



# Climate Communications Report

## of the

### Marine Fisheries Advisory Committee (MAFAC) Resiliency Working Group

August 2017

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## 1. Introduction

In October 2015, NOAA Fisheries charged the Marine Fisheries Advisory Committee (MAFAC) to provide advice on how NOAA can best meet coastal and fishing community needs with respect to resources, habitat, and socio-economic resiliency in a changing climate. MAFAC accepted the charge and established an Ad Hoc Resilience Working Group, comprised of members from MAFAC and its Climate and Marine Resources Task Force (CMRTF). The Resilience Working Group undertook six different tasks; the charge to the Task 5 subgroup was to recommend effective communication strategies for providing forecasts of climate changes and impacts to key fishery audiences and stakeholders. All recommendations from the Resilience Working Group must be discussed and approved by MAFAC before submission to NOAA Fisheries.

The working group determined that to fulfill this charge it needed a better understanding of fishery stakeholders' (or NOAA customers) views and attitudes about large-scale environmental change and the information resources different groups need and use regarding the effects of change on fisheries, aquaculture, and coastal communities. This subgroup developed and conducted a survey to gather information from stakeholders and customers on their concerns and information needs related to changing conditions of marine ecosystems, and their preferred communications methods to receive the information from NOAA. The working group believes this information will have long-term strategic value to NOAA in designing communications materials, including forecasts, that meet the needs of stakeholders, and we are excited to share our findings with the agency.

NOAA currently provides some information on climate-related impacts on marine ecosystems including fisheries, aquaculture, and coastal habitats. This information is intended for use by all stakeholders, including resource managers (e.g., Fishery Management Councils, Commissions), fishermen, communities, cooperatives, and others to help them prepare for and respond to changing conditions. The information is provided through a variety of methods including websites, scientific reports, and presentations. The NOAA Fisheries Climate Science Strategy<sup>1</sup> and related Regional Action Plans call for increased effort to produce, deliver, and use climate-related information in fulfilling NOAA Fisheries activities. The MAFAC customer survey was designed to provide NOAA Fisheries with information to help address this need.

The purpose of this survey was to better understand the types of climate information products NOAA constituents or stakeholders or customers find useful and desire, and their preferred mechanisms for receiving such information. The survey solicited information on the best ways to increase access, delivery, and use of this information. The goal is to provide the information of most use to support stakeholder efforts and empower actions and strategic decision-making at local to national scales.

## 2. Methods

The voluntary survey was developed by the members of the Resilience Task 5 subgroup, with assistance from NOAA Fisheries Office of Policy staff and climate change coordinator, along with the NOAA survey coordinator. Any survey released by a federal entity is required to receive clearance from the Office of Management and Budget (OMB), in accordance with the Paperwork Reduction Act (PRA). This survey met the requirements of NOAA's pre-approved customer service survey format, and was approved by OMB (Control Number 0648-0342). The survey consisted of 14 questions pertaining to what issues are of most concern to stakeholders and customers, what resources they use, whom they perceive to be the experts or credible sources of information, and the most useful information formats. This survey was

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<sup>1</sup> Link, JS, Griffis R, and Busch S (Editors). 2015. NOAA Fisheries Climate Science Strategy. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-F/SPO-155, 70p.

designed to provide information on priorities by sector or user group and on how NOAA can best communicate the information in a way that is most understandable and useful to them.

The survey used the web-based SurveyMonkey® platform. A pdf/printable version was available that could be filled out and returned as a scan or by mail for those with limited web access. The team distributed the survey through nationwide networks and email newsletters that reach all states and United States territories and reach a range of NOAA Fisheries constituents, including those from or engaged in commercial, recreational, and subsistence fishing; aquaculture; seafood industry; researchers; managers; government officials; and non-profit and environmental organizations. A link to the survey was posted on the homepages of the NOAA Fisheries and MAFAC websites and sent to the 10,000 people who receive the NOAA Fisheries e-newsletter, *FishNews*. Additionally, it was distributed to the networks of

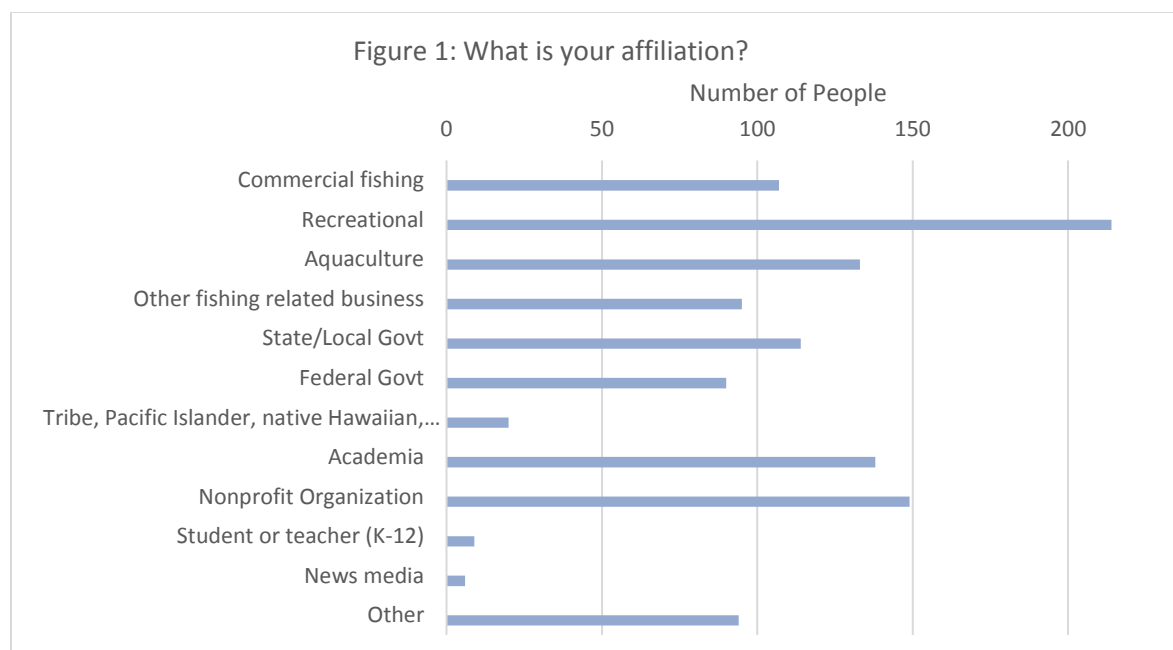
The survey was available for a period of 30 days during which time it was completed by 820 people. The survey tool can be found in Appendix A.

For several survey questions, respondents were permitted to check more than one possible answer, and this is noted in the discussion of results. Additional details on the survey methodology and its limitations can be found in Appendix B.

## 3. Results

### 3.1 RESPONDENT PROFILE

Responses were received from 820 individuals. For many questions, respondents could select more than one answer. Most respondents identified themselves as recreational anglers or charter for-hire, followed by commercial fishermen or industry representatives, researchers, managers, and affiliated with non-profits (Figure 1).



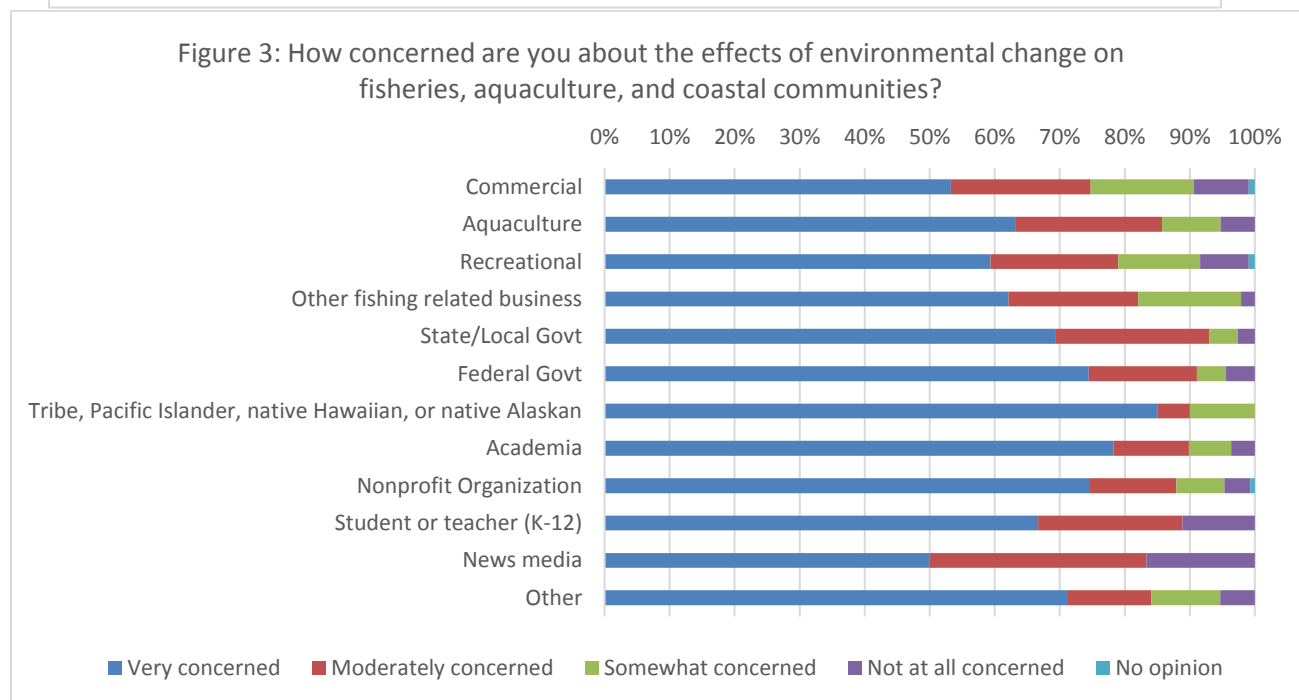
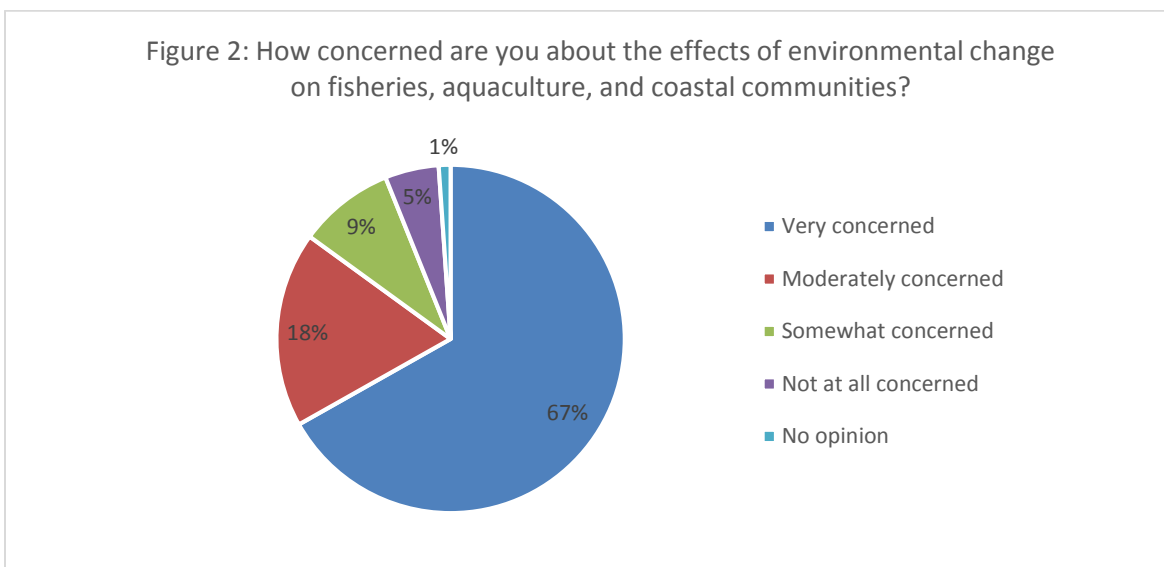
Respondents were primarily interested in information for the New England, West Coast, Mid Atlantic, and Alaska regions. However, it is important to note that respondents were asked to identify the region they are most interested in, rather than the region where they reside. For example, a fisherman who lives

in Bellingham, WA but who fishes in the Bering Sea may indicate her interest in Alaska, not the west coast. A saltwater angler who lives in Maryland but mostly enjoys fishing in Florida would indicate his interest in the Gulf of Mexico and South Atlantic, not the Mid-Atlantic. Given the highly mobile nature of many U.S. fishing sectors, the working group determined that the geographic focus of respondents' fishery related activities was more consistently relevant to questions this survey seeks to answer than their place of residence. However, this choice makes it impossible to tease out differences between small, local fisheries and more mobile groups. Geography is important, but NOAA should consider carefully how best to frame these questions to inform its communication strategy.

Most respondents heard about the survey from a direct email from NOAA or email from another source.

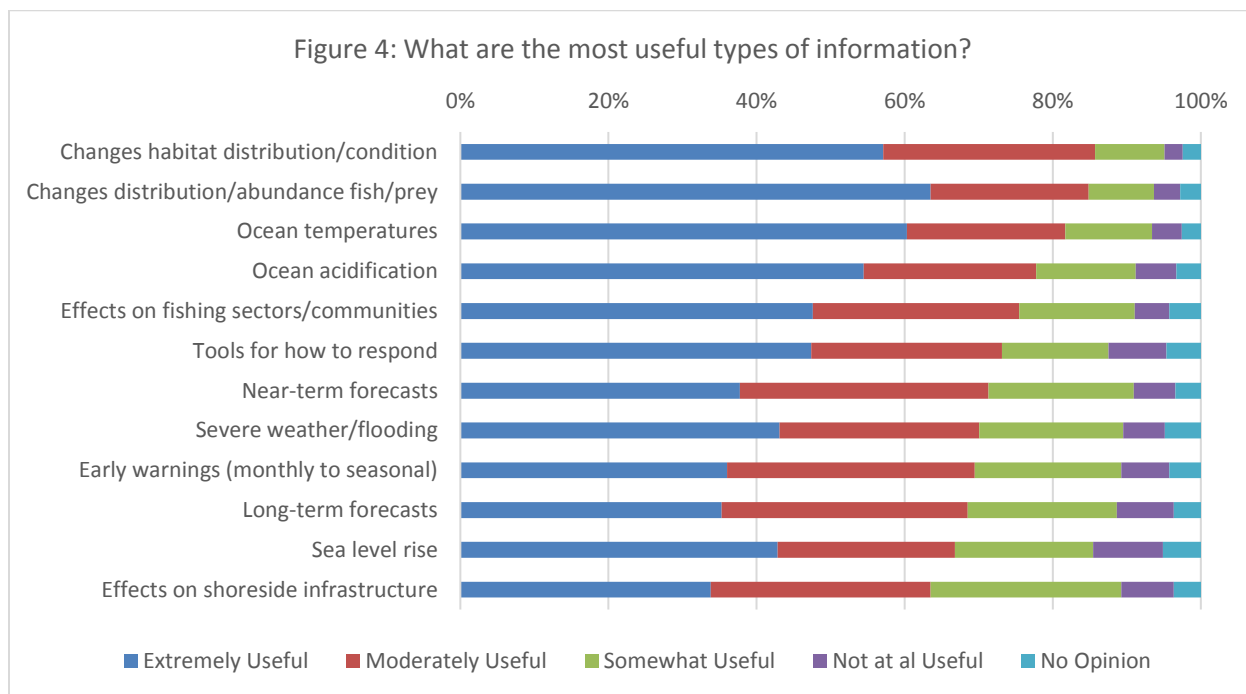
### 3.2 OVERALL RESULTS

The following is a summary of the responses to each of the seven survey questions.



**Level of concern:** Overall, 85% of respondents indicated that they are “very concerned” or “moderately concerned” about the effects of environmental change on fisheries, aquaculture, and coastal communities - 6% indicated that they are either “not at all concerned” or hold no opinion (Figure 2). Exact percentages varied across stakeholder groups and regions. The most concerned stakeholder groups (those responding as very or moderately concerned) were State/ Local Government (93%), Federal government (91%), NGOs (87%), aquaculture (86%), tribes, Pacific Islander, native Hawaiian, or native Alaskan (90%), and academics (90%) (Figure 3). Other stakeholder groups also reported high levels of concern: commercial fishing (74%), recreational fishermen (79%). *Bottom line, environmental change is a pressing concern for a significant majority of fishery, aquaculture, and coastal community stakeholders.*

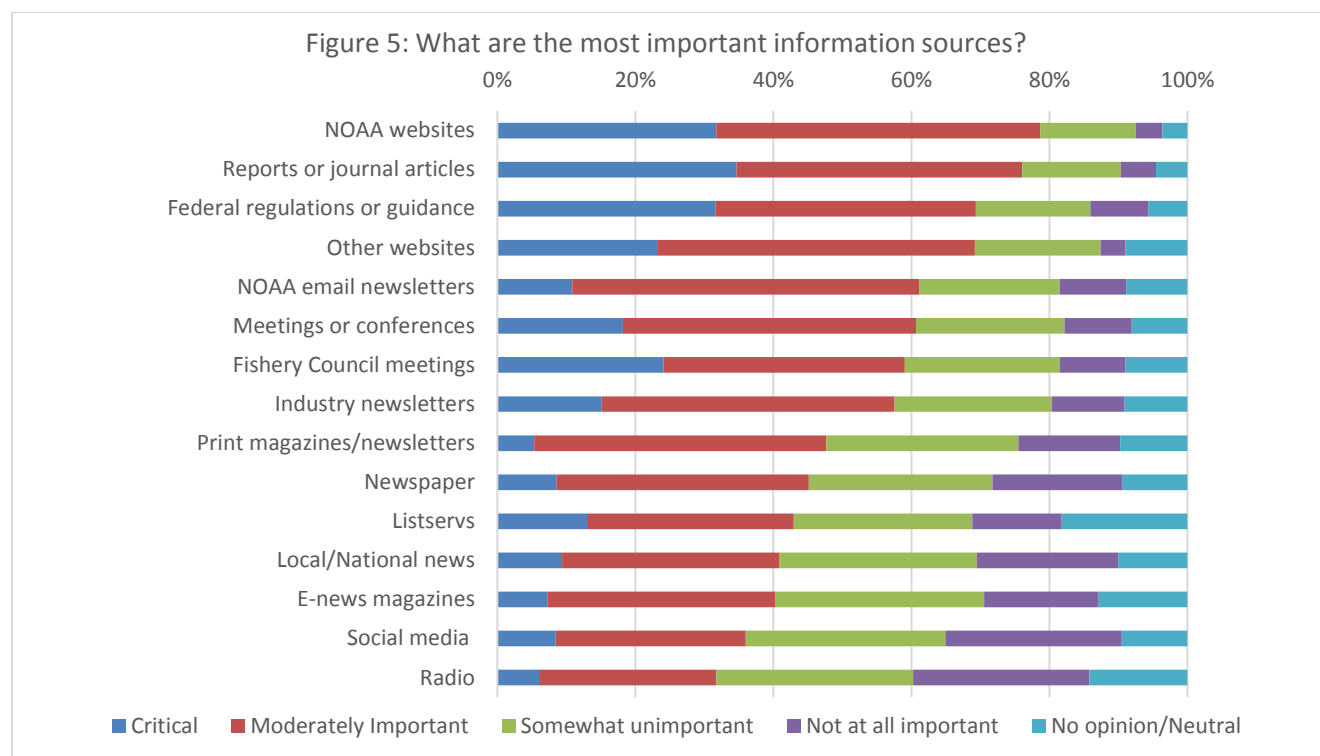
**Most useful information types:** The information types ranked as most useful to people were changes in fish/prey distribution, changes in habitat distribution or condition, and changing ocean temperatures (Figure 4). The information types reported as least useful of the choices provided were the effects of environmental change on shoreside infrastructure, long-term forecasts (>5 years) of future ocean conditions, and sea level rise, but even these were ranked overall as moderately to somewhat useful. 89 people wrote in other information sources that would be useful to them, including real-time displays of data regarding rate of change and future forecasts (16 people), short- and long-term forecasts in watershed-specific hydrological conditions (i.e., stream flow, temperature, ice cover, riverine impacts) (9 people), and potential economic and cultural impacts of climate change on coastal communities for fishing and aquaculture (6 people).



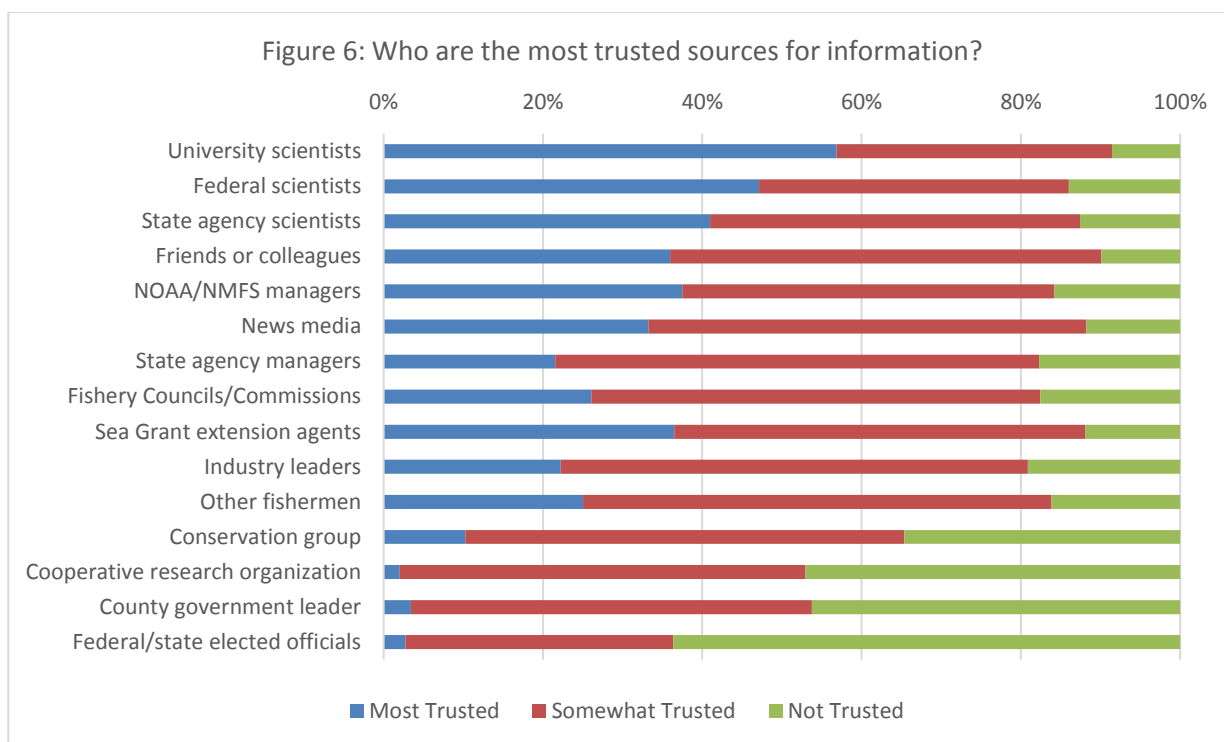
**Information sources:** The most important information sources on the effects of environmental change for respondents were NOAA websites, reports or journal articles, and industry newsletters (Figure 5). Of the options provided, the least important sources for the survey-takers were social media, listservs, and e-news magazines. It is worth noting that respondents were asked to rank options on a scale of 1 (Extremely useful) to 4 (Not at all useful), with 5 representing no opinion. No information source was rated as “extremely useful”. On average, the three most important sources were rated only as “moderately useful.”

Respondents were asked to write in their top 3 most used sources of information; 610 people responded. Of those, 62 mentioned personal colleagues and word of mouth; 69 listed NOAA newsletters (9 people specifically said *FishNews*); and 68 people identified print magazines including *National Fisherman* (23 people) and trade magazines. The NOAA websites most useful to respondents were the

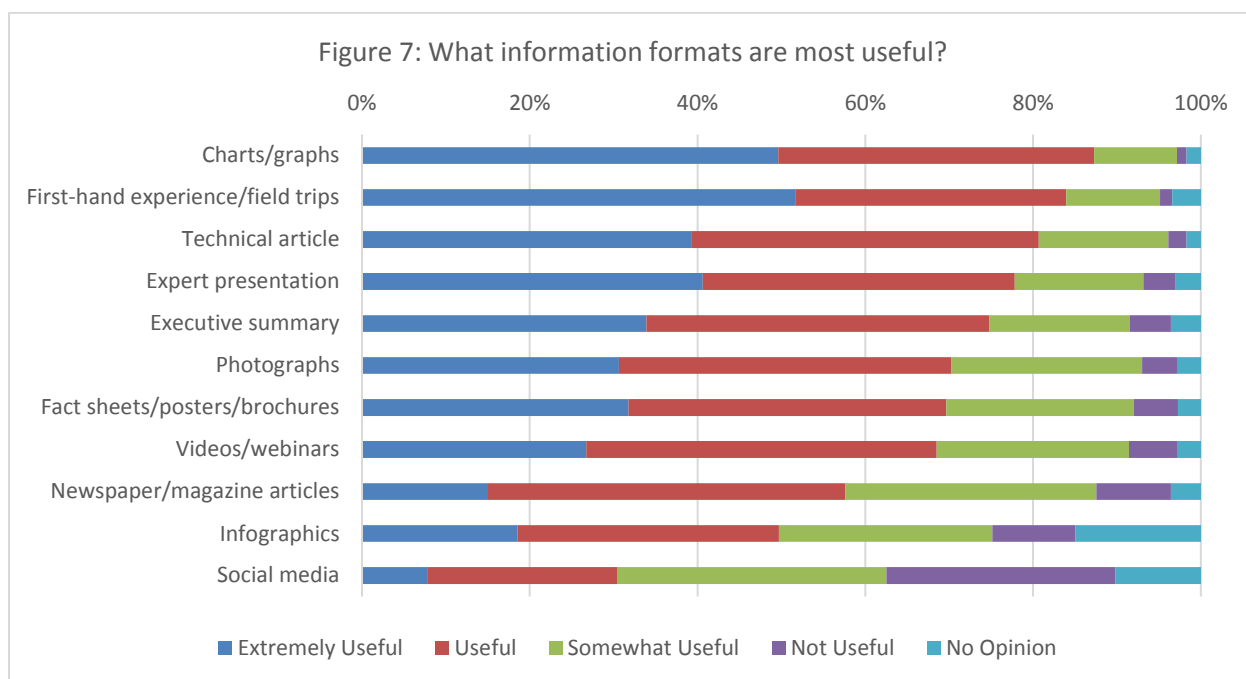
Weather/Tide/Current information sites (58 people) and the National Data Buoy Center (18 people). Fishery Management Council websites were mentioned by 27 people, and an additional 29 people mentioned Council meetings as an important source of information. Radio was identified by 44 people, including 15 mentions of National Public Radio. There were 161 mentions of journal articles, with NOAA technical reports mentioned 14 times, and American Fisheries Society mentioned 11 times.



**Trusted Experts:** The most trusted/credible experts for information of environmental change for respondents overall were university scientists, followed by federal scientists and state agency scientists (Figure 6). For responses by sector/affiliation, respondents generally considered people with the same affiliation as them to be the most trusted sources. The least trusted sources were news media, federal or state elected officials, county or municipal government leaders, and conservation group representatives.

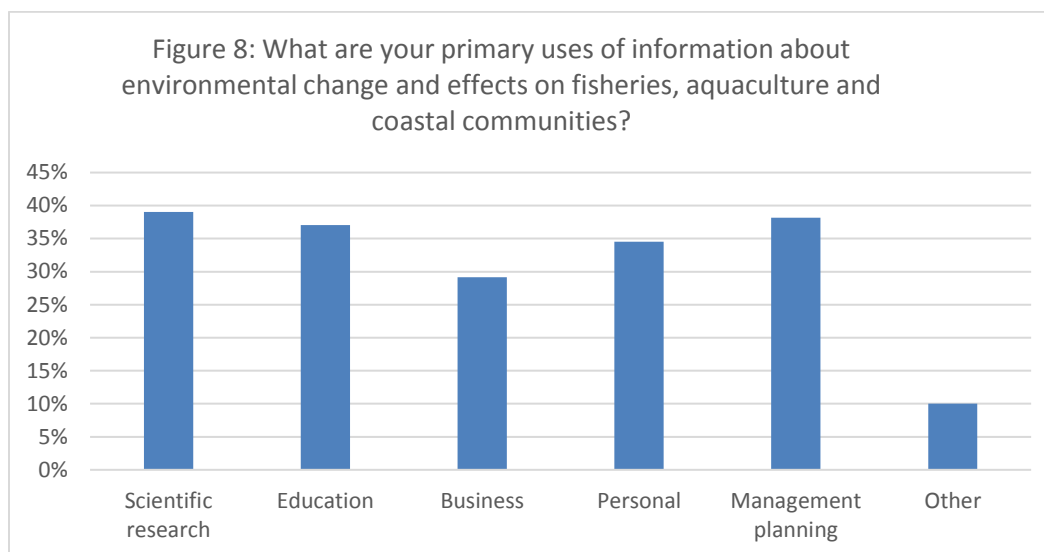


**Information Formats:** The survey respondents considered charts/graphs, first-hand experience, and technical articles to be the most useful information formats (Figure 7). The least useful information formats were social media and infographics.



**Primary use for environmental change information:** Survey respondents were asked to identify their primary use of information about environmental change (more than one option could be selected). Responses indicate the greatest use of this information is in scientific research (46%) and management planning (45%), with fewer reporting using it for business purposes (34%)(Figure 8). This may suggest that respondents see few opportunities to act within their business operations to respond to environmental

change, see that action is more appropriately in the realm of research or management planning, or that the information products currently provided do not meet the needs of their business, or some combination.



**Model communications:** E-newsletters were the most popular response to the question asking respondents to identify a NOAA communication that had impressed them favorably (50 out of 222 responses). Of the E-newsletters respondents mentioned, *FishNews* (7 people) was noted most frequently. NOAA websites were mentioned by 28 respondents, while 21 respondents identified specific government reports. Videos or webinars distributed by NOAA were highlighted by 16 people, and 39 people mentioned personal interactions that were favorable. NOAA research studies were also mentioned by six respondents.

### 3.3 RESPONSES BY AFFILIATION/SECTOR

The sections below report high-level findings by respondent self-identified affiliation. Respondents were able to select more than one affiliation if desired.

#### Commercial Fishing

- 107 respondents selected Commercial Fishing as their affiliation.
- 75% were either very or moderately concerned about the effects of environmental change on fisheries, aquaculture, and coastal communities.
- The most useful information types for this sector were changing ocean temperatures, changes in distribution or abundance of fish or prey, and changes in habitat distribution or condition.
- NOAA websites were the most important source, followed by industry newsletters, Fishery Management Council meetings, and Federal regulations or guidance.
- Industry leaders and friends or colleagues were seen as the most credible sources of information, followed by university scientists and other fishermen.
- First-hand experience and field trips were seen by this sector as the most useful information source, followed by charts or graphs.
- This sector uses information about environmental change primarily for business, personal, and management planning purposes.

#### Recreational Fishing

- With 214 responses, the recreational fishing sector had the highest number of individuals responding to the poll.



- This sector represents a broad cross section of interest where recreational fishing can be a job or leisure pursuit.
- For analysis purposes, the recreational fishing sector included those who selected their affiliation to be a Recreational angler, For-hire/charter/headboat captain or guide, or Crew - for-hire/charter/headboat.
- 115 of the respondents had an affiliation outside of recreational fishing, including 44 in commercial fishing, 28 in aquaculture, 12 in academia, 21 in state/local government, and 38 in other fishing related businesses.
- 79% were either very concerned or moderately concerned about the effects of environmental change on fisheries and coastal communities.
- Recreational fishermen chose changes in distribution of fish or prey as the information they felt would be most useful to them, changes in habitat distribution or condition as the second most valuable set of information, and effects on fishing sectors or communities as a close third.
- Preferred information sources were NOAA websites, with federal regulations or guidance second, and reports or journal articles a close third.
- University scientists were their most trusted sources of information about the effects of environmental changes, followed by friends or colleagues, federal and state agency scientists, and NOAA or NMFS managers.
- The information formats most preferred were charts or graphs followed by personal experience and field trips and then technical articles. These responses were similar to those of other sectors.
- Of the 214 recreational fishermen who responded to the survey, 130 reported that their primary use of information about environmental changes was personal.
- 90 recreational fishermen (42%) responded that their primary use of the information was for business, which suggests that at least some of the respondents in this sector are engaged in the business of recreational fishing (shoreline fishing guides, charter boat crew, tackle stores, coastal accommodations, etc.) or other marine related business, or that they have a fishing-related business and also enjoy fishing recreationally.

### **Aquaculture**

- 133 respondents to the survey identified themselves as participating in aquaculture.
- 86% said they were very or moderately concerned about the effects of environmental change.
- This sector was most interested in information associated with changing ocean temperatures, ocean acidification and other changes to ocean chemistry, and changes in habitat distribution or condition. These interests may vary among land-based, estuarine, and open ocean aquaculture practitioners due to their different locations.
- Reports or journal articles, industry newsletters, and information provided on NOAA websites were identified as the most important sources of information about environmental changes.
- The experts they identify as most credible are university scientists, Sea Grant extension agents, industry leaders, and federal scientists.
- Along with commercial fishermen, this group indicated the greatest need for information on environmental changes for business purposes (57% of respondents)
- Charts or graphs, technical articles, and first-hand experience and field trips were identified as the most useful forms of information.

### **Other Fishing-related Industry**

- 94 respondents selected this affiliation.
- Their primary use for information was business or personal.
- They were primarily interested in data on distribution of fish and changes in habitat.
- They were least interested in information on sea level rise compared to other kinds of information listed.
- They mostly rely on federal regulations and guidance, reports or journal articles, NOAA websites, and Fishery Management Council meetings for information on environmental changes.
- Industry leaders, university scientists, and other fishermen were seen as the most trusted sources of information.

## State and Local Government

- 114 respondents associated themselves with the state/local government sector.
- They were most interested in changes in distribution or abundance of fish or prey, and changes in habitat and changes in ocean temperature.
- Additionally, this sector indicated that tools to respond to environmental change would be useful for them.
- The State and Local Government sector is similar to others in that it prioritizes NOAA websites, journal articles, and federal regulations as sources of information.
- The State and Local Government sector primarily uses the information for management planning.
- This sector found charts and graphs to be the most useful information format, while also valuing expert presentations, field trips, and technical articles.
- This sector expressed higher trust in scientists (university, federal, and state), compared to responses from other sectors.

## Federal Government

- 90 respondents identified themselves with the Federal Government sector.
- 91% were very or moderately concerned about environmental changes for fisheries and coastal communities.
- Their primary use for the information was for scientific research, education, and management planning.
- University and federal scientists as well as NOAA/NMFS managers were their most trusted experts.
- This sector found NOAA websites and journal articles to be the most important information sources for environmental change.
- This sector found technical articles, expert presentations, and graphs and charts to be the most useful information formats.

## Tribe, Pacific Islander, Native Hawaiian, or Native Alaskan

- 20 respondents selected this affiliation.
- This sector comprised only 2% of the responses, but had the highest percentage of respondents (85%) that are very concerned about the effects of environmental change on fisheries, aquaculture, and coastal communities. 90% of tribal respondents were either very or moderately concerned about the effects of environmental change.
- This sector was most interested in changes in distribution or abundance of fish or prey, as well as changes in ocean temperature, changes in habitat distribution or condition, and ocean acidification and other changes in ocean chemistry.
- The information sources that this sector preferred included Federal regulations or guidance, NOAA websites, and reports or journal articles.
- The least favored information sources were social media and listservs.
- This sector's most trusted experts were university scientists, friends or colleagues, and federal scientists, followed closely by other fishermen.
- As with other sectors, the Tribes and Indigenous Pacific Islanders sector found charts or graphs as useful information formats. This sector also found photographs to be useful, followed by first hand-experience and field trips, and videos or webinars.
- This sector used information about environmental change and its effects principally for education and management planning purposes.

## Academia

- 138 respondents were in the Academia sector.
- 90% were very concerned or moderately concerned about environmental changes for fisheries and coastal communities.
- Consistent with other sectors, the Academia sector was most interested in data on ocean temperature, impacts on fish distribution, and changes in habitat.

- The Academia sector's preferred information source by far was reports and journal articles, followed by NOAA websites and federal regulations.
- This sector had the most trust in academic, Federal, and state scientists.
- The Academia sector uses this information primarily for scientific research and education.

### **Nonprofit**

- 149 respondents were in the Nonprofit sector.
- 87% were very concerned or moderately concerned about environmental changes for fisheries and coastal communities.
- They were most interested in data on ocean temperature, impacts on fish distribution, and changes in habitat.
- NOAA websites and journal articles were their important information sources for environmental change.
- Their most trusted experts for environmental information were university, Federal, and state scientists.
- First-hand experience/field trips, expert presentations, and graphs and charts were identified as the most useful information formats.
- Their primary use for the information was for scientific research, education, and management planning.

### **Student or Teacher (K-12)**

- 9 respondents selected this affiliation, which is one of the two sectors least represented in the survey results.
- This sector was most concerned about changes in distribution or abundance of fish or prey, changes in habitat distribution or condition, and ocean acidification or other changes in ocean chemistry.
- This sector ranked social media as its top information source (the only sector to do so). Other important sources for this sector included reports or journal articles, federal regulations or guidance, and NOAA websites.
- It ranked friends or colleagues as the most trusted source of credible information, followed by state agency scientists and university scientists, Sea Grant extension agents, and members and staff of fishery management councils and commissions.
- This sector indicated that firsthand experience and field trips were by far the useful information format, followed by charts or graphs. Tied in third place were photographs, expert presentation, and social media. It was one of only two sectors to rank social media as a preferred information format.
- This sector uses information about environmental change principally for scientific research and education.

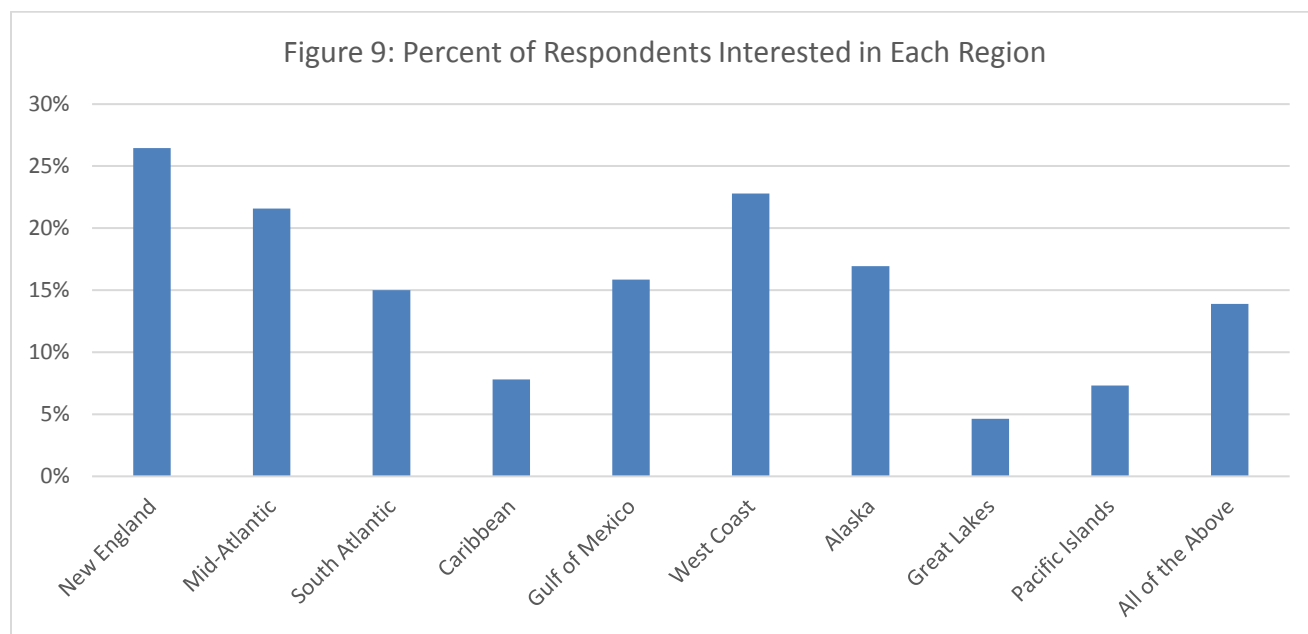
### **Other**

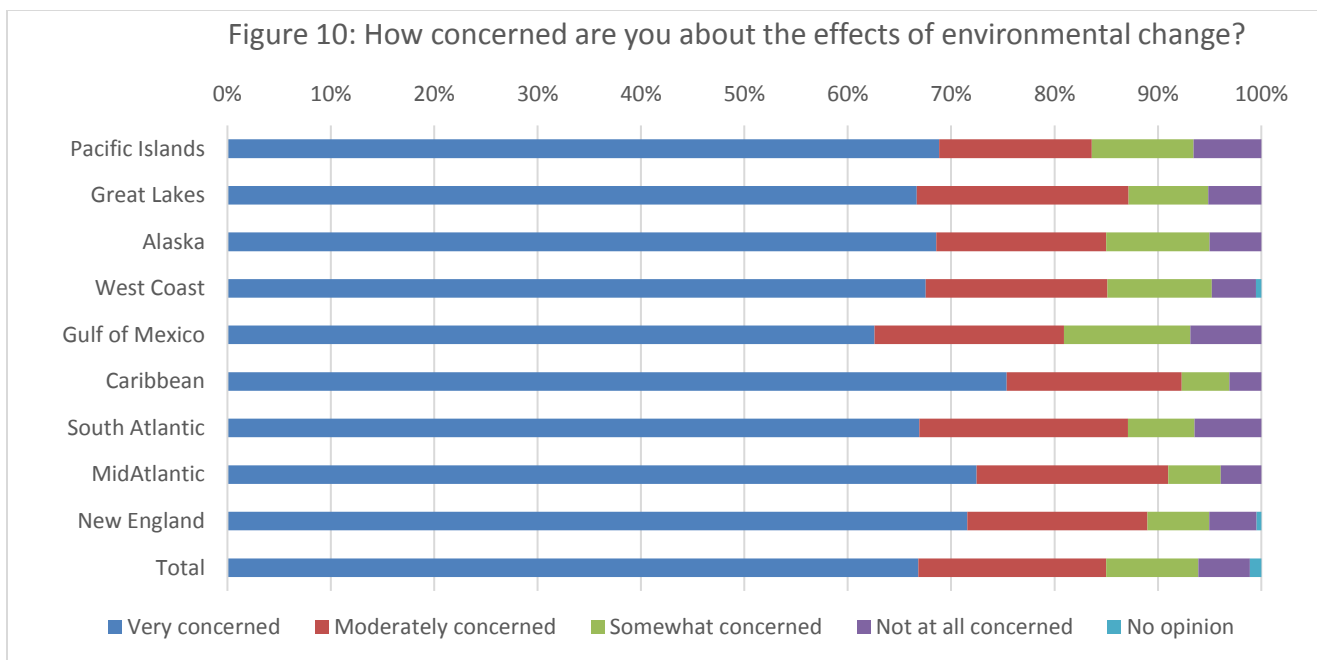
- 94 people selected "other" as their affiliation.
- Of respondents who wrote in affiliations, 57 responses fit in affiliations already presented; 40 respondents' affiliations were new categories; and 1 respondent answered "no."
- Of the new categories, 17 people were in an environment/marine-related business; 8 people were in fisheries management, and 14 people were in a non-marine/environmental related business (i.e. retail, contractor, etc.).
- 84% were either very or moderately concerned about the effects of environmental change on fisheries and associated sectors.
- Information about changes in distribution/abundance in fish or prey, changes in habitat distribution or condition, changing ocean temperatures, and ocean acidification were the most useful for them.
- NOAA websites were the most important information source for them, followed by Federal regulations or guidance, and reports or journal articles.

- The most trusted experts for this group were university, Federal, and state agency scientists and NOAA/NMFS managers.
- They found charts or graphs, field trips/first hand experiences, and expert presentations to be the most useful information formats.
- Respondents in this group were fairly evenly split among their use of this information for business, personal, management planning, scientific research, and education purposes.

### 3.4 RESPONSES BY REGION OF INTEREST

As noted above, respondents had the ability to select which region they were most interested in regarding the effects of environmental change. This region may or may not correspond with where a respondent lives. The regions of interest were fairly well distributed, with fewer people indicating an interest in the Caribbean, Pacific Islands, and Great Lakes (Figure 9). Levels of concern about the effects of environmental change were fairly similar across regions (Figure 10), with the highest levels of concern in the Caribbean. Likewise, the top responses to the other survey questions were generally consistent across regions (Table 1), with a few exceptions.





<b>Table 1. Top 3 responses for selected survey questions by respondents' region of interest. (Top 4 are included when there was a tie). Responses in red text differed from the top responses in other regions.</b>					
	NEW ENGLAND (217 respondents)	MID ATLANTIC (177 respondents)	SOUTH ATLANTIC (123 respondents)	CARIBBEAN (64 respondents)	GULF OF MEXICO (130 respondents)
Q 2. Most useful information	<ul style="list-style-type: none"> <li>○ Changes in habitat distribution or condition</li> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Changing ocean temperatures</li> </ul>	<ul style="list-style-type: none"> <li>○ Changes in habitat distribution or condition</li> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Changing ocean temperatures</li> </ul>	<ul style="list-style-type: none"> <li>○ Changes in habitat distribution or condition</li> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Changing ocean temperatures</li> </ul>	<ul style="list-style-type: none"> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Changes in habitat distribution or condition</li> <li>○ Sea Level Rise</li> </ul>	<ul style="list-style-type: none"> <li>○ Changes in habitat distribution or condition</li> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Severe weather or flooding</li> </ul>
Q3. Top sources	<ul style="list-style-type: none"> <li>○ Reports and Journal Articles</li> <li>○ NOAA websites</li> <li>○ Federal Regulations or guidance</li> </ul>	<ul style="list-style-type: none"> <li>○ NOAA websites</li> <li>○ Reports and Journal Articles</li> <li>○ Federal Regulations or guidance</li> </ul>	<ul style="list-style-type: none"> <li>○ Reports and Journal Articles</li> <li>○ NOAA websites</li> <li>○ Federal Regulations or guidance</li> </ul>	<ul style="list-style-type: none"> <li>○ Reports and Journal Articles</li> <li>○ NOAA websites</li> <li>○ Federal Regulations or guidance</li> </ul>	<ul style="list-style-type: none"> <li>○ NOAA websites</li> <li>○ Reports and Journal Articles</li> <li>○ Federal Regulations or guidance</li> </ul>
Q5. Most trusted experts	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ State agency scientists</li> </ul>	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ State agency scientists</li> <li>○ NOAA &amp; NMFS managers</li> </ul>	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ State agency scientists</li> </ul>	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ NOAA &amp; NMFS managers</li> </ul>	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ State agency scientists</li> </ul>
Q7. Most useful formats	<ul style="list-style-type: none"> <li>○ First-hand experience/field trips</li> <li>○ Charts/graphs</li> <li>○ Technical articles</li> </ul>	<ul style="list-style-type: none"> <li>○ Charts/graphs</li> <li>○ First-hand experience/field trips</li> <li>○ Technical articles</li> </ul>	<ul style="list-style-type: none"> <li>○ Charts/graphs</li> <li>○ First-hand experience/field trips</li> <li>○ Technical articles</li> </ul>	<ul style="list-style-type: none"> <li>○ Charts/graphs</li> <li>○ First-hand experience/field trips</li> <li>○ Expert Presentations</li> </ul>	<ul style="list-style-type: none"> <li>○ Charts/graphs</li> <li>○ First-hand experience/field trips</li> <li>○ Technical articles</li> </ul>
Q9. Primary info use	<ul style="list-style-type: none"> <li>○ Scientific research</li> <li>○ Education</li> <li>○ Management Planning</li> </ul>	<ul style="list-style-type: none"> <li>○ Scientific research</li> <li>○ Education</li> <li>○ Personal</li> </ul>	<ul style="list-style-type: none"> <li>○ Education</li> <li>○ Scientific research</li> <li>○ Personal</li> <li>○ Management Planning</li> </ul>	<ul style="list-style-type: none"> <li>○ Education</li> <li>○ Scientific research</li> <li>○ Personal</li> </ul>	<ul style="list-style-type: none"> <li>○ Scientific research</li> <li>○ Education</li> <li>○ Personal</li> </ul>

TABLE 1, Continued

	WEST COAST (187 respondents)	ALASKA (139 respondents)	PACIFIC ISLANDS (60 respondents)	GREAT LAKES (38 respondents)
Q 2. Most useful information	<ul style="list-style-type: none"> <li>○ Changing ocean temperatures</li> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Ocean acidification/other changes in ocean chemistry</li> </ul>	<ul style="list-style-type: none"> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Changing ocean temperatures</li> <li>○ Changes in habitat distribution or condition</li> </ul>	<ul style="list-style-type: none"> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Effects on fishing sectors or communities</li> <li>○ Changing ocean temperatures</li> </ul>	<ul style="list-style-type: none"> <li>○ Changes in distribution or abundance of fish or prey</li> <li>○ Changes in habitat distribution or condition</li> <li>○ Near-term forecasts of ocean and resources</li> </ul>
Q3. Top sources	<ul style="list-style-type: none"> <li>○ NOAA websites</li> <li>○ Reports and Journal Articles</li> <li>○ Federal Regulations or guidance</li> </ul>	<ul style="list-style-type: none"> <li>○ Reports and Journal Articles</li> <li>○ NOAA websites</li> <li>○ Federal Regulations or guidance</li> </ul>	<ul style="list-style-type: none"> <li>○ NOAA websites</li> <li>○ Reports and Journal Articles</li> <li>○ Federal Regulations or guidance</li> </ul>	<ul style="list-style-type: none"> <li>○ Reports and Journal Articles</li> <li>○ Federal Regulations or guidance</li> <li>○ Meetings and Conferences</li> </ul>
Q5. Most trusted experts	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ State agency scientists</li> </ul>	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ NOAA and NMFS managers</li> </ul>	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ NOAA and NMFS managers</li> </ul>	<ul style="list-style-type: none"> <li>○ University scientists</li> <li>○ Federal scientists</li> <li>○ NOAA and NMFS managers</li> </ul>
Q7. Most useful formats	<ul style="list-style-type: none"> <li>○ First-hand experience/field trips</li> <li>○ Charts/graphs</li> <li>○ Technical articles</li> </ul>	<ul style="list-style-type: none"> <li>○ Charts/graphs</li> <li>○ First-hand experience/field trips</li> <li>○ Expert Presentations</li> </ul>	<ul style="list-style-type: none"> <li>○ Charts/graphs</li> <li>○ First-hand experience/field trips</li> <li>○ Technical articles</li> <li>○ Expert Presentations</li> </ul>	<ul style="list-style-type: none"> <li>○ Charts/graphs</li> <li>○ Technical articles</li> <li>○ First-hand experience/field trips</li> </ul>
Q9. Primary info use	<ul style="list-style-type: none"> <li>○ Management Planning</li> <li>○ Scientific research</li> <li>○ Education</li> </ul>	<ul style="list-style-type: none"> <li>○ Scientific research</li> <li>○ Management Planning</li> <li>○ Education</li> </ul>	<ul style="list-style-type: none"> <li>○ Management Planning</li> <li>○ Education</li> <li>○ Scientific research</li> <li>○ Personal</li> </ul>	<ul style="list-style-type: none"> <li>○ Scientific research</li> <li>○ Education</li> <li>○ Personal</li> <li>○ Management Planning</li> </ul>

## 4. Key Findings

The survey served as an initial foray into the concerns and information needs and preferences of NOAA stakeholders or customers related to changing climate and ocean conditions. The results from this survey can be used by decision-makers to guide how to deliver needed information on changing conditions in the most useful formats to NOAA stakeholders and customers. The basic demographic information obtained during this survey can be used to provide targeted recommendations to the agency regarding optimal communication strategies for different stakeholder groups and regions. Based on the demographic information, there is insufficient information about Teachers/Students (K-12), Tribal/Pacific Islanders, nor news media to draw conclusive results about their preferences. Information from the Great Lakes, Caribbean and Pacific Islands should also be enhanced. More research should focus on these groups and regions to understand how to reach or engage those constituents and identify those challenges for NOAA. Overall, this survey is an initial milestone in providing the agency with an overview of those areas that require additional attention through follow up surveys and/or other engagement activities.

### 4.1 Priority Interests

1. There is ***significant concern*** about changing conditions of marine and coastal ***ecosystems*** among all regions and sectors. This level of concern justifies prioritization of continued development and delivery of useful information. The vast majority of respondents were either very concerned or moderately concerned with the effects of environmental change on ***fisheries, aquaculture, and coastal communities***. NMFS should continue to understand and forecast the potential magnitude and scope of these effects on stakeholders and develop strategies to help address them.
2. NMFS should prioritize providing information on changes in ***distribution or abundance of fish or prey, changes in habitat distribution or condition, and changing ocean temperatures***. These three types of information were viewed as most useful across all respondents. NOAA Fisheries should continue to strengthen efforts to track and assess marine ecosystem conditions in each region for inclusion in the NOAA Fisheries Ecosystem Status Reports.
3. NOAA must continue to ***maintain the value of its scientific content*** even while engaging the public through social media and visually appealing communications.
4. Many of the survey responses echo findings and input received from internal and external sources in development of the NOAA Fisheries Climate Science Strategy. There is ***opportunity to engage other partners and customers in implementation of the strategy in each region***.

### 4.2 Formatting Preferences

5. ***NOAA websites, reports/journal articles, and federal regulations/guidance*** were viewed as the top 3 information sources. NOAA should continue to utilize those information mechanisms to convey important information in the future, but there is room for improvement. No products were rated higher than “moderately useful,” either overall or among any group.
6. The most useful information formats were ***charts/graphs, first-hand experience and field trips, and technical articles***. These formats should be continued and utilized to the extent possible.
7. Encourage ***use of meaningful and plain language*** in reports when discussing indicators and worry/ trigger points. When interesting information is available, consider the most useful ways to package or bundle it. NOAA should consider if language translation is needed for materials; the survey did not address this potential need.

### 4.3 Future Engagement Strategies

8. Federal government staff were most frequently seen as regional leaders in understanding and addressing environmental change. NMFS should ***continue this leadership role*** by providing useful information for its customers.



9. Since university, Federal, and state agency scientists were seen overall as the most credible sources of information regarding environmental change, NMFS should continue to *use experts as spokespeople* to convey important information.
10. Sectors aligned as very concerned about environmental change, but did not find any information formats “very” useful (no perfect scores), reflecting *need for improving delivery methods* to satisfy interests in this topic. For example, commercial and recreational fishermen, “other” fishing, Tribe and Pacific Islander groups indicated that they are very concerned about environmental change and that specific types of information were “very” useful, but they did not show a strong feeling about the methods of delivery. This finding suggests need to consider mediums recommended by sectors for future use in targeted outreach campaigns.

#### 4.4 Future Survey Considerations

11. NOAA customers align with multiple groups. Providing respondents with the option to select multiple cross-disciplinary responses creates difficulty in identifying sectoral or regional opinions. Additionally, ascertaining whether the respondent is providing their opinion based on livelihood dependency, recreational, or personal interest would be helpful. Future coastal community surveys may want to add the sectoral category of boating-related business.
12. The timing of the survey may affect responses if distributed amongst many other surveys or if during a time of peak public interest.
13. Question phrasing is influential. Questions may need to be repeated in different surveys to confirm conclusions or be specific to reflect desired output.
14. The low number of responses from stakeholders that identified themselves as tribes, Pacific Islander, native Hawaiian, or native Alaskan, or those from the Caribbean indicates our survey did not reach this group well. Overall these groups indicated a high level of concern, yet despite our comprehensive survey distribution, the working group was not successful in engaging them in meaningful numbers. Lack of access to internet and translated versions into other languages were likely barriers for certain groups. NOAA should be aware that outreach strategies may miss these groups, and of the limitations of this study in understanding their needs with particular focus on carefully considering challenges of disseminating information to remote communities and language barriers.

## 5. Recommendations

Based on the key findings highlighted above, the Task 5 subgroup recommends the following actions for consideration during the implementation of the NOAA Fisheries Climate Science Strategy and other relevant communications:

- NMFS should review the results of this survey in detail to identify specific priorities and gaps in communications by sector and region.
- Once identified, these specific needs and hypothesized conclusions should be verified by additional targeted surveys or user-accessible data collection efforts. The preferred outreach and delivery strategies of stakeholder and customers should be used to increase participation amongst sectors and increase credibility of post-survey analysis.
- Using findings from survey efforts, NMFS should measure and track the effectiveness of communications considerate of multiple levels of understanding of information and the diversity of purpose and sector. NMFS should also integrate relevant strategies in tool development.