

Howe Sound Science and Knowledge Workshop, 27 March 2015

- Summary Report -

Event hosted by The Vancouver Aquarium / Coastal Oceans Research Institute, Squamish Nation, and
The David Suzuki Foundation

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Executive Summary

The Howe Sound Science and Knowledge Workshop brought together 60 expert knowledge holders from a diversity of backgrounds to identify and share observations, information, data and stories that relate to the aquatic biophysical features of Howe Sound.

The workshop was held at the Vancouver Aquarium on March 27 2015, hosted by The Vancouver Aquarium's Coastal Oceans Resource Institute (CORI), The David Suzuki Foundation, and The Squamish Nation. Participants included knowledge holders from three local First Nations (Squamish, Tsleil-Waututh, and Musqueam Nations), the Department of Fisheries and Oceans, the Provincial Government, local consulting companies, academic institutions, and multiple non-governmental organizations and community groups.



The day was full and the room was charged with energy and enthusiasm. Short presentations in the morning provided perspectives on the importance of knowledge gathering and integration to inform future planning and management. The rest of the day proceeded with a series of roundtable discussions where participants shared their knowledge on local species and habitats, physical characteristics, and drivers of change, in addition to identifying linkages across information sources, critical information gaps, and 'next step' initiatives. The day concluded with a witnessing ceremony lead by the Squamish Nation, where four witnesses shared their observations and perspectives.

The workshop met several objectives. First, the day provided an opportunity for participants to build relationships, share information and network. Many individuals working in related fields in Howe Sound found it valuable to communicate findings and data that provide input into ongoing monitoring, restoration and research initiatives. Second, the workshop resulted in a broad overview of observations and available information relating to the ecosystem status, trends, and drivers of change in Howe Sound. This information was collected through roundtable discussions, and provides a starting place for understanding some of the critical biophysical features, habitats and interactions occurring in the Howe Sound aquatic environment. Lastly, participants discussed future initiatives for integrating knowledge and provided input on the desired outcomes, key elements, and structure required to advance these potential next steps.

A key outcome of the workshop was the generation of a "knowledge and information inventory" based on the information that was provided by workshop participants as well as from organizations or individuals that were unable to attend. This inventory provides an initial step to identifying observations,

stories, maps and data collected in Howe Sound and includes both information references (reports, scientific literature, grey literature) and spatial information (maps and georeferenced data). The opportunity now exists to build upon this effort and create more detailed, integrated and accessible information platforms or databases that can support decision making, planning, management and education.

A key message from the day is that knowledge integration is valuable and should continue in Howe Sound. Stewardship of the area, including improved planning and resource management, will benefit from a collective effort to integrate different information sources, to monitor key species, habitats and physical characteristics, and to share information in a way that is accessible to both the public and decision-makers.

We would like to thank all the workshop participants, as well as those who expressed interest but were unable to attend. Special thanks go to the workshop hosts (Stephen Foster, Chris Lewis, John Nightingale, and Chief Bill Williams - right to left below), the organizers and facilitators (Jenn Burt, Karin Bodtker, Andrew Day and Lisa Wilcox - right to left below) as well as the break-out session facilitators who were essential to capture the essence of the day.



Workshop Context

Howe Sound is an incredibly unique ecosystem, home to a diversity of aquatic species and habitats. It is the traditional territory of three First Nations, it has a dynamic history of industrial activities, and it is the place of residence, recreation, and study for both locals and visitors to the Sea-to-Sky corridor. As such, information about the aquatic environment is housed by a diversity of knowledge holders, institutions, scientists, environmental professionals, and engaged citizens. This workshop was organized to bring together these diverse knowledge sources in recognition that current and future stewardship and planning within Howe Sound will benefit from a more integrated understanding of the aquatic features, physical characteristics and ecosystem interactions.

A previous effort to integrate scientific knowledge within Howe Sound took place in 1991, when the Department of Fisheries and Oceans hosted a 3-day workshop to bring together scientists and environmental professionals working in the region. Topics of discussion at that event included marine pollutants and water quality, geological processes, fluvial dynamics, salmon populations and habitats, and both physical and biological oceanography. The workshop report¹ compiled the scientific research and knowledge for Howe Sound at the time. However, no similar efforts have been made until now to assemble knowledge on the state of the ecosystem and how it has changed. The 2015 workshop was seen as an opportunity to re-engage science and knowledge experts in an effort to reassess Howe Sound aquatic ecosystem, learn from each other and perhaps answer questions such as; what has changed, what remains the same? What more do we know? What are today's pressures and threats to the system? What future changes do we anticipate?

At two key public forums in Howe Sound in 2013 and 2014, First Nations, community groups, businesses, institutions and engaged citizens identified “integrating and communicating information/knowledge” as a priority action to address key issues and future planning for the Howe Sound aquatic environment.² This workshop was organized to meet this need and to support the interests of the Squamish Nation who are engaging in a marine planning effort. (Agenda in Appendix 1)

Purpose

To bring knowledge holders together to identify and share observations, information, experiences, and future knowledge priorities related to the aquatic biophysical features of Howe Sound.

Objectives

- Share and document observations about the status, trends, and drivers of change related to biophysical features in the Howe Sound ecosystem
- Share and catalogue available information (published resources, reports, observations, grey literature, spatial data) and identify key knowledge gaps
- Identify and discuss linkages and relationships within the ecosystem
- Identify and discuss priorities, opportunities and specific initiatives for advancing knowledge
- Enable participants to build relationships and connections that advance their work.

¹ Levings, C.D., R.B. Turner, and B. Ricketts. 1992. Proceedings of the Howe Sound Environmental Science Workshop. Can. Tech. Rep. Fish. Aquat. Sci. 1879. 270 pp. <http://www.dfo-mpo.gc.ca/Library/145871.pdf>

² Burt, J., Foster, S. and A. Day. 2014. Howe Sound Aquatic Forum: Summary of the Day. <http://sustainablehowesound.ca/wp-content/uploads/2015/02/Howe-Sound-Aquatic-Forum-Summary.pdf>

Summary of Workshop Outcomes

1. Relationship building and networking among participants

The workshop included over 60 participants, including representatives from three local First Nations (Squamish, Tsleil-Waututh, and Musqueam Nations), the Department of Fisheries and Oceans, the Provincial Government, local consulting companies, academic institutions, and multiple non-governmental organizations and community groups. See the participant list in Appendix 2.



In the morning session, participants were grouped within “knowledge themes” to discuss information pertaining to specific areas of expertise and aquatic knowledge. In the afternoon, roundtables were mixed such that connections and relationships between knowledge themes and knowledge holders could be made. Several participants commented in the follow up survey that “meeting people”, “networking and making relationships to follow up on,” and “data exchange and interacting with people face-to-face” was the most valuable aspect of the workshop.

“I found that working in small groups fostered mixing and promoted input from all participants.” Workshop participant

2. Benefits of knowledge gathering and integration

Chris Lewis from the Squamish Nation opened with a welcome and introduction, outlining the context for their support and enthusiasm for this knowledge gathering initiative. He described how knowledge integration was a critical component of their terrestrial management plan - XAY TEMIXW (SACRED LAND) Land Use Plan - and that they would like to now bring together knowledge to inform marine planning. At the end of the day, Chris shared a Squamish story to remind us all of the importance of coming together to share information:



Mink, a trickster, had a big potlatch on Gambier Island. All the animals from around the area came to his longhouse, even the undersea creatures. In addition to all the other species, he invited the whale. After everyone else was already inside, in order to join the gathering, whale had to swim fast and launch himself onto the land in order to peek his head into the door of the longhouse. In doing so, his large head blocked the whole entrance and trapped everyone else inside. This was all part of Mink's plan to get everyone together and force them to talk to each other.

Now the whales, who have returned to Howe Sound after a long absence, are doing the same thing – they have trapped all of us in one room and we are talking to one another.

Bob Turner and Colin Levings provided context for this workshop by reflecting on the **Howe Sound Watershed Environmental Science Workshop** that was organized in 1991 through joint federal-provincial funding (Environment Canada-Natural Resources Canada-DFO-BC Environment). They described meeting outcomes and their perspective on the importance of coming together again now to reassess the state of Howe Sound science and knowledge (presentation provided in Appendix 3).

Tawney Lem, executive director of West Coast Aquatic (WCA), gave a presentation about the science and knowledge gathering that occurred for Barkley and Clayoquot Sounds. Her presentation highlighted the critical role that gathering, integrating, and disseminating knowledge plays in building relationships, planning and undertaking restoration projects, directing stewardship, and planning for all types of marine uses in the West Coast Vancouver Island region (presentation provided in Appendix 4).

3. Generating a marine knowledge inventory for Howe Sound

Howe Sound Marine Knowledge Inventory

Key objectives of the workshop were to share and document observations and catalogue available information. As a result, a *marine knowledge inventory*, based on information shared by workshop participants as well as that provided by organizations or individuals unable to attend, has been

generated. This inventory ‘rolls up’ documented observations, stories, and data collections for Howe Sound.

Currently the Howe Sound Marine Knowledge Inventory holds 367 diverse entries describing types of knowledge ranging from personal anecdotal stories, books, scientific reports, raw data and spreadsheet databases to videos and websites. Themes include wildlife (e.g., fish, amphibians, mammals, birds, and invertebrates), archaeology, climate, estuaries, geology, human use, hydrology, physical processes, physical structure, plants, algae, pollution and wetlands. The inventory is too large to include in this report but is available upon request (please contact one of the workshop organizers). The Vancouver Aquarium’s CORI will house the inventory, which is intended to be a living document and will be used as one source of information to pursue a State of Howe Sound initiative.

Maps and Spatial Information

Prior to the workshop, readily available spatial data for Howe Sound were compiled by Living Oceans Society and a list of mapped features was provided to each workshop participant. These mapped features are included in the knowledge inventory. Colour maps were displayed at the workshop to illustrate some of these features, stimulate discussion and provide an additional format for participants to record information. An [online map³](#) was also developed and displayed to demonstrate a sample interactive tool. A resource and mapping table allowed workshop



participants to browse atlases for other regions, discuss Howe Sound maps with Karin Bodtker from Living Oceans Society, test the online map and contribute spatial data. During the course of the day, some participants contributed spatial information which has been included in the knowledge inventory, along with the spatial data collated prior to the workshop.

4. Observations and information on Howe Sound aquatic systems

For the first sessions, participants were assigned to one of six “knowledge themed” roundtables, based roughly on areas of experience and expertise. Roundtable themes were:

- 1) Pollution and Environmental Monitoring;
- 2) The Open Ocean (e.g., marine mammals and oceanography);
- 3) Invertebrates;
- 4) Estuaries and Nearshore Habitats (including birds);
- 5) Salmonid Species;
- 6) Non-Salmonid Fishes.

In these groupings, participants were asked to share their research, observations and stories related to key aquatic features/characteristics, focusing on information related to feature status, trends, pressures

³ <http://www.arcgis.com/apps/Viewer/index.html?appid=6e60758f77db448aa9234009a0b44295>

and drivers of change, and data/knowledge gaps. Later, participants from the knowledge themes were mixed at tables and asked to discuss linkages and relationships among themes in the context of a more integrated ecosystem.

Please note: The sections below document individual observations and anecdotal stories mixed with reports of scientific data that were discussed by workshop participants and recorded by note-takers at their roundtables. The following summary gives a flavour of the rich discussions at the roundtables.

Status and trends of aquatic features in Howe Sound

Marine pollution and environmental effects monitoring

Several types and sources of pollution - past and present - and observed trends were discussed. These included:

- Emissions affecting air quality; from pulp mills emissions are decreasing, while from road traffic emissions are increasing.
- Non-point source run off; possibly increasing due to urbanisation.
- Debris entering the water (e.g., structural, from forestry operations, plastics, micro beads); generally seen as increasing, except from log booming activity which has decreased.
- Dioxins and furans from pulp mills; levels are much reduced due to regulations and mill monitoring.
- Metals from mining operations; the Britannia mine leaching problem is largely cleaned up, and regulations have diminished new contamination.
- Sewage from municipalities, point source; trending up due to population growth.
- Vessel discharge; the feeling is that vessel traffic has increased but this might be a knowledge gap.
- Creosote from pilings; situation is stable, but could be improved by removing old creosote pilings.

The extent to which each of these is monitored varies greatly.

Marine mammals

After a 100-year absence, transient killer whales, white-sided dolphins and humpback whales were observed in Howe Sound, as witnessed by many, and recorded by Vancouver Aquarium's Cetacean Sightings Network (CSN). This group identifies hotspots as cetaceans use the Sound more and more. The recent increase in marine mammals is a good indicator of highly productive ecosystem. Jeff Marliave observes that seal pupping is up in Howe Sound, at a level comparable to the 1980s (very high). He suggested this might possibly relate to an abundance of herring, hake and pollock.

After a hundred-year absence, there are more transient killer whales, white-sided dolphins and humpbacks in Howe Sound. There is a continual evolution of hotspots as cetacean use grows.
- Tess Danelesko, Vancouver Aquarium

Marine birds and waterfowl

Marine bird expertise was minimal at the workshop, however invited experts who were unable to attend identified several sources of information on bird species (surveys, databases, etc.) in Howe Sound that have been included in the knowledge inventory. It was acknowledged that a significant amount of the bird data currently available in Howe Sound remains in a 'raw' format and has not been analyzed or

summarized in formal publications or reports. It was suggested that efforts to bring bird knowledge holders together to attempt to summarize what is known from existing data in the Howe Sound area would be highly valuable. Some specific observations were documented through discussion. Long-term declines have been observed in Western Grebe and black duck populations in the Sound, but it appears that these declines are not currently documented in reports or scientific publications.

Invertebrates

Annual commercial prawn catches in the Sound have been variable and show no clear upward or downward trend. Commercial catch is thought to be a good indicator of prawn abundance since 2001 when prawn management changed. DFO prawn surveys in the Sound suggest prawn abundance in the Britannia mine area may be increasing; this is something to watch and may warrant further analysis. Chief Bill Williams reported that First Nations were pushed out of the prawn fishing industry in the 1960s but First Nations youth are now re-entering the fishery and have a steep learning curve without role models. Anecdotally, Musqueam Elders prefer shellfish from Howe Sound rather than elsewhere in the region because they taste better.

Divers have observed changing sea star numbers—particularly a drop in sunflower stars—and an increase in green sea urchins, leading to replacement of kelp forests with urchin barrens. The wasting disease that has affected sea stars in the last few years may be spreading to other species such as sea cucumbers and sea slugs. Divers have also observed that sponges are growing, crabs of the genus *Cancer* are increasing, but on the whole biodiversity seems stable.

There are numerous sites where large glass sponge bioherms are located in Howe Sound. These sponges are unique globally, not existing anywhere else apart from select areas in BC. Glen Dennison and colleagues have used high-resolution mapping equipment to document the location and density of more than a dozen reefs to date. This group has employed drop cameras to photograph and map the reefs. Numerous observations suggest that sponge bioherms provide refuge for juvenile rockfish, invertebrate larvae and gravid females. Divers have observed large schools of rockfish 50 to 60 ft above the bioherm areas.

The sponge bioherms are fragile (skeletons of silica) and subject to physical damage. Observations of recreational prawn traps being dropped over bioherm areas in Lions Bay, and other bioherms, is a concern.

Anecdotal evidence, observed debris and sedimentation, fossil records, and video footage suggest that several glass sponge bioherms, now dead, exist beneath sedimentation, and the timing of smothering is unknown. Divers have observed areas of dead sponges, where no living sponges remain. The extent of glass sponges, living and dead, in Howe Sound is still being determined. Data suggest they are vulnerable to temperatures above 10°C.

Participants reported a lack of resources to study marine invertebrates, especially non-commercial species, perhaps due to low public interest. To date, diving, trap and trawl data have been the primary information sources on invertebrates.

Forage fish

Reports suggest that some forage fish were more abundant historically in Howe Sound and observed in locations where they are no longer found. For example, herring were abundant at Snug Cove in the

1940s and 1950s, but are no longer seen at Bowen Island. Similarly, sand lance were abundant near Gibsons in the past, but have not been reported there recently. Keats Island may be important in recent years for forage fish. Historically, consistent surveys for forage fish were lacking. Individuals and non-profits groups are now taking the initiative to survey. This is true for herring as well. Trends in sound-wide herring abundance are uncertain because DFO survey effort has ceased and changes in the nature and location of the herring fishery throughout the Strait of Georgia led to changes in herring movement and spawning. Recent observations suggest that herring spawn abundance in the vicinity of Woodfibre and in Squamish reach is on the rise. Two distinct herring stocks are recognized in Howe Sound (local



and regional), and participants suggested this be taken into account when opening and managing fisheries to avoid depletion.

It was noted that walleye pollock broodstock continue to be present in Howe Sound (observations suggest they have always been here). After successful reproduction in Howe Sound (and likely other similar inlets) they move into the Strait of Georgia. Pollock succeed in Arctic outflow years; related to ENSO events.

The Squamish River once supported a significant eulachon run and a eulachon fishery. First Nations report abundant eulachon in the 1950s and industrial impacts such as acidification and pollution likely put an end to this. Recently however, larval eulachon have been observed at the water's surface in the Sound.

Eelgrass and nearshore habitats

We lack historical data on locations and extents of eelgrass beds, even though it is such an important habitat. Lack of a baseline from which to compare means trends in quality and abundance are hard to determine. Recent surveys undertaken by Islands Trust around the Islands of Howe Sound suggest that many existing eelgrass beds have been damaged by anchors and buoys and are thus diminished.

Nearshore and shorezone types have been classified and mapped by the Province are available as a dataset known as the B.C. shorezone. Each kilometer of shoreline was classified based on aerial photographs, so the detail of information is limited to that scale.

Ancestors of the Squamish people say that the river path was altered as a result of clear-cutting and log-jams. "The river is not where it belongs." There was much discussion of changes to nearshore habitats due to development and infrastructure. The disappearance of brown kelps (e.g. *Agarum*) was noted in particular. However, habitat restoration projects are now active for brownfield sites and eelgrass beds. The Squamish River Society is a good source of knowledge in this area and a student at Quest University is currently compiling existing data on the Squamish estuary.

Salmon

Species of salmon discussed included chinook, sockeye, pink, coho, and chum. Salmon were abundant in the Squamish area in the 1860s, but salmon runs were heavily impacted by hydro dam construction in 1950. Recent juvenile surveys indicate that Howe Sound maybe a good quality juvenile rearing habitat, as similar habitat becomes less available elsewhere in the region and as global warming intensifies. New information suggests that Howe Sound is used for rearing by salmon that spawn in the Fraser River

watershed, in particular the Harrison Lake sockeye (sea type) and South Thompson chinook. Information on juvenile out-migration routes and survivals is relatively new so the dynamics and reasons for seemingly higher survival of young fish using Howe Sound are not well understood. A big run of pink salmon is expected this year, but smaller numbers are being observed, while chum salmon numbers have plummeted in Squamish. Chinook are being affected by changing winter weather patterns and habitat alteration. Howe Sound contains important streams and estuaries for coho, but they seem to be less well studied.

Howe Sound is being used for rearing of salmon that don't originate from the area.
- Dave Brown, Squamish to Lillooet Sportfish Advisory Committee

Rockfish

Historically rockfish were abundant and easy to catch (i.e., even in the 1980's). They have since been overfished with increased fishing intensity and gear efficiency. Reports of poaching (illegal fishing) in the Rockfish Conservation Areas, which were set aside in 2005 to protect rockfish habitat and rebuild populations, continue and DFO has little capacity to monitor. The spawning population of yelloweye rockfish around Pasley Island may be isolated and limited data suggest that recovery of this population may be underway. One participant suspects a connection between glass sponge recovery and rockfish recovery.

Pressures and drivers of change in the Howe Sound aquatic environment

Climate change

Major pressures and drivers of change in Howe Sound include those related to climate change, such as sea level rise and ocean acidification. Impacts on fish abundance and distribution (e.g., herring) are likely but data to work with are spotty. Trends in salmon abundance and juvenile use of Howe Sound for rearing may be related to climate change.

Increasing population and vessel traffic

Threats associated with increased population, urbanization, and vessel traffic in the area include:

- nearshore developments;
- increased habitat damage from boat mooring, anchoring, and abandoned ships/boats;
- dock construction over sensitive habitats like eelgrass;
- increased fishing activity and the potential damage to bottom habitats such as glass sponges;
- pollution from garbage, land-based discharges, and aging infrastructure;
- pollution from vessel effluent;
- introduction of invasive species such as tunicates and green crabs (currently not present in Howe Sound) through ballast water or attachment to boat hulls.

Further, the threats associated with larger vessels, such as liquefied natural gas (LNG) tankers, include an increase in noise pollution, the risk of bottom contact, wave surge damage to bottom habitats, and wake impacts to the intertidal zone and invertebrates.

Recreational fishing

Federal government monitoring in the area is insufficient to successfully enforce recreational fishing limits, closures, and regulations, due to lack of allocated resources. While recreational fishing effort and its impacts are not well studied, reports of poaching at several Rockfish Conservation Areas in Howe Sound continue. Ironically, rockfish seem to be increasing in some areas without Rockfish Conservation Areas, for example in some locations around Bowen Island. Poaching of lingcod is also reported. One

impact recently reported is damage to glass sponges from prawn traps, which occurs in part because areas immediately adjacent to glass sponges contain higher prawn abundance and are targeted by fishers.

Industrial activities

Historical log booming sites and the build-up of industrial pollutants on the west side of the Sound may be the cause of poor eelgrass growth in some areas, such as Gambier Island.

Several proposals for new industrial activities including an LNG plant and a gravel plant introduce new threats to the marine environment and each could be a significant driver of change.

Shoreline development

Development along the shore in Howe Sound seems to occur without regard for wetlands or other sensitive areas such as eelgrass beds. Regulations on floating marine structures and buoys may be insufficient and a lack of enforcement capacity exacerbates the problem.

Limited regulatory capacity

As a driver of change in Howe Sound aquatic ecosystems, limited regulatory capacity came up several times. As mentioned above, limited enforcement of sport fishery closures may be impacting rockfish populations. In addition, participants felt that pink salmon stocks, and possibly other fish stocks, may be at risk due to inadequate data to support commercial fishery management decisions.

Information and knowledge gaps

Knowledge gaps were acknowledged in conversations throughout the day and some are documented here. Almost every themed discussion group noted a lack of baseline information or consistent data from which conclusions about trends could be drawn:

- A lack of consistent and comprehensive herring spawn surveys means we cannot know if there is actually resurgence or if they have just moved to Howe Sound from elsewhere.
- There are gaps in the understanding of many salmon species originating in and using Howe Sound. Examples include limited understanding of pink salmon stocks and their movements in and out of Howe Sound, chum stocks and reasons for their decline, young coho salmon use of Howe Sound habitat, and possible increased use of the Sound by juvenile sockeye and chinook salmon out-migrating from Fraser River tributaries.
- To date, information has been lacking on non-commercial invertebrate species, areas beyond the intertidal zone and even commercially important fishery species that are returning to the Sound.
- Better understanding of oceanographic processes in Howe Sound could help determine how vulnerable it is. For example, we know little about how Howe Sound is influenced by other marine areas, such as the Fraser River and the Strait of Georgia, and the impacts and activities in those areas.
- Monitoring, specifically in the Squamish estuary, is a gap. What do we know about sea level rise, invertebrates in the estuaries, and species at risk in the area? Given government commitments (successive Squamish Estuary Plans since 1980s) and conservation work in the estuary, it's

There is good information on species diversity in the intertidal, but once you move beyond this, the data gets thinner and thinner.

- Ken Fong, Fisheries and Oceans Canada

striking how much remains unprotected. We know how estuaries function in terms of water flow, etc., but need more information on processes.

- There is a real lack of consistent, long term, government funded monitoring. This gap needs to be filled by others and we need a keeper for sharing that knowledge (e.g., a 'hub').

As the many gaps were noted, the benefits of long-term data sets and a data hub were also discussed:

- If long-term data is made available, it could be used to analyze trends, make comparisons, identify potential conflict areas and conservation needs, write peer-reviewed publications, bring attention to Howe Sound ecology and engage multiple researchers and stakeholders.
- A single knowledge hub will help with accessing and standardizing data. Having access to a wide range of data will help build the continuous and long-term body of information that is needed to better understand the area.



In addition to data gaps, access to data was reported to be an issue, as well as appropriate methods for the integration of different types of knowledge:

- Much of the information on Howe Sound is unpublished, held by retiring scientists, other individuals, and sometimes industries.
- Some knowledge holders prefer not to share information if it is incomplete or unpublished, and several knowledge holders feel that in many cases federal security concerns have trumped data sharing.
- Initiatives that are collating and sharing datasets include the *Strait of Georgia Data Centre* (<http://sogdatacentre.ca>), a provincial initiative to make data layers available - *DataBC* (<http://www.data.gov.bc.ca/dbc/about/>), and a federal government initiative *Open Data* (<http://open.canada.ca/en/open-data>).
- Traditional use studies and mapping have been done that could go back 100 years. While they strengthen First Nation rights and title arguments, this knowledge is generally not publically available.
- Methods and protocols are needed to gather and integrate traditional knowledge, local knowledge and western science. There are good data on Howe Sound, but they are not linked together well.
- The diversity of data types we need to consider include published, unpublished or “grey” literature, physical, biological, human use, traditional and local. It would be beneficial for the diversity of people working in Howe Sound to recognize, reconcile and respect differences, and help each other gain the capacity to contribute to an overall plan for the Sound rather than divide or silo themselves. Developing an engagement framework could help people connect before they collide. Developing these relationships will require moving from a history of distrust to a plan to continue in a positive way.

Improving access to datasets to multiple researchers and stakeholders can yield new insights, connections, and avenues for public, government and scientist involvement.
- Chris Neufield, Quest University

We need to remember to connect before we crash or collide.
- Chris Lewis, Squamish Nation

On the whole, workshop participants felt that better and more complete information would lead to better management. In speaking about gaps in general, these other themes emerged:

- There is a lack of public awareness of the ecology of Howe Sound, e.g., the importance of invertebrates and key habitats, and the locations where fishing is prohibited and why. Who should be tasked with delivering this information and how can it be done effectively?
- We need to understand Howe Sound and the broader region surrounding it more holistically. We can improve our understanding of how cumulative effects and individual impacts affect the land, water and air, individual species, ecosystems and ecosystem processes. For example, how is Howe Sound influenced by warming in the Northeast Pacific?
- On a more localized scale in the Sound, better recognition is needed of the connection between land, sea and sky, the influence of the Squamish River, and the connections between species. What are the links between the sea star wasting disease, the increase in urchins, decrease in kelp, and the health of the prawn fishery? There are still many uncertainties about the sea star wasting disease and its possible spread to other species.
- The data collected through workshops like these and similar efforts to integrate knowledge are so valuable for future assessments as Howe Sound faces growing pressures from various developments. The quality of these assessments (environmental impact assessments, cumulative effects assessments) is influenced by the data that is available. It is hoped that this initiative and future efforts to inventory and integrate knowledge can help support and strengthen these assessments by making more Howe Sound science information, as well as traditional and local knowledge accessible.



Whose responsibility is it to inform the public? At one time this was government's but whose is it now?
- *Richard Beamish, Emeritus Scientist, Fisheries and Oceans Canada*

What kind of Howe Sound story emerged from the workshop?

Can there be one story to provide an overall picture of the health of Howe Sound? Many aspects of Howe Sound health have certainly changed since the 1990's, but weaving all the documented changes and individual observations into a single story is a challenging prospect. Ecosystem changes are complex, indicators hard to choose, and sometimes observed 'trends' seem to be contradictory. Even if succinct stories did not emerge at the roundtables, threads of a story are evident.

In the past year, observations of the wasting of sea stars, an invasion of sea urchins, apparent increases in abundance of herring, reappearances of whales and dolphins, and a distinct lack of snow are all top of mind. Salmon stocks, other than pink salmon, may be declining, but are not well understood; nor are rockfish populations. However, small fish foraging in Howe Sound appear to be doing well (e.g., herring, juvenile Harrison sockeye, South Thompson chinook salmon, and other forage fish). People are involved in eelgrass and forage fish mapping, establishing community parks and other conservation initiatives, sharing information and working on increasing awareness across the Howe Sound community. Inclusion of First Nations and traditional knowledge in these dialogues has increased, alongside an interest in

continued collaboration. Over time and for a myriad of reasons, First Nations report having had to change the species they fish and consume, and still traditional foods are less abundant than what they once were. Industrial pollution continues, but not at the scale of the 1990's, and now numerous development proposals require consideration. Climate changes have led to drastic fluctuations in snow pack and a change from a single spring freshet to repeated fresh water inflow events over an extended period. Overall, changes are apparent, some positive, some negative, and just as we've managed and reduced some threats, others are looming to challenge us.

Some workshop participants felt that sharing the Howe Sound story could involve documenting information and showing it on maps, in a manner similar to West Coast Aquatic. Others saw that sponges could play the role that coral reefs do in the tropics, as a flagship species for conservation in Howe Sound. Stories focused on sponges could easily connect to rockfish, prawns and other species, and demonstrate the impacts of vessel traffic, fisheries and pollution.

We've got something special going on in Howe Sound in a world that is short of good news stories... But this trend may not continue.
- Bob Turner, Bowen Island Conservancy

Howe Sound is unique in many ways and its continued study will be of benefit to locals and the wider scientific community alike. Enthusiastic participation at this workshop suggests that this community, part of the human aspect of the Howe Sound ecosystem, is embracing a trend toward improved understanding and stewardship of the Sound. Someone said, "We have a social consciousness within the Sound" and that is part of the Howe Sound story as well. Pursuing an integrated approach to planning in the area would help ensure that good news reports continue to emerge from Howe Sound.

5. Discussion on initiatives to advance knowledge integration

The final session of the day was focused on discussing specific initiatives for advancing knowledge integration. Ideas for these initiatives were generated at previous forums and two new topics were added by workshop participants. For each knowledge initiative, roundtable groups were asked to discuss **why** the initiative is important, **what** key elements it should include, **who** could be involved and **when** it should happen.

Conduct a "State of Howe Sound" Report

Why: A need for this report was originally identified at the Howe Sound meeting in 1991. It could address the need for connecting and updating baseline data and the people who collect it, help understand how the different pieces fit together into a larger whole and help prioritize research needs. As an education tool, the document could help people connect with Howe Sound and make more informed decisions.

What: This report must be user-friendly and be accessible to all public audiences, including children and youth. It will be a way for them to discover Howe Sound, like a well-informed tourist map. Through storytelling on a shared platform, it will simplify, reduce, condense, focus and deliver information. It will bring together stories that draw on existing easily accessible natural, social and traditional science/knowledge, but it isn't a substitute for any of the original research or knowledge gathering. It will include good news stories. More than just a document, it will be a process through which people will

submit user-friendly reports of their work for public communication. It will be an introduction to Howe Sound that will inspire some people to look more deeply. Perfection is not required!

There are existing examples that can be consulted, for example the Vernon master plan, DFO's State of the Ocean Reports, and examples from Puget Sound Partnership and West Coast Aquatic.

Who: Vancouver Aquarium's Coastal Oceans Research Institute (CORI) is willing to be involved. The project could link to the Province of B.C.'s State of the Environment reporting and cumulative effects assessment roadmap and original knowledge holders. Graduate students could be brought into the project as well.

When: A working group could be established, following up from this workshop, and further planning could occur at the Salish Sea conference in Vancouver, in April 2016.

Establish a system(s) for Howe Sound information management

Why: Information management is needed to consolidate, validate, georeference and update data that are otherwise scattered, to make them organized, usable and accessible. Compiling collective knowledge would enable people to better understand Howe Sound on an ecosystem level. There is still a need, however, to examine current data management systems and confirm whether a new system is needed.

What: This compilation must link existing data sharing websites. It will require data sharing protocols, a technical workshop for potential contributors and funding for maintenance. It could take multiple formats depending on the potential audience that would use it, for example mappers, monitors and others – both users and contributors.

Who: This initiative could bring together the Vancouver Aquarium, Pacific Salmon Foundation, the Community Mapping Network and Ocean Networks Canada. It could build on pre-existing relationships.



Establish a Howe Sound integrated monitoring network

Why: Integrated monitoring would ensure collaboration and avoid duplication among people involved in different types of ecosystems (e.g., river, ocean). The role of integrated monitoring in sharing resources and information would help all users who need this information. Integration around a central, logical hub would provide greater flexibility and sustainability.

What: The network would include a go-to contact person, web portal, and a clearinghouse of knowledge, information and monitoring resources. It would require equipment, Geographical Information Systems (GIS) analysis, resources and coordination.

Who: The network could include students, divers, nature groups, birders, key individuals, Squamish First Nation, volunteers (including those operating through existing programs), non-governmental organizations, industry, entities that tend to seek information, monitors, citizen scientists, BC Ferries and other vessels or structures that could house sensors. CORI could house the go-to person. Liaisons could be made with other similar areas, for example Puget Sound, Saanich Inlet, Cowichan Bay, California and Alaska, to learn and share information.

Help improve knowledge integration to inform fisheries management

Why: Informed fisheries management decisions, for example reopening of fisheries in Howe Sound, need adequate science. Particular needs include better understanding of genetics, instability, threats, uncertainty, bycatch and recreational uses of important habitats.

What: This knowledge integration must balance large and local scales, increase public engagement by DFO, increase funding and enforcement, identify the role of local knowledge, increase transparency and inclusion to build trust, and provide opportunities to be proactive, adequate communication around uncertainty, and a process to integrate new management methods. Knowledge must include science on allowable catch, identified limits, monitoring, a quantitative framework and a long term plan. Associated outreach should include information sessions, workshops and a follow-up roundtable.

Who: Existing examples to model include First Nations' involvement in goose barnacle fishery assessment, work through West Coast Aquatic, and in the Columbia River area. Funding could be sought for the Pacific Salmon Foundation to do the work of integration. The sport fish advisory committee's weekly calls could be an existing channel for communication. First Nations can play a role in making and communicating decisions. One challenge is limited capacity at DFO.

Compile and communicate aquatic Traditional Knowledge

Why: Traditional Knowledge contributes to baseline information and understanding of how things were and could be, as well as trends. It also provides instruction for how to respect species. It is important to document it while it is still available.

What: Traditional Knowledge can be presented in various formats beyond the written, for example video and mapping of traditional names, photos and quotations to show what is or was where, for example via Google Maps. It can be shared in public venues, for example camps, on signposts, through invitational gatherings (for example the Witness Project that took place between 1995-2005). As with any other kind of data, managers need education on how to use Traditional Knowledge. A particular challenge is people's dependence on quantitative data.

Who: Coastal Guardians, knowledge holders, municipalities and Squamish Nation's fisheries department and ambassadors could be involved. Squamish Nation could share through guided tours of Howe Sound. Chiefs could talk about what's happening in Salish Sea from height of land to ocean, and determine the pressing issues. Starting points could be a study started 7 years ago on the Squamish Watershed for presentation to Chiefs and water testing conducted during annual canoe journeys. West Coast Aquatic's mapping work can be used as an example.

Establish a voluntary protected areas strategy

Why: Currently, less than 1% of Canada's oceans are protected, far less than its commitment to 10% under the Convention on Biological Diversity. There is a need to protect aquatic life in Howe Sound. Rockfish are an example of species that are in need of protection but with few resources for monitoring and enforcement, RCAs are threatened by poaching and invasive fishing methods. DFO needs support to justify more resources for this. It is important to be doing something concrete for conservation, beyond holding meetings.



What: The protected areas strategy could increase fish stocks through full protection in areas that are currently only partially or minimally protected, for example RCAs, to close loopholes. Funding is needed to determine the effectiveness of existing areas such as RCAs. Protection requires improved enforcement, in part through community stewardship, to complement and enhance enforcement by DFO. Education is part of protection, and could include action-oriented interpretation programs on beaches, community engagement programs, community stewardship and signage explaining rules and reporting. Positive examples include a proposed Halkett Point Park marine extension. Several potential protected areas have already been identified. Lobbying for increased protection has worked in the past. There are global examples to follow, but local examples include Whytecliffe Park, Porteau Cove and Channel Islands.

Who: Voluntary efforts and partnerships could involve First Nations, non-governmental organizations, community stewards, Power Squadrons, government scientists and trainers and local governments. For example, BC Parks has no ability to stop poachers in Porteau Cove, but could deputize local bylaw officers to assist.

Workshop Conclusion

According to Chris Lewis of the Squamish Nation, from a First Nations worldview, when something reappears that hasn't been around for a while, it is a message that something has changed. For example, the recent reappearance of whales and dolphins in Howe Sound has given many people pause and inspired them to pay attention to the ecosystem dynamics of Howe Sound. The returning mammals also highlight how little we understand about many system interactions in Howe Sound. Documenting,

sharing and learning from these observations is important for informing our knowledge and management of this unique seascape.

Our ancestors and Elders would say those whales came to see you because they wanted you to stop, smell the roses, and say, 'What's going on here?' They didn't just come back because there's more herring.
- *Chris Lewis, Squamish Nation*

It is important to think about what is known, and thus the workshop focused on assembling and sharing knowledge. People at the table participating in sharing knowledge have changed over time. This event included First Nations, NGOs and citizen scientists, whereas in the 1990's only government scientists were involved. Public outreach is now undertaken by non-governmental organizations in Howe Sound. The recent reappearance of charismatic species will help to engage the community and motivate people to act. Someone said, "It is important to think about what is known, but it is crucial to focus on what is needed." Future management, planning and stewardship of Howe Sound will benefit from collective knowledge building and integration. Participants were energised to follow up on the ideas and information gathered at this workshop.

To close the day, a series of witnesses chosen by the host organizations were called to speak briefly about their observations of the workshop. Chief Bill Williams of Squamish Nation closed the meeting by acknowledging and thanking all organisers and participants.

Participant Feedback, post-workshop

A feedback survey was distributed to participants following the workshop; 30 responses were received. In summary:

- Most responses conveyed that the workshop was interesting, a good mix of people, informative and productive. Its role as a networking opportunity and for relationship building was seen as highly valuable. Some felt that it was too ambitious, people were missing from the room, it was a difficult forum for gathering information and could have benefitted from greater focus.
- Overall, people felt most of the workshop's objectives were met, particularly relationship building and sharing and documentation of information.
- Of the six future initiatives discussed in Session 3, the State of Howe Sound report received the most post-workshop support in survey responses, followed by integrated monitoring, integrating knowledge to inform fisheries management, compiling and communicating traditional knowledge and Howe Sound information management.

Appendices

Appendix 1: Meeting Agenda

Howe Sound Aquatic Forum - Knowledge Gathering - AGENDA

9:00am - 4:30pm, March 27 2015

The Vancouver Aquarium, AquaQuest Entrance

Hosted by The Vancouver Aquarium / Coastal Oceans Research Institute, Squamish Nation, and The David Suzuki Foundation
Facilitators: Jenn Burt (SFU), Karin Bodtker (Living Oceans Society)

Meeting Purpose:

To bring knowledge holders together to identify and share observations, information, experiences, and future knowledge priorities related to the aquatic biophysical features of Howe Sound.

Meeting Objectives:

- Share and document observations about the status, trends, and drivers of change related to biophysical features in the Howe Sound ecosystem
- Share and catalogue available information (published resources, reports, observations, grey literature, spatial data) and identify key knowledge gaps
- Identify and discuss linkages and relationships within the ecosystem
- Identify and discuss priorities, opportunities and specific initiatives for advancing knowledge
- Enable participants to build relationships and connections that advance their work.

Schedule:

8:30 - 9:00 **Arrival; coffee and refreshments provided**

9:00 - 9:50 **Welcome and Introductions**

- Welcome and Protocol from Squamish Nation (Speaker: Chris Lewis)
- Welcome from The Vancouver Aquarium / Coastal Oceans Research Institute (John Nightingale) and The David Suzuki Foundation (Steven Foster)
- Welcome from MLA Jordan Sturdy (West Vancouver-Sea to Sky)
- Overview of the day (Jenn Burt)

9:50 - 10:10 **The Benefits of Knowledge Gathering and Integration**

- Bob Turner (Howe Sound Environmental Science Network) and Colin Levings (Fisheries and Oceans Canada, Emeritus). Looking Back, Moving Forward - the 1991 Howe Sound Environmental Science Workshop.
- Tawney Lem (West Coast Aquatic). The results of a Science and Knowledge Gathering Initiative in Barkley and Clayoquot Sounds

10:15 - 11:10 **Session #1 – Knowledge about Status, Trends, Drivers of Change, and Information**

Participants work within “knowledge theme tables” to answer the following questions:

1. What research results, observations, and information do you have related to status, trends, and drivers of change of aquatic features within Howe Sound? (see Worksheet #1)
2. What information is available for key aquatic features in Howe Sound (literature, datasets, knowledge holders, GIS information, other)? (see Knowledge Inventory Forms).
3. What are some key information and knowledge gaps? (Worksheet #1 continued)

11:10 - 11:20 Working Break: Refreshments provided

11:20 - 12:15 Session #1 Continued

* Note: please visit the “map table” to explore a draft interactive Howe Sound atlas and provide your commentary and feedback on available spatial data.

12:15 - 1:00 Lunch provided

1:00 - 2:20 Session #2 – Knowledge Integration

Participants work in “mixed knowledge tables” to discuss the following questions:

1. Drawing on this mornings’ discussions, what similarities and key linkages exist or have been observed between the status, trends, and drivers of different aquatic features? (Worksheet #2)
2. Is there an overall picture and outlook about the current health of Howe Sound biophysical features that can be summarized? If so, what might a 2015 ‘Howe Sound story’ look like from a biophysical perspective? (Worksheet #2 continued)

2:20 - 2:35 Break

2:35 - 3:30 Session #3 – Initiatives to Advance Knowledge

Participants self-select a table that reflects their interest in a particular initiative (some options below) and discuss how these initiatives could be advanced in Howe Sound (Worksheet #3).

(1) ‘State of Howe Sound’ Report/Assessment, (2) Howe Sound Information Management (Atlas and/or Database), (3) Howe Sound Monitoring Network, (4) Integrated Education and Outreach Initiatives, (5) Future Gatherings and Networking Activities, (6) Compiling and Communicating Aquatic Traditional Knowledge (7) Other Specific Research and Knowledge Initiatives.

1. Why is this initiative important? Who would be the users and/or benefit?
2. What key elements should this initiative include?
3. Who is willing to be involved? Are there currently similar initiatives?
4. When should this happen? Are the upcoming opportunities? Who can lead them?

3:30 - 4:20 Summary of Next Steps, The ‘Howe Sound 2015 Story’, and Calling Speakers

4:20 - 4:30 Thank You and Concluding Remarks

Appendix 2: Participant List

HOWE SOUND SCIENCE AND KNOWLEDGE WORKSHOP PARTICIPANTS

Participant	Organization	Title
Ken Ashley	BCIT Rivers Institute / BCIT Ecological Restoration Program	Director / Instructor
Lance Barrett-Lennard	Vancouver Aquarium	Director, Cetacean Research Program
Richard Beamish	Fisheries and Oceans Canada	Emeritus Scientist
Bonny Brokenshire	Bowen Island Municipality	Bylaw Enforcement
Dave Brown	Squamish to Lillooet Sportfish Advisory Committee	Vice-Chair
John Buchanan	Squamish Environment Society	Co-Caretaker
Peter Chandler	DFO Institute of Ocean Sciences	Physical Oceanographer
Lena Clayton	Marine Life Sanctuaries Society	Researcher
Terry Curran	Pacific Salmon Foundation	Strait of Georgia Data Centre
Tess Danelesko	Vancouver Aquarium	B.C. Cetacean Sightings Network
Glen Dennison	Marine Life Sanctuaries Society	Director
Bridget Doyle	Tsleil-Waututh Nation	Environmental Stewardship Coordinator
Kate Emmings	Islands Trust / Islands Trust Fund	Ecosystem Protection Specialist
David Fierro	Okanagan Nation	
Ken Fong	Fisheries and Oceans Canada	Research Biologist
Matt Foy	Fisheries and Oceans Canada	Restoration Biologist
Julie Gardner	Dovetail Consulting	Principal
Donna Gibbs	Vancouver Aquarium	Marine taxonomist
Maria de Jong Westman	Capilano University	Department Head, Biology
Jeff Juthans	Department of Forest, Lands and Natural Resource Operations	Land & Resource Specialist
Steve Kachanoski	BC Ministry of Forests, Lands and Natural Resource Operations	Cumulative Effects Project Manager
Tawney Lem	West Coast Aquatic	Manager
Colin Levings	Fisheries and Oceans Canada	Emeritus Scientist
Randall Lewis	Squamish Nation	Environmental Coordinator
Nathan Lewis	Squamish Nation	
Kari Mancer	Sea to Sky Clean Air Society	
Jeff Marliave	Vancouver Aquarium	Vice President, Marine Science
Neil McDaniel	Neil McDaniel Video and Marine Consulting	Principal
Caroline Melville	Instream Consultants	Project Manager
Roy Mulder	Marine Life Sanctuaries Society	President
Chris Neufeld	QUEST University	Life Sciences Tutor
Chrys Neville	Fisheries and Oceans Canada	Fisheries Biologist
Dianne Ramage	Pacific Salmon Foundation	Director, Salmon Recovery Programs
John Rich	Ratcliff and Company	Aboriginal law

Participant	Organization	Title
Peter Ross	Vancouver Aquarium	Director, Ocean Pollution Program
Dennis Rutherford	Fisheries and Oceans Canada	Research Biologist
Jessica Schultz	Vancouver Aquarium	Coordinator, Howe Sound Research Program
Willard Sparrow	Musqueam Indian Band	Musqueam Advisor
Doug Swanston	Seacology	Principle, Biologist
Adam Taylor	Underwater Council of BC / Marine Life Sanctuaries Society	Director / Director
Edith Tobe	Squamish River Watershed Society	Executive Director
Bob Turner	Howe Sound Environmental Science Network, Bowen Conservancy	Chair
Mel Turner	Elders Council for Parks	Heritage Centre, General Outreach

WORKSHOP HOSTS

Organization	Title	
Stephen Foster	David Suzuki Foundation	Howe Sound Campaign Lead
Chris Lewis	Squamish Nation	Councillor / Official Spokesman
John Nightingale	Vancouver Aquarium	President & CEO
Bill Williams	Squamish Nation	Hereditary Chief

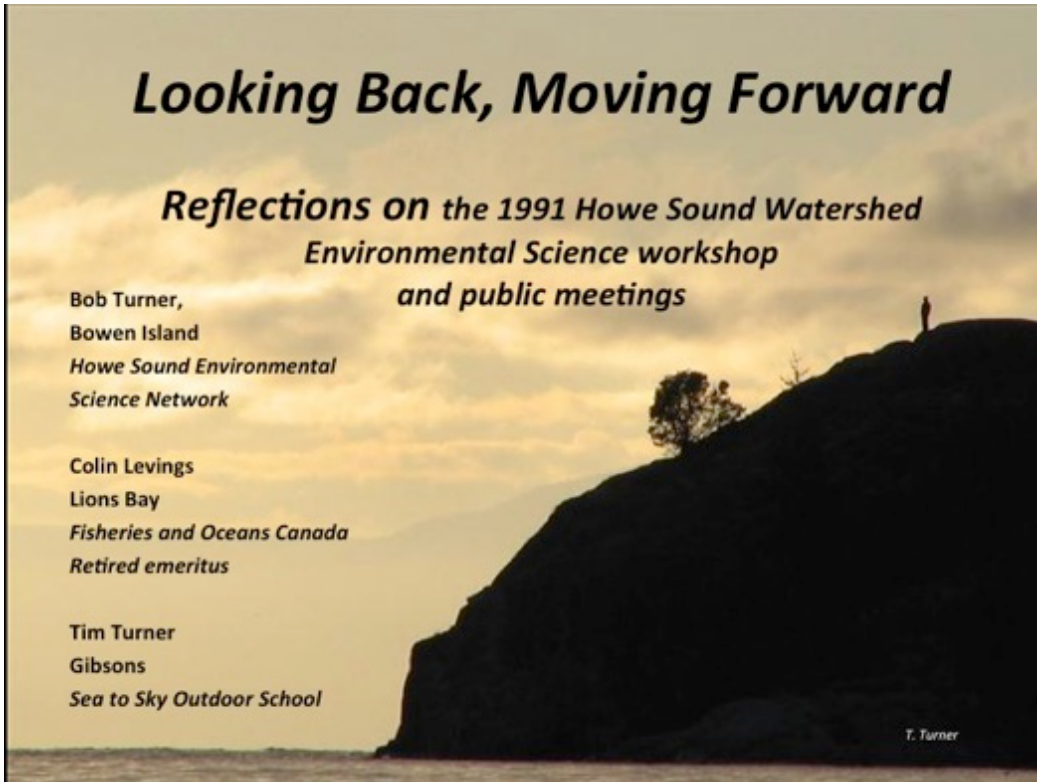
WORKSHOP ORGANIZERS/FACILITATORS*

Organization	Title	
Jenn Burt*	Simon Fraser University	Researcher, Coastal Ecology
Andrew Day	Vancouver Aquarium	Executive Director, Coastal Oceans Research Institute
Karin Bodtker*	Living Oceans Society	Director, Mapping and Analysis
Lisa Wilcox	Squamish Nation	Management Team

BREAKOUT-SESSION FACILITATORS

Organization	Title	
Susan Abs	Eclipse Environmental Consulting	Principal
Sandra Bicego	District of West Vancouver	Manager of Environment and Sustainability
Kyle Empringham	David Suzuki Foundation	Public Engagement Specialist
Michelle Molnar	David Suzuki Foundation	Environmental Economist
Anu Rao	David Suzuki Foundation	Senior Specialist, Marine Planning
Ruth Simons	Future of Howe Sound Society	Executive Director

Appendix 3: Bob Turner and Colin Levings Presentation



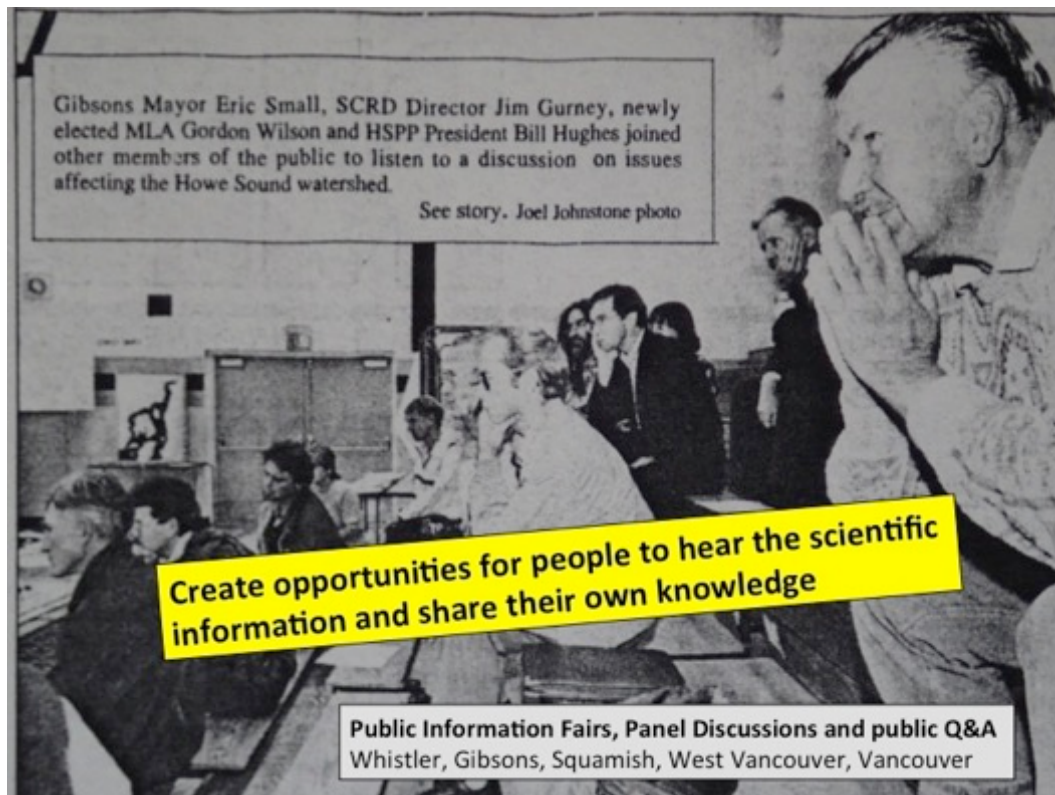
There was a clear need

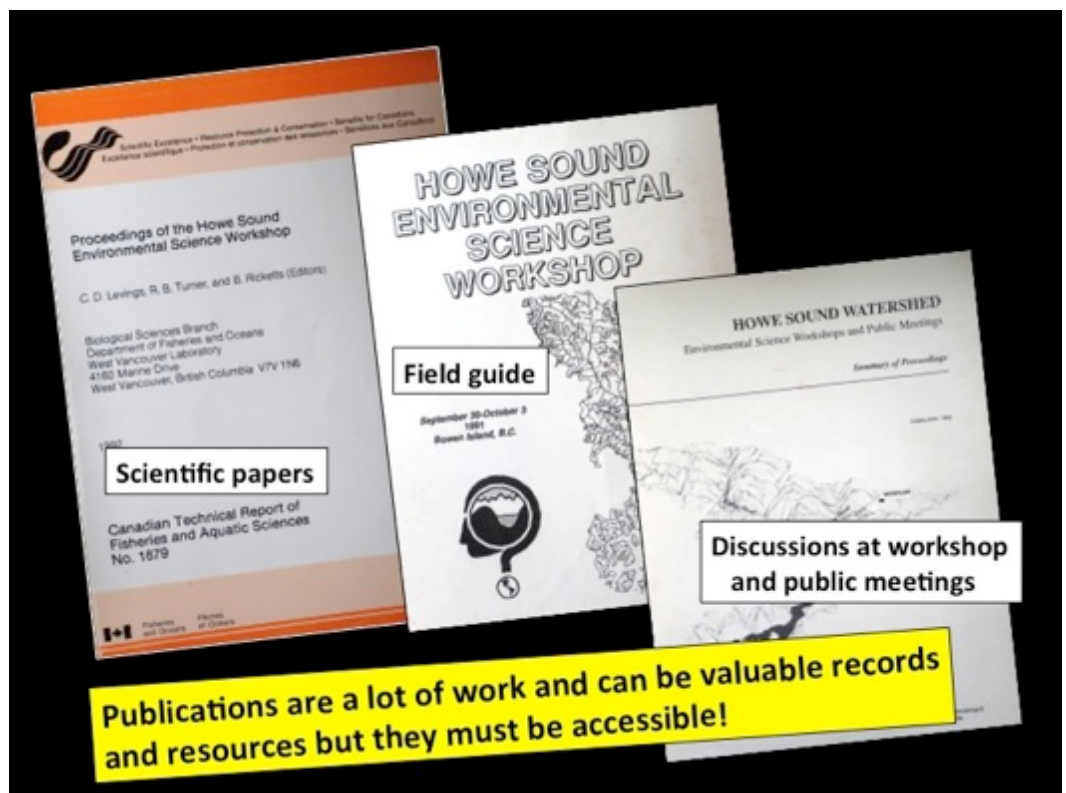
What could science tell the public about the health of Howe Sound?



**So we organized a three day meeting of scientists and environmental professionals.
Reflecting back, what lessons speak to us today?**









What has been done since the 1991 Workshop ?

Numerous projects on a variety of topics – for example a search on Google Scholar for papers since 2011 (400 records reviewed; grey literature underestimated, a problem)

Howe Sound topic	Number of papers
Salmon ecology	6
Sediments	6
Rockfish	4
Sponges	3
Airshed/climate	3
Lingcod/sculpins/crustaceans	3
Phytoplankton	2
Marine biodiversity	2
Contaminants	2
Bacteria	1
Birds	1

Squamish River topic	Number of papers
Landslides	3
Hydroelectric	3
Salmon	2
Floods	2
Sedimentology	2
Birds	2
Volcanoes	2
Hydrology	1
Riparian vegetation	1

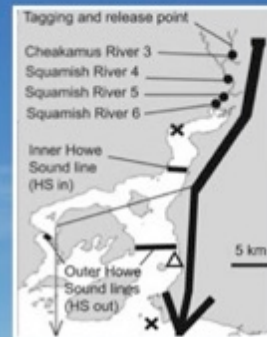


Would A Complete Online Listing Of Papers/Reports on Howe Sound Science be Useful?




Some examples on the Marine Ecosystem side

- **Steelhead-coho Migration Routes**
(Melynychuk and others)
- **Fraser River Sockeye In Howe Sound**
(Beamish and others)
- **Juvenile Chinook Population Identifications**
(Tobe/DFO/PSF)
- **Marine Riparian Linkages To Salmon Food Webs**
(Levings and others)
- **Rockfish Ecology**
(Marliave and others)
- **Britannia Mine Ecosystem Effects**
(Levings and others)
- **Sponge Ecosystem Studies/Monitoring**
(Dennison and others)



Moving Ahead With Science

- **“Landscape Approach”**
embed science in community decision-making
- **Advances** (Hydroacoustics, Genetics, Remote Sensing, Food Web Analyses) enable faster progress;
Traditional knowledge and **citizen science** also helping.
- **Modeling** now enables more comprehensive approaches (e.g. Ecopath and successors) but require lots of data on ecosystem components
- To understand **Howe Sound ecosystem processes** have to look upstream to the river and downstream to the Strait of Georgia



Moving Ahead in Howe Sound

Empower our knowledge community

- **Keep meeting!!** (online, field trips, meetings, retreats)
- **Organize/share our information** (atlas, data, publications, articles)

Engage and energize the public

Connect people to Nature

A Witness Program. School field trips. Outdoor schools. Camp Suzuki.
Online stories. State of Environment updates. Citizen science.

Promote pride of place in Howe Sound

Celebrate! The Brackendale Eagle Festival. The Herring Festival.
Future of Howe Sound Society. Howe Sound Rangers?

“Reframe” Howe Sound with a bold idea.

A Salish name? A National Park? A World Biosphere Reserve?

Science and Knowledge Gathering in the Barkley and Clayoquot Sounds

Presentation to the Howe Sound Aquatic Forum



The Objective



Arrive at a place where we have the ability to see the broader ecosystem picture and make informed decisions.

Knowledge gathering/sharing = the foundation of more integrated decision-making



The Challenge



The Process

Set out on a *Knowledge Gathering* exercise – not just statistics and numbers, – but people’s experience on the water, First Nations’ cultural history, etc.



Knowledge Gathering Components

Document Library

- Joint initiative of the NTC, CBT, WCA
- Public can upload reports to one central location
- Good resource

Limits

- Static, non-georeferenced, difficult to get people to spend time to upload despite the easy format

Fisheries Statistics Database

- DFO catch statistics from 1960's – '80's
- Excel format

Limits

- Static, non-georeferenced



Knowledge Gathering Components

West Coast Vancouver Island Atlas

- Collaboration between WCA, Uu-a-thluk, and CBT
- Hosted by the Community Mapping Network
 - Basemaps
 - Biogeoclimatic zones
 - Presence of birds, mammals
 - Human uses – fisheries, aquaculture, tourism capability, oil and gas
 - Bathymetry

Limits

- Inability to interact between multiple maps

http://www.cmnbc.ca/atlas_gallery/west-coast-vancouver-island-atlas



Knowledge Gathering Components

Barkley Sound Knowledge Symposium

- 3 days, good variety of people and disciplines
- Presentation style
- Yielded some data
- Created partnerships and knowledge network
- Led to authoring of Socio-Ecological Assessment
 - Effort to integrate and summarize information from the Symposium



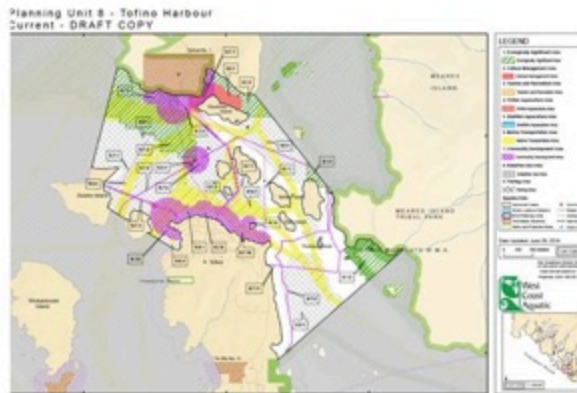
Limits

- No explicit way to bring all information together to apply to Marine Planning

Knowledge Gathering Components

Spatial Mapping

- 110 maps from 300 datasets
- Combination of local knowledge and scientific research
- Boundaries, reserves, protected areas
- Oceanography & Physiography
- Ecology
- Human Uses

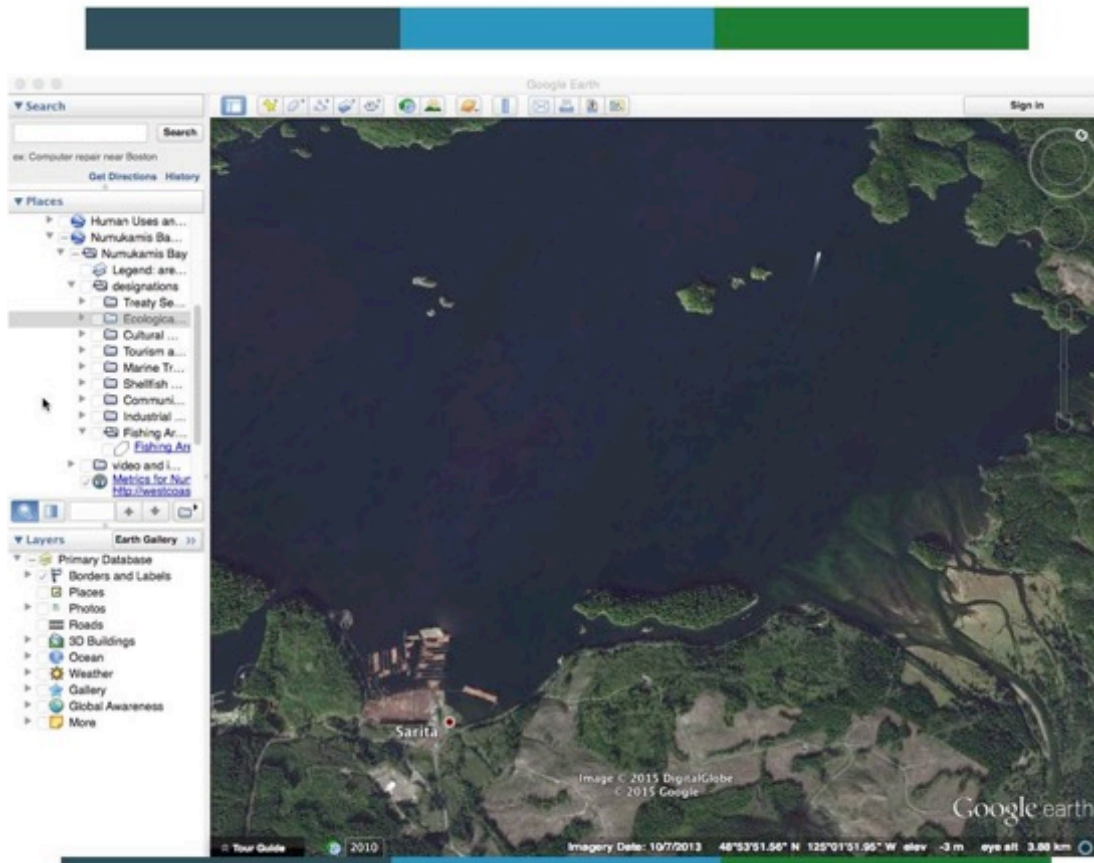


http://westcoastaquatic.ca/plans/marine_atlas/

Making the Data Accessible

Google Earth Platform

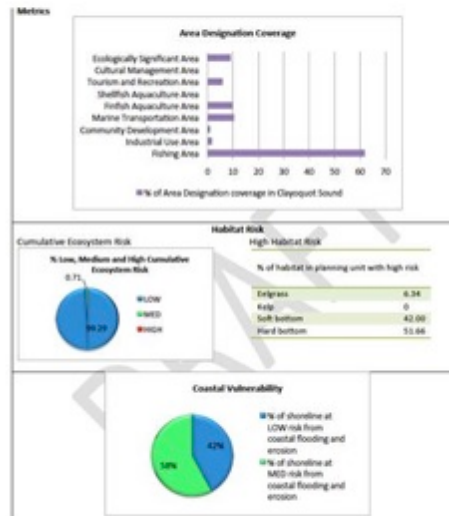
- Interactive, cost and time effective, intuitive, animated
- Georeference information (e.g. documents and videos)
- Makes lots of types of information accessible
 - Original layers
 - Compression of information
 - Metrics (health of area)
 - Model outputs (e.g. HRA, cumulative effects)



Making the Data Accessible

MSP Narrative

- Another way to capture local knowledge, observations, regulations etc.
 - Attributes
 - Metrics
 - Management emphasis
 - Plan recommendations
 - Management provisions



Key Findings

No single group had the mandate or capacity to draw the knowledge and data together to create a more complete picture of the ecosystem.



- Need an organization/forum that:
 - Can bring everyone together
 - Can “hold neutral space”
 - E.g. non-governmental, non-advocacy
 - Has the trust to enter into protocols and conduct local knowledge interviews
 - Can take the initiative

Key Findings

A set of relationships is represented in the body of knowledge, which finds expression through integrated decision making and use.

- Utilization by many different decision makers
 - Federal, Provincial, Regional, First Nations
- Utilization in many different decision-making contexts
 - MSP
 - Aquaculture management
 - Salmon planning
 - Industry applications
 - Referrals
- Example: Roundtables

Outcomes



- Integration of new types of data (e.g. coastal erosion, cumulative effects) & giving it a home in context with all other data
- A knowledge legacy out of data that was disparate, incomplete, often inaccurate, and generally poor
- Increased ability to make informed decisions.

WE.SEA.FUTURE.

Thank you!

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