WORKSHOP ON ASSESSING PACIFIC WALRUS POPULATION ATTRIBUTES FROM COASTAL HAUL-OUTS

Photo: Patrick Walsh, USFWS

March 19-22, 2012

National Park Service Headquarters
Anchorage, Alaska

Workshop Proceedings Compiled and Edited By:
Martin Robards
& Joel Garlich-Miller

February, 2013

Sponsored By:
U.S. Fish and Wildlife Service
Wildlife Conservation Society
Trust for Mutual Understanding
National Park Service

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Marine Mammals Management, U.S. Fish and Wildlife Service,
1011 East Tudor Road, Anchorage, Alaska 99503

February, 2013

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Photo: NPS

Workshop participants on the final day of the workshop.

CLOCKWISE FROM BACK LEFT: Eduard Zdor, Katerina Wessels, Marina Bell, Varvara Semenova, Lori Polasek, Michael Winfree, Cynthia Christman, Chad Jay, Mark Udevitz, Ed Weiss, Anatoly Kochnev, Vera Metcalf, Martin Robards, Andrey Subbotin, Nikita Ovsyanikov, Anthony Fischback, Raphaela Stimmelmayr, Vladimir Chernook, Willard Neakok, Joel Garlich-Miller, Sergei Kavry, Stephanie Sell, Perry Pungowiyi, Dan Munson, and Joel Berger. (Stanislav Belikov and Andrei Boltunov were not present for the photograph.)

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ABBREVIATIONS USED THROUGHOUT THE DOCUMENT

ADF&G	Alaska Department of Fish and Game
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

EXECUTIVE SUMMARY

The population dynamics and health of Pacific walruses, as well as their habitat use in the rapidly changing Arctic environment, are poorly understood. This limits the ability of wildlife agencies in both the United States and the Russia Federation to manage walruses effectively for their conservation and the needs of local communities. With that in mind, this workshop sought to: a) synthesize current information about coastal haul-out use by walruses from a broad suite of agencies and interests, b) identify critical data gaps in understanding of coastal haul-outs, c) develop scientifically-rigorous protocols for monitoring walruses at coastal haul-outs to be used in both Chukotka and Alaska; and d) design science-based monitoring programs to implement the protocols that can incorporate indigenous communities, developers, and scientific and management agencies, for the purposes of both long-term haul-out monitoring and protection. The workshop was held in Anchorage, Alaska in March, 2012, and included key Chukotkan (Russian Federation) and Alaskan (U.S.) walrus specialists from agencies, scientific institutes, indigenous villages and groups, and non-government organizations.

The workshop was an important step forward in developing long-term on-the-ground capacity to conserve walruses in their rapidly changing Arctic environment and, more broadly, in fostering the resilience of wildlife and local communities through collaborative efforts that bridge the Bering Strait.

KEY RECOMMENDATIONS FROM THE WORKSHOP ARE DISCUSSED IN THE SUMMARY SECTION AND INCLUDE:

1. Continue to standardize information protocols for data.

2. Reinvigorate a central online location for sharing data (the Pacific Walrus International Database).

3. Summarize literature and information on disturbance impacts to walruses and develop best-practice guidelines to protect haul-outs from disturbance.

4. Document scale and goals for each monitoring effort and tailor protocols to fit needs.

5. Develop methods to assess abundance and demographic composition (including seasonal trends) of key haul-outs.

6. Continue to develop remote monitoring techniques (e.g., using remote cameras or aerial surveys) to better assess walrus distribution and abundance over entire regions.

7. Assess power to detect changes in abundance on large Chukotkan haul-outs.

8. Update walrus haul-out distribution map.

9. Continue to develop community-based stewardship opportunities to protect haul-outs from disturbance, building on existing community successes.

10. Establish policy tools for ensuring the long-term safety of walruses hauled out on the Alaskan and Chukotkan coasts.

BACKGROUND ON THE NEED FOR THE WORKSHOP

The Pacific walrus (*Odobenus rosmarus divergens*) is represented by a single stock of animals that inhabit the continental shelf waters of the Bering and Chukchi seas. The population ranges across the international border of the United States and the Russia Federation, so both nations share common interest in the conservation and management of this species. Walruses are also a valuable subsistence resource in many coastal communities in Alaska and Chukotka, playing a vital role in local food and economic security. The need to develop international conservation and management efforts, including monitoring population status and trends, and assessing human impacts, are priorities for wildlife managers seeking to conserve the walrus population and ensure the long-term food security of subsistence hunters in both countries.

Figure 1 Sea-ice extent on 8/26/12 compared to median extent from 1979 to 2000.

The distribution and habitat use patterns of walruses is rapidly changing. Female walruses and their dependent young migrate north in spring, following the receding pack ice to shallow productive feeding grounds in the Chukchi Sea. Broken sea ice provides a platform for accessing offshore feeding areas, isolated from terrestrial predators, while providing a sheltered environment for young animals against stormy seas.

Traditionally, broken pack ice has persisted in shelf areas of the Chukchi Sea throughout the entire summer melt season, and walruses have remained offshore using this ice to rest, feed, and nurse their young. However, in recent years, the Chukchi Sea shelf has become entirely free of sea ice by late summer — with periods of no ice cover ranging from a few weeks to as long as three months. The rapid sea-ice retreat from continental shelf regions in July and August (Figure 1) is expected to persist, and perhaps accelerate in the future.

Diminished summer sea-ice habitat in shelf waters is now limiting access to productive shelf feeding areas. Because walruses cannot remain at sea for long periods (weeks) or dive and efficiently feed in water over 100 m in depth, they now need to rest onshore every few days to stay close to their shelf feeding areas. This is leading to increased dependence on terrestrial haul-outs by large numbers of walruses.[1]

Over the past decade, the number of walruses using

In the United States, the term "haul-out" is used as both a noun (a site on land or ice) and as a verb (the act of getting out of the water at the site). In the Russian Federation, usage is only as a noun – the place where walruses have come out on shore regularly. Haul-out can also be used to denote physical places as well as biological aggregations.

[1] See Nesterenko and Katin (2009) for a detailed discussion on the semantics associated with the term haul-out. Nesterenko, V.A., and I.O. Katin. 2009. Haul-out: Scope of the term and procedure for identification. Russian Journal of Ecology 40(1): 48-54. Original Russian Version published in 2009 in Ekologiya (1): 53-59.

coastal haul-outs along the Chukchi coast has increased dramatically and the season of haul-out occupancy seems to increase with each coming year. The size of some of these haul-outs is staggering, with many tens of thousands of animals regularly hauling out in some Russian Federation locations. Up until a few years ago, the formation of coastal haul-outs along the Chukchi seacoast was primarily a Russian Federation phenomenon; however, similar patterns are developing in Alaska, although the location and number of animals using coastal haul-outs in Alaska has been highly variable. Walruses on these large haul-outs are vulnerable to disturbance events that can result in large mortality events. Furthermore, large concentrations of walruses at specific coastal haul-outs risk depleting local prey resources (compared to when a large proportion of the animals were floating over the substrate on sea ice) and increasing the transmission of diseases.

As summer sea-ice conditions continue to deteriorate, commercial activities along the Arctic coastline and continental shelf waters are expanding, raising the potential for increased interactions with people and negative impacts to the walrus population. Such concerns over the potential impacts of diminishing sea-ice habitats prompted walrus researchers, managers, and subsistence users to gather in 2010 at the 6th Marine Mammals of the Holarctic Conference in Kaliningrad, Russian Federation to discuss emerging conservation and management issues associated with changing sea ice habitats; identify data gaps and information needs for the conservation and sound management of the Pacific walrus; and to discuss and coordinate future monitoring and research efforts.[2] The conservation and management issues associated with changing sea-ice habitats were discussed, including the need to: a) identify data gaps and information needs for the conservation and sound management of the species; and b) coordinate future monitoring and research efforts.

Recommendations generated in Kaliningrad included the need to develop monitoring programs for coastal walrus haul-outs in the United States and the Russian Federation that could effectively inform management and policy decisions for the conservation of walruses and their critical habitats. Bringing together an exclusive group of practitioners, actively involved with the implementation, management, and operation of walrus programs (rather than upper-level agency staff), this 2012 workshop accomplished the vital next step for transboundary walrus managers to take concrete action.

[2] Garlich-Miller, J., and A. Boltunov. Proceedings of the Second U.S.-Russia Walrus Working Group Meeting. March 2010, Kaliningrad, Russia. U.S. Fish and Wildlife Service, Marine Mammals Management. 19 pp.

WORKSHOP OBJECTIVES

The objectives of this workshop were to: (1) facilitate sustained, in-depth professional interaction and collaboration between walrus experts in the United States and the Russian Federation; (2) formulate recommendations regarding methods and approaches for the long-term bilateral monitoring of coastal walrus haul-outs; and (3) devise strategies for their implementation. This information will serve as a basis for agencies and organizations to prioritize and plan future research and monitoring programs at coastal walrus haul-outs in both Alaska and Chukotka.

Anatoly Kochnev placing a satellite transmitter on a walrus. Photo: Chukot-TINRO

SPECIFICALLY, THE 2012 WORKSHOP ADDRESSED THE NEED TO:

1. Identify information gaps and priorities for research and management.

2. Prioritize goals and standardize approaches for monitoring walruses at coastal haul-outs, including for location and timing of use, sources and impacts of disturbances, size and composition of walrus herds, disease assessment, and genetic sampling.

3. Provide specific recommendations to policy-makers in the United States and the Russian Federation for designing and implementing programs capable of monitoring and responding to the impacts on and threats to the walrus population.

SESSION I:
ESTIMATING ABUNDANCE AND DEMOGRAPHICS AT COASTAL HAUL-OUTS

Session Chair: Chad Jay, U.S. Geological Survey

Round Island walrus haul-outs in Bristol Bay, Alaska. Photo: Gina Robinson (ADF&G)

BACKGROUND

Information on the seasonal abundance and demographics of walrus herds occupying specific coastal haulouts are of vital interest to scientists and managers. This information directly informs resource management decisions (e.g. resource extraction, coastal development, hunting activities, visitor programs), as well as land use planning, impact assessments, mitigation strategies for development projects, and contingency plans for disaster response. Estimates of abundance and demographics at coastal haul-outs may also offer information pertinent to range-wide population structure, abundance, survival/reproductive rates, and trends in these parameters, which are needed for the effective management of the walrus population.

SESSION GOALS AND OBJECTIVES

- Refine standardized sampling techniques and approaches for estimating herd size and demographics.

- Synthesize perspectives on the constraints and potential for using individual versus aggregated coastal haul-out monitoring results as a proxy for population status and trends.

- Ensure consistent attention to:
    - o Standard metrics
    - o Scale of inference (population, complex, region, other)
    - o Methods for collecting observations
    - o Potential bias
    - o Sampling design

Obtaining useful information from walrus haul-outs: considerations for sampling and abundance estimation

Mark Udevitz, U.S. Geological Survey

Courtesy Photo

"The primary difficulty with assessing walrus population parameters from coastal haul-outs is that walruses spend 70-80% percent of their time in the water. This is analogous to an iceberg, because the majority of the iceberg is below the water. We need to be very careful making inferences about the part we can't see from the part we can see." – Mark Udevitz

Figure 1 Different potential scales of investigation and inference.

THREE DIFFERENT APPROACHES ARE GENERALLY USED FOR RESEARCH AND MONITORING AT COASTAL HAUL-OUTS:

1. Direct or indirect observation
2. Instrumentation of animals
3. Tissue sampling

FOR ANY OF THESE APPROACHES, CAREFUL CONSIDERATION OF THE SCOPE OF INFERENCES BEING MADE FROM THE INFORMATION COLLECTED IS NEEDED, RANGING FROM (FIGURE 1):

1. Inferences about the entire population
2. Regional inferences about segments of the population
3. Local inferences about the walruses using a single haul-out

ISSUES ASSOCIATED WITH ESTIMATING USE AT A SINGLE HAUL-OUT:

Estimating use at a single haul-out is a complex undertaking in-and-of-itself, irrespective of trying to scale up to larger regional or population inferences. Efforts need to:

- Acquire accurate estimates of the number of walruses on a haul-out at a given time;
- Account for variation in those numbers over time; and
- Identify which component of a population is using a haul-out (both with respect to the population as a whole, and those actually on the haul-out at a specific time (as opposed to in the water).

ISSUES ASSOCIATED WITH ESTIMATING USE AT MULTIPLE HAUL-OUTS:

Inferences over additional haul-outs add complexity to the inherent challenges of monitoring at a single haul-out (discussed above). To scale up to inferences about multiple haul-outs, we need to know:

- Where all the haul-outs in a region of interest are, and when they are being used; and
- How many walruses are using multiple haul-outs (to avoid double counting).

The following three studies are relevant to this discussion:
POWER TO DETECT TRENDS WITH DIFFERENT MONITORING STATISTICS – CAPE PEIRCE (ALASKA):

Daily counts from Cape Peirce were used to look at the effectiveness of two different statistics as tools to detect trends: maximum attendance (solid line in Figure 2), which is the highest count from each year; and the mean (dashed line in Figure 2), which is the average of the counts each year. We assessed the power ("power" is the probability of detecting trends) to detect a ten percent annual change in use over ten years based on daily counts each summer (Figure 2). Results indicate that 1) the mean has a higher power to detect trends than the maximum statistic; and 2) maximum counts are generally more variable than means and less sensitive to changes.

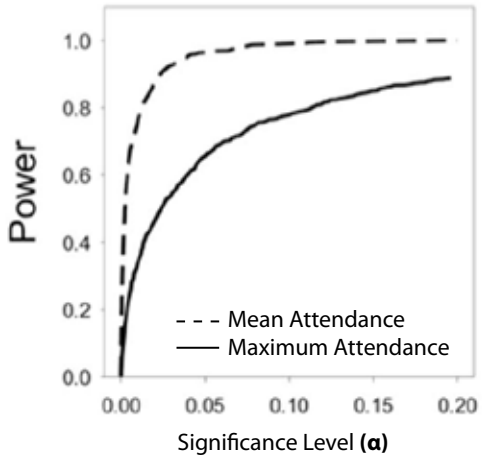

Figure 2 Power to detect trends using the statistics of mean attendance and maximum attendance at coastal haul-outs.

POWER TO DETECT TRENDS WITH DIFFERENT LENGTHS OF MONITORING PERIOD – CAPE PEIRCE (ALASKA):

Data from Cape Peirce were used to assess the power to detect the same trend as a function of significance level using the mean as the monitoring statistic and varying the number of counting days each year, ranging from 134 days (every day during the season) to just 15 days (Figure 3). Results indicate that there is almost no practical difference in the outcomes for efforts ranging from 134 to 61 days. In other words, at least in this instance, the number of days with counts could be cut in half before losing much power to detect trends. In general, there will always be an optimum sampling frequency where more sampling doesn't increase the power to detect change.

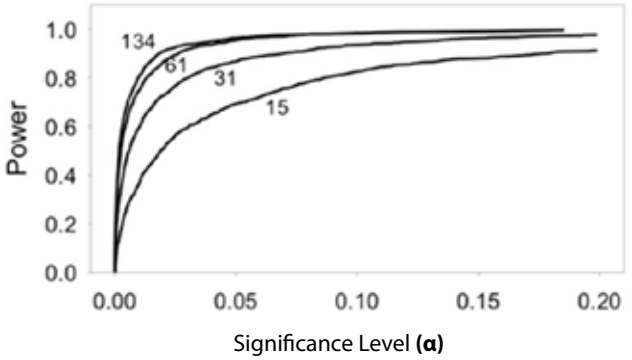

Figure 3 Power to detect trends using different periods of observation at coastal haul-outs.

QUESTION (*Martin*): Has the power to detect long-term trends, for example, based on an annual, every five years, or decadal monitoring period been assessed?

ANSWER (*Mark*): Not yet, but this could be done with historical data to assess the power to detect trends over different annual monitoring periods.

DIFFERENCES IN BLIND COUNTS AMONG MULTIPLE OBSERVERS - ROUND ISLAND (ALASKA):

Differences in counts of hauled-out walruses conducted by two observers at Round Island were assessed during a time when multiple observers were making multiple independent counts during each daily visit. The objective of this study was to assess what aspects of the monitoring design contributed most to variation in estimates of use. We compared independent counts of the same walrus groups from the two observers and plotted the difference between the counts as a function of how big the groups were (Figure 4). Results indicate that for small groups, differences between the counts of experienced (solid line) or inexperienced observers (dashed line) are small (distance between lines). Also, there is better overall agreement between counts made by more experienced observers. But regardless of experience, differences between counts increase with increasing walrus group size, and are substantial for large groups. An additional finding from this study was that some observers tended to make consistently higher counts than others, indicating that counts by at least some of the observers were biased.

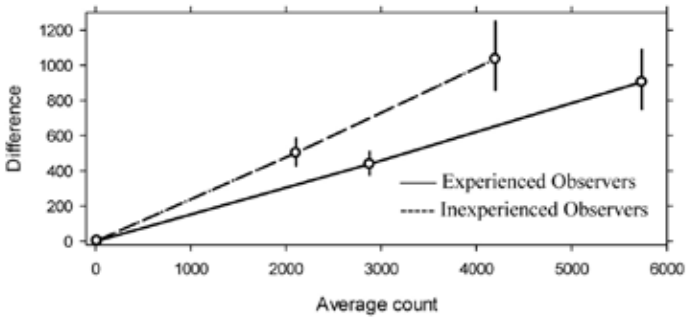

Figure 4 Differences in haul-out counts based on experience of observers and size of haul-outs.

SUMMARY

The standard error of the estimated mean number of walruses changes as we vary different aspects of the monitoring design. In general, the biggest source of variation will be the day-to-day differences in numbers of walruses at a haul-out, and though we can get some gain in precision by increasing the numbers of observers, or numbers of counts per observer, the biggest gains will come from increasing the number of days when counts are made. Nevertheless, there is a point beyond which there will not be much gain from continuing to increase sampling frequency.

QUESTION (*Stanislav*): How applicable are results from the smaller Alaskan haul-outs to the work at larger haul-outs in the Russian Federation Federation?

ANSWER (*Mark*): Results may not extrapolate directly, but the general trend of increasing error with increasing size of haul-out will persist. Errors will be greater at large haul-outs.

QUESTION (*Chad*): In order of variation encountered, what are the most important factors for increasing the power to detect trends when monitoring at a haul-out?

ANSWER (*Mark*):

1. Increase the number of visits to the haul-out in a given season.
2. Add a second observer (but no more than two observers are necessary).
3. Have each observer make more than one count (but no more than three are necessary).

QUESTION (*Vladimir*): Which coefficient would you use for an aerial survey to assess the proportion of walruses onshore versus offshore?

ANSWER (*Mark*): Transmitters deployed on walruses could be used to directly estimate the numbers of animals in the water, or to develop models like those that were created for the sea-ice surveys in 2006.

Haul-out monitoring in Chukotka: methods and protocols

Anatoly Kochnev, Chukotka Branch of the Pacific Research Fisheries Center (Chukot-TINRO)

Photo: Anatoly Kochnev

Figure 5 Priority walrus haul-out monitoring sites in Chukotka:
1) Cape Schmidt
2) Cape Vankarem
3) Kolyuchin Island
4) Cape Serdtse-Kamen
5) Cape Unikyn
6) Cape Inchoun
7) Cape Peek
8) Cape Nunyamo
9) Cape Krigugon
10) Cape Kygynin (Arakamchechen)
11) Retkyn Spit
12) Meeskyn Island Spit

The large Chukotkan haul-outs present unique challenges that have required steady evolution of monitoring methodologies over time. Haul-out monitoring has been developed over many years and is constantly being improved as more information is collected. The coastal walrus haul-out monitoring programs in Chukotka provide information about: 1) abundance, 2) demographics, 3) mortality, and 4) recruitment of walruses. Haul-outs have been recorded at numerous places over time in the Russian Federation, but vary in importance through space and time.

Abundance and demographics monitoring would ideally include twelve priority haul-outs (Figure 5), but available funding limits us to eight of these sites (and not all sites in every year): Cape Schmidt, Cape Vankarem, Kolyuchin Island, Cape Serdtse-Kamen, Cape Unikyn, Cape Inchoun, Retkyn Spit, and Meeskyn Island Spit.

The primary methodology used by Chukot-TINRO and partners to assess abundance on large haul-outs is to calculate the areal coverage of walruses on a beach. Many of the large Russian Federation haul-outs consist of several areas bounded by capes or rocky promontories, allowing each area to be counted separately. Animals are counted in three zones: on the beach, in the surf, and then those out to one kilometer offshore. For those on the beach, observers originally used graph paper, but now use computers. Every day observers draw the area of walruses hauling out (using stakes placed on the beach to help mark areas). Abundance is calculated using the formula:

$N = (S+kS/100)/1,13385$

Where:
N = total number of walruses on the haul-out
S = area of coastal haul-out in square meters
k = coefficient to include walruses in the littoral area
1.13385 = area taken up by one animal (m^2)

The area of a haul-out's footprint can be too difficult to measure, in which case the default is to directly count animals. This is possible when a haul-out can be observed from a high point. For large groups, walruses are counted along each side of a group and then the total is extrapolated from those counts (i.e., number along the length of a haul-out is multiplied by the number across the haul-out). If time is restricted, counts are made by orders-of-magnitude (tens or hundreds). Direct visual counts are made of walruses in the water. Consistent with conclusions made by Mark Udevitz, accuracy of walrus counts are dependent on the experience of the observers. Meteorological data, sea conditions, and sea ice are also recorded.

In an ideal world, all twelve of the priority sites would be monitored, which would provide a high degree of reliability for estimating the walrus population over a large area. However, funding (from Chukot-TINRO and non-governmental organizations such as Wildlife Conservation Society, World Wildlife Fund, and Pacific Environment) is only sufficient for a subset of sites. Outside the priority sites, Chukot-TINRO works with marine mammal hunters who delegate villagers to provide monitoring of additional haul-outs (see Section V). However, this data is not used in general agency statistics due to the risk of inconsistent methods. Nevertheless, these additional counts provide some assurance that large numbers of walruses are not being missed because walruses are hauled-out somewhere else.

QUESTION (*Dan*): What sort of density do you find on flat areas?

ANSWER (*Anatoly*): A density of 1.13385 m^2 per walrus was calculated in the 1980s for haul-outs numbering over 40,000 animals. On small haul-outs, actual numbers are calculated (no formula is needed).

Walrus haul-outs at Wrangel Island (Russian Federation): recent trends and monitoring perspectives

Nikita Ovsyanikov, Russian Academy of Sciences, Wrangel Island State Nature Reserve

Photo: Nikita Ovsyanikov

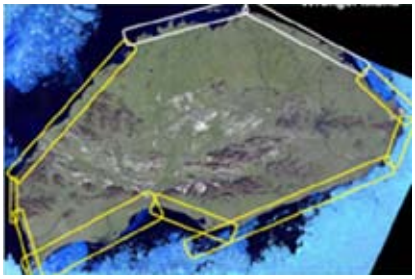

Figure 6 Wrangel Island survey transects.

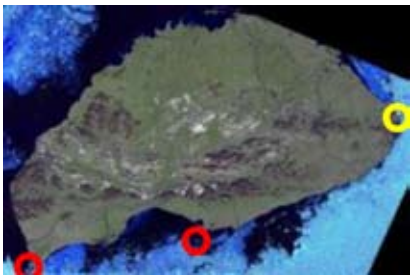

Figure 7 Wrangel Island primary haulouts.

The primary research goal for walrus monitoring on Wrangel Island is to understand the role of walruses as food for polar bears. Consequently, demographics are not described (although Chukot-TINRO monitored this until 1998). Current research objectives are to understand the distribution and dynamics of coastal haul-outs, mortality (including predation), and disturbance.

Wrangel Island hosts mostly females and young. Visitation by males is quite rare, and almost never exceeds more than a few tens of males at any one time. Surveying takes place from the ground or on marine transport, including tourist vessels. Transects are surveyed every year, sometimes multiple times in a season (Figure 6). Every few years, the northern coastline is surveyed, although this is difficult because of very shallow waters on the north side of the island. Since 2007, Cape Corvin has been routinely monitored, but Herald Island has been rarely surveyed due to logistics.

Consistent with Anatoly Kochnev's methods, walruses are counted on two sides of a haul-out and those numbers multiplied to get a total. Primary haul-outs are shown with red circles and Cape Corvin with a yellow circle (Figure 7).

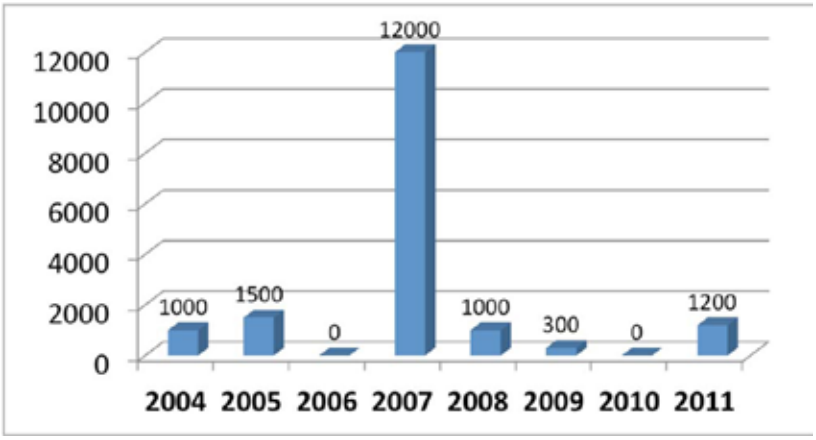

Figure 8 Maximum number of walruses observed on Wrangel Island haul-outs.

Walruses hauled out on Wrangel Island in 2004, 2005, 2007, 2008, 2009, and 2011 with a maximum number of 12,000 animals in 2007 and a minimum of 300 animals in 2009. They were absent in 2006 and 2010 (Figure 8). Herald Island observations from 2009 to 2011 found walruses there in all years with a maximum number of 100 animals.

In recent years, walruses have redistributed and now spread out more around the island. This may be a result of walruses seeking shelter from predation by polar bears. Generally, it is atypical for walruses to abandon large sand spits in favor of hauling out on rocks like sea lions; however this occurs on Wrangel Island. Finding only a few walruses on a beach is uncommon on Wrangel Island, and when it does happen the animals are often sick or weak. This occurred a few years ago along the entire southern coast and some parts of the northern coast. Walruses were likely exhausted and needed to get out of the water. Further research could establish if the number and distribution of these small groups could be an indicator of the health of the population.

RECOMMENDATIONS FOR FURTHER WORK ON WRANGEL ISLAND:

- Demographic composition of the herd
- Demographic variations between haul-outs
- Pollutants and physiological parameters in dead and live walruses
- Temporal dynamics of haul-out use, within and between days
- Relationship between Wrangel Island walruses and other segments of the population
- Individual identification of animals in the groups/segments of a haul-out
- Continuous video recording of haul-out sites over a season
- Aerial photography to improve counts
- Satellite tracking of walruses tagged on Wrangel Island

Courtesy Photo

Courtesy Photo

Ideas for near-shore aerial surveys in Chukotka

Vladimir Chernook, GiproRybFlot

Courtesy Photo

During the range-wide survey of 2006,[1] Russian Federation scientists concluded that it could be more cost-effective to assess walruses on coastal (terrestrial) haul-outs, rather than on ice. Consequently, in 2011, scientists started to develop methods to accomplish this task, based on those used by Norwegian scientists in the Barents Sea for Atlantic walruses. A suite of aerial photography – infrared, and visual (at one km distance) – were used in this effort (Figure 9).

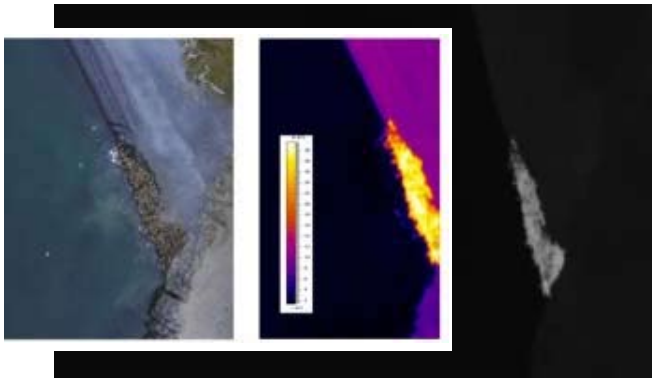

Figure 9 Left panel is photo; middle panel is infrared image (Flir A325); right panel is infrared image.

During the pilot surveys, poor weather conditions forced the plane to fly as low as 300-500 m on some days. To minimize disturbance to walruses under these circumstances, we flew farther from shore (about 300 m). Nevertheless, walruses stampeded into the water on one occasion when we circled about 500 m away at an altitude of 300 m, causing three mortalities.

[1] Speckman S.G., Chernook V., Burn D.M., Udevitz M.S., Kochnev A.A., Vasilev A., et al. 2011. Results and evaluation of a survey to estimate Pacific walrus population size, 2006. Marine Mammal Science 27:514–553.

Based on our surveys, walrus numbers and sometimes length of tusks (particularly when animals were looking at the plane) were collected. Two people counted animals on each survey and numbers were identical for each observer. Observers tried to measure the animals that were clearly visible to get size composition for the group.

Thermal imagery clearly indicated that a haul-out is not homogenous in terms of the density of animals across the haul-out area.

The ultimate goal is to assess the entire Chukotkan walrus population which we expect could be done in a 5-leg aerial survey, encompassing about 35 flight hours, and a total of 50 hours (including refueling and sleep) as the minimum needed to do the entire aerial survey of all Chukotkan coastal haul-outs. This approach allows for the survey to be completed across the entire coast in only a few days (Figure 10).

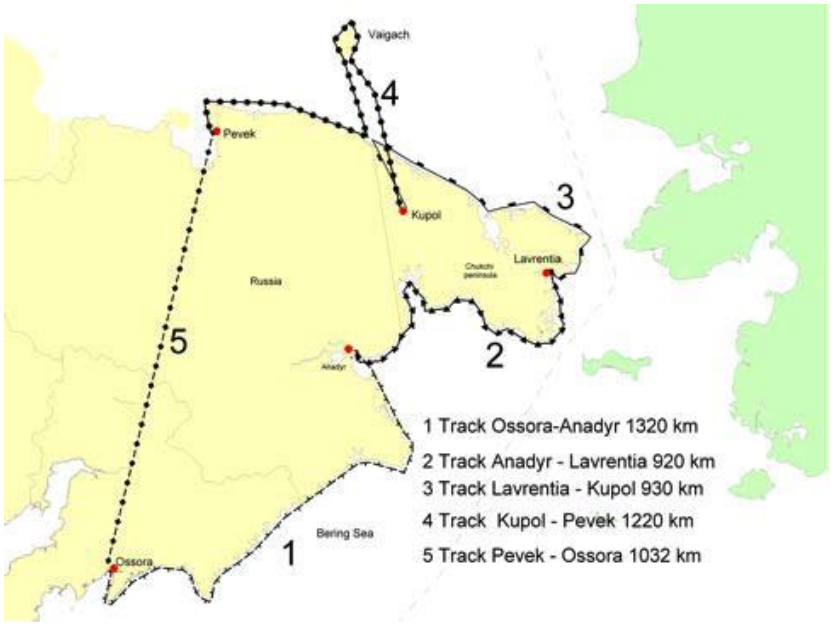

Figure 10 Prospective flight path for a fall survey of the Chukotkan coastal haul-outs.

During a rapid, coast-wide survey, we would hope to collect data on:

- Haul-out location and configuration
- Number of walruses
- Sex/age structure
- Number of dead walruses
- Number of polar bears and whales

COMMENT (*Eduard*): We need to be extremely careful with aerial surveys to avoid disturbances (a concern also raised by locals at the Barrow Workshop[2]). A coast-wide survey will need more than three days. Anatoly estimated more like six or seven days. Around Serdtse-Kamen, such a great concentration of walruses will require different counting methods.

RESPONSE (*Vladimir*): We will only get a few days of consistently good weather.

COMMENT (*Chad*): To estimate sex/age requires animals to look towards the camera. However there is a fine line between disturbing them enough to look up and causing a stampede.

COMMENT (*Anatoly*): The aerial survey method can definitely be used to estimate numbers, but you shouldn't put too many tasks within your protocol. Don't try and do abundance and sex/age composition at the same time. If you separate these goals, the planes can move further off the haul-outs so that animals are not disturbed. Having amassed a lot of data on disturbance stimuli, we know that walruses do not react to magnitude of sound. Instead, walruses react to the change in sound levels. If planes avoid circling over haul-outs, disturbances will likely be avoided.

QUESTION (*Chad*): How was the infrared imaging used?

ANSWER (*Vladimir*): First, it was used to identify locations. Visual observers may miss a group of walruses, but the heat scanner will register them. Second, infrared can be used to delineate the walrus footprint. The haul-outs in this aerial effort were small, the largest was 500 animals. In the future, with larger haul-outs, the density can be established from the heat signature. However, this needs to be calibrated on large coastal haul-outs.

QUESTION (*Chad*): Can the thermal imagery be done at a higher altitude?

ANSWER (*Vladimir*): We used it at 1,000 m. It could probably be used at 2,000 m if weather conditions were favorable.

QUESTION (*Mark*): How does thermal imagery on terrestrial haul-outs compare to when walruses are on ice?

ANSWER (*Vladimir*): Even though methods are similar and the resolution of the equipment has improved (both photographic resolution and thermal imagery resolution; resolution is now down to 30-40 cm), animals on ice lie in small groups so surveys need to cover large areas. Animals on shore are often in big groups so they can be surveyed much faster than the smaller groups on ice. One would need 20-30 days for ice and 2-3 days on land, which is more economical. There are more walruses on shore during good weather, which is when surveys would take place; satellite tagging is easier; and the effort would not need an expensive icebreaker.

COMMENT (*Joel G-M*): We should analyze data from the Russian Federation and the United States on the heterogeneity of thermal imagery from haul-outs to investigate herd heterogeneity.

[2] Garlich-Miller, J. 2012. A Community Workshop on the Conservation and Management of Walruses on the Chukchi Sea Coast. February 23-24, 2012. Iñupiat Heritate Center, Barrow Alaska. USFWS Administrative Report, R7/MMM 12-1.

Pacific walrus haul-out monitoring at Togiak National Wildlife Refuge and Walrus Islands State Game Sanctuary: 1975-2012

Stephanie Sell, Alaska Department of Fish and Game
Michael Winfree, U.S. Fish and Wildlife Service

Courtesy Photo

Staff from Togiak National Wildlife Refuge and the Walrus Islands State Game Sanctuary, located within Bristol Bay, have cooperatively monitored walrus haul-outs in Bristol Bay since the mid-1980s. Ground-based counts, aerial surveys, and remote cameras have all been used to monitor the number of walruses using the primary haul-outs at Cape Peirce, Cape Newenham, Round Island, Hagemeister Island, and Cape Seniavin (Figure 11). Monitoring methods have evolved over time to adapt to research needs, budgetary constraints and haul-out use patterns. Traditional ground-based methodologies were standardized in 1997 by USFWS, USGS and ADF&G, and supplemented with aerial surveys. Remote monitoring applications are now also being implemented cooperatively with other agencies as those involved seek to achieve a more complete picture of haul-out use within Bristol Bay.

Figure 11 Haul-outs in Bristol Bay.

SUMMARY OF DATA COLLECTED AT DIFFERENT SITES IN BRISTOL BAY

Cape Peirce
Ground surveys (1985 – present)
Aerial surveys (1980s – present)
Remote cameras (2010 – present)

Round Island
Ground surveys (1976 – present)
Remote cameras (2011)

Cape Seniavin
Periodic aerial surveys
Remote cameras (2011)
Ground surveys (1998 – 99, 2001, 2003)

Cape Newenham
Ground surveys (1991 – present)
Aerial surveys (2003 – present)

Hagemeister Island
Aerial surveys (2005 – present)
Remote cameras (2011)

Courtesy Photos

While USFWS and ADF&G have collected walrus haul-out data for many years, early protocols are not always available, making it hard to compare recent data with earlier efforts. The current goals are to consistently provide numbers for managers and subsistence hunters that describe walrus use of haul-outs and their movements, and to collect data to assess the impacts of disturbance.

Times for direct visual count surveys (8:00, 14:00, 17:00) are randomly selected (amongst the three time periods) at the beginning of each season. Our observation point at Main Beach on Round Island is 800 m from the walrus herd, which we count by tens in the field. Photo counts are also made each year at Main Beach.

Aerial surveys of Bristol Bay are conducted by USFWS between 610 m and 1,220 m depending on conditions. Photographs are counted twice and averages reported. Field counts are later compared to the photo count with the protocol calling for the photo count to be used as the final number.

In 2010, agencies started using stationary cameras (Reconyx) at Cape Peirce, and in 2011, also at Hagermeister and Round islands. These cameras take a photo every hour and are downloaded 2-3 times per season (image quality depends on weather and light). Photos are counted twice and averages used to give the time of start, peak, and end of a haul-out event.

Remote cameras will ultimately allow agencies to simultaneously monitor all of the Bristol Bay haul-outs. Next steps are to facilitate downloading the camera data more regularly, perhaps using satellite uplinks.

RECOMMENDATIONS:

- Simultaneously monitor all Bristol Bay haul-outs to provide information on habitat use and dynamics of walruses within the Bristol Bay/Bering Sea ecosystem, as well as assess the impact and level of human disturbance.
- Collaborate with partners to ensure cost effective efforts that maximize coverage.
- Use real-time cameras in conjunction with satellite telemetry.

QUESTION (*Martin*): How consistent are the different methods (i.e., direct observations, aerial surveys, and remote cameras)?

ANSWER (*Michael*): At Cape Peirce, when the remote cameras were originally deployed, the photos gave a 15% lower count in abundance. Since then, camera positions have been adjusted so that the full haul-out is in the frame and results are much more consistent with direct observations. Some beaches need multiple cameras to cover the entire haul-out area.

QUESTION (*Anatoly*): Is your data just for abundance, or do you collect demographic information as well? Is it possible to collect mortality data? Or would this require a different study?

ANSWER (*Michael*): Most walruses that haul-out in Bristol Bay are males, so little is done on sex and age composition. As far as mortality – yes, samples and location are collected. Most mortality is at Cape Peirce, where when disturbed, walruses go the shortest distance to the water, which is off a cliff. However, there have not been any of these mortality events in the last few years.

QUESTION (*Joel B*): What disturbances have you observed in Bristol Bay?

ANSWER (*Michael*): Boat traffic (sac roe herring) has a three-mile buffer reducing its disturbance, but disturbances can be caused by as little as a raven cawing. One of the problems of increasingly using remote devices (cameras) is that we are less able to monitor disturbance.

QUESTION (*Chad*): Is there any aerial surveillance for new haul-outs?

ANSWER (*Michael*): No, we are not currently looking for any new haul-outs.

QUESTION (*Stanislav*): We need to know why numbers change at haul-outs. Is there any research on food sources around haul-outs?

ANSWER (*Michael*): No, there are no studies of benthic resources in the Bristol Bay area, although this would be useful.

Estimating the age composition and size of Pacific walrus herds on haul-outs from gyro-stabilized, high-definition videography

Daniel Monson, U.S. Geological Survey
Chadwick Jay, U.S. Geological Survey

Courtesy Photo

Since 2007, USGS has been developing a method to estimate the age composition of walruses gathered at coastal haul-outs to help monitor walrus demographics.

In September 2010 and August 2011, USGS used Cineflex® (Figure 12), an airborne, high-resolution, high-zoom camera system equipped with a gyro-stabilized telephoto lens to obtain video images of hauled-out walrus herds from an altitude of 914-1,220 m. This system allowed for operating sufficiently far from resting walruses to minimize (but not preclude) the risk of disturbance. This system was necessary because this region has little physical relief, and is not conducive to getting an abundance assessment without aerial methods. In areas with relief, less expensive video systems recording from over-looking high points could be used to collect the video footage.

The herd is sub-sampled representatively. An entire group is photographed and then the camera is zoomed into the herd while the helicopter does a "hold sequence" for filming. Helicopters hold for as long as possible – usu-

Figure 12 Helicopter equipped with Cineflex®.

Walrus numbers are added to an image after the photo is captured from a helicopter. Photo: USGS

ally about 30-60 seconds. From captured images, a single frame is used as a reference photo, in which all individuals are assigned a number (usually 250-400 animals). About 10% of the animals are then randomly chosen and identified by age and sex. By using video, most of the animals will move their head around during a hold sequence providing adequate views for aging. It was not possible to determine age for approximately 6% of the randomly selected individuals. Calves tend to be on top of other animals facilitating their identification.

Nearly 70% could be aged to the full eight-category scale described by Fay and Kelly (Figure 13).[3] However the probability of aging error is higher with eight age categories, and 30% could not be aged to this resolution so only three age-classes were used in the analysis: dependent young (0-2 years), juveniles (3-5 years), and adults (≥ 6 years). Most walruses in this study were females with calves. Some younger males are mixed in with the group, however, it is difficult to pick them out. Preliminary analyses reveal that a 2.4 (CI = 1.9 to 3.0) fold greater

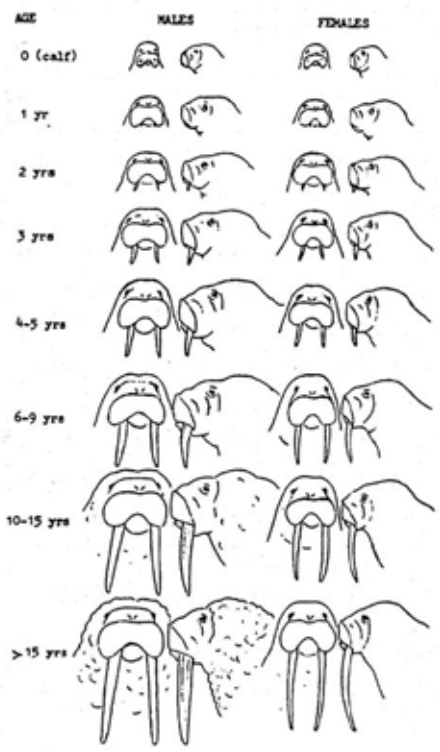

Figure 13 Fay and Kelly's age categories.

[3] Fay F.H., Kelly B.P. 1989. Development of a method for monitoring the productivity, survivorship, and recruitment of the Pacific walrus population. Final Report, OCSEAP Study MMS 89-0012. Minerals Management Service, Anchorage, Alaska.

proportion of females with dependent young were identified onshore than reported from offshore age composition studies, suggesting that females with young disproportionately utilize coastal haul-outs, or that their arrival onshore is earlier than females without calves. However, offshore surveys were conducted 10-20 years ago making direct comparisons of limited use. Further data collection and analysis throughout the haul-out period and in years when offshore surveys are also done is required to assess how the age structure of onshore herds reflects true population age structure.

Over time, more frequent and annual assessments of herd age composition will allow us to monitor the cumulative effects of sea-ice changes on walrus reproductive success. Cow-calf ratios in particular (similar to ungulates) will give an index of productivity. Overall age composition can provide inference about population productivity for population models.

We have also developed a method to scale the videographic images to estimate density of animals on haul-outs. The system being used wasn't originally designed to scale images, as there was no scale. Consequently, in 2011, markers were placed 10 m apart on beaches and geo-referenced so that images can be scaled. We counted 80 of these images in 10 m^2 quadrants, covering the entire herd in a representative way. Densities ranged from 39 to 145 animals per 100 m^2 and averaged 0.88 per m^2 (standard error = 0.02). This is 1.136 m/walrus, comparable to the Russian Federation figure (see this section, Kochnev's first presentation on page 18).

The largest observed aggregation of walruses in Alaska to date occurred on September 26, 2010 near Point Lay when the herd there covered a minimum of 48,822 m^2 of beach, which equates to an estimated herd size of 42,963 animals (95% CI = ± 1,914). Herd size is highly dynamic; in the fall of 2011, a haul-out grew by more than 13,000 animals over a 24-hour period (Figure 14).

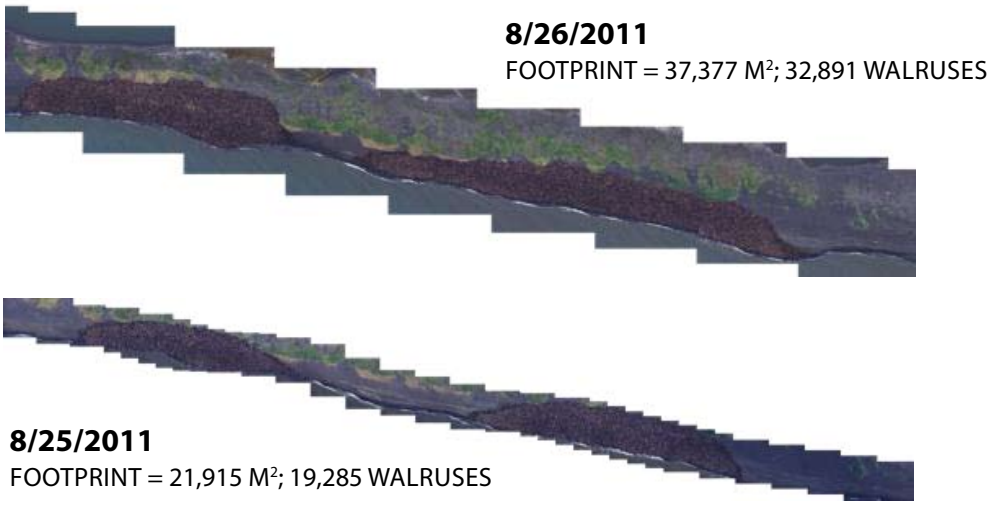

Figure 14 Examples of Cineflex® aerial imagery and rapid changes in haul-out size over 2 days in 2011.

The greatest unknown that needs to be addressed in this study is the number of animals that remains offshore. Additional goals are to look at how age or sex structure changes over time in the season and between years.

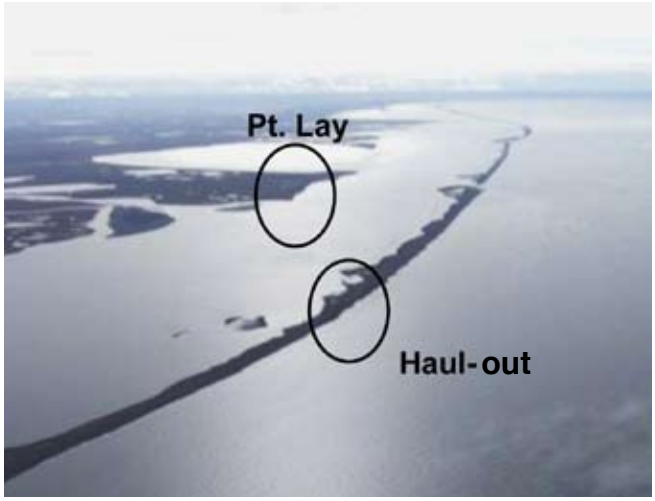

Photo: USGS

QUESTION (*Stanislav*): I didn't see many walruses in the water in your images, is this normal?

COMMENT (*Eduard*): Some consider that only 20% of walruses are on shore at any one time.

COMMENT (*Anthony*): The tags put out from Barrow indicated that the percentage of walruses on a beach at any one time is relatively small, but this needs to be further verified.

QUESTION (*Vladimir*): What kind of zoom is on the camera and how expensive is it?

ANSWER (*Dan*): The camera has a 42X zoom and can be doubled from that for an effective zoom of 84X. Gyro-stabilization allows it to work on a vibrating platform like a helicopter. I don't know the exact cost, but it is in the hundreds of thousands of dollars. Our contractor said the helicopter was the cheaper part of the system. We are thinking of using small, un-manned helicopters to do this with less cost.

COMMENT (*Joel G-M*): More work is needed on group heterogeneity, particularly for large groups. We need to know if animals sampled on the edge of a herd (i.e., for genetics) are representative of the whole herd.

ANSWER (*Dan*): This is the plan.

QUESTION (*Joel B*): Were the differences in cow-calf ratios behavioral or demographic in nature?

ANSWER (*Dan*): Behavioral – the data doesn't support this being demographic.

QUESTION (*Martin*): How can we resolve the offshore bias?

ANSWER (*Dan*): The transmitter information is one of the tools being used. Another option is to do the offshore survey in the same year as an onshore survey.

QUESTION (*Willard*): When there were 30,000-plus walruses onshore, were there still a lot of walruses coming in from offshore?

ANSWER (*Dan*): We don't know. That would require a survey out to Hanna Shoal and back.

QUESTION (*Vladimir*): Could the Cineflex® be used for a large-area survey?

ANSWER (*Dan*): There are better camera platforms to do actual surveys. For example, we had to use markers on beaches, as our system wasn't designed for scaling to numbers.

QUESTION TO WILLARD (*Lori*): What is your impression of disturbance from the helicopter?

ANSWER (*Willard*): While we watched the walruses on the haul-out from the helicopter, it appeared that they didn't hear the helicopter.

ANSWER (*Dan*): Even on the ground, it was hard to know when the helicopter was passing overhead. The helicopters worked down to 914 m when there was some wind and surf noise. If there wasn't any environmental noise, the walrus would notice the helicopter, so it was raised to an altitude of 1,219 m.

Sex/age composition of Pacific walruses on the Russian Federation haul-outs

Anatoly Kochnev, Chukotka Branch of the Pacific Research Fisheries Center (Chukot-TINRO)

Courtesy Photo

Assessment of age/sex composition is based on Fay and Kelly[1] and is done every five days to allow for information to be collected on changes throughout a season. The sex and age of animals is assessed as well as how many females there are in comparison to young ones. Also assessed is the percentage of young walruses at different ages to get a survival measurement for each generation. Sex/age composition of different haul-outs and at different times in the season are very different (Figure 15); seasonal variability cannot yet be fully described. Females and calves are more common on rocky haul-outs and males are more common on the sandy beaches.

[1] Fay F.H., Kelly B.P. 1989. Development of a method for monitoring the productivity, survivorship, and recruitment of the Pacific walrus population. Final Report, OCSEAP Study MMS 89-0012. Minerals Management Service, Anchorage, Alaska.

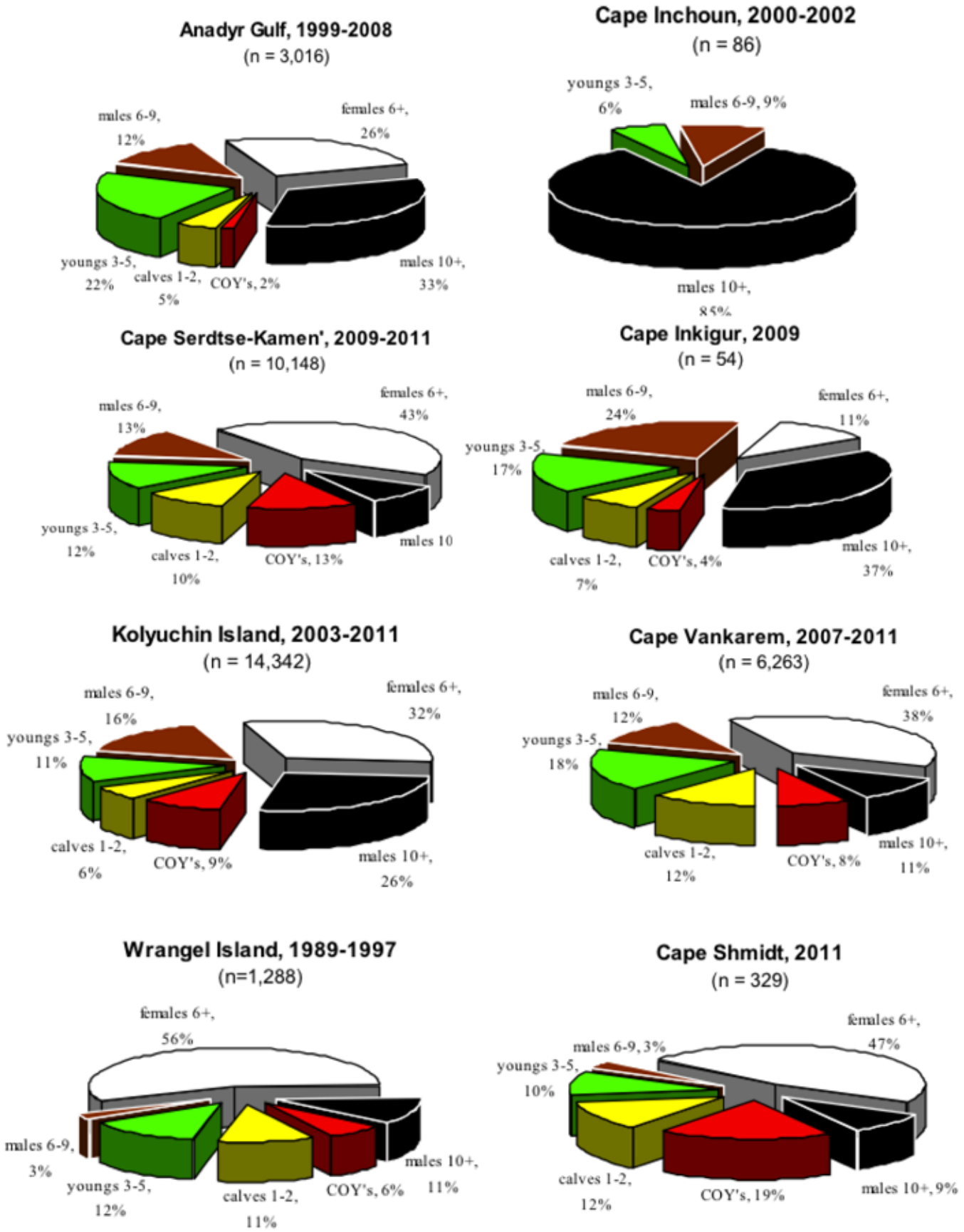

Figure 15 Demographic composition of primary Chukotkan haul-outs.

Kolyuchin Island has the longest dataset on demographics. At this site, we have seen big changes in composition over time. In recent years, females and calves-of-year have declined. On the island, Fay historically estimated the percentage of very young walruses (less than one-year old) as 15% of the population. Current numbers in Chukotka are 8-9%.

Demographics are estimated along the edges of a herd. If a haul-out is relatively uniform in composition, four samples are taken – two on the sides and two in the middle. For full counts, the depth of the haul-out from water through to the top of the beach is assessed, as males are generally located furthest from the water. Wherever possible, we use bluffs for our observations to give better visibility of all animals. At Cape Serdtse-Kamen, there is a bluff about 2 m above sea level. Observers crawl to the bluff in an effort to not disturb the animals. On Wrangel Island observers used to use towers that were 10-12 m tall.

The declining proportion of young animals will be monitored into the future (Figure 16).

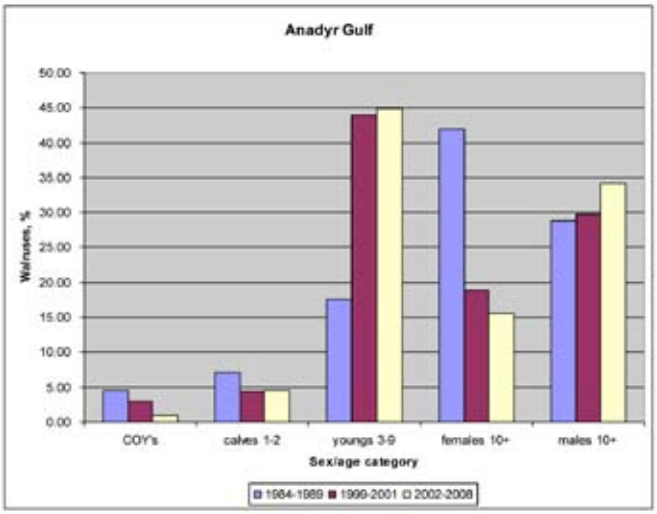

Figure 16 Age structure of haul-outs in Anadyr Gulf from 1984-2008.

QUESTION (*Joel G-M*): Is Cape Serdtse-Kamen a good place to get a snapshot of most of the population at one point in place and time?

ANSWER (*Anatoly*): Yes, at the end of October/November nowhere else has comparable aggregate abundance.

QUESTION (*Lori*): Do you use photos for data on sex/age composition or direct observations?

ANSWER (*Anatoly*): We have been using direct visual observations for estimations at haul-outs. We may use the photos in the future if that is a more efficient method.

SESSION 1 DISCUSSION

It is critical to focus on the goals of monitoring. This seems obvious, but goals are not generally well articulated in many studies – either with respect to management or research. Goals will differ based on who is requiring the information. For example, refuge managers may have different needs than agency staff responsible for a marine mammal population such as walruses. Local and regional monitoring supports local decisions (e.g., fishery impacts, reintroduction of traditional hunts, ship grounding and booming requirements). In addition, there needs to be a process to feed local information that has been collected up to those working on data at wider scales (regional/population).

Data collected could be used to determine local abundance or sex/age composition, or it could be used for inference to a regional or population level. The latter scale requires careful thought, as inferences need to incorporate sampling across the entire range of the population. Most of our discussion so far fits within the regional level. However, all the information we collect – as long as we study many of the haul-outs – can be used to provide inferences about the population as a whole.

QUESTION (*Joel G-M*): Are there priority regions in Chukotka?

ANSWER (*Anatoly*): Yes, two regions linked to the predominance of females and calves: the northern Chukotkan coast and Wrangel Island. In addition, the northern part of the Gulf of Anadyr is important. The Koryak and Kamchatka coasts were historically important for males. Those areas could be used as control sites and studied with aerial surveys. We don't need to closely monitor these males; it is not practical regarding expense, especially given that there are no current development concerns there. However, the currents in the region could bring spilled oil from the United States. We need to understand how an oil-spill might impact this whole area. We should also consider that in the fall there is often a time period when the entire population is on land or in the water – not on ice – making this potentially a valuable time to collect broad data over large areas.

COMMENT (*Anatoly*): How do we protect and conserve major haul-outs? We need to work with locals to help them understand how some harvesting/hunting methods can negatively affect the haul-out and the population under present conditions. Historically, the Soviet Union was much better at nature conservation and protection of haul-outs. Rangers around major haul-outs helped limit disturbance, but we don't have this anymore.

COMMENT (*Joel G-M*): We must fully involve local residents in haul-out protection efforts.

COMMENT (*Sergei*): Natives who live next to each haul-out need to be actively involved in the preservation of the resource and development of the rules that can be used at regional and federal levels. We need to secure support at the federal level to engage in international efforts, as conservation needs a bilateral approach to capture the "the whole picture." Hunters now do more to preserve haul-outs; they themselves try to limit the impacts of tourism, vessels, and airplanes. In addition, they are using new methods in harvesting animals, supporting traditions, and helping preserve haul-outs (see Session V).

COMMENT (*Ed*): At Round Island, we understand haul-out dynamics, but the picture is incomplete without having as many haul-outs included as possible. Also, we need a central place to consolidate data. For example, if we observe a decline at Round Island, we don't know if animals are just going to Cape Seniavin.

COMMENT (*Nikita*): If we fail in management, we will have nothing to conserve or use. We need to be specific in our research needs so we can be clear about what we need to do. As an example, if we continually monitor a haul-out site and numbers are decreasing, what does that mean?

COMMENT (*Dan*): Everyone has local needs, but we need to get clarity as to whether or not an understanding of the whole population is desired. We need to identify what datasets need to be collected (systematically and comparable), and the person or group best suited to consolidate the information.

COMMENT (*Anatoly*): We need data for evaluating mortality. The only place where we observe many dead walruses is on coastal haul-outs. The more haul-outs that can be looked at the better estimate of total mortality we'll be able to have. If we can identify age/sex structure of dead walruses, this would allow us to infer to regional and population levels.

COMMENT (*Raphaela*): I want to emphasize the importance of including offshore foraging habitat in research.

COMMENT (*Chad*): We need to start thinking about centralizing and archiving data in an accessible manner. The Pacific Walrus International Database should be reinvigorated.

PRIORITIES AND RECOMMENDATIONS

PRIORITIES

Session I discussions prioritized several important themes that continued to be raised throughout the workshop. Importantly, the need for explicit documentation about the goals of a specific monitoring effort and about the scale of inferences being made from data collected at a haul-out. Protocols for monitoring and research should be tailored in a manner that balances specific objectives with both the capacity/costs for accomplishing goals, and minimizing impacts (i.e., disturbance) to walruses.

With reference to specific variables, in Alaska seasonal mean numbers are a more powerful statistic than seasonal maximum number for assessing trends in population change over time, but similar research has yet to be done for the larger haul-outs in the Russian Federation. Across the range of walruses, a much better understanding of demographic patterns and trends is needed.

RECOMMENDATIONS

- Assess the timing, location, and relative abundance of walruses at primary haul-outs.
- Address the dearth of information on demographics of Pacific walruses in the scientific literature through research at haul-outs. Birth rates and survivorship are critical for management in a changing environment. Assessing numbers and sex/age composition at haul-outs (using appropriate precision) can inform science, policy, and management (including hunting) at local community and government levels. Finally, the age/sex demographic heterogeneity and dynamics of hauled-out walruses should be assessed to inform aerial surveys or ground-based sampling efforts.
- Work with a statistician (e.g., Mark Udevitz) to assess an optimal sampling strategy for the 12 highest priority haul-out sites in the Russian Federation (i.e., power to detect trends if monitored at annual or multi-year frequencies).
- Develop indicators of both regional and overall population status using data from haul-outs and associated ecological data. Apparent reductions in haul-out use during the mid-1900s were seen as an indicator of population decline, but ice conditions were not included in these.
- Promote community stewardship through locally-based walrus demographic monitoring.

SESSION II:

GENETICS-BASED CAPTURE-MARK-RECAPTURE OF PACIFIC WALRUSES FOR ESTIMATION OF ABUNDANCE AND DEMOGRAPHIC RATES

Session Chair: Patrick Lemons, U.S. Fish and Wildlife Service

Courtesy Photo

BACKGROUND

The general lack of information with respect to abundance and demographic rates of Pacific walruses makes it difficult to monitor and manage the population in a changing environment. USFWS and its partners are considering launching a long-term, genetics-based, capture-mark-recapture project to obtain direct estimates of abundance as well as age and sex-specific demographic rates of walruses. Because walruses do not handle physical capture well, USFWS will utilize a proven remote biopsy technique for collection of skin samples from marine mammals (Palsboll et al. 1997) and will identify individuals using molecular genetic techniques. Such a capture-mark-recapture approach will help estimate demographics (including age and sex-specific survival), recruitment, fidelity and movement, abundance, and population growth rate.

A workshop conducted in 2002 explored the feasibility of conducting a genetics-based, capture-mark-recapture project for estimation of walrus abundance (Garlich-Miller 2003). The results of the 2002 workshop suggested that there were no insurmountable obstacles to conducting a capture-mark-recapture project for walruses. Furthermore work conducted as a result of the workshop revealed that a sufficient number of reliable and appropriate genetic markers were available with sufficient resolution to identify individuals (Garlich-Miller 2003). At that workshop, participants stressed the importance of obtaining a representative sample of the population, which is the greatest challenge of this project. If walruses exhibit population sub-structuring, and a representative sample was not obtained, then an abundance estimate would be negatively biased. Recent work, however, revealed that the walrus population appears panmictic with minimal population sub-structuring (Sonsthagen et al. 2012). Therefore, if we obtain a random sample of the population, an abundance estimate would be representative of

the global population. Minimum sample size requires that 1% of the population is captured (i.e. genetically sampled) annually or about 2,500 animals based on a conservative population estimate of 250,000.

Sampling strategies discussed during the 2002 workshop included recommendations to sample in the Bering Strait during spring as walruses migrate north, the Chukchi Sea in summer as walruses haul out on shore, or in winter at breeding aggregations in the Bering Sea. The former two options are being considered, as the latter would be logistically difficult and expensive due to the risk of bad weather and need for a monetarily expensive icebreaker.

SESSION GOALS AND OBJECTIVES

- A facilitated discussion about the genetics-based capture-mark-recapture project as a whole.
- Assess the merits of sampling animals randomly at land-based haul-outs as compared to animals hauled out on sea ice.
- More generally, assess the feasibility of sampling walruses on land, as opposed to on ice or from the subsistence hunt. Key discussions revolved around:
  - o General methods for obtaining a representative sample;
  - o Feasibility of sampling walruses at land-based haul-outs;
  - o Feasibility of sampling walruses hauled out on sea ice; and
  - o Feasibility of sampling dead walruses and/or those from subsistence hunts.

SESSION DISCUSSION

GENERAL METHODS FOR OBTAINING A REPRESENTATIVE SAMPLE

During the session, participants discussed general methodological issues including biases associated with re-sampling the same individuals on multiple days, the ability to sample all age and sex classes, and obtaining a representative sample of the population.

Genetic samples would be obtained from individual walruses utilizing a proven remote biopsy technique common for sampling cetaceans and pinnipeds (Palsboll et al. 1997). Biopsies are taken using crossbows and arrows attached with a biopsy head. Researchers can biopsy animals from up to about 40 m away without having to physically handle the animal. This technique has been used for many years with little or no detectable effects on numerous species of marine mammals (Karesh et al. 1987, Gemmell and Majluf 1997, Wiig et al. 2000, Hoberecht et al. 2006, Reeb and Best 2006) including walruses (Fischbach et al. 2008, Sonsthagen et al. 2012).

Unlike traditional capture-mark-recapture studies, animals sampled with the crossbow technique do not have a visual mark, and therefore cannot be visually identified at a later date. Participants at the workshop suggested that the possibility of repeatedly sampling the same animal within one sampling period presents not only a logistical challenge, with respect to obtaining the desired sample size, but also a monetary challenge as all samples must be analyzed molecularly for individual identification. Currently no reasonable methods exist for applying permanent visual marks to walruses. However, participants suggested that given the low sampling rate, this is unlikely to be a large problem during the course of this study.

Participants also discussed the feasibility of ensuring biopsy samples would be taken from all age and sex classes. Not all age and sex classes move within their environment in a similar manner. For example, during the spring migration, female and juvenile walruses migrate north with the retreating pack ice into the Chukchi Sea, while most adult males migrate to land-based haul-outs in Bristol Bay, Alaska and the Gulf of Anadyr, Chukotka. This presents a logistical challenge for obtaining a representative sample of the population. If, for example, a significant portion of the adult male population remains un-sampled, the resulting abundance estimate would be negatively biased. Participants suggested that, given the polygynous mating system of walruses, adult males are the demographic group of least concern to managers as one male can mate with multiple females. As a result of these discussions, participants suggested that adult males should not be sampled during the first years of this project – allowing emphasis to be placed on the female component of the population which is more important to productivity. Therefore, abundance and demographic rates of adult male walruses will not be obtained during this time period. In addition, current biopsy techniques have only been developed for sampling adult and subadult walruses; not for young of the year. Therefore participants recommended that techniques be developed for sampling walrus calves as this demographic group is the most sensitive to changes in sea-ice conditions resulting from global climate change (Udevitz et al. 2012) which is predicted to result in a population decline (Jay et al. 2011).

Finally, participants discussed the feasibility of obtaining a representative sample of the overall population. A key logistical difficulty of obtaining a representative sample is the challenge associated with working in the Russian Federation. Currently, Russian Federation regulations prohibit non-Russian Federation researchers from collecting samples from walruses in the Russian Federation and exporting those samples out of the country without specific permits. Permits are not easily obtained; past efforts to collect samples from other marine mammals in the Russian Federation and import those samples into the United States have met with mixed results. The primary goal of obtaining a global abundance estimate for walruses requires that animals caught must be representative of the global population and therefore require sample collection in the Russian Federation. If samples are not collected from walruses in the Russian Federation, estimates of abundance would only be representative of the United States population, or an unknown mixture of United States and Russian Federation animals. Unfortunately, the general lack of information on movement and fidelity rates of walruses sampled in the United States and the Russian Federation prohibits us from assessing whether animals sampled in the United States are representative of the global population.

Courtesy Photo

Participants noted that, based on satellite telemetry data, it appears that up to 75% of the population move west along the Chukotkan coast as they migrate north of the Bering Strait during spring while the remaining 25% moves east along the Alaskan coast. Therefore, participants recommended the adoption of two strategies to maximize the probability of successfully obtaining a representative sample of the population. First, they recommended targeting walruses hauled out on sea ice just north of St. Lawrence Island before they migrate north through the Bering Strait. Targeting walruses hauled out on ice south of the Bering Strait but north of St. Lawrence Island would allow access to most of the population in a relatively small area, only missing those that remain very close to the Chukotkan coast. Second, participants recommended starting a biopsy sampling program utilizing Russian Federation subsistence hunters to collect samples from live walruses during the spring migration to augment the samples collected from walruses in United States' waters.

FEASIBILITY OF SAMPLING AT LAND-BASED HAUL-OUTS

During the session, participants discussed the advantages and disadvantages of utilizing coastal haul-outs to access large numbers of animals for use in a genetics-based capture-mark-recapture project. The most obvious advantage to sampling walruses hauled out on land is the relative ease of access to very large numbers of animals. This would allow researchers to collect large numbers of samples easily and efficiently, which would help ensure the minimum sample size requirement (2,500 animals) is met.

Despite the advantages associated with access to large herds of land-based walruses, participants discussed numerous logistical difficulties associated with sampling on terrestrial haul-outs. Several presentations during this workshop demonstrated demographic structure within terrestrial haul-outs. This demographic structure could result in biases if samples obtained from the haul-out are not representative of the haul-out structure as a whole. For example, preliminary information suggests that younger animals tend to occur at the periphery of the haul-out while older animals tend to occur in the center of the haul-out (refer to Dan Monson's presentation in Session I). Because access to animals is limited to those along the herd's periphery, a sample collected at such a land-based haul-out would over-represent younger age classes and under-represent older age classes. Two potential solutions would be to 1) sample animals in the water as they come and go from the haul-out; or 2) sample as haul-outs form, as they tend to build along the edges. Nevertheless, it is difficult to predict when and where haul-outs will form challenging the logistics of either of these potential solutions. Additionally, not all animals will use land-based haul-outs in some years while in other years haul-outs may not form if sufficient sea ice is present.

Perhaps most importantly, participants raised significant concerns about working on terrestrial haul-outs with regards to animal welfare. Collecting biopsy samples from terrestrial haul-outs is risky with respect to causing a stampede, which can result in an injury or death to animals. Walruses hauled out on land are particularly sensitive to disturbance and large mortality events numbering in the hundreds to thousands have been documented in recent years (Garlich-Miller et al. 2011). Participants noted that the conservation community, researchers, and local communities all have expressed concerns with sampling at terrestrial haul-outs. Participants also noted that while experienced field workers can minimize the risk of disturbance, walruses tend to be highly sensitive and unpredictable when hauled out on shore.

FEASIBILITY OF SAMPLING ON SEA ICE

During the session, participants discussed the advantages and disadvantages of collecting biopsy samples from walruses hauled out on ice. The most significant disadvantage to sampling on ice is the monetary cost associated with chartering a research ship capable of accessing walruses in this habitat. The required ship must be capable of operating in the often-harsh conditions of the Bering and Chukchi seas, including in broken sea ice where the walrus groups are found. The duration of a charter would be three to four weeks in order to approach enough groups of walruses to achieve the minimum sample size required. A ship capable of working in these conditions, for this long, would require substantial financial costs.

Figure 1 The Bering Strait Region with potential sampling areas.

Despite the cost issues, participants were in overwhelming agreement that sampling on ice would offer the best opportunity for meeting the project's goals. Because the entire walrus population, minus adult males, must pass through the Bering Strait during the spring migration, the probability of obtaining a representative sample is higher when compared to sampling from coastal haul-outs. Furthermore the risk of causing an injury or death to animals while sampling is greatly reduced under this scenario as animals are close to water and therefore the research activities are unlikely to cause injuries if animals flee.

Participants recommended sampling in the Bering Strait region during the spring migration (Figure 1, solid yellow circle). Because of the restrictions for obtaining samples from Russian Federation waters, as outlined above, a sampling strategy designed around this region would present the best opportunity for accessing the bulk of the walrus population in a relatively small area (as animals missed on the Russian Federation side of the political boundary would be relatively few). Participants also discussed increasing the sampling area to the south (Figure 1, dashed yellow line) as this would further open up the sampling area. However, the two primary subsistence-hunting communities both occur on St. Lawrence Island and interference with this important subsistence area (including other species such as bowhead whale) needs to be avoided.

SAMPLING WALRUSES FROM THE HUNT OR OTHER DEAD ANIMALS

Participants discussed the utility of collecting biopsy samples from dead walruses or walruses collected during the subsistence hunt in both the United States and the Russian Federation for use in a genetics-based capture-mark-recapture project. In traditional capture-mark-recapture studies it is impossible to determine whether a marked animal that is never recaptured is dead or alive but gone from the sampling area. This results in a negatively biased survival rate and is often termed "apparent survival." By collecting biopsy samples from harvested animals, we know an animal's fate and can control for animals that have permanently emigrated from our sampling area versus those that died or were killed prior to being recaptured. Between the United States and the Russian Federation, annual removal of animals by the subsistence hunters averages approximately 5,000 animals. However, a large proportion (i.e. 40%) of this take is the result of animals being struck but lost (i.e., animals mortally injured in a hunt but not retrieved; for example, due to sinking) and therefore not available for sampling. This would leave approximately 3,000 harvested walruses that could be sampled for use in a capture-mark-recapture project.

Participants noted that age and sex information was not necessary for samples collected from dead walruses as their only use would be as a recapture. Recaptured walruses would already have age and sex identified as this is required when the animals are first captured. Furthermore, selection bias by hunters shouldn't be a serious issue as the bias tends to be localized and the overall harvest appears to show little gender bias. Participants noted that the low proportion of the population that would have been previously sampled would result in very few animals being recaptured during the harvest. For example, at the rates of sampling outlined in this workshop, only 1-3% of the population would have been sampled previously. If researchers successfully collected samples from all 3,000 walruses collected during the subsistence harvest, only 30-90 of them would result in a recapture. Given the costs associated with the molecular analysis, the utilization of subsistence-harvested samples would be monetarily expensive and yield few useable samples.

PRIORITIES AND RECOMMENDATIONS

PRIORITIES

Participants felt that a genetics-based capture-mark-recapture project for estimation of abundance and demographic rates of walruses was warranted. The general lack of information on abundance, age and sex-specific survival rates, and recruitment of walruses makes monitoring and managing the population in a changing environment difficult. Participants from both the United States and the Russian Federation agreed on the recommendations outlined below.

RECOMMENDATIONS

Note: since the March, 2012 workshop, USFWS has adopted these recommendations and is moving forward with this project.

- Given the logistical difficulties of this project – including the challenges with collecting samples from all demographic groups – adult male walruses should not be sampled in the first years of this project. By adopting this strategy, USFWS would reduce the sample-size requirements for the project overall, and allow the sampling strategy to be focused on one general area during a relatively short time period.

- Given the logistical difficulties with obtaining a representative sample of walruses on terrestrial haul-outs, and the risks associated with sampling at these haul-outs, the study plan should not be designed around sampling walruses on land.

- Design a study plan to sample walruses hauled out on sea ice during the spring migration and centered on the Bering Strait region. This approach will maximize the likelihood of obtaining a representative sample of the population; reduce the risk of injuring or killing animals in an unintended disturbance; and increase the relative ease with which researchers can move around herds and groups to access animals.

- From a scientific perspective, samples collected from walruses hauled out on sea ice should be augmented with samples collected from live walruses by subsistence hunting communities, particularly those in the Russian Federation. Because of the restrictions associated with working in Russian Federation waters this would facilitate a mechanism for collecting samples from walruses that don't enter United States' waters, further maximizing the probability of obtaining a representative sample of the population.

- Given the high cost of the overall project and the small "bang for the buck" associated with samples collected from harvested walruses, samples from subsistence-harvested walruses will not be collected in the first years of this study, or until sufficient funding is obtained for this objective.

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SESSION III:
MONITORING THE LOCATION AND TIMING OF COASTAL HAUL-OUT FORMATION

Session Chair: Martin Robards, Wildlife Conservation Society

Walrus aggregation at Cape Serdtse-Kamen in fall 2010. Photo: M. Chakilev (Chukot-TINRO)

BACKGROUND

Information on the location and timing of coastal haul-out formation is needed to evaluate and mitigate potential interactions with human activities. For example, baseline information on the location of important coastal habitat areas and the ability to predict when and where walruses are likely to be concentrated is needed for contingency disaster response plans (e.g. for an oil spill). Information on the distribution and composition of walrus herds throughout their range also provides a basis for evaluating long-term changes in habitat use patterns.

Whereas Session I of this workshop considered how to assess actual numbers and demographics at a haul-out or suite of haul-outs, this session focused primarily on assessing the spatial distribution (regional and range-wide) of all haul-outs.

SESSION GOALS AND OBJECTIVES

- Identify existing data sources, information gaps, and opportunities to synthesize new information across regions.

- Discuss strategies and approaches for coordinated data collection and sharing at range-wide and regional scales.

A discussion about assessing the long-term distribution of Pacific walrus coastal haul-outs

Martin Robards, Wildlife Conservation Society

A few years ago, in collaboration with the Eskimo Walrus Commission and Anatoly Kochnev, Martin Robards summarized existing data on coastal walrus haulouts throughout the range of walruses (Figure 1). This effort needs updating and more interpretation. This presentation sought to address shortcomings of the broad synthesis and identify opportunities to move the project forward in a manner useful for researchers and managers.

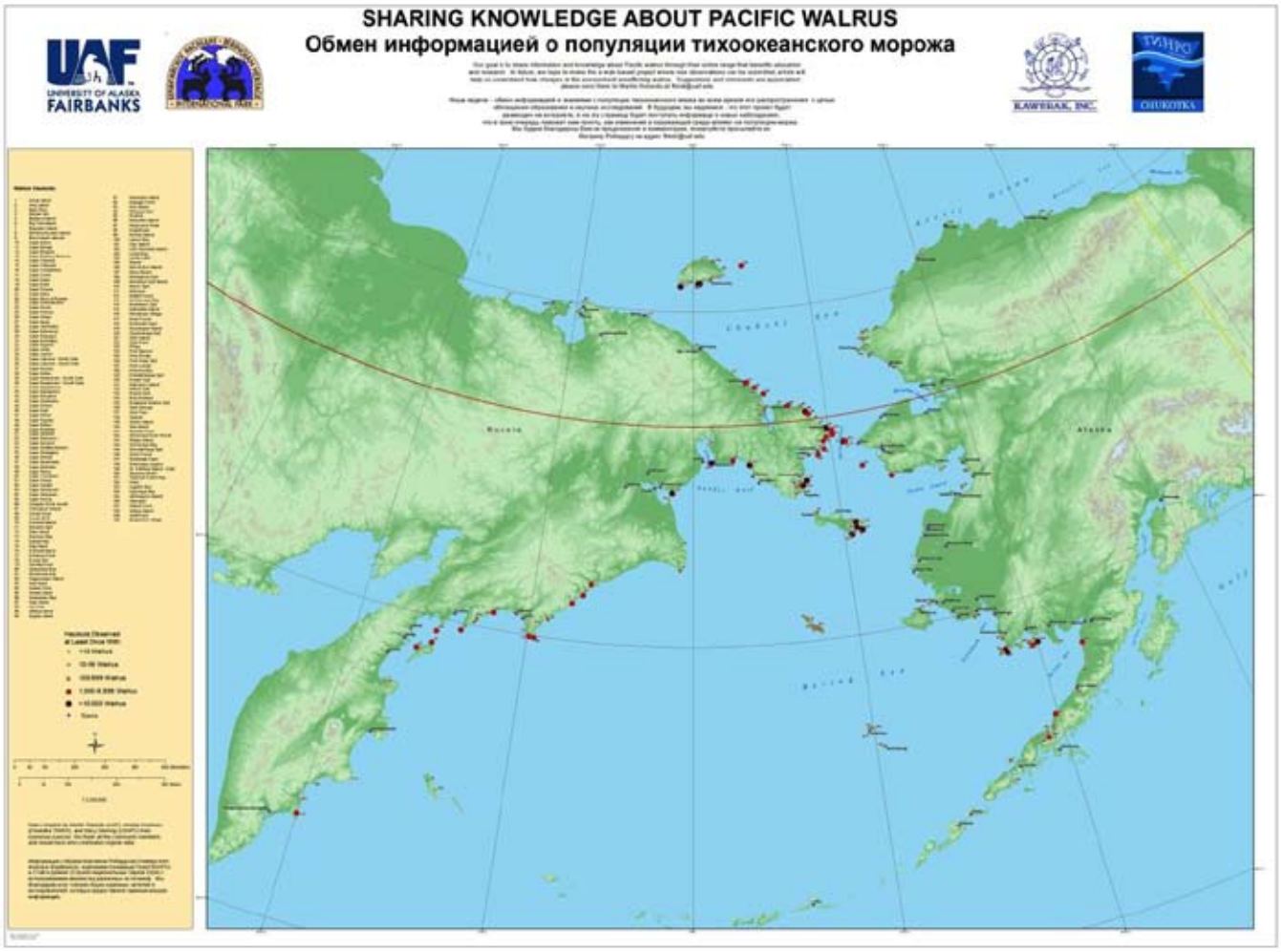


Figure 1 Historical range-wide distribution of walrus haul-outs. Note how no large haul-outs existed in NW Alaska at the time this map was produced (2006). Figure available from mrobards@wcs.org.

QUESTION (*Martin*): Would the current distribution of haul-out monitoring efforts on the north Chukotkan coast allow us to see if walruses are moving west into the East Siberian Sea?

ANSWER (*Varvara*): Cape Schmidt is a much bigger haul-out now, with more than 25,000 walruses present in 2008 and over 50,000 walruses in 2009. However, in 2010 and 2011 there were only a few thousand for short periods of time. On Ayon Island, to the west, there were no haul-outs in the last 5-7 years. In 2007, a few animals came ashore, but were killed immediately by local hunters. So, there is no real evidence for more haul-outs forming west of Wrangel Island.

ANSWER (*Anatoly*): Historically there were no large haul-outs west of Wrangel Island. The largest numbers of hauled-out walruses in this area were at Cape Shelagsky (north of Pevek) and in Chaun Bay. Some traditional local knowledge indicates that there used to be some larger haul-outs in that area over 100 years ago. Now there are only a few small places where 2-5 animals occasionally come ashore. Local people would tell us if they had seen more. The Siberian Sea is not very rich in food for walruses, so it is unlikely that large haul-outs will form in that area.

QUESTION (*Martin*): Is there recent information from Kamchatka (Figure 2)?

COMMENT (*Anatoly*): Unfortunately, Kamchatka (TINRO) does not conduct continuous surveys in the region like they did 30 years ago. However, even with field surveys, they don't see walruses like they used to. Habitat use has shrunk since the 1970s. Only 1,000-2,000 walruses are seen in the summer and fall periods in Karaginsky Bay.

COMMENT (*Vladimir Burkanov, National Marine Mammal Laboratory (NMFS/NOAA), Seattle; not present at the meeting – via email*): I surveyed most of Kamchatka's walrus haul-outs in 2010 (late June) as part of our Steller sea lion surveys. All surveyed haul-outs were empty except for a few walruses hauled out in Anastasiya Bay. We found no new areas with evidence that walruses had been hauling out during the period May-June 2010. Karaginsky Island has rarely (if ever) been used over the last decade, despite being a large haul-out before this. The last time walruses hauled out on Karaginsky Island was in the late 1980s. It also looks like walruses have abandoned Verkhoturov Island which they had used every year from 1979 to my last observations of them there on June 19, 2004. At that time, only four males were on the beach and one male was in the water.

Figure 2 Zoomed-in image of Karaginsky Bay area on haul-out distribution map.

QUESTION (*Martin*): Can we identify coastal haul-out complexes in Chukotka and Alaska? A complex being a group of inter-connected haul-outs used by a relatively consistent group of walruses.

ANSWER (*Anatoly*): We still don't understand haul-outs or complexes very well, but I think there is a complex in the northern Anadyr Gulf/southern part of Chukotka Peninsula. Wrangel Island haul-outs are all connected with each other. Now with satellite tagging (collaboration with Chad Jay at USGS), we can get more conclusive data. We need to get more tags out at different haul-outs to better understand linkages among haul-outs. Genetics sampling will also allow us to get at the genetic differences that may exist between different complexes.

COMMENT (*Chad*): As far as Bristol Bay is concerned, there has never been any evidence of a radio-tagged animal leaving the area in the summer and early fall, so that may be considered a complex.

COMMENT (*Anatoly*): If an animal comes out in the same place in two or more years – this is a haul-out. It may exist for a year or two and then be unused for many years. In certain ice conditions at the end of the 19th century and the beginning of the early 20th century, some haul-outs were very big, but they then disappeared or became very small. The range map (start of this section) includes haul-outs that are used annually as well as those that to our knowledge were only used once in a century. We need to classify each haul-out in accordance with their importance for the animals. This will help us better understand walrus distribution, as everything needs to be viewed as part of a whole.

COMMENT (*Varvara, reiterated by Nikita*): I would recommend going back to the range-wide map and not only differentiating haul-outs by size, but use color to differentiate those that are regularly used, and those that are historic or contemporary. Haul-outs are currently marked in a manner where sick animals that come ashore are classed in the same way as healthy ones.

COMMENT (*Chad*): It is also important to clarify between the areas that were surveyed and no walruses were found and those that simply were not surveyed in the past. Not understanding this can confound this type of data. This also points to the importance of regular surveillance to gain a full and complete picture of the situation.

COMMENT (*Nikita*): Range-wide map needs to include more than historic haul-out data; it needs to include biological and ecological features such as sea ice. Two walruses coming out is not a haul-out.

COMMENT (*Antatoly*): We need to continue monitoring for new haul-out sites, such as those we are observing along the Chukchi coast (Figure 3).

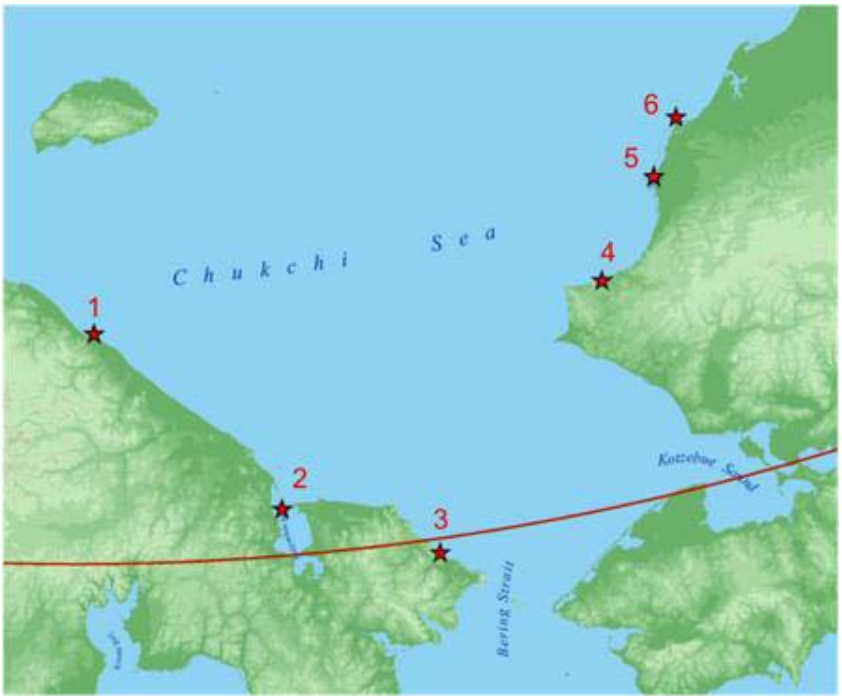


Figure 3 New haul-outs or newly re-established haul-outs numbering in the thousands of animals:

1) Cape Schmidt
2) Belyaka Spit
3) Cape Unikyn
4) Corwin Bluff (Cape Lisburne)
5) Point Lay
6) Icy Cape

Pacific walrus haul-out monitoring efforts in Bristol Bay

Michael Winfree, U.S. Fish and Wildlife Service
Ed Weiss, Alaska Department of Fish and Game

Photo: ADF&G

ADF&G has monitored Pacific walrus haul-out use in Bristol Bay, primarily at Round Island, since 1975, and has managed the area in cooperation with USFWS since the mid-1980s. Monitoring methods and locations have evolved over time to adapt to research needs and haul-out use patterns. Earlier efforts focused on Round Island and northern Bristol Bay. The primary goal of research efforts is inventory and protection of refuge resources. Areas and responsible parties include:

- Cape Newenham, Cape Peirce, Hagemeister Island – monitored by Togiak National Wildlife Refuge
- Round Island (Walrus Islands State Game Sanctuary) – monitored by ADF&G
- Cape Seniavin (State of Alaska lands) – monitored opportunistically and through special projects by USFWS Marine Mammals Management, ADF&G, Alaska Peninsula & Togiak national wildlife refuges, and Alaska SeaLife Center

Historically, walrus haul-out use has also been recorded at several other locations including Amak Island, Port Moller, Cape Constantine, and the Twins, but these sites are not known to be active haul-outs at this time.

Traditional ground-based observer counts of the major haul-outs at Cape Peirce, Cape Newenham, and Round Island were described in the first session. However, on-going challenges with this monitoring effort include, 1) a lack of comprehensive monitoring across all primary haul-outs, 2) limited coordination between Bristol Bay sites (to determine bay-wide trends), 3) and limited information on how observations in Bristol Bay inform and connect with other walrus population monitoring efforts in the Bering Sea ecosystem.

To address these challenges, traditional ground-based observer counts are being combined with, and in some cases, replaced by aerial surveys and remote cameras. The Togiak National Wildlife Refuge, ADF&G, Alaska Peninsula/Becharof National Wildlife Refuge Complex, and Alaska SeaLife Center are now collaborating in their use of remote cameras to more comprehensively monitor haul-outs at Round Island, Cape Seniavin, Cape Peirce, Cape Newenham, and Hagemeister Island with the goals of developing a Bristol Bay-wide minimum population estimate; collecting information on regional habitat use; and understanding the impact and level of human disturbance.

ROUND ISLAND

- Annual ground monitoring (May 1 – August 15)
- Grant request submitted to expand ground monitoring (September – October) through 2015
- Remote cameras deployed by Alaska SeaLife Center in 2011 and 2012; goal to expand this method in the future

Peak walrus numbers at Round Island have been relatively consistent for the last 10 years, but significantly lower than historic highs recorded over the past 35 years (Figure 4). Timing of the annual peak count is getting later each year (particularly since 2003). Within the last 10 years, differences in magnitude of haul-out use are not great, but overall numbers are generally declining. Seasonally, there are generally larger numbers of walruses in the spring/early summer; however in 2011 the trend reversed with higher numbers later in the year (Figure 5). More analysis is necessary to look at this historically.

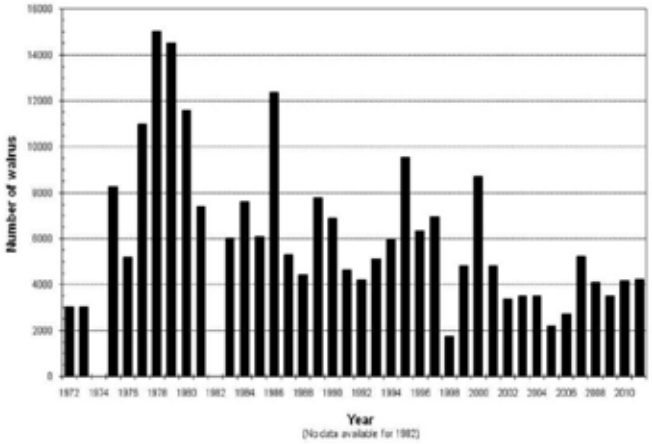


Figure 4 Peak walrus counts at Round Island between 1972 and 2011.

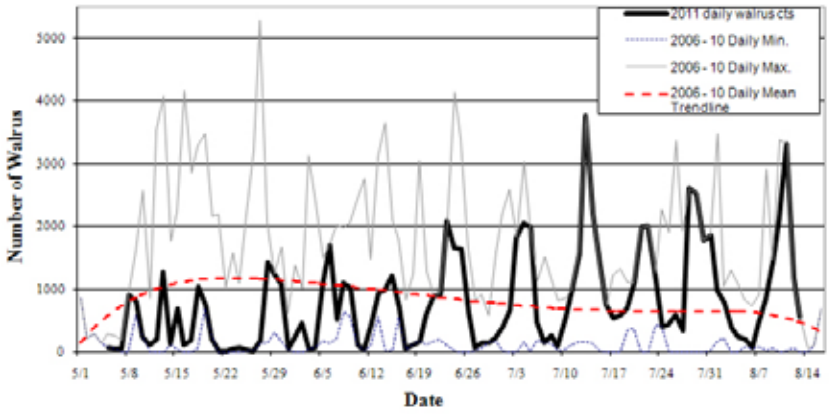


Figure 5 Daily walrus counts in 2011 (east-beaches only) compared to 2006-10 data.

CAPE SENIAVIN

- Alaska SeaLife Center and USFWS deployed remote cameras in 2011 and 2012
- Opportunistic aerial observations and ground counts over many years with some opportunities to compare across methods (Figure 6)

At Cape Seniavin, data includes four partial seasons of ground counts and some sporadic aerial observations. Data is insufficient to determine trends; however, use has increased since occupation of the haul-out was first observed in 1978. Occupancy may be trending toward later summer peaks as earlier records indicate peak use in April.

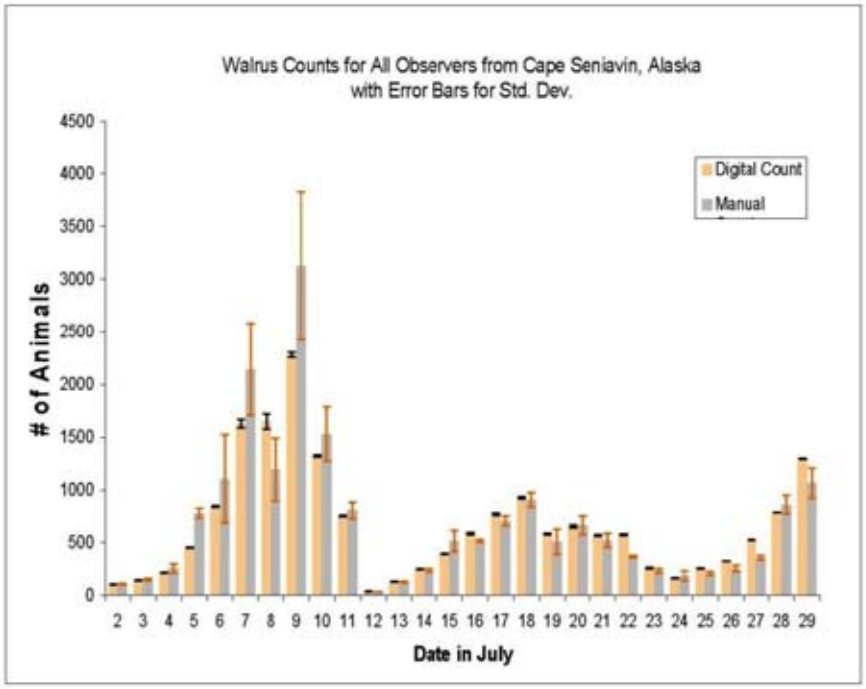


Figure 6 Daily walrus manual and aerial counts using digital imagery with standard deviation bars, during the July 2003 field season at Cape Seniavin, Alaska.

Estimates of overall numbers over time at Cape Seniavin (note seasons and timing may differ between years so conclusions should be made cautiously).

April 16, 1908 = 1,000

1982 = 1,500 – 2,000

1998 = max 1,785, avg. 828

1999 = max 1,556, avg. 917

2001 = max 1,125, avg. 446

2003 = max 3,127, avg. 694

CAPE PEIRCE

- Ground monitoring declining
- Moving towards camera-based monitoring
- Deployed remote cameras 2010 to present

While walrus use of the haul-out at Cape Peirce seems to be occurring later in the year, there are a few caveats. Prior to the use of aerial surveys in 2003, the haul-out was monitored through mid-October. During this time, the annual peak count only occurred in October once. Since 2003 when aerial surveys began, the peak count at Cape Peirce has occurred in October twice, November once, and December twice (i.e., a period longer than the original observations).

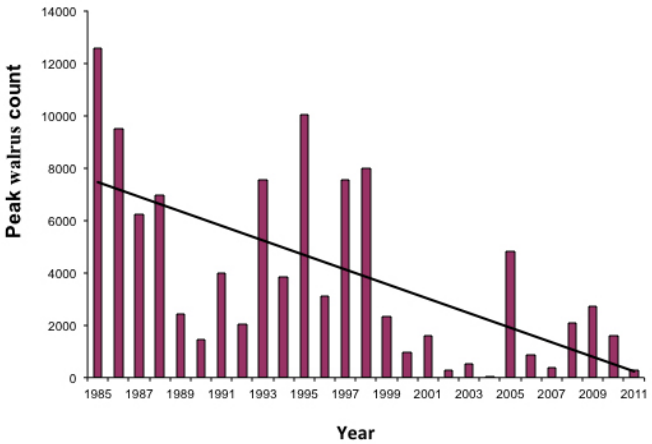


Figure 7 Annual peak count of walruses at Cape Peirce between 1985 and 2011.

There is a lot of variability in haul-out use at Cape Peirce. Twelve years ago, it was thought there was a cyclic pattern of walrus use at Cape Peirce. However, if the cycle had continued, we would have expected an increase in recent numbers (based on those cycles), but this has not been observed (Figure 7). Given that ground counts used to only be conducted through mid-October, trend data is limited. Observers are now using aerial surveys and camera monitoring to track walruses later in the year.

CAPE NEWENHAM

- Aerial Surveys

Cape Newenham does not have cameras installed at the haul-out beaches and surveys have been sporadic over different seasons (Figures 8 and 9).

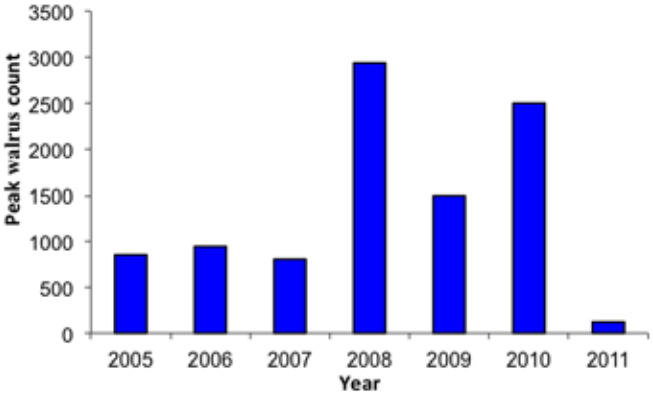


Figure 8 Peak annual count of walruses at Cape Newenham between 2005 and 2011.

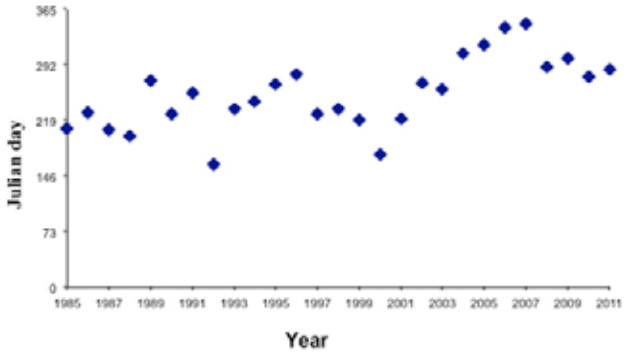


Figure 9 Seasonal timing of peak annual count of walruses at Cape Newenham between 1985 and 2011.

Walruses in snow at Cape Newenham. Courtesy Photo

HAGEMEISTER ISLAND (Currently the primary haul-out used by subsistence hunters.)

- Aerial surveys 2005-2010
- Remote cameras deployed 2011

Hagemeister Island has emerged as a relatively new haul-out. As a result, regular monitoring of this haul-out is also new. Some of our highest recent counts in Bristol Bay came from Hagemeister Island (2008 through 2010; Figure 10). Aerial surveys provided limited data, so remote cameras have replaced them to gain more information on when walruses are using this haul-out.

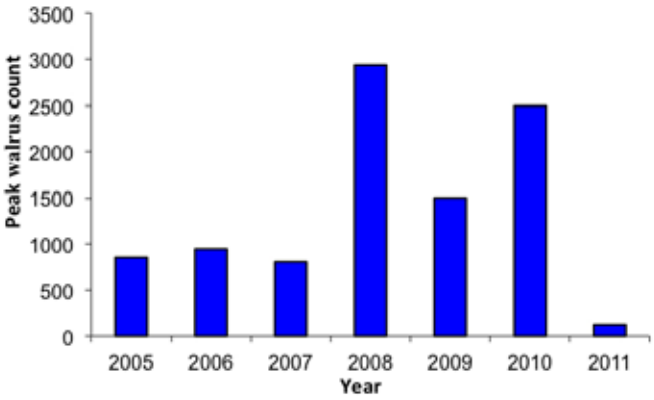


Figure 10 Peak annual count of walruses at Hagemeister Island between 2005 and 2011.

BRISTOL BAY WALRUS HAUL-OUT DATABASE

- ADF&G is working on quality assurance and quality control for data capture and management of Round Island data.
- USFWS is working on quality assurance and quality control related to capture and management of Togiak National Wildlife Refuge haul-out data.
- Bristol Bay data will be included in the Pacific Walrus International Database in the future.
- USFWS and USGS are developing frameworks for long-term data storage and providing data over the internet.

ONGOING QUESTIONS TO BE RESOLVED INCLUDE:

1. Would simultaneous monitoring of all walrus haul-outs help us understand the walrus population better?
2. How do we collaborate on consistent data-collection protocols?
3. Will cameras be a viable solution to monitoring all Bristol Bay haul-outs?
4. How do we coordinate data archival and analysis for the entire bay?
5. How can we better link data to management decisions?

QUESTION (*James*): Are there any efforts to provide a correction factor to standardize data from ground-based cameras and aerial surveys?

ANSWER (*Michael*): We are working on that protocol.

QUESTION (*Patrick*): Have you looked at the survey frequency that is necessary to monitor trends?

ANSWER (*Ed*): No.

QUESTION (*Stanislav*): Is there coordination between ADF&G and USFWS on data collection and analysis?

ANSWER (*Ed*): There is some, but not real time. Data is compiled towards the end of the year and reports are shared from the different sites (e.g., Cape Seniavin).

COMMENT (*Joel G-M*): Currently, there is no Bristol-Bay wide data synthesis, only some episodic analyses done by Mark Udevitz. Cape Seniavin is clearly an important site, but there is no systematic method for monitoring it, which is a clear gap in our data.

Satellite walrus imagery

Varvara Semenova, Marine Mammal Council

A 2011 pilot study of Atlantic walruses fitted with satellite tags led to 35 satellite images of a haul-out region around Vaygach Island (immediately south of Novaya Zemlya). The images (0.7 m resolution) are taken from an altitude of 500 km and an inclination of 97.3°. Images are taken every 3-4 days, and each captures a 7 km^2 area. The images allowed location of haul-outs and number of walruses to be assessed. The same methodology was then used at Cape Kojevnikova and Cape Schmidt to assess Pacific walruses. Boundaries of haul-outs were marked and later verified on the ground.

ADVANTAGES OF SATELLITE ASSESSMENT OF HAUL-OUT SIZE AND LOCATION

- Up-to-date information about haul-out location and walrus distribution;
- Very high resolution;
- Ability to estimate the number of walruses at certain haul-outs;
- Relatively low cost; and
- Practical method for assisting ground or aerial walrus surveys.

DISADVANTAGES OF SATELLITE ASSESSMENT OF HAUL-OUT SIZE AND LOCATION

- Can only be done when clear (~40% of pictures are obscured by clouds);
- Image quality is dependent on shooting angle; and
- Surveys require ground component to assess detectability of walruses on shore.

QUESTION (*Anatoly*): How much does this cost?

ANSWER (*Varvara*): About 16,000 rubles (~$400-500) per image. Only good images are purchased – (i.e., it is unnecessary to purchase images taken on a cloudy day).

QUESTION (*Anthony*): How did the craft's operators find these locations?

ANSWER (*Varvara*): The operators moved the satellite to areas where we thought there was high probability of a haul-out.

COMMENT (*Joel G-M*): When exploring QuickBird as a satellite platform, there were problems associated with the vapor (clouds) caused by the walrus on a haul-out.

Marine mammal aerial surveys in the Chukchi Sea

Cynthia Christman, Alaska Fisheries Science Center

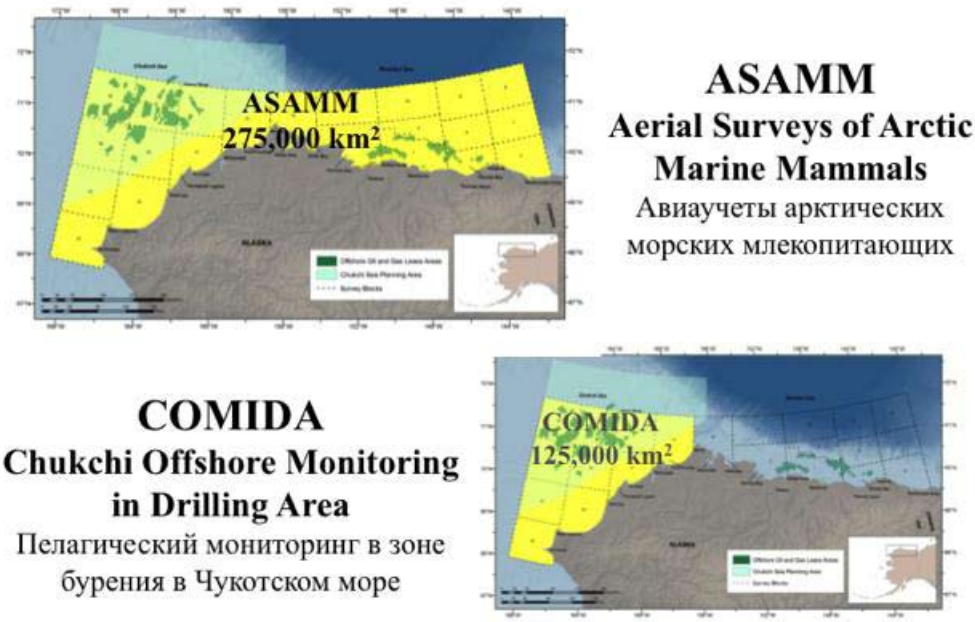


Figure 11 Spatial coverage of the Aerial Surveys of Arctic Marine Mammals and Chukchi Offshore Monitoring in Drilling Area.

The Alaska Fisheries Science Center, working through an interagency agreement with the Bureau of Ocean Energy Management is building from the earlier Aerial Surveys of Arctic Marine Mammals in the Beaufort Sea (Figure 11). One of the primary objectives is to document distribution and relative abundance of marine mammals in the Chukchi and Beaufort seas during the open water seasons. The offshore lease areas are the primary targets for the surveys.

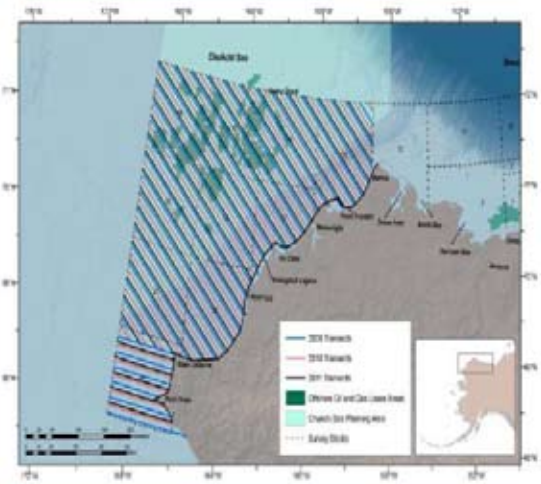


Figure 12 Coverage for Chukchi Offshore Monitoring in Drilling Area aerial surveys.

Systematic surveys were conducted of the coastline from mid-August to early October in 2009-2011. Whereas previous studies were more focused on cetaceans, and not pinnipeds such as walruses, 2012 marked the second year of a five-year project to better document pinnipeds.

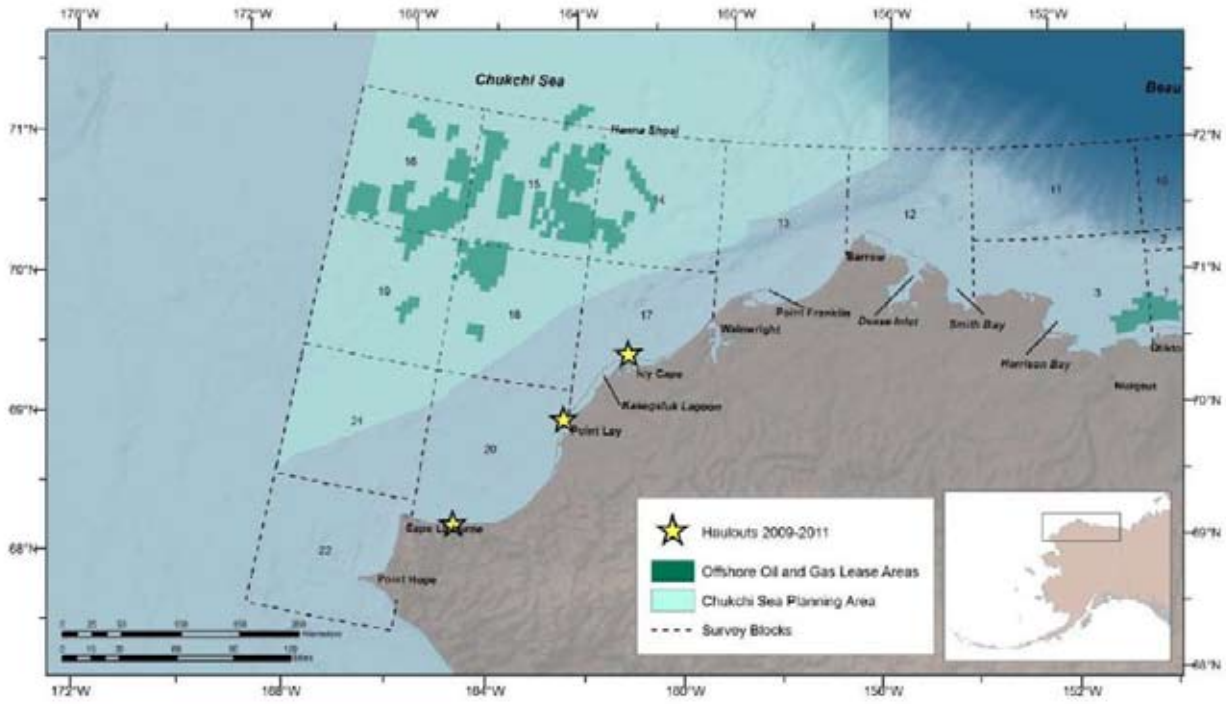
A fixed-wing, twin-engine aircraft with observers and a data recorder were used for the surveys. Effort, environmental conditions, and sightings were recorded. A custom data collection program is interfaced with a GPS to give real time mapping. Pictures were taken of coastal haul-outs or carcasses, and Level A stranding reports filled out if necessary. Coastal flight transects were offset 1 km from shore, and flown at a frequency of once per week at an altitude of about 400 m, maximizing visibility while minimizing disturbance of marine mammals (Figure 12).

Original plans sought to fly directly over haul-outs at an altitude of about 600 m to take vertical photographs from a belly port in the aircraft. Unfortunately, the earlier approaches flushed about 200 animals. After consultation with USFWS (Joel Garlich-Miller), we hypoth-

esized that the beach topography had amplified noise. These haul-outs were up against steep cliffs, and noise from the plane may have been bouncing off the cliff face. After this incident, we decided to be conservative and only fly offshore from haul-outs requiring photographs be taken at an oblique angle.

We found three locations with haul-outs (Figure 13): Icy Cape, Point Lay, and Cape Lisburne (walruses observed on Cape Lisburne haul-out on only one day).

Overall, the timing of haul-out use in Alaska ranged from mid-August to early October with the greatest range across a season (in conjunction with greater survey effort) in 2011 (Figure 14).



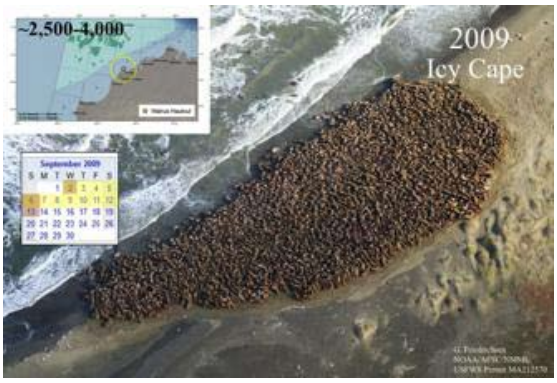


Figure 13 Location and aerial images of the three walrus haul-out locations observed during Chukchi Offshore Monitoring in Drilling Area surveys.

This effort is the only broad-scale aerial survey on the northwest Alaskan coast; however, due to the diverse objectives of the survey, there are a few issues that needed to be resolved. October surveys have been hampered by weather, and the sea state can reduce the number of potential haul-outs. Surveys south of Point Lay had to be abandoned in some cases when storm surges swamped the entirety of coastal beaches. Furthermore, much less survey effort has been given to the coastline from Point Lay to Point Hope because it is less relevant to the immediate survey goals of describing marine mammals in the Chukchi lease areas. Consequently, some areas may not have been surveyed frequently enough to observe haul-outs. With funding and personnel, an ideal survey would run from Barrow to Point Hope in a single flight (not segments as done now) and every week.

In addition to issues over frequency and coastal coverage, several factors still need to be addressed concerning aircraft configuration; correcting oblique versus vertical images; lack of a dedicated camera and high-quality photo window (versus Plexiglas); and effort trade-off between reporting presence/absence versus group-size or demographics.

The historical database for survey data can be found at: http://www.afsc.noaa.go/nmml/cetacean/bwasp/index.php

Figure 14 Timing of haul-out activity as observed during Chukchi Offshore Monitoring in Drilling Area surveys.

QUESTION (*Vladimir*): How long does it take to do all transects on the Chukchi coast (i.e., including offshore – not just the coastal pinniped surveys)?

ANSWER (*Cynthia*): We start surveying in June/July – early on we like to go from Barrow to Point Hope against the migration to minimize duplicate animals (and vice versa later in the season). One survey day (five hours) is enough for two or three transect lines, and we have a total of 33 transect lines. Transects are different lengths but 15 flights and two weeks are needed to accomplish an entire survey.

QUESTION (*Anatoly*): Some images are at a significant angle to the coast – have you assessed the necessary correction factor for animals hidden behind one another? Could you use an over-flight and then a series of others at different angles to calculate a series of correction coefficients based on offset to the beach and angle of observation?

ANSWER (*Cynthia*): We would ideally like to fly straight overhead with a wide-angle lens to get a footprint and then fly at a lower altitude, using telephoto pictures to subsample the herd to determine density. However, we remain concerned about overflying haul-outs with cliffs and disturbing walruses. We are considering trying to do a transformation called a rubber-stretch. This is a GIS technique where an image is transformed so it looks flat, but this would still need calibrating as Anatoly mentions.

COMMENT (*Joel G-M*): It is important to clarify the objectives for the specific haul-out monitoring in question. Here, our focus is on distribution – not abundance. If that is the goal (and orders of magnitude of use is sufficient) then concerns about stampedes clearly take precedence. Getting higher-resolution data to get actual abundances must be balanced with risk to the animals.

Present status of the Pacific walrus in the Russian Federation

Anatoly Kochnev, Chukotka Branch of the Pacific Research Fisheries Center (Chukot-TINRO)

Courtesy Photo

The range-wide map, shown at the start of this session, plots all incidences of walruses coming out on shore at any time. This was used to single out the most important areas for walruses in summer and fall. The largest numbers of haul-outs are in the Bering Strait and the goal here is to look at trends in appearance and disappearance of those haul-outs.

1800s: In the nineteenth century, there was broad coverage of walrus haul-out use, but observations are from a wide array of sources.

1900-1910: There is little information during this timeframe. Large haul-outs were documented in Anadyr Gulf and from the first expedition to Wrangel Island. Very variable data can be derived from explorers, whalers, and traditional knowledge; however, there is very little scientific data.

1920s: Intensive exploration of Chukotka, but very limited information on haul-out sizes.

1930s: Walrus hunting with Natives in conjunction with Soviet vessels. This is the first period when trained biologists made observations. Most haul-outs at that time were concentrated on the Chukotka Peninsula and Wrangel Island (less in southern part of the range).

1940s: Little information was collected during the war. Walrus numbers are thought to be very low and number of haul-outs few.

1950s: No haul-outs were documented in the southern region (south of Gulf of Anadyr).

1960s: Aerial surveys started. After a long period, some haul-outs appear in the southern part of the range.

1970s: More walruses in the southern part of the range. Primary haul-outs remain in Bering Strait and

on Wrangel Island. A few haul-outs are recorded in the Chaun Bay area.

1980s: No haul-outs documented on the northern shore of the Chukotka Peninsula. Few walruses documented on Wrangel Island. Many walruses documented on Bering Strait sites and in the southern parts of the range along the Kamchatka and Koryak coasts.

1990s: Fewer haul-outs in the southern range with fewer numbers of walruses. Wrangel Island haul-outs grew very large and were the biggest in the whole area at the time.

2000s: No aerial surveys, just direct observations and Traditional Ecological Knowledge (Figure 15). Numbers on Wrangel Island declined, but increased on Kolyuchin (where some people were unable to get in their houses at times due to walruses), and on the north shore of the Chukotka Peninsula. During this time, concerns developed that harvesting was reducing the population.

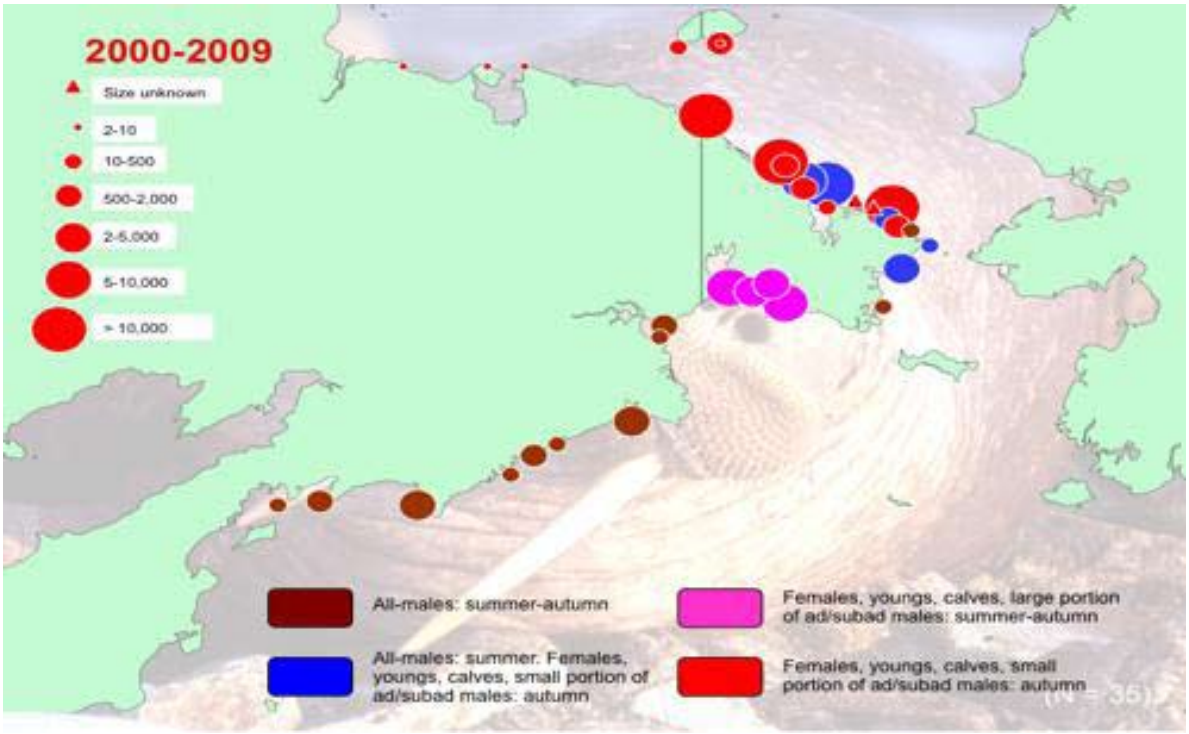


Figure 15 Size and demographic usage of walrus haul-outs on the Russian Federation coastline from 2000-2009.

SUMMARY

Overall, there are fluctuations in the distribution of haul-outs between the south and the north over time. Current thought is that haul-out use depends on sea ice. Northern parts of Anadyr gulf are the most stable haul-outs. From 1983 to 2008, walrus numbers at the southern haul-outs declined. This is a very similar picture to what was reported for Bristol Bay (perhaps the same factors are causing the declines).

There is high seasonal variability at haul-outs and profound inter-annual differences (Figures 16 and 17). In 2011, when Chukot-TINRO monitored four sites with the help of USGS and Wildlife Conservation Society, many walruses hauled out in small groups according to the Native people in Chukotka. The decrease in numbers in the early season is likely a result of the large numbers of walruses at Point Lay in Alaska.

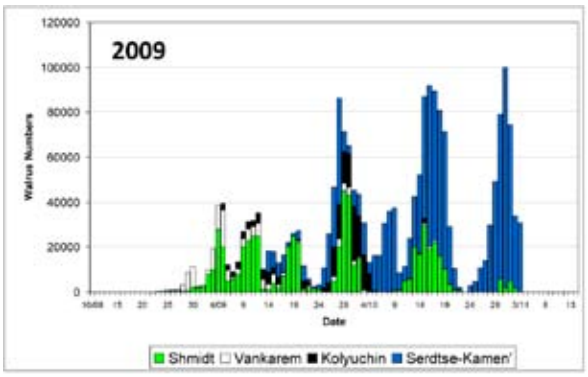
QUESTION (*Joel G-M*): Can you talk a bit about reasons for changing distributions.

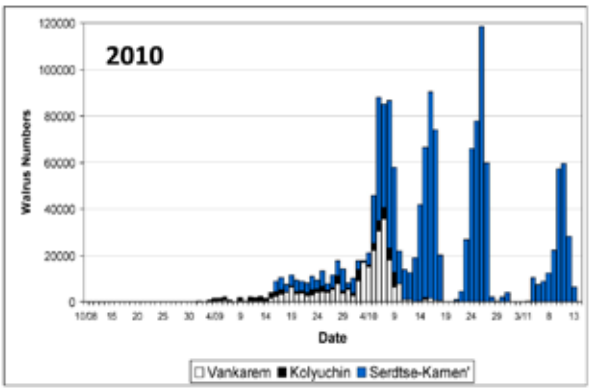
ANSWER (*Anatoly*): Confounding impacts from anthropogenic factors and the change in sea ice make analysis difficult. However, new data for estimated sea-ice concentrations in the first half of the 20th century may be available in the near future.

COMMENT (*Lori*): Food availability may also be a factor in walrus distribution – if they use an area for a while, they might need to move elsewhere for new food.

ANSWER (*Anatoly*): I agree. Food sources can cause movements of walruses from haul-out to haul-out. Decreases in numbers on one haul-out and increases on another can be explained (if there are no changes in ice or hunting pressure) through food changes.

COMMENT (*Stanislav*): Harvest, sea ice, and changes in food sources all affect distribution. However, changes in biomass of benthic communities are linked to changes in whole ecosystems and the effects of climate changes and oceanography.





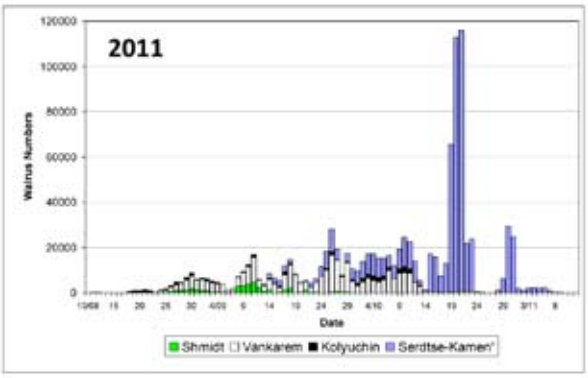


Figure 16 Seasonality of coastal haul-out use at major Chukotkan haul-outs in 2009, 2010, and 2011.

WEST HAULOUTS: FIRST HAUL OUT DATES

Area	Years	N (except 2007)	2007	Other years, lim	Difference, days
Wrangel Island	1958-2008	19	Aug 05	Aug 29 – Sep 28	24
Cape Shmidt	2007-2008	1	Aug 28	Sep 20	23
Vankarem	2002-2008	6	Aug 05	Aug 30 – Sep 25	25
Kolyuchin Island	2002-2008	4	July 14	July 25 – Aug 24	11

WEST HAULOUTS: LAST HAUL OUT DATES

Area	Years	N (except 2007)	2007	Other years, lim
Wrangel Island	1958-2007	16	Sep 21	Sep 3 – Oct 23
Cape Shmidt	2007-2008	1	Oct 21	Oct 21
Vankarem	2002-2008	5	Oct 22	Oct 1 – 29
Kolyuchin Island	2002-2008	3		Oct 1 – 26

EAST HAULOUTS: LAST HAUL OUT DATES (local communications)
Usually for 2000s – middle of November, 2007 – 10-15 December

Figure 17 Timing of occupancy for select walrus haul-outs on the Russian Federation coastline from 2000-2009.

PRIORITIES AND RECOMMENDATIONS

PRIORITIES

There was wide consensus that clear objectives should be set for any survey effort that could disturb walruses, particularly those using aerial survey techniques. For several efforts discussed in this session, emphasis was placed on greater stand-off distances because key objectives are presence/absence of animals and can be assessed in the orders-of-magnitude. It is the mixing of goals associated with assessing broad-scale distribution and abundances of haul-outs with fine-scale assessment of individual haul-outs that resulted in many of the challenges raised in this section.

A priority of identifying new haul-outs was addressed, including opportunities to expand the Chukchi Offshore Monitoring in Drilling Area flight capacity to include a single, weekly flight from Barrow to Point Hope. Russian Federation participants also emphasized the need to increase funds available to support long-term monitoring of the 12 large priority haul-outs on the Chukchi coast (see Section I, Figure 5).

RECOMMENDATIONS

- Update range-wide haul-out distribution map in accordance with the relative importance for the animals and how regularly they are used. Include Traditional Ecological Knowledge to fill in gaps in the historical haul-out locations.
- Continue to compile data on haul-out use in Kamchatka and along the Koryak Coast to confirm the continued shrinking of range-wide habitat utilization.
- Synthesize Bristol Bay-wide data.
- Develop protocols for use of remote cameras to monitor across a region (such as Bristol Bay).
- Assess practicality of a weekly aerial survey from Barrow to Point Hope to monitor walrus haul-outs in the fall.
- Standardize methods for collecting and processing information from aerial surveys. A lot can be done with few resources. For example, establish correction factors for counting walruses from oblique aerial photographs.
- Continue use of satellite tags to better understand linkages between haul-outs.

SESSION IV:
MONITORING MORTALITY AND MORBIDITY AT COASTAL WALRUS HAUL-OUTS

Session Chair: Raphaela Stimmelmayr, North Slope Borough, Department of Wildlife Management

BACKGROUND

Disturbance-related mortality at coastal haul-outs along the Chukchi Sea coast is an emerging conservation and management issue for the walrus population. Information about the sources and effects of disturbance-related mortality is needed to inform conservation and management efforts and population projections. Crowding, climatic and nutritional stressors, and prolonged exposure to land-based environments are also creating conditions favorable for the introduction and transmission of diseases. Data on the regional prevalence of diseases is crucial to get a better understanding of underlying disease dynamics and etiology.

SESSION GOALS AND OBJECTIVES

- Review existing information on sources and levels of morbidity and mortality at coastal haul-outs.
- Discuss priorities and approaches for enumerating (or estimating) mortality rates at coastal haul-outs.
- Develop recommendations concerning field methods and surveillance tools to monitor health and disease status of walruses at Russian Federation and Alaskan haul-outs.

Monitoring mortality at coastal walrus haul-outs in Alaska

Joel Garlich-Miller, U.S. Fish and Wildlife Service

Figure 1 Walrus mortality event, Icy Cape, September 2009. Photo: Craig George, North Slope Borough

Disturbance-related mortality at coastal walrus haul-outs is an emerging conservation and management concern. Walrus calves, which typically have high rates of survival, are particularly vulnerable to trampling injuries and mortalities at crowded coastal haul-outs. Resource managers are becoming increasingly concerned that declining juvenile survival rates could have negative effects on the population. Recent population modeling efforts suggest that an increase in haul-out-related mortality of calves could have a greater effect on the population than an equivalent increase in harvest-related mortality (which is distributed among all age classes) because calves have a greater potential to contribute to future population growth. Therefore, disturbance-related mortality of calves at coastal haul-outs may have relatively important population consequences. Information about sources and levels of mortality at coastal haul-outs is needed to inform population models and develop effective conservation and management strategies for this species.

Large coastal haul-outs occupied predominately by females and dependent young have become well-established along the Chukchi Sea coast of the Russian Federation over the past decade. Coastal haul-out sites are not (yet) as well established along the Chukchi Sea coast of Alaska. Prior to 2007, there was only intermittent use of coastal sites on the Arctic coastline – typically during the fall migration. Walruses occupying coastal haul-outs typically stayed for a period of a few days or weeks before continuing on their southern migration. The best known and most consistently used fall haul-out site occurs at Cape Lisburne where herds of 2,000-5,000 walruses are regularly observed in late September and October. Walruses have only begun to occupy coastal haul-outs during

the summer months in Alaska, presumably in response to the loss of summer sea-ice habitats in offshore regions of the eastern Chukchi Sea. In August 2007, scattered herds of walruses were reported at several locations along the Alaskan coast between Cape Lisburne and Point Barrow. Aggregations of up to 2,000 animals were observed at Point Lay, Icy Cape, and at an area just north of Cape Lisburne known locally as Corwin Bluff. Aerial survey efforts also documented many single animals and mother-calf pairs hauling out at various locations along the coast in mid-August. In 2008, sea ice persisted in offshore regions of the eastern Chukchi Sea and no walrus haul-outs were reported along the Alaskan coast. In the summer of 2009, offshore sea ice persisted through August, and coastal haul-outs did not form until September. The coastal haul-outs that did form were relatively small (3,000-5,000 animals in some locations) and only persisted for a period of three weeks. In 2010 and 2011, offshore sea ice disappeared by early August and a large coastal haul-out (10,000-40,000 animals) formed near the community of Point Lay in late-August and was occupied through the end of September.

Mortality levels along the Chukchi Sea coast of Alaska have been relatively modest in comparison with the reports from Russian Federation haul-outs in recent years. In September 2009, a mortality event involving approximately 150 walruses was reported at Icy Cape (about 80 km from Wainwright). A herd of 3,000-5,000 walruses was observed at the site by a National Marine Fisheries Service Chukchi Offshore Monitoring in Drilling Area survey crew a week prior to the discovery of the carcasses. A response team composed of the Alaska SeaLife Center, North Slope Borough, and local hunters from Wainwright was mobilized to examine the carcasses. Based on evidence of extensive bruising and the observation that all carcasses were calves or yearlings, the investigative team concluded that the cause of death was consistent with trampling by other walruses. While disturbance from aircraft could not be discounted, investigators found no evidence of hunting or other recent human activities near the carcasses. Several of the carcasses had been scavenged by polar bears or brown bears; however it is unknown whether bears caused the disturbances that may have led to the mortalities or were drawn to the site later to scavenge carcasses.

In recent years in Alaska, walrus herds have concentrated primarily at the Point Lay walrus haul-out site. In 2010, a herd of more than 40,000 walruses used the site. In 2011, herd size peaked at approximately 20,000 in late August. In 2010, the community of Point Lay, ADF&G, and the North Slope Borough partnered to initiate carcass surveys near the Point Lay haul-out site. Mortality rates at the Point Lay haul-out have been relatively modest (less than 50 animals per year) likely due to the efforts of local villagers to keep disturbances at the site to a minimum.

Although mortality rates are expected to be higher at coastal haul-outs than in offshore ice environments, there is only sparse information available to quantify disturbance-related mortality at the present time. Monitoring programs need to be developed to assess mortality along the coast. Ideally, this effort would be coordinated with ongoing efforts in the Russian Federation to get a comprehensive picture. Information on the distribution, abundance, and demographics of walrus carcasses along the coast could provide a gross estimate of annual haul-out-related mortality and perhaps an index of changes in mortality levels over time. There are several potential streams of information on carcass locations in the United States and the Russian Federation (e.g., haul-out monitoring programs, stranding reports, local observations) and there is a recognized need to get all these various sources of information into a standardized format and database for analysis.

COMMENT (*Anatoly*): To do surveys of walrus remains at coastal haul-outs, surveys need to be done quickly because they are frequently washed to sea or redistributed by surf action. If you use a marking system (e.g. flipper tags, or cutting off digits on the rear flipper) this can help prevent double counting carcasses.

COMMENT (*Anatoly*): Animals that are traumatized during a stampede often move into the water and die there. This is particularly true of calves that get carried out to sea by the stampeding herd. If they have air in them, they may surface and wash ashore, but if crushed, they will not. Consequently, we don't know how to estimate true mortality rates as we are probably only seeing some of them. It is important to understand that carcass counts can be a useful baseline or index but they are unlikely to reflect absolute numbers.

COMMENT (*Anatoly*): Another approach to assessing mortality would be to monitor herd demographics (i.e., examining the age and sex composition of animals at coastal haul-outs), or female-calf ratios at the haul-outs. Demographic studies are probably the best option for estimating or quantifying age-specific mortality rates.

COMMENT (*Joel G-M*): Information on carcasses comes in from a variety of locations and sources. It would be desirable to try to standardize and coordinate data collection efforts (nationally and internationally) and to develop a shared database to get a comprehensive picture of mortality rates along the coast. (See "Priorities and Recommendations" section for further details.)

Mortality levels at coastal haul-outs in Chukotka in fall 2007

Anatoly Kochnev, Chukotka Branch of the Pacific Research Fisheries Center (Chukot-TINRO)

In the Russian Federation, the large coastal haul-outs along the Chukchi coast, which are occupied primarily by females and dependent calves have the most serious mortality events. Historic reports of large mortality events date back to the 1930s, although they did not appear common or widespread. In the late 1950s and 1960s there were a series of large mortality events documented on the Punuk Islands (St. Lawrence Island, Alaska). Unfortunately, there is not good information on historic mortality levels at Russian Federation haul-outs until the haul-out monitoring programs began in 2003. Although there is not complete coverage of all Russian Federation haul-outs, researchers can say with some degree of confidence that mortality levels at coastal haul-outs have risen significantly over the past decade; particularly in 2007 when walruses occupied haul-outs over a much longer window than normal.

Over the last 20 years, the distribution of walruses has moved north, presumably in connection with the reduction of ice in the Arctic seas. The number of walruses summering in the Bering Sea has declined significantly since the 1980s, as has the proportion of females occupying mixed coastal haul-outs in the Gulf of Anadyr. Walruses are now using a very restricted area of coastal waters in the summer for feeding, generally within 60 km of shore during the ice-free season in the Chukchi Sea. With the loss of sea-ice habitats in offshore areas of the Chukchi Sea, the number of animals using coastal haul-outs on the Chukchi Sea coast and the duration of time they are restricted to land-based haul-outs has increased.

While on haul-outs, walruses are prone to stampeding when predators are present, including feral dogs or wolverines, which would not normally kill a walrus directly. Predation almost always leads to stampedes, and more abortions occur during these events as well. Population recruitment appears to have been affected by increased abortion rates and high calf-mortality levels on coastal haul-outs. Analysis of mortality data over time suggests that years of high calf mortality are correlated with sparse ice conditions (Figure 2).

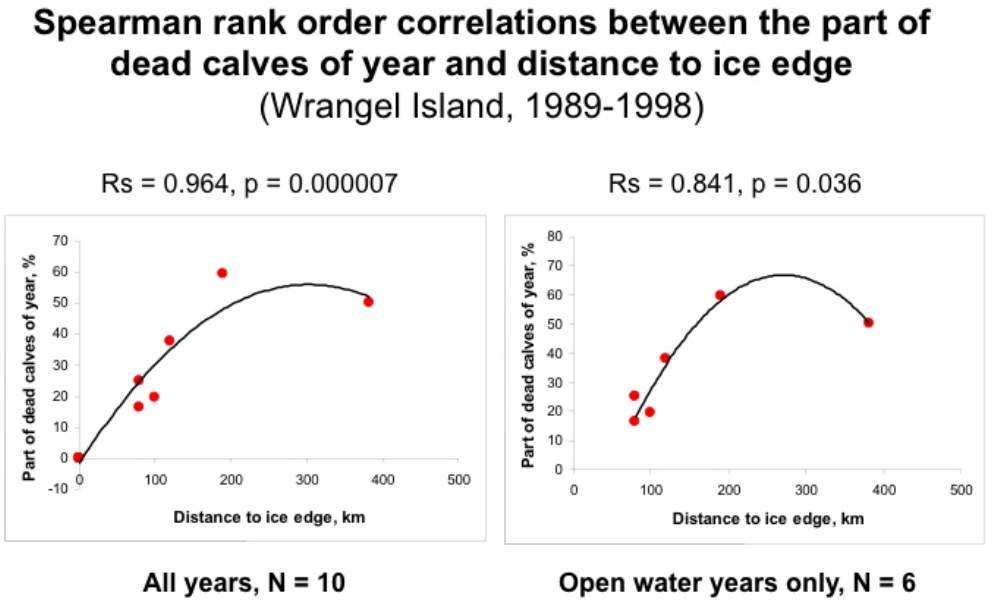


Figure 2 Correlation between calf mortalities at coastal haul-outs and distance from the offshore pack ice (Data from Kochnev).

ESTIMATING THE SIZE AND DEMOGRAPHICS OF WALRUS MORTALITIES AT COASTAL HAUL-OUTS IN 2007

In 2007, the continental shelf of the Chukchi Sea was completely free of sea ice by mid-August. The ice edge eventually retreated hundreds of miles north of the continental shelf and ice did not begin to form again until late-October. Large aggregations of walruses formed at coastal haul-outs along the Russian Federation Chukchi Sea coastline in August, and the animals stayed much longer than normal (into November and December).

Many walrus carcasses were observed at coastal haul-outs along the Russian Federation coastline in the fall and winter of 2007 (Table 1). It is likely that many more carcasses were swept to sea and not observed. All told, it is estimated that between 3,000-10,000 walruses died along the Chukotkan coastline during the summer and fall of 2007. Most of the animals appeared to have died from trampling associated with haul-out disturbances. The sex-age composition of dead walruses at the Cape Vankarem haul-out in 2007 suggested great vulnerability of the young of the year calves.

Area	Observed Carcasses	Corrected Estimate
Wrangel Island	96	96
Cape Schmidt	577	888
Coast from Cape Schmidt to Nutepel'men	200	200
Cape Vankarem	300	320
Kolyuchin Island	30	340
Coast from Nutepel'men to Enurmino	Uncertain – many	100
Vicinity of Enurmino	120	150
Cape Serdtse-Kamen	120	185
Chegitun	870	870
Vicinity of Inchoun (within 13 km)	100	100
Vicinity of Uelen	30-40	200
TOTAL	**~2,613**	**3,449**

Table 1 Estimation of walrus mortalities on the Chukchi coast, fall 2007.

QUESTION (*Joel G-M*): What data is currently collected from carcasses at the Russian Federation haul-outs?

ANSWER (*Anatoly*): At a minimum, carcass location, sex, and age (e.g., cow, calf, sub-adult, male).

QUESTION (*Chad*): Are there any qualitative or quantitative methods to evaluate body condition of the carcasses?

ANSWER (*Anatoly*): We have not developed a quantitative method for determining body condition, as has been done for polar bears. We just note when we see shoulder blades or that the skin is hanging in folds indicating that the animal is clearly emaciated. Anecdotally, it looks like walruses at Kolyuchin and Serdtse-Kamen get thinner the longer they occupy the haul-outs although there is considerable variation amongst individuals.

COMMENT (*Nikita*): You need to mark carcasses so they are not counted twice. Flipper tags can be torn off by the surf, so we cut off the big toe from the right hind flipper. Even if a carcass is washing in the surf you can usually pull up a rear flipper to inspect and mark it.

COMMENT (*Anatoly*): We can collect data on the number of carcasses through coastal surveys and inspect some of them to try to determine cause of death; however, unless you are actually present at the haul-out when a disturbance event occurs it is difficult to correlate the number of dead bodies with the number of disturbances. Some of the remote surveillance tools discussed in the haul-out monitoring session may help provide some insight into the frequency and sources of disturbance events. It is important to point out that some crushing deaths of calves will occur even if there are no noticeable disturbances.

Ulcerative dermatitis disease syndrome – a new disease in walrus and ice seals?

Raphaela Stimmelmayr, North Slope Borough
Joel Garlich-Miller, U.S. Fish and Wildlife Service
Willard Neakok, Native Village of Point Lay

Figure 3 Cases of ulcerative dermatitis disease syndrome observed at the Point Lay walrus haul-out in September 2011. Photos: Raphaela Stimmelmayr (NSB DWM) and Tony Fischbach (USGS)

During September 2011, hunters and USGS wildlife biologists reported bleeding skin sores on some walruses that hauled-out onto the barrier island near the coastal community of Point Lay, Alaska. In response, USFWS wildlife biologists in collaboration with the North Slope Department of Wildlife Management's wildlife veterinarian and local hunters travelled to the site in September and October and conducted two ground-based coastal surveys. Fifty-one carcasses found near the haul-outs were examined. Cause of death could not be determined for the individual carcasses, but many animals exhibited injuries associated with trampling (e.g., bleeding from the nose, bruises, crushed chest). Reports of ulcerated skin lesions were confirmed on some of the fresh carcasses, which were inconsistent with tusk strikes or similar injuries. Many (but not all) of the carcasses with skin lesions also had signs of trampling injuries, raising the possibility that these two factors might be related; if animals were sick they might have been slower moving and more vulnerable to trampling. However, the mortality rate appeared small compared to the size of the walrus herd (~20,000) aggregated at Point Lay.

Carcass surveys also confirmed the presence of ulcerated skin lesions on many of the walrus carcasses. Ulcerated skin lesions are characterized by surface tissue being lost and/or necrotic (dead). Calves and sub-adults were the predominant age classes affected by these uncommon,

round skin lesions. The observed lesions had a generalized body distribution including the face and flippers. On the basis of several randomized herd surveys, approximately 6% of the estimated 15,000-20,000 live walruses hauled out on the barrier island appeared to be afflicted with the observed skin condition (age-class distribution: 65% sub-adults and 35% adults). Live animals observed with skin lesions appeared otherwise healthy and robust. Some of these had healing sores suggesting that the condition is not necessarily lethal. However, one very sick sub-adult male lying outside the herd had ulcerated lesions and was bleeding from the nose and mouth. This animal was euthanized and necropsied.

During the two surveys, two field necropsies were conducted: one on a fresh, beach-cast carcass of a female calf and one of the euthanized, sub-adult male. Some common gross findings were circular to elongated, fissured skin lesions of variable depth; congested, blood-filled lungs; soft, discolored liver; thymus depletion (calf); and swollen, wet lymph nodes. Some of the histo-pathological findings were dermal vasculitis (inflammation of skin blood vessels), hemorrhagic (blood-filled) lungs, myocarditis (inflammation of the heart muscle), hepatitis (inflammation of the liver), and lymphoid depletion. Initial epidemiologic, clinical, and pathologic findings are suggestive of an infectious process, most likely a virus, however despite exhaustive efforts, initial diagnostic investigations have not identified specific pathogens. Solitary or mixed bacterial growth has been detected but no significant bacterial isolates have been identified to date. Preliminary testing for bio-toxins (i.e. algal toxins) has been largely negative or at very low detectable levels. Thus the origin of the disease and the chain of events leading to it remain unclear.

In Alaska, the unusual skin condition in young walruses has only been observed at the Point Lay haul-out (Figure 3), and reporting from other Alaskan walrus hunting communities largely indicates healthy, unaffected walruses. Russian colleagues have observed walruses with similar skin lesions at coastal haul-out sites in Chukotka over the past decade. They report that the condition is most prevalent in younger age classes of animals, and typically in animals in poor body condition. Moscow zoo vets investigating the lesions said that they found bacteria of unknown origin in association with the diseased calves. They also see a lot of calves being aborted – particularly on rocks.

In December 2011, the National Oceanic and Atmospheric Administration and USFWS declared an Unusual Mortality Event for ice seals and walruses (2011 Northern Pinniped Unusual Mortality Event). Multidisciplinary and multi-institutional investigative teams have been established, and further diagnostic analyses (e.g., man-made toxins, radionuclides, contaminants, auto-immune mediated diseases, environmental factors) are ongoing. The ongoing disease investigation is a process of elimination of etiological factors. Some similarities exist between the symptoms observed in ice seals and walruses. However, the seal outbreak expanded temporally and geographically, whereas walruses have only been found with skin lesions at coastal haul-out sites. Alaskan native hunters have not seen skin lesions on walruses in the Bering Strait, so it is unknown if the seal and walrus condition is the same. In addition, the seal infection appears to result in high mortality, which is not the case for walruses. Both ice seals and walruses appear to be able to recover from the disease but more data is needed. There appears to be no zoonotic risk as no apparent cases of animal-human transmission of the disease have been reported. However, as a precautionary public health measure, hunters have been advised to use their customary and traditional practices when salvaging, butchering, and preparing walruses and seals for food (i.e., cooking of meat).

COMMENT (*Nikita*): We need to document how scavengers consume carcasses. Almost all diseased seals found on Wrangel Island beaches were only partially consumed by polar bears. Sub-adult male polar bears catch diseased seals to eat. However, how they consume diseased carcasses is very different from how they eat normal carcasses, suggesting they do not enjoy it. The consumed carcasses were not broken down (i.e., all the bones were together), so it appeared as though the polar bears were just pulling off the flesh similar to how an Arctic Fox would consume a carcass.

COMMENT (*Anatoly*): When a mortality monitoring form is created for multiple parameters, don't forget that the biologists doing monitoring are always busy; so please select the most important parameters. To obtain a good sample from a herd, researchers doing the age/sex composition (of hundreds of animals) could add other simple health observations, but would need to know the one or two features that are most valuable. In Chukotka, it would be difficult to measure depth of blubber as most animals lay on their stomach. I also don't understand why length is needed; it is a waste of time if age has already been established. One needs distance from body to edge of surf to know if the animal died on the beach where observations are being made or if it drifted there. Also important, is date of discovery, date of assumed death, if there are decomposition gases, notes on skin condition, and if the carcass is intact or not.

COMMENT (*Anthony*): We need notes if the neck is damaged and if it is bleeding out of the nose, etc.

COMMENT (*Sergei*): We need to note if an animal is misshaped as a result of emaciation or internal organ pathology.

COMMENT (*Stanislav*): It is important to record all the details that can relate to the cause of death.

QUESTION (*Lori*): Do people think that surveying the periphery of a herd, where we've already heard that the sick animals congregate, would be effective?

ANSWER (*Joel G-M*): Looking at animals closely is more important than their position in the herd. Ideally we would take random picks, but that is just not possible. We will try to target the sick animals and document the age group of any assessed animals. Right now our focus is on the presence or absence of sick walruses at a haul-out.

COMMENT (*Sergei*): I saw animals with lesions on their heads. Local people say the disease is spread when walruses press muzzles together when they meet in water – a kind of "kiss" by touching whiskers with other animals. We know that when they fight, they try to hit each other on the head. Walruses scratch themselves – sometimes against each other or on rocks.

COMMENT (*Eduard*): Last fall, nobody paid attention when we informed Russian Federation authorities about the disease and that scientists from the United States were investigating it. Only after additional information was received were some samples taken for analysis. I am not complaining, but given that this is our way of life, perhaps it would be possible for United States' agencies to ask their Russian Federation counterparts to inquire about whether anything is wrong and support information exchange. Last year, we had to translate flyers developed for Barrow to share information with our villages.

COMMENT (*Nikita*): We need to go higher in the government than Chukot-TINRO.

PRIORITIES AND RECOMMENDATIONS

PRIORITIES

Monitoring sources and levels of mortality at coastal haul-outs

Information about sources and levels of mortality occurring at coastal haul-outs is needed to inform population models and develop effective management strategies to mitigate disturbance-related mortality at coastal haul-outs. There are many logistical challenges in getting a reliable census of annual mortality at coastal haul-outs. Most of the haul-outs form in remote, unmonitored locations and carcasses are prone to wash away or re-distribute along the coast over time due to surf action and ocean currents. Recommendations from workshop participants to overcome some of these logistical challenges included focusing monitoring efforts on a few, key haul-out sites and staffing them with on-site monitors during the haul-out season to document sources and impacts of disturbances. The application of remote surveillance equipment should also be explored and developed.

Information on stranded walrus carcasses can come from a variety of sources (e.g., haul-out monitoring projects, anecdotal reports from communities, formal and informal stranding response networks, dedicated and incidental coastal surveys) and is collected at a variety of resolutions (ranging from anecdotal observations of carcasses along the coast to detailed necropsy reports). There was consensus amongst workshop participants that efforts should be taken to try and standardize data collection methods to the extent possible and to develop a common shared database to store the information. Several workshop participants agreed to review a draft stranding form developed by the USFWS (Appendix 1, this session) and work towards developing a shared database.

It was noted by several workshop participants that while carcass counts could provide a useful index of mortality rates at coastal haul-outs, the results were likely to be negatively biased to an unknown degree. The collection of demographic information (i.e., age-sex composition of free ranging walrus herds) was recommended as the best approach to estimating rates of recruitment and survivorship between age classes.

Health assessment and disease monitoring at haul-outs

Morbidity and mortality rates in walrus populations are projected to increase with the ongoing shifting of species-specific ecological (e.g., sea-ice extent, ocean acidity) and epidemiological constraints (e.g., warming Arctic, immigration of non-native species, vectors, and pathogens) and the concurrent expanding development of offshore oil production sites and the general increase in Arctic marine traffic.

The causes and amounts of natural mortality among walrus populations are little known and not well documented. On the basis of case studies reported by Fay[1] natural agents of morbidity and mortality for walrus, in order of importance, are predation (including human harvest), intraspecific traumatization, mortality due to trampling, calf and yearling segregation, malnutrition, and starvation. Parasitism, although present, is not considered to be an important factor unless animals are otherwise debilitated. More recent case study reviews by the USFWS from subsistence-harvested walruses on St. Lawrence Island highlighted the presence of various tumors, trauma-associated lesions, and age-related degenerative changes. Among infectious causes, viral and bacteriological serology studies of subsistence harvested walruses have indicated exposure to some potentially pathogenic bacteria and viruses, but there is no evidence that these agents are significant morbidity/mortality factors in free-ranging walruses.

In September of 2011, walruses with an unusual ulcerative skin condition were reported at a coastal walrus

[1] Fay, F. H. 1982. Ecology and biology of the Pacific walrus, Odobenus rosmarus divergens Illiger. United States Department of Interior Fish and Wildlife Service, North American Fauna 74.

haul-out in Alaska. The cause of the disease syndrome remains unclear: laboratory testing for known pinniped disease agents have thus far proven negative. Russian Federation workshop participants noted that walruses with similar skin symptoms have been observed at coastal haul-outs in Chukotka in recent years. The syndrome appears to be most prevalent in younger age classes of animals. Afflicted animals often appear otherwise healthy and normal in appearance. No further investigations into the etiology of this unknown skin-disease syndrome have been conducted in the Russian Federation. Based on the 2011 field investigations at the Point Lay haul-out, there was some mortality associated with the disease syndrome. However, at this time there is not enough epidemiological data to assess disease burden and develop reliable baseline estimates for morbidity and mortalities associated with Ulcerative dermatitis disease syndrome among walrus populations. To improve our general understanding about the ecological importance of this "new" disease syndrome and other causes of natural morbidity and mortality in walrus populations, range-wide, haul-out-based health and disease monitoring efforts are recommended despite the many inherent caveats.

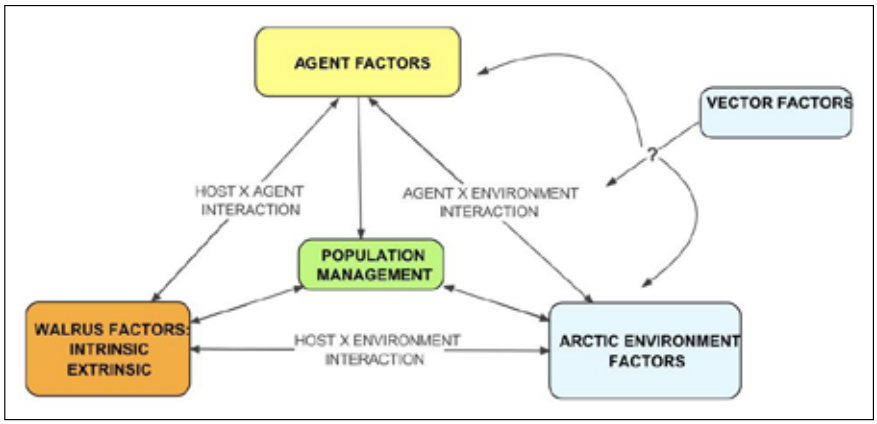


Figure 4 Epidemiologic triad for walruses.

A modified surveillance tool that addresses the general epidemiological priorities for reporting on the ulcerative skin syndrome as well as other disease conditions is needed. Health and diseases in free-ranging wildlife populations do not occur randomly but are always a manifestation of complex interactions between the host, the agent (current concept of agent has been broadened to include chemical and physical causes of disease or injury), and the environment (Figure 4). Through a standardized approach for recording observational health and disease data at coastal haul-outs in the Russian Federation and Alaska we will be able to detect and monitor for emerging disease syndromes and establish comparable baseline information on prevalence rates of known and unknown disease conditions; haul-out specific demographic disease distribution (i.e., age-classes and gender); geographic and temporal aspects of disease distribution; and host (e.g., body condition, reproductive status, age) and environmental (e.g., sea ice, temperature, wind) contributing factors.

The proposed disease surveillance at coastal haul-outs will complement established ecological research and subsistence foods bio-monitoring programs. In a changing Arctic ecosystem, walrus distribution, habitat use, and the ecology of disease agents (e.g., bacterial, viral, fungi, parasitic, algal biotoxins) as part of the ecosystem will be affected with expected changes in disease dynamics, trends, and potential new hosts. The expansion of disease investigations for walrus populations is a timely and much needed addition to long-term population studies.

RECOMMENDATIONS

- Monitor haul-outs to assess sources of disturbance, baseline threshold levels for responses by animals, and impacts (i.e., cause and effect), including habituation. Data would be used to promote responsible activities by oil and gas developers, tourism operators, and maritime transport interests throughout the range of coastally hauling out walruses in a manner that mitigates disturbance.
- Determine the sources and levels of mortality and morbidity at coastal haul-outs.
- Develop a standard, bilateral data collection format and shared database to monitor mortality of walruses at coastal haul-outs.
- Develop a standard, bilateral data collection format and shared database to monitor health and disease of walruses at coastal haul-outs.

Appendix 1. PACIFIC WALRUS MORBIDITY AND MORTALITY REPORT – LEVEL A DATA

ANIMAL ID:_____ **DATE OF OBSERVATION:**_____ **FWS ANIMAL ID:**

LOCATION:_____

LAT. (dec. deg.):_____ **LONG.** (dec. deg.):_____

EXAMINER:_____ **CONTACT INFORMATION:**_____

REPORTER:_____ **CONTACT INFORMATION:**_____

GROUP EVENT? ☐ YES ☐ NO ☐ UNKNOWN IF YES, NUMBER OF CARCASSES/SICK ANIMALS: ____ (within 100 meters of each other)

REPORT DETAILS: (SITE SPECIFIC AND CIRCUMSTANTIAL INFORMATION) _____

(USE BACK OF FORM FOR ADDITIONAL REMARKS)

ANIMAL STATUS: ☐ INJURED OR SICK ☐ FRESH DEAD ☐ MODERATE DECOMPOSITION ☐ ADVANCED DECOMPOSITION ☐ MUMMIFIED/SKELETAL ☐ CONDITION UNKNOWN

GENDER: ☐ MALE ☐ FEMALE ☐ UNKNOWN **AGE:** ☐ CALF ☐ YEARLING ☐ SUBADULT ☐ ADULT ☐ UNKNOWN

BODY CONDITION: ☐ NORMAL OR ROBUST ☐ EMACIATED ☐ UNKNOWN (if pelvic bones or rib cage are clearly visible –emaciated)

STANDARD LENGTH (cm): _____ ☐ ACTUAL ☐ ESTIMATED ☐ UNKNOWN (straight line measurement -snout to tail)

BLUBBER DEPTH AT STERNUM (cm): _____ ☐ UNKNOWN (depth of blubber + skin at sternum)

WOUNDS OR SIGNS OF TRAUMA? ☐ YES ☐ NO ☐ UNKNOWN IF YES, DESCRIBE BELOW

SKIN LESIONS ? ☐ YES ☐ NO ☐ UNKNOWN IF YES, DESCRIBE BELOW

OTHER TISSUE ABNORMALITES? ☐ YES ☐ NO ☐ UNKNOWN IF YES, DESCRIBE BELOW

BEHAVIOR ABNORMALITES? ☐ YES ☐ NO ☐ UNKNOWN IF YES, DESCRIBE BELOW

HUMAN INTERACTION? ☐ YES ☐ NO ☐ UNKNOWN IF YES, CHOOSE ONE OR MORE:

☐ BOAT COLLISION ☐ GUN SHOT/HARVEST ☐ FISHERY INTERACTION ☐ DISTURBANCE EVENT ☐ OTHER:_____

PHOTOS? ☐ YES ☐ NO (CONTACT/REFERENCE):_____

NECROPSY REPORT? ☐ YES ☐ NO (CONTACT/REFERENCE):_____

SAMPLES COLLECTED? ☐ YES ☐ NO (CONTACT/REFERENCE):_____

IDENTIFICATION TAG? ☐ YES ☐ NO (TAG #, COLOR, PLACEMENT):_____

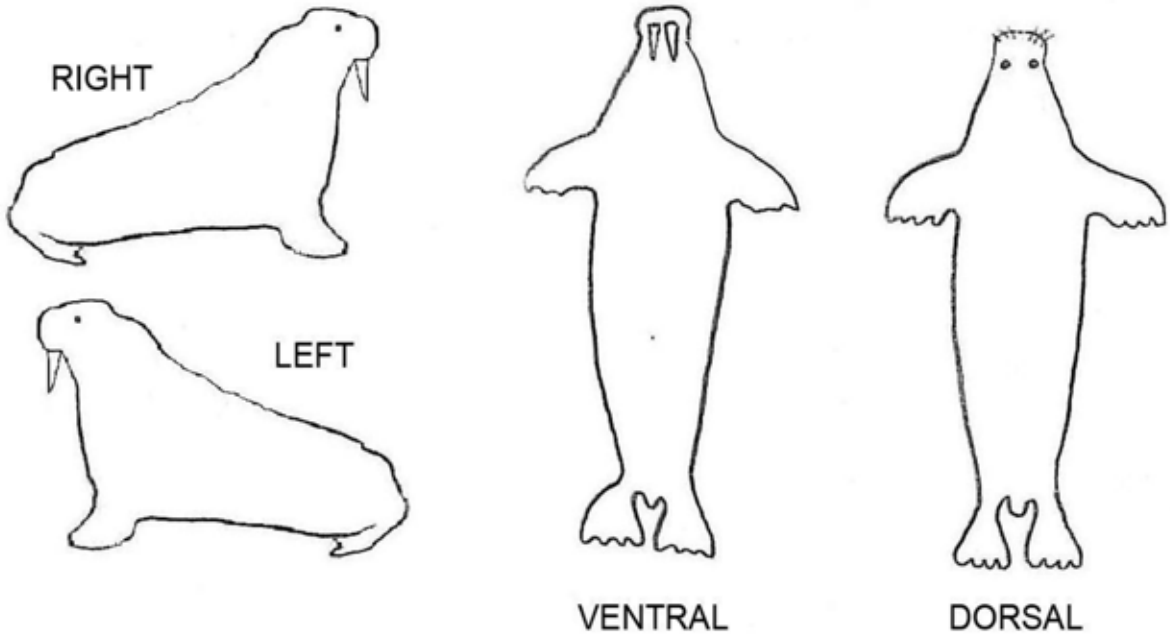
ANIMAL DETAILS: (ANIMAL SPECIFIC INFORMATION: DESCRIBE ANY INJURIES, LESIONS, ABNORMAL TISSUES OR BEHAVIOR) _____

(USE BACK OF FORM FOR ADDITIONAL REMARKS)

REPORT DETAILS CONTINUED: (SITE SPECIFIC AND CIRCUMSTANTIAL INFORMATION)

ANIMAL DETAILS CONTINUED: (ANIMAL SPECIFIC INFORMATION: INJURIES, LESIONS, ABNORMAL TISSUES OR BEHAVIOR)

(USE DIAGRAM BELOW TO ILLUSTRATE THE LOCATION AND DISTRIBUTION OF WOUNDS OR LESIONS)



Send this form to: USFWS, Marine Mammals Management, MS 341, 1011 East Tudor Rd, Anchorage, AK 99503

Phone: 1-800 362-5148, Fax: (907) 786-3816, email: Joel_GarlichMiller@fws.gov

SESSION V:

MITIGATION OF DISTURBANCES AND RELATED MORTALITY AT COASTAL HAUL-OUTS ON THE CHUKCHI SEA COAST

Session Chair: Joel Garlich-Miller, U.S. Fish and Wildlife Service

BACKGROUND

The number of walruses using land-based haul-outs along the Chukchi Sea coast during the summer months and the duration of haul-out use has increased markedly over the past decade. One of the most pressing conservation concerns with these large, densely-packed haul-outs is the potential for injuries and mortalities associated with stampedes caused by disturbance events. Large numbers of walruses have perished at coastal haul-outs in Chukotka in recent years. Younger age classes of animals are particularly vulnerable to trampling injuries and mortality. Resource managers have raised concerns that increased mortality rates at coastal haul-outs will have negative effects on the population. Frequent disturbances at preferred haul-out areas could also lead to haul-out abandonment and displacement from preferred forage areas. Information concerning sources, frequency, and effects of disturbances at coastal haul-outs are needed to inform impact assessments and mitigation strategies.

SESSION GOALS AND OBJECTIVES

- Review existing information on sources, frequency and effects of disturbance at coastal haul-outs.
- Review existing management and conservation efforts to mitigate disturbances at coastal haul-outs.
- Develop recommendations and identify priorities for mitigating disturbance impacts at haul-outs.

Community efforts to protect the walrus haul-out at Cape Vankarem, Chukotka

Sergei Kavry, UMKY Patrol

A large coastal walrus haul-out near the village of Vankarem, Chukotka Alaska. Photo: Sergei Kavry

The native people of Cape Vankarem have been working for many years to re-establish a historically used walrus haul-out site near their village. The development of rules, regulations and protection measures at the haul-out site has occurred primarily at the local level. Initially, local hunters forbid people from visiting the haul-out during the walrus fall migration and tied up or shot stray dogs from the village that harassed walruses. In addition, hunters have modified their hunting practices at the haul-out, resurrecting a traditional spear-hunting practice (instead of firearms) to hunt walruses without causing panic and abandonment of the haul-out. Efforts to make the haul-out more secure for walruses go beyond hunters and have engaged the broader community. The community organized a cleanup effort of construction debris to make the haul-out area more habitable and appointed a haul-out guardian who oversees hunting efforts and visitation to the haul-out to minimize impacts. These efforts appear to have paid off; the Vankarem haul-out has seen regular use over the past decade.

Disturbance events at the haul-out can result in stampedes, walrus mortalities, and undesirable indirect impacts to the Vankarem community. When walrus carcasses remain after a disturbance event and the sea freezes, polar bears come to Cape Vankarem to feed on the carcasses, which often results in conflicts with the community. To combat this, community members decided to minimize attractants and remove walrus carcasses from the haul-out to a location away from town. In 2006, with the support of the World Wildlife Fund, the people of Vankerem developed the UMKY (Polar Bear) Patrol project. The

UMKY Patrol works to ensure the safety of people living near polar bears, preserve the walrus haul-outs, and support local participation in scientific projects on polar bears and walruses. In order to keep local residents safe, the UMKY patrol escorts children to school, patrols the village for bears, and informs people about the current situation. Additional polar bear patrols have since been created in other villages.

In 2006, the people of Vankarem voted to support the creation of a nature monument at the Cape Vankarem walrus haul-out (photo, page 77), a decision that was eventually approved by the government of Chukotka in August, 2007 (Figure 2). In 2011, the Chukotkan Department of Agriculture helped create a ranger position at Cape Vankarem. Signs posted at Cape Vankarem Natural Monument help to establish appropriate conduct near the haul-out to prevent disturbances.

Figure 2 The Cape Vankarem Natural Monument was established in 2007 to protect the biological resources of the area.

Sources of disturbance at the Vankarem haul-out:

Other walruses: The Vankarem haul-out has areas with steep slopes. Sometimes walruses fall onto others below. The level of disturbance is fairly mild and the walruses calm down pretty fast.

Polar bears: Polar bears are drawn to Cape Vankarem in the fall to look for carcasses. They can cause significant disturbances at the haul-out.

Gulls: When gulls take-off in a flock, the resulting activity can cause many walruses to stampede into the water. It is difficult to do anything about this source of disturbance.

Hares: Hares see walruses as rocks, whereas walruses see the white hares and get scared. A hare eradication project near the haul-out to minimize disturbances has been considered.

Domestic dogs: Dogs can harass walruses and disturb them by barking. Dogs that harass the walruses are tied up or shot.

Local residents: Local residents are a frequent source of disturbance at the haul-out. Disturbances often occur during the pursuit of traditional subsistence activities such as duck or marine mammal hunting; or when gathering plants and berries in the tundra above the haul-out (particularly if the wind changes so people are upwind of the haul-out).

Tourists: Tourists have varying impacts and disturbance levels on walruses. Visitors often wear brightly colored protective gear, the effects of which are unknown. In groups of different ages, young people move faster than older people, spreading the disturbance out over time and space. Greater coordination is needed between haul-out protection and tourist groups who have few translators.

Vessel traffic: Periodically, approaching cruise ships will disturb hauled-out walruses. Fishing trawlers anchored in bays during storms can also occasionally disturb them. Walruses are disturbed by the smell of diesel fuel – this factor is not as significant, but can cause walruses to leave an area. Maritime vessel traffic and groups of ships should be routed away from the haul-outs.

Aviation traffic: Regular disturbances happen during take-off and landing of helicopters and aircrafts visiting the village. Disturbances from military helicopters and plane flights occur with less frequency. Rules of landing require planes to circle the village to ascertain landing direction at the airstrip that is only 700 m from the haul-out. Wind direction can force airplane pilots to fly over the haul-out on landing. Agreements now in place ensure that helicopter pilots do not circle over the haul-out if it is occupied. In addition, the landing pad was moved further away from the haul-out to reduce disturbance. Disturbance levels are relatively low if there is a steady sound, however the noise level is much higher during take-off and landing.

Capture crews: Attempts are being made to stop outside interests from coming in to capture walrus calves for aquariums. Local elders are important in leading this effort. Individuals who finance the capture of calves come to villages with money and create division, which has negative impacts on community well-being.

The Haul-out Keepers project in Chukotka

Eduard Zdor, Association of Traditional Marine Mammal Hunters of Chukotka

The Association of Traditional Marine Mammal Hunters of Chukotka (Association) represents 20 Native villages and more than 8,000 traditional consumers of marine mammal products in Chukotka. The Association's mission is "to preserve the aboriginal life-style and traditional subsistence of Chukotka Native Peoples." In Chukotka, local villagers and scientists benefit from working together to advance the collective understanding about walruses. Although local villagers cannot engage with all the science, they can provide the spatial coverage that the scientific community doesn't have the capacity (i.e., people and funding) to do.

The Haul-out Keepers project is one example of scientists and community members working together to achieve the sound management of subsistence resources. The mass mortality of walruses in the Arctic coast of Chukotka in the fall of 2007 worried hunters and villagers. The Association's board discussed the need for special protection of key walrus habitats in 2008 and decided to focus on monitoring and protection of haul-outs.

The central goal of the haul-out keepers project is to monitor the main walrus haul-outs on the Chukotka coast. It is a collaborative effort between the Association and Chukot-TINRO with project funding coming predominantly from non-governmental organizations such as Pacific Environment and the Eskimo Walrus Commission. Those involved worked with scientists to develop protocols and training for surveying coastal walrus haul-outs that can be adapted for use by experienced hunters who do not have specialized scientific training. Data is collected and analyzed regarding both the time of haul-out formation and the disruption of coastal haul-outs. Data collectors gather information on the size of the haul-out, walrus sex and age structure, rate of mortality, and factors of disturbance at the haul-outs. Those involved with the project developed posters and other information materials to educate the general public about walrus conservation efforts and created a website to publish information about the Haul-out Keepers project and its results (http://www.pacificwalrus.ru).

Monitors identified the primary sources of disturbances at haul-outs as aircraft taking off near the haul-outs and hunting activity. Haul-out hunting can be a major disturbance factor, but is also an important pursuit for local people. Unlike airplanes that are difficult to reroute, hunting activities can be modified to create less disturbance. For example, hunters can minimize disturbance if they wait till the least number of walruses are on a beach so they don't disturb a large herd. The Association monitors hunting and works with elders to set the dates for the spear hunt.

Fishing trawlers are not an issue of great concern on the Chukotkan coast. However, there was one instance of a cruise ship approaching a haul-out on Kolyuchin Island last year that spooked the herd. The Association is planning to contact the tourist company to let them know that this is unacceptable.

Disturbances caused by military activities also occur in Chukotka. Last year border guards flew over the Kolyuchin haul-out at about 200 m in a helicopter. This spooked 10,000 animals and resulted in the crushing deaths of several calves. This kind of disturbance (that causes mass stampedes) should be stopped immediately as the cost to the community's food security is too high. The Association wrote a letter to the military which responded by saying that it would try to avoid such disturbances in the future.

Emerging management issues at coastal walrus haul-outs along the Chukchi Sea coast of Alaska

Joel Garlich-Miller, U.S. Fish and Wildlife Service

Up until a few years ago the formation of coastal haul-outs along the Chukchi Sea coast was primarily a Russian Federation phenomenon, however a similar pattern has started to develop in Alaska in recent years. In four of the past five years, sea ice has disappeared from continental shelf waters of the eastern Chukchi Sea forcing walruses to shore along the coast of Alaska. The location and number of animals using coastal haul-outs in Alaska has been highly variable and is thought to be influenced by the availability of sea ice in offshore areas. The largest haul-out observed to date in Alaska has occurred on a barrier island near the community of Point Lay. Approximately 30-40 thousand animals were observed at the site in 2010.

As noted by those working in the Russian Federation, several thousand animals have perished along the Russian Federation coastline in recent years from disturbance events at coastal haul-outs. Alaska has seen some trampling mortalities at coastal haul-outs as well, fortunately, the events have not been at the scale described in Chukotka. A mortality event involving approximately 150 walruses (primarily calves and yearlings) was reported at Icy Cape in the fall of 2009. The cause of the disturbance leading to the mortality event was never determined. USFWS has recently begun local carcass surveys near the Point Lay walrus haul-out in partnership with the community. In 2011, there were approximately 30 mortalities at the haul-out site – mostly calves and yearling animals that died of trauma. This was actually quite a low mortality rate when you consider the size of the haul-out (approximately 20,000 walruses).

Minimizing disturbances at coastal walrus haul-outs along the Arctic coast of Alaska has become a significant management issue in recent years. The USFWS has worked closely with the Eskimo Walrus Commission and the North Slope Borough on outreach efforts to raise awareness about disturbances and the associated consequences. Outreach efforts have included public service announcements, informational posters, and community meetings. USFWS has also developed and distributed flight advisories and guidelines for local air carriers and pilots, and has worked with the U.S. Federal Aviation Administration to establish temporary flight restrictions over large haul-out areas. Response plans demand flexibility because animals seem to haul-out in different locations and at different times each year depending on the ice conditions in offshore areas. USFWS has established an informal communication network among government, commercial pilots travelling along the coast, and concerned community members to help identify and share information about haul-outs as they develop so that appropriate and focused protection measures can be put in place.

Some of the most important and effective efforts to minimize disturbance-related stampedes at coastal haul-outs have occurred at the local level. The large coastal haul-out at Point Lay is along a well-used flight path, and very close to the community; precisely the set of circumstances that has resulted in large mortality events in other locations. The community has taken on an active stewardship role at this haul-out and has worked hard to minimize potential sources of disturbance. Community leaders have worked with air carriers to alter flight routes into the community and with community members to ensure that both local residents and visitors keep a respectful distance from the haul-out when walruses are present. These efforts appear to be working; disturbance-related mortalities at Point Lay have been remarkably low over the past two seasons.

As walruses become more dependent on coastal haul-outs, local conservation and management efforts are going to become increasingly important for the future of the population. The coastal communities of Alaska and Chukotka are well positioned to take an active role in conserving and managing this important subsistence resource. Looking to the future, it will be important for agencies, non-governmental organizations, and local communities to work together to organize, fund, and support community-based initiatives.

Community efforts to protect the walrus haul-out at Point Lay, Alaska

Willard Neakok, Eskimo Walrus Commission

Photo 2 The walrus haul-out near Point Lay, Alaska forms on a barrier island across from the village. Photo: Rebecca Shea (NOAA)

Aircraft over-flights are one of the main sources of disturbance at the Point Lay haul-out. The community has been working with USFWS, the U.S. Federal Aviation Administration, and pilots coming into the community to try to divert planes away from the haul-out.

Local boat traffic has to pass by the haul-out via a deep-water channel that is situated very close to the haul-out. As such, individuals have to use caution when passing to ensure that it is done slowly and quietly so as not to disturb the walruses. There has been high compliance by all 18 small boats in the village. When animals first arrive at the haul-out the entire village is notified by radio and sometimes village meetings are called to develop a management strategy.

Subsistence hunting has not been a significant source of disturbance at the haul-out as hunters do not hunt the main herd. Instead, they focus their hunting efforts during the early stage of haul-out development or target smaller groups of animals away from the main haul-out.

There has been a lot of interest from the media and adventure seekers in coming to the haul-out to take photographs. Due to the risk of disturbance, the community does not want people coming to cover haul-out occurrences. Instead, the Eskimo Walrus Commission has provided the media with some of its own photographs. One media crew was allowed to conduct local interviews and to take photos of the haul-out from a distance with a guide present. This approach worked and others have generally left the walruses alone.

The community needs assistance to manage marine vessels (e.g., tourist boats, private yachts, and ship traffic) transiting past the haul-out. It would also be beneficial to have a centralized place to report disturbance by aircraft or maritime vessels. A Learjet was seen circling over the haul-out last year but locals couldn't see identification numbers on the plane. Spotting scopes would be useful to see identification numbers on planes or boats so that the Eskimo Walrus Commission can report disruptive behavior to the authorities.

Avoiding haul-out disturbance on St. Lawrence Island

Perry Pungowiyi, Native Village of Savoonga

The walrus haul-outs on Saint Lawrence Island generally form in late October through December when walruses migrate from summer feeding areas in the Chukchi Sea. Not all walruses migrate into the Chukchi Sea in summer; some animals remain near St. Lawrence Island year round. Clams wash up on the south side of the island when there is a southerly storm; walruses harvested in this region have stomachs full of clams.

The largest fall haul-outs form on the Punuk Islands just off the eastern end of St. Lawrence Island. Every year hunters find dead animals on the Punuk Islands. Even though there are no people in the area, walruses gather and trample each other. Community members have observed dead calves, pregnant females, and occasionally some larger walruses in addition to aborted fetuses. Polar bears also use this area, and feed on walrus carcasses. A haul-out of spotted seals is also active at Southeast Cape. There used to be thousands of seals there; however, we think that because of continued disturbances around that area, the numbers of seals are smaller than they used to be.

When hunters go to the walrus haul-outs on the Punuk Islands in the fall, elders tell them to only take what is needed. Wind direction and hunting at the edges of the haul-out are important factors that must be considered to minimize disturbance when hunting walruses at the haul-out. When hunters find dead walruses they take the tusks and share the resource. Community leaders have always emphasized the need to keep the area pristine to ensure walruses will always return.

Occasionally, air traffic from Nome can disrupt walruses and hunting activities (primarily during the spring migration). When hunters see a plane, they call the USFWS agent in Nome and notify him that people are disturbing walruses and interfering with the subsistence hunt. Even helicopters that have kept a distance of one mile from the haul-out have disturbed walruses and caused the animals to move off the ice when wind directions are such that they cause noise to travel.

The Savoonga community is concerned about shipping traffic through the Bering Strait. The main migratory pathway for walruses and bowhead whales through the Bering Strait is to the west side of the island. If possible, the community would like to see ships kept on the Nome side of the Bering Strait. Locals have encountered fishing boats from Nome traveling to St. Lawrence and the Punuk islands to look for ivory. There needs to be better education to the wider public and stakeholders in the Bering Sea that the two communities privately own St. Lawrence Island and the neighboring Punuk Islands. Fishing fleets from the south are also coming close to the island. Ideally some type of recognized buffer zone could be established to protect the island's subsistence resources.

St. Lawrence Island communities have recently adopted local hunting ordinances revived from the 1940s that limit the number of walruses taken per trip. This demonstrates that local communities are interested and capable of managing their own resources. Currently, the ordinances focus on walrus trip limits, however sea-bird management may be revived in the future as well. The IRA Councils worked with the Eskimo Walrus Commission, Kawerak's legal counsel, and the USFWS to develop the walrus ordinances. The Native Villages of Savoonga and Gambell received funding through a tribal wildlife grant to implement the program and are currently working to form marine mammal councils in both communities.

SESSION V DISCUSSION

SOURCES, FREQUENCY, AND EFFECTS OF DISTURBANCE AT COASTAL HAUL-OUTS

Walruses occupying coastal haul-outs along the Chukchi Sea coast are vulnerable to disturbances from a variety of sources. Disturbance-related mortality at these densely crowded haul-outs can be significant in some years, particularly among calves. Walrus calves normally have very high survival rates and resource managers are becoming increasingly concerned that this "new" source of mortality will have consequences on the population.

Workshop participants noted that not all sources of disturbance at the haul-outs are anthropogenic. Walrus herds have been known to react to terrestrial predators and scavengers drawn to the haul-outs to feast on carcasses. Hares and flocks of birds have been known to trigger panic in the herds as well. It was noted that feral dogs are also a significant source of disturbance at some haul-out sites located near coastal communities.

Workshop participants identified aircraft over-flights and human visitation to the haul-outs as the primary sources of anthropogenic disturbances. Military and commercial flights along the coast have been responsible for most of the large-scale mortality events that have occurred in recent years. Recently, a survey plane flying at an altitude of 800 m caused a stampede. It was also noted that large helicopters and multi-engine airplanes have the greatest potential to cause a herd to stampede and that reactions were most likely to occur when landing, taking off, or circling over a haul-out. The low constant drone of a passing aircraft was considered less likely to elicit a response.

Subsistence hunters participating in the workshop acknowledged that subsistence hunting could be a source of disturbance at some haul-out sites. Several communities are proactively trying to develop ways to hunt walruses without causing major disruptions at the haul-outs. It was noted that frequent disturbances at coastal haul-outs by hunters can cause abandonment of the haul-out for many years and result in decreased hunting opportunities in the future. The Eskimo Walrus Commission recognizes the potential consequences of hunting at haul-outs and recently passed a resolution encouraging coastal communities to work towards the development of local ordinances to reduce disturbances at coastal walrus haul-out sites.

Eco-tourism was identified as an emerging concern. In Chukotka, marine vessels have started to bring tourists to coastal walrus haul-outs and there have already been some reported disturbances from tour ships. In Alaska, the village of Point Lay has also been receiving increased numbers of inquiries from photographers and the media interested in coming to visit the haul-out site. Workshop participants noted that most of these sites do not have established visitor programs, guidelines, or rules for tourism operators and there is a significant potential for disruption at the haul-out from uninformed (or unscrupulous) visitors.

Marine shipping and near-shore vessel traffic was also identified as an emerging concern. As sea ice in the Chukchi Sea diminishes, more and more ships are entering the region raising the potential for increased interactions with, and impacts to walruses. Workshop participants identified as a high priority the need to develop appropriate guidelines and regulations governing vessel traffic near coastal haul-outs.

EFFICACY OF EXISTING MANAGEMENT AND CONSERVATION EFFORTS

Workshop presenters detailed many ongoing conservation and management efforts to mitigate sources of disturbance at coastal haul-outs. Initiatives by government agencies and local communities to mitigate disturbances from passing aircraft and haul-out visitors appear to be reducing levels of disturbances and haul-out mortalities. Outreach campaigns for military and commercial pilots regarding the sensitivity of walruses to over-flights, have reduced (but not eliminated) the frequency of disturbances.

There is growing awareness in coastal communities in Chukotka and Alaska of the importance and benefits of protecting local walrus haul-outs from disturbances. Some communities (notably Vankarem and Point Lay) have taken on active stewardship of their local haul-outs with considerable success in reducing haul-out related mortalities.

CHALLENGES

Workshop participants noted many challenges in developing and maintaining effective protection measures for the emerging walrus haul-outs along the Chukchi Sea coast. Some of the biggest challenges include:

Logistics: There are many walrus haul-out sites along the coastline of Alaska and Chukotka. Many of these locations are remote and logistically difficult to access or monitor for disturbances. Walruses also do not appear to have strict fidelity to particular haul-out sites, making it difficult to predict precisely when and where they are likely to show up along the coast.

Funding: Government funding for walrus management activities and haul-out monitoring programs is limited – particularly in Chukotka. Non-government organizations have played an important role in helping coastal communities in Chukotka develop local management plans; however securing stable long-term funding to support local programs and initiatives remains a constant challenge.

Cultural differences and balancing competing interests: Many residents in coastal communities are wary of outside interests, particularly with respect to issues involving wildlife and subsistence resources. Local residents are also more likely to be disproportionally affected by any rules or regulations governing human activities near coastal haul-out sites. Walrus hunting activity is a particularly sensitive subject; while it is a potential source of disturbance at coastal haul-out sites, walrus hunting is also a culturally and economically important activity in many communities.

As sea ice in the Arctic diminishes, opportunities for commercial activities such as oil and gas exploration, shipping, fishing and tourism are increasing. Workshop participants have noted a marked increase in human activity along the coast in recent years. While these activities have the potential to bring economic benefits to the region, they also have the potential to impact wildlife and subsistence resources. Participants recognized that balancing all these competing interests without adversely impacting important walrus habitat areas would be challenging.

PRIORITIES AND RECOMMENDATIONS

PRIORITIES

Workshop participants were asked to prioritize areas of concern and develop recommendations to reduce disturbances at coastal haul-outs. It was noted that in general, haul-out sites occurring in close proximity to villages were most likely to experience high levels of human interactions, and were also more logistically feasible to access and monitor. Participants emphasized that programs involving local residents are cheaper to operate; benefit from the local knowledge and expertise of residents; and increase community acceptance of the program goals.

Development of regulations governing over-flights of walrus haul-outs was identified as a high priority.

RECOMMENDATIONS

- Continue education and outreach efforts for military and commercial aviators about the sensitivity of walrus herds to disturbances and the effects of stampedes on mortality levels.
- Work with aviation officials to develop flight advisories and guidelines for pilots to minimize disturbances of sensitive areas during specific times of year.
- Increase outreach and education in coastal communities about why it is important to protect the haul-outs. Most communities realize that they play an important role in keeping the walrus population healthy by helping to reduce unnecessary disturbances and mortalities at haul-outs. Protecting the haul-outs also helps to ensure that the haul-out is not abandoned and that local subsistence hunting opportunities persist.
- Keep dogs and vehicles away from haul-outs when walruses are present.
- Develop management plans (for hunting and tourism) in villages situated in close proximity to haul-outs. Communities should consider developing their own local ordinances to minimize disturbances at coastal haul-outs. Elders are the traditional authority in the villages and should be involved in the process.
- Pursue funding for local management programs. Employment opportunities in the villages are scarce and new jobs would be welcomed. Furthermore, getting people involved and invested in stewardship activities will go a long way toward accomplishing conservation objectives. Point Lay and Cape Vankarem offer potential stewardship models.
- Coordinate with government agencies to deal with marine shipping companies that navigate along the coast near the haul-outs. Develop marine buffer areas around key haul-out sites.
- Develop management plans to protect haul-outs and adjacent waters in the future Beringia National Park.
- Prohibit the capture of walrus calves by private companies at coastal haul-outs (primarily a Russian Federation concern).
- Develop analytical tools to assess walrus numbers from photographs that can be used by community partners (e.g., this has been requested by Vankarem).
- Develop real-time information sharing through Facebook or something similar.

SESSION VI:
WORKSHOP SUMMARY

Session Chair: Martin Robards, Wildlife Conservation Society

Photo: ADF&G

RECOMMENDATIONS CONCERNING HAUL-OUT MONITORING

Below are the summarized priorities and recommendations from each of the workshop's five working sessions.

SESSION I

PRIORITIES

Session I discussions prioritized several important themes that continued to be raised throughout the workshop. Importantly, the need for explicit documentation about the goals of a specific monitoring effort and about the scale of inferences being made from data collected at a haul-out. Protocols for monitoring and research should be tailored in a manner that balances specific objectives with both the capacity/costs for accomplishing goals, and minimizing impacts (i.e., disturbance) to walruses.

With reference to specific variables, in Alaska seasonal mean numbers are a more powerful statistic than seasonal maximum number for assessing trends in population change over time, but similar research has yet to be done for the larger haul-outs in the Russian Federation. Across the range of walruses, a much better understanding of demographic patterns and trends is needed.

RECOMMENDATIONS

- Assess the timing, location, and relative abundance of walruses at primary haul-outs.
- Address the dearth of information on demographics of Pacific walruses in the scientific literature through research at haul-outs. Birth rates and survivorship are critical for management in a changing environment. Assessing numbers and sex/age composition at haul-outs (using appropriate precision) can inform science, policy, and management (including hunting) at local community and government levels. Finally, the age/sex demographic heterogeneity and dynamics of hauled-out walruses should be assessed to inform aerial surveys or ground-based sampling efforts.
- Work with a statistician (e.g., Mark Udevitz) to assess an optimal sampling strategy for the 12 highest priority haul-out sites in the Russian Federation (i.e., power to detect trends if monitored at annual or multi-year frequencies).
- Develop indicators of both regional and overall population status using data from haul-outs and associated ecological data. Apparent reductions in haul-out use during the mid-1900s were seen as an indicator of population decline, but ice conditions were not included in these.
- Promote community stewardship through locally-based walrus demographic monitoring.

SESSION II

PRIORITIES

Participants felt that a genetics-based capture-mark-recapture project for estimation of abundance and demographic rates of walruses was warranted. The general lack of information on abundance, age and sex-specific survival rates, and recruitment of walruses makes monitoring and managing the population in a changing environment difficult. Participants from both the United States and the Russian Federation agreed on the recommendations outlined below.

RECOMMENDATIONS

Note: since the March, 2012 workshop, USFWS has adopted the recommendations and is moving forward with this project.

- Given the logistical difficulties of this project – including the challenges with collecting samples from all demographic groups – adult male walruses should not be sampled in the first years of this project. By adopting this strategy, USFWS would reduce the sample-size requirements for the project overall, and allow the sampling strategy to be focused on one general area during a relatively short time period.
- Given the logistical difficulties with obtaining a representative sample of walruses on terrestrial haul-outs, and the risks associated with sampling at these haul-outs, the study plan should not be designed around sampling walruses on land.
- Design a study plan to sample walruses hauled out on sea ice during the spring migration and centered on the Bering Strait region. This approach will maximize the likelihood of obtaining a representative sample of the population; reduce the risk of injuring or killing animals in an unintended disturbance; and increase the relative ease with which researchers can move around herds and groups to access animals.
- From a scientific perspective, samples collected from walruses hauled out on sea ice should be augmented with samples collected from live walruses by subsistence hunting communities, particularly those in the Russian Federation. Because of the restrictions associated with working in Russian Federation waters this would facilitate a mechanism for collecting samples from walruses that don't enter United States' waters, further maximizing the probability of obtaining a representative sample of the population.
- Given the high cost of the overall project and the small "bang for the buck" associated with samples collected from harvested walruses, samples from subsistence-harvested walruses will not be collected in the first years of this study, or until sufficient funding is obtained for this objective.

SESSION III

PRIORITIES

There was wide consensus that clear objectives should be set for any survey effort that could disturb walruses, particularly those using aerial survey techniques. For several efforts discussed in this session, emphasis was placed on greater stand-off distances because key objectives are presence/absence of animals and can be assessed in the orders-of-magnitude. It is the mixing of goals associated with assessing broad-scale distribution and abundances of haul-outs with fine-scale assessment of individual haul-outs that resulted in many of the challenges raised in this section.

A priority of identifying new haul-outs was addressed, including opportunities to expand the Chukchi Offshore Monitoring in Drilling Area flight capacity to include a single, weekly flight from Barrow to Point Hope. Russian Federation participants also emphasized the need to increase funds available to support long-term monitoring of the 12 large priority haul-outs on the Chukchi coast (Figure 18).

RECOMMENDATIONS

- Update range-wide haul-out distribution map in accordance with the relative importance for the animals and how regularly they are used. Include Traditional Ecological Knowledge to fill in gaps in the historical haul-out locations.
- Continue to compile data on haul-out use in Kamchatka and along the Koryak Coast to confirm the continued shrinking of range-wide habitat utilization.
- Synthesize Bristol Bay-wide data.
- Develop protocols for use of remote cameras to monitor across a region (such as Bristol Bay).
- Assess practicality of a weekly aerial survey from Barrow to Point Hope to monitor walrus haul-outs in the fall.
- Standardize methods for collecting and processing information from aerial surveys. A lot can be done with few resources. For example, establish correction factors for counting walruses from oblique aerial photographs.
- Continue use of satellite tags to better understand linkages between haul-outs.

SESSION IV

PRIORITIES

A central focus of this session was the need for consistency in data collection and ease of sharing that data among researchers in both Alaska and Chukotka. There was agreement that it would be valuable to synthesize existing data and develop consistent protocols for monitoring and responding to disturbance events and factors leading to increased mortality or morbidity of the walrus herd.

RECOMMENDATIONS

- Monitor haul-outs to assess sources of disturbance, baseline threshold levels for responses by animals, and impacts (i.e., cause and effect), including habituation. Data would be used to promote responsible activities by oil and gas explorers and developers, tourism operators, and maritime transport interests throughout the range of coastally hauling out walruses in a manner that mitigates disturbance.
- Determine the sources and levels of mortality and morbidity at coastal haul-outs.
- Develop a standard, bilateral data collection format and shared database to monitor mortality of walruses at coastal haul-outs.
- Develop a standard, bilateral data collection format and shared database to monitor health and disease of walruses at coastal haul-outs.

SESSION V

PRIORITIES

Workshop participants were asked to prioritize areas of concern and develop recommendations to reduce disturbances at coastal haul-outs. It was noted that in general, haul-out sites occurring in close proximity to villages were most likely to experience high levels of human interactions, and were also more logistically feasible to access and monitor. Participants emphasized that programs involving local residents are cheaper to operate; benefit from the local knowledge and expertise of residents; and increase community acceptance of the program goals.

Development of regulations governing over-flights of walrus haul-outs was identified as a high priority.

Photo: ADF&G

RECOMMENDATIONS

- Continue education and outreach efforts for military and commercial aviators about the sensitivity of walrus herds to disturbances and the effects of stampedes on mortality levels.
- Work with aviation officials to develop flight advisories and guidelines for pilots to minimize disturbances of sensitive areas during specific times of year.
- Increase outreach and education in coastal communities about why it is important to protect the haul-outs. Most communities realize that they play an important role in keeping the walrus population healthy by helping to reduce unnecessary disturbances and mortalities at haul-outs. Protecting the haul-outs also helps to ensure that the haul-out is not abandoned and that local subsistence hunting opportunities persist.
- Keep dogs and vehicles away from haul-outs when walruses are present.
- Develop management plans (for hunting and tourism) in villages situated in close proximity to haul-outs. Communities should consider developing their own local ordinances to minimize disturbances at coastal haul-outs. Elders are the traditional authority in the villages and should be involved in the process.
- Pursue funding for local management programs. Employment opportunities in the villages are scarce and new jobs would be welcomed. Furthermore, getting people involved and invested in stewardship activities will go a long way toward accomplishing conservation objectives. Point Lay and Cape Vankarem offer potential stewardship models.
- Coordinate with government agencies to deal with marine shipping companies that navigate along the coast near the haul-outs. Develop marine buffer areas around key haul-out sites.
- Develop management plans to protect haul-outs and adjacent waters in the future Beringia National Park.
- Prohibit the capture of walrus calves by private companies at coastal haul-outs (primarily a Russian Federation concern).
- Develop analytical tools to assess walrus numbers from photographs that can be used by community partners (e.g., this has been requested by Vankarem).
- Develop real-time information sharing through Facebook or something similar.

Date/Time	*Session (Chair)*

MONDAY (19TH)

09:00 – 09:30 **WELCOME AND INTRODUCTIONS**

I. ESTIMATING ABUNDANCE AND DEMOGRAPHICS AT COASTAL HAUL-OUTS (CHAD JAY)

09:30 – 12:30 **PRESENTATIONS AND DISCUSSION:**

- Haul-out monitoring in Chukotka: methods and protocols (Kochnev)
- Walrus haul-outs at Wrangel Island (Russian Federation): recent trends and monitoring perspectives (Ovsyanikov)
- Pacific walrus haul-out monitoring at Togiak National Wildlife Refuge and Walrus Islands State Game Sanctuary: 1975-2012 (Sell/Winfree)
- Obtaining useful information from walrus haul-outs: considerations for sampling and abundance estimation (Udevitz)

12:30 – 14:00 **LUNCH**

14:00 – 17:00 **PRESENTATIONS AND DISCUSSION**

- Sex/age composition of Pacific walruses on the Russian Federation haul-outs (Kochnev)
- Estimating the age composition and size of Pacific walrus herds on haul-outs from gyro-stabilized, high-definition videography (Monson/Jay)
- Ideas for near-shore aerial surveys in Chukotka (Chernook)

TUESDAY (20TH)

09:00 – 11:00 **SESSION WRAP-UP**

- Recommendations concerning standardization of data collection methods
- Additional research and monitoring needs (domestic, international)
- Role of monitoring at index sites/complexes for assessing population status and trends in a) abundance; b) cow/calf ratios; and c) survivorship

II. GENETICS-BASED CAPTURE-MARK-RECAPTURE OF PACIFIC WALRUSES FOR ESTIMATION OF ABUNDANCE AND DEMOGRAPHIC RATES (PATRICK LEMONS)

11:00 – 12:30 **PRESENTATIONS AND DISCUSSION**

- Past feasibility studies, modeling efforts, and precision of estimates; abundance, population growth-rate, and population demographic rates (Lemons)

12:30 – 14:00 **LUNCH**

14:00 – 17:00 **DISCUSSION AND SESSION WRAP UP**

- Feasibility of sample collection from walruses at land-based haul-outs and on sea ice
- Sampling design

Date/Time	*Session (Chair)*

WEDNESDAY (21ST)

III. MONITORING THE LOCATION AND TIMING OF COASTAL HAUL-OUT FORMATION (MARTIN ROBARDS)

09:00 – 12:00 **PRESENTATIONS AND DISCUSSION**

- A discussion about assessing the long-term distribution of Pacific walruses (Robards)
- Present status of Pacific walruses in the Russian Federation (Kochnev)
- Marine mammal aerial surveys in the Chukchi Sea (Christman)
- Pacific walrus haul-out monitoring efforts in Bristol Bay (Winfree/Weiss)
- Satellite walrus imagery (Semenova)

SESSION WRAP UP

- Strategies for monitoring location and timing of haul-out use at a) range-wide, and b) regional scales

12:00 – 13:30 **LUNCH**

IV. MONITORING MORTALITY AND MORBIDITY AT COASTAL WALRUS HAUL-OUTS (RAPHAELA STIMMELMAYR)

13:30 – 17:00 **PRESENTATIONS AND DISCUSSION**

- Mortality levels at coastal haul-outs in Chukotka in fall 2007 (Kochnev)
- Monitoring mortality at coastal walrus haul-outs in Alaska (Garlich-Miller)
- Ulcerative dermatitis disease syndrome – a new disease in walrus and ice seals? (Stimmelmayer/Garlich-Miller/Neakok)

SESSION WRAP UP

- Review and finalize a bilateral carcass survey reporting form
- Propose and finalize a case definition for ulcerative dermatitis disease syndrome

THURSDAY (22ND)

V. MITIGATION OF DISTURBANCES ANDRELATED MORTALITY AT COASTAL HAUL-OUTS ON THE CHUKCHI SEA COAST (JOEL GARLICH-MILLER)

09:00 – 12:30 **PRESENTATIONS AND DISCUSSION**

- Emerging management issues at coastal walrus haul-outs along the Chukchi Sea coast of Alaska (Garlich-Miller)
- Community efforts to protect the walrus haul-out at Cape Vankarem, Chukotka (Kavry)
- The Haul-out Keepers project in Chukotka (Zdor)
- Community efforts to protect the walrus haul-out at Point Lay, Alaska (Neakok)
- Avoiding haul-out disturbances on St. Lawrence Island (Pungowiyi)

SESSION WRAP UP

- Recommendations for further synthesis and research on thresholds of disturbance for hauled-out walruses
- Recommendations for standard operating practices for vehicles, vessels, and aircraft in proximity to haul-outs

12:30 – 14:00 **LUNCH**

VI. WORKSHOP WRAP UP AND COMPLETION OF ANY RUN-OVER SESSIONS (MARTIN ROBARDS)

14:00 – 17:00

- Formulation of recommendations concerning haul-out monitoring
- Identify priority tasks
- Proposals for joint studies
- Opportunities for funding: federal, NGO, industry, other

День/Время*	Заседание (Председатель)*
Понедельник (19.03)*	1. ОЦЕНИВАНИЕ ОТНОСИТЕЛЬНОЙ ЧИСЛЕННОСТИ И ДЕМОГРАФИЧЕСКИХ ПОКАЗАТЕЛЕЙ НА ПРИБРЕЖНЫХ ЛЕЖБИЩАХ (Чад Джей [Chad Jay])*
09:00-12:30	Выступления и обсуждение*
	- Обзор методики для мониторинга лежбищ на Чукотке (**Кочнев**)
	- Обзор методики для мониторинга лежбищ на о. Врангеля (**Овсянников**)
	- Обзор методики для мониторинга лежбищ в Бристольском Заливе (**Сель/Вайс/Винфри [Sell/Weiss/Winfree]**)
	- Исследования и особенности лежбищ Бристольского Залива (**Удевиц [Udevitz]**)
12:30-14:00	ОБЕД
14:00-17:00	Выступления и обсуждение*
	- Обзор исследований возрастно-полового состава на Чукотке (**Кочнев**)
	- Обзор исследований возрастно-полового состава на Аляске (**Монсон [Monson]**)
	- Концепции для прибрежных аэросъемок на Чукотке (**Чернук**)
Вторник (20.03)*	Закючение заседания*
09:00-11:00	- Рекомендации в сфере стандартизации методов сбора данных
	- Дополнительные нужды в сфере исследования и мониторинга (внутренные, международные)
	- Роль мониторинга в оценке состояния популяции и динамика а) численности б) соотношение самок/моржат в) выживаемость на месте сбора данных
	2. ОСНОВАВШИЙ НА ГЕНЕТИКЕ МЕТОД ПОИМКИ-МЕЧЕНИЯ-ПОВТОРНОЙ ПОИМКИ ТИХООКЕАНСКИХ МОРЖЕЙ ДЛЯ ОЦЕНКИ ОТНОСИТЕЛЬНОЙ ЧИСЛЕННОСТИ И ДЕМОГРАФИЧЕСКИХ ПОКАЗАТЕЛЕЙ (Патрик Лемонс [Patrick Lemons])*
11:00-12:30	Выступления и обсуждение*
	- Прошлие анализы осуществимости, работа по моделированию, точность оценок; относительная численность, темп роста численности, демографические показатели популяции (Лемонс)
12:30-14:00	ОБЕД*
14:00-17:00	Обсуждение и заключительное обобщение заседания*
	- Осуществимость набора образцов от моржей на наземных лежбищах и на морском льде
	- План набора образцов

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Среда (21.03)*	**3. МОНИТОРИГ МЕСТОНАХОЖДЕНИЯ И СРОКОВ ОБРАЗОВАНИЯ ПРИБРЕЖНЫХ* ЛЕЖБИЩ (Мартин Робардс [Martin Robards])***
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09:00-12:00*	**Выступления и обсуждение***
*	- Обзор предыдущих наборов данных (Робардс)!
*	- Обзор существующей работы по сбору данных на Чукотке (**Кочнев)***
*	- Обзор существующей работы по сбору данных на юго-западе Аляске! **(Кристман [Christman])***
*	- Обзор работы по сбору данных в Бристольском Заливе (**Вайс/Винфри)***
*	*
12:00-13:30*	**ОБЕД***
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*	**4. МОНИТОРИНГ БОЛЕЗНЕННОСТИ* И СМЕРТНОСТИ НА ПРИБРЕЖНЫХ* ЛЕЖБИЩАХ (Рафаела Стиммелмайр [Raphaela Stimmelmayr])***
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13:30-17:00*	**Выступления и обсуждение***
*	- Наблюдения смертности и болезненности на прибрежных лежбищах на Чукотке (**Кочнев**)!
*	- Наблюдения смертности и болезненности на прибрежных лежбищах на Аляске: необычный случай смертности! (**Гарлич-Миллер [Garlich-Miller])***
*	- Исследование болезни моржей: диагностические итоги (**Стиммелмайр).***
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Четверг (22.03)*	**5. УМЕНЬШЕНИЕ СМЕРТНОСТИ, СВЯЗАННОЙ С АНТРОПОГЕННЫМ* ВМЕШАТЕЛЬСТВОМ НА ПРИБРЕЖНЫХ ЛЕЖБИЩАХ (Гарлич-Миллер)***
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*	*
09:00-12:30*	**Выступления и обсуждение***
*	- Обзор: Административные инициативы для уменьшения возмущения на прибрежных лежбищах (**Гарлич-Миллер)***
*	- Местные инициативы для для уменьшения возмущения на прибрежных лежбищах:
*	Российский опыт (**Кавры, Здор)***
*	Опыт США (**Неакок, Пунгови-йи [Neakok, Pungowiyi)***
*	*
12:30-14:00*	**ОБЕД***
*	*
14:00-17:00*	**6. ЗАКЛЮЧЕНИЕ СЕССИИ И ЗАВЕРШЕНИЕ НЕЗАВЕРШЕННЫХ ЗАСЕДАНИЙ (по* необходимости)* (Мартин Робардс)***
	- Составление рекомендаций в области мониторинга лежбищ!
	- Определнеие приоритетных задач!
	- Предложения для совместных исследований!
	- Потенциальные источники финансирования: федеральные, общественные организации, предприятия, и др.!

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