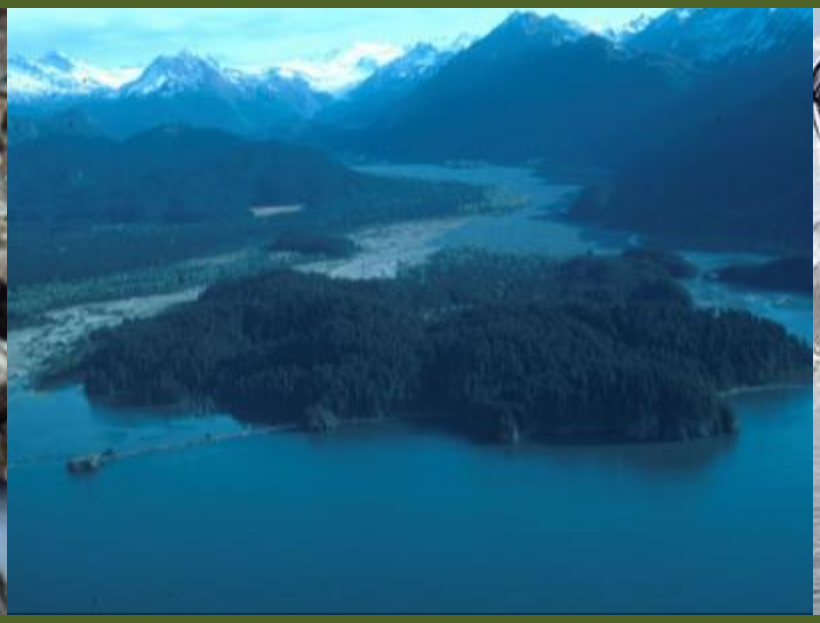
Kachemak Bay Research Reserve

Oyster Population Resiliency

SITUATION ASSESSMENT REPORT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1. Overview

Climate-related changes to the ocean are emerging as a global problem. While the extent of these effects is currently unknown, there could be possible threat to Alaska commercial fisheries which are valued at approximately $4 billion (Alaska Marine Conservation Council 2011). The shellfish mariculture industry in Alaska has been impacted by loss of oyster larvae ('spat') due to more acidic waters in the Pacific Northwest. As ocean conditions continue to change, better information and tools may be needed to develop oyster resiliency and maintain their productivity in Alaska for current and future generations. A workshop is being planned to bring together stakeholders and leverage expertise from west coast National Estuarine Research Reserves, who are working to understand and address the resilience of native oyster populations in the face of rapidly changing ocean conditions.

2. Purpose

The purpose of the Situation Assessment is to clarify issues and identify stakeholder concerns in order to recommend ways to make collaborative dialogue successful at the workshop. Specifically, the Situation Assessment was conducted to:

1. Provide a greater understanding of perspectives, interests and concerns held by various stakeholders;
2. Allow key stakeholders to express their views in the planning phase of the workshop;
3. Identify common interests in workshop content and areas of disagreement;
4. Provide independent recommendations on tools that might be employed during a workshop to ensure effective dialogue among stakeholders;
5. Identify desirable outcomes or information gains from the workshop.

3. Area Description

(Source: SeaGrant Marine Advisory Program, 1992)

Alaska's aquatic farming industry is young. In 1988, the Aquatic Farm Act was signed into law authorizing the Alaska Department of Fish and Game (ADF&G) to issue permits for the construction and operation of aquatic farms and hatcheries that would supply aquatic plant or shellfish seed stocks to aquatic farms.

Pacific oysters grow very well in Alaska where the cold water supplies abundant, high-quality plankton. Although native to warmer waters, Alaskan shellfish can match growth achieved by shellfish raised in the Pacific Northwest because of the dense plankton blooms. In Alaska, because cold water retards maturation, high-quality oysters are available year round. Cold, clean water also reduces bacterial contamination, extending shelf life and assuring safety when eating cultured oysters, especially when eaten raw.

Pacific oysters cannot reproduce in Alaska due to the cold water. In Alaska there is no shellfish hatchery; therefore, all farmed Alaskan oysters are imported as spat (juvenile oysters) from Pacific Coast hatcheries. Resilience of outside sources of oyster spat is an issue due to mortalities

associated with more corrosive waters in the Pacific Northwest, and the inability for facilities to meet the market demand in Alaska.

In Alaska, oysters are grown in suspended nets that are anchored in the ocean. Kachemak Bay is an ideal location for rearing oyster given the extreme tidal fluctuations, which average a vertical difference of 15 feet (Fig 1). Located in a relict glacial-fjord estuary, Kachemak Bay is relatively buffered against large storms generated in the Bering Sea and Gulf of Alaska. The Bay's bathymetry is characterized by a submerged glacial moraine at the mouth of the Bay, and trenches and holes reaching 175 m deep. On the south side, the Bay is guarded by jagged snow-covered peaks. The Harding Icefield, one of the last remaining alpine ice sheets left in North America, hosts seven glaciers that flow into Kachemak Bay. In contrast, the northern side is part of an extensive lowland, with a gentle topographic gradient and no active glaciation.

Kachemak Bay is legislatively designated State Critical Habitat area; however, aquatic farms are allowable and limited to suspended aquaculture only. Within Kachemak Bay there are 12 active oyster farms, which are located in protected bays and inlets on the south side of the Bay. The approximate locations of these are shown in Figure 1.

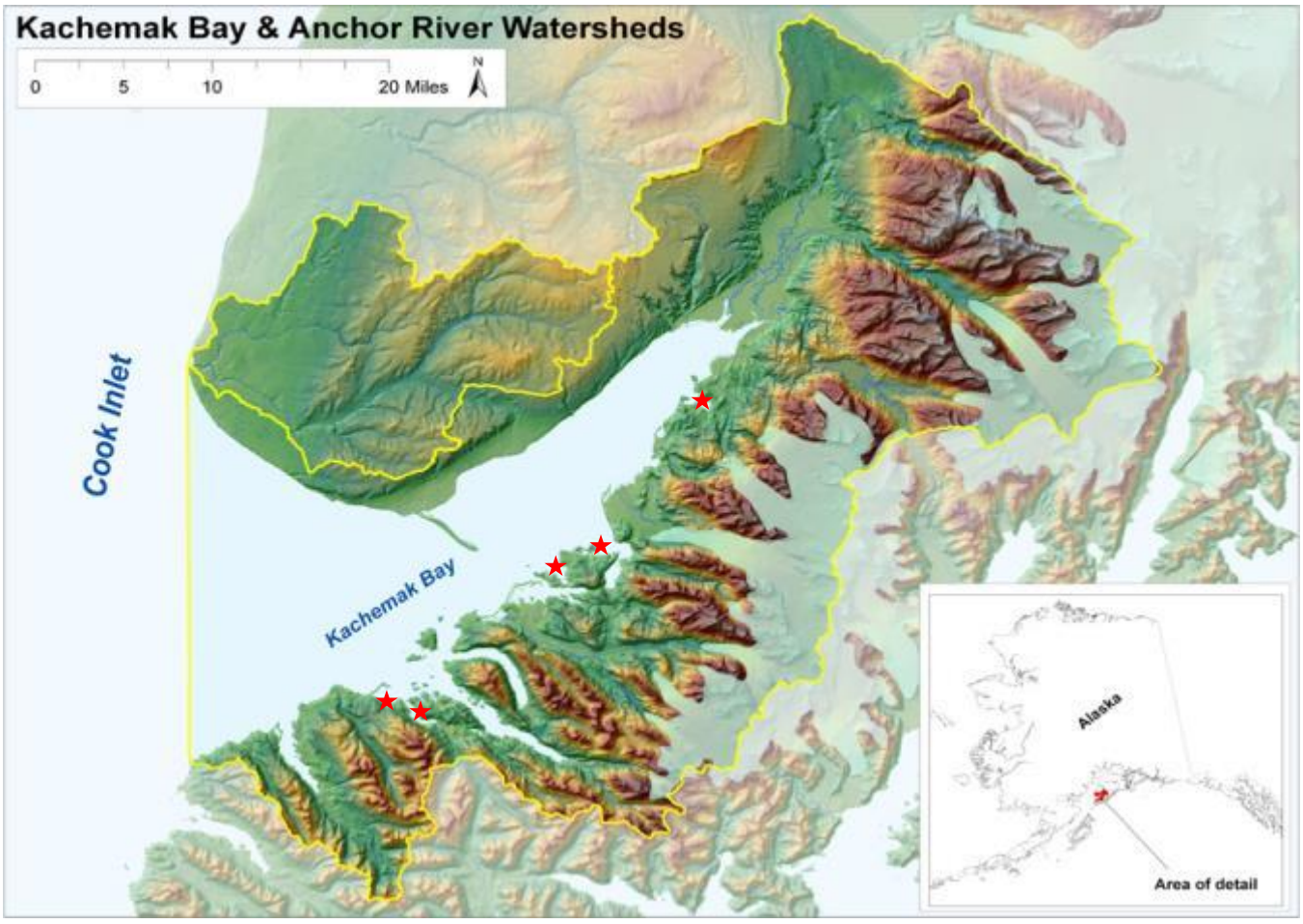

Figure 1. The approximate locations (shown by red stars) of oyster farms on the south side of Kachemak Bay, AK.

4. Methods

The following methods were used to conduct the Situation Assessment:

a. Identification of Stakeholders: General categorizes as well as specific organizations and individuals were identified for interview. These stakeholders included:

- State and Federal Agencies (Alaska Department of Fish and Game (Commercial Fisheries and Aquaculture), Department of Environmental Conservation, Department of Natural Resources, Kachemak Bay Research Reserve, NOAA Kasistna Bay Labs)
- University Researchers & Affiliates (SeaGrant, University of Alaska Fairbanks)
- Shellfish Industry (oyster growers, Alaska Shellfish Farms, Kachemak Shellfish Mariculture Association, Jakolof Bay Oyster Co, local co-op managers: Alaska Shellfish Growers Association, Pacific Coast Shellfish Growers Association)
- Environmental Organizations (local non-profits: Cook Inletkeeper, Alaska Marine Conservation Council, WWF, Alaska Ocean Observing System)

b. Interview Process: Individuals identified were invited to participate in the interview process, either in person or by phone. Interviews were conducted one-on-one as informal conversations using a working list of questions to spark discussions and elicit input. Stakeholders interviewed are listed in Table 1.

c. Interview Questions: The following questions were used during stakeholder interviews as a starting point for conversation.

- What is your role in the oyster community?
- What are some of the challenges or issues that the Kachemak Bay oyster community currently faces or may face in the future?
- Of these, which issues are priorities to be addressed at the workshop?
- How well-defined are these issues?
- Do you have ideas on how these issues can or should be addressed?
- What should not be discussed?
- How well-educated are you on these issues, or what additional information might be needed at the workshop?
- Are there other key individuals or organizations we should be talking to?
- What would be a desirable outcome from the workshop or what would make this a successful process?

d. Interview Responses: Response to these questions were then compiled and analyzed to summarize stakeholder input. Outcomes were be assigned to four categories:

- **Stakeholder Interests :** the tangible and intangible values which are often behind positions, by group

- **Stakeholder Perspectives:** key thoughts about how the issues can or should be addressed
- **Stakeholder Vision for Outcome:** desired outputs from workshop
- **Key Issues to be Addressed:** the problems, and any potential challenges or conflicts

5. Assessment Results

5.1 Stakeholder Interests

The interview process identified nine primary oyster-related interest groupings. The interests noted below are not exhaustive. Rather, they represent the key interests expressed during the interviews:

1. Agricultural
2. Business and Industry Operator
3. Infrastructure Owner
4. Environmental
5. Federal Government
6. State Government/Management
7. Tribal
8. Research
9. Public Health

5.2 Stakeholder Perspectives

Following is a summary of stakeholder comments organized by these topics, with associated key issues, perspectives and questions.

Marine Ecosystem

Key issues:

- The trends and variability of ocean conditions in Kachemak Bay are not well understood, although monitoring is ongoing.

- A network for ocean acidification monitoring is in its infancy for Kachemak Bay.

Stakeholder views on this topic include:

- Information on phytoplankton blooms is valuable; disseminating information about the timing of phytoplankton blooms is needed for juvenile oyster planting.

- Uncertainty exists on the range of temperature, pH, and salinity in Kachemak Bay. The ability to evaluate trends and predict these variables is needed.

- Ocean pH is being collected for pelagic waters in the Gulf of Alaska, but is just beginning to be collected for Kachemak Bay. Water samples are being collected opportunistically by vessels. Cooperation with oyster growers is needed for more regular and targeted sample collection.

- Tidal fluxes and glacial meltwater result in varying salinity levels in Kachemak Bay. Understanding the acceleration of freshwater to the Bay and potential impacts to oysters is needed.

- Climate stressors (temperature, salinity, pH) and PSP are important concerns for the local mariculture industry. While PSP is a concern it is often associated with warmer water temperatures although there have been documented cases year-round in Alaska.

- Water temperature is the single known variable to influence adult oyster growth and survival. Fluctuations in temperature likely impact the oyster's ability to filtrate.

Oysters Growth and Survival

Key issues:

- Adult oysters experience considerable winter mortalities, although the causal factors are largely unknown.

- The relationship between oyster mortalities and ocean condition variability has not been robustly examined.

Stakeholder views on this topic include:

- Pacific oysters in Alaska are among the slowest growing species in the industry.

- Overwinter survival is the biggest issue with adult oysters in Kachemak Bay.

- There are issues with oyster mortality, although these are typically non-episodic.

- Mortality often happens in the winter at rates up to 30-40%. The reason for mortality is largely unknown and may be related to husbandry practice or ocean conditions.

- Adult oysters rely on energy storage from protein (not fat) to survive Alaska winters. This factor may be associated with the observed winter mortalities.

- Closer documentation about oyster survival by growers and information sharing with researchers is needed to help identify survival trends that could be linked to ocean conditions.

Native Species

Key issues:

- Native bivalve species in Kachemak Bay have undergone abrupt population declines in the past decade. The reason for this demise is largely unknown.

- Restoration and enhancement efforts in Kachemak Bay must be prescriptive to ensure success.

- The regulations within the Kachemak Bay Critical Habitat area may preclude certain restoration activities from happening within its boundaries.

Stakeholder views on this topic include:

- The decline of native bivalve species (scallops, mussels, razor clams etc.) in Kachemak Bay was abrupt and not well understood. Impacts to population are speculative and include: overfishing, ocean acidification, depredation by sea otters, recruitment, and other unknown factors. The rates of decline are alarming and are considerable cause of concern for native bivalve populations, as well as the potential fate of the oyster fishery.

- The decline in native bivalve species needs to be reversed (note: there is a specific distinction between bivalve and shellfish, as the term shellfish also includes crabs which are not the focus of this assessment).

- There is missed market opportunity in Kachemak Bay by not commercially harvesting native bivalve species. Instead many of these species are imported from outside the region or Alaska.

- Research and understanding of larval transport and settlement is needed, particularly for native bivalve species.

- Population densities of native bivalve species may be a limiting factor to spawning success, and may need further explored. "Spawning sanctuaries" have been used in other regions as restorative or precautionary measures.

- Fouling of marine inverterates on fishing gear is an issue. In Kachemak Bay there were previous monitoring efforts on larval barnacle and mussel pre-settlement, which was shared with oyster growers to assist with mitigation. Larval monitoring efforts have fallen by the wayside in recent years.

- Littleneck and razor clams are an important part of the cultural history and identity of native tribes in Kachemak Bay. Restoration proposals have been submitted by native villages in Kachemak Bay, but have yet to be funded. The regulations within the Kachemak Bay Critical Habitat area may preclude certain restoration activities from happening within its boundaries.

- Further research is needed around causal factors for native bivalve population decline in Kachemak Bay. Restoration and enhancement efforts have been preliminarily considered, but actions need to be prescriptive to ensure success.

- Aquaculture for native mussel species is being explored in Kachemak Bay. The techniques have been developed and refined over a period of 10 years. Growers are working to develop a market for this species and one that may displace clams (which are imported from outside AK).

Hatchery

Key issues:

- The shellfish mariculture industry in Alaska relies upon importing oyster larvae ('spat') from the Pacific Northwest, and has been impacted by loss of spat due to more acidic waters there.

- In Alaska, preliminary efforts are underway to set oyster larvae in facilities located within the state. Research is needed to better understand husbandry practice and water quality conditions to ensure success at these facilities.

Stakeholder views on this topic include:

- Oyster hatcheries in the lower 48 have experienced catastrophic larval mortalities attributed to water pH, carbonate availability, and freshwater levels. Whiskey Creek in Oregon is actively treating and managing water acidity to maximize success of larval development. Since 2012-13 in Kachemak Bay, oyster seed has been imported (at >250 um) to the hatchery/seed setting facility for larval development. This facility has demonstrated great success in juvenile oyster development.

- The reasons for juvenile oyster mortality in a hatchery setting are poorly understood, and could be associated with husbandry and water quality.

- More research and information sharing around efforts to improve Pacific oyster spat production in the lower 48 is needed to help safeguard the industry.

- More information is needed on what local facilities in Alaska should be doing now to prepare for ocean acidification.

- Ocean acidification research to water intakes at the Alutiiq Pride hatchery facility in Seward, AK (in partnership with the University of AK, Fairbanks) is underway beginning fall 2013.

- The capacity for algae/phytoplankton production and storage is a current limiting factory for the setting facility in Homer.

- As a potential, long-term strategy to safeguard industry in Alaska an oyster hatchery could be developed. This would buffer against current seed instability for imported spat.

- Energy becomes a cost prohibitive barrier to making production of local spat economically viable.

- The market demand for oyster seed in Alaska exceeds the supply. Only about 50% of the oyster seed needs in Alaska are filled by hatcheries in the lower 48.

- Results from a 10-year study indicate that particular lineages of larval brood stock appear to perform better in different water quality conditions. More research and attention is needed as to whether particular brood lineages demonstrate resiliency to acidic waters. These studies in Alaska are time-prohibitive, as it takes up to three years for oysters to reach maturity.

Governance and Management

Key issues:

- In Alaska, widespread indifference of recreational and subsistence harvesters to PSP warnings causes considerable concern for the Alaska Division of Public Health and the Alaska Department of Environmental Conservation.

- Commercial oyster growers are required to conduct regular tissue testing; however, , the timeliness of these results is an issue and cause of concern for the industry.

Stakeholder views on this topic include:

- Public health knowledge relating to oysters is beneficial to oyster growers to control and protect their industry.

- There is a need to transfer shellfish-related information research to public health sector in order to improve decision-making.

- More awareness and attention to public health issues around bacteria and toxic dinoflagellates is needed by the general public.

- Currently there are separate recreational (voluntary) and non-recreational (industry-required) PSP testing requirements. Opportunities to share information cross-sector may be helpful.

- Health officers don't always participate in the oyster farming practice. More participation will increase their exposure and understanding of relevant issues.

Issues to Avoid

Ideas were shared by stakeholders on issues that are not best addressed at the proposed workshop.

- Oyster growers carry the financial responsibility for water quality monitoring to fulfill state regulatory requirements despite not contribution to the demise of water quality. Recreational tourism and lodges may be the culprit(s) and should share in the burden for testing.

- Results from PSP tissue testing lags market and consumption demand. Reliable and acceptable on-site tissue tests are needed to expedite reporting.

- Enhancement efforts for wild shellfish stocks; this is a politically sensitive topic.

- Exhaustive discussion on regulatory requirements for water quality monitoring and fiscal responsibilities for conducting monitoring
    - Current regulations are at regional-level and cannot be changed locally.

5.3 Stakeholder Vision for Outcome

From stakeholder interviews the following desired outputs for the workshop were identified:

- Create a nearshore water/pH monitoring program for Kachemak Bay and involve shellfish industry in sampling. These goals are similar to those previously identified by growers in other areas of Alaska (AMCC 2012, Ocean Alaska Priorities 2007).

- Central data portal for Kachemak Bay ocean measurements (e.g. temperature, salinity, pH) used and accessed by researchers and oyster growers. Portal may show results from PSP testing, as well as relevant information links. Alaska Ocean Observing System Cook Inlet portal is a possible option for data hosting and visualization.
    - This information needs appropriately packaged in a manner most useful to the oyster industry.

- Broader geographical database to include ocean condition information and relative success of bivalve species along the Pacific coast. This tool may allow oyster growers to evaluate and forecast the success of different species in Alaska.

- Kachemak Bay workgroup that convenes regular to receive and provide oyster-related information. Specifically the group would focus on :
    - The utility of research information being disseminated to oyster growers;
    - The success and failure of oysters that season;
    - Incidental observation of conditions or growth that could be linked to available data.

- Formative evaluation(s) of data products and their relative usefulness to ensure outcomes meet desired targets.

- Proceedings document from workshop that could be used by organizations to leverage legislature to prioritize funding.

- Research topics for Kachemak Bay identified, and exploration of partners or networks able to meet research need (e.g. PSP testing, species diversification and development, natural growth. This goal was previously identified by oyster growers in Alaska (State Input to Action Plan 2006).
    - Consolidate research around condition index for oysters to better forecast survival.

- Better information sharing between researchers and growers in Alaska. Improved knowledge on the specific work being done by different organizations.

- Sustained funding sources to support research and product development in Kachemak Bay.

- Effective regional partnerships are needed to create cohesive plans and policies for mariculture in Kachemak Bay.

5.4Key Issues to be Addressed

During stakeholder interviews the following priority issues were categorized that should be addressed during the workshop.

- Review climate-related oyster studies from other areas and restoration planning tools developed to promote population resiliency. Identify lessons learned from these collaborative studies that may be applied to Kachemak Bay.

    Key Questions for Collaborators:
    - Who were the project partners and how were they engaged?
    - What was most useful in the collaborative process and what was not?
    - What was most useful in the research context and what was not?

- Provide synthesis of research on ocean conditions in Kachemak Bay relevant to bivalves, including oceanography in Kachemak Bay and recent water quality analysis (NOAA Kasistna Bay Lab and KBNERR), including:
    - Benthic mapping
    - Larval transport
    - Ocean circulation models
    - Water column and sub-bay stratification
    - Ocean condition time-series analysis
    - SWMP trend summaries
    - Bivalve life history studies

- Identify potential knowledge links between oyster-related NERR studies and Kachemak Bay for climate stressors. Address data gaps that may be important to more closely investigate.
    - Consider key observations of oyster growth and survivorship that could be paired with ocean measurements and anomalies.
    - Identify optimal conditions for juvenile oyster planting.
    - Review of the importance of fresh water as an impediment to oyster survival
        - There is heavy freshwater outflow into Kachemak Bay from glaciers and snowmelt. Layering is variable throughout the Bay and by season. To what degree and how do snow fall and rain influence stratification?

    Key Questions for Collaborators
    - What information was gathered and used to support the restoration efforts?
    - What is temperature range for successful spawning?
    - Were there predation issues? If so, how were these addressed?
    - What oyster sensitivities to ocean conditions were measured?
    - Were these sensitivities overcome? If so, how?
    - How is ocean pH monitored- in what locations and at what intervals?
    - What life stages of oysters are most sensitive to pH?

- Review of current ocean acidification knowledge in Alaska and summary of pH monitoring within Kachemak Bay (using SWMP and offshore water monitoring)
    - Synthesis of water quality monitoring that is underway with University of Alaska, Fairbanks at the Alutiiq Pride hatchery in Seward, Alaska.
    - Critical review of how water quality information in Kachemak Bay is being collected with specific focus on opportunities to improve current methods.

    Key Questions for Collaborators
    - What examples from other regions are there in partnerships to protect water quality in other areas?

- Specify how the information and process from NERR studies can be translated to better understand native bivalve population declines and inform restoration strategies
    - Identify potential knowledge links from the oyster-related NERR studies that could be applied to native bivalve restoration in Kachemak Bay.
    - Address data gaps around variables that may be important to more closely investigate.

    Key Questions for Collaborators
    - What products were developed from the project? Could these be adopted for this region?

- Evaluate current collaborative networks in Kachemak Bay and identify other potential collaborative efforts to strengthen policy, funding, and farming/hatchery strategies.
    - Help identify next steps and what communities in Kachemak Bay can do.
    - Recognize the value of well-coordinated monitoring and record-keeping by researchers and growers.

6. Next Steps

Next steps for the workshop development include:

- **Finalization of the situation assessment report:** Review and comment on the draft assessment report by project collaborators, followed by incorporation of input and finalization.

- **Draft workshop agenda**: The final situation assessment report will inform a draft workshop agenda, including presentation and participant sessions (e.g. break-out groups, round table discussion, etc). The draft agenda will be shared with the project collaborators for input and then finalized.

- **Subject matter experts**: The final workshop agenda will information recommendations about potential additional technical experts who will serve as resources for the workshop.

- **Workshop**: KBRR and project collaborators will host a public workshop focused on the materials and agenda mentioned above.

Literature Cited

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Oceans Alaska (2007). Tipping the Balance: Research. Development, and Training: A Strategic Plan to Support the Growth of the Shellfish Industry in Alaska. Meeting proceedings October 31, 2007. Anchorage, Alaska.

SeaGrant Marine Advisory Program (1992). Alaska's Marine Resources, Dec 1992 vil. VII No. 4

Shellfish Industry (2006). State Input to Action: Mission, Priorities, and Communication. Planning session proceedings January 9-10, 2006.

Table 1. Stakeholder Interview List

Name	Affiliation	Role
Steve Rykaczewski	Early Tide Seafarms, Kachemak Bay Oyster Cooperative President	Oyster grower, President
Sean Ruddy	Kachemak Shellfish Mariculture Association Manager	Oyster grower, Manager
Margo Reveil	Jakolof Bay Oyster Company	Oyster grower
Weatherly Bates	Alaska Shellfish Farms; Alaska Shellfish Growers Association	Oyster grower
Roger Painter	Alaska Shellfish Growers Association	President
Marie Bader	Moss Island Oyster Farm	Oyster grower
Angela Doroff	Kachemak Bay Research Reserve	Research Coordinator
Ray RaLonde	SeaGrant Alaska Marine Advisory Program	Aquaculture Specialist
Jan Rumble	Alaska Dept of Fish & Game, Commercial Fisheries Division	Groundfish and shellfish management biologist
Cynthia Pring-Ham	Alaska Dept of Fish & Game, Commercial Fisheries Division	Mariculture Program Manager
Bob Shavelson	Cook Inletkeeper	Executive Director
Dave Aplin	World Wildlife Fund	Arctic Program Outreach Director
Kris Holderied	NOAA Kasistna Bay Lab	Director
Jeff Hetrick	Alutiiq Pride Shellfish Hatchery	Director
George Scanlan	Department of Environmental Conservation	Environmental Health Officer
Ellen Tyler	Alaska Ocean Observing System	Project Coordinator
Ginny Litchfield	Alaska Dept of Fish & Game, Habitat Division	Habitat Biologist