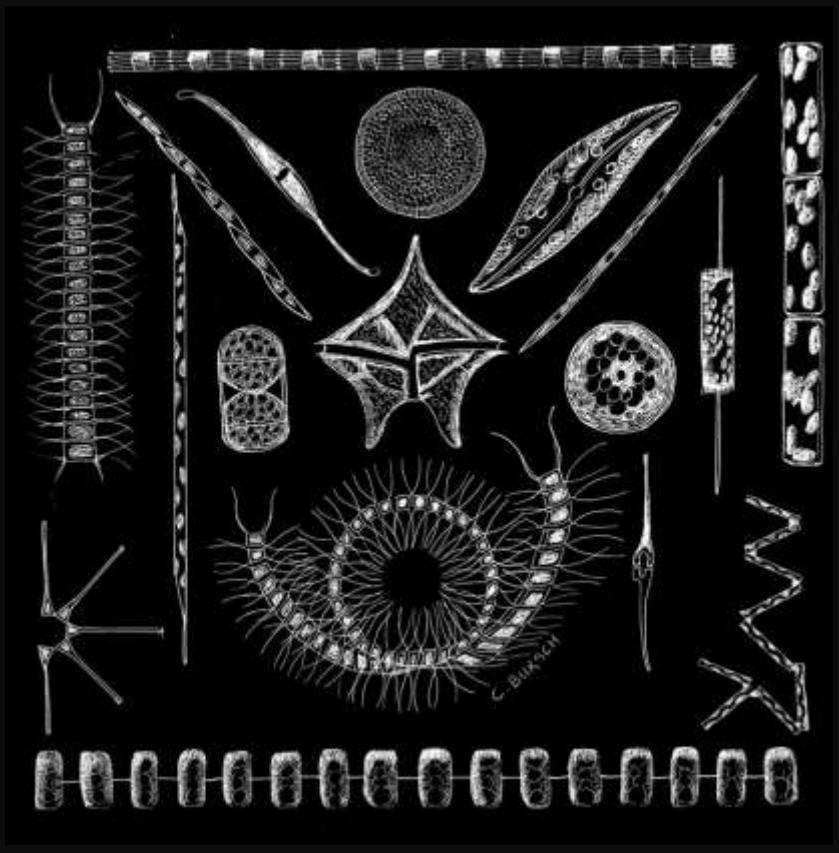
Kachemak Bay Phytoplankton and Harmful Algal Bloom Workshop

February 11-12, 2014

Workshop Proceedings



April 2014

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Kachemak Bay Research Reserve, 2014. Homer, AK

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EXECUTIVE SUMMARY

Overview

Within the Kachemak Bay community several organizations are involved in the study and monitoring of phytoplankton for potential harmful algal blooms (HABs). While these studies are largely conducted independently, discussion about the current state of phytoplankton monitoring in Kachemak Bay, the unique challenges researchers face, and opportunities for increased coordination prompted formation of the First Annual Kachemak Bay Phytoplankton and Harmful Algal Blooms Workshop. The workshop, organized by the Kachemak Bay Research Reserve, brought together regional experts and the local community to share their questions and results with key subject matter experts to guide the future direction of local phytoplankton research and monitoring.

The workshop consisted of a plenary session, two breakout sessions and a final facilitated session over two days. The plenary session was led by an invitational speaker followed by thirteen summary presentations representing nine organizations currently involved in local research, HAB monitoring, and state regulation. In session two, participants broke into three groups to discuss long-term trends and bloom triggers, tracking and identification methods, and regional networking before reconvening to summarize discussions. In session three, participants broke into two groups to discuss event response, and mechanisms for reaching decision-makers before reconvening to summarize discussions. The final session was a discussion to identify next steps and action items to maintain interaction and data sharing among participants.

Following the summary presentations, session two breakout groups explored long-term trends and triggers to phytoplankton blooms, tracking and identification methods, and regional networking. Participants agreed that having a coordinated regional network would improve efficiency of data analysis, information sharing, and funding opportunities. Local community monitors, applicability of methods, and available monitoring tools were seen as assets to identifying and tracking phytoplankton blooms region wide. Time series data and visualization through GIS were suggested for determining large scale patterns. Seasonal pycnoclines, freshwater influence, and ocean currents were discussed as significant factors in bloom timing and longevity. Participants identified the need for a standardized database accessible across agencies, and a pilot study involving full vertical column sampling to enhance existing methods.

Session three breakout groups considered event response, and mechanisms for reaching decision-makers. Participants cited several obstacles to effective event response, with a lack of reliable field tests or coordinated processes to expedite potentially toxic samples and inform the public topping the list. The broad range of decision-makers and resource users, along with their different information needs and current means of information acquisition and dissemination were discussed. Participants recommended continued phytoplankton monitoring, trend analysis, safe consumption practices and data sharing through online exchanges.

The final facilitated session focused on workshop outcomes and needs, and planning next steps to maintain interaction among workshop participants. Six priorities were identified: 1) create a phytoplankton database (that could be part of a centralized data base used to mirror the

environmental variables of the System Wide Monitoring Program) ; 2) standardize sampling methods; 3) continue plankton identification and training; 4) form a coordinated information sharing network; 5) improve public notification of potentially harmful blooms; and 6) develop a regional event response plan.

Conclusions and Recommendations

Based on the priorities identified during the facilitated session, workshop participants agreed to complete the following broad action items: (Specific action items can be found in *Appendix B; Actionable items Table*).

- Proceed with two more years of KBRR community based phytoplankton monitoring and coordination with other researchers in Kachemak Bay to add to baseline data. Within two years, establish sentinel sites for continued research.
- Continue to update the phytoplankton identification guide and provide cross-organizational annual HAB training to standardize protocols and streamline collection and data entry.
- A working group was formed to explore centralized database options for hosting and sharing phytoplankton data. They will report back to the full group in Fall 2014.
- Once a database is established, populate it with as much phytoplankton data as possible from past and current work and to use in the future. Outreach materials can then be created from all data to give user groups a more complete picture of Kachemak Bay phytoplankton rather than scattered results over various agencies.
- To improve information sharing, participants suggested holding annual, informal spring meetings beginning this year to coordinate local efforts on sampling schedules, event response, media key messages and public notification during the summer. Development of timely public bulletins on local non-toxic and harmful blooms were discussed also.
- An event response group was formed with a goal of holding a facilitated meeting in April 2014. The future goals of this group include making a flow chart showing a cascade of actions and contacts in the event of a toxic bloom, creating an outreach plan for toxic events, and working on getting quicker, easier tests for toxic shellfish into the hands of user groups.

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WORKSHOP GOALS

Phytoplankton serves as the base of the marine food web, providing an essential ecological function for marine life and a key food item for zooplankton and shellfish. Phytoplankton may rapidly proliferate and "bloom" in the marine environment, depending on ocean conditions. While most algal blooms are beneficial to the ecosystem by adding nutrients and oxygen, they can sometimes produce toxins that are harmful to humans and marine animals.

In recent years, the Kachemak Bay community—from scientists to oyster farmers, to subsistence users, to school children—has come to realize the significance of phytoplankton in the bay. As a result, the local interest in learning more about these tiny oxygen-producing, nutrient-dependent, photosynthesizing microalgae has risen. In response to this interest, the Kachemak Bay Research Reserve hosted a 2-day workshop to bring locals and experts together to share their knowledge and discuss future phytoplankton research and monitoring in Kachemak Bay.

The workshop had four main goals:

- Facilitate information exchange about phytoplankton and harmful algal blooms in Kachemak Bay
- Encourage improved cooperation and communication among researchers, agencies, and shellfish growers
- Identify major impediments to research and monitoring, and the integration of this information into a coordinated network to address them
- Determine next steps towards future coordinated interaction

Kachemak Bay Research Reserve held this workshop as the first in a series of annual workshops to expand the community's knowledge about phytoplankton and encourage regional coordination.

WORKSHOP STRUCTURE

The workshop was held at the Alaska Islands and Ocean Visitor Center in Homer, Alaska, February 11-12, 2014. There were two invited subject matter experts from the Center for Coastal Fisheries and Habitat, National Centers for Coastal Ocean Sciences, NOAA, and 37 invited participants from around the state and local community representing a variety of interests, including: research, resource management, public health, monitoring, subsistence use, mariculture, and education.

The workshop consisted of four sessions, the first being led by the plenary speaker on comparative ecosystem approach to the study of phytoplankton in the hopes of defining key environmental variables or processes that can serve as important monitoring metrics. Thirteen individuals then presented summaries of their work in these areas.

The second session involved three breakout groups that addressed key topics of local interest. The first breakout group examined whether long-term trends could be determined, and if bloom triggers could be found in Kachemak Bay. The second breakout group explored the best methods for tracking and identifying phytoplankton in Kachemak Bay. And the third breakout group discussed the idea of having a coordinated network for regional monitoring and research in Kachemak Bay.

The third session consisted of two breakout groups that addressed topics of a broader nature. The first breakout group discussed bloom event response, while the second breakout group looked at mechanisms needed to bridge research and monitoring information to decision-makers.

The final session was a plenary discussion to identify next steps and actions needed to maintain participant interaction and data sharing beyond the workshop. The discussion focused on outcomes and research needs identified during the breakout sessions, ways to facilitate future interactions and data sharing, and potential strategies to overcome funding shortfalls.

BREAKOUT SESSION SUMMARIES

Trends and Triggers

The overall goals of this breakout session were to discuss long-term trends in phytoplankton blooms in Kachemak Bay, and to identify triggers that may help predict future events. Participants discussed seasonal pycnoclines, freshwater influence, and ocean currents as significant factors in bloom timing and longevity in Kachemak Bay. Time series data and visualization through GIS were suggested for determining large scale patterns.

Water in Kachemak Bay is known to exhibit a variable density gradient during the spring and summer time periods. The top 10-20m of water are generally warmer, have more photosynthetically active radiation, and are less saline. Over time, phytoplankton eventually depletes the nutrients in the surface waters. At approximately 20m below the surface, water is more saline (dense) and colder than the surface waters. The density and temperatures of the water serve as a barrier to phytoplankton living near the surface. The nutrient-rich water is effectively trapped beneath where the phytoplankton occurs because of the water density gradient (pycnocline).

The nutrient depletion in the upper waters can cause stagnation and terminate potential phytoplankton blooms in waters above the pycnocline even when there are ample light and warmer water temperatures. This is more likely to happen in the spring time and within the first 10m of water. Phytoplankton blooms occurring later in the season are likely to be deeper and closer to the pycnocline as phytodetritus from earlier blooms settles down through the water column and motile zooplankton below the pycnocline move up.

Participants discussed other nutrient inputs that may offset nutrient depletion in the surface waters in Kachemak Bay. While terrestrial data is lacking, a small amount of iron from spring runoff and glacier melt may provide a brief benefit to phytoplankton before it oxidizes and precipitates out. These nutrient inputs have been largely unquantified to date. The group discussed that if terrestrial iron were present, it would be evident in the chlorophyll signal. At this time, the group concluded the terrestrial-based nutrient inputs were not likely to be a driver in setting up phytoplankton bloom structures in Kachemak Bay.

Participants surmised that when the density gradient breaks down during the fall and winter seasons, the whole system is refreshed with nutrients—primarily nitrate. How well this mixing occurs will influence the resources available for spring phytoplankton blooms.

Participants discussed whether tidal flushing is adequate to refresh nutrients in sub-bays such as Jakolof Bay where some oyster farms are located. They considered the potential for nutrient reservoirs and phytoplankton cysts to drive spring zooplankton blooms, and agreed that regular sampling during anticipated bloom times could capture this data.

Participants suggested conducting a pilot study adding 20m sampling to existing CTD casts and System-wide Monitoring Program surface/bottom sampling in greater Kachemak Bay to capture the high level of productivity that occurs along the density gradient. Comparing these data with those taken along the Seward Line on the Outer Coast could indicate if the same water is moving from the Gulf of Alaska through Kachemak Bay, which could enhance understanding of bloom origins and timing.

Participants concluded that in order to determine long-term trends, they first needed to define what a normal, or nearly normal, bloom was for a particular location. Having that information would provide the background needed to spot anomalies, which could then be compared to normal patterns.

During this discussion, participants also examined existing data collections available to users, and the limitations and benefits of online databases such as EPA's Environmental Information Exchange Network, whose parameters are similar to those used by the Kachemak Bay Research Reserve. Participants identified the need for a standardized, sharable database accessible across agencies, as well as a coordinator to identify funding sources and ensure proper data format. This topic was discussed in a later break-out session as well.

Best Methods

The goal of this breakout session was to identify the best methods for tracking and identifying phytoplankton in Kachemak Bay. Participants cited local community monitors, applicability of methods, and other available monitoring tools as assets to identifying and tracking phytoplankton blooms region wide.

An examination of current methods and available information revealed several ongoing opportunities for data exchange between organizations including Kasitsna Bay Laboratory, oyster farmers, Alaska Department of Fish & Game, Seldovia Village Tribe, Gulf Watch, and Kachemak Bay Research Reserve. Historic salinity and temperature data in Kachemak Bay, as well as data from the oil industry, BOEM, Tutka Bay and Port Graham hatcheries, and M/V Tustumena Ferry (Vessels of Opportunity) were also mentioned. Participants recognized the value in using the Phytoplankton Monitoring Network protocols and equipment.

A review of current strengths of the Kachemak Bay community with regard to phytoplankton showed a willingness of volunteers to collect and deliver samples, a willingness among participants to share information, opportunities for partnerships, and the applicability of methods to regions beyond Kachemak Bay. Flexibility to sample when volunteers are available was cited as a primary reason for the program's success, as was Kachemak Bay's connection to experts at the Phytoplankton Monitoring Network in South Carolina.

In their discussion of other monitoring tools that could be employed, participants identified 24-hour automated sampling and real-time telemetered chlorophyll-a sampling through the Research Reserve's SWMP program. They also suggested coordinating more closely with community monitors through phone calls or apps to encourage data reporting when they don't have time to do a protocol sample. Could we keep track of "observations"?

Several gaps in collection and data were discussed, as well as opportunities to fill them. A lack of data exchange and duplication of effort among local entities were seen as key issues, as were differences in protocols and databases used. Participants noted that no phytoplankton data existed for the north side of Kachemak Bay, and no data were being collected in connection with razor clam studies in Ninilchik. A lack of funding to analyze existing data collections was also mentioned, along with a lack of data on stream nutrients to determine their contribution to marine phytoplankton blooms.

Questions over best sampling times with regard to tide spawned the idea of sampling at high, low, slack and throughout one 24-hour period. Other ideas included looking at existing stream nutrient data to better understand limiting factors, turbidity data to indicate light levels, and holding a one-day "data blitz" for participants to share different ways of graphing data.

Participants concluded that data collected should be used and outreached through a final product of some kind.

Coordinated Network

The primary goal of this breakout session was to explore potential benefits and obstacles to forming a coordinated network for regional monitoring and research. Participants agreed that having a coordinated regional network would improve efficiency of data analysis, information sharing, and funding opportunities.

Groups involved with a coordinated network would include: personal use fishermen; oyster growers/shellfish harvesters; hatcheries; researchers; resource managers; public health officials, Alaska Department of Environmental Conservation, community monitors, and tribal/subsistence users.

Participants identified several benefits to having a coordinated network, including: improving data analysis efficiency, standardizing collection and reporting methods; streamlining information outreach; coordinating event response; encouraging data exchange through a centralized data deposit; improving management decisions; reducing effort duplication; improving access to funding; and encouraging exploration of research priorities.

There was some discussion regarding compatibility of existing data collections and potential impediments to a coordinated network. Participants discussed that data is collected at different scales with no standardization which affects large-scale data analysis and calibrations.

The lack of a regionally-specific database or centralized data deposit, cross-organizational access to data, and funding to maintain a database were also mentioned. Participants also recognized the need for expertise in public communications, and a coordinator dedicated to the network.

Participants concluded that developing a standardized, sharable database accessible across agencies and naming a network coordinator dedicated to overseeing the database and identifying funding sources were priorities for the group.

Event Response

The goal of this breakout session was to explore current event response processes, limitations and potential improvements to bloom event responses throughout the region. Participants cited several obstacles to effective event response. Lacking reliable field tests for shellfish farmers and a clear, coordinated process to expedite potentially toxic recreational samples and inform the public topped the list. Differences in agency missions, transportation time from sampling to identification (i.e., sample condition, reporting time), and misidentification all contributed to problems in responding to an event in Kachemak Bay.

Quite a bit of discussion surrounded *Alexandrium* and the concern over verification and public notice before a bloom peaks. The Research Reserve currently sends samples suspected of containing *Alexandrium* to the Phytoplankton Monitoring Network on the east coast, but that's the extent of KBRR's role. The Alaska Department of Environmental Conservation is the agency responsible for commercial testing, including oyster farmers, but the Division of Public Health (under the Alaska Department of Social Services) handles information on recreational shellfish toxins. The Alaska Department of Fish and Game issues press releases for recreational closures. This information disconnect between agencies for purposes of event response was identified as a serious problem.

Participants considered ways to improve the existing system, including faster field testing for recreational users and oyster farmers, as well as increased testing during peak shellfish harvest times. Also someday hosting ocean circulation model outputs on the AOOS web portal would be useful, in conjunction with KBRR SWMP data, to evaluate bloom structures. Another suggestion was to use molecular techniques to track phytoplankton before temperatures increased in order to detect early levels of toxicity.

Participants made several recommendations including: continued bi-weekly phytoplankton updates by KBRR staff; developing a clear notification list if *Alexandriuim* is found in Kachemak Bay; creating a flow chart of the existing response process; adding links to ADEC's website to increase public awareness of confirmed events; and asking ADEC to prioritize emergency shellfish tissue samples.

Participants concluded that processing potentially toxic tissue samples at the State lab, and improving the process to expedite public alerts of known PSP outbreaks were a priority.

Reaching Decision-Makers

The goal of this breakout session was to find ways to bridge research and monitoring data to resource managers, regulatory agencies, public health officials, shellfish farmers, subsistence users, and other consumers.

Participants discussed the broad range of decision-makers and resource users and their different information needs, as well as current means of information acquisition and dissemination. Various State agencies are responsible for testing and issuing press releases about shellfish toxins depending on whether the product is commercial or recreational. Public health officials

who communicate information on recreational paralytic shellfish toxins need solid, quantitative, verifiable, science-based information that's statistically rigorous and defensible. Quality control is essential to harmful algal bloom information. Resource managers and tribal leaders need information on harvest, abundance and environmental conditions to properly regulate the resource. Traditional knowledge and values are useful in particular testing practices, but there is a need for alternative methods to improve safe consumption of the subsistence resource (i.e., safe harvest times, product handling, cleaning practices). Phytoplankton monitoring and trend analysis was cited as a common need among decision-makers.

Participants examined the ways that agencies and resource users communicated their information. Much is via agency website, but fliers, online data exchanges, reports and published research are also popular means of conveying current information to the public and each another.

Participants concluded that there was no single means of bridging research and monitoring to all decision-makers due to their varying needs. They recommended continued phytoplankton monitoring, trend analysis, safe consumption practices, and data sharing through online exchanges.

NEXT STEPS AND ACTIONABLE ITEMS

The final facilitated session focused on workshop outcomes and needs, and planning next steps to maintain interaction among workshop participants. Six priorities were identified: 1) create a phytoplankton database (that could be part of a centralized data base used to mirror the environmental variables of the System Wide Monitoring Program) ; 2) standardize sampling methods; 3) continue plankton identification and training; 4) form a coordinated information sharing network; 5) improve public notification of potentially harmful blooms; and 6) develop a regional event response plan.

An outline of the discussion and a table showing next steps can be found in Appendix B.

CONCLUSIONS AND RECOMMENDATIONS

Based on the priorities identified during the facilitated session, workshop participants agreed to the following broad action items: (Specific action items can be found in *Appendix B; Actionable items Table*).

- Proceed with two more years of KBRR community based phytoplankton monitoring and coordination with other researchers in Kachemak Bay to add to baseline data. Within two years, establish sentinel sites for continued research.
- Continue to update the phytoplankton identification guide and provide cross-organizational annual HAB training to standardize protocols and streamline collection and data entry.
- A working group was formed to explore centralized database options for housing and sharing phytoplankton data. They will report back to the full group in Fall 2014.
- Once a database is established, populate it with as much phytoplankton data as possible from past and present work to use into the future. Outreach materials can then be created from all data to give user groups a more complete picture of Kachemak Bay phytoplankton rather than having scattered results over various agencies.
- To improve information sharing, participants suggested holding annual, informal spring meetings beginning this year to coordinate local efforts on sampling schedules, event response, media key messages and public notification during the summer. Development of timely public bulletins on local non-toxic and harmful blooms was also discussed.
- An event response group was formed with a goal of holding a facilitated meeting in April 2014. The future goals of this group include making a flow chart showing a cascade of actions and contacts in the event of a toxic bloom, creating an outreach plan for toxic events, and working on getting quicker, easier tests for toxic shellfish into the hands of user groups.

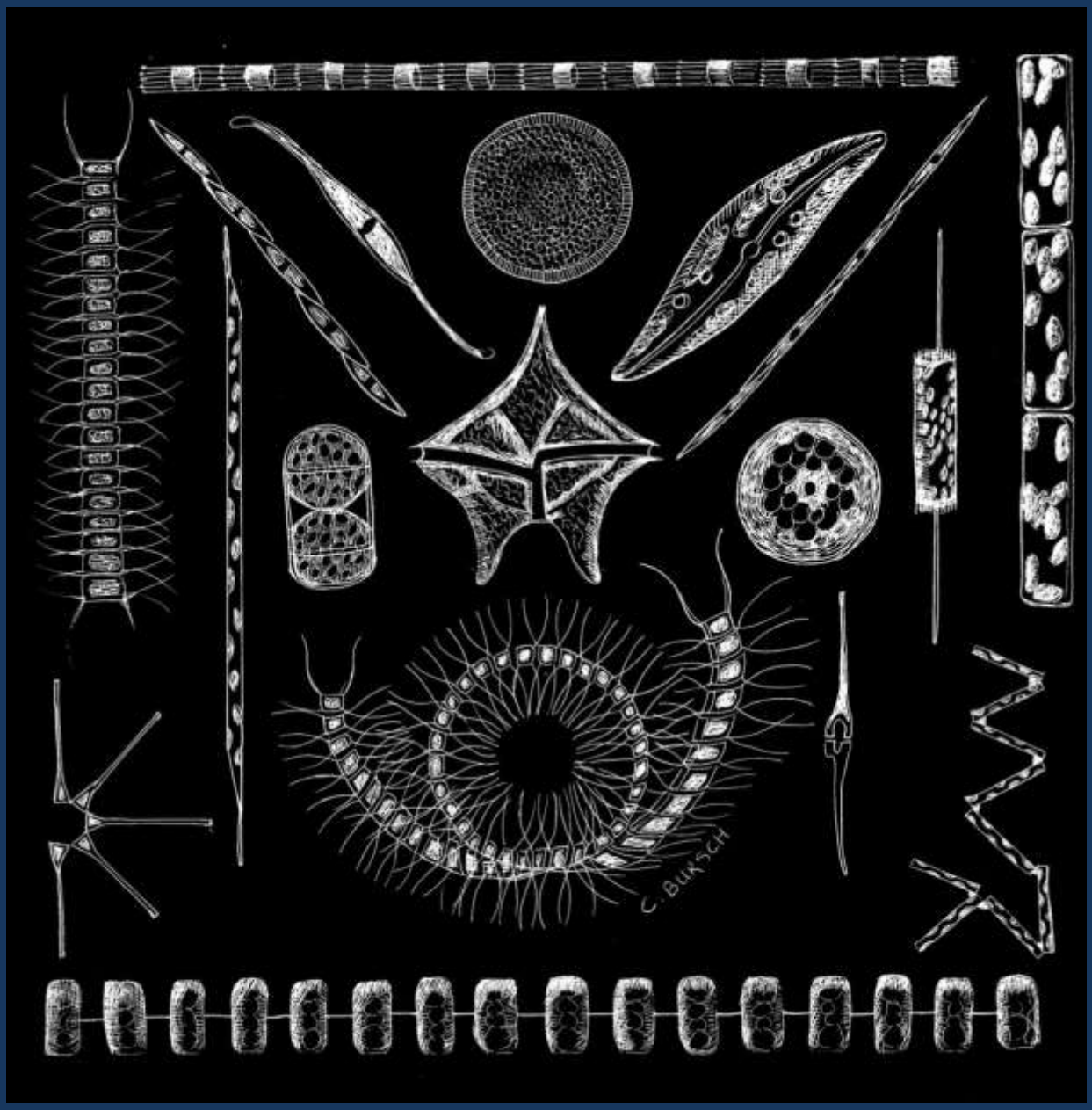
Appendix A: Workshop Agenda

Kachemak Bay Phytoplankton and Harmful Algal Blooms

February 11-12, 2014

Islands & Ocean Visitor Center Homer, Alaska

PROGRAM & ABSTRACTS



Overview

Phytoplankton serve as the base of the marine food web, providing an essential ecological function for marine life and a key food item for aquaculture and mariculture alike. Phytoplankton may rapidly proliferate and "bloom" in the marine environment. While most algal blooms are beneficial, sometimes they can produce toxins and sicken humans and marine animals.

Within Kachemak Bay there are several organizations involved in the study and monitoring of phytoplankton for potential harmful algal blooms (HAB). While these studies are largely conducted independently, discussion about the current state of phytoplankton monitoring in Kachemak Bay, the unique challenges researchers face, and opportunities for increased coordination have given rise to the first-ever Kachemak Bay Phytoplankton and Harmful Algal Blooms Workshop. This Workshop, organized by the Kachemak Bay Research Reserve, brings together regional experts and the local community to share their results with key subject experts to guide the future direction of local phytoplankton research and monitoring.

The objectives of this workshop are to:

- Facilitate information exchange about phytoplankton and harmful algal blooms in Kachemak Bay
- Encourage improved cooperation and communication among researchers, agencies, and shellfish growers
- Identify major impediments to research and monitoring, and the integration of this information into a coordinated network to address them;
- Determine next steps towards future coordinated interaction.

Plenary Speaker

Dr. Tester earned her B.A. with honors in Life Sciences and Chemistry at California State University in Sonoma, her M.S. in Oceanography from Oregon State University and her Ph.D. in Oceanography also at Oregon State University.

Pat has worked for the National Oceanic and Atmospheric Administrative, (NOAA) with the National Ocean Service and National Marine Fisheries Service since 1981.

All this means that Pat Tester is a biological oceanographer with interests in phytoplankton-zooplankton interactions and the effects of toxic or harmful phytoplankton on marine food webs. Her early work includes remote sensing in the detection and tracking of algal blooms which led to real time satellite imagery. Pat's congressional testimony in 1987 led to the Small Business Administration amending the definition of "disaster" to include "red tides, brown tides and other natural events" so low cost loans could be made to communities affected by HABs.

Midcareer, Pat's interest in using molecular techniques to resolve HAB problems ranging from species identification to toxin detection culminated in multiple awards for developing a domoic acid test kit. Having served on a number of international steering committees (2006-2008, 2010-2014), Pat is a founding member and past president of the International Society for the Study of Harmful Algae. The North Pacific Research Board appointed Pat to its Science Panel in 2002 and she continues to serve in that capacity. Her current interests in Alaska support shellfish safety and focus on detection technologies for paralytic shellfish toxins and the organism responsible for those toxins

Patricia A. Tester, Ph.D.
Chief Scientist, JHT (NOAA Contractor)
NOAA Supervisory Oceanographer (Retired)
Center for Coastal Fisheries and Habitat Research, National Ocean Service, NOAA

Agenda

Tuesday, February 11

8:15- 8:30 Registration and check-in

8:30 -8:45	Welcome & workshop goals	**Catie Bursch** Kachemak Bay Research Reserve
8:45-9:30	Plenary A Comparative Ecosystem Approach to Understanding Phytoplankton and Harmful Algal Blooms in Kachemak Bay Alaska	**Pat Tester** Center for Coastal Fisheries and Habitat, National Centers for Coastal Ocean Science, NOAA
9:30-9:45	Introductions	
9:45-10:05	Kachemak Bay Research Reserve's research and monitoring program: updating the circulation model for Kachemak Bay	**Angela Doroff** Kachemak Bay Research Reserve
10:05-10:25	A Hydrographic Model for Cook Inlet	**Georgina Gibson** University of Alaska Fairbanks
10:25-10:45	Oceanographic Drivers for Phytoplankton Blooms in Kachemak Bay, Alaska	**Kris Holdereid** NOAA Kasitsna Bay Laboratory
10:45-11:00	Networking break	Coffee/tea- auditorium
11:00-11:20	A Community's First Effort to Understanding Primary Production in Kachemak Bay: the Good and the Bad	**Catie Bursch** Kachemak Bay Research Reserve
11:20-11:40	Bloom and Bust: Monitoring Phytoplankton populations in Kachemak Bay	**Domonic Hondolero** NOAA Kasitsna Bay Laboratory
11:40-12:00	Abiotic Conditions and Bloom Timing in Kachemak Bay (possibly poster instead of presentation)	**Steve Baird** Kachemak Bay Research Reserve
12:00-13:00	Lunch	Provided for registered participants

13:00- 13:20	Quantitative assessment of *Chaetoceros Spp.* Concentrations and Adaptive Salmon Smolt Stocking Procedures in the Nick Dudiak Fishing Lagoon on the Homer Spit, Alaska	**Mike Booz** Alaska Department of Fish and Game
13:20-13:40	Guide to Phytoplankton of Kachemak Bay	**Jane Middleton** Community HAB Monitor
13:40-4:00	Breakout session overview	**Stacey Buckelew** Kachemak Bay Research Reserve
14:00-14:10	Restroom break	
14:10-15:30	Breakout sessions Session 1: Can long-term trends be determined for Kachemak Bay: Can bloom triggers be found? Session 2: Best methods for tracking/identifying phytoplankton in Kachemak Bay. Session 3: Coordinated network for regional monitoring and research.	Session moderators: **Stacey Buckelew** **Jess Ryan** **Angie Doroff**
15:30-16:00	Groups reconvene & summarize sessions	**Angie Doroff**

Wednesday, February 12

8:30- 8:40	Summary from previous day	**Pat Tester**
8:40- 9:00	Developing an Integrated Monitoring System for Detecting Toxic *Alexandrium* Species and Saxitoxins in Kachemak Bay Alaska	**Wayne Litaker** Center for Coastal Fisheries and Habitat, National Centers for Coastal Ocean Science, NOAA
9:00-9:20	Detection of Human Exposure to Saxitoxin and Neosaxitoxin in Urine by Online-SPE-LC MS/MS	**William Bragg** Centers for Disease Control and Prevention
9:20-9:40	Testing for Toxins in Alaskan for Commercial Shellfish & Recreational Shellfish Monitoring	**George Scanlan** Dept of Environmental Conservation
9:40-10:00	A Tale of Two Species: An Exploration into the Effects of Increased *Alexandrium* populations on Shellfish Harvesting in Kachemak Bay	**Persnickety Protoperidinium** National Ocean Science Bowl Homer High School Team
10:00-10:20	Networking break	
10:20-11:40	Concurrent breakout sessions Session 4: Bloom event response Session 5: Mechanisms to bridge research and monitoring to decision makers.	Session moderators: **Stacey Buckelew** **Jess Ryan**
11:40-12:00	Groups reconvene & summarize sessions	**Marianne Aplin** – facilitator
12:00-13:00	Lunch	Provided for registered participants
13:00-15:00	Planning the next steps with concrete action items What are the outcomes/research needs identified in breakout sessions the group wishes to accomplish? What are the next steps that can be taken to maintain interaction and data sharing?	**Marianne Aplin**- facilitator

Appendix B: Next Steps Outline and Actionable Items

Session 4 – February 12, 2014

Next Steps (Facilitated Session)

Actionable Steps next 1-3 years: Who can do these, and is there funding? What can this group do to make sure there's follow-up and these actions get addressed?

- Centralized database - **Create working group** (Kris, Catie, Dom, Julie, Weatherly/Margo) to:
    - Look at EPA WQ Exchange Network, AOOS database & see if either meets our needs
    - ID needs, report what each database offers, and make recommendations
    - Discuss who will maintain database
    - ID a database to put phytoplankton info into (different from NOAA's)
    - Find private? database for oyster growers to share PSP data with other oyster growers
    - Etc….

- Sampling methods – standardize & streamline within next 1-2 years to improve data
    - Step 1: **ID database to use and start populating it**
    - Step 2: **ID someone (intern) to coordinate this effort; hold combined data workshop to evaluate current methods and analyses** (Stacey?)
    - Standards (mesh size, sampling techniques)
    - Streamline (what' being sampled, sampling frequency)
    - Ask how coherent the system is, quality of samples received – recommendation to continue current HAB monitoring methods for now; get data analyzed and extract information out of the data to help inform the selection of sentinel sites. Hold steady with monitoring next 2 years. NOAA will help with data analyses with real questions behind them, hypothesis-driven
    - Goal: establish sentinel sites for Kbay; include animal samples along with water samples
    - Goal: match/combine/compare KBRR SWMP, ADF&G, KBL and phytoplankton KBRR HAB monitoring data
    - If Phytoplankton Network (NOAA) isn't feasible for counting cells, find another database to get us to reach goal of sentinel sites

- Species ID – Phytoplankton Guide (done!)
    - Suggestion to put line drawings next to photos in guide instead of on separate page. iPhone app next? ☺ Jane can do this

- Catie to update email list of group to report new spp., and for people to report new spp. To KBRR to update the Guide
- PCR Bridge at UAA/KPC – do they have one?
- Cell counting training – Kasitsna Bay possibly creates training text or video if Steve Kibbler can come up in August.
- Catie to continue annual HAB community monitoring training (spring/April)

- Info sharing/tools – public, internal.
  - How is info being shared (websites, PSAs) on a regular basis
  - Hold **informal meeting with KBL, KBRR, oyster farmers, ADF&G early spring or winter** so we know what we're all doing in the upcoming summer. Coordinate early on, make a plan, determine protocols and contacts for event responses, monitoring, etc. Keep it small, Kbay coordination. Also form "key messages" for potential media contacts
  - **Educate general public on facts** (via media, flyers, brochure, public events, etc.) about blooms, recreational harvests, etc.
  - Mechanism for sharing "events" or potential blooms with one another, but NOT the public **(internal sharing network)** – prevention, front-loading, increasing awareness

- Public health
  - Commercial harvest handled through ADEC (George)
  - Recreational harvest handled through Public Health (need to identify who this person is)
  - Coordination between both agencies does occur & ADEC issues press release when necessary
  - How is community notified by ADEC? Coordinated public information outreach
  - What do oyster farmers do when Alexandrium is discovered?
    - Call George Scanlan (Commercial harvest). If George is notified of Alexandrium, would he then call KBRR? No established protocol yet.
    - **Action Item: George will ask if shellfish samples should be harvested when Alexandrium is discovered and sent to the State Lab.**
    - **Action Item: George to ask if PSP information can be made more publicly available**

- Event response
  - **Get test kits** to oyster growers, villages, sentinel sites (on-going tests)
  - Create working group to **write up event response, plan** (George, others?) – **early April** (Stacey to coordinate)
  - **ID coordinator of event response plan write-up**

- **ID primary contact for KBay event response:** Mike Booz? KBRR? (Jess, Mike to investigate, discuss with staff). This is a time-consuming commitment!!! Whoever is named as the contact, will be on "on call" for response. (KBRR Manager???) Must be someone with decision-making power. Does the State already have point people in communities? SeaGrant Extension Agent?

Action Items Tables

Central Database related items:

Centralized database	Kris Catie Dom Julie Weatherly Margo	Next steps	Goal deadline	Done
Identify database needs: Survey participants for needs and existing databases.	Catie	Send out survey monkey	April 30, 2014	
Research existing databases and see if one meets our needs.	Catie, Julie, Kris		April 30, 2014	
Determine new database maintenance needs and how they will be filled.	Ori, Kris, Angie		May 30, 2014	
Report on data base research and make recommendation.	All meet	meeting	Sept 2014	
Database in place			Feb 2015	
Database populated	Student or intern	Get intern or student	Sept 2015	

Determined by consensus at KBRR Phytoplankton/HAB conference 2/12/2014

Information Sharing

Information Sharing	Who	Next steps	Goal deadline	Done
Access to test results of commercial shellfish. Can PSP info be made more publicly available?	George Scanlan	send email with reminder	Sept 2014	
Form a formal group like Wetland Working Group	Stacey coordinate	Set date		
Determine members	Stacey	advertise		
Who is the contact at each agency?	Stacey	Make list		
Determine how often to meet	Stacey	Survey		
Determine 3 circles…internal work group, Caties list of folks interested in updates, public	Group	Set date		
Determine how best to educate public on PSP	group			
Address changes in resources and practices over time	group			
Form informal group KBL, KBRR, Oyt farmers, ADF&G	Catie	Doodle poll for April meeting	April 18,2014	
Discuss summer sampling. Coordinate. Phyto sample from Ninilchik and other shellfish sites coord.	group	Combine with HAB training?	At HAB training April 25, 2014	
Create one graph showing coord. Cell Counts for 2012 and 2013	Catie Dom/Mike	Call Steve Morton	April 18, 2014	
Information to Public				
Develop one page bulletins on each harmful species	Wayne	Make template	April??	
Develop one page bulletins on each non-toxic bloom we have had	Catie/Dom Get photos			
Determine how best to educate public on PSP Frame Soundbites? And other products identified…outreach list and plan to community.	group			
Plan a 24 hour sampling blitz. Notify monitors at training April 25, 2014	Catie/Dom/ Mike/Ori	Use KBRR sampler	By Sept 1, 2014	
Work on a get-together at AFEnv. Or AMSS next winter in Anchorage.	Pat	Feasibility?	Sept 1, 2014	
Check with Coowe Walker and Sue Mauger about fresh water input	Catie	Call em	May 15, 2014	

Determined by consensus at KBRR Phytoplankton/HAB conference 2/12/2014

Public Health and Event Response

Public Health & Event Response	Who	Next steps	Goal deadline	Done
Form event response sub-group Reveils, Weatherly, Coop, ADF&G-Booz, KBRR, NOAA, DEC, CDC.	Catie	Doodle for best date	Feb 27, 2014	X
Find meeting facilitator	Margo?	Set date	April 18, 2014	
Define toxicity concentrations	Wayne L		April	
Draft handouts of public notices	Wayne L			
Meeting goal is to do the best we can to put a response plan together for this summer. Anything long term can be taken up at meeting in the fall.			April 2014	
Should shellfish samples be sent in if Alex is detected?	George Scanlan		April 5, 2014	
Write up a flow chart of who gets contacted when, if there is a concern.	Jess?	Do some initial research		
Create criteria for "concern"	Sub-group			
Identify primary contact for an event response. ADF&G? KBRR? Someone in decision making position? What do other areas of the state do? SE?	Sub-group	Discuss with supervisors before meeting	April 5, 2014	
How is community notified by ADEC?	Sub-group			
How can we have a coordinated public info outreach?	Sub-group			
Testing				
Get test kits to oyster growers, villages, "sentinel sites" in the future for ongoing testing.	Sub-group	Order tests		
Could water testing be made more of a public benefit instead of falling on just farmers?	Sub-group			

Determined by consensus at KBRR Phytoplankton/HAB conference 2/12/2014

Plankton Species Identification, training and methods

Plankton Species Identification, Training, and Methods.	Kris Catie Dom Julie, Mike	Next steps	Goal deadline	Done
Update KBRR phytoplankton Guide	Catie, Jane		Sept 2014	
Seek photos – email those with cameras with wanted species	Catie	Email group	April 25, 2014	
Continue annual spring identification and sampling trainings, counting techniques	Catie, Dom, Mike	Set date for 2014	April 25, 2014	
Continue Phytoplankton updates and increase to 2X/mon Send to local group	Catie, Jess	Make template	April 25, 2014	
Training in August at Kasitsna Bay Lab if S. Kibbler can come	Dom, Kris	Set date	April 25, 2014	
Take movies at August training of sampling and counting methods.	Dom, student?	Have camera?	August 30, 2014	
Produce movie or written protocol from S.Kibblers visit	NOAA student		Feb 2015	
Look into PCR locally	Catie	Call college	April 25, 2014	
Proceed for next two summers with coordinated sampling			Oct 2015	
i-phone app? http://www.youtube.com/watch?v=RswbKVnf-Dw	Catie	Already developed by volunteer at PMN	Share at April 25, 2014 HAB training	X

Determined by consensus at KBRR Phytoplankton/HAB conference 2/12/2014

Appendix C: Breakout Session Questions and Notes

Breakout Session 2 – February 11, 2014

Working Group 1: Can long-term trends be determined for Kachemak Bay?
Can bloom triggers be found?

- **Explore current data collection available**
  - Catalog of who's doing what – result of this workshop-then a Surveymonkey by KBRR.
  - April 1-2nd - AOOS citizen monitoring workshop
  - Next year – Pat would like to hold a phytoplankton symposium in Anchorage to facilitate what to do next (between AMSS and AFE meetings to encourage attendees from both)
  - Need coordinator position to identify funding, get data in proper format, someone committed to project
    - Where is data housed and how is it made available to users? Who does not have a data base who needs one?
  - Database maintenance
    - Online database – national databases don't have enough parameters to capture locally intriguing data
    - Quality control – must be discussed
    - EPA database parameters are similar to KBRR's
      - zooplankton, phytoplankton, water quality data
      - biological, physical and chemical data templates – fairly straightforward
      - framework allows sharing with EPA and partners
      - reports available
      - converting from Excel database very time-consuming due to different format
      - EPA metadata file – Excel template sheet with macros is exported as text file
        - You can't see anyone else's data
        - Quality control will flag if you forgot something
        - Out-of-range shows-up in metadata – you can filter later, but not flagged
        - Add outliers to notes to communicate with everyone who has access

- **What are the parameters usually used for forecasting plankton blooms?**
  - Pycnoclines (variable by season)
    - Spring bloom typically in top 10m; later blooms found deeper
    - Highest Chl-a production at pycnocline boundary
    - Permanent pycnoclines ~100m
  - Depth, density and salinity of pcynocline – affects mixing
  - Surface currents – ACC, Alaska Stream, gyres
  - Storms (seasonal) – wind effect on surface currents and mixing
  - Surface temperature and light (seasonal) – affects freezing
  - Nutrient (nitrate) availability – found deep, reservoirs drive next year's bloom
  - DO level – refreshed by incoming currents

- **Are there tools that could be employed?**
  - Data visualization through GIS to indicate large spatial scale and patterns, with or without interpolation
  - Time series
  - Standardized, structured database
  - Form workgroup to find the best "tech tools"?
  - Improve sampling methods – CTD casts deeper for long-term database

- **Identify impediments and/or data gaps**
  - Tribal consortiums may have data but no means of sharing it
  - Lack of experience working with data
  - Lack of coordination, training and funding available
  - Redundancy of data
  - No warehouse to share data
  - Funding sources and energies are fragmented, resulting in inefficiencies
  - Terrestrial nutrient input lacking
  - Focus on HABs or all phytoplankton?
  - Rain, snowpack, glacial melt
    - Is there a partition of this data?
    - Has % of input per source changed?
    - Timing of freshwater input depends on source?

- **Discuss opportunities to fill data gaps and/or future directions**
  - Revisit national plankton database?
  - Stratify nutrient samples - sample near pycnocline
    - Current samples are above and below
    - Sample whole vertical column to get nutrient reservoir

        - Do pilot work – full column sampling annually, normal surface and depth all year
    - Enlist oyster farmers to sample
    - Obtain stream nutrient data from Cook Inlet Keeper or KBRR Headwater stream work

- Noteworthy comments from Pat & Wayne:
    - Anomalies are what we're interested in, not the normal patterns. It's the outliers that we want to look at more closely.
    - What is a bloom? This is subjective, depends on location. Knowing what's normal or 'nearly normal' is great background information so outliers can be spotted.

Breakout Session 2 – February 11, 2014

Working Group 2: Best methods for tracking/identifying phytoplankton in Kachemak Bay

- **Explore current methods used/information available**
    - Using the plankton monitoring network protocol and equipment
    - Collecting salinity, temperature for the past 12 years
    - Current: exchange of information with ADF&G and Kasitsna Bay Lab, Oyster Farmers collect phytoplankton and water quality data, Soldovia Village Tribe, Gulf Watch, SWMP data.
    - Historic: data from Tustumena Ferry (2002 – 2005) and other Vessels of Opportunity, BOEM? Oil industry?
    - Tutka Bay Hatchery used to collect phytoplankton data which appears to be lost,
    - Maybe in Port Graham Hatchery too – at least zooplankton.

- **Review the current strengths of the Kachemak Bay community in regards to phytoplankton**
    - Willingness of volunteers to collect samples and get them to KBRR, some doing their own samples and some dropping them off here
    - Applicability to regions beyond Kachemak Bay like Kodiak
    - Partnerships opportunities available to reduce effort and increase data/knowledge
    - Willingness to share information.
    - Our East Coast resource with Pat and Wayne at PMN.
    - Flexibility to sample when the volunteer can, without being responsible for capture on a given date or time.
    - Returning volunteers – so asking for realistic opportunities.

- **Are there other monitoring tools that could be employed?**
    - SWMP program also does daily phytoplankton with an automated water sampler one day each month for nutrients and a chlorophyll a sample. It collects 1 litter of water. It could be used daily if desired and could be put in different locations. It has 24 bottles and rotates around to fill each bottle in a 24 hour. Catie and Jess and Jane could read the samples and Pat would like to come up too.
    - SWMP has three chlorophyll a instruments that have to potential to give real time plankton blooms. Have them in two locations – Homer and Seldovia. They are telemetered on the deep sondes and provide data every 15 minutes year-round.
    - Finding people who are willing to volunteer to do counts
    - Chlorophyll readings at Seldovia that show when a bloom occurs – over several years we should be able to predict what's blooming. Then we can make specific counts to verify.
    - Work with coordinators like Frank who don't want to fill out data sheets – call them once a week or some easy phone app, or some incentive.

- **Identify collection/data gaps**
    - Lack of data exchange from ADF&G and Kasitsna Bay Labs, and UAF, research efforts that have taken place and they don't share the data with us, or ask us for our information.
    - Don't duplicate efforts – by recreating past efforts and ongoing.
    - Retrieval of historical knowledge
    - Different protocols being used – tide, daylight, frequency.
    - Different or lack of cohesive Data collection – different data bases
    - Funding gets cut on organizations like AHAB and the information is lost with it
    - Any kind of standardization helps, Dom collects within the hour before high tide.
    - Is the Bay covered? No one does anything on the North side of the Bay. Probably huge benthic layer.
    - ADF&G is working up in Ninilchik to Calm Gulch to monitor clams with DEC, but no plankton work is being done.
    - Razor clams at Ninilchik are much more productive than at Clam Gulch, growing twice as fast. So sampling at Ninilchik would be good to sample at high tide.
    - Almost no history of sampling in Tutka Bay and beyond Seldovia to the west.
    - Collect samples in places that get a lot of fresh water input, knowing that they will get increased melt water as the climate changes.
    - Counting cells is the most accurate way to monitor
    - See the data all the way to the final product.

- **Discuss opportunities to fill gaps and/or other ideas**

- Does collecting at different times of the day and at different levels of tide radically change the phytoplankton species count? Frank thinks it's a radical shift. How could we get around this? More concentrated sampling – maybe some volunteer could do a one-day "phytoplankton blitz" each summer, taking four samples – one at high tide, one at low tide, one each slack tide. Couple this with the SWMP automated sampler.
- Per Pat – there's a QPR assay that can give a quantitative measure of two spp of *Alexandrium* and xxx as long as there are at least 3 cells.
- Is anyone measuring light levels? Sondes do. Would tell us about our turbidity.
- What are the limiting factors in terms of nutrients? Look at Tammy's nitrogen loading on streams that have alder cover to see if those streams lead to more productive plankton/shell fish areas.
- Stream nutrient data - look at N to P ratios to see if phosphorus is a limiting factor. Is there ammonium on the north side in late summer vs nitrate
- It would be interesting to tie phytoplankton with zooplankton in terms of trophic levels.
- Funding gap - sonde data is underutilized due to lack of manpower to graph the data we've already collected.
- Have a data blitz week – people come together to see how different people graph and utilize data, and what level of data sets make for viable findings (i.e. more than one sample per month to identify bloom periods).
- Make sure that the data collected get used and outreached – make sure there's a final product.

Breakout Session 2 – February 11, 2014

Working Group 3: Coordinated network for regional monitoring and research

- **Who would a coordinated network involve?**
  - Personal use fishermen
  - Oyster growers/shellfish harvesters
  - Hatcheries
  - Researchers
  - Resource manager, including those involved in enhancement and restoration
  - Public health officials, DEC
  - Community monitors
  - Tribal/subsistence users

- **What are the benefits to having a coordinated network?**
  - Efficiency of data analysis

- See answers in below questions- there is overlap here

- **What information could be provided through a coordinated network?** (e.g. monitoring information, trend analysis, public notifications)
  - Standardization of methods and reporting
  - Central data housing (example: EPA Exchange Network)
  - Streamline cross organizational and public information dissemination
  - Coordinate event response
  - Improved management decisions stemming from information sharing
  - Information tools tailored to meet public needs
  - Access to up-to-date information, and accurate information to public regarding public health concerns
  - Reduce duplicative effort across organizations and allow organizations to focus on individual strengths/niches
  - Improved access to funding
  - Ability to share resources
  - Collectively take next steps to explore priority research needs

- **Discuss impediments to a coordinated network: Do participants collect the same information or is information collected not compatible?**
  - There is a lack of regionally-specific database & no centralized data housing; lack of ready access to data collected across organizations
  - Funding to maintain data base and services is lacking
  - Data is collected at difference scales with no real framework/standardization; this impedes larger scale data analyses and calibrations
  - Limited in-person communications across organizations, particularly for communities across K Bay
  - Lack of coordination across agencies and expertise in public communications
    - A "champion" of these efforts (e.g. dedicated network coordinator) is missing
  - Information translation of technical information is lacking
  - Lack of strategic goals and visioning among the HAB community
  - Lack of long-term funding to support network and data services

- **Is there organization hesitancy to participate or share information (e.g. competition for funding, publication, etc)?**
  - No, there is a culture of information sharing and willingness to collaborate

- **What steps would need to be taken to develop a regional network?**

Group 1:

- Dedicated data coordinator and central location to house information; potential options include: EPA Exchange Network, AOOS
- Once data system has been identified then can focus efforts on key variables driving plankton events/blooms; the above step is critical to reducing excess efforts in data analysis/synthesis and will allow the group to get to "what really matters" (e.g. driving variables)
- In the next 1-3 years conduct preliminary analyses to i.d. driving variables; identify data gaps
    - Id crucial problems with data through data exploration to prioritize future efforts
    - This will provide a good overview of the ecological system in K Bay
- Attend state conferences to outreach information from this network & coordinate statewide to prioritize future efforts (important to include Bruce Rite, ADFG, Matt Forester, SeaGrant, State Ecological Network)
- Standardize data collections methods and make adjustments to sampling/monitoring scheme to focus on prioritized efforts and pilot different/new methods identified

Group 2:

- Utilize predictor variables identified in GOA to forecast conditions in K Bay
    - This could serve as an early warning system for blooms in K Bay
- Identify systematic process for information dissemination to resource managers and growers
    - Allow growers access to physical condition monitoring tools (e.g. CTD, SWMP information, etc) so they can adjust or mitigate their operations as necessary to reduce risk to public health
    - Develop website or app where this information can be accessed and stored
- Standardize methods for phytoplankton monitoring
    - Associate physical characteristics with bloom events
    - Standardize monitoring gear types
    - Identify data compatibilities need for trend analyses
    - Utilize outside expertise to assist with monitoring design
- Identify location for central data housing and archive
    - Create system that is uniquely tailored to the region with search features to query data
- Clearly define the intent of the network and whether priorities are focused towards research or monitoring
- Conduct analysis across all existing data sets to identify bloom predictors
- Identify dedicated person to clean-up datasets and conduct analyses

- PhD student with Mark Johnson is a possibility, however students are ephemeral
- Student could be first "next best" step although a dedicated coordinator should be identified in the future, potentially with DEC, ADFG, NOAA

Breakout Session 3 – February 12, 2014

Working Group 1: Bloom Event Response

- **Explore what process is currently taken in response to events, including detection, etc.**
  - Phytoplankton blooms – report to Dom, Catie, any community monitor, oyster farmers
  - Different mission KBL and KBRR
    - KBRR needs to look at samples ASAP to potentially ID preliminary
    - KBL might improve 'glancing' at under scope (add to process)
    - Human error during *Pseudo-nitzschia* bloom (samples left to die before reading). If Catie sees a sample with any of the 3 spp. known to carry toxins, she gets a datasheet from the sampler, or calls them, and verifies the identification based on resources, then goes to that site and samples 1L of water to be tested by the lab on the East Coast (impossible).
  - Most toxic spp. is *Alexandrium* so any *Alexandrium* we move on. Don't wait for bloom. Send samples ASAP. Catie can't warn people if *Alexandrium* is detected. If toxic, it's not clear on chain-of-command. Catie's role is to get samples to Plankton Monitoring Network, but that's it. KBRR is not a safety regulatory organization. Someone else has to notify the public.
  - Wayne has a meeting next week on coordinating efforts within Fed gov't. Not sure how it will turn-out, but his lab (Beaufort) is not part of the formal Network. What Wayne did last time with *mikimotoi* is make sure results were given to KBRR ASAP. He cited talking points for public information – factual information. Not a press release, but you can say there's a bloom and list potential known affects. You can provide good information without telling them what to do. Just give the facts. Big impact to public without causing alarm.

- **What are the limitations of the current processing (shipping, getting results to the group)? See above shipping to East Coast "overnight" – not impossible**
  - Other method: Catie sees cells, filters water, freezes cells, FedEx to NC (48 hrs minimum verification). Lab tests cells for toxin.
  - 1-2 weeks maximum from the first *Alexandrium* sample to the peak of the bloom. Sample every week during the hottest time of the year? Visible vs. invisible

bloom – the problem is a delay in when samples are collected vs. when they're analyzed.
    - State Lab gives samples low priority – 5 weeks, no mechanism to receive "emergency" samples
    - Sport Fish Division would issue press release? But what about economic cost of uncertainty. It has to come from ADEC, not SF Division.
    - Have these 'talking points' come from ADEC, not KBRR or SF Division

- **What are the benefits to having a coordinated network (public health, resource mgt, tourism, etc?)**
    - Organized chain of command, information issued directly from one official source first

- **Discuss impediments to having a coordinated network?**
    - No means for State to handle "emergency" PSP cases (low priority)
    - Potential economic loss while waiting for test results
    - Suggestion by George (DEC) to send 'emergency' samples under the Recreational Shellfish project and request immediate results. There is plenty of room in the Recreational Shellfish project to swap samples, so just do this. You can also test for DA (razors), but more expensive and will eat away at allotted funding.
    - Unclear roles, time it takes to coordinate and test, rumors surfacing in meantime, pressure from public to know
    - Misperception of public that the State is certifying all AK beaches for recreation. Not the case (only active commercial beaches are certified, only beaches determined toxic are closed) – funding issue, but not very public-friendly!

- **Is there organization hesitancy to participate in response or share information (competition for funding, publication, etc.)?**
    - Yes, liability concerns over people's lives – economic effect on shellfish farmers
    - State is responsible for certifying and alerting the public to closed beaches. Borough is not involved.
    - No easy way for public to find-out if beaches are safe – why is this???

- **What steps would need to be taken to develop a response network?**
    - Develop clear notification list - If *Alexandrium* is seen, report it! (oyster farmers, CACS, community monitors, KBRR)
    - Catie will coordinate with the 'new Jeff Paternoster' and find-out what happens after he gets the samples. No information on this process after that point.
    - Clarify process and let everyone know (Catie to provide flow chart)

- Make existing ADEC database available to general public! Make this request to ADEC.
- Ask ADEC to prioritize "emergency" shellfish sample tests
- Have announcements, links, maps showing where people can go to find information
- Continue sending Catie's (Jess is back-up) 2-week updates on what KBRR finds – add to email list anyone interested
- Consider taking samples beyond Kachemak Bay. Recreational beaches in LCI?

Suggested Improvements:

- Fast field testing. Put pressure on (who? State?) and NOAA will get tests out. NOAA needs support from community now, with Federal cutbacks. Let recreational harvesters test shellfish themselves.
- Test during the peak harvest times.
- Match SWMP data (AOOS graph) with phytoplankton community monitoring samples. Have someone tracking overall big picture trends after samples are taken.
- Combine Wayne's and Julie's data (abundance data and ?)
- For initial tracking before temperature increases, focus on sending samples to Wayne (electro techniques) to detect "ramp up" at lower levels of toxicity.
- Improve phytoplankton sampling (filtration) techniques to avoid cell breakage.

Breakout Session 3 – February 12, 2014

Working Group 2: Mechanisms to bridge research and monitoring to decision-makers

- **Who?**
  - Public health officials
  - Resource managers
  - Water quality regulatory
  - Regulatory agencies and water quality regulatory agencies
  - Consumers
  - Tribal council - environmental programs

- **What type of information is needed by each group?**
  - Public health managers: need solid, quantitative, verifiable science-based information. Must be statistically rigorous and defensible: PST levels, coliform, vibrio data required. QA/QC data HAB information (i.e. environmental, organism abundance, presence/absence). Useful: consumption rates. DEC will be the area closure official. ADFG issues releases based on the PST results from DEC. ADFG issues press release. Work in concert. KBRR data is ample to

allow for DEC to provide some of the base information. DEC also has other aspects that are monitored as well (coliform, vibrio, etc. as water quality monitoring agents).

- DEC does not certify recreational beaches. However, there is DPH communications for illness incidence for recreational beaches. DPH deals with shellfish toxins for recreation, DEC deals with commercial shellfish closures and issues.
- ISC bases closures solely on toxin levels and this is codified.
- Resource managers, tribal, and environmental measures: Harvest information, abundance, environmental data i.e. temperature for prediction of blooms for stocking, toxicity (i.e., PST, local and traditional knowledge regarding consumption, levels of illness, environmental conditions that precede blooms). Traditional knowledge and incorporation of traditional values into harvest practices. Useful in particular for testing practices and safety of consumption. People will continue to use the resource, the question is how to make them safe to use (i.e. cutting siphon/extracting gut). Alternatives for subsistence resources to make them more safe to use –need to test methods/approaches for ways to improve safety
- Regulatory (EPA, USCG, NOAA): Scientific information, Area closures (i.e. ballast water regs), Emergency response information –i.e. bloom events.
- Consumers: harvest location, consumption safety, how to be safe with consumption at high levels common to native communities. What people need to know about the risks of consumption?
- Tribal groups: harvest location, consumption safety, how to be safe with consumption at high levels common to native communities. What people need to know about the risks of consumption, and potential alternatives to consumption timing (e.g. what are alternative of "safe" foods that could be harvested in that season) and cleaning practice (e.g. what can be done to safely handle harvest and reduce risks)

- **How are they communicating information? What is being done and what can we do?**
  - Public Health: websites, for DEC program, there is a community manager within community to disseminate. Fliers on illnesses and risks associated with shellfish, DPH also has website. Commercial growers part of monitoring program.
    - What is needed for public health: HAB monitoring data, needs to be easily available (i.e. SWMP, NOAA tidal, SEAMAT data). Ecological limits data for growth data (temperature salinity, optimal ranges for growth). Published by Pat and Wayne for future release, expected to publish in 2014.

        - Harvest and consumption rates from ADFG website.
    - Resource managers: ADFG has some monitoring programs. Some creel surveys during harvest. Use of equipment from NERR, also share a lot of resources with NERR such as the plankton monitoring counts. Concern was maintaining validity with sampling frequencies etc.
        - What is needed for Resource managers: continued plankton monitoring and trend analysis
    - Reg. agencies: Direct research/consultation for federally nexus products, toxicity testing with EPA funding for salmon. Contaminants ADEC testing too. Also community based monitoring programs provide to EPA (LEO, Alaska Native Tribal Health Consortium, EPA, HIS).
        - What can do to get them this info: EPA exchange network/national archive/ USGS/EPA. DEC/NPDES permits. SWMP data interface.
        - Build familiarity with these various data bases, date exchange services within the regulatory managers.
        - LEO observation network for unusual/emergency hot topic events.
    - Consumer: Website, fliers, posting on beaches, commercial test results, bloom hotline, press releases. Bruce Wright website, KBNERR website, community council website
        - User friendly website, options/alternatives suggestions (i.e. color coded consumption), links to other community's websites. Reports pages
    - Tribal Council: Consumption rates studies by SVT; local knowledge of best cleaning practice of shellfish to reduce risk to human health
        - How do we scale consumption levels to toxicity to let people know what is safe? SVT and Port Graham have some information consumption rate information (can possibly disseminated by CDC staff). Also state DPH epidemiology. EPA assistance for studies that would help define exposure based on consumption. Also the CDC study to look at levels of immunity to saxotoxin of various communities. Other study to test toxin levels at prepared vs. raw clams. Ray Ralonde did this study, not published. Limited replicates, needs to be robust study. (Port Graham/SVT interest in taking it on).

Moderator Guiding Questions; Developed before workshop to guide discussions.

2014 Kachemak Bay Phytoplankton and HAB workshop

Breakout session & group discussion: Moderator guiding questions

Moderator objective:

- Provide structured forum for discussion about focal topic
- Use guiding questions to elicit participation among all members of the group
- Consider viewpoints of all members, and assist in clarifying areas of uncertainty
- Facilitate consensus building around specific ideas or actions needed
- Capture main ideas/areas of agreement/needs on flip chart, including associated challenges or impediments

Session 2 Breakout (Tu Feb 11 2:15-4:00 pm)

- Group1: Can long-term trends be determined for Kachemak Bay? Can bloom triggers be found?
    - Explore current data collection available.
    - What are the parameters usually used for forecasting plankton?
    - Are there tools that could be employed?
    - Identify impediments and/or data gaps
    - Discuss opportunities to fill data gaps and/or future directions

- Group 2: Best methods for tracking/identifying phytoplankton in Kachemak Bay
    - Explore current methods used/information available.
    - Review the current strengths of the Kachemak Bay community in regards to phytoplankton, (Survey results)
    - Are there other monitoring tools that could be employed?
    - Identify collection/data gaps
    - Discuss opportunities to fill gaps and/or other ideas

- Group 3: Coordinated network for regional monitoring and research in Kachemak Bay
    - What are the benefits to having a coordinated network?
    - What information could be provided through a coordinated network? (e.g. monitoring information, trend analysis, public notifications)

- Discuss impediments to a coordinated network: do participants collect the same information or is information collected not compatible?
- Is there organization hesitancy to participate or share information (e.g. competition for funding, publication, etc)?
- What steps would need to be taken to develop a regional network?

Session 3 Breakout (We Feb 12 10:15-12:00)

- Group 1: Bloom event response

    - Explore what process is currently taken in response to events, including detection, sampling, analyzing, and dissemination
    - What are the limitations on the current process: response time, shipping, getting the results out to user groups…
    - What are the benefits to having a coordinated network (e.g. for public health, resource management, tourism, etc)
    - Discuss impediments to a coordinated network:
    - Is there organization hesitancy to participate in response or share information (e.g. competition for funding, publication, etc)?
    - What steps would need to be taken to develop a response network?

- Group 2: Mechanisms to bridge research and monitoring to decision makers

    - Identify the d-m groups of interest (e.g. who are they?)- public health, resource managers, public, water quality regulators- others?
    - Identify what types of information are needed by each d-m group.
    - Discuss current pathways for transmitting information & associated challenges (by group).
    - Identify opportunities to more effectively deliver this information & time scales in which information is needed for d-m purposes (by group).
    - Identify potential organizations that could take on this responsibility.

Session 4 Group Discussion (**We Feb 12 13:30-15:00): Planning the Next Steps**

- What are the outcomes/research needs identified in breakout sessions the group wishes to accomplish?
- How should this group or forums be structured to facilitate interactions in the future (e.g. process to establish coordinated/structured network)?
- What are the next steps that can be taken to maintain interaction and data sharing?
- Are there potential strategies to overcome funding shortfalls?

Appendix D: Presentation Abstracts

A Comparative Ecosystem Approach to Understanding Phytoplankton and Harmful Algal Blooms in Kachemak Bay Alaska

Tester Patricia*, Litaker Wayne

Center for Coastal Fisheries and Habitat Research, National Centers for Coastal Ocean Science, National Ocean Science, 101 Pivers Island Road, Beaufort, NC 28516 USA

The advantage of applying a comparative ecosystem approach to the study of phytoplankton in Kachemak Bay is that it strengthens the scientific understanding of complex dynamics controlling ecosystem structure, productivity, resilience and population connectivity, as well as effects of climate variability and anthropogenic pressures on living marine resources and critical habitats. Retrospective studies that analyze, re-analyze or synthesize existing information (historic, time-series, ongoing program) are especially valuable to the comparative approach. One goal of the Conference will be to identify Kachemak Bay-specific data sets to information monitoring efforts and ecosystem management activities. Specific comparisons between Kachemak Bay and similar ecosystems will define key environmental variables or processes that can serve as important monitoring metrics. For example, a recent study in the Baltic found that diatoms and dinoflagellates had comparable nutrient requirements (excluding Si), appeared to provide similar ecosystem services with respect to new production but a decadal shift toward dinoflagellate dominance was credited to climate variability. The amount and timing of freshwater input are critical to both nutrient delivery and stratification in the Baltic as well as Kachemak Bay. In the Baltic, dinoflagellates were favored by enhanced water column stratification. What does this portend for Kachemak Bay and the potential for harmful (dinoflagellate) blooms?

Kachemak Bay Research Reserve's research and monitoring program: updating the circulation model for Kachemak Bay

Doroff, Angela M.

Research Coordinator, Kachemak Bay Research Reserve

Knowledge of circulation patterns is essential for determining the transport of pollutants, harmful algal blooms, and invasive species. Similarly, understanding circulation patterns also informs us of the physical processes that shape our coastline and determine productivity. The mission of the Kachemak Bay National Estuarine Research Reserve (KBNERR) is to enhance understanding

and appreciation of the Kachemak Bay estuary and adjacent waters to ensure that these ecosystems remain healthy and productive. As a sentinel site for the region, the KBNERR serves the coastal communities by providing baseline and long-term datasets that range from the headwaters to open ocean. Baseline work region has been accomplished through efforts of KBNERR and through key collaborations with local, regional, and national partners. The data collected in our monitoring programs provides the basic "ingredients" to examine long-term environmental trends in weather, water chemistry, and biology. An example of long-term monitoring and base-line data for Kachemak Bay include our ongoing System-Wide Monitoring Program featuring water quality, meteorological, and emergent salt marsh vegetation mapping. Currently, the KBNERR is involved with three major projects that will help update and refine ocean circulation patterns in Kachemak Bay; 1) we are collaborating with University of Alaska, Fairbanks to collect data on tidal and sub-tidal circulation patterns from drifting buoys; 2) we are collaborating with UAF to validate a NOAA regional circulation model based on KBNERR long-term oceanographic data collected since 2001; and 3) we are collaborating with the NOAA Kasitsna Bay Lab to monitor oceanography and plankton trends in lower Cook Inlet and Kachemak Bay. Collectively, these studies at the KBNERR contribute to our understanding of regional circulation patterns.

A Hydrographic Model for Cook Inlet

Gibson, Georgina[1]; Johnson, Mark[1]; Coyle, Kenneth[1]; Lyon Lanerolle[2]

1. University of Alaska Fairbanks, 2. National Ocean and Atmospheric Administration

A high resolution hydrographic model has been developed for Cook Inlet by NOAAs National Ocean Service. The model was initially developed to be an operational forecast system. The model is three-dimensional, high resolution with the capacity to resolve the strong tides and the wetting/drying of the coastline observed in the Inlet. In this presentation we will provide an introduction to the hydrographic model and to the validation efforts that we are undertaking to assess the model skill in reproducing observed conditions within the inlet. We will demonstrate the utility of hydrographic models in addressing questions of ecosystem relevance through research examples that have used coupled hydrographic-biological models in Alaskan waters. Our aim is to provide grounding in the utility of models as research tools, and to generate discussion about how model products can support harmful algal bloom research and monitoring programs in Kachemak Bay.

Oceanographic Drivers for Phytoplankton Blooms in Kachemak Bay, Alaska

Holderied, Kristine, Brainard, Starr, and Ko, Stanley

NOAA Kasitsna Bay Laboratory, kris.holderied@noaa.gov, 907-235-4004

Subarctic estuaries are affected by several environmental conditions that can cause phytoplankton blooms, including the blooms of toxic species which are known as harmful algal blooms or HABs. Kachemak Bay Alaska, a subarctic fjord, experiences occasional HAB events, including paralytic shellfish poisoning events associated with blooms of the dinoflagellate *Alexandrium* species. Kachemak Bay waters are affected by seasonal and inter-annual changes in temperature and the bay receives freshwater input from precipitation, snow pack melt and glacier melt. The bay also exchanges water with Cook Inlet and experiences periodic upwelling of ocean water from the adjacent Gulf of Alaska shelf. Temperature, salinity, water column stratification and circulation are all factors which may influence plankton growth and these conditions can vary significantly with freshwater input and ocean water upwelling. Our ongoing oceanographic monitoring program measures these conditions and their spatial and temporal variability, in order to assess future HAB risks under changing climate conditions. Oceanographic conditions are measured using vertical oceanographic profile station data collected in repeated small boat surveys with a conductivity-temperature-depth (CTD) profiler and water quality monitoring station data from the Kachemak Bay National Estuarine Research Reserve water quality monitoring stations at the Homer and Seldovia harbors. Kachemak Bay oceanography is strongly influenced by freshwater input, resulting in a persistently high stratification and vertical stability that can maintain phytoplankton cells near the surface. Significant inter-annual variability includes differences in mean monthly water temperatures of up to 6 degrees C in winter and 5 degrees C in summer, as well as in the timing of spring snow melt and enhanced water stratification in the summer. A future goal is to combine water temperature and stratification data with other factors such as nutrient concentrations and phytoplankton ecology, to create an index for periods of increased HAB threats.

A Community's First Effort to Understanding Primary Production in Kachemak Bay: the Good and the Bad

Bursch, Catherine

Kachemak Bay Research Reserve, Alaska Dept. of Fish and Game, Division of Sport Fish

Kachemak Bay Research Reserve has been monitoring the phytoplankton of Kachemak Bay since 2009 with the support of the NOAA Phytoplankton Monitoring Network. The main goal of the program is to look for groups of phytoplankton that are known to carry toxins that can result in shellfish poisoning in humans. Not being satisfied to learn only about the harmful algae in Kachemak Bay, this group has pushed to learn about the other important primary producers because of lack of information on this topic. Over the past five years, roughly forty different volunteers have contributed over four hundred plankton samples for the program. As each volunteer made a tow, labeled a bottle, or filled in a data sheet, the expertise and information of

the program grew. This is a perfect time to reflect on how much more we know now than we did five years ago. It's also a good time to examine the frustrating and ineffective areas of the program that have kept us from a deeper understanding of primary production in our Bay.

Bloom and bust: monitoring phytoplankton populations in Kachemak Bay

Hondolero, Dominic, Holderied, Kristine, Pickens, Chris

NOAA

Establishing baseline monitoring information on ecological systems is essential for determining current health of the ecosystems as well as providing the ability to detect changes to ecosystems. NOAA's Kasitsna Bay Laboratory, in partnership with the NOAA Phytoplankton Monitoring Network and the Kachemak Bay National Estuarine Research Reserve, has been monitoring phytoplankton populations in Kachemak Bay for 2 years. In Kachemak Bay it appears that spring phytoplankton blooms begin when PAR reaches a threshold of approximately 380 millimoles/m^2 in early April. This bloom continues until nutrient levels begin to drop in late July and a second bloom generally occurs in August and September. The spring bloom is dominated by diatoms of the genus *Chaetoceros.* The 2012 late summer bloom was dominated by *Pseudo-nitzschia* species. Spring and summer were dominated by *Chaetoceros* spp., which declined in late summer and fall, disappearing in winter when dinoflagellate species became dominant. Near-synoptic sampling of several sites in Kachemak Bay on the same day does indicate spatial differences in productivity, with highest cell counts (>1,000,000 cells/liter) at Jakolof Bay near the middle of Kachemak Bay and Bear Cove located at the head of Kachemak Bay. However, additional sampling would be needed to assess the spatial variations in productivity. In 2013 there were two bloom events that discolored water over large areas, a red water event in June which was caused by the ciliate *Mesodinium rubrum* and a brown water event in late September, early October which was caused by micro algae *Karenia mikimotoi*. Our Kasitsna Bay Laboratory monitoring program is providing information on seasonal plankton patterns and bloom events to resource managers and the public, and future work will incorporate this baseline information into ecological models of the productive Kachemak Bay estuarine ecosystem.

Community Monitoring for Phytoplankton: Comparison with Long-term Weather and Water Data

Baird, Steve; Bursch, Catie; Doroff, Angela

Kachemak Bay Research Reserve

This poster will present the results of KBRR's phytoplankton community monitoring. We will relate the timing and magnitude of plankton blooms with various physical factors as measured by our long-term water-quality and weather monitoring data. We will specifically examine the relationship between plankton and such factors as PAR (photosynthetically active radiation, or available sunlight), turbidity, and temperature.

Quantitative assessment of *Chaetoceros Spp.* Concentrations and Adaptive Salmon Smolt Stocking Procedures in the Nick Dudiak Fishing Lagoon on the Homer Spit, Alaska.

Booz, Mike; Kee, Jon; and Kerkvliet, Carol.

State of Alaska Department of Fish and Game, Division of Sport Fish.

Starting in the mid 1980's, the Nick Dudiak Fishing Lagoon located on the Homer Spit has been stocked annually with Chinook and coho salmon by the State of Alaska Department of Fish & Game (ADF&G), Division of Sport Fish to create a terminal sport fishery in an easily accessible area. From the late 1980's through 2009, annual effort averaged 21,000 angler days with an average annual harvest of 1,900 Chinook salmon and over 7,000 coho salmon. Salmon smolt were reared in hatcheries located in Anchorage and trucked to Homer when ready for stocking. Smolt were held in floating net pens for five days prior to release in an attempt to help facilitate homing to the release location. In 2009, a large number of coho salmon smolt died during the holding period. Pathology results found *Chaetoceros Spp.* as the source of mortality through suffocation and laceration of the gills. Every year since this event, the levels of *Chaetoceros* have impacted ADF&G's ability to hold salmon smolt in net pens prior to release. Stocking methods have adapted through trial and error to find alternative methods that reduce mortality while still trying to facilitate homing to the release site. Initial sampling to assess the levels of *Chaetoceros* was qualitative and did not provide adequate information to decide how to stock salmon smolt. In 2012, ADF&G attempted to quantitatively assess the concentration of *Chaetoceros* daily in the Nick Dudiak Fishing lagoon from mid-April through July. Results suggested that the concentration of *Chaetoceros* were well above safe levels to hold salmon smolt in net pens throughout the stocking period. In 2013, *Chaetoceros* assessment was reduced to days around each stocking and helped guide how salmon smolt were stocked.

Guide to Phytoplankton of Kachemak Bay

Middleton, Jane; Bursch, Catie

Middleton, Jane: HAB volunteer; Bursch, Catie: ADF&G educator, illustrator and HAB Program Coordinator.

The Guide to Phytoplankton of Kachemak Bay is a pictorial guide to diatoms, dinoflagellates and ciliates found in Kachemak Bay, Alaska. Its purpose is to provide HAB monitors a reference

when they analyze their samples and help them recognize harmful algae present in the waters of the bay. Educators will also find the guide useful when teaching about the ocean, marine ecosystems and identification of microscopic life.
This presentation will include a brief discussion about how to take good photographs from a microscope using a hand-held digital camera or built-in microscope camera.
The guide will be amended from time to time, as we obtain better photographs or find previously unidentified organisms. Users of this guide are encouraged to report new sightings to Catie Bursch at 226-4661. Include in your report a preserved sample, photo if possible, and complete description of the organism.

The guide may be downloaded as a PDF from the Kachemak Bay Research Reserve website: www.kbrr.adfg.alaska.gov.

Harmful Algae Blooms in Alaska: An Historical Perspective, Current State of Knowledge, and Prospects for Research and Monitoring.

Ray was not able to attend and did not present. In his place Julie Matweyou presented.
RaLonde, Raymond

Alaska Sea Grant Marine Advisory Program

Alaska has significant and apparently growing problems with harmful algae blooms (HAB) causing ecological and human health impacts. Most prevalent is regular occurrences of paralytic shellfish poisoning (PSP) causing illness and fatalities among shellfish harvesters. Marine mammals and birds are also showing evidence of risk. *Alexandrium* dinoflagellate blooms that cause PSP are unpredictable, and appear to be locally generated. HAB and toxin monitoring has been inadequate and public warnings to prevent human illnesses have limited effect. Monitoring of PSP in shellfish has revealed much about the Alaska problem and collaborative research is underway to explore inexpensive laboratory and field methods that can enable expansion of monitoring. Domoic acid, another marine toxin produced by several species of *Pseudo-nitzschia* diatoms, has been isolated in Alaskan shellfish testing, a two-year monitoring program found low concentrations in shellfish, but little is known about the potential human health and ecological impacts. Harmful algae blooms of other species throughout Alaska cause significant damage to Alaska's salmon enhancement program and raise concern about their ecosystem impacts in a number of locations, including Kachemak Bay.

This presentation will summarize monitoring and research results, describe the current state of knowledge about HAB occurrences in Alaska, the status of current monitoring programs and research efforts, and suggest projects for additional research and monitoring initiatives.

Detection of Human Exposure to Saxitoxin and Neosaxitoxin in Urine by Online-SPE-LC-MS/MS

Bragg, William[1]; Lemire, Sharon[1]; Coleman, Rebecca[2]; Hamelin, Elizabeth[1]; Johnson, Rudolph[1]

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[2] ORISE Fellow, Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Laboratory Sciences, Atlanta, GA 30341

Saxitoxin (STX) and neosaxitoxin (NEO) are potent neurotoxins chiefly responsible for paralytic shellfish poisoning (PSP) in humans and marine mammals. PSP occurs through the ingestion of bivalve shellfish that have consumed toxin producing dinoflagellates associated with red tide. Depending on the levels of STX and NEO exposure the symptoms of PSP can range from mild to life-threatening, including paralysis, nausea, muscle weakness and tingling of the mouth and limbs. Worldwide cases of PSP have been reported from as far south as Chile and as far north as Alaska, where these exposures can be major concerns for the public health because of commercial, subsistence and recreational shellfish harvesting. Due to the fact that the initial presentation of symptoms for PSP is nonspecific, a clinical measurement is needed to confirm exposure to the toxins. Our group has developed an online solid phase extraction liquid chromatography method for the analysis of STX and NEO in human urine with tandem mass spectrometry, reducing analysis time and increasing sensitivity while maintaining precision and accuracy at or below 15%. This method rapidly identifies PSP toxin exposure, which can facilitate the work of public health authorities to track and contain the outbreak of PSP, complementing the many shellfish monitoring programs worldwide.

Testing for Toxins in Alaskan for Commercial Shellfish & Recreational Shellfish Monitoring

Scanlon, George

State of Alaska, Dept of Environmental Conservation, Shellfish Permit Coordinator

Molluscan shellfish are interesting animals that have been an important part of peoples' diets worldwide, particularly in Alaska, for hundreds of years. As delicious as these animals taste, they have unique characteristics that can make them very dangerous under certain conditions.

Shellfish are filter feeders and therefore have the ability to concentrate microorganisms, including human pathogens (example: norovirus), and toxigenic micro-algae, from the water column if these organisms are present. Bivalve shellfish are quite often consumed raw or partially cooled and if pathogens or toxins at high concentrations are present, human illnesses can result. Pacific oysters, mussels and clams other than geoducks monitored through the state's Uniform Sampling Plan have been largely free of paralytic shellfish toxins (PST).

While levels of PST in shellfish varies greatly from species to species and within different areas of the state, the ability to predict PST levels is extremely difficult. Our efforts to implement and maintain a conservative approach to PST monitoring has resulted in no reported illnesses associated with commercially harvested shellfish. All paralytic shellfish poisoning illnesses so far reported in the state have been from recreational or personal use harvest.

There is no state program in Alaska to certify beaches as "safe" for recreational or subsistence harvest. A limited four year pilot PST monitoring program for recreational shellfish harvest began in 2012 and it's ongoing.

There is research conducted to monitor the occurrence of Harmful Algal Blooms (HABs) and that the research is not widespread. Conditions in Alaska are not as predictable as is the case in other locations. DEC does not necessarily use this information to determine whether areas may be opened or closed for harvest of shellfish with regard to PST. Instead, Alaska has set up monitoring plans

Alaska has more coastline than the East and West Coasts of the lower 48 combined and many areas where shellfish are harvested are not easily accessible. The cost and logistics in collecting and shipping samples can be very challenging. Only the state's Environmental Health Laboratory (EHL) in anchorage is certified by the National Shellfish Sanitation Program to conduct official regulatory testing for shellfish. In addition the EHL is responsible for analyzing animals, food, water, and environmental samples for regulatory purposes that require all of their current resources. DEC must use all of its resources to administer the commercial shellfish program.

A Tale of Two Species: An exploration into the effects of increased Alexandrium populations on shellfish harvesting in Kachemak Bay.

Logan Reveil, Molly Mitchell, Nolan Bunting, Axel Gillam, and, Sierra Moskios.

Persnickety Protoperidinium; Homer National Ocean Science Bowl Team

Kachemak Bay has the optimum conditions for shellfish of all types. A wide tidal variation and nutrients from glacial runoff, provide a highly favorable environment for the growing of oysters, mussels, and clams. In addition, the region's temperate summers discourage the development of Alexandrium, the dinoflagellate most commonly known to cause Paralytic Shellfish Poisoning (PSP). And as such, commercial and recreational harvesting has become one of the most productive in all of Alaska. However, this may not always be the case. The higher water temperatures and lower salinity levels caused by climate change are favored by Alexandrium. Furthermore, increased boat traffic and changing currents may lead to more frequent blooms of Alexandrium. This paper explores what an increase in Alexandrium would mean for Kachemak Bay's burgeoning shellfish industry and investigates what can be done to solve the problem of PSP.

*****Julie Matweyou, Kodiak MAP agent with Sea Grant presented on PSP in Kodiak. Abstract not available at time of printing, but Julie can be reached at** julie.matweyou@alaska.edu **for more information.**

Appendix E: System Wide Monitoring Program Description

Kachemak Bay National Estuarine Research Reserve: System-wide Monitoring Program

DATA FROM LONG-TERM MONITORING PROGRAMS PROVIDE THE BASE LAYERS TO ADDRESS ECOLOGICAL QUESTIONS IN KACHEMAK BAY

This program, locally known as SWMP (pronounced "swamp"), started in 2001, shortly after the Kachemak Bay Research Reserve's designation in 1999. The program bridges local information needs on water chemistry, nutrients, and weather with the National Estuarine Research Reserve's (NERR) goal of standardizing monitoring methods across 28 reserves nationwide.

What exactly is SWMP?

Our program provides baseline information on water temperature, salinity, dissolved oxygen, pH, turbidity, chlorophyll-a, and nutrients (Nitrite + Nitrate, Ammonium, Orthophosphate, and Silicate) at five sites in Kachemak Bay. Weather conditions, such as air temperature, relative humidity, barometric pressure, wind speed, wind direction, and total solar radiation, are monitored at two sites. Information collected indicates habitat quality for coastal and estuarine environments. Water quality sites at Homer and Seldovia harbors have two monitoring stations each: one at 1 m (3.3. ft) below the surface, and one at 1 m above the sea floor (Figure 1).

Why are we interested in monitoring water chemistry and weather in Kachemak Bay?

There are several layers to answering this question! The information collected is important for tracking short-term variability and long-term changes in the ecosystem. Long-term, quality-controlled data is valuable for addressing complex ecological questions about Kachemak Bay. Figure 2 illustrates how SWMP long-term monitoring supports coastal decision-makers and communities in our region. The "data collected" column is synonymous to basic ingredients of a recipe; when combined together in certain combinations these ingredients can meet the interests of the public, resource managers, and the Reserve's research and monitoring programs. The "direct application of data" column indicates some of the ways baseline weather and water chemistry data is applied to answer short- and long-term questions about environmental change in our area. Synthesizing this data is an essential step in coastal decision-making processes, such as those listed under "secondary application of data."

The SWMP program is supported by a NOAA grant on two levels. The first level of support is funding is made available to each reserve to implement and maintain a monitoring program at each reserve in the system. Secondly, NOAA supports the quality control, management, archiving of the data through a central data management office. Since 2001, the KBRR has had a dedicated staff working to meet the goals of the SWMP program, and we look forward to continuing to work together to provide this information in the future!

KBRR collaborates with a diverse and dedicated group of people to apply this information into local and regional projects

Historical (2001-2013) and real-time data can be accessed through the **Centralized Data Management Office**: http://cdmo.baruch.sc.edu/ . Real-time data can also be accessed through:

- **AOOS** has a new real-time sensor map showing KBRR water quality and weather stations, including the data from the Anchor Point weather station (when the telemetry is operational), which is not easily available elsewhere: http://data.aoos.org/maps/sensors
- **SWMP Mobile application**. Near real-time SWMP data is now available on your smartphone or tablet at:www.nerrsdata.org/mobile

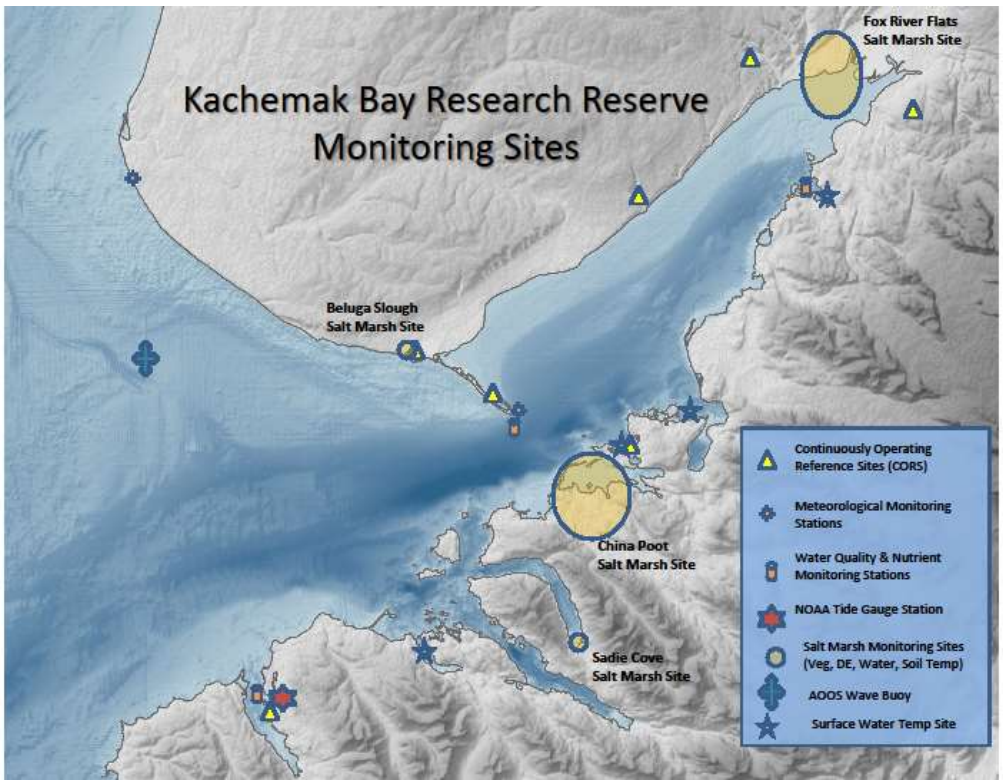

Figure 1. Location of monitoring sites within the Kachemak Bay Research Reserve. Weather and water quality monitoring sites are part of the NERR national monitoring program, and information collected is consistent across all 28 reserves.

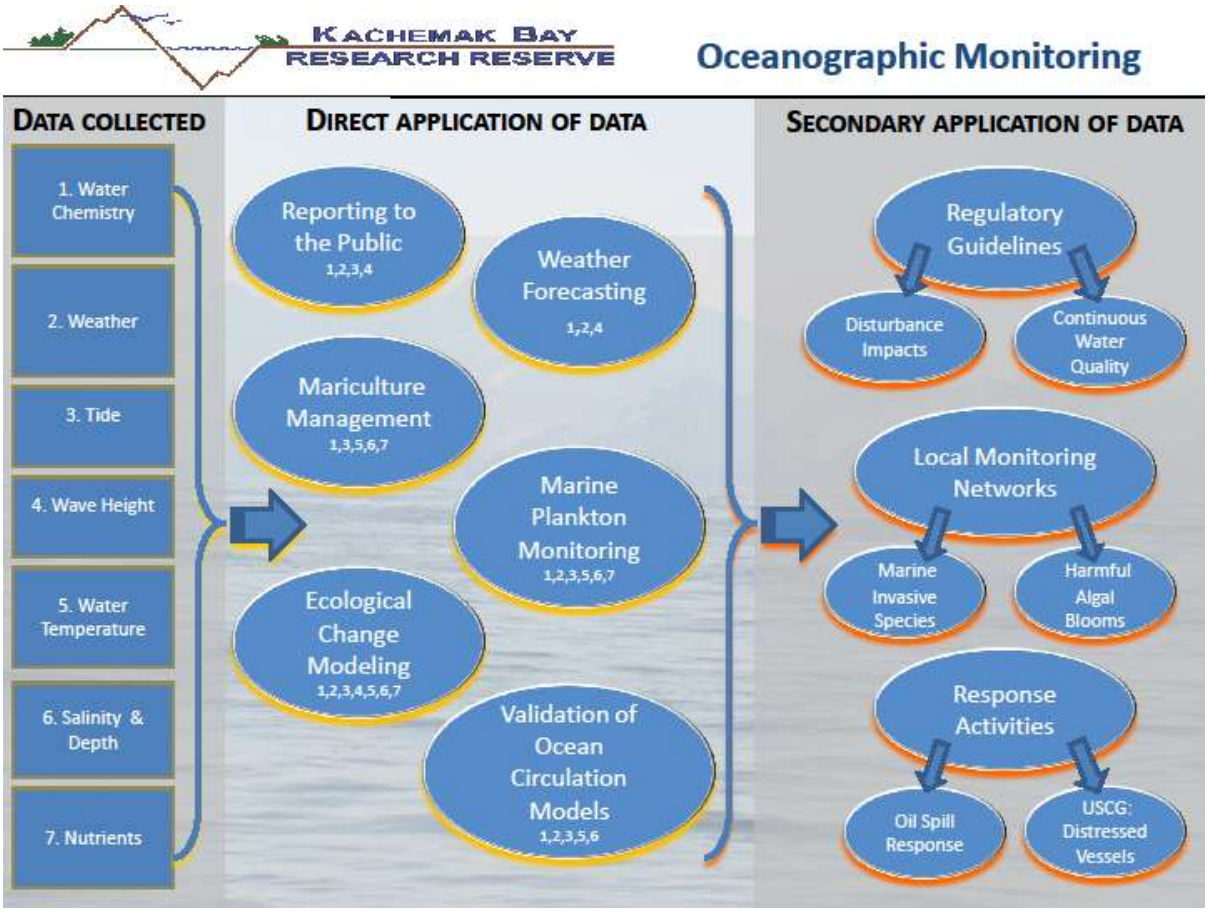

Figure 2. This schematic illustrates some of the ways SWMP long-term monitoring supports the general public, research and monitoring programs, and coastal decision-makers in our region.

Appendix F: Workshop Participant Contact Information

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Laukitis	Shelly		Fisherman / business owner	Homer resident
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			Community College biology students (5)	Kenai Peninsula College, KB Campus