*Draft Notes: 040506*

# "Sound Science" Workshop

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## I. Overview

On March 31, 2006, the Northwest Fisheries Science Center (NWFSC) of the National Oceanic and Atmospheric Administration (NOAA) hosted the "Sound Science" Workshop at the NOAA Sand Point Facility in Seattle, Washington. The workshop served as a forum to gain support for the content of the "Sound Science" document and to generate ideas for upcoming Puget Sound Partnership science workshops and discussions.

### Introduction and objectives

Usha Varanasi (NWFSC) and Jim Kramer (Shared Strategy) welcomed participants to the workshop and thanked those present for their work and comments to date. Nancy Tosta (Ross & Associates) facilitated the overall discussion and reviewed the meeting agenda and objectives:

- Gain support for the content of the "Sound Science" document, including four key topics: Puget Sound ecosystem components, primary threats to ecosystem functions, key gaps or uncertainties in understanding ecosystem responses to human and natural activities, and key findings from document and implications for Partnership recommendations.
- Discuss the process for developing and finalizing the Sound Science document.
- Discuss content on key sections of the document to identify areas of agreement and disagreement

Mary Ruckelshaus (NWFSC), a lead author of the document, briefed participants on the current draft of the "Sound Science" document, including the four major sections: humans and Puget Sound, processes, habitats, and food webs. She asked the participants for assistance in exploring these topics and identifying areas of agreement, disagreement, and clarification on threats and gaps identified in the document.

Participants were subsequently divided into four facilitated groups focusing on the main sections of the document. Each group addressed the following:

- *Areas of agreement for each section*
- *Concerns, areas of disagreement, or suggestions for each section*
- *Identification of additional threats or threats that should not be included*
- *Key gaps in the science with a sense of priority*

The discussions from the breakout groups are recorded in sections II-V in this document. Participants reconvened after lunch to hear a summary of the morning breakouts (section VI) and then broke into three groups to discuss key findings. These are presented in sections VII-IX.

**Overall Structural Ideas from the Breakout Groups**

- Write an executive summary or condensed 10 page summary of the document. Alternatively, consider a more concise version of the current document (reduce length to 30-40 pages) by removing the language or discussion of generic science information. For each topic, provide the key information and refer to appendices for more information.
- All science facts must be cited. Create a footnote system or bibliography. For example, use numbers in the text and refer to citations in a bibliography.
- Include a discussion of trends, including future projections and reasons for why issues are important to address now
- Include pull out boxes with captions and more detailed information on specific subjects.
- The following suggestions were offered as alternative approaches for overall organization:
    - Alternative Organization #1:
        - What are the key drivers?
        - What are the key uncertainties around those drivers?
        - What are the interactions between drivers?
        - How do those interactions and drivers change over time?
    - Alternative Organization #2:
        - Definition of Puget Sound
        - Valuation of Puget Sound
        - Assessment of Puget Sound
        - Recommendations
    - Alternative Organization #3:
        - Define the ecosystem – recognizing that a major cause of change is human actions.
        - Describe why it is important to keep the ecosystem healthy (e.g., define links between human health and oceans)
        - Discuss how people can help change the downward trends in the environment.
    - Alternative Organization #4:
        - Describe management and the effects of management (successes/failures)
        - Describe the driving forces of change (trends and scenarios)
        - Characterize the state of the interrelationships between humans and the ecosystem

**Key Messages/Suggestions from the Breakouts**

- Clearly define the audience
- Acknowledge humans as a component of the ecosystem and better integrate their actions and effects throughout the document (not only in a "humans" section).
- Do not always refer to humans as the "problem," but recognize they are a component of the ecosystem and can provide solutions and opportunities.
- Clearly acknowledge what are facts in the document, clarify where there are questions and gaps – and cite the references.
- Include disclaimer that the document is not a comprehensive review of Puget Sound science topics, but a concise overview of key scientific issues in the region.

# II. Humans and Puget Sound Breakout Group

**Participants**

- Mark Plummer – NOAA's NWFSC
- Usha Varanasi – NOAA's NWFSC
- Jim Kramer – Shared Strategy
- Tom
- Scott
- Randy
- Marina Alberti – UW
- Dave Fluharty – UW School of Marine Affairs
- Patrick Christie – UW School of Marine Affairs
- Karen
- Casey Rice – NOAA's NWFSC
- Stewart Toshach
- Nat Scholtz – NOAA's NWFSC
- Walt Dickhoff – NOAA's NWFSC

## Discussion of the overall structure of the document

***Note-taker's comment:***
*These notes read like a script, where the words in italics were not actually stated. Much of the discussion can be broken into parts, in retrospect. The parts are: 1) a discussion of the overall structure of the document, 2) a discussion of the questions that should be raised in the "humans" section of the document, 3) a discussion key science gaps, and 4) a discussion of the decision framework section of the document.*

Mark: There's pressure to make this document short, so when you identify possible changes, think in terms of sentences or paragraphs, not pages.

Usha: Will there be appendices to the document?

Jim: That's an option.

Mark: *As an overview of the document*:

- the diagrams in the "humans" section of the document are one-sided
- aquaculture is described mostly as a "threat," not in terms of its value
- maybe its value can be worked into the decision framework section at the end
- the "humans" section is boiled down
- introduce the concept of "human valuation" later in the document

Scott: Who is the presumed audience for the document?

Mark: Partnership-level people. The "humans" section of the document should allow them to see how humans fit in with the other topics.

Scott: Are people supposed to be able to read the section and make decisions based on it?

Randy: What people want is to make a list and prioritize it for how to spend money. This document can support making that list.

Marina: Had the same concern as Scott, but applauds the work done thus far, but what are the questions that we are trying to answer with the document?

- What potential futures are we looking at?
- Where should we invest our resources to best protect ecosystem functions?
- What is driving ecosystem functions? (both human and non-human drivers)
- Once the drivers are identified, then ask what are the uncertainties about those drivers.

We need to develop scenarios about the future

Jim: You're saying: "we need to understand what the future will bring." But most of the document is about the past and present.

Dave: The purpose of the document is to provide a baseline to generate discussion. This is what science is predicting will happen – this is what is happening. Hopefully, the document will be read widely, for education and ideas. The document is more of a starting point.

Tom: Changing people's values and behavior is critical. This may be part of what we need for the future. Not so much changes to the ecosystem, but changes in the people inhabiting it.

Patrick: *Identifies himself as an environmental sociologist, then goes on to say that:*

He was struck by the tone of the document. There was a clear message that humans are the problem. However, people are also the sources of opportunities and innovative solutions. If the document is framed in terms of "people = the problem," then this leads to traditional environmental solutions. He also noted that the document doesn't call for empirical research on management systems – in other words, questioning why management systems are in the form that they are in. How humans manage their environment and how that management can be improved is a well-established are of scientific study.

Karen: *agrees with Patrick, and then observes that*: the social science section of the document is very short relative to the natural resource sections. The document needs a deeper set of questions about humans. It doesn't discuss social management systems. Threats aren't linked back to either natural sciences or social sciences.

Mark: Patrick wants to examine the idea that we can look at ecosystem institutions scientifically. Could the "key science findings" include something about ecosystem institutions?

Marina: Can we, as a group, propose that the synthesis is done differently so there is a more explicit connection between humans and natural processes? If we pose humans as threats, then

we've failed. The synthesis needs to be developed around scenarios for the next 20 years. The entire document needs to be shaped around different questions. For example:

- What are the key drivers?
- What are the key uncertainties around those drivers?
- What are the interactions between drivers?
- How do those interactions and drivers change over time?

Usha: You have to define the ecosystem in the document. This is "part 1." Regardless of whom you attribute change in the environment to, the underlying major cause of change is human actions. That's a fact. Stating it won't offend people. It's a fact. The second part of the document can answer certain questions like: 1) why is it of value to keep the ecosystem in good shape, 2) what are the links between human health and oceans, and 3) why is it important to keep the ecosystem healthy? This second part is what Congress has been interested in as a message. The third part of the document can answer the question: how can people help change the downward trends in the environment. People want to know this. Overall, the facts are what they are. The tone of the document can change, but the facts cannot. If you have these three parts, there is the synthesis.

Karen: This structure of the document (i.e., Usha's, outline above) makes more sense than its current format.

Stewart: Science is one possible solution for the current environmental problems. There are other possible solutions: political, social, economic, legal. If legislators only look at the scientific solution, then they miss the other possibilities.

Jim: Legislators understand this. There are other groups making similar documents.

Casey: There needs to be a critical evaluation of science and management in Puget Sound somewhere in the document. What the legislators are asking us is "What's going on? Why are our management policies not working?" In reading this document, it's difficult to know which answers are conventional wisdom supported by real data, and which answers are "expert opinion." To inform society (i.e., the readers of the document), you need to acknowledge what the facts are, but also acknowledge where the gaps are.

Marina: Facts about what? We need to define the questions here.

## Discussion about questions raised in the "human" section of the document

- Brainstorming about the questions the document should raise?
  - Why have the actions taken by scientists to make Puget Sound healthy not worked?
  - Is it that we're doing the wrong things, or not enough of the right things?
  - What are the major drivers of change in Puget Sound – both biophysical and human?
  - How do humans manage the environment?
  - What is the jurisdictional landscape of Puget Sound?
  - What are peoples' perceptions of Puget Sound? (lack of research on this topic)

- What are the drivers of change in Puget Sound?
- What are the trajectories of change?
- What are the uncertainties surrounding the drivers?
- What is the spatial distribution of human use? How will the distribution change?
- How do you do good science without data management? (databases are a mess.)
- What are the full dimensions of human actions that create stress on the environment?
- What values are driving people?
- How are human actions related to the larger picture?
- Why is there resistance to current management laws and mandates? How can the situation be improved?
- What has worked elsewhere in terms of management? Are there better management models in other countries?
- How can we involve Canadians in drafting the document? They are part of Puget Sound.
- What would make human systems more resilient/adaptable to future changes in the environment?
- How do humans respond to changes in the environment?
- How do we fund science that occurs over a long temporal scale?

- The Great Lakes have a long-term plan. The cost of the plan is $12 billion, but there's no funding for it, so we do need to consider costs here. How much is society willing to pay?
- Where do these questions fit into the structure of this document? Here is an alternative structure:
    - Definition of Puget Sound
    - Valuation of Puget Sound
    - Assessment of Puget Sound
    - Recommendations

- We need to pull back from making recommendations about what lies ahead. We need to maintain the boundary between making this a science document and making this a science-informed policy document.
- Some of these questions can be answered in terms of social science, others in terms of natural science.
- Which questions need to go in the "humans" section of the document? Which questions are for the broader document? And which are really beyond the scope of the document?
- These questions can be lumped into 2 groups: 1) management and the effects of management (successes and failures), and 2) the driving forces of change (trends and scenarios – basically Marina's questions).
- There is also a third group: accurately characterizing the state of the interrelationships between humans and the ecosystem. Urbanization is a huge topic that brings together many of the questions. The drivers of urbanization are interrelated:
    - Human population growth / demographics
    - Land conversion

    - Coastal sprawl
    - Climate change
- Future scenarios could be used to integrate the human section and the biophysical section of the document. They shouldn't just be limited to the human section.

**Discussion of key science gaps**

- Stewart: The "key science gaps" identified in the document only constitute a small list.
- Mark: The connections between drivers and the ecosystem should go into the "key science gaps" section.
- Tom: A lot of drivers are symptoms, rather than causes. Why do these drivers happen? There's a history to them.
- Marina: Yes, but that's outside the scope of the document. What legislators want to know is how to invest money. We don't know how the climate trajectory will affect urbanization. "Where do the interactions occur?" That is the most important scientific question.
- Mark: That isn't a science gap that belongs on p. 30 (in the existing "key science gaps" section), but a question for a section that doesn't exist yet.
- Casey: One gap is that we need a better understanding of the link between human activities and ecosystem structure/function. We need to link these trends/drivers (i.e., human activities) to the biophysical.
- Nat: We should also link these trends/drivers to the appropriate policies that already exist (e.g., the C.A.O. in King County, and the Clean Water Act).
- Patrick: There needs to be a coherent section on the options for methodologies. With new methodologies, you can integrate data sets. Having a coherent section about how you go about implementing some of the suggestions in the document would go a long way.

**Discussion of the decision framework section of the document**

- Marina: The document has a lot of frameworks that aren't very consistent with one another. Lines should be drawn between assessment tools (like UrbanSim) and decision making tools. Regarding the decision framework: who are the agents (the decision makers)? They, and their interactions, need to be stated and understood. What decisions are we making and at which scales?
- Stewart: It's a waste of money to build decision support systems until you have data to populate the system.
- Dave: Good science can come out of a data-poor or data-rich environment.
- Tom: The decision support system, as stated, is unclear. What do the boxes and arrows represent?
- Mark: The decision support system (DSS) section was supposed to include not only the DSS but also a part about integrated science. The integrated science part got cut.
- Patrick: Should Box 3.4 on p. 84 be placed first in the document, and used to motivate questions?

- Mark: You'll notice that government is only a small part of Fig. 3-4.
- Tom: There is the notion of top-down and bottom-up forms of management. The document seems to speak about top-down management (or at least it does in Fig. 3-4).
- Marina: This is why we need to identify the "agents." Are they individuals? Are they agencies?
- Mark: What are the laws, regulations, means, governance instruments, etc. that we currently have in place to affect Puget Sound? It may be that only 33% of the actions on Puget Sound lie within those means/instruments.
- Randy: This list (of laws, etc.) has already been made
- Walt: A major gap is in understanding how human activities influence ecosystem processes and pathways.
- Nat: One suggestion would be to begin with the DSS rather than diluting human activities throughout the document.
- Karen: Human impacts should be better integrated into the rest of the document.
- Jim: The best way to grab the decision-makers' attention is to say: "We know that you're going to make X, Y, and Z decisions. This draft will help you make those decisions."
- Tom: Ultimately, the individual is the decision-maker, not some god-like being.

# III. Processes Breakout Group

**Participants:**

- Al Duxbury (UW Oceanography)
- Alan Chapman (Lummi Tribe)
- Anglea Grout (Metro King County)
- Ann Seiter (Sound Science document editor)
- Brad Gaolach (WSU/ King County Extension)
- Carol Maloy (Washington Department of Ecology)
- Cindy Barton (USGS)
- Dave Beauchamp (UW School of Aquatic and Fisheries Sciences)
- Fred Goetz (US Army Corps of Engineers)
- Kim Stark (King County)
- Mitsuhiro Kawase (UW Oceanography)
- Nate Mantua (UW Climate Impacts Group)
- Jan Newton (UW Applied Physics Lab)
- Rick Palmer (UW Civil and Environmental Engineering)
- Jeff Richey (UW Oceanography)
- Tim Quinn (Washington Department of Fish and Wildlife)

**Overall suggestions for processes section**

- Increase the utility of the document by including trends in Puget Sound processes. This should include not only historical trends, but future projections to identify potential problems or challenges and discuss why these issues should be addressed now.
- Write a disclaimer for the section on processes: this is a basic overview of natural processes in the Puget Sound. Discuss and acknowledge the amount of variation that exists for all processes (including benthic).
- Consider moving all of the language on human activities and influences to human actions sections or consistently discuss how humans impact the processes throughout the section.
- Consider organizing the processes section by geographic scale and discuss how the processes work at various scales (global, regional, WRIA level, small scale - coastal streams, etc). Scale is a good organizing principle. Reorganize the section to start with the Puget Sound basin and then discuss terrestrial and aquatic inputs at the watershed level. After discussing these inputs, move to discuss larger external influences such as climate change.

**Suggestions – with general agreement and areas of concern**

- Revise the presentation of scales in section 2.3. Does not work to combine global, aquatic, terrestrial, marine, and near shore processes. Describe the effects of various processes at different scales – e.g., climate has effects local to sound-wide.

- Broaden the geographic range to include the Fraser River as part of the Georgia Basin (information could be extracted from the Georgia Basin Conference recommendations). The map on page 35 needs to include the Fraser River.
- Discuss the circulation patterns of the Strait of Juan de Fuca (which are different than Puget Sound). The Straits Commission produces materials which could provide useful information on this subject.
- Include a description of local climate patterns. Local climate language should focus on rain shadows, simple local variability, local climate history, and insert a few illustrations (Nate Mantua of the Climate Impacts Group will provide language and diagrams as necessary).
- Fred will revise the diagram on page 36 (send a revised diagram and several other illustrations from an older document).
- Emphasize the importance of upwelling: nitrite concentrations at the entrance of the Strait of Juan de Fuca and Admiralty Inlet are much higher than nitrite concentrations in the Puget Sound.
- Include a discussion of water quality issues: USGS has vast amounts of information on water quality in the Puget Sound (Mary and Cindy: discuss USGS and Department of Ecology water quality information which was cut out in second draft of the document).
- Revise the section to include more "meat" or substance for management professionals. The document should not be written in a journalistic style.
- Create a simple conceptual diagram at beginning of the processes chapter (a triangle with three parts: process ⇨ bottom; structure ⇨ right; function ⇨ left of side).
- Include a list of processes discussed in the document for global, terrestrial, fresh water, and marine processes. Fred will provide the list of near shore processes. Create a diagram to illustrate the relationship of all processes. Fred will send several examples from King County water and land documents.
- If more water quality information is needed, the Department of Ecology may provide a set of water quality indicators. Cindy (USGS) will email Mary Ruckelshaus (NOAA) the links to the USGS freshwater inflow data online. Add language on freshwater inputs to the Puget Sound. Include a diagram showing the input of the Skagit River and other rivers in the area. An additional suggestion: review the Puget Sound Water Quality Authority's ambient monitoring program document which did not receive much attention. It may have failed for political reasons: what is the lesson learned in this case?
- Discuss the "net effect" of tides in the region.
- The Elwha River example on page 53 is a good one – the Elwha affects water inflow processes and the river should be mentioned in any general discussion of circulation processes.
- Jeff suggested changing the diagram on page 16 to separate marine, freshwater and terrestrial components. Focus the reorganization of the diagram on the box in middle of Figure 1-2 (marine, freshwater, and terrestrial processes) and try to capture or include more on terrestrial and freshwater interactions as well as climate and land processes.
- Discuss tradeoffs: there are some benefits to certain land uses or agricultural practices that directly affect fresh water quality – developments create more stormwater.
- Introduce the concept of indicators in the processes section. This helps augment the discussion of trends. Fred will send in factoids on Puget Sound indicators.

- Add a discussion of quality models such as ENVVEST or other models which are used by port managers and other city or county officials. Any discussion of models must include a disclaimer: every model needs validation and calibration to achieve some level of accuracy – models still have a long way to go in terms of predicting outcomes in the area.
- Add language to recognize off shore processes and the importance of these processes for juvenile salmon populations.

## Key threats

- Consider earthquakes and volcanic events as long term threats: recognize that such events are a threat on a different time scale.
- Consider new terminology – threat is not the correct word for this section. Alternative words which are more policy neutral include: drivers, uses, agents of change, and consequences
  - Primary impacts and primary consequences
  - Drivers may be a more prudent term (threats are a type of driver)
- Climate change as a threat falls under Humans and Puget Sound section.
- Do not include harmful algal blooms under human impacts or activities.
- Do not prioritize or order the key threats for this section.
- Toxics and oil spill should be split into separate bullets.
- Point source pollution or loading should be covered under human activities (including wastewater treatment plants). Similar biological processes should be covered in the section on food webs: add a cross-reference to the processes section if necessary.
- Separate climate variability from climate change (multi-directional change).
- Land use is a driver and it directly affects the health of Puget Sound (causes major changes in vegetation).
- Fresh water diversions should be mentioned in the bullet on water diversions (do not use the term “withdrawal” because it may cause confusion).
- Tsunamis should be in the same category as earthquakes and volcanic eruptions (long term geological threats). Landslides fall under short term geological threats.
- Include descriptions of threats in each bullet to improve consistency. Also include information on the biological impact under each bullet (this will link the section on impacts back to the discussion of ecosystem values).
- Additional threats include: watershed development/ land use change, large woody debris, fish transport, floodplain development, over water structures, human product use (changes in vegetation), air pollution, tide gates and culverts, fish hatcheries, and aquaculture.

## List of key science gaps

- Air deposition and air quality (currently the chapter does not discuss either topic).
- Linkage of near-off shore processes
- Discussion of physical, chemical, and biological cycling needed

- Pelagic – benthic coupling
- Land use changes and influences
- Impact of climate change on water demand and the consequences for regional water supplies
  - Is there too much emphasis on climate change?
- Lack of baseline information and monitoring programs
- Legacy of historical and current activities which affect processes such as transport.
- Impacts of pharmaceuticals and personal care products (these topics may fall under the food web section)
- How do natural processes affect the distribution of harmful algal blooms?
- Historical perspective: what did the regional ecosystem to look like several hundred years ago?
- Surface circulation in Puget Sound may be broken into two elements: toxics and oil spills
  - What data do we need to know?
  - What kind of detail do we need to know in terms of scale to be able to make meaningful management decisions?
- Spatially specific definition of processes in different locations
- Lessons learned from those who worked on the Chesapeake Bay and San Francisco Bay projects.
  - Ask to review any lessons learned or best practices documents from these projects.
- Inability to make long term economic and demographic forecasts
- Page 55 (top bullet): What are the time frames to see effects, both positive and negative, on restoring the mechanisms that support natural habitats?

# IV. Habitats Breakout Group

**Participants**

- Randy Carmen
- Terrie Klinger
- Michelle McClure
- Alan Mearns
- Tim Quinn
- Michael Rylko

**Breakout Discussions: Habitats**

- (Michelle providing overview of how the document is structured, specifically around habitat structure (typology)). For the habitat section we ended up with near shore benthic, offshore benthic and open water. Did we miss anything important, did incorrectly capture anything, what do we need to add, etc.?
- How will people use this document and what is the target audience? Was there a decision to be general?
  - (Michelle) There was a desire to not recreate the wheel, and not to define the weeds of a particular habitat. The audience is policy-makers so we need to be general. If you think we need to go into more detail/the weeds, you should tell me that.
- This section (Habitat) collapses on the marine-section, but it does not really fit well with the ecosystem services section.
- Lost the **freshwater** in the marine content of the document.
- We (Puget Sound shore group) define offshore (nearshore?) differently than you do, so we might want to use common definitions. We need to **show the link with riparian vegetation.**
- Did not see **floodplains** in this section of the document.
- Ecosystem management and some other human disturbed landscapes is very detailed classification. One approach is saving a bit of all pieces. **By collapsing, lose diversity of various habitats. We need to be careful about saying there are three habitats that need to be saved (i.e., we do not want policy-makers to think that there are only three habitats that need to be saved).**
- We do not want to lose **variability of habitat** in Puget Sound.
- Ecology mapping of habits done about 15 years ago may be helpful to reference. Plays into concept of continuum and diversity. (Contact Michael Rylko for further information about mapping.)
- (Michelle) We went back and forth and decided to keep Food Web and Habitat as separate sections because we wanted to show the link to Processes.
  - I would keep these separate. Based on the lessons we have learned in terrestrial environments, they do not have all the linkages and ecology figured out (which they will not for a while). We need to give managers an alternative for conserving ecosystems. TNC (the Nature Conservancy?) for diversity would be a good reference.

- Need to make **linkage of processes supporting habitats**. In beginning of section we should discuss drift cells, sediment.
    - Many of these things were in an earlier draft and pulled out to simplify the document. We need some detail, but it became very difficult to include detail at the appropriate level for the entire Puget Sound.
- (Michelle) We have been trying to find maps. If you have ideas, please email Michelle. It is important to create the visual grab in this document.
    - Perhaps drawings could be used as visual aids.
- Play to/use examples presented in other section to show your link in habitats
- Geographical scope, hopefully it eventually goes beyond Canada.
- **Missing from institutional framework is reference to international linkages.**
    - Both sides of the border did an assessment of habitat. This would be a good compendium to reference.
- Ecosystem diversity matrices are used to describe potential vegetation and what exists on the site. Is this done for marine environments?
    - Carl Shock attempted to predict the biology or community structure from a number of parameters; this has been done to smaller extent.
        - All things that drive type of plant communities to sustainability. We do this more and more in terrestrial environments. Would this be helpful for marine environments? Key person to contact about this is Megan T (?)
- Set of drawings of near Puget Sound and Strait of Juan de Fuca habitats from 25 years ago. This would need to be recreated. UW Sea Grant published booklets, NOAA technical studies, and Rick Stricklend did a plankton book. (Contact Michael Rylko for further information.)
- What happened to citations and references in this version?
    - (Michelle) We left out, but will add when closer to final document. References will focus on key papers/research.
- Have you seen TNC's typology of the most important bio-rich areas in Puget Sound? Consists of habitat typing and species distribution data. May be alternative way of looking at deep water habitat/species. May be of some value for open water.
- **Salt marshes** need to be addressed more rigorously in this document. It is really compelling to see the percentage we have lost to building dikes for agricultural reasons. Discuss sub-estuary, where rivers meet marshes. 2020 is not that big of a timeframe.
- (Michelle) In the framework, we tried to lay out a way that allows policy makers to determine which activities will be pursued. Not all can be done, so someone will need to figure out which are best to pursue based on tradeoffs.
    - Breakdown level of habitats that people will address. Focus on how long it may take to recover a habitat.
- There is a section in the document that implies that the habitats are stable, which they are not; we need to **capture what can change them (habitat)**, like sea level (e.g., Restoration Puget Sound Natural Area Preserve, the only thing that was not agreed upon the county mapping sea level and impact to habitats).
- Is the document really part of a way to monitor changes over time, as an assessment tool? The way it is structured, it is really descriptive on background versus being written for

future monitoring. What is the document meant to be, descriptive or prescriptive? Is it going to be a measuring tool? If it is we need to be smart about what we call a habitat.

- On the use of the document, Mary says the document is less about the technical quality and more a rallying call for scientist to point out big problems - take broader scan and point out the red flags.

**Michelle recap of what she is hearing from participants:**

1. Start out with clearer connection between habitat and processes, then
2. Greater detail on habitat types that is more consistent with Pilsner work, then
3. Take types of those items that are striking (the red flags), including distribution and trends, then
4. Present problems based on information communicated in prior items/sub-bullets

- Also need to set the stage for filling the gaps, so we can eventually have a big picture view
- Also need the continuum idea of habitats – head waters.
  - Difficulty of achieving this with a space limitation. There is no way to be fully comprehensive; you might do better to choose a couple iconic habitats as examples. We do not want people to think this is comprehensive report/document.
- From terrestrial perspective, what if we articulate that everything that happens upstream matters without going into extreme detail.
  - Use examples to demonstrate this idea (e.g., salt marshes). What is missing is any complexity at all.
- You can almost introduce habitat at the larger scale. Big scale to small scale (e.g., habitats are on an oyster shell). Show/capture scale, but state that the document will focus on the bigger scale.
  - Representatives should go in front of policy makers with a map of the whole picture, but indicate that we can only put our focus in so many places. It is so important to capture scale.
  - Represent greater complexity, scale, and scope in the document. Not in detail, but to get the message across.
    - (Michelle) Participants should email Michelle if they have ideas on how to do this. Polite and cogent comments/suggestions are welcome!!

**Sufficiency of Detail**

What other habitats that rise to level of salt marshes and floodplains, with respect to important habitats to include in the Habitat section

- Shorelines and riparian shorelines (going from riparian to armor shorelines)
- Seasurface microlayer
- Rocky shores (real rock)
- Deeper habitats (below photic zone where soft, mushy, and dark)
- Mesopelagic fauna of Puget Sound

- Cores taken that show pollutant level from 1880. We need people to recognize big picture and understand trade offs. (Contact Alan Mearns for further information)

**Threats**

Identify the things that should be on the list of threats, and prioritize the threats. End goal is having the right threats.

- Ocean cycles are a natural variability; this is not a threat. The threat is if the ocean cycles disappear. Uncomfortable with the word "cycles." Cycle implies symmetric oscillation versus variability. **Ocean "conditions"** would be more appropriate. Management should know to recognize ocean variability as a threat. But this does not belong in this category (natural phenomena).
  - Maybe climate change should include/incorporate ocean conditions
- Having a difficult time with threats. You can directly impact habitats and you can have a long-term impact to habitat. Should we represent the scale of threat? You may not change the area, but you have damaged the habitat (e.g., fragmentation with a dike).
- Having problems with dichotomy. Some of the natural phenomena are indirect human impacts.
- There are certain input processes that cannot be managed (natural variability) so have less risk approach (precautionary approach). E.g., cutting management acts is too thin, but cutting reserve is riskier.
- Natural phenomena are sources of natural variability; **threats come from human activities – direct and indirect cumulative type. Also missing non-linear responses (e.g., climate change, happening quicker than we thought (exponential = non-linear).**
- **We need more upfront in document to discuss how threats affect the system - tipping point, cumulative impact, etc.**
- **Show the point at which the system breaks.** Concept of armoring of shorelines is important to management; analysis of bays on Bainbridge Island of docking system to show that if the same management regime is used this is what the shoreline will look like eventually. Docks are a really good example of cumulative impact – one isn't so bad, but 800 are bad (e.g., Sandy Hook).
- Need more emphasis on upslope processes under human influence/threats. We should reward those land owners that implement the large scale riparian lands. Could have two slides to demonstrate wrong and right actions (e.g., Sandy Hook). Good distinction – know vs. judgment. Where do you put the burden of proof for the impact?
- Do we want to know what Puget Sound was like 200 years ago?
  - (Michelle) That was a component we wanted to get in here, but were not able to
    - Look for work by Timothy Eagan
- Putting invasive species last may convey/indicate that it is less important. Because they are biological in nature and reproduce they are far less manageable and a greater challenge than other issues, so you might consider moving this up in the list.
  - (Michelle) The threats are not in order. We need to make distinction of dependencies with respect to elevation of threats.
- (Michelle) Are there other things that should get the attention that invasive species gets?
  - Depends on how the document/threat section is used. Will it be used at face-value or will there be background expertise. **Identify threats with enough information that you can work toward fixing – low hanging fruits.**

- **Use approach of being comprehensive and then focus on the main things we are worried about, and rely on examples and best judgment of threats.**
- (Michelle) What are the five big threats?
- New dams are not an issue, so change title or put into water regulation. Are we trying to say that the existence of dams is a threat because we still want to remove? We could put "**Dams" or "Existence of Dams"** as threat.
- Commercial and recreational fishing is a difficult threat. Not sure if the Puget Sound Partnership will grapple with this.
    - (Michelle) The partnership is not the only recipient of this document. We should state threats that need to be stated, remembering that there are other audiences.
    - This is only one aspect of biomass removal.
    - Perhaps we need to distinguish between uses and threats. Fishing is a use. Some pose threats. Aquaculture is a use but there are many threats that result from it. The threat as a result of fishing is target species removal. **Suggest a section/threat/use of aquaculture with subsections underneath/within.**
- Shoreline development should be "**shoreline modification**." Development is a use and not a threatening impact based on use.
- **Need consistency of "use" versus "threatening impact."**
- Stormwater releases should be "runoff." Is it water or the toxics in the water that is the threat? In an undisturbed area, runoff is not a threat. Hydrological shift - there is a delivery problem of getting all at once. Surface water runoff is the better threat because it includes runoff, delivery (hydrological shift), and what is in it the water (toxics). Toxics should be "pollutants". **Toxics as the threat, with water regulation as a sub? Physics and chemical threats.**
- Harmful Algal Blooms should be **Algal Blooms**. These are part of natural variability. Not all are bad or harmful. It comes down to temperature and nutrients. This comes down to riparian protection.
    - **New threats are temperature, nutrients, and circulation that modifies waterbodies and the outcome is algal blooms. Circulation, flushing, exchange of nutrients.**
- For oil spills, it is the **undocumented leakage** that is a problem, which **cause cumulative effects of oil spills. Change to "Toxics and Spills".** Might all be lumped into contaminants. Maybe a sidebar on the potential to harm, compare all the threats to each other to identify level of causing harm.
- **Atmospheric deposition** is not in list/document. This is a data gap.
- Direct damage to benthic habitat – are **pipelines and cables** (include in description). The actual pipelines are dangerous, not just the laying of them.
- Additional comments on threats should be sent to Michelle by email. (Contact Randy Carmen, he specifically stated that he had comments for the Shoreline Development regarding wording.)

**Key Science Gaps**

What are the priorities to filling the gap? Compelling science that has the potential to change policy by regulation or changing human behavior. Identify the "if we had X (the gap topic/item) we could do more effective management" gaps

- We have examples and knowledge to change our behavior, but we are not doing it. So where is the break in the administrative side?
  - How do you take science information and get it into a decision making system and have it acted on?
  - Having historic vs. current pictures/views could be so dramatic it might compel human behavior – need really powerful maps.
  - We need to talk about changing habitats as the critical point, not the detailed description of habitats.
    - It is very difficult to identify critical habitat. You need the historical comparison to the current distribution. Do not spend a lot of effort unless you have a story to tell.
  - **Gap in policy and implementation**. Lack of ability to get what we know into the decision-making mechanism (social science gap – why no action when info exist).
  - It is not a lack of science, because information is identified all the time, for last 10 years.
    - Perhaps the data we have is not the right level. We are missing status and trends.
    - We also do not know the interconnection of processes – integrative science.
  - Shared strategy worked well because there was a back and forth between the scientist and the policy people to identify what they can and cannot have with regard to information.
  - Problem of **scale of science**.
    - The science we have is not adequate to mention the management questions; however we have enough information now to start acting.
    - Long-term and short-term science information – short and long-term strategy behind science. We don't know enough about science but that should not be an obstacle.
    - We need to make this statement in the key findings portion. Status, trends, interconnection, scale, etc.
      - Status and trends may not be a real gap. But there is a question of where these are necessary for certain issues. Threshold and tipping points along the line might be the missing gap.
      - What is the measure of success by 2020? You need the good and bad tipping points – inflection point.
        - The decline and recover timeframe will not be symmetric, we do not want that message to be conveyed to policy makers. We need to monitor that we are on the right path.
        - Yes, but we need to be judicious about it, by monitoring the appropriate projects and the performance.
        - **Threshold and tipping point** – is carrying capacity part of this, including variation of the carrying capacity?

- Third bullet – impact of marine reserves – if you go down that road you need to look at impact of management measures or strategies. Look at marine reserves as one of those (management measure/strategy), and then you can look at the network.
- Ecosystem value – we need a value of property and Puget Sound – link to ecosystem services and habitats.

# V. Food Webs Breakout Group

### Areas of Agreement (among the group, if not with the document)

- Food webs and other species interactions are complex
- The integrity of the ecosystem is important to maintain for the important species
- It's all connected, but it's hard to show and know it all
- Base of the Puget Sound food web is phytoplankton and detritus
- Energy flows up the food web
- Ecosystem-based management requires an understanding of these interaction (particularly as pertains to human interactions)
- Human activities and uses influence species interactions
- Important threats
  - Broader ones (climate, ocean cycles) are more important than more localized
- Threat criteria should be developed to prioritize importance
  - Likelihood of occurrence
  - Severity of impact
  - Scale of impact
  - Increasing trend?
  - Persistence of impact
  - Cumulative impact?
  - Magnification of effect?
  - Are there indicators?
- Priority for study are actions that directly affect distribution, abundance and productivity of predators and prey
- Need to be clear who the audience is (managers and policy makers, not scientists)
- Should be more up front in the section as to why it is important to know what is going on in the Puget Sound food web
  - It seems like it just drops out of nowhere
  - Need to provide context (maybe cite Chesapeake Bay as example?)
- Need to emphasize that gaps are knowledge gaps and not programmatic gaps
- Other interactions need to be brought into the discussion
  - Food web is okay as an example, but should mention other interactions (competition, parasitism, disease, positive interactions)

### Areas of Disagreement (w/the document)

- Should be more about threats/impacts in the section
- Plankton issue from Andrea C. (she will help write the section)
- Where are macro algae apart from kelp?
- Detrital base of the food web is given short shrift

- Allochthonous input is underemphasized
- More detail
  - Should be more specific with "have increased" statements (e.g. Zostera increase; how much is it? A lot? A little? What's the rate?)
  - Should be more specific about # of invertebrate species (1000s?)
  - Should be consistent in detail
- Should be general in the food web diagram and present details in boxes
  - E.g. charismatic fauna, important or key trophic linkages
  - Example that describes how some fauna undergo ontogenetic change and occupy different place in the food web over time
  - Orca-salmon-sea lion box
  - Maybe show sub food webs in additional diagrams
  - E.g. West/O'Neill figure showing bentho-pelagic coupling
  - John Field CA current EcoSim model (could show complexity but then highlight segments
  - Detritus box—what it is

- Human use examples
  - Harvest
  - Habitat
  - Toxics
  - Climate
  - Could have a box to demonstrate a top-down and bottom up human impact

- Should clarify some threats
  - Is it climate (change)?
  - Which ocean cycles?
  - What about atmospheric deposition?

# VI. Summary of morning breakout group discussion

### Summary of Small Group Discussions

Purpose is to describe areas of agreement and disagreement and identify areas needing additional discussion/work. Michelle volunteered to summarize the key areas of agreement and disagreement from the breakout session groups.

- Human group: humans are a process and need to be integrated into the system (ecosystem), with the thought that social science can add a lot and should be involved in effective management.
- Processes group: need to start local and then go global, and enhancement of fresh water.
- Habitat group: habitats are not static and are dynamic components of the system (ecosystem). Start with general description and then hone in on examples.
- Food Web group: discussion on other ecological interactions (pathogens)
- There was convergence of thought among the groups. All four groups thought there should be more on trends, including historic. Habitat and processes, discussed that threats are uses and consequences/impacts of the use. Some desire that the threats were more consistent. Integrative data management needs to be pulled together.

### Review Process

- Participants can provide comments until April 10. The third draft of the Sound Science document will be available by April 17. Comments on the third draft are due by Friday, April 21. The document will be sent to the printer by May 22, and available in June.
  - Why such a quick schedule? This is one of the Partnerships main supporting documents, so schedule is theirs.
  - Shouldn't you move up the date prior to the 10th and then give additional time on next round. We would be delighted to do that, if people are fine with this.
  - What is the process for taking comments and making revisions? Michelle and Mary will determine a process for managing received comments; this process will be circulated to participants.
  - Will there be a public record of all the comments submitted? Yes, comments will be publicly available on a website, which is underway.
  - This is a process rather than a document – living document. The first draft release will be sent to the Partnership in June; additional changes can be made to this document after.
  - Organizers will speak with the Partnership and other people involved about idea of putting out a draft this Spring and following up with something more final this Fall.
  - What is the time when the document is accepted as the gospel? If it is a process/living document, hopefully we can counteract natural tendency to close out the document.

# VII. Key Findings from Group 1

**Participants**

- Al Duxbury (UW Oceanography)
- Brad Gaolach (WSU/ King County Extension)
- Glenn Cannon (UW Oceanography)
- Jeremy Davies (NOAA)
- Karen Terwilleger (WA State Legislature)
- Lyman Thorsteinson (USGS)
- Mary Ruckelshaus (NOAA)
- Randy Shuman (King County Metro)
- Scott Brewer (Hood Canal Coordinating Council)
- Tim Quinn (Washington Department of Fish & Wildlife)

- Now is the time to act – what are the options available from a scientific standpoint?
- Land use affects salmonoids population in freshwater systems (4.3.2) – link freshwater and terrestrial systems.
- Add more information on what is known (versus what is unknown) to assist policy makers in their decisions.
- Not taking action may create a more dramatic impact on humans – an important point which is yet to be discussed in the document.
- How do we manage growth sustainably? There is a need to balance our growth against ecosystem services.
- Be more explicit about tradeoffs – converting agricultural land into sub developments may have a negative impact on freshwater quality.
- One unknown is the source and disposition of toxics into the Sound – there is a need to quantify rate and quantity of toxics entering the Sound.
- Emphasize that prevention is cheaper than mitigation.
- Stormwater is an important issue that is not discussed within the document.
- Efforts to restore and protect Puget Sound will help salmon populations (there is a need to make an explicit link to salmon recovery efforts).
- Human effects on the ecosystem limit the ability of natural systems to respond to changes.
- We need to focus attention on invasive species as an important topic – this area is not pristine or unaffected.
- This could be a very scholarly reference for a review of the state of science on PS.
- Understand the difference between key findings and key science needs.
- Different basins and different sections are interconnected – how do we make the explicit links between systems?
- The human dimension is lacking or missing in ecosystem science.
- What is the “future ecological service”? Should it be valued more in the future than it is now?
- Be careful not to create a research agenda or send any messages asking for research funding.
- Ecosystem research is largely in its infancy. The governance of area is critical in terms of relevance of research and management of ecosystems.

- The goal is of the Sound Science document is to summarize the current and past research briefly. The authors want to summarize what is known, what is unknown, what are the management implications, and how do we move forward.
- What is uncertainty? What is the risk? It is best to start with what we know and can do and present the uncertainties later – even if there isn't much space to address all of them.
- In terms of audience – ask ourselves: why would Ron Sims want to read this?
    - Discuss how the Puget Sound has changed since the 1970s and provide data to augment the discussion.
- Micro level changes in regulations and land use changes are having a positive effect on in the area.
- Another positive outcome: land is being set aside for sustainable forestry.
- Lump some findings together (use e.g. to provide more details)
- Near shore habitat loss: salt marsh declines (60% loss) – habitat loss is dramatic.
- Discuss issues surrounding how to improve the communication of scientific research results
- Discuss the ability to better communicate the results of science and the ability to use science for decision making.
- Crucial finding: there is current scientific information to support new action, but it is not communicated effectively.

**Findings that should not be in the Sound Science document**

- Rising sea levels are out of our control.
- It may be important to mention some findings, even if funding to research or address the problem does not exist (the presence of high concentrations of PCBs in Puget Sound Orcas).
- It is a slippery slope to remove any of the current findings.
- One goal is to help the reader envision: what will the Sound look like in 2020? What will land coverage look like? How will populations be distributed? What can we do about it? – add some detail about what this means.

# VIII. Key Findings from Group 2

**Participants**

- Jim Kraemer – Partnership for Puget Sound
- Casey Rice – NOAA's NWFSC
- Cindy Barton – USGS
- Patrick Christie – UW School of Marine Affairs
- Tim Essington – UW SAFS
- Mark Plummer – NOAA's NWFSC
- Mitchell – (I'm not sure about this name)
- Tom Hubbard
- Phil Levin – NOAA's NWFSC
- Dave Beauchamp – UW SAFS

- Alan Devol

- Jim: What are the "key findings" in this document for management (with the term "management" used loosely – it could be a single individual or a large agency)? Are there key findings that are missing?
- Casey: The document lacks a critical evaluation of historical management in Puget Sound.
- Cindi: Puget Sound proper is a recipient of everything that goes into the basin. Increases in the human population lead to changes in land use. This will lead to changes in what ends up in Puget Sound. So one key finding is that one can expect changes in the delivery of water at what the water contains.
- Patrick: If you break down the key findings in the document:
  - 5 are ecological findings
  - 2 are climate findings
  - 1 relates to the human population
  - We can't frame the issues of Puget Sound purely as a natural science question.

  The one finding related to humans is problematic. This approach doesn't work, and the fact that it doesn't work has been proven. The document also should highlight instances where Puget Sound management is working.
- Tim: The document takes the increases in human demands as a given without looking at the potential to change human demands. What are the incentives that drive those increases?
- Mark: Is this a gap in knowledge or a key finding?
- Patrick: Maybe a gap is a key finding.
- Mark: Then one key finding is: "understanding gaps will lead to better management."
- Mitchell: Under traditional management, we're screwed.
- Tom: Key finding 4.2.3 is the only one that tackles humans
- Cindi: But it says nothing about humans' alterations of surface water and how that will impact Puget Sound.
- Phil: Just as Puget Sound needs a wider "ecosystem-based" management model, there are a lot of wider threats/drivers that come from outside the ecosystem. For example, aquaculture is driven by wider economics. With contaminants, one can regulate Puget Sound sources, but not what's entering the Sound from outside.
- Patrick: Ecosystem-based management within Puget Sound alone will not be sufficient. You need to address outside sources of contaminants and outside drivers of the economy.
- Phil: Regarding key findings 4.3.1 – 4.3.3: these ecological findings aren't very satisfying. They basically say "we don't know anything" in 3 different ways. Maybe condense this into one finding. As for additional findings, how about: "fundamentally altering food chains, either by pulling thins out (harvest) or putting things in (hatcheries), is likely to have impacts throughout the food web on ecosystem services?"
- Mark: Can we say more than just "altering food chains will change things?" Can we be more specific?
- Tim: Anything more that we state will have to be probabilistic.

- Mark: Will your probabilities narrow or become wider depending on what species you're talking about?
- Dave: Yes, definitely. There is information that can focus some of the probabilistic findings. There is not much known about phytoplankton/zooplankton, but we do know about season food habits and life stages[1].
- Phil: We have enough information about the ecosystem to be able to build rudimentary models about management, but we don't have enough information to build better models.
- Tom: The key findings start off very wide and get narrower. It would be better if the findings stayed broad throughout. The last finding (the one related to armoring) is a very narrow opinion without much science to back it.
- Casey: Yes, there's no distinction in this finding between what is actually known about Puget Sound and what is just expert opinion.
- Dave: If you can identify the bottlenecks that may be absorbing restoration efforts, you may be able to improve management. For example, salmon restoration focuses on the nearshore (as in finding 4.4.1), but a lot of mortality occurs offshore in the Sound at a later life stage.
- Mark: *Objects to the implications of the shoreline armoring finding (4.4.1)*
- Patrick: *Reads his own list of key findings*[2]
- Mark: Expresses interest in the scale of management. Is the nested structure of management most effective, even if it's not most rational? Should there be a single unit of management, or multiple units drawn from multiple scales?
- Patrick: The definition of ecosystem-based management is debated. Some believe humans are part of the ecosystem, others do not. The document could be strengthened by a more statement about what flavor of ecosystem-based management we're espousing.
- Casey: *Other possible key findings*:
  - Puget Sound is an asset – we value it.
  - Puget Sound is not dead – it's a rich and productive place.
  - But the historical research/management has failed to sufficiently protect/recover the Sound.
  - There are data gaps.
  - The proposed solutions may be part of the problem (e.g., hatcheries)
    - Why are hatcheries not mentioned anywhere in this document?
- Phil: The message one gets from reading this document is that Puget Sound is not unique. Puget Sound is degraded. There are lots of different users with conflicting interests. The message should be that the Sound is not dead. We have a unique opportunity to change things in a potentially short amount of time. It's not a lost cause.
- Alan: The problem is not unique, but the ecosystem of the Sound is more complex.
- Dave: Is the idea that "if you do right for salmon, then you fix the rest of the ecosystem" correct? Or is it too narrow?
- Casey: Wild Chinook are an ecologically diverse species that still have a wild component, so in a lot of ways Chinook are not a bad focus. But if you just say that you

[1] Dave was speaking quickly and I didn't capture half of what he said here. It might be worth asking him to repeat it.
[2] I asked Patrick to send me his list. I'll forward it separately.

want healthy Chinook, then people will just manufacture them or protect a tiny part of the environment that they need.

- Phil: If you do single-species management successfully, then you screw things up in the wider ecosystem. The details are altered. Maybe nobody cares about those details, but maybe they end up being important, overall.
- Patrick: Iconic species, like Chinook, are good to bring people of very different backgrounds together (e.g., tribes and sport fishermen). In Puget Sound, there are still iconic species - like Chinook and orcas - that can be a unifying force.
- Tom: But you need iconic species that are at the bottom of the ecosystem, as well as top predators like orcas and Chinook.
- Mark: If you embrace ecosystem services as a guide for managing ecosystems, then you may end up with unexpected tradeoffs (e.g., if we tweak the ecosystem to increase numbers of some iconic species, you may do it at the expense of other species).
- Jim: From a human perspective, there is a value/benefit of focusing on iconic species. On one level, this makes sense, but there are some tradeoffs/unexpected consequences. There is a limitation to managing only for iconic species. The Partnership for Puget Sound will not have the vision to see this. But they will have the influence to make vision into reality.
- Tom: PSNERP picked "valued ecosystem components" (VECs). Scientists recoiled because the VECs were all iconic species. However, the idea was the VECs would simply be a way to communicate. In other words, stay away from using VECs as actual goals; just use them to communicate the value of what you're trying to accomplish. Keep the iconic species as a rallying point, not as goals.
- Mitchell: The benefit of VECs is that they cross habitat types.
- Phil: *Offering a dissenting opinion*: Icons are good, but if you manage icons in order to get to an ecosystem state, then you'll end up with a very different ecosystem than if you manage for a list of indicators of ecosystem health.
- Casey: We need a historical baseline. How many graphs of indicators have humans (i.e., population growth through time) on their x-axis?
- Patrick: The document should say that we would like to get to a state of monitoring in Puget Sound as in such-and-such a place. For instance, can we model Puget Sound monitoring after Great Barrier Reef monitoring?
- Phil: Maybe Great Barrier Reef monitoring is such a good scheme because the reef itself is an icon. Puget Sound, as a whole, is not an icon.

# IX. Key Findings from Group 3

**Participants**

- Liz Duffy
- Kurt Fresh
- Tom Good
- Ann Sieter
- Carol Maloy
- Michelle McClure
- Alan Mearns

- Patricia Michaud
- Jan Newton
- Tony Paulson
- Jacques White

- (Michelle McClure) Quick summary of key findings. Four divisions – ecosystem wide, water quality and quantity, species, and habitat. Systems approach to management allows you to manage more, better. This (ecosystem) is key point. Others are things that are relatively important. Partnership separated water quality and quantity; we did not because we found that they are linked.
  - Quality and quantity should be separated out.
    - (Michelle) When you sit down to write them, you wind up with some of the same things in both bins, which is why it was together.
- Suggestion that "ecosystem-wide" in 4.1 should be "system-wide"
  - Most participants support the term "ecosystem-wide"
  - Many staff/people contributed to this document and many used different language/terminology
- (Michelle) The Partnership focus is on everything, not just fish. Healthy ecosystems and economies for Puget Sound. This document is not intended to be a fisheries oriented document; it is intended to be an ecosystem focused document. We do recognize that the key findings and the rest of the document are not 100 percent in sync. We want to focus on nailing the key findings then customizing the document to the findings
- Shouldn't we say that smarter decisions will be made with quantitative modeling of ecosystems, that this is a way to implement? I do not see 4.1 as a finding because it is the premise of the document. The things we have as implications become findings, with the addition of quantitative/qualitative modeling. This should be the first sentence in bullet one re: Hood Canal. Example of Ecosystem model – Chesapeake is an example.
  - But partnership wants to do something that has not been done elsewhere; Chesapeake did not work.
  - Recommendation should be to go outside of Puget Sound, only to see what the experiences are.
- There isn't a place where ecosystem-wide modeling has been 100 percent effective.
- If we build the document toward quantitative decision-making point, we need to say it is a key finding.
- The problem is that the Hood Canal model is not a good model because it does not include fish.
  - The model will include fish in year two.
- We could use the Lake Washington example/model. One components of this is that it had/has a link to the public.
  - They were able to do this because the system is much simpler; Puget Sound is much more complex. The model will need to be more complicated with the complexity of the system that is being modeled.
  - Lead off with Lake Washington example to set premise. When you get further into the document, note that Lake Washington is a good example but complexity of the Puget Sound requires more complex quantitative models.

- The success of Lake Washington was tying policy and politics with the science, and including the decision process
- Suggested change– smarter decisions and supportive quantitative modeling.
  - New suggestion – what makes good ecosystem-wide modeling and list various components that make a model good (e.g., includes link to public, appropriate quantitative modeling for level of complexity of system, link to policy, etc.)

- 4.2.1 and 4.2.2 fit together, and the Partnership should plan for it (climate impacts).
- There was a lot of discussion of including trending in that section. If that happens you might want to intersperse trending throughout the document.
- Climate impacts cut across everything. **Climate impacts and how we manage them in the future is the issue, and will be clear in the document.**
- Another major finding is that we will have to do more to counteract climate and resource population. Where does this belong?
- Rethink structure. 4.2 is slightly off. Climate, population growth, contaminants. Group considering that these are the key high-level themes, and that water quality and quantity, habitat, and species are subs under each key theme.
- **New finding: need to do more prevention than cleanup of what already exists in environment/ecosystem**
- Much of what we are talking about is what can we do better in the future. But where is the element of how we can fix the damage we have done? We need restoration. The status quo is a decline, just to tread water you have to do more. Where does this fit into the document?
- State of the Sound report is organized by trends and indicators, but does not go deeply into the future. Doesn't the Partnership want to look to the future?
  - (Michelle) This document is supposed to be a big picture approach.
  - What extent of our problems today comes from our legacy sources? **Suggest that we just indicate that we want to fix our legacy problems and provide steps for prevention in the future.**

- Suggest reorganization of findings section:
  - Key or overarching points/philosophies or bill of rights for findings
    - ecosystem approach, is beneficial when it has these elements (well informed by science, connected by policy, etc)
    - prevention is a better cure
    - Education sooner than later (status quo is a decline)
  - Organizations
    - population growth as an agent of change has wide reaching implications
      - contaminants
      - development
      - shoreline modification
  - Climate change as an agent of change has wide reaching implications
    - Water quality
    - Water quantify

        - Habitats
    - Ecosystem understanding is poor
        - Food web
        - Connection
        - Habitat modification
        - Processes

- There was a philosophical basis for threat evaluation. Threats should be evaluated based on their scale, longevity, likelihood to occur (this should be added to threats section). Second, a lot of the science part of this document will discuss connectivity between land, freshwater, and Puget Sound. The degree of connectivity and complexity is important because if our actions are not well informed, this could have deleterious and negated results. This is a point under the ecosystem finding.
    - With regards to threat evaluation, maybe we can identify where the road blocks/obstacles are. Incorporate into philosophical bill of rights – modeling – you need to do something to address road blocks.

- Connectivity of the science and policy makers is lacking. Maybe scientist are not going out on a limb and saying this is bad, stop doing it.
    - Is there a finding that there is a science to policy communication failure? Thinks there is a lack of education and focus to get the information to the public. Maybe there are simple recommendations on what the public can do (e.g., picking up dog poop). This all fits into ecosystem finding.

Comments, suggestions, or clarifications should be sent to Mary Ruckelshaus at mary.ruckelshaus@noaa.gov or Michelle Mclure at michelle.mclure@noaa.gov