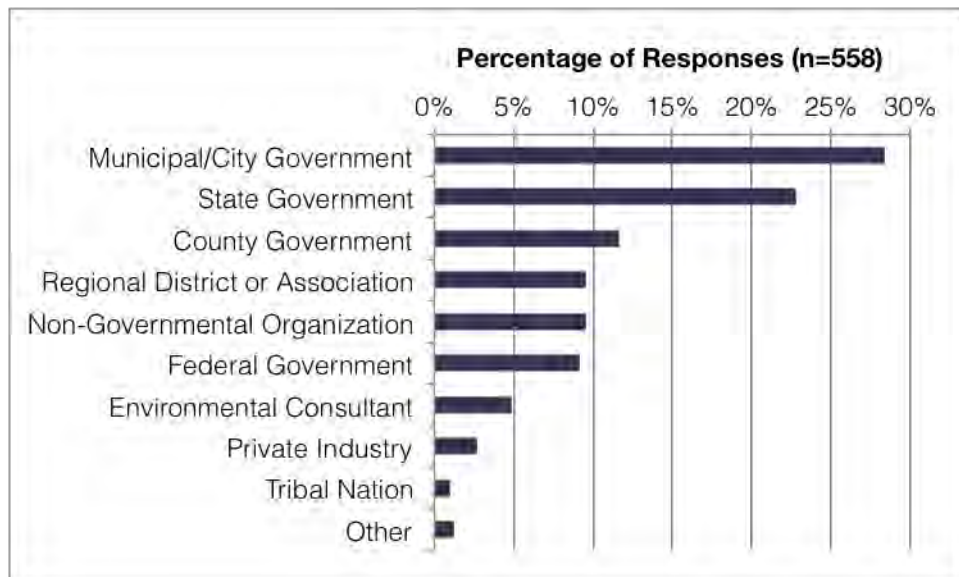
- Appendix I: Survey Population (I.1- I.4)
- Appendix II: Current Coastal Management Challenges in California (II.1 - II.7)
- Appendix III: Coastal Adaptation to Climate Change (III.1 - III.14)
- Appendix IV: Data and Information Needs (IV.1 -IV.8)
- Appendix V: Partner Climate Change Resources (V.1 - V.2)
- Appendix VI: About the Authors (VI.1)

APPENDIX 1: SURVEY POPULATION

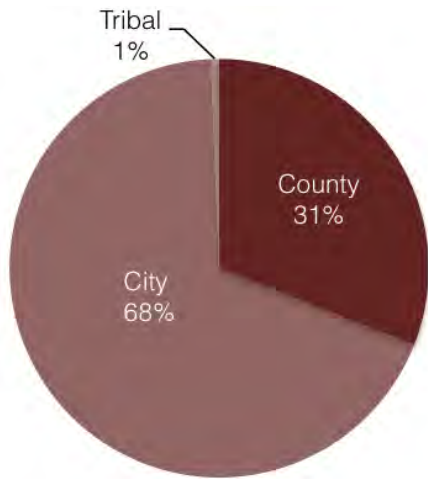
1. Please indicate if you are an elected official.



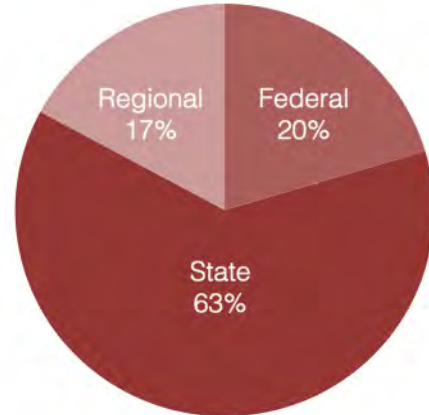
2a. If a non-elected official, please indicate the governmental/organizational sector in which you work.



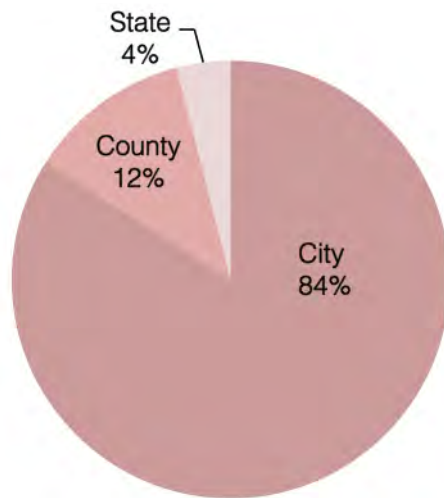
2b. Please select your jurisdiction.



City/County Respondents
(n=155)

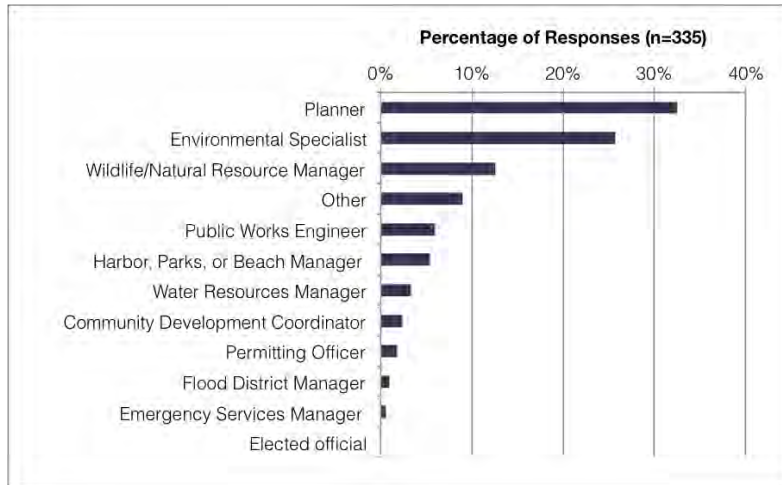


State, Federal & Regional Respondents
(n=152)

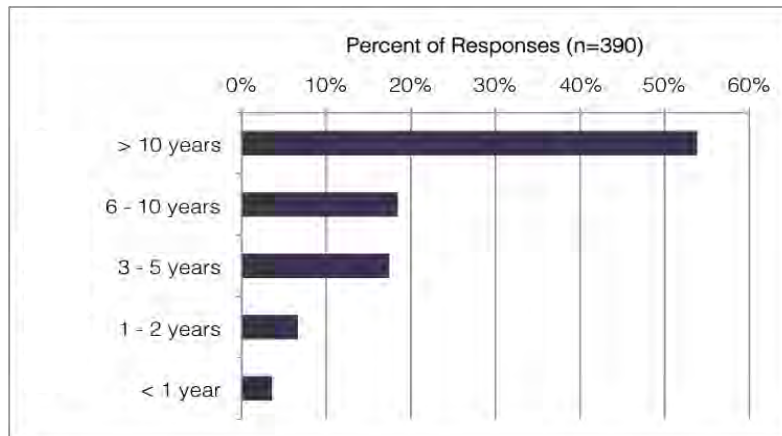


Elected Officials
(n=25)

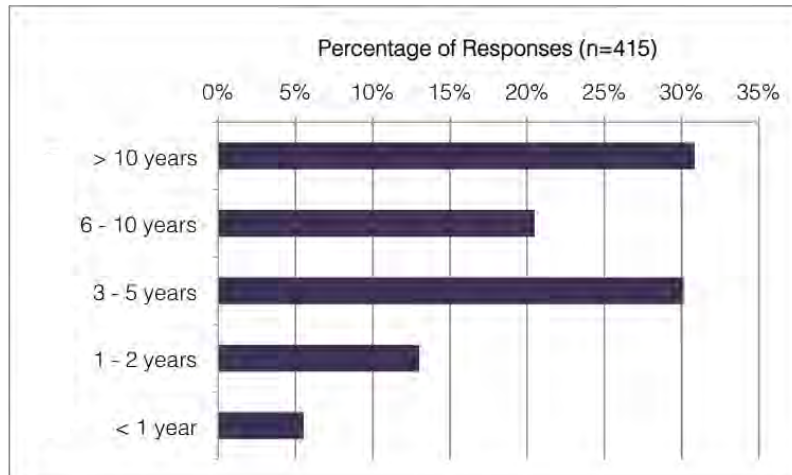
3. Please indicate what type of position you hold in your organization.



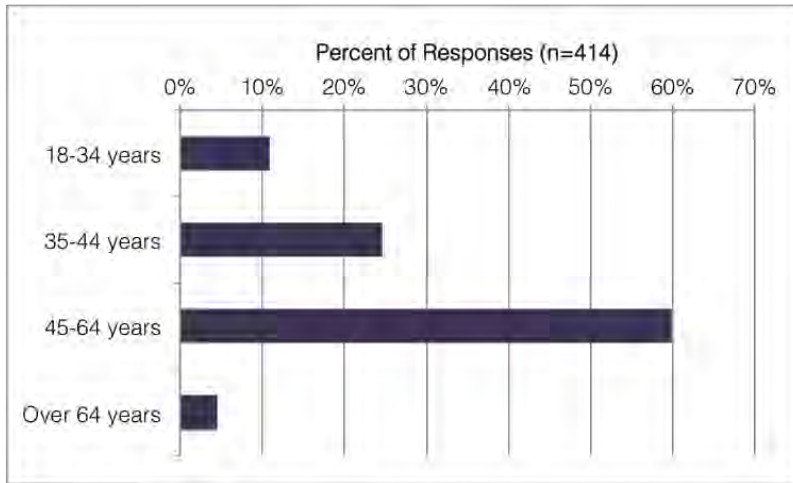
4a. How many years have you been employed in your organization?



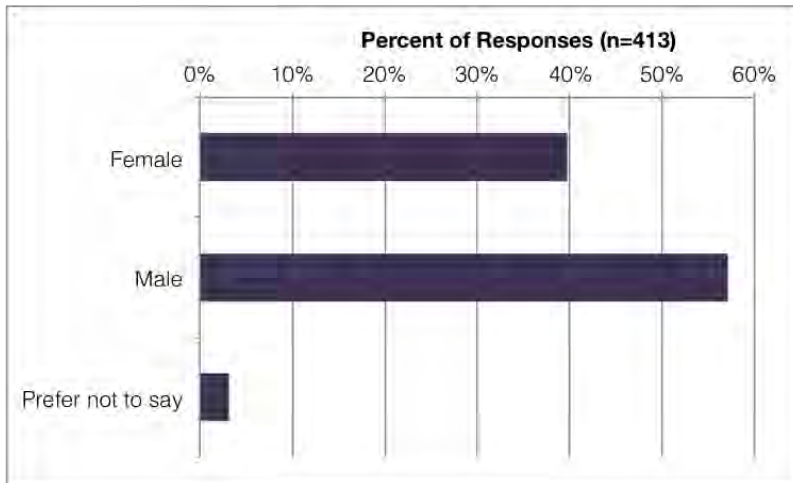
4b. How many years have you held your current position?



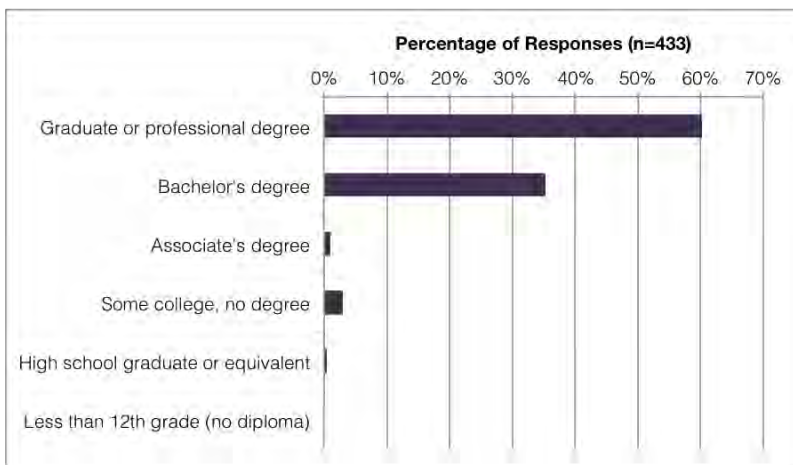
5. What is your age?



6. What is your gender?

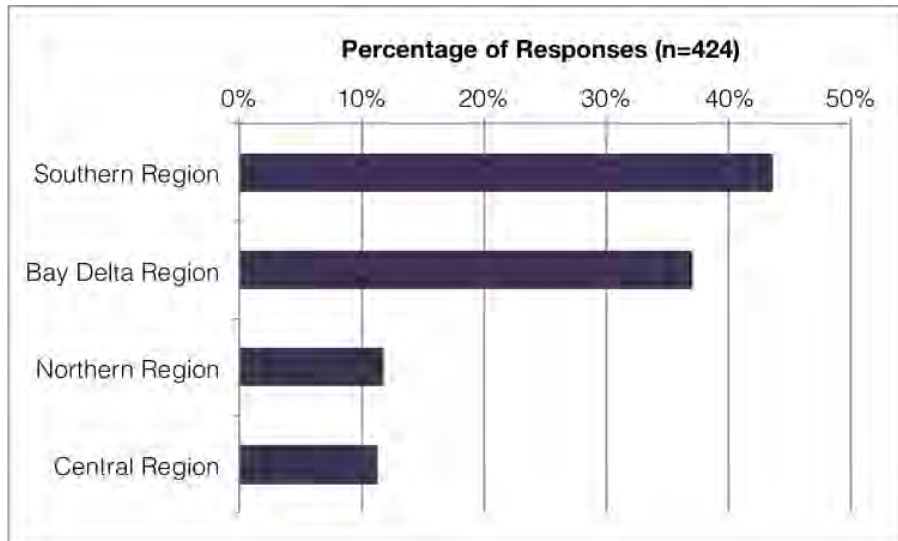


7. What is the highest level of education you have completed?



APPENDIX II: CURRENT COASTAL MANAGEMENT CHALLENGES IN CALIFORNIA

8. Please indicate the region in which you work.



Northern Region includes four counties:

- Del Norte
- Humboldt
- Mendocino
- Sonoma

Bay/Delta Region includes 12 counties:

- Sonoma
- San Francisco
- Napa
- Contra Costa
- Solano
- Alameda
- Sacramento
- San Joaquin
- Marin
- Santa Clara
- San Mateo
- Santa Cruz*

Central Region includes two counties:

- Monterey
- San Luis Obispo

Southern Region includes five counties:

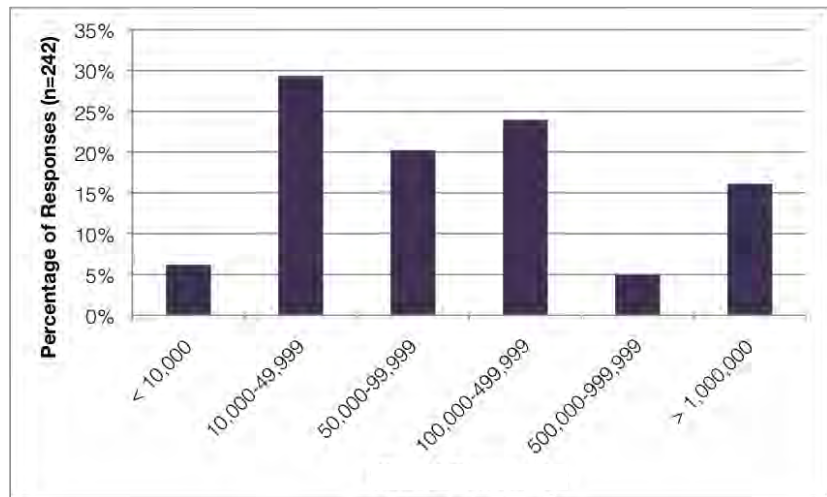
- Santa Barbara
- Ventura
- Los Angeles
- Orange
- San Diego

* The map utilized to identify respondents' geographic region included Santa Cruz County in the Bay Area/Delta region. We recognize that Santa Cruz is considered a central coast county. Because it is impossible, with anonymous data, to extract the Santa Cruz County respondents from the Bay Area/Delta region cohort, results in the remainder of this report referring to the Bay area include Santa Cruz.

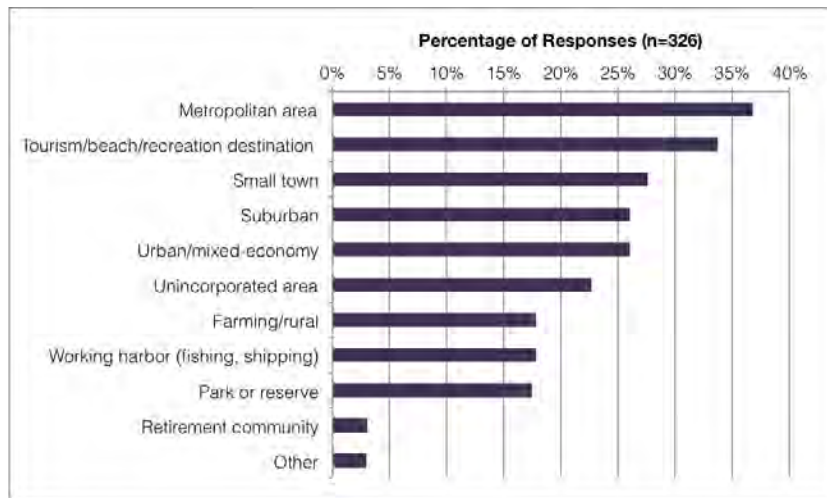
9. What is the approximate length of the shoreline that you manage or are concerned about in your work (i.e., entire length of coastal waterfront, including ocean, bay, lagoon, and estuarine shorelines, within your jurisdictional limits)?

Respondent Category	Mean (+/- Standard Deviation) (miles)	Median (miles)	Mode (miles)	n
City/County	32 (49)	10	3	206
Regional/State/Federal	480 (589)	220	1100	201
Elected Officials	16 (28)	4	1	26

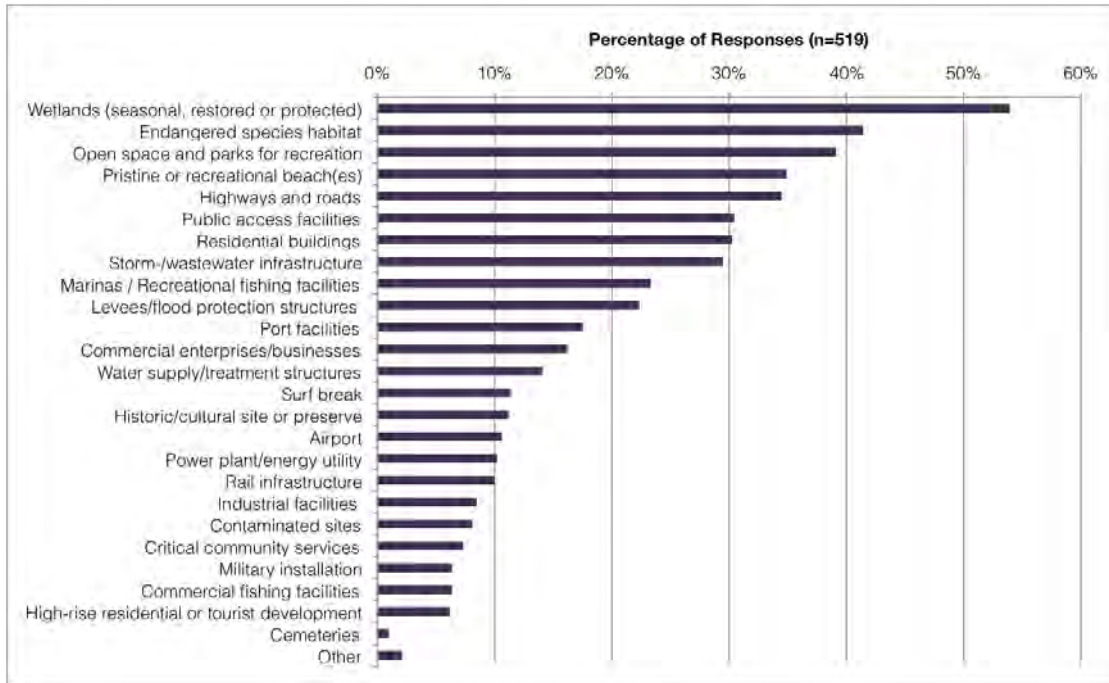
10. What is the approximate size of the population of the community you describe in Question 8?



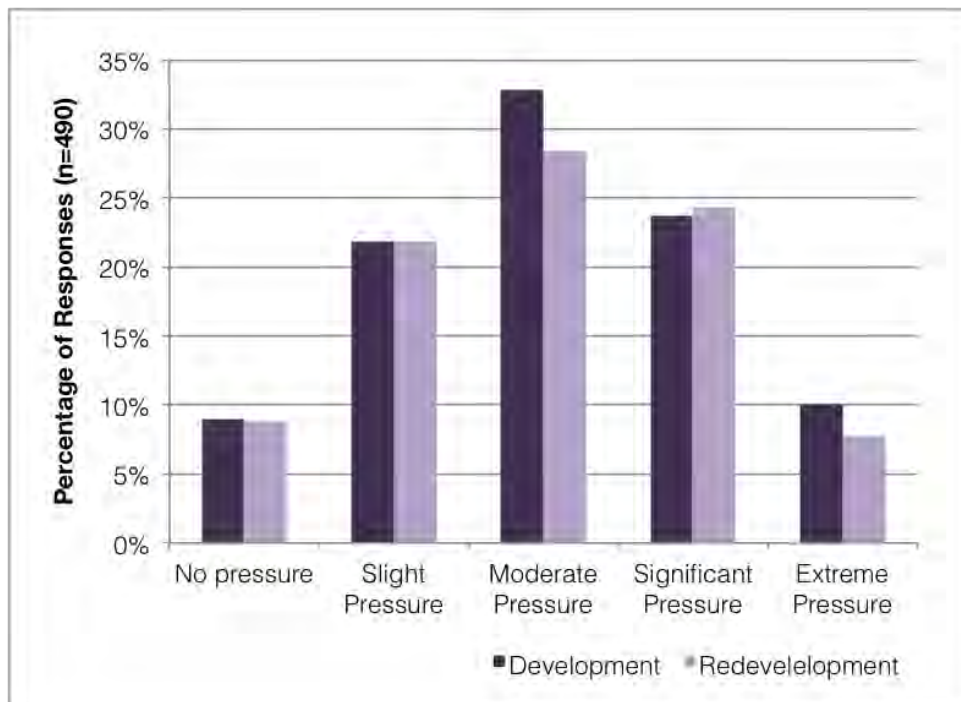
11. Which characteristics best describe the community in which you work?



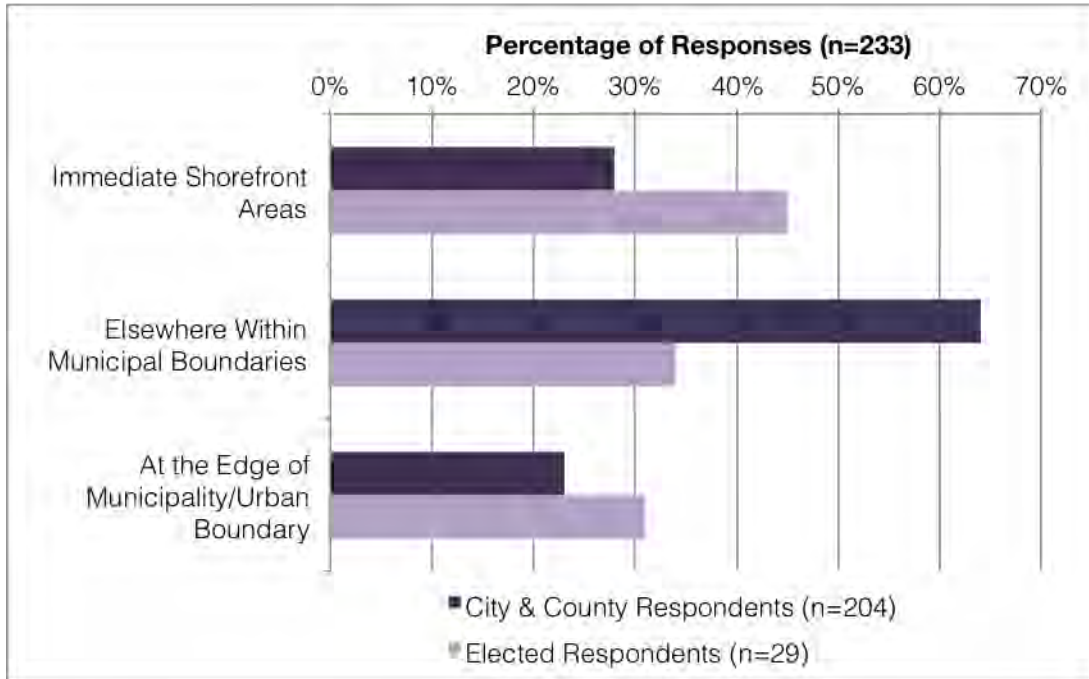
12. What are the predominant types of sensitive infrastructure, development, or habitats that are located in the immediate shorefront areas (i.e., in the 100-year floodplain, along bluffs/cliffs) in the area that you manage? (Mark all that apply)



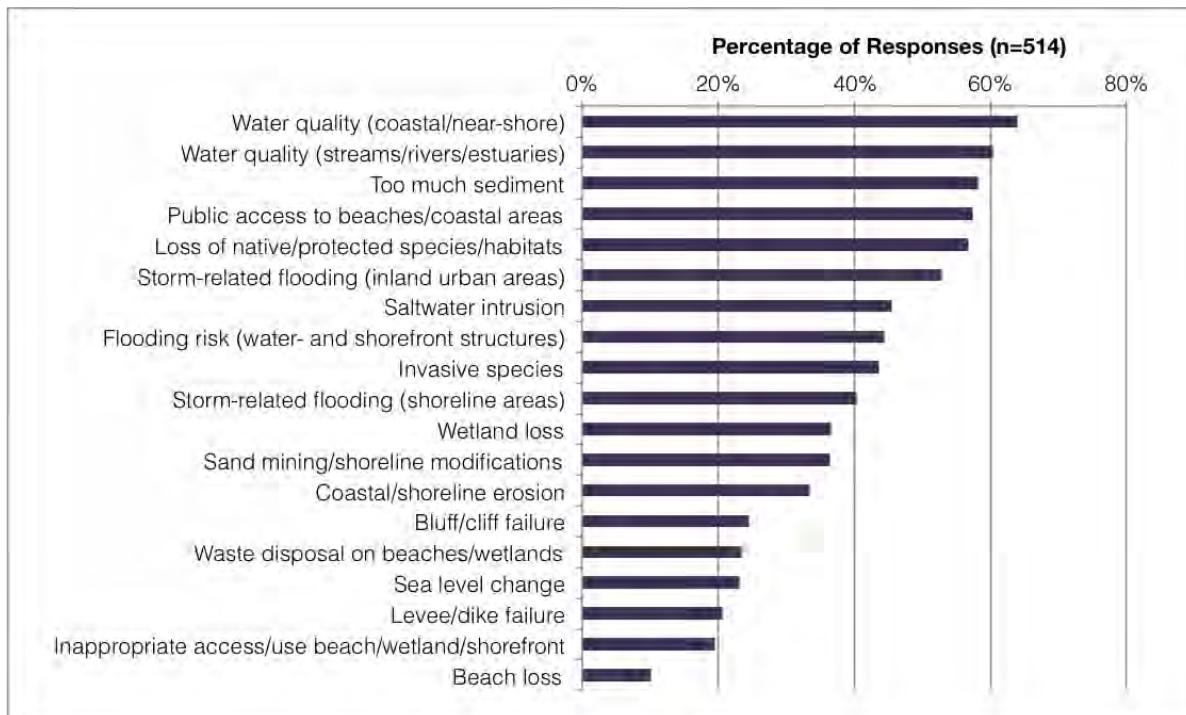
13. How would you describe the degree of development/redevelopment pressure occurring in your community or region?



14. Where do you see the greatest development pressure at present?

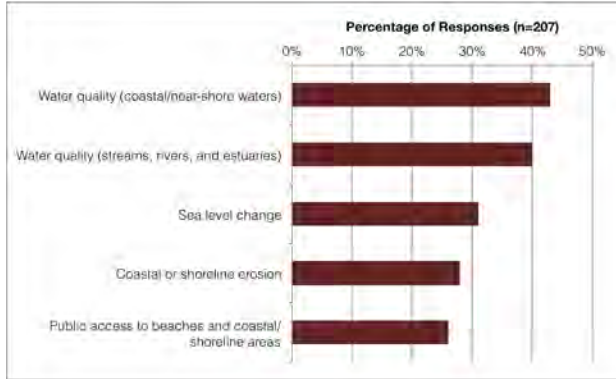


15. What type(s) of coastal management challenges does your community currently face?

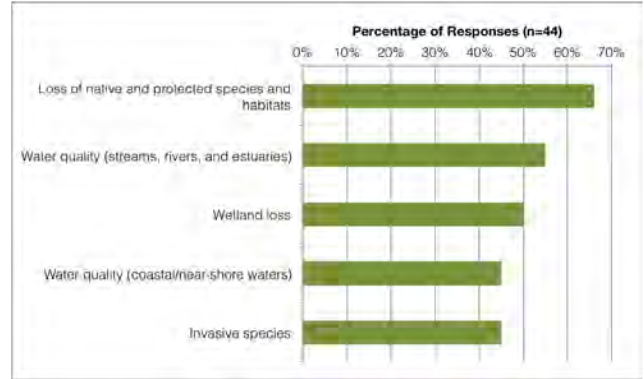


16. Of the challenges selected in Question 7, which do you consider the top five most challenging in your community at present? (Responses broken down by respondent type.)

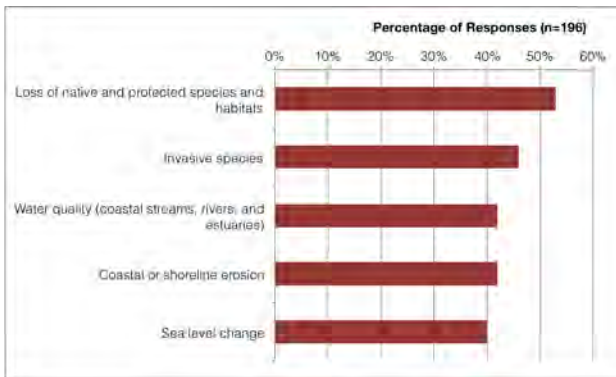
City/County Respondents



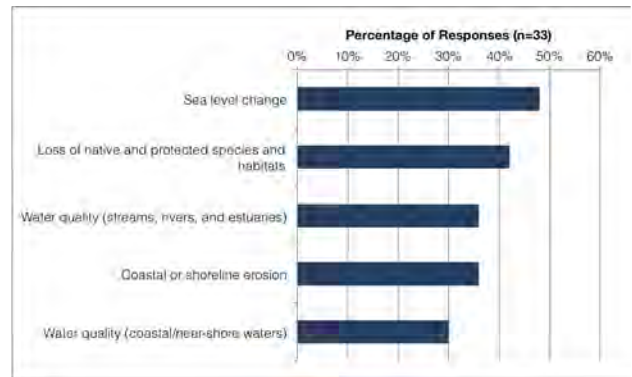
NGO Respondents



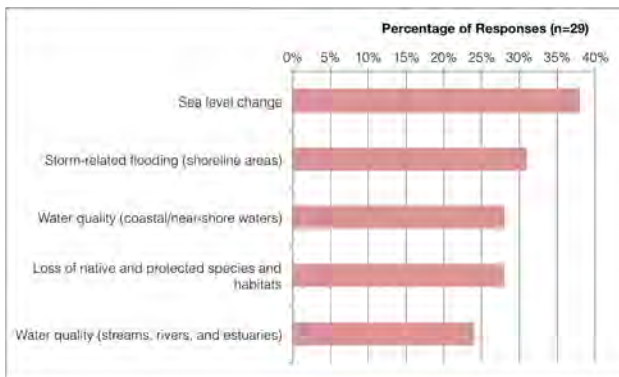
State, Federal & Regional Respondents



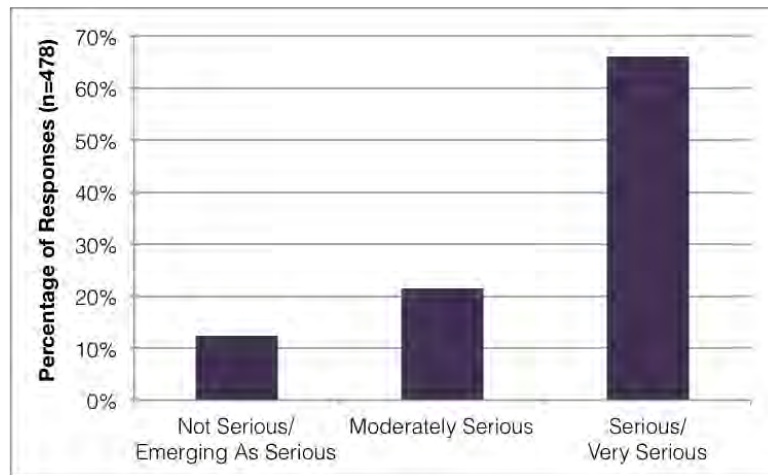
Private Industry & Environmental Consultant Respondents



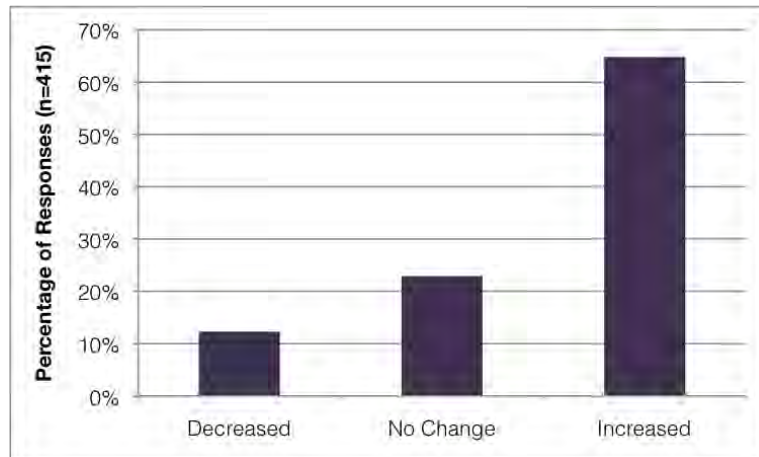
Elected Officials



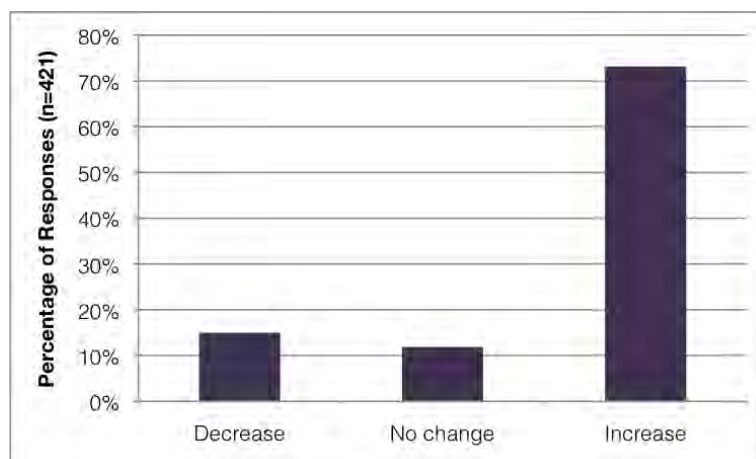
17. How serious would you consider this top coastal management challenge?



18a. How has the severity of this top management challenge changed in your community over the past 5 years?



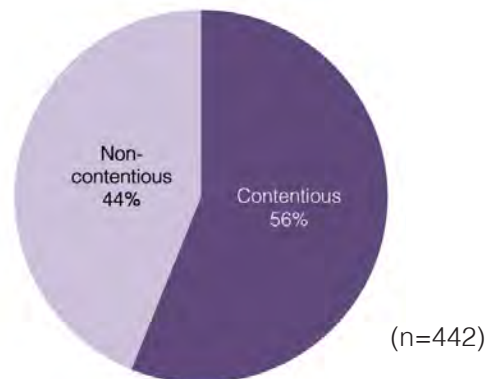
18b. How do you expect the severity of this top management challenge to have changed in your community in 5 years from now?



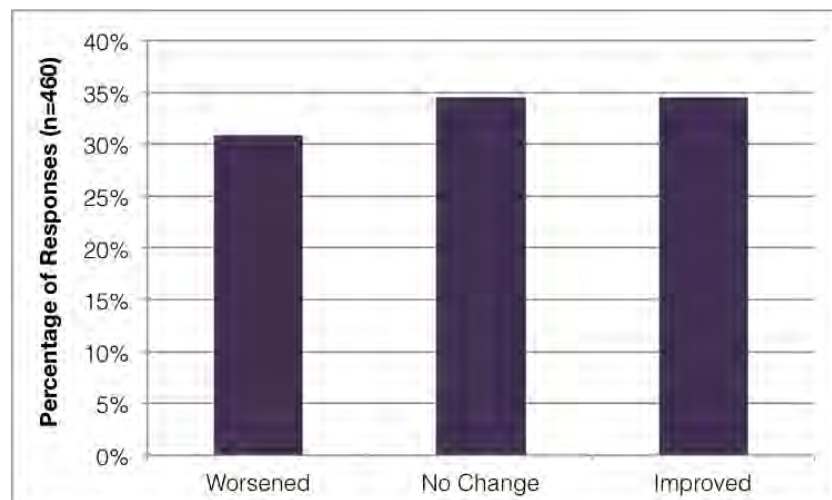
18c. Which are the top three groups of stakeholders involved in your top coastal management challenge?

Respondent Type	Top three stakeholders
City/County	State Agencies/Commissions Local Governments Federal agencies/departments
Regional/State/Federal	Local Governments Environmental Advocacy Groups State Agencies/Commissions
Elected Officials	Environmental Advocacy Groups State Agencies/Commissions Local Governments
NGOs	Environmental Advocacy Groups State Agencies/Commissions Local Governments
Environmental Consultants/ Private Industry	Environmental Advocacy Groups Federal agencies/departments State Agencies/Commissions

19a. How would you characterize the current political atmosphere around your top management challenge?

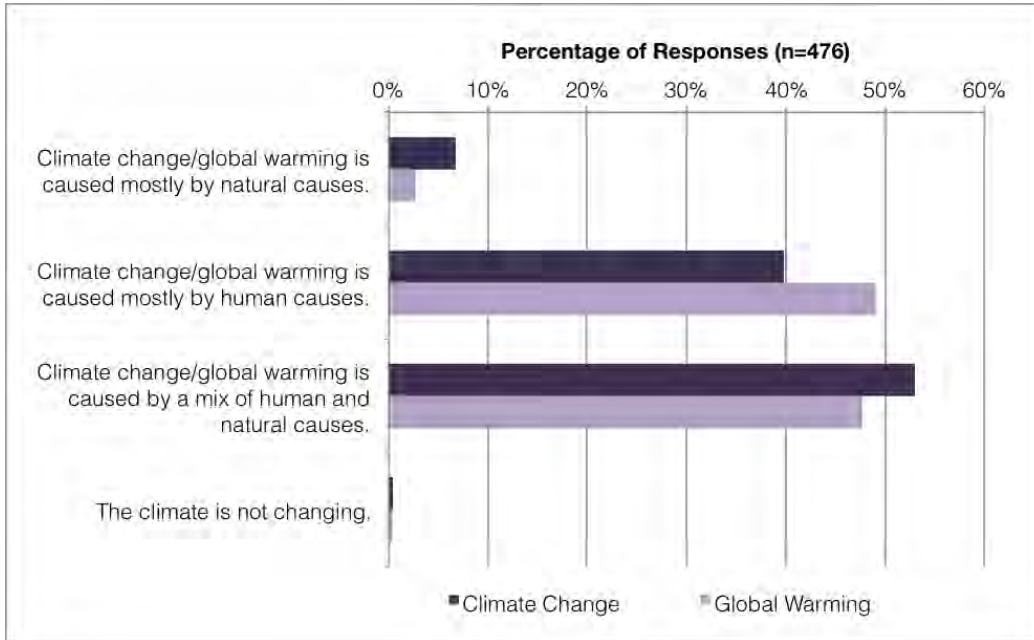


19b. How has the current political atmosphere around your top coastal management challenge changed over the past 5 years?

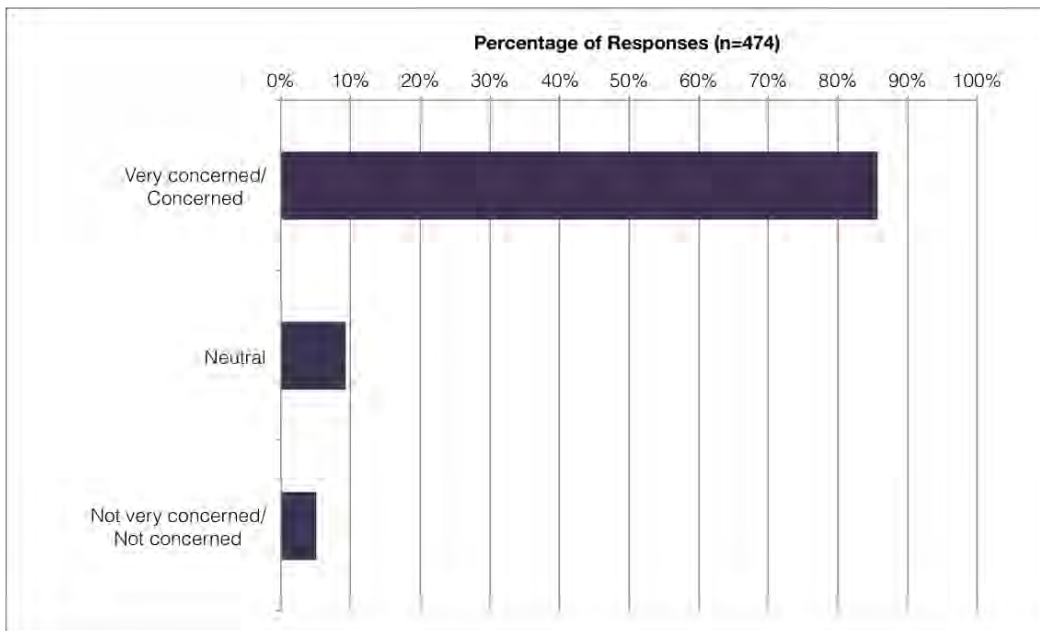


APPENDIX III: COASTAL ADAPTATION TO CLIMATE CHANGE

20. Please indicate which of the following statements comes closest to your opinion of climate change or global warming.

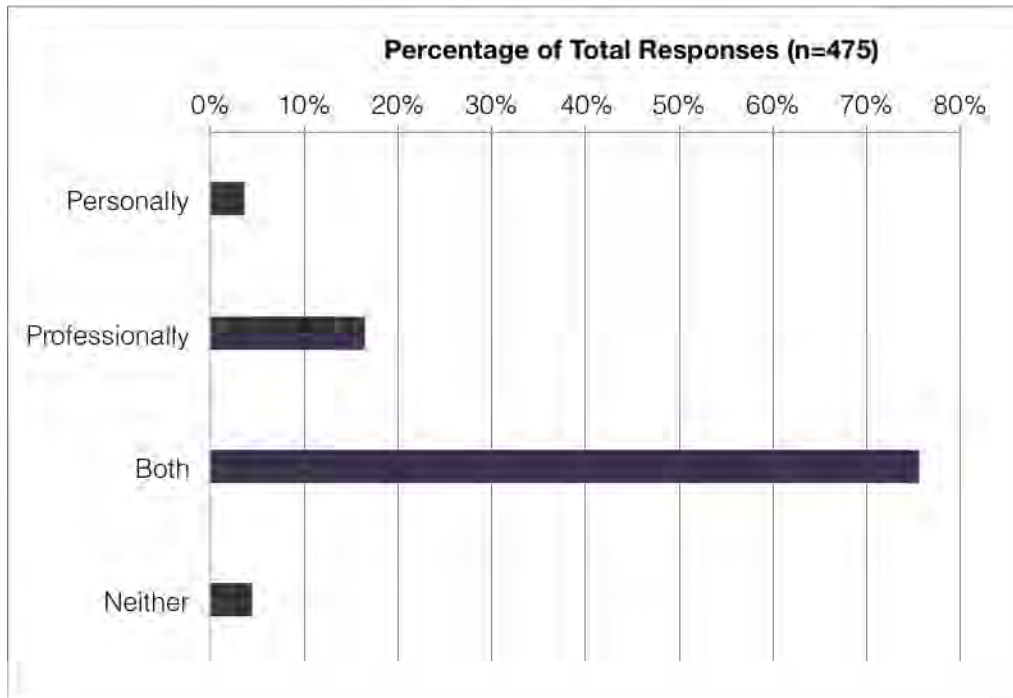


21. What is your personal level of concern about climate change/global warming?

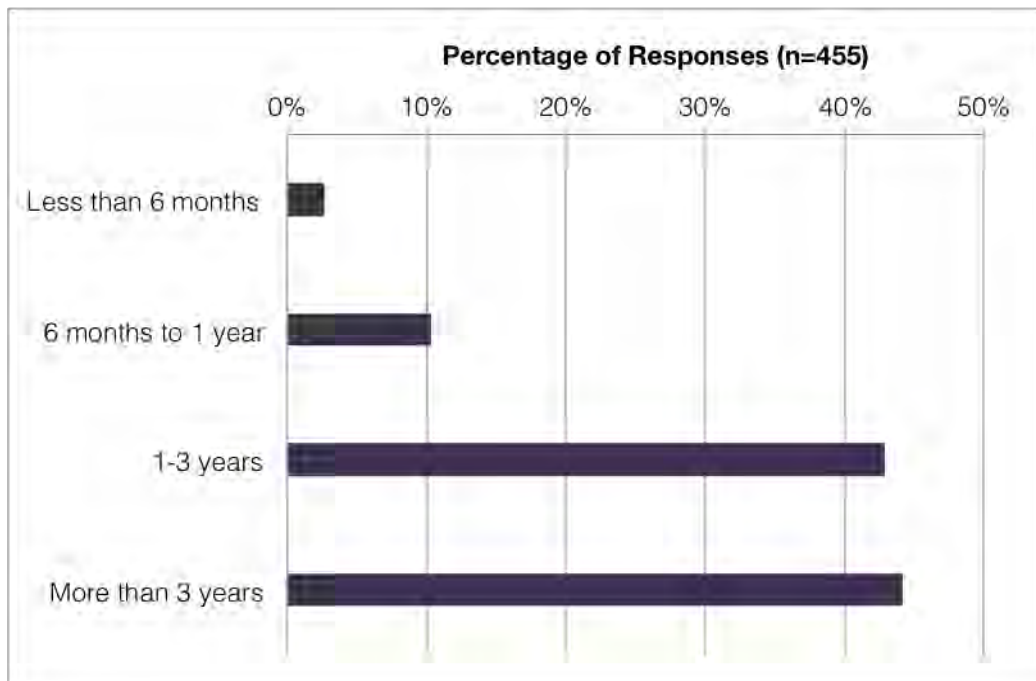


247 respondents received surveys using the term “climate change”
 229 respondents received survey using the term “global warming”

22a. Have you ever, personally or in your work, considered the potential impacts of climate change on your community or region?

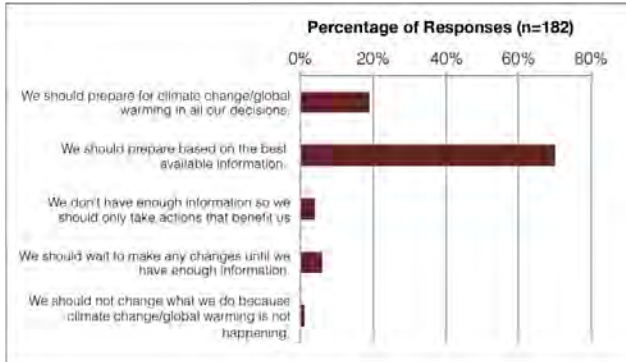


22b. If you have begun considering the impacts of climate change in your work, approximately how long have you done so?

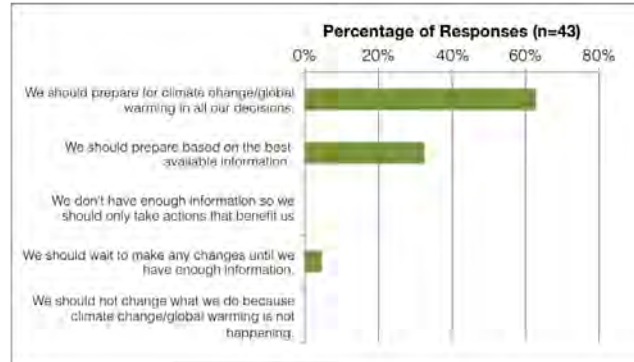


23. Which of the following statements best represents your attitude toward preparing for changes in coastal areas that might result from future climate change? (Responses broken down by respondent type.)

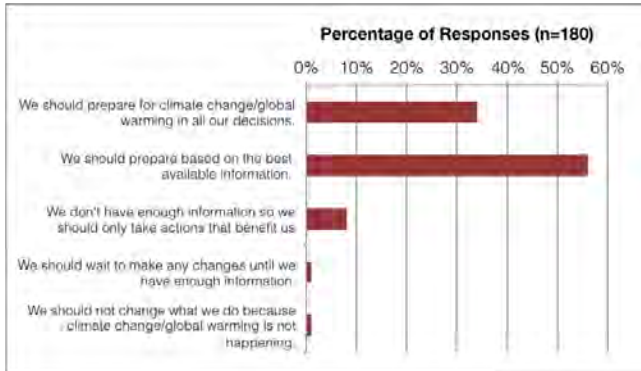
City & County Respondents



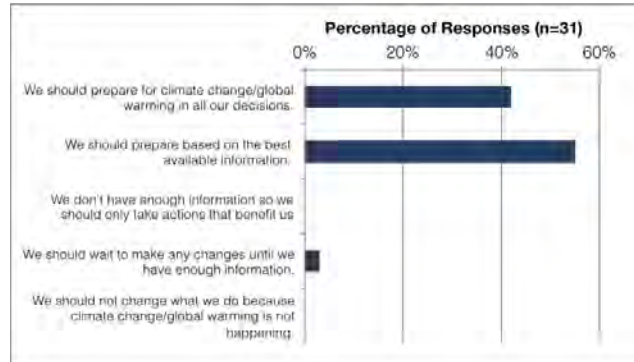
NGO Respondents



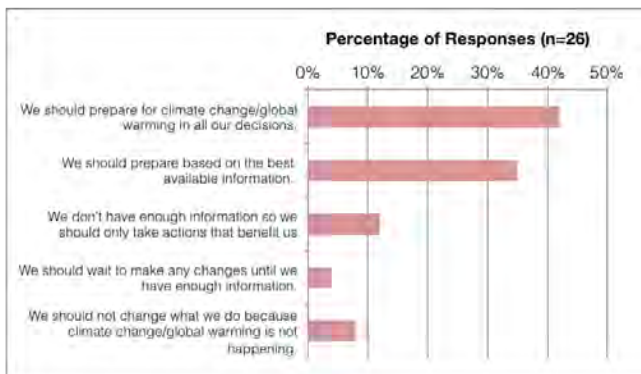
State, Federal and Regional Respondents



Private Industry & Environmental Consultant Respondents



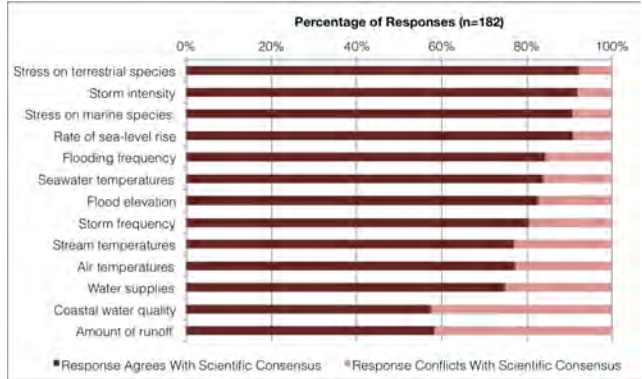
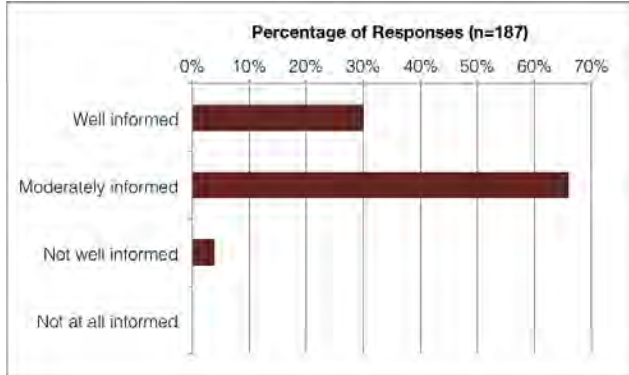
Elected Official Respondents



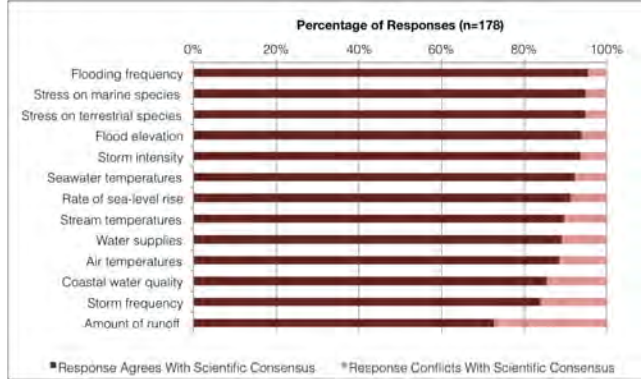
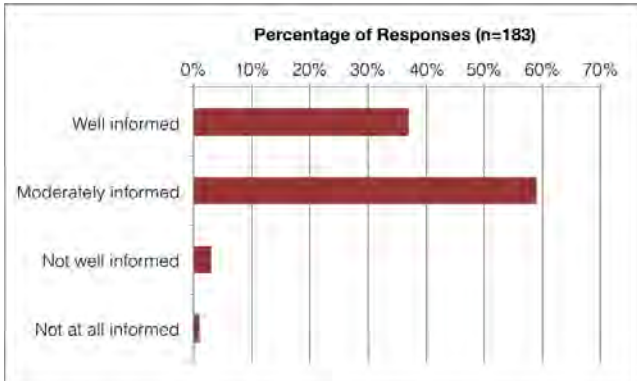
24. How well informed do you feel you are about climate change? (Responses broken down by respondent type.)

25. How do you think climate change may affect the local average conditions and natural environment in your region over the next 3 - 4 decades? (Responses broken down by respondent type.)

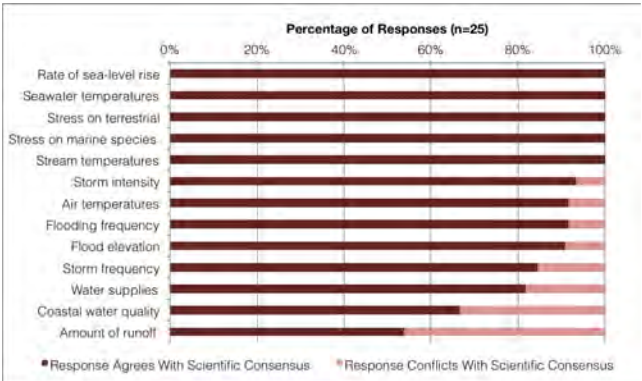
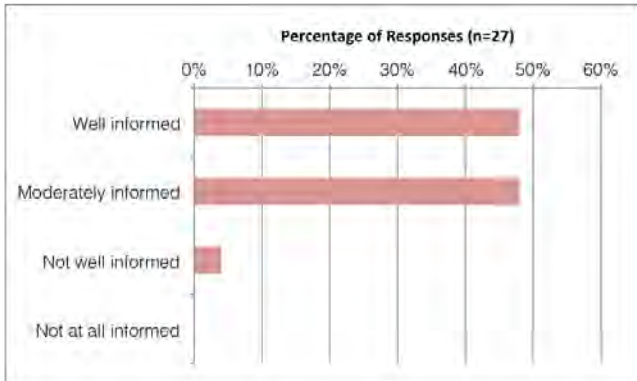
City & County Respondents



State, Federal and Regional Respondents



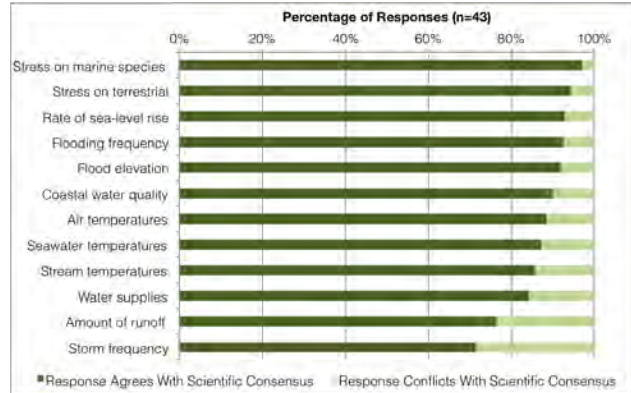
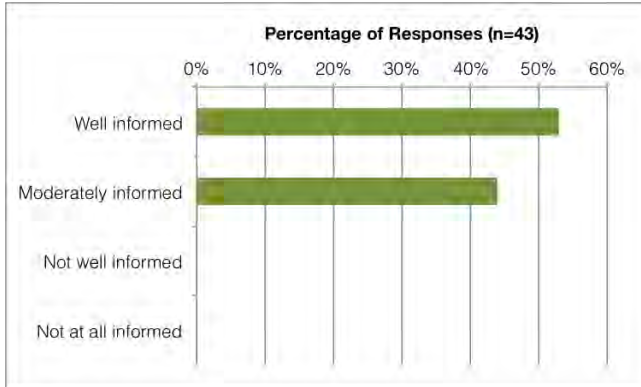
Elected Official Respondents



24. How well informed do you feel you are about climate change? (cont'd)

25. How do you think climate change may affect the local average conditions and natural environment in your region over the next 3 - 4 decades? (cont'd)

NGO Respondents



Private Industry & Environmental Consultant Respondents

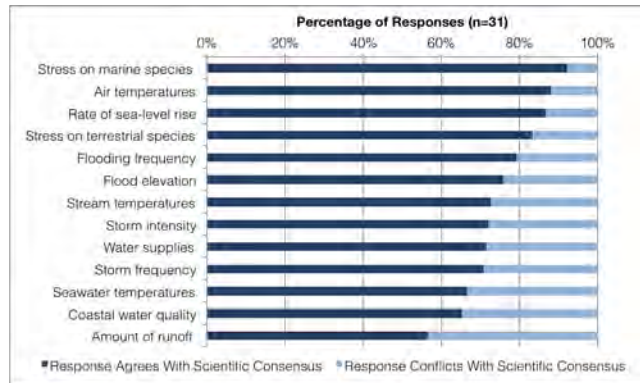
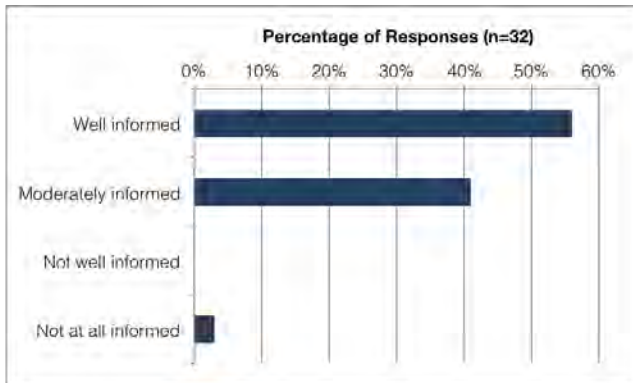
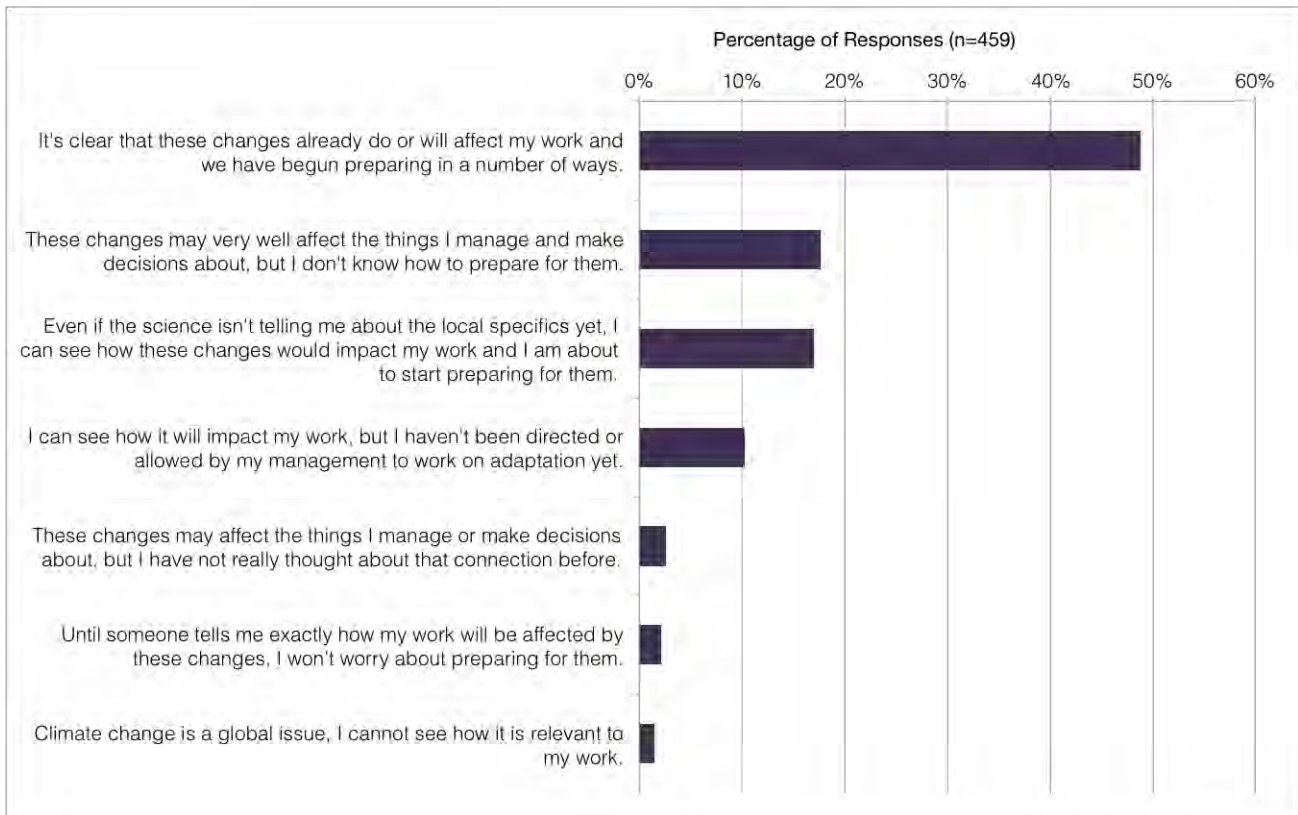


Table 3. Table identifying scientific consensus for various climate change impacts based on analysis of Cayan et al. (2009).

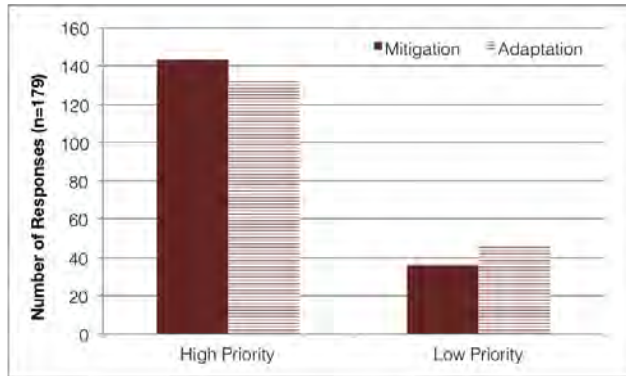
Impact Area	Scientific Consensus
Air temperatures	Air temperatures will increase
Seawater temperatures	Seawater temperatures will increase
Stream temperatures	Stream temperatures will increase
Rain- and snowfall (precipitation)	Depends on region (question not included in analysis)
Water supplies	Water supplies will decrease
Amount of runoff	Amount of runoff will increase
Flooding frequency	Flooding frequency will increase
Flood elevation	Flood elevation will increase
Rate of sea level rise	Rate of sea-level rise will increase
Storm frequency	Still scientific debate (question not included in analysis)
Storm intensity	Still scientific debate (question not included in analysis)
Stress on terrestrial species	Stress will increase
Stress on marine species	Stress will increase
Occurrence of algae blooms	Still scientific debate (question not included in analysis)
Coastal water quality	Coastal water quality will decrease

26. How do you think climate change could impact your work?

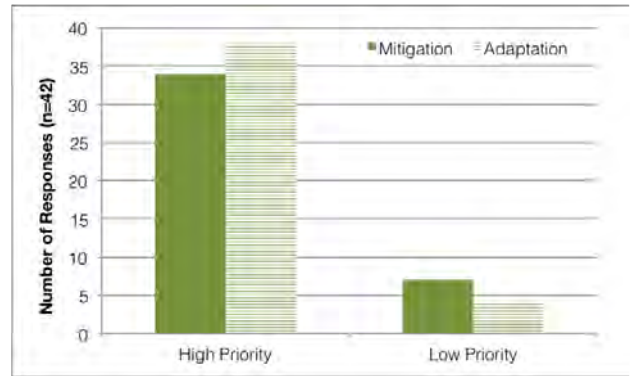


27. Please rate how important it is in your work to address climate change through (a) the reduction of greenhouse gas emissions from energy and land use (mitigation) and (b) efforts to plan and prepare for the projected impacts of climate change (adaptation). (Responses broken down by respondent type.)

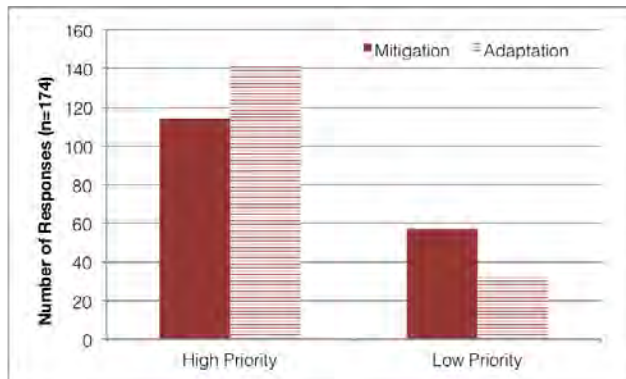
City & County Respondents



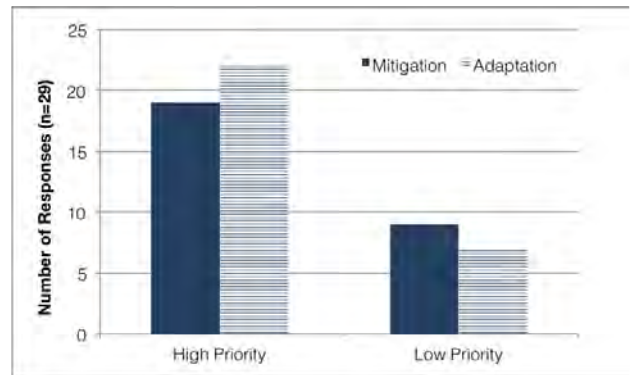
NGO Respondents



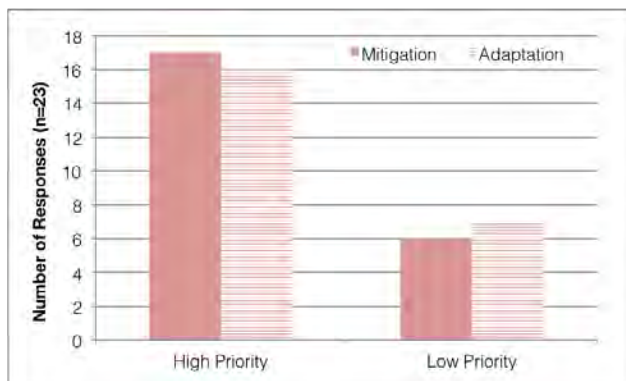
State, Federal & Regional Respondents



Private Industry & Environmental Consultant Respondents

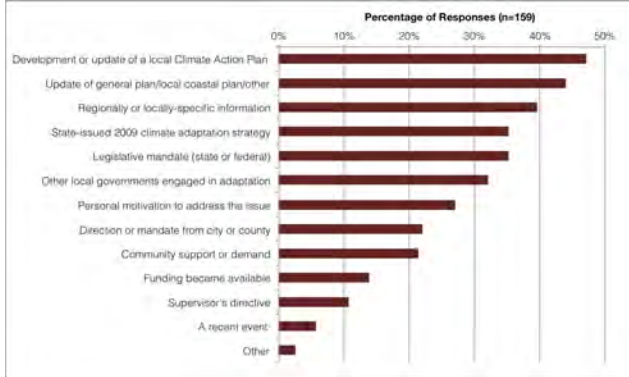


Elected Officials

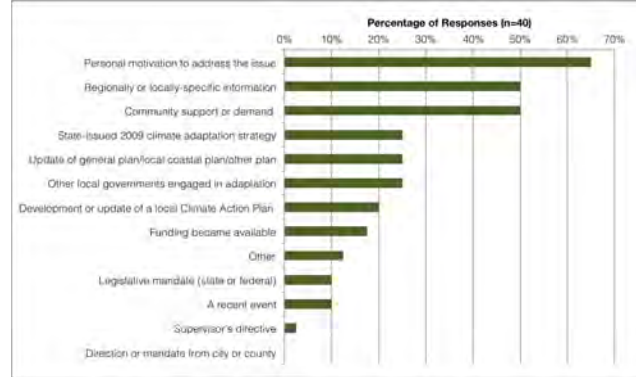


28. If you are engaged in, or contributing to, planning for climate change (adaptation) in your community or region at this time, what prompted your action? (Responses broken down by respondent type.)

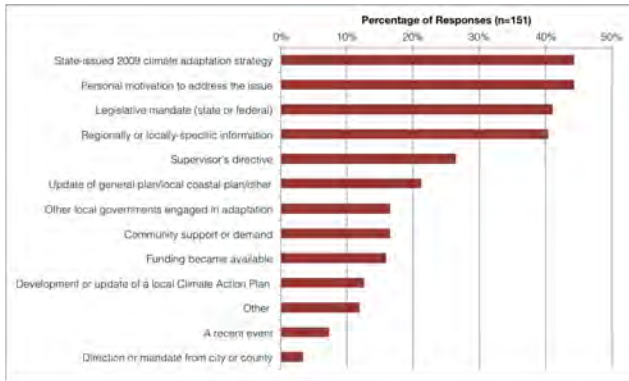
City & County Respondents



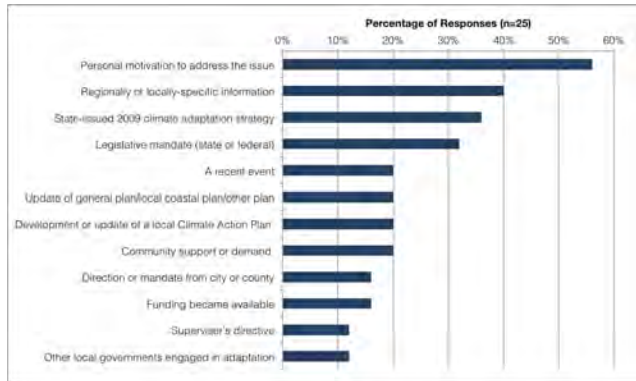
NGO Respondents



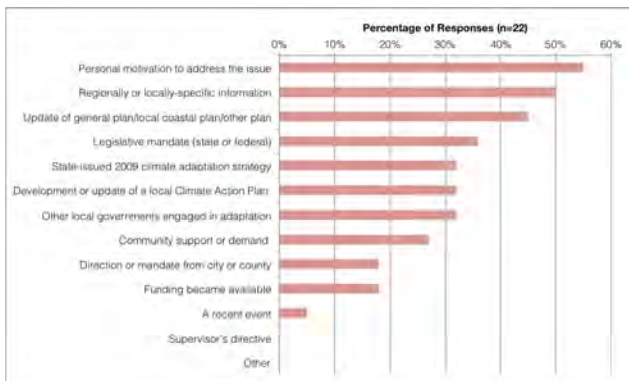
State, Federal & Regional Respondents



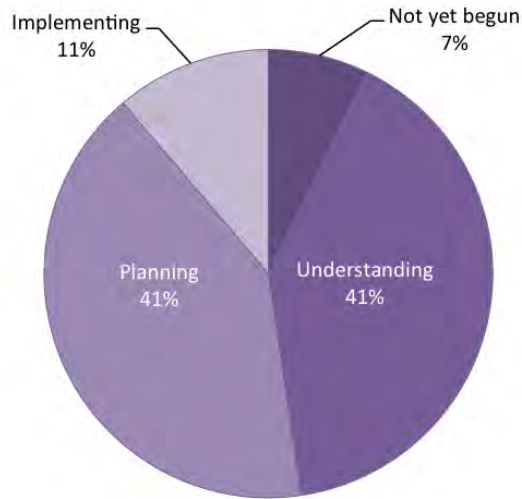
Private Industry & Environmental Consultant Respondents



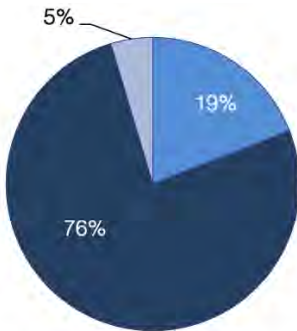
Elected Officials



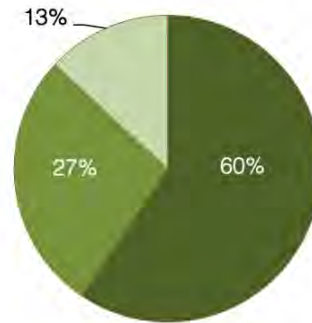
29a. Which category best describes your current phase of climate change planning and implementation?



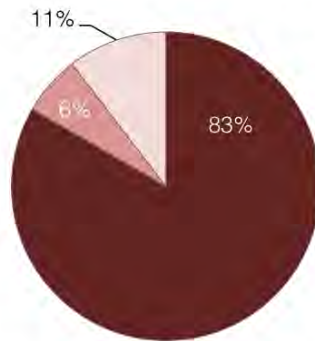
29b. Please provide more detail on your activities or contributions to in this phase by selecting one of the statements below.



- We have not looked into it or are just beginning to become aware of the issue.
- We have started to gather some information to better understand the issue.
- We have completed an assessment of the issue.



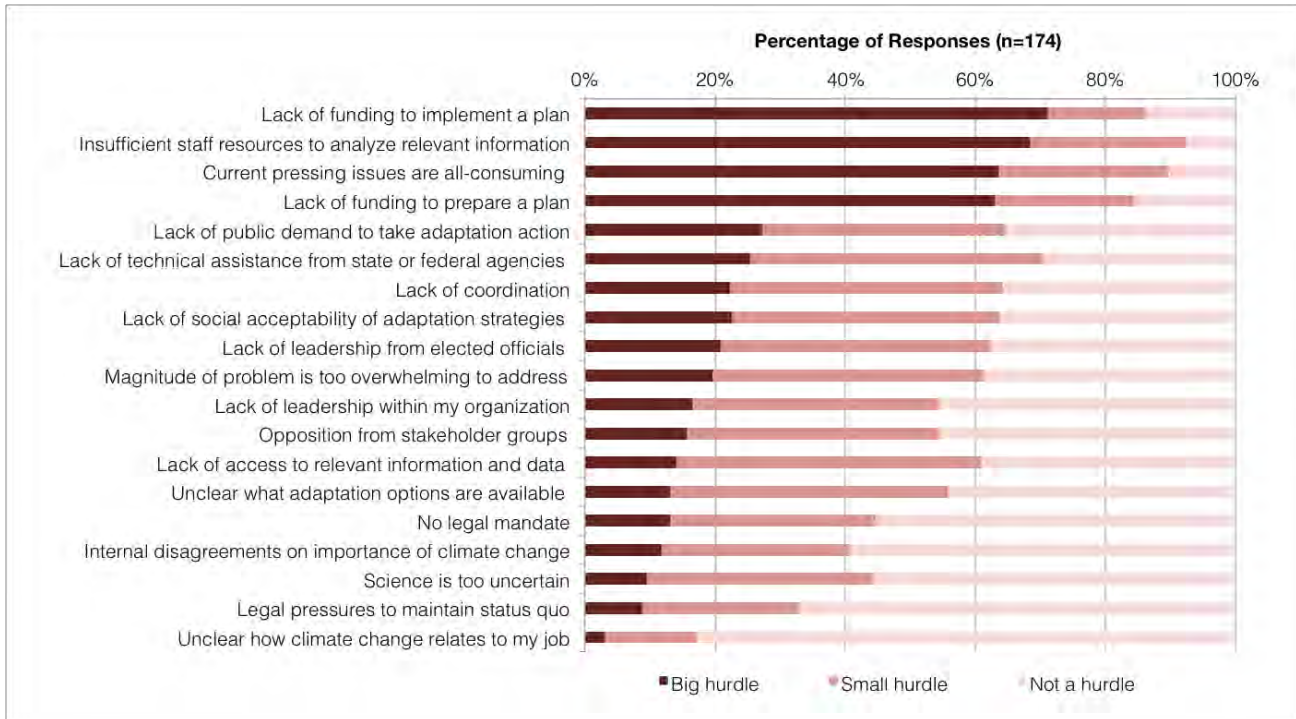
- We are brainstorming a range of options to prepare for and manage climate change risks.
- We have completed an assessment of potential response options.
- We have selected a subset of response options to move forward with.



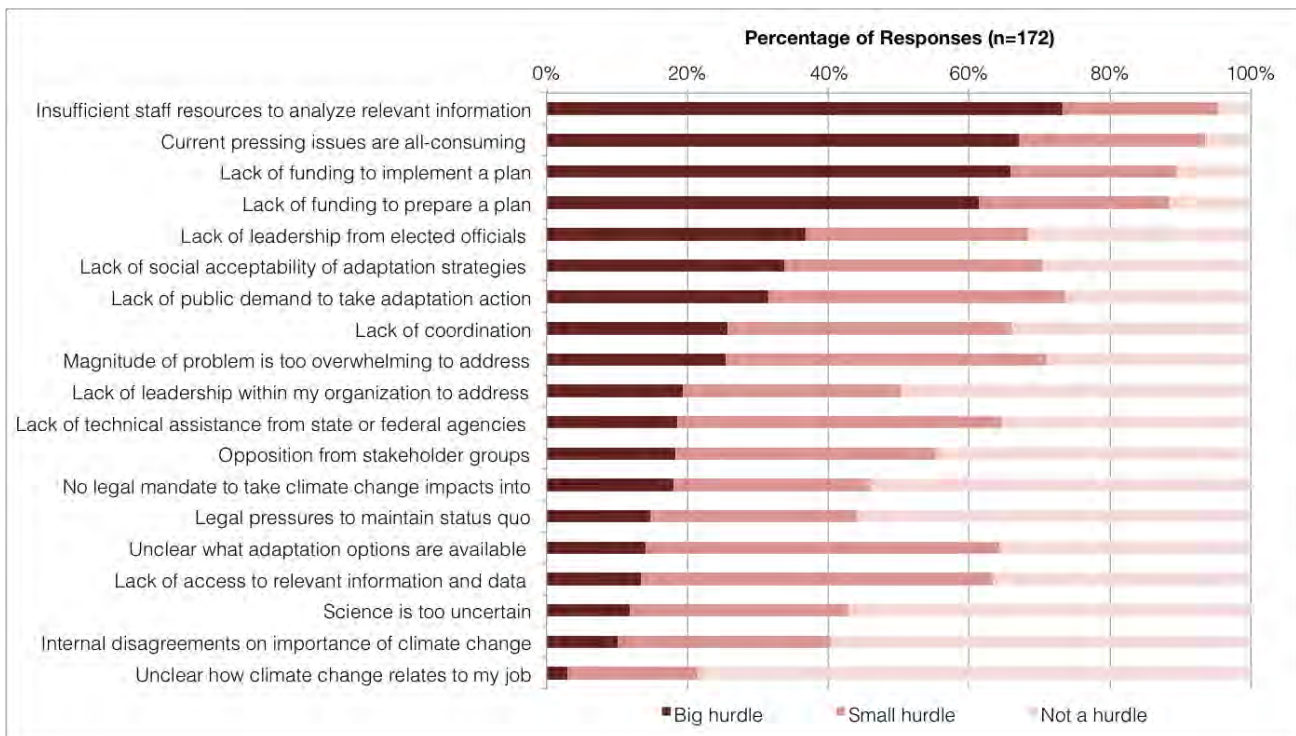
- We have begun implementing the selected response options.
- We are monitoring how well the implemented responses are working out.
- We are evaluating and reassessing how well the implemented options are faring.

30. Whether or not your organization has already taken action to prepare for the possible impacts of climate change, how much of a hurdle has each of the following issues been in your efforts to date? (Responses broken down by respondent type.)

City & County Respondents

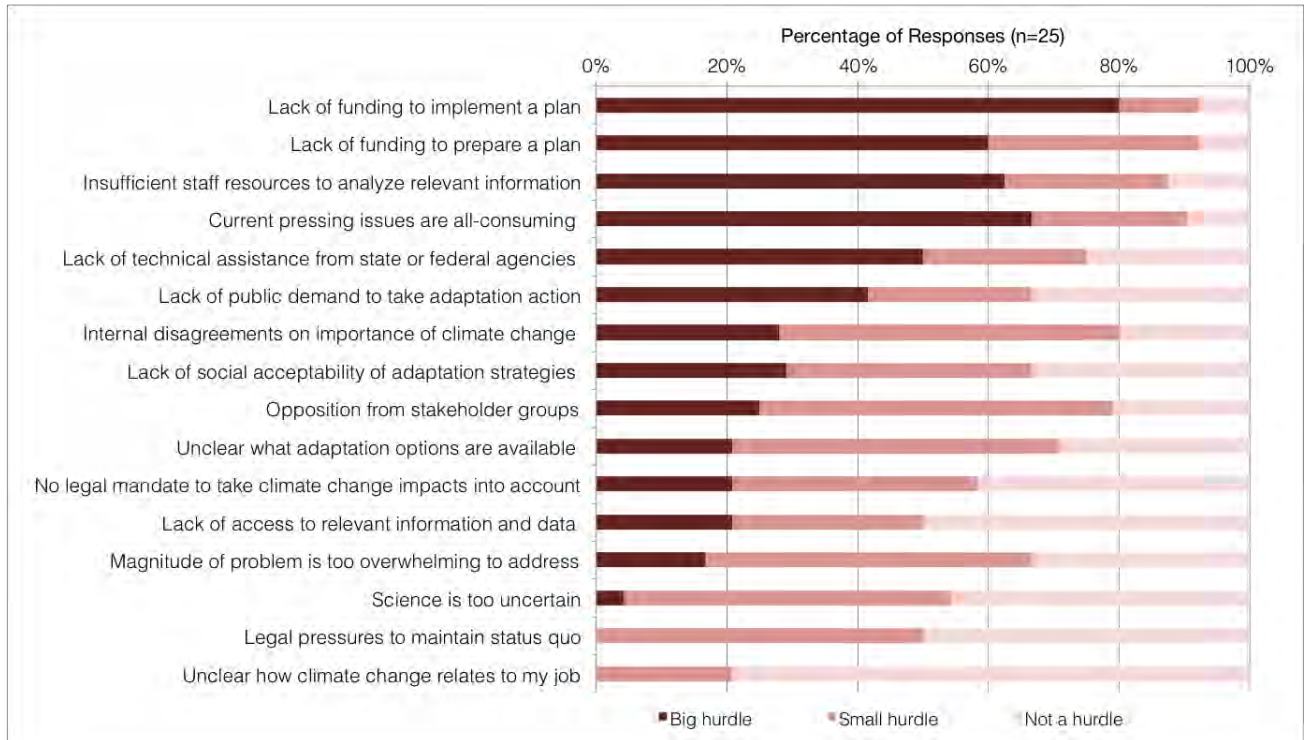


State, Federal & Regional Respondents

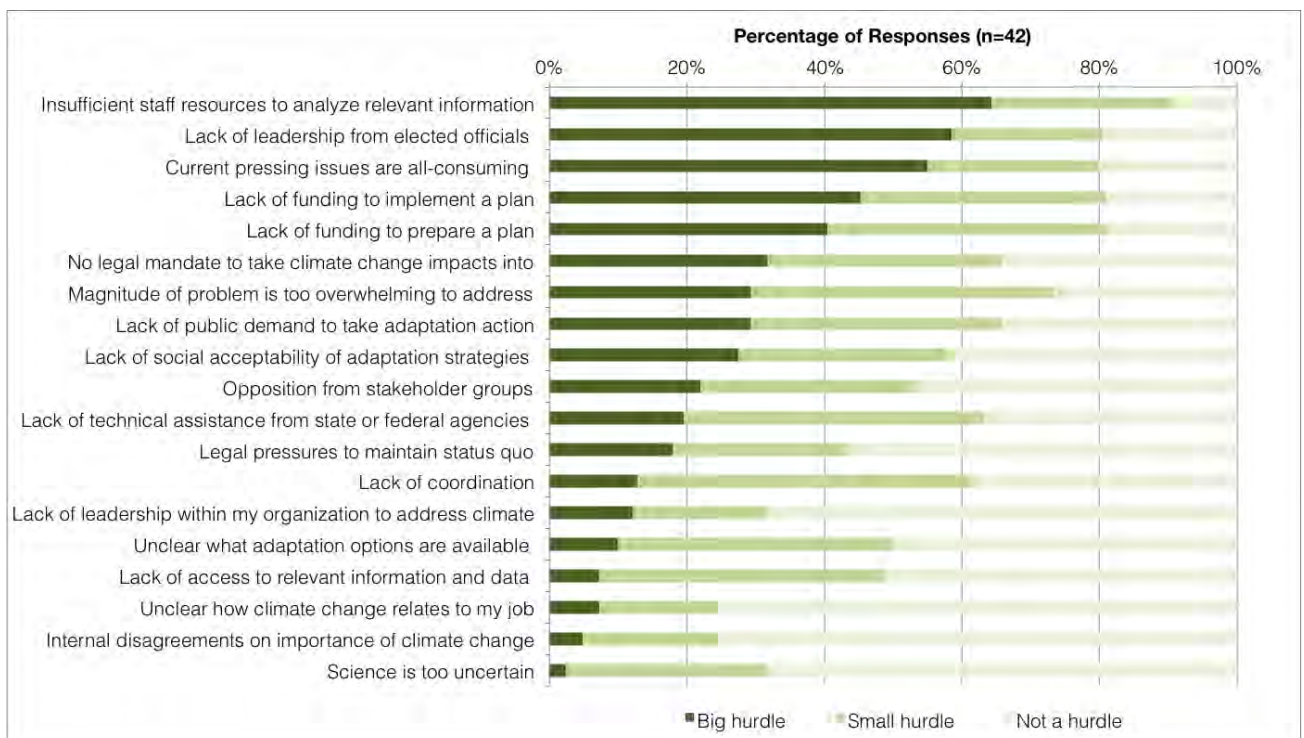


30. Whether or not your organization has already taken action to prepare for the possible impacts of climate change, how much of a hurdle has each of the following issues been in your efforts to date? (Responses broken down by respondent type.)

Elected Official Respondents

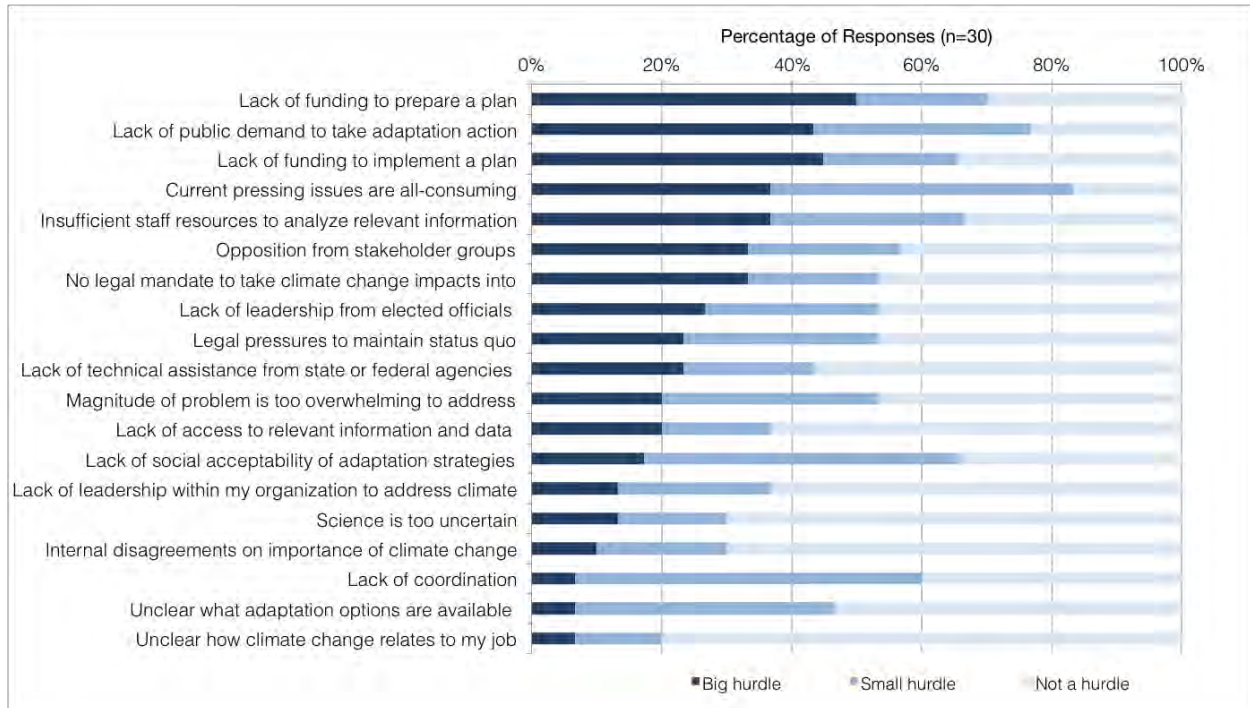


NGO Respondents



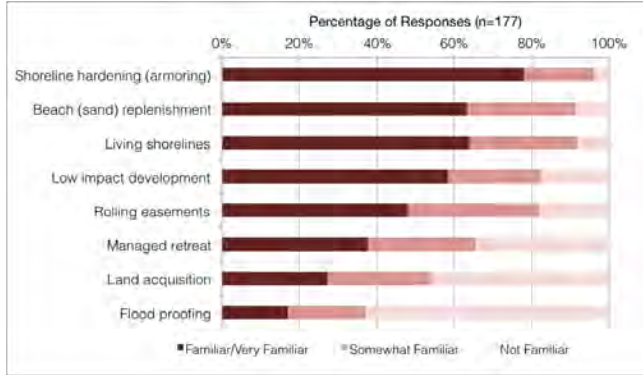
30. Whether or not your organization has already taken action to prepare for the possible impacts of climate change, how much of a hurdle has each of the following issues been in your efforts to date? (Responses broken down by respondent type.)

Private Industry & Environmental Consultant Respondents

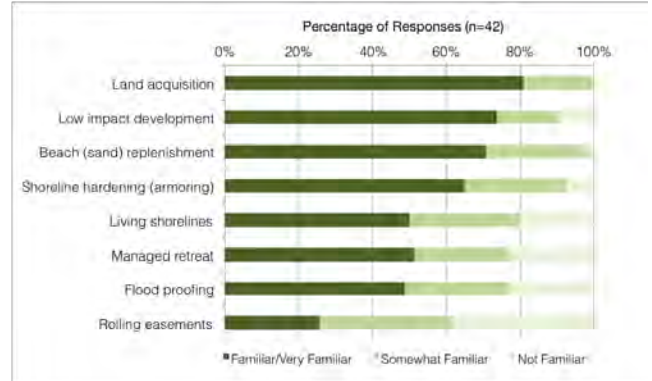


31. Please describe how familiar you are with each of the following coastal adaptation options.
 (Responses broken down by respondent type.)

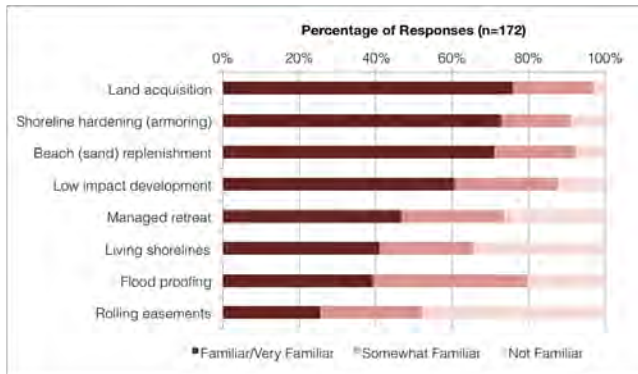
City & County Respondents



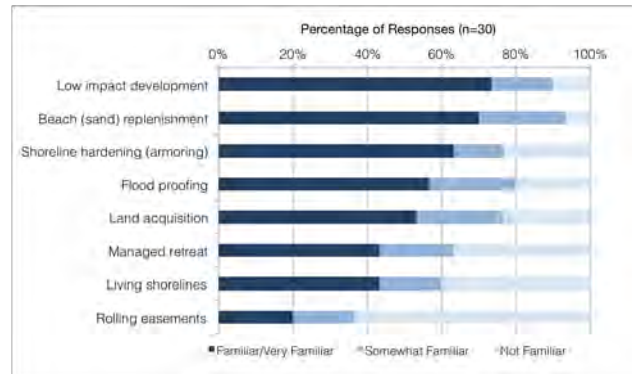
NGO Respondents



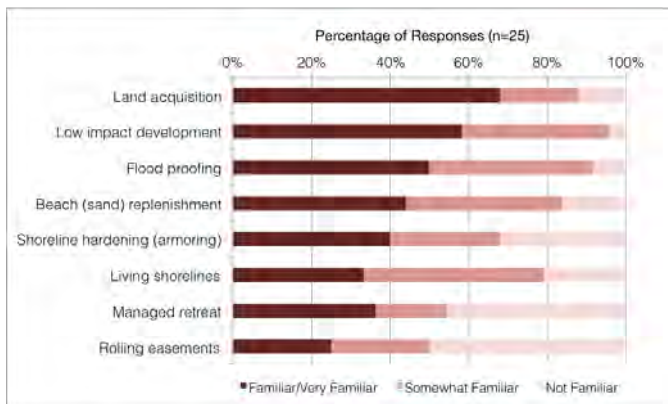
State, Federal & Regional Respondents



Private Industry & Environmental Consultant Respondents

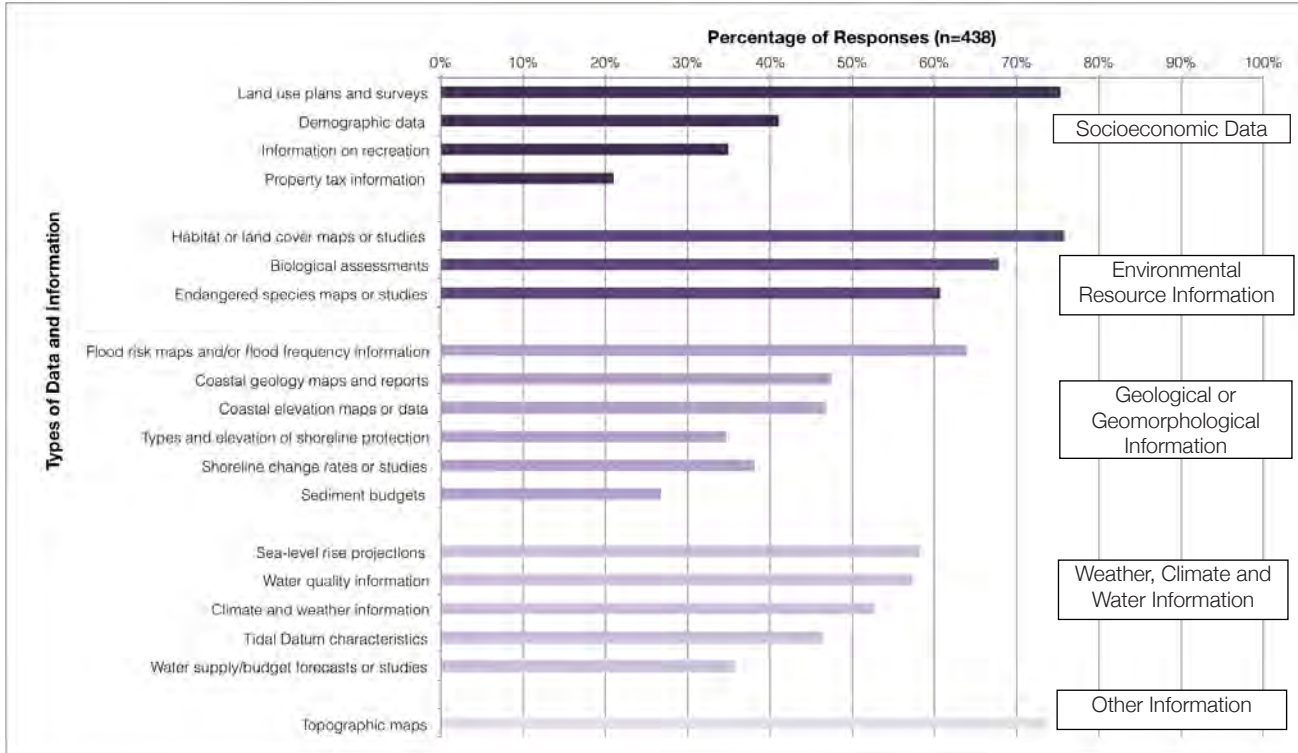


Elected Officials



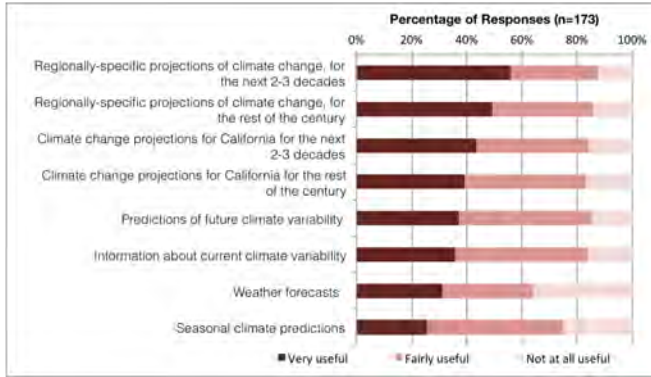
APPENDIX IV: DATA AND INFORMATION NEEDS

32. In order to carry out your daily job responsibilities, what data and information do you consult regularly?

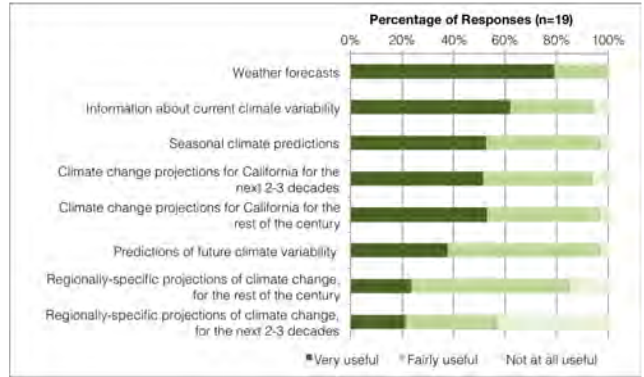


33a. In the work you do, please rate the usefulness of the following types of *weather and climate* information for assessing the risks from climate change to local coastal resources. (Responses broken down by respondent type.)

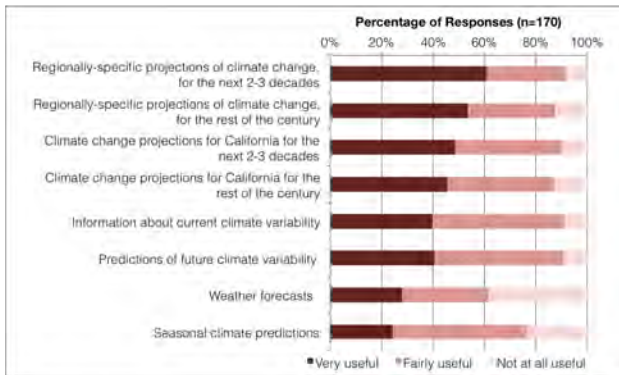
City & County Respondents



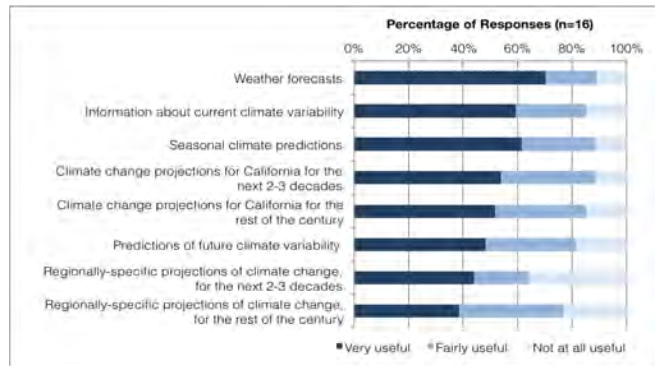
NGO Respondents



State, Federal & Regional Respondents

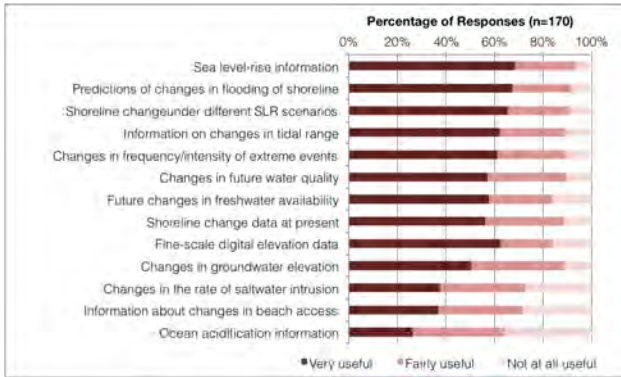


Private Industry & Environmental Consultant Respondents

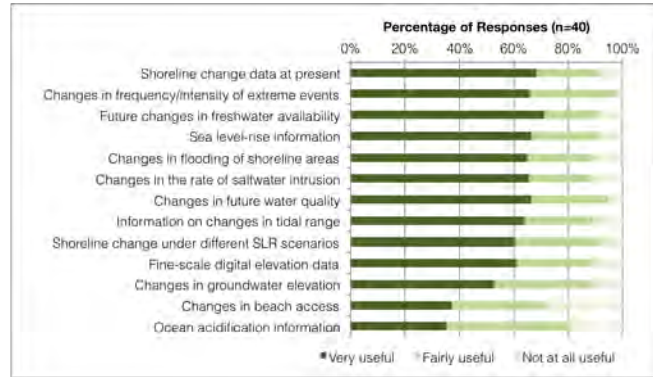


33b. In the work you do, please rate the usefulness of the following types of *physical information* for assessing the risks from climate change to local coastal resources. (Responses broken down by respondent type.)

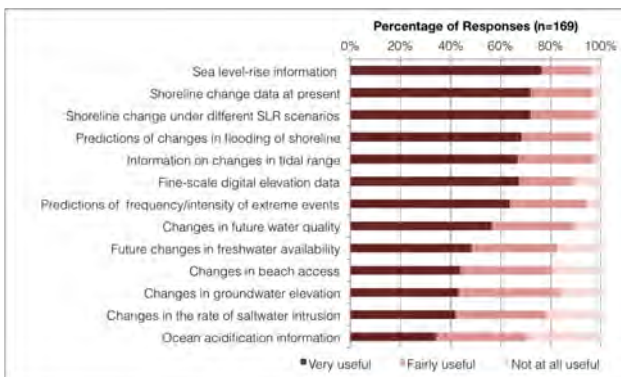
City & County Respondents



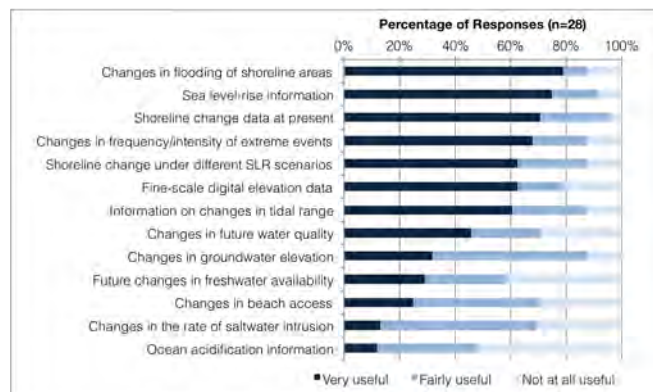
NGO Respondents



State, Federal & Regional Respondents

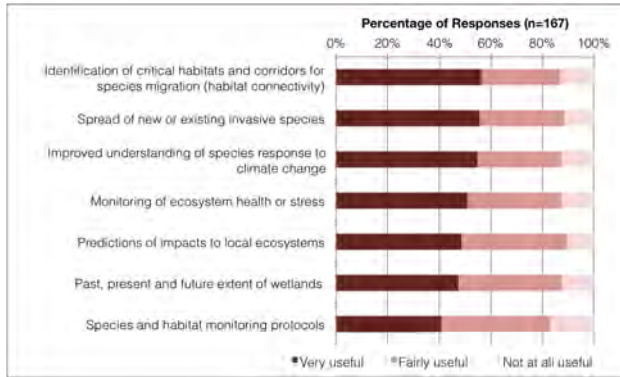


Private Industry & Environmental Consultant Respondents

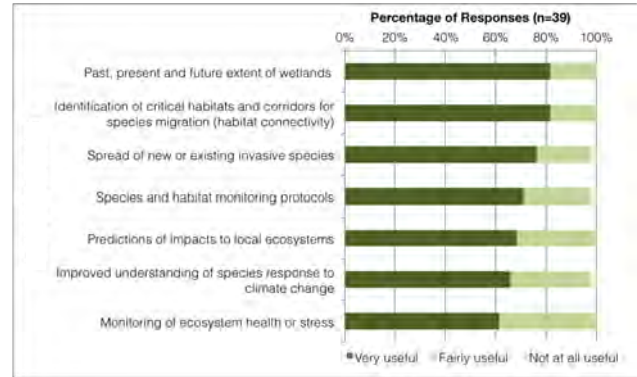


33c. In the work you do, please rate the usefulness of the following types of *biological information* for assessing the risks from climate change to local coastal resources. (Responses broken down by respondent type.)

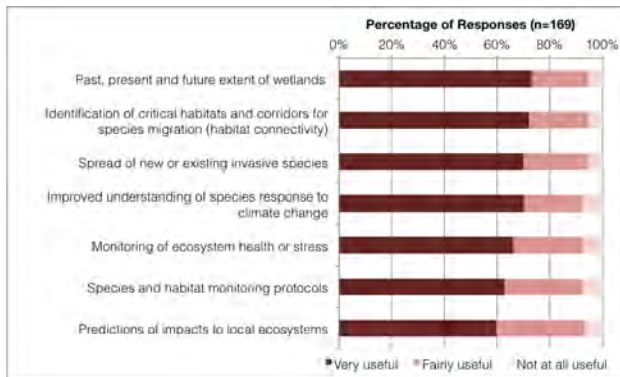
City & County Respondents



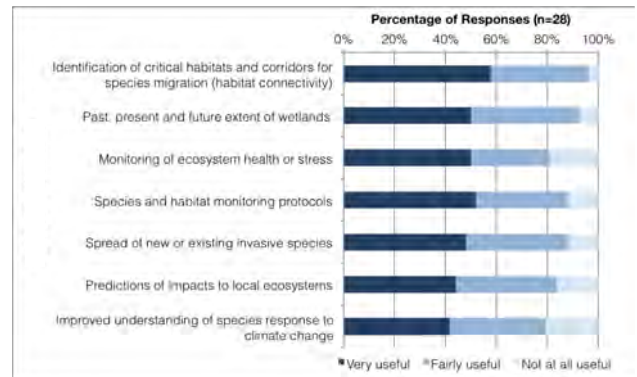
NGO Respondents



State, Federal & Regional Respondents

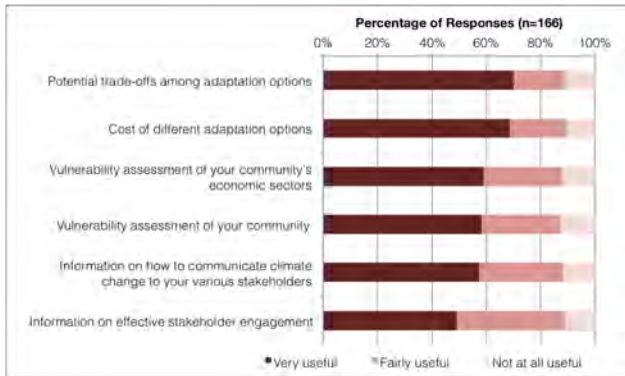


Private Industry & Environmental Consultant Respondents

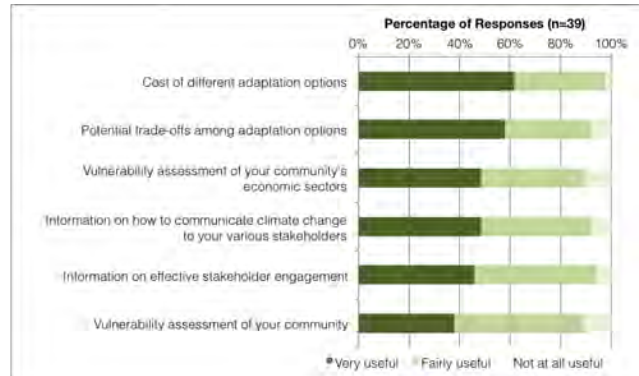


33d. In the work you do, please rate the usefulness of the following types of *socioeconomic* information for assessing the risks from climate change to local coastal resources. (Responses broken down by respondent type.)

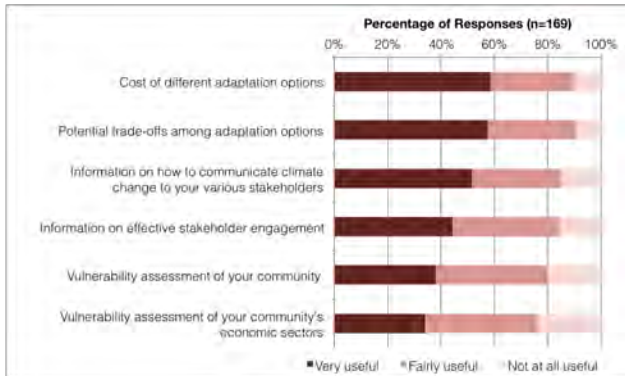
City & County Respondents



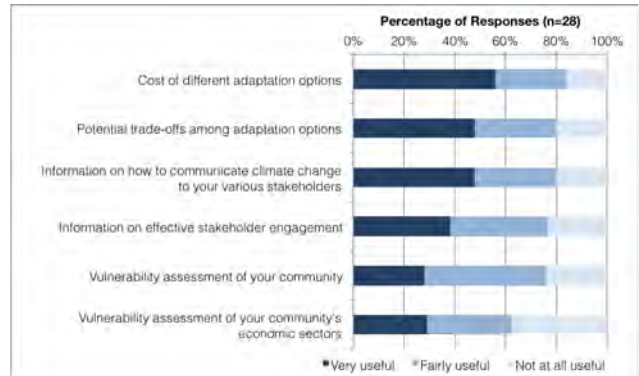
NGO Respondents



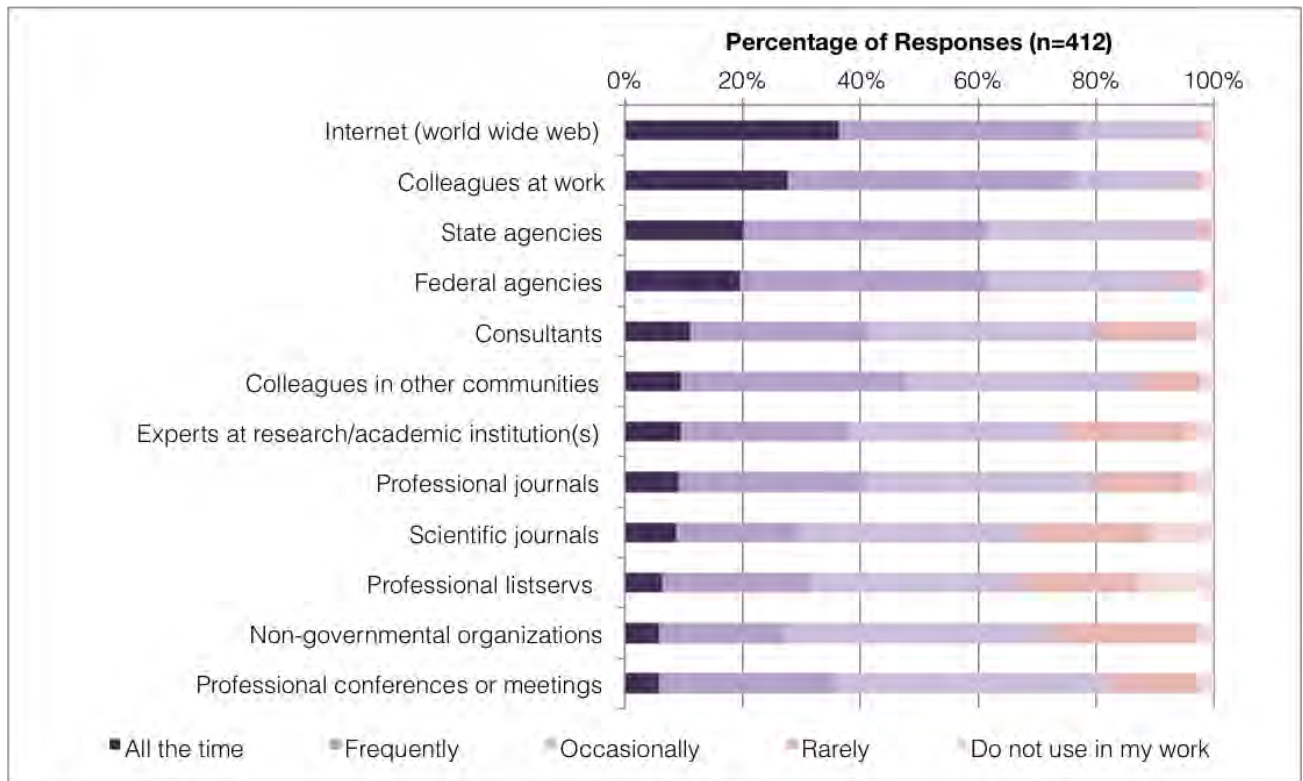
State, Federal & Regional Respondents



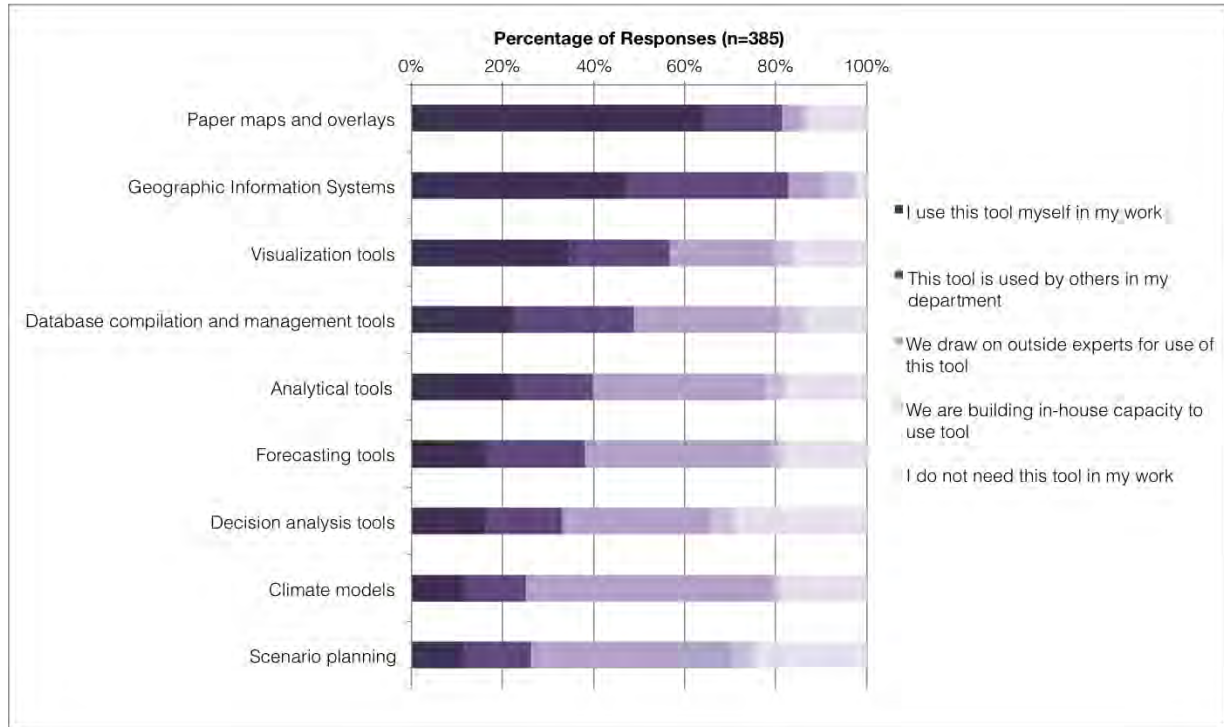
Private Industry & Environmental Consultant Respondents



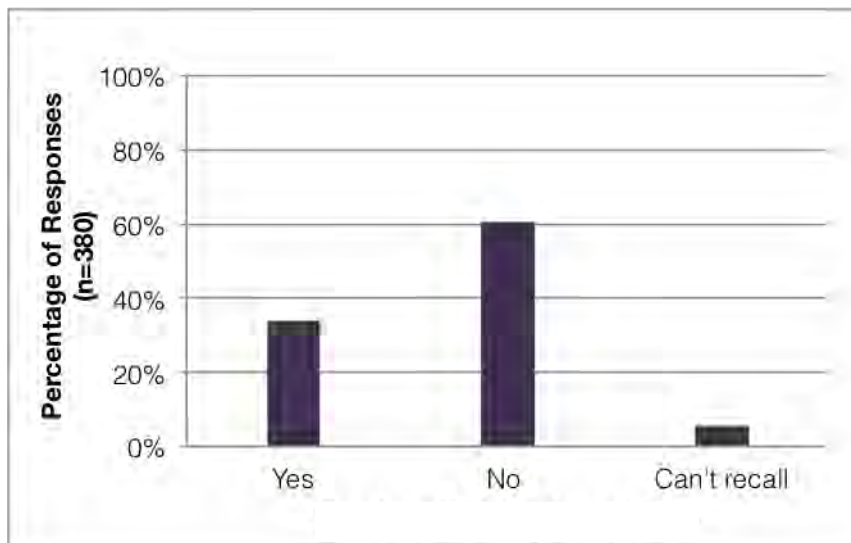
34. What sources do you typically consult to obtain the data and information you need for your work?



35. Please rate the use of the following information processing tools in your work.

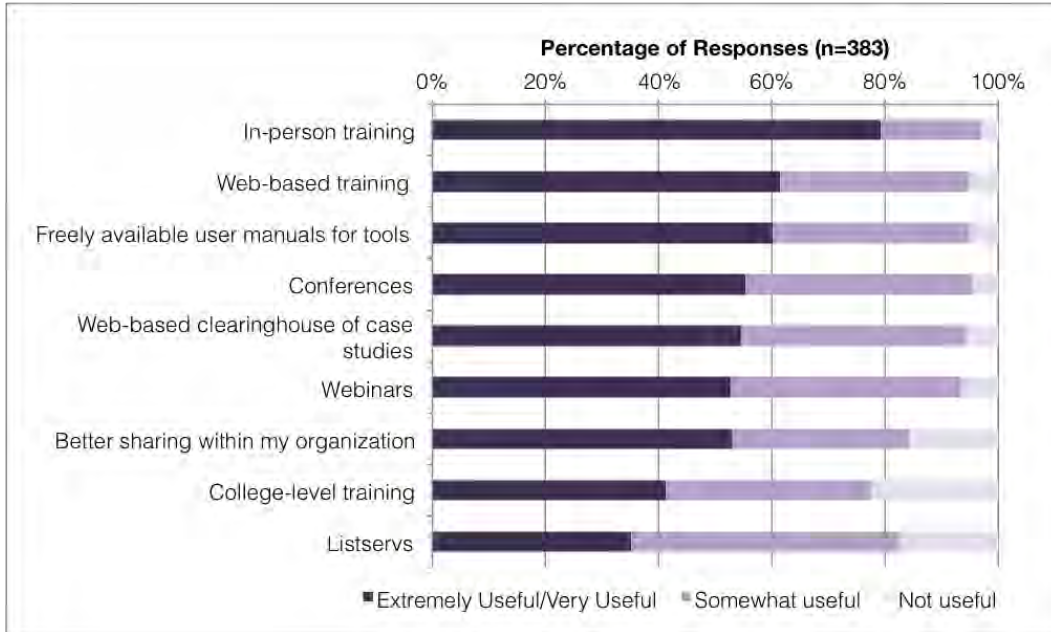


36. Have you already participated in any formal training(s) on planning for climate change?

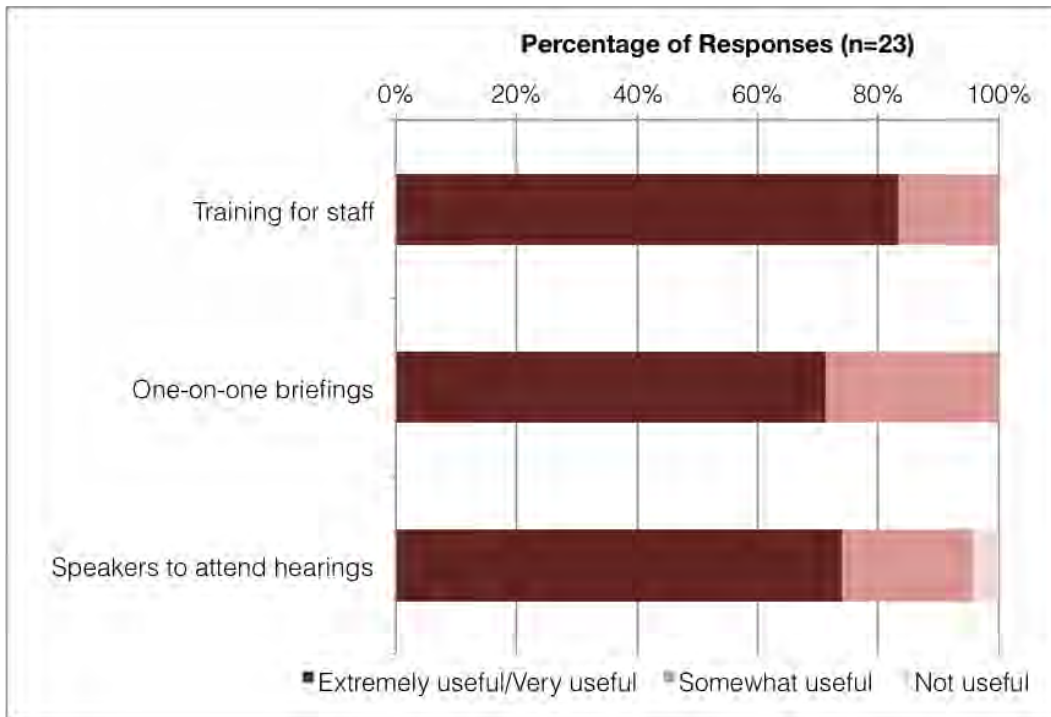


37. To make the most effective and efficient use of the available information and tools to support planning for climate change, please rate how useful each of the following opportunities to learn more about them would be to you.

All Respondents (Except Elected Officials)



Elected Officials



APPENDIX V: SURVEY PARTNER CLIMATE RESOURCES

California Coastal Conservancy

- *Guidance for Addressing Climate Change in California Coastal Conservancy Projects: Section IV: Vulnerability from Sea Level Rise and Extreme Events, 2012.* (<http://scc.ca.gov/category/climate-change/>)

California Ocean Protection Council

- Coastal Mapping (LiDAR) Data Available, 2012 (<http://www.opc.ca.gov/2012/03/coastal-mapping-lidar-data-available/>)
- Heberger, M., et al. of the Pacific Institute, 2009. *The Impacts of Sea-Level Rise on the California Coast. A paper from the California Climate Change Center.* (http://www.pacinst.org/reports/sea_level_rise/)

Center for Ocean Solutions

- Center for Ocean Solutions Workshops (<http://centerforoceansolutions.org/education/workshops>)

California Sea Grant College

- California Climate Change Extension (<http://ca-sgep.ucsd.edu/focus-areas/effective-response-climate-change/california-climate-change-extension>)

National Oceanic and Atmospheric Administration Coastal Services Center

- CanVis (<http://www.csc.noaa.gov/digitalcoast/tools/canvis>)
- Coastal Climate Adaptation Community of Practice (<http://collaborate.csc.noaa.gov/climateadaptation/default.aspx>)
- Coastal County Snapshots (<http://www.csc.noaa.gov/digitalcoast/tools/snapshots>)
- Coastal Inundation Mapping (<http://www.csc.noaa.gov/digitalcoast/training/inundationmap>)
- Coastal Inundation Mapping Guidebook (http://www.csc.noaa.gov/digitalcoast/_pdf/guidebook.pdf)
- Coastal Inundation Toolkit (<http://www.csc.noaa.gov/digitalcoast/inundation>)
- Digital Coast Website (<http://www.csc.noaa.gov/digitalcoast/>)
- ENOW Explorer (<http://www.csc.noaa.gov/digitalcoast/tools/enow>)
- *Incorporating Sea Level Change Scenarios at the Local Level.* (<http://csc.noaa.gov/digitalcoast/publications/slcScenarios>)
- *New Mapping Tool and Techniques for Visualizing SLR and Coastal Flooding Impacts, 2011* (http://csc.noaa.gov/digitalcoast/_pdf/New-Mapping-Tool-and-Techniques-for-Visualizing-SLR-Impacts.pdf)

- Sea Level Rise and Coastal Flooding Impacts Viewer (<http://www.csc.noaa.gov/digitalcoast/tools/slviewer>)
- Roadmap for Adapting to Coastal Risk (<http://www.csc.noaa.gov/digitalcoast/training/roadmap>)
- *Technical Considerations for Use of Geospatial Data in Sea Level Change Mapping and Assessment*, 2010. (http://www.csc.noaa.gov/digitalcoast/_pdf/SLC_Technical_Considerations_Document.pdf)

Tijuana River National Estuarine Research Reserve

- *Sea Level Rise Adaptation Strategy for San Diego Bay* (http://www.icleiusa.org/climate_and_energy/Climate_Adaptation_Guidance/san-diego-bay-sea-level-rise-adaptation-strategy)
- *Tijuana River National Estuarine Research Reserve Coastal Training Program Training Workshops* (<http://trnerr.org/?p=1876>)

San Francisco Bay Conservation and Development Commission

- *Incorporating Adaptation to Climate Change in Pinole's General Plan Update* (http://www.bcdc.ca.gov/planning/climate_change/AdaptPinolePlan.shtml)
- Local Government Adaptation Assistance Program (http://www.bcdc.ca.gov/planning/climate_change/LocalGov.shtml)
- *The City of Berkeley Builds Resilience by Addressing Climate Change Mitigation and Adaptation in its Climate Action Plan* (http://www.bcdc.ca.gov/planning/climate_change/AdaptBerkeleyPlan.shtml)
- *San Francisquito Creek Joint Powers Authority Factors Future Sea Level Rise into Coordinated, Watershed-Level Flood Protection* (http://www.bcdc.ca.gov/planning/climate_change/AdaptAction.shtml)

Partner Websites

- California Coastal Commission (<http://www.coastal.ca.gov/>)
- California Nevada Applications Program (CNAP) at the Scripps Institution of Oceanography, University of California, San Diego through the NOAA Regional Integrated Sciences and Assessment (RISA) Program (<http://meteora.ucsd.edu/cap/>)
- California Ocean Protection Council (<http://www.opc.ca.gov/>)
- California Ocean Science Trust (<http://calost.org/>)
- California Sea Grant College Program (<http://www-csgc.ucsd.edu/>)
- Center for Ocean Solutions, Stanford University (www.centerforoceansolutions.org/)
- Coastal Services Center, National Oceanic and Atmospheric Administration (www.csc.noaa.gov/)
- Gulf of Farallones National Marine Sanctuary (farallones.noaa.gov/)
- San Francisco Bay Conservation and Development Commission (www.bcdc.ca.gov/)
- San Francisco Bay National Estuarine Research Reserve (sfbaynerr.org/)
- Southern California Coastal Ocean Observing Systems (www.sccoos.org/)
- Susanne Moser Research & Consulting and Stanford University (www.susannemoser.com/)
- Tijuana River National Estuarine Research Reserve (<http://trnerr.org/>)
- University of California, Berkeley (<http://berkeley.edu/>)
- University of Southern California Sea Grant (<http://www.usc.edu/org/seagrant/>)

ABOUT THE AUTHORS



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Phyllis Grifman is Associate Director of the Sea Grant Program at the University of Southern California, where she manages Sea Grant's research, outreach and education portfolios. She works with stakeholders at state, local and federal levels, developing programs and partnerships that foster connections between science and policy. Phyllis received her B.A. and M.A. from UCSB, focusing on marine and environmental policy.



Adina Abeles, M.A.

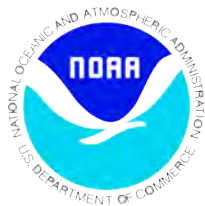
Adina Abeles, with the Center for Ocean Solutions, focuses on creating a broader understanding of how climate change will impact the ocean and coast and how to prepare for these impacts. She received her BA from Cornell University and her Master's from the University of California, Santa Barbara.



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Susan Schlosser is the University of California Sea Grant Extension Program advisor in Eureka, California. Her climate adaptation program addresses use of land, freshwater and coastal resources. The program aims to increase community capacity to plan and implement strategic actions for expected climate effects. Projects include habitat mapping, use of tool and models, and adaptation planning. She has a bachelor's degree from UCSC and a master's degree in Marine Science from San Jose State University.





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