Statement on Salish Sea Harbor Porpoise Research and Management Needs
Salish Sea Harbor Porpoise Workshop | February 7, 2013 | Anacortes, Washington

Background
Harbor porpoise (*Phocoena phocoena*) are one of the most frequently sighted cetaceans in the Salish Sea. Anecdotal information, possibly supported with stranding encounter rate data, suggests that harbor porpoise may have increased in Puget Sound, or have shifted their distribution back to Puget Sound relative to earlier decades.

On February 7, 2013, Pacific Biodiversity Institute, Cascadia Research Collective and the SeaDoc Society hosted scientists from Washington and British Columbia (see Appendix 1) to determine the state of knowledge on this species and coordinate ongoing research efforts.

The group discussed what was currently known about harbor porpoise habitat needs, distribution, population trends, life cycle, genetics, behavior and role in the ecosystem. The workshop goals were to foster communication, identify the data that could be used to prepare manuscripts, determine the research that would most enhance our understanding of the harbor porpoise, seek opportunities for collaboration, and prioritize critical harbor porpoise conservation issues that need to be addressed.

Presentations (see Appendix 2) were given on stock assessments, distribution, strandings (dead and alive), sightings, genetics, visual and acoustic observation, behavior, and passive acoustic detection efforts. The group then jointly identified a (non-ranked) suite of research and conservation needs that would both help increase our understanding of the species, as well as its conservation and management.

Research and Management Needs Identified

Abundance Estimates:
A stock assessment for this population has not been conducted since August of 2002 and 2003 when aerial surveys in the Strait of Juan de Fuca, San Juan Islands, Gulf Islands, and Strait of Georgia were last completed (Chandler and Calambokidis 2003). At that time, the corrected estimated abundance for the U.S. Washington Inland Waters stock (which excludes British Columbia's waters) was 10,682 (CV=0.38) animals (NOAA, 2011, J. Laake, unpublished data). No current estimate of abundance is available for this stock.

In addition to being well beyond the 3 to 5 years required by the National Marine Fisheries Service, abundance estimates are an essential piece of information needed to understand stranding trends, the potential impact of fisheries bycatch, and to inform a suite of management decisions. In addition to historic aerial stock assessment surveys, the group discussed increasing the use of vessel surveys as well as acoustic surveys. As data are also important for BC waters and impact the same harbor porpoise, it will be important to include these waters in regional assessments.

> ***Group Consensus Statement:*** A traditional stock assessment for harbor porpoise for the Salish Sea is past due and needs to be conducted. Although there are weaknesses with the aerial survey technique, it should be conducted as it covers the greatest area and permits comparison with historical population assessments for this stock. Vessel surveys, citizen reporting of sightings and acoustic surveys also should be conducted. While these methods also have shortcomings, they provide valuable data that can complement the aerial surveys.

Fisheries Bycatch:
Harbor porpoise are vulnerable to entanglement in fishing nets and fisheries bycatch could be an important mortality factor for the species within the Salish Sea. A list of fisheries known to have incidental takes of harbor porpoise is available (NOAA, 2011), but the actual takes still need to be quantified. We need an accurate assessment of fisheries

takes on harbor porpoise in both Washington and British Columbia to better understand the impact of fisheries on the conservation status of the species. This assessment should include Tribal and Non-Tribal Fisheries.

> ***Group Consensus Statement:*** Fishery entanglement is potentially a concern for harbor porpoise in the Salish Sea. Although driftnets and set net fisheries are not as active as they have been historically in the region, necropsies of stranded animals and anecdotal reports indicate that bycatch in net fisheries is occurring. Data from other regions such as the Bay of Fundy suggest that stranding mortality only detects 1 to 2% of the actual bycatch. Accurate estimates of fisheries bycatch along with harbor porpoise stock assessments are needed for Washington and British Columbia, to better determine whether fisheries activities pose a conservation concern. In the mean time, solutions to better evaluate and address bycatch (such as use of acoustic pingers on nets) exist and should be considered. Federal, state, and provincial agencies need to work collaboratively but urgently on this important issue and a subcommittee of researchers can assist in this process.

Contaminants:
Although some contaminants such as PCBs and DDT have decreased in the region, newly emerging contaminants such as PBDEs are of concern. Some analyses have been previously conducted on harbor porpoise tissues but have not been published. Monitoring contaminant ratios could be an ancillary technique for evaluating population structure within the Inland Waters Salish Sea stock. Central Puget Sound might be an ideal area to investigate the relationship between contaminant levels and infectious diseases.

Diseases:
Stranding investigations have identified a subset of harbor porpoise mortality factors. However, a comprehensive review of harbor porpoise mortality still needs to be conducted for the Salish Sea. Peer-reviewed publications also need to be prepared for specific infectious agents where data has been amassed, including *Cryptococcus gattii*, protozoal organisms, *Brucella ceti* and *Coxiella burnetti*.

> ***Group Consensus Statement:*** Federal Funding through NOAA's John H. Prescott Marine Mammal and Rescue Assistance Grant has supported data collection on harbor porpoise strandings and diseases. It is in jeopardy with the potential termination of this program. As it is important to see that more of this information published, the Prescott grant program should be continued, along with comparable efforts in British Columbia with the BC Cetacean Stranding Network.

Stranding Trends:
Until the mid-2000s, statewide annual harbor porpoise strandings remained fairly consistent at an average of six animals. Strandings throughout the region peaked in 2006 with 64 porpoise (49 in Washington, 15 in Oregon), and an Unusual Mortality Event (UME) was declared for both states. The overall cause of the UME remains unknown and is likely related to some combination of multiple factors, which may include an increasing harbor porpoise population, a change in porpoise distribution due to prey shifts or changing oceanographic features, increased public awareness and reporting capabilities, and emerging diseases. Although the UME was closed in 2008, annual mortality in the years following the event have been near or above UME levels. Where cause of death could be determined, infectious and parasitic diseases, traumatic injuries (both natural and human-induced), malnutrition, congenital defects, and metabolic derrangements have been the most commonly diagnosed conditions in recent years.

Health Assessment:
An overall health assessment effort using live-captured healthy animals was briefly discussed. While such an effort would provide concurrent information on infectious disease exposure, contaminants, endocrine status, nutritional status, age and other metrics, it would be expensive, logistically challenging, and pose some risk to the animals.

Vessel disturbance, vessel interactions and noise:
Baseline studies on harbor porpoise and sound, funded by the Snohomish PUD through the Department of Energy, have been conducted and the Bureau of Ocean Energy Management is interested in the impact of noise from mining on species like the harbor porpoise. Preliminary work suggests that continuous low-frequency sound might be a stressor but doesn't cause flight. More data are needed to understand the impact of seismic disturbance on porpoise. Data is needed as well to understand the degree to which recreational vessels and recreational sonar stress harbor porpoise in regions like Central Puget Sound. Shore-based observations might be an important tool for this type of work. Auditory evoked responses should be studied, possibly using trained captive animals. Partnerships with groups such as the Pacific Whale Watch Association may be useful to help monitor vessel interactions.

> ***Group Consensus Statement:*** Monitoring of harbor porpoise behavioral responses to the use of Naval Mid-frequency Active Tactical Sonar should continue to be monitored given the implication of past use possibly resulting in elevated strandings. Planned Naval use of MFAT Sonar should always be coordinated with harbor porpoise researchers to better understand impacts. The Salish Sea also represents an important area for assessing the impact of vessel traffic and noise, especially the impact of smaller recreational boats on harbor porpoise.

Diet:
Data on harbor porpoise diet has been collected from past stranded animals by NOAA though it has not been published. The group recommends that efforts should be made to facilitate publishing this data. The Canadian Department of Fisheries and Oceans has a paper in review on porpoise diet that should be shared with the group. Information on diet is critical for our understanding of harbor porpoise population trends, as well as to better understand the food chain in the Salish Sea.

Movements and Distribution:
Harbor porpoise movements and population structure have been examined with a number of techniques including genetics, pollutant rations, and deployments of VHF tags. Some of these results have suggested fairly local populations and mtDNA genetic differences among areas, although a recent genetic study of inside waters of BC and Washington did not find evidence for population structure. Tagging studies reveal daily vertical and horizontal movements and give good hints to spatial distribution. However, any use of this technique should consider the ethics and cost involved as prior research in this field (Read and Westgate) have shown it is quite likely some porpoises will die due to stress-related causes from the process of attaching a tag. More advanced short-term tags that include hydrophones and an accelerometer might help examine other aspects of underwater behavior and movement. Time depth recording devices in concert could help shed information on habitat use, as well as diet.

Calving:
There are data on when neonates are sighted and a thorough evaluation of stranding records could help pinpoint calving dates for the inland waters stock. The use of lactating animals for this study should be questioned as the Vancouver Aquarium has seen their non-pregnant female lactating frequently. In addition, knowing what percent of the fertile females were pregnant would also be important to understanding the demographics.

Age Structure and Morphology:
Data that Brad Hanson has collected (teeth) and Pat Guerin's data from Neah Bay bycatch could be used to better understand growth in harbor porpoise from this region.

Hybridization:
Current genetics work suggests that harbor porpoise hybridization with Dall's porpoise is probably impacting Dall's porpoise more than harbor porpoise because back-crosses seem to be to Dall's. We still need to better understand the relative fitness of these hybrids.

Behavior:
Very little is known about how the male-female pairs interact. The harbor porpoise seem to be obligatory social in captivity and in the wild. Previously conducted behavioral studies in this region can be used as a foundation for future work, with boat and shore-based monitoring proposed as methods for studying this.

Reproduction:
Captive animals at the Vancouver Aquarium could be used to assess and better understand reproductive hormones and cycles in harbor porpoise. This could be done using blood. The use of blow and saliva samples being investigated at the Mystic Aquarium also should be studied.

Foraging Hotspots:
Preliminary data were presented on select foraging hot spots more data are needed to help identify critical areas. Localized or focal studies have the benefit of answering this and many other questions

Indicator Species:
Many impacts on and elements of the harbor porpoise life cycle—such as disease, contaminants, noise, by-catch, food, and reproductive success—are indicative of the health of the ecosystem. Understanding the population and population trends of this species can provide insight into addressing broader ecosystem issues.

Literature Cited

Chandler, T., and J. Calambokidis. 2003. 2003 aerial surveys for harbor porpoise and other marine mammals off Oregon, Washington, and British Columbia. Contract report to National Marine Mammal Laboratory, Seattle, WA. (Report available from Cascadia Research, www.cascadiaresearch.org). 25pp

NOAA. 2011. Harbor Porpoise (*Phocoena phocoena vomerina*) Washington Inland Waters Stock Assessment.

Appendix 1: February 7, 2013 Harbor Porpoise Workshop Participants

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Host Organizations: Pacific Biodiversity Institute [http://www.pacificbio.org], Cascadia Research Collective [http://www.cascadiaresearch.org], and SeaDoc Society [http://www.seadocsociety.org]

APPENDIX 2: Presentation Abstracts

Salish Sea Inland Waters Harbor Porpoise Research Workshop
Anacortes, Washington, USA | February 7, 2013

History and changes in harbor porpoise in the Salish Sea

John Calambokidis[1], Brad Hanson[3], Jessie Huggins[1], Dyanna Lambourn[2], Steve Jeffries[2], Joe Evenson[2], Bethany Diehl[1,2], and Josh Oliver[1,2]

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Harbor porpoise presence and distribution in the Salish Sea have seen some significant changes in recent years. Once considered one of the most frequently sighted cetaceans in Puget Sound in the 1940s they almost completed disappeared from the Puget Sound Basin and Hood Canal by the early 1970s (south of Admiralty Inlet). Reasons for this disappearance were not known but were suspected to be related to incidental takes, disturbance from vessel traffic/noise, or pollution. Declines in harbor porpoise were noted in other developed protected waters in the 20th century including San Francisco Bay, the Baltic Sea, and Wadden Sea. Harbor porpoise in the eastern North Pacific have been studied over the years using a variety of approaches. Their vulnerability to human activities, especially incidental entanglement in gillnets throughout their range, has lead to concerns about their status, restrictions to fishing activities and the use of acoustic pingers. NOAA-fisheries recognizes numerous population units along the US West Coast especially in California based on genetics and contaminant ratios including an Oregon/Washington outer coast stock and a Washington inland waters stock. Aerial surveys have been the primary method to assess abundance but these are now more than 10 years out of date. Starting around 2007, numerous harbor porpoise were sighted at multiple locations throughout southern and central Puget Sound, an area where they had been common in the 1940s but had been virtually absent from for at least the last 40 years. While the return of this species may be positive, it has also resulted in the death of a number of these animals due to entanglement in nets. An additional and possibly related new development in the last few years has been the sighting and stranding of unexpected cetacean species, in southern Puget Sound including two Bryde's whales, two bottlenose dolphins and two long-beaked common dolphins, and two Risso's dolphins, all species typically seen further south or in deeper more offshore waters.

Status of Harbor Porpoise in British Columbia

Anna Hall, University of British Columbia

Pacific harbor porpoise are federally listed as Special Concern under the Species at Risk Act. Though the species occurs throughout coastal waters, the distribution is heterogenous with localized areas of higher density. Threats to harbor porpoise survival include predation by transient killer whales, by-catch in net fisheries, various diseases and vessel strikes. In some regions, such as the Juan de Fuca Strait, harbor porpoise occur year-round, but seasonally localize in relatively small areas during the reproductive season (April - October). Biophysical evaluation of an 18-year (1991 - 2008) multi-source data set identified a likely harbor porpoise breeding site—the first for this species in British Columbia. Harbor porpoise foraging behavior was also evaluated using a long-term sightings data set (1995-1996, 1998-2008) and found that porpoise often forage in groups using tidally well-mixed sites on a temporary but predictable basis. On-going studies are investigating harbor porpoise habitat use and behavior on British Columbia's north coast.

Much remains to be done to better understand the ecology and threats to survival of harbor porpoise in British Columbia.

Harbor Porpoise Distribution in Southern British Columbia Based on Opportunistic Sighting Reports

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The BC Cetacean Sightings Network (BCCSN) is a long-standing citizen-science project based at the Vancouver Aquarium and operated in collaboration with the Cetacean Research Program of the Canadian Department of Fisheries and Oceans. The BCCSN recruits and trains dedicated volunteers willing to record their opportunistic sightings of cetaceans, and works with them closely to minimize errors in species identification. Since 1986 the BCCSN has received 5780 harbor porpoise sighting reports, with most coming in the last 10 years. We used a novel approach to distinguish true variation in the distribution of harbor porpoise from variation in the distribution of BCCSN members. First, we divided our observers into seven categories, such as whale watch operators, large vessel crew and parks users. We then modeled the distribution of observers in each category based on factors such as proximity to homeports, traffic management data for large vessels, and park locations and visitorship. Finally, we created a distribution map layer for each category in a GIS program, weighted it by the number of observers it contained and also by the relative effectiveness of each category of observer at reporting sightings, and summed the layers. The result was a distribution map of relative sighting effort, from which we calculated sightings per unit effort. This analysis identified harbor porpoise summer hotspots SW of Vancouver Island from Port Renfrew to Barkley Sound and in Haro Strait, Boundary Pass, south-central Strait of Georgia and several mainland inlets NW of Campbell River. Winter hotspots included Port San Juan, Haro Strait, Swanson Channel, the central Strait of Georgia, Burrard Inlet, Howe Sound, and waters in and near Nodales Channel.

Intergeneric Hybridization and Population Structure in Harbor Porpoises of British Columbia and Northern Washington

Carla Crossman, University of British Columbia

Harbor porpoises have been known to hybridize with the closely related Dall's porpoise, and these hybrids have only been found in the northeast Pacific. Identifying these hybrids in the wild can be extremely difficult.

In collaboration between the University of British Columbia and the Vancouver Aquarium, we used genetics to analyze tissue samples taken from stranded porpoises to genetically identify mixed ancestry of hybrid porpoises. In addition, we used mtDNA and microsatellites to investigate the population structure of harbor porpoises. We identified a single population distributed along the coast of British Columbia and northern Washington.

Recent trends in harbor porpoise strandings in Washington State

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Harbor porpoise are the most commonly stranded cetacean in Washington State. Until the mid-2000s, statewide annual harbor porpoise strandings remained fairly consistent at an average of six animals. Strandings throughout the region peaked in 2006 with 64 porpoise (49 in Washington, 15 in Oregon), and an Unusual Mortality Event (UME) was declared for both states. A cause of the increase in strandings was not determined. Although the UME was closed in 2008, the high number harbor porpoise strandings have continued, with mortalities in 2011 even higher than those during UME years. Causes of mortality in recent years include infectious and parasitic diseases, traumatic injuries, and malnutrition. The more frequent documentation of stranded animals with evidence of fishery interaction since the beginning of the UME, primarily in central and southern Puget Sound and Hood Canal, is of particular concern, especially given the likely small number of porpoise in these areas.

Medical management of live-stranded harbor porpoises by the Vancouver Aquarium's Marine Mammal Rescue Centre

Martin Haulena, Chelsea Anderson, Lindsaye Akhurst, Chelsea Himsworth, and Stephen Raverty, Vancouver Aquarium Marine Mammal Rescue Centre

Since 2006, 5 live-stranded harbor porpoises have been recovered and presented to the Vancouver Aquarium's Marine Mammal Rescue Centre for rehabilitation. Estimated age at stranding ranged from 6 weeks to 3 years, with younger animals stranding more frequently in the summer and early fall. Animals ranged in weight from 12.1 to 42 kg at admit. Each animal received 24-hour care by trained veterinary staff and rescue volunteers. Length of stay ranged from 2 to 71 days for animals that died during rehabilitation. Animals that strand as dependent calves are considered non-releasable and two perinatal animals that were successfully rehabilitated are permanently housed in a habitat at the Vancouver Aquarium. The causes of death in the other three animals include: severe metabolic compromise, hydrocephalus, and encephalomyelitis associated with *Cryptococcus* sp. Medical challenges with stranded porpoises include diagnosis of the underlying cause of stranding, very high metabolic rate and nutritional demands particularly with neonates, and the effect of stranding on muscles and pulmonary function resulting in a requirement for intensive and prolonged supportive care.

Visual and Acoustic Observations

Aileen Jeffries, Pacific Biodiversity Institute

Visual observations and acoustic recordings of harbor porpoises have been collected in the Fidalgo Island and Rosario Strait area since 2009, to determine their abundance, distribution and behavior. Pacific Biodiversity Institute has information on the seasonal use of Burrows Pass, seasonal appearance of calves, aggregations of large numbers of porpoises and diurnal cycles of presence. Data from C-PODs we have tested will be described and the possibility of using acoustic monitors for population estimates discussed.

Detecting Porpoise Acoustically in the San Juans and Admiralty Inlet

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Harbor porpoise produce stereotypical echolocation clicks that can be detected and classified acoustically using acoustic data loggers such as C-PODs. We report standard C-POD measurements of Detection Positive Minutes from recent deployments in Haro Strait and San Juan Channel and compare these to earlier to data from Admiralty Inlet. All sites show significant diel patterns with highest DPM occurring at night. In the San Juans a peak in DPM is evident in September with low values the rest of the summer, while Admiralty Inlet peaks in January and has its lowest rates in May. The most tidally dynamic sites have the highest DPM values. Limitations imposed on acoustic monitoring in these dynamic sites will be discussed. The possibilities for monitoring population trends will also be highlighted.

Behavior and factors affecting harbor porpoise distribution

Florian Graner, SeaLife Productions

Florian studied the harbor porpoise in Indre Sognefjord, Norway. He will talk about how his study might give insight to the behavior of the harbor porpoise in the Puget Sound and describe factors affecting their distribution.