



Best approaches and future needs to prepare fishing communities and fishing-dependent sectors for the impacts of climate change

August 2017

Executive Summary

Members of the Marine Fisheries Advisory Committee (MAFAC) and MAFAC's Climate and Marine Resources Task Force formed a subgroup (subgroup Task 4) to identify the best approaches and future needs to assist fishing communities and fishing-dependent sectors prepare for the impacts of climate change. NOAA-sponsored a workshop, "Advancing Resilient Fishing Communities in a Changing Climate: Challenges and Opportunities"¹ in May of 2016 that some of the subgroup members attended. The workshop provided information that facilitated the development of an action plan to address Task 4.

Subgroup members interviewed climate change adaptation practitioners from six U.S. fishing communities involved in community resiliency projects. Gleaned from the interviews were information, ideas, and advice on how to: initiate adaptive planning, plan for and improve stakeholder and community engagement, identify appropriate planning practitioners², select scientific experts that would be trusted, and hold productive meetings, among other topics.

The subgroup's overall recommendations are:

- NOAA should prioritize and provide funding for climate change adaptive planning for fishing-dependent sectors - both for creation of the initial community plans and the maintenance and updating of these plans.
- A practitioner's guide and training course should be created by NOAA to improve the effectiveness of the planning process.

Introduction

In October 2015, NOAA Fisheries charged the 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. Six tasks were identified by MAFAC members and they engaged their Climate and Marine Resources Task Force members in this work.

The subgroup for Task 4 was charged with identifying the best approaches and future needs to prepare fishing communities and fishing-dependent sectors for the impacts of climate change.

¹ The May 2016 Workshop report is available by request through the NOAA Fisheries Office of Policy.

² A practitioner is an individual or group with expertise in: climate change adaptation planning, strategic community planning, assessment of impacts and vulnerabilities to risk events, or engaging communities to more effectively manage risk. The expertise has generally come from Sea Grant programs, university researchers, or non-profit organizations.

Impacts of climate change have typically focused on coastal community infrastructure threats due to sea level rise, storm surge, coastal flooding, and changes in historical rainfall patterns and levels. There are many case studies of community planning processes to adapt to these types of threats; however, the task force experience was that there were few examples of fishing community planning processes that address the specific climate change impacts for these stakeholders. Examples of these additional climate change impacts on fishing communities are the result of changes to the resources they are dependent upon. These include changes in fisheries species composition, productivity, and distribution due to changing ocean conditions (e.g. warming waters); emergence of harmful algal blooms and bacterial or viral diseases; introduction or survival of invasive species; oxygen-minimum zones where fish and shellfish cannot live; ocean acidification; increased frequency and severity of storms; and reduced productivity of spawning and rearing waters.

While there is growing information on the impacts of changing climate on ocean conditions and marine resources, there is little information on where, when, and how these changes will impact different fishing communities and fishing sectors, and how to prepare for and respond to these changes.

Fishing community residents are dependent on marine resources for both economic and personal well-being through involvement in commercial, recreational, and subsistence fisheries. Change is a constant issue for harvesters, processors, and fishery-dependent communities due to the natural fluctuations in fish stocks, global market pricing, and the ever-changing regulatory environment. Yet, climate change adds another layer of uncertainty that participants need to understand and plan for. Successful fishing communities and sectors must have access to healthy, productive, and sustainable fishery stocks to remain economically viable especially for those fishing communities that are highly dependent upon the local fishery stocks right outside the community's front door.

Methods

Following the October 2015 MAFAC meeting, seven MAFAC and Climate and Marine Resources Task Force members identified their interest in Task 4, “*Identify best approaches and future needs to prepare fishing communities and fishing-dependent sectors for the impacts of climate change.*” The group developed this work plan:

- Review the social and economic comments that MAFAC submitted on the NMFS Climate Science Strategy (in spring 2015).
- Participate in the NOAA-sponsored a workshop, “*Advancing Resilient Fishing Communities in a Changing Climate: Challenges and Opportunities*” in May of 2016 to better understand community issues and meet practitioners.
- Review any other relevant literature and existing tools/resources on this topic
- Identify case studies of communities that have attempted to address social and economic challenges and the future risks they perceived, review the documentation available, and develop a short report that provides background, problem statement, planning process used, action plan and its implementation, a conclusion, and future needs.
- Conduct interviews with practitioners or fishermen who worked on the community projects identified to gather more information and lessons learned.

- Develop a final report and recommendations.

The Task 4 subgroup discovered six examples of fishing communities engaged in climate change planning processes across the U.S.

- Rhode Island Fishermen
- South Thomaston, Maine Lobster fishermen
- Wellfleet, Massachusetts shellfish fishermen
- Jamestown S'Klallum Tribe (Washington)
- Swinomish Tribe (Washington)
- Southeast Alaska Central Council of Tlingit and Haida Indian Tribes

The goal of each interview with these groups was to understand how their process functioned to determine if there were lessons learned that could be adapted to enhance fishing community resiliency planning processes for other fishing communities. Each interview had a lead interviewer from the Task 4 subgroup, a second member to assist with the questions and discussion, and a NOAA Fisheries staff member assisted by taking notes.

Summary of interview results

Case study summaries for each of the six examples are included in Appendix A, and this report summarizes the results of these interviews. The results are organized by the topics discussed during the interviews with the community climate change practitioners.

1. Initial engagement of practitioners and communities

a. How did communities and practitioners link up?

In most cases, the researchers or practitioners who have sought grant funding to conduct this work contacted the communities rather than the other way around. In some cases, open workshops that educated fishing communities about potential climate change impacts resulted in the communities identifying their interest in a planning process and they approached the workshop leaders for assistance. In one case, the effort was very “bottom up” within the fishing community which had a very engaged fisherwoman directly lead the effort. It appears that climate change adaptation planning likely would not happen without some outside funding available.

- **We recommend that funds be made available for climate change adaptation planning and these funds allow some latitude for development of relationships between the appropriate motivated communities and educators.**

b. How can NOAA enable communication between or network communities interested in developing a plan to adapt to climate change with the practitioners that facilitate these processes?

Having valued leaders in the community participating is very important. Important questions to address from the start are: (1) does the community wish to be engaged in the topic? And, (2) is it relevant to them? Well-known, established, and organized fishing groups help to get a broader fishing community together and engaged. For example, working with a network of many tribes instead of just one or a few tribes will help further the process. Timing can also be a critical element; if a fishing community experiences some economic crisis due to a fishery crash, it will likely garnish immediate engagement by those fishery stakeholders affected.

We learned that it is important for practitioners to schedule workshops with scientists or other experts tailored for specific community fishing groups. Participation improves when the right people are involved, stakeholders know who the researchers are (e.g. Sea Grant or a local NOAA Fisheries or University scientist), meetings are held in a familiar location at convenient (to the stakeholders) times, and the practitioners interact with the fishermen to understand their issues and lifestyle. It was important to link the topics that the scientists or experts were to address directly to the issues of most concern to the fishermen which could be gleaned from preliminary interviews, surveys, or conversations (see 3a below).

Most of the practitioners stated that it's best to engage participants about the changes they are seeing themselves, on the ground, versus telling them what is changing or will change due to climate change (bottom up versus top down processes). A practitioner should search for common issues and cross-cutting themes based on conversations with the different fishing sectors. It is helpful to employ a collaborative approach that starts with a conversation with a small group then bring in additional people as the conversation expands.

Other important tools that were used include an online portal/platform that was created with active practitioners to help identify the best experts within agencies to help that community. A clearing house mechanism may be helpful to connect communities with similar problems to solve. A list of NOAA personnel and expertise would be useful to connect community interest topics with the appropriate experts.

- **We recommend the development of tools to help local fishing communities and governments prepare for climate change such as a:**
 - **Series of guide books or primers,**
 - **List of NOAA personnel and their expertise, and**
 - **Clearing house for facilitating the connection of similarly situated communities.**

2. Identification of a planning horizon

a. Did the community identify long-term versus short-term issues and risks?

These cases did not appear to directly focus on risks defined as “short” or “long” term. However, most were focused on the changes that were currently being witnessed or observed in their region and their need to adapt to those changes. This suggests that initially, and by necessity, these communities focused on short to medium term impacts.

It may be best for communities to consider adaptive planning by identifying their current issues and the potential solutions versus predicting longer term problems which may be too abstract for

the participants and the uncertainty associated with those projections. However, projecting current problems with a longer term focus could better inform long-term adaptive planning processes.

- **We recommend that the practitioner and community stakeholders focus on short to medium term impacts and planning processes initially.**

b. What was the community's perception of the risk involved?

These fishing communities were well informed. The members didn't need a primer on what climate change is – they were already seeing changes and had a list of concerns. They understood that climate change was affecting the fish and shellfish stocks and possibly the fishing communities' access to these stocks, however they needed help focusing on what the probable causes were for the changes they were experiencing, what types of short and long term risks these may pose, and how best to plan or adapt to survive into the future.

c. What types of scientific personnel were needed to answer questions and better educate the group on the specific climate changes that might be expected and the uncertainty associated with identified risks?

It's best to have key scientists or technical experts that are trusted, well respected, and good communicators who can translate the science information and link it with the issues the community members are seeing in the ecosystem. It helps if these experts are local and already involved with or familiar to the community.

The practitioners should act as facilitators – they collect questions and then work to find the right scientists or experts to answer those questions. The key to success, is engaging practitioners that value the experience and input of the fishermen.

- **We recommend that practitioners identify and engage local or trusted science and technical experts to share technical information with the fishermen.**

3. Information that needs to be gathered and presented to the community participants to enable smooth and productive meetings

a. What was the process to identify the information needed to support the planning process?

In most cases, the practitioners started the conversation by first listening to community members to hear their perspective and understand the issues of direct concern. In some cases, the practitioners gathered this input through individual stakeholder interviews, and in other instances, the input was gathered in a group meeting setting.

b. What information was gathered prior to the meeting(s) or after an initial conversation with community members?

In some cases, a community profile was developed as a resource for the practitioners at the outset, and a high level summary of on-going changes or predicted changes was compiled in

advance of group meetings, to have in hand, if the information was needed. In most cases, there was an initial conversation, and the needed, specific information was provided after the process started.

c. How and where did the group get their information?

Often, fishery stakeholders shared their local and traditional knowledge about their fisheries. Experts were brought in to make presentations to the fishing groups based on the identified interests. In-person meetings worked best – they allow for a lot of discussion and exchange of views across stakeholders and the different science disciplines. After the initial in-person meetings, follow-ups can be conducted by webinar or conference calls.

- **As with many processes, good communications, trust, and placing value in the information that the fishermen have to share themselves is important to successful processes.**

4. Regarding process

a. Did you have a single meeting or multiple meetings?

It was typically necessary to conduct multiple meetings. They were essential to build trust to allow fruitful discussions about the community's needs. Multiple meetings tend to make the community more invested in their plan, which is a stronger impetus to actually implementing the plan.

b. What were the best ways to enable smooth and productive meetings?

The practitioners served as the meeting facilitators. The community is usually not asked to facilitate or organize, but content is based on the community's needs. Flexibility is needed and we learned it was best to avoid scheduling meetings during the community's commercial fishing season. One group wanted to meet on Sunday mornings, another met evenings. Focusing on times and places convenient to the fishing community (vs. practitioners, experts, resource managers) reinforces the 'bottom up' nature of the process. However, it is also important to not let too much time go between meetings to keep momentum up, once the efforts got underway.

c. Did you have engagement or cross-communication with other fishing sectors?

The groups mostly focused on their own sector-specific issues except for in one case study. When talking across sectors, contentious issues where consensus would never be reached should be avoided.

d. Was a solution or path forward identified?

The information we gleaned on this was not conclusive, in part because most of these processes are still underway, and not necessarily completed. Some actions have been identified and accomplished but there was no clear accounting. In every case study interview, the answer was "yes," but the practitioner did not provide details regarding adaptation. Since most processes are still underway, it may have been premature to suggest a path forward at this time.

However, the practitioners and community leaders did consider their efforts successful with respect to the level of engagement they received from the fishermen. For most, the first step is education and understanding about climate change issues. The acknowledgement that changes are occurring, and the fishermen's engagement in a process that helps them deal with the change is a major first step.

e. Did the groups or practitioners have suggestions for the process?

Those interviewed had some direct recommendations for holding productive meetings:

- Provide good food and a location that the stakeholders like.
- Come up with the right length and time for the meetings, based on your own group's desires. Some preferred all day meetings while others wanted shorter 2-hour sessions.
- Have everyone in one room face-to-face - with people in the room you can find a way to keep them involved and engaged.
- Framing the effort as a learning process and building trust was important.
- Fishermen are inherently adaptive and innovative – they identify problems and come up with solutions. Practitioners and experts need to enable and support that.
- Information should be provided so that stakeholders can develop solutions.
- Depending on seasonal timing, small stipends are helpful incentives, if fishermen are expected to lose fishing or work time.

Funding was critically important. These stakeholders are the most vulnerable and have the least capacity to confront these challenges. Federal programs are needed that can facilitate the partnership of experts and practitioners with fishing communities.

5. Information to persuade a group to re-engage or continue the process.

There is significant value in creating an adaptation plan, but it will be important to mainstream the work into ongoing community or planning efforts versus having it be a one-off effort. There may be value in having regular meetings (annually) of the stakeholder group, since the system is constantly changing. How to move work forward after a grant period ends is tricky. It would be beneficial to require a work plan that creates ownership and holds participants responsible and accountable. The grant process should require grantees to update or revisit their adaptation plans annually. This creates outputs and outcomes versus just investments in a short-term educational process. For fishery communities and tribes that have staff available, those staff should continue to keep the climate change adaptation plan updated and current and continue to work with the practitioners or science experts when needed.

- **We recommend grants be structured in such a way to engage the community for both the up-front adaptive planning process, as well as the implementation and maintenance of the plan, and future reengagement of the planning processes, when needed.**

6. Funding

a. What funding sources were available to conduct the meetings with the community?

Most of the funding to support the meetings and planning efforts came, at least in part, from Federal sources:

- National Science Foundation
- NASA
- NOAA’s Regionally Integrated Science and Assessment program (RISA)
- NOAA Sea Grant
- NOAA Fisheries Saltonstall-Kennedy Grant Program NOAA’s Coastal and Ocean Climate Applications (COCA) program
- Bureau of Indian Affairs partnership
- Environmental Protection Agency, Indian General Assistance Program

Most Federal grant opportunities require matching funds which can come from state or local grant opportunities, foundations, or in-kind matches (see 6b). The State of Washington provided funding for one case study.

b. What other ways were meetings and processes financed?

Meetings should be part of efforts that are already supported financially (e.g. planned fishery meetings or conferences or regional planning meetings). Alternative funding sources include private foundations, philanthropic community members or organizations, and partnerships with similar interest groups (tribes, tribal corporations, community development quota entities, rural community groups or networks, etc.). Volunteer resources and in-kind donations of time and materials can be used to help the meetings happen, such as donated food, meeting location, or through other fundraising efforts.

7. Other lessons learned.

It takes a lot of effort to build trust and relationships. Sustained funding from NOAA will help to make the relationships lasting, build trust, support networking, and provide the results people need to make decisions and move their adaptation plans forward.

8. How useful would a publication (or other communication material) aimed at communities and outreach staff to help them understand how to start and conduct a climate change planning process be?

After conducting the interviews, it became clear to the Task 4 subgroup that it is very important to maintain resources such as the NOAA Climate Resilience Toolkit. The University of Washington developed their own adaptation guidebooks for local government and tribes. The Climate Adaptation Knowledge Exchange has a repository of information, but it needs to be reformatted to make it more user-friendly.

It would be most useful to have efforts and communication materials targeted at the people who are working with fishing communities – “Cliff notes” for these practitioners. Few can read a guidance document and just implement it. Workshops and trainings for practitioners would also be helpful.

- **We recommend the development of workshops and trainings for practitioners.**

Conclusions and Recommendations

Our primary recommendation is that NOAA should fund fishing community resilience planning.

- All the case studies reviewed were initiated and successful due to grant funding, and most of those grants were funded through NOAA.
- Funding should allow efforts to expand fishing community resilience planning– both for new communities to start a planning process and to allow communities to maintain and refresh their climate change adaptation plans, as needed.
- Funding sources should allow latitude so that the appropriate relationships can be identified and built between practitioners and motivated communities.
- Planning efforts allow communities to be pro-active, rather than reactive, and allow them to have more control and shape their own destiny. The amount of funding necessary is not very steep (usually <\$100,000 for multi-meeting, one year or multi-year effort) compared to what is spent on fishery planning and management in general

Second, NOAA should develop a practitioners training course and guidebook. Examples of important insights that could be included in a guidebook, based on the findings of this effort include:

- The practitioner’s role is to facilitate, organize, and value the experience and input of fishermen.
- Get the right community members, science personnel, and practitioners engaged in the process. The participation of valued community (or local, or regional) leaders is vital to success.
- Employ a collaborative approach that starts with a conversation about what community members are seeing on the fishing grounds – take a “bottom up” versus “top down” approach to engage fishermen productively.
- Meet in person at places that community stakeholders are comfortable with – local meeting halls, community centers, or even the local bar. Meetings times and dates should work within the stakeholder’s schedules – avoid fishing seasons. Provide food to make the meeting less formal and more social.
- Focus, at least initially, on short to medium term impacts and planning for the kinds of changes already observed by the community stakeholders. The longer term planning can follow.
- Create an adaptive planning process that creates outputs and outcomes to hold participants responsible and accountable for longer term planning than just a one-off effort to that was intended to meet the grant funding requirements; engage the community for both current adaptive planning and maintenance/reengagement of the planning processes.
- Develop a list of NOAA personnel and other experts that are available to assist, and to connect community stakeholders with individuals that can address particular climate impact topics of interest.

APPENDIX A – CASE STUDIES

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Case Study: South Thomaston, Maine

(Source: Webler, T.S., E. Stancioff, R. Goble, J. Whitehead. Dec. 2016. Environmental Modeling with Stakeholders: Participatory Modeling and Community Dialog About Vulnerability of Lobster Fishing to Climate Change. Springer. Pp. 267-287. The document can be found at <http://www.vcapsforplanning.org/pubs.html>)

Background

South Thomaston is a major commercial fishing port in Knox County, Maine with about 100 fishing boats using the port. The city of about 1,500 people houses one of the largest lobster cooperatives in Maine. While some historically caught species in Maine have seen declines, lobster catches have increased over the past 30 years and South Thomaston has been one of the top ten ports for landings, bringing in an estimated 11.37 million in 2013. Most of the catch was lobster.

Problem Statement

In the spring of 2012, warm water occurrences in the Gulf of Maine during the winter months resulting in lobsters shedding their shells in March and April instead of July and August, as has happened historically. Large numbers of soft shelled lobsters were landed at the same time that Canadian lobsters were caught resulting in a market glut and lower prices. Although more than 127 million pounds of lobsters were caught in 2012 (valued at over \$341 million), an increase of approximately 18 million pounds over 2011, the total value in 2012 decreased by \$3.7 million compared to 2011. Following the 2012 fishing season, fishermen interviews were conducted to gauge major concerns. The fishermen interviews revealed a great deal of concern about climate change and its impact on the community. Fishermen and community members both offered potential solutions but there was no consensus on action to take.

Planning Process

Using the results of the surveys, the VCAPS (Vulnerability Consequences Adaption Planning Scenarios) Team developed a process to use in three meetings with fishermen, local government

(volunteer town officials) and other community members about climate vulnerability. In the first meeting, experts from the University of Maine and the Maine Department of Marine Resources were invited to provide information about how climate change might impact lobsters and the community. Specifically, they provided information about the potential impacts by warmer water and air temperatures, ocean acidification, sea level rise, increased storms, and longer periods without rain. The VCAPS Team diagrammed causal pathways and potential management actions as the discussions took place. During this meeting, the VCAPS Team also facilitated a participatory modeling effort using systems dynamic modeling where fishermen discussed their understanding of the human-natural system while researchers built the model.

After some model revisions, a second meeting was held with a smaller group of lobstermen. During the second meeting (occurring a month later), the fishermen reviewed the model and made suggestions for improvement. Some also contributed personal financial and catch data. This data were kept confidential. The model was structured so that individual fishermen's effort could be incorporated.

At a third meeting, a group of seven lobstermen and community members met to hear about the model and look at different lobster shell shedding scenarios and their impacts on fishermen income. The conclusion was that income could be resilient to changes in shedding but that coordinated effort by fishermen would be needed to change fishing behavior. A fourth meeting was scheduled for 2014. That meeting would present an updated model incorporating shell disease incidents. Work continues on this project with more meetings scheduled for February 2017.

Action Plan and Implementation

While discussions are still occurring about implementing a specific action plan regarding coordinated fishing behavior, a real benefit of the VCAPS process was identification of specific management actions throughout the seafood handling process that can be taken to increase resilience of the South Thomaston Fishery.

Conclusion

The process used by the VCAPS Team to develop a system dynamics model with fishermen, community members and scientists helped the participants identify resilience strategies for responding to climate change impacts. Specifically, the process helped fishermen identify new ways of operating their businesses to mitigate against potential future climate impacts.

Case Study: Wellfleet, MA

(Source: Tuler, Seth. A Community Based Approach to Planning for the Effects of Climate Change on Shellfishing in Wellfleet Harbor. Interdisciplinary and Global Studies Division, Worcester Polytechnic Institute, MA. Presentation made at 3rd Annual Cape Coastal Conference. December 10, 2015. Presentation can be found at <http://www.vcapsforplanning.org/pubs.html>. Additional articles available at <http://wellfleet.serius.org>.)

Background

Wellfleet, MA is a town of about 2,700 people located in Barnstable County on Cape Cod. Shellfish play an important role in the ecology of Wellfleet Harbor and the town's economy. Wellfleet harvests about 23% of the total shellfish landings in Massachusetts with a value of about \$4.5 million.

Problem Statement

The potential impacts of sea level rise and other climate change impacts on shellfish resources have been well documented and were presented to a Working Group on Climate Change impacts of shellfishing in Wellfleet Harbor. These potential impacts include species' range expansion, increased human pathogen incidence, rainfall and storm event increases in frequency and intensity resulting in possible closures and ocean acidification resulting in changes in shellfish growth, mortality and disease.

Planning Process

In 2013, a Working Group was formed that included representatives from local government offices, the Shellfish Advisory Board, Wellfleet Bay Audobon Sanctuary, the MA Aquaculture Association, and oyster and quahog growers. Additional help was provided by shellfish researchers and coastal/marine scientists. The Working Group met from 2013-2015 (six meetings) to discuss and learn about potential threats to shellfishing from climate change, the role of shellfishing to mitigate impacts from climate change and strategies to increase resilience of Wellfleet and its shellfish fishery. The Vulnerability, Consequences, and Adaption Planning Scenarios (VCAPS) was used to structure the discussion and learning process. A matrix of potential climate change impacts and strategies to address and mitigate against those impacts was created.

Action Plan and Implementation

The potential impacts and mitigation strategies and action matrix is being used for further discussion with the town about how to respond to climate change. In addition, a website was created that provides information in the form of presentations and factsheets about the expected impacts of climate change on shellfish and the Wellfleet community specifically.

Conclusion

The process used by the VCAPS Team has provided the Wellfleet, MA community with the information needed to have the discussions necessary to make decisions about how to respond to climate change.

Case Study: Swinomish Climate Change Initiative - Climate Adaptation Action Plan

(Source: Swinomish Indian Tribal Community Office of Planning and Community Development 2010. Swinomish Climate Change Initiative Climate Adaptation Action Plan. http://www.swinomish-nsn.gov/climate_change/climate_main.html)

Background

In the fall of 2008 the Swinomish Indian Tribal Community started work on a landmark two-year Climate Change Initiative to study the impacts of climate change on the resources, assets, and community of the Swinomish Indian Reservation and to develop recommendations on actions to adapt to projected impacts. There are upwards of 1,300 homes on the Reservation, and total Reservation population is estimated at somewhat over 3,000. Under the guidance and coordination of the Swinomish Office of Planning & Community Development, the first year of the project was devoted to assessment of projected impacts, as presented in an Impact Assessment Technical Report issued in the fall of 2009. The second year of the project was focused on evaluation of strategies and options for recommended actions to counter identified impacts. The ultimate goal of the project was to help ensure an enduring and climate-resilient community that can meet the challenges of anticipated impacts in the years to come.

Problem Statement

The initiative focused on a range of threats and potential problems associated with climate change including impacts on fishing and aquaculture but also on agriculture and human health. Threats of particular concern for fisheries and aquaculture include inundation from sea level rise and storm surges and associated loss or decreased viability of habitat. Ocean acidification was also noted as a threat to shellfish, as was temperature change for salmon. The tribe is particularly concerned about threats to shellfish (clams, crabs, oysters, shrimp, mussels) and salmon which have a strong cultural, as well as economic and nutritional, importance. In addition to viability of shellfish resources, the tribe is concerned about increased incidence of toxic shellfish due to toxic algal blooms. Traditional foods such as salmon and shellfish are “cultural keystone” aquatic species to the Tribe; much more than a food source, these foods are a vital contribution to the cultural, spiritual, and social life of tribal members (Garibaldi and Turner 2004). Shellfish can be harvested year-round, providing a stable, high protein food source. Individual beaches are treasured for their shellfish populations and are maintained to avoid over-harvest. Loss of a traditional food is directly related to loss of morale, and cultural health and well-being (Arquette et al. 2002; Kuhnlein and Receveur 1996).

Planning Process

While acknowledging the importance of action to mitigate the causes of climate change, the Tribe consciously directed the approach for this project toward adaptation actions to counter the anticipated effects of climate change on the Reservation community, given the geographic characteristics and coastal location of the Reservation that makes it particularly vulnerable to potential impacts. The project was structured over two years, beginning in late 2008, with the first year devoted to detailed assessment and analysis of climate change impacts. The Swinomish Office of Planning & Community Development provided the core staff team to manage and carry out project activities. To assist with complex analysis of myriad scientific issues, the Tribe enlisted the support of the University of Washington Climate Impacts Group (CIG), a premiere regional climate research entity. Anticipating issues for residents in low-lying areas of the Reservation as well as critical issues reaching off-Reservation, a Strategy Advisory Group was formed consisting of representatives from Skagit County, the Town of LaConner, and the Shelter Bay Community (a 900-unit residential development on leased tribal land).

In addition, a community outreach effort was begun through formation of a tribal outreach group, assisted by a Communications Facilitator retained by the Tribe. The aggregate intent and ultimate goal of the project was to help ensure an enduring and climate-resilient community that can meet the challenges of anticipated impacts in the years to come. The primary tasks for the first year's work consisted of: 1) scoping and technical assessment of potential impacts, based on analysis of numerous scientific models and data; 2) mapping of "risk zones" and inventory of assets and resources within those zones; 3) a vulnerability assessment of the Reservation community and resources, based on the identified impacts; 4) a risk analysis of potential impacts, based on the completed vulnerability assessment; and 5) preliminary scoping of potential strategy and policy issues.

During the second year of the project, the staff team continued working with CIG, the advisory group, and community group, as well as key staff in various disciplines, to assess potential strategy options for targeting to identified impacts. Tasks for this strategy assessment included: 1) identification of applicable adaptation goals; 2) evaluation of a wide range of potential strategy options in multiple categories for application to given impacts; 3) development of proposed recommendations for adaptation strategies across the spectrum of impacts; and 4) consideration of policy issues for implementation, such as coordination, timing, and funding.

For the Swinomish Climate Change Initiative, community-based response evolved into creation of the Climate Change Education and Awareness Group (CCEAG), facilitated by Shelly Vendiola, who was retained as the project's communications and outreach facilitator. CCEAG was established to assist with communication of complex issues to the community and gathering of input on tribal perspectives toward climate change issues. This work entails establishment of an *honorable engagement* process for the Swinomish community by raising awareness of climate impacts on the tribal community, and it opens a pathway for community input to inform and guide policy and decisions about how the tribe will adapt and prepare to deal with the impacts of climate change.

CCEAG has met regularly and has participated in community-wide events to raise awareness about climate change and share information about future efforts for community education and empowerment. The group conducted a series of community meetings and interviews to bring people together to talk about changes they have seen, as well as hopes and concerns. Fact sheets and tribal newsletter articles were developed based on project reports and activities to communicate and summarize the general impacts to the Swinomish Reservation residents and surrounding areas.

Action Plan and Implementation

The planning process identified a range of strategies and specific actions to forestall or adapt to impacts of climate change. These include protection of land from inundation (with armoring) as well as planned retreat (including removal of bulkheads and riprap that prevent shoreward migration) and acquisition of new land. As mentioned above, the planning process went well beyond a focus on marine fisheries and aquaculture, but the following actions related to marine fisheries and aquaculture were planned:

- Land acquisition for shoreward migration
- As an experimental option, shellfish could be seeded in upland operations to allow for proper growth and development under controlled conditions. Once they reach sufficient size and maturity, they could be transplanted to established beds.
- Shoreward habitat migration, reestablishment of shellfish beds further inland as sea-level rises
- Pocket estuary restoration to protect habitat for out-migrating salmon.
- Strengthen traditional food roles to identify whether seafood is safe

Conclusion

The tribe also takes a very long-term view toward planning with duty to conserve resources for future generations. The Swinomish tribe have a strong dependence on living marine resources that reflects not only their importance for livelihoods and nutrition (both of which are highly important) but also a cultural dependence on the shellfish and salmon harvested on and around the reservation. This may tend to restrict the tribe's ability or desire to substitute away from threatened resources in terms of consumption and livelihoods and increase the importance of strategies that will protect the viability of these resources.

A number of adaptation projects were proposed for the short-term (1-5 years) mainly relating to research and zoning activities as well as education and outreach. Potential sources of funding were identified. I could not find information on what activities have actually been implemented in support of the plan.

Other Resources

Accessible reports are:

- [Impact Assessment Technical Report, October 2009](#)
- [Climate Adaptation Action Plan, October 2010](#)

(Note: They won a DOI award in the summer of 2016 for this work:

<https://www.doi.gov/pressreleases/seven-recipients-presented-first-climate-adaption-leadership-award-natural-resources.>)

Case Study: Jamestown S'Klallam Tribe: Climate Vulnerability Assessment and Adaptation Plan

(Source: Jamestown S'Klallam Tribe. 2013. Climate Change Vulnerability Assessment and Adaptation Plan. Petersen, S., Bel, J. (eds.) A collaboration of the Jamestown S'Klallam Tribe and Adaptation International http://www.jamestowntribe.org/programs/nrs/nrs_climchg.htm)

Background

The Jamestown S'Klallam Tribe resides on the northeastern portion of the Olympic Peninsula, in northwestern Washington. In recent years, the Tribe has identified climate change as a major concern for their community and has therefore prepared a Climate Vulnerability Assessment and Adaptation Plan to promote the continued resiliency of their community. The Jamestown

S’Klallam Tribe developed the Adaptation Plan with support from a U.S. Environmental Protection Agency (EPA) Indian Environmental General Assistance Program (IGAP) grant. The Tribe partnered with Adaptation International, a climate change consulting firm, and Washington Sea Grant, a collaborative project between NOAA and the University of Washington, to develop the plan.

Problem Statement

The planning process focused on threats related to sea level rise, coastal flooding, temperate increases, reduced precipitation, and ocean acidification. While the process considered a variety of physical, ecological, and socio-economic impacts there was a substantial focus on impacts on living marine resources, particularly salmon, clams and oysters on which the tribe is highly dependent. In addition to concerns about viability of these resources, threats of increased problems with toxic shellfish related to harmful algal blooms (HABs) were a planning focus.

Planning Process

The project team convened a committee of fifteen tribal elders, staff members, and council members, and held a two-day workshop to work with the climate committee on identifying adaptation priorities and developing adaptation strategies. Adaptation International and Washington Sea Grant provided summaries of a wide range of anticipated climate impacts and the committee then identified and prioritized key areas of concern for the Tribe. This workshop provided opportunities for the committee to share their expertise and led to a multi-disciplinary and refined understanding of the specific climate issues facing the Jamestown S’Klallam Tribe. Primary outcomes from the workshop included selection of key areas of concern and detailed climate vulnerability rankings, based on potential climate exposure, sensitivity (how susceptible an area of concern is to a given climate impact), and adaptive capacity (the ability of that system to adapt to a given climate impact). The vulnerability rankings take into account community input when prioritizing areas of concern. By investigating climate impacts and identifying key areas of concern, the Jamestown S’Klallam Tribe’s climate adaptation plan reflects community priorities while also acknowledging the sectors that may be most severely impacted. Viability of salmon, clams and oysters, and shellfish toxin were ranked as very high priority areas of concern.

Action Plan and Implementation

The action plan includes several action priorities related to living marine resources and seafood.

Salmon

- Reduce other stressors on salmon stream habitats including urbanization, sedimentation and pollution.
- Protect Restore streamside habitat vegetation and control erosion.
- Restore connections from flood plains by setting back dikes and other barriers
- Ensure sustainable harvesting of salmon
- Manage hatcher programs to minimize harm to wild stocks

Clams and Oysters

- Monitor and improve local water quality

- Ensure sustainable harvesting of clams and oysters and rebuild/restore stocks and shellfish beds
- Use hatcheries to restock areas where native bivalves are limited
- Transplant native bivalves to other areas
- Develop cultural center to enhance understanding of shellfish heritage

Shellfish Biotoxins

- Extension and monitoring program to identify predictors of HABs
- Decrease stressors that promote HABs such as high nitrogen and phosphorous loadings from agricultural run-off
- Enhance beach alert system

Conclusion

The S'klallam tribe is taking a long-term view toward planning for climate change. The tribe has a strong dependence on living marine resources that reflects not only their importance for livelihoods and nutrition (both of which are highly important) but also a cultural dependence on the shellfish and salmon. This may tend to restrict the tribe's ability or desire to substitute away from threatened resources in terms of consumption and livelihoods and increase the importance of strategies that will protect the viability of these resources.

Next steps were identified as (1) prioritizing adaptation strategies for implementation and identifying individuals or departments responsible for implementation; (2) Building community support for climate preparedness; (2) incorporating climate preparedness into tribal government operations and policy; (4) collaborate with surrounding communities, counties and other key stakeholders to monitor key changes in climate likely to affect the tribe. The planning process took place in 2013. It is not clear what concrete actions have been taken since.

Case Study: Resilient Fisheries Rhode Island

(Sources: National Marine Fisheries Service, 2017. Fisheries Economics of the United States, 2015. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-F/SPO-170, 247 p. and Schumann, S. 2017. Report of the workshop "Future-Proofing Rhode Island's Commercial Fisheries", South Kingstown, R.I., 21 February. Online at: www.resilientfisheriesRI.org.)

Background

Rhode Island's commercial fisheries are diverse and brought over \$81 million in revenue from 75 million pounds in landings in 2015, employing an estimated 421,000 people (FEUS, 2016). Key species caught include lobster, scallops, squid, flounder, quahog clams, porgies, mackerel, herring, and goosefish.

Problem Statement

Resiliency and uncertainty about the future due to climate change were important issues not yet explored by the Rhode Island commercial fishing industry. The industry recognized there were other drivers of change and vulnerability facing the industry: environmental impacts of wastewater treatment and offshore renewable energy; social issues such as loss of working

waterfront, the low level of participation by young people in the industry, and lack of public awareness and support for commercial fisheries; and the rigidity and piecemeal nature of the fisheries science and management system.

Planning Process

The Resilient Fisheries Rhode Island Project, began in 2015 as a bottom up, collaborative learning exercise of the Rhode Island commercial fishing industry, initiated by a Rhode Island fisher and industry advocate, Sarah Schuman.

Schumann applied for and received a SK Grant for \$75,000 with the goal of helping the Rhode Island commercial fishing industry be empowered through learning, pooling resources, and strategizing to increase resilience to change under the guidance of 10 steering committee members from across Rhode Island. While it was a challenge to bring people together from all over Rhode Island to participate in the project, representation of a single sector would not have been sufficient to address the goals of the project.

The project consists of four phases involving representation from all sectors and gear users of the commercial fishery.

- Phase I (September 2015 - September 2016) was a series of 50 one on one interviews with commercial fishery participants to identify drivers of change occurring in the fishery and potential adaptive solutions.
- Phase II (December 2016 – February 2017) consisted of 10 two-hour workshops that each explored one topic raised by fishermen including climate change, ocean acidification (ocean), ocean acidification (bay), Narragansett Bay ecosystem change, fostering the next generation of fishermen, changes in seaweed ecology, socio-economic vulnerability, squid in a changing climate, black sea bass explosion, and diversity and flexibility.
- Phase III consisted of an all-day workshop with scenario building with a diverse and representative group of 45 Rhode Island fishermen in February 2017.
- Phase IV (to be completed at the end of 2017) will consist of a final report.

Although the project began with a focus on climate change, it was quickly recognized that fishermen don't always know what is causing change and non-climate factors could be influencing changes that they were seeing. In addition, some did not believe that climate change was occurring but still needed to deal with the change they were seeing on the water. Therefore, a broader resilience focused approach was adopted. In this way, all fishing industry stakeholders would have an interest in participating.

Action Plan and Implementation

While Phase I focused on identifying drivers of change occurring in the fishery, Phase II explored these changes. For Phase II, NOAA staff, RI Department of Environmental Management staff, Commercial Fisheries Research Foundation staff, and independent researchers were recruited for about half of the 10 workshops to provide information about temperature and species shifts, ocean acidification, and social vulnerability, among other topic

areas. Researchers included fisheries scientists, economists, anthropologists, and educators. Schumann had known some of the NOAA staff and others were found online but admits that a listing of scientists and others that could have provided expertise would have been helpful. A publication aimed at helping communities and outreach staff to provide them with ideas to start a climate change planning process and information about the different approaches taken would also be helpful.

With regards to audience, most of the workshops were industry only. It was important for the industry members to feel comfortable, particularly in airing their questions. Several of the two-hour workshops took place at bars so that the meetings were social in nature and refreshments were provided. Meetings were purposely held in locations where management meetings did not occur. Fishermen were paid a stipend for their time off from work (for all day workshop only). The workshops typically contained information requested by fishermen as well as new information provided by the presenter. The meeting was structured to allow for flexibility in the agenda so that industry members could add additional items on the day of the workshop. However, divisive topics (like consolidation) were avoided and topics focused on commercial wild harvest. In an effort to continue discussion and networking after the meetings took place, a listserv and members-only website/discussion forum was created. It is hoped that the listserv can be used to engage the larger community on topics fishermen are interested in, like water treatment, after the project is completed.

Phase III of the project was an all-day workshop that split the participants into four breakout groups. The groups were presented with randomly assigned scenarios describing how the future might look in 2025-2030. Groups were provided both a hypothetical natural environment and a hypothetical socio-political environment. Groups were tasked with developing strategies that the industry can start advocating for in the present to help the industry thrive in 2025-2030. At the end of the workshop, strategies were shared and scored across groups and those strategies that worked in multiple scenarios rose to the top.

Phase III resulted in a listing of crosscutting strategies that would work across multiple scenarios and are therefore robust to future change and uncertainty (Schumann, 2017). Three of the strategizing categories were advocated by all four breakout groups and these were:

- Collective industry organizing,
- Local and niche marketing, and
- Make science and management more adaptive and dynamic.

Three other strategizing categories were advocated by three breakout groups and these were:

- Improve water quality and address wastewater concerns,
- Public relations campaign, and
- Human capital/Workforce development.

Phase IV of the project is in process and is expected to be completed by the end of 2017.

Conclusion

The Resilient Fisheries RI scenarios planning process provided a mechanism to use consensus-based tools to help industry members identify challenges and opportunities to address their uncertain future. The fishing industry participants sketched out the contours of an industry-wide roadmap for the future which is available to all industry members to utilize and build on in the coming years.

Case Study: Southeast Alaska’s Central Council of Tlingit and Haida Indian Tribes

(Source: Holen, Davin. 2017. Southeast Alaska Environmental Conference: Report on the Climate Change Adaption Summit. Alaska Sea Grant.)

Background

The Tlingit and Haida Indian Tribes of Southeast Alaska tribes have traditionally been mariners, fishermen, hunters, gatherers, and traders. They rely on key resources such as salmon, herring, shellfish, deer, seal, and berries for food security and yellow cedar and cultural sites for cultural activities. Tall cedar trees are traditionally used for clan houses, totems, canoes, ceremonial dance regalia, baskets, and utensils and yellow cedar is used in creating bentwood boxes, Chilkat blankets, and cultural elaborations important to some of the tribes.

Problem Statement

The Tribes were observing that the resources they depended upon were subject to climate change impacts such as flooding from heavy rains, ocean acidification, warming waters, snowfall variations, harmful algae blooms, invasive species, contamination of water sources, changes in the terrestrial environment, and phenology which threaten their future availability. These factors impact food security and culturally important resources. For example, in some parts of Southeast Alaska, residents have observed yellow cedar start to disappear. Tribal residents also noted that warmer water in the outflow of streams is disrupting salmon migration patterns, which makes it more difficult to ensure adequate escapement and to determine harvest timing.

Planning Process

In December 2015 a climate change adaptation workshop was organized and hosted by the Swinomish and Tulalip Tribes of Washington in collaboration with the Southeast Alaska Tribal Ocean Research (SEATOR), U.S. Forest Service, Central Council of Tlingit and Haida Indian Tribes of Alaska (CCTH), Sitka Tribe of Alaska (STA), and others. The goal was to discuss climate stressors and prioritize the resources of highest concern due to the impacts of climate change. The five resources identified were salmon, shellfish, berries, cedar, and cultural resources.

As a follow up to the first workshop, in September 2016, Alaska Sea Grant, the CCTH and STA planned a second two-day workshop in Ketchikan to review climate change impacts to the five identified subsistence and cultural resources. This workshop was added on to the annual Southeast Alaska Environmental Conference and became known as the Southeast

Alaska Climate Adaption Summit. Funding was provided by the North Pacific Landscape Conservation Cooperative (LCC). The goal of the workshop was to build greater collaboration and sharing of tools and information between agencies, the University, local non-profits, and Tribal environmental programs. The first day of the workshop reviewed the climate change issues and impacts to these resources, and participants worked in six groups of 10-12 participants to consider what monitoring, mitigations, or adaptation strategies Tribes could undertake and implement quickly without additional funding to address the resources and impacts. On the second day, agency and university researchers presented some of the latest monitoring efforts and practices that could work for tribes to give them additional ideas, followed by brief presentations on potential future adaptation efforts. At the end of the second day, the environmental coordinators from the Tribes drafted work plans for the coming year that included some of these monitoring and adaptation efforts. This summit was planned as a critical step in operationalizing climate adaptation planning for Tribes in Southeast Alaska.

The Workshop was attended by 80 participants, 50 of which were environmental program managers and coordinators from 17 tribes in Southeast Alaska. The remaining participants were from Federal and State agencies, the University, and non-profits. Sea Grant staff facilitated discussions.

Action Plan and Implementation

A primary outcome of the Workshop was a list of recommendations for management and engagement with communities. These are:

- 1) Due to changing phenology for salmon and deer migration, there should be more flexible seasons for local harvest, especially subsistence seasons.
- 2) Shellfish are an important species for subsistence and abundance has declined in recent years. There should be an effort and permitting to allow for the seeding of new shellfish beds in intertidal zones.
- 3) More effort should be invested by managers in understanding the impacts of increasing temperatures on rainfall and snow pack, and how this will influence future salmon rearing and spawning habitat.
- 4) More studies should be conducted to understand the impacts of historic mining, and whether changes in precipitation from climate change will cause erosion at these sites.
- 5) HAB monitoring should include shellfish monitoring, as well as an increase in funding to understand the impacts of a warming ocean on the frequency and spread of HABs.
- 6) The impacts of ocean pH on Alaska marine species should be more fully studied (Holen, 2017).

A second outcome of this workshop was development of a climate change adaption plan by the CCTH which can be used as a template for tribes to use and tailor to their own use.

Finally, a third workshop outcome was creation of a website called Adapt Alaska. The website is being developed to compile and centralize community resilience and adaptation information and serve as a portal to other relevant climate change websites specific to Alaska. While website creation was funded with remaining workshop funds, additional funds were provided by the Aleutian Bering Sea Islands Association and the Aleutian Pribilof Islands LCC.

Conclusion

Coastal community residents in Alaska recognized they can take small steps to adapt immediately and begin a planning process to adapt to changes that come in the future. Knowledge and observations made by Alaska Natives and rural residents of the changing climate can become part of adaptation solutions and provide feedback for scientific observations.

The participants recognized the importance of building collaborations between agencies, universities, local non-profits, and Tribal environmental programs. In addition, organizers of the summit recognized that a central repository is needed to provide communities with basic information on climate change and resulting impacts in Alaska, a method of sharing stories of successes, and tools for planning monitoring, mitigation, and adaptation activities as an outcome of this project.