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PERSPECTIVE

Alaska Beluga Whale Committee—a unique model of co-management

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Abstract

The Alaska Beluga Whale Committe (ABWC) was formed in 1988 to conserve beluga whales (*Delphinapterus leucas*) and manage beluga subsistence hunting in western and northern Alaska in cooperation with the National Marine Fisheries Service (NMFS). When the ABWC was formed, there was no consistently funded research or management programme for belugas in Alaska, and co-management was a new concept. The ABWC brought together representatives from beluga hunting communities; federal, state, tribal and local governments; and beluga researchers to develop and implement a programme to manage belugas. With funding from NMFS and others, the ABWC has collected data necessary for informed management decisions including the following: harvest data; aerial surveys of belugas in Bristol Bay and the eastern Bering and Chukchi seas; beluga tracking studies, including training hunters to attach transmitters; a pioneering genetics study of beluga stock identity that has facilitated collection of >2000 beluga skin samples; and a genetics-based mark–recapture study to estimate beluga abundance in Bristol Bay and validate aerial survey estimates. The ABWC is currently engaged in regional management planning in Kotzebue Sound and the eastern Bering Sea. It produces results that are scientifically valid, locally accepted and cost-effective and is an example of what can be achieved when Native hunters, scientists and managing agencies respect and listen to one another and work together. However, the current NMFS co-management funding process has fundamentally altered the relationship between NMFS and ABWC, with NMFS now acting more like a funding agency than a partner.

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Keywords

Subsistence; *Delphinapterus leucas*; collaboration, Alaska Natives

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Abbreviations

ABWC: Alaska Beluga Whale Committee
ADFG: Alaska Department of Fish and Game
ANO: Alaska Native Organization
EBS: eastern Bering Sea
IWC: International Whaling Commission
MMPA: US Marine Mammal Protection Act (1972; US Public Law 92-522)
NMFS: US National Marine Fisheries Service
NSB: North Slope Borough (municipal government in northernmost Alaska)

Introduction

Indigenous communities in Alaska have harvested marine mammals, including beluga whales (*Delphinapterus leucas*), for thousands of years to help meet nutritional and cultural needs (Meek 2009). In 1972, the MMPA placed a moratorium on the taking of marine mammals; however, Section 101(b) of the Act exempted taking by any Indian, Aleut or Eskimo residing in Alaska and dwelling on the coast of the North Pacific or the Arctic Ocean if such taking is for subsistence purposes and occurs in a non-wasteful manner. Passage of the Act was followed by 10–15 years during which there was variable and often very little communication between Alaska Native hunters and the managing federal agencies regarding marine mammals. Exceptions were the Alaska Eskimo Whaling Commission, formed in 1977, to safeguard the bowhead whale (*Balaena mysticetus*) and its habitat and to support the whaling culture of its member communities (Suydam et al. 2021), and the Eskimo Walrus Commission, which was formed in 1978 to advocate for and represent Alaska Native concerns regarding federal management of walruses (*Odobenus rosmarus*; Metcalf & Robards 2008).

Ensuring sustainable harvests is essential for the conservation of marine mammal stocks and resilience of communities dependent on the subsistence lifestyle and culture. How this is accomplished differs greatly between modern natural resource agencies and Indigenous peoples. While Indigenous people often encourage hunting practices and manage through cultural norms and

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education of young hunters, natural resource agencies establish enforceable rules and regulations around harvesting that are based on Western approaches to management, such as using scientific information about population size, harvest levels and reproductive capacity (Fernandez-Gimenez et al. 2008; Gadamus & Raymond-Yakoubian 2015). Obtaining adequate scientific information can be a challenge in remote areas and in the face of rapid environmental and social changes in the Far North. Agency requirements for rigorous population estimates for management focus discussions on statistical methods and numbers but neglect ecosystem complexity and local values surrounding harvesting and may be unsuccessful in influencing the behaviour of hunters (Robards et al. 2009; Gadamus & Raymond-Yakoubian 2015).

Sharing responsibility for resource decision-making between the government and resource users (Pinkerton 1989; Singleton 1998) has emerged as one way to bridge the gap between the fundamentally different approaches of Western science and Indigenous culture to managing subsistence resources and achieving sustainable harvests. Co-management approaches can link long-term Indigenous Knowledge about species and ecosystems with scientific research. Combining these forms of knowledge may provide a more realistic understanding of the system than either alone (Meek 2009). Developing and promoting co-management organizations, which involve Indigenous hunters and leaders, can facilitate the collection of data needed to make informed management decisions and for community acceptance of management protocols that are implemented.

Co-management is sometimes criticized by both government and the local resource users. It may be perceived as a means of expanding government authority and placating local communities rather than actually sharing power more equitably with local people (Cruikshank 1998; Fernandez-Gimenez et al. 2008) or, in the words of hunters, "They manage, we cooperate." Some believe that co-management structures have merely been inserted into existing institutions of bureaucratic wildlife management (Nadasdy 2003).

In 1988, the ABWC was formed with the goals of maintaining healthy populations of beluga whales, providing for adequate subsistence harvests of belugas and protecting hunting privileges for Alaskan subsistence hunters (Adams et al. 1993). It was formed at least partially in response to the 1977 crisis surrounding the IWC's moratorium on subsistence hunting of bowhead whales (Gambell 1993; Suydam et al. 2021). Although it was not formed as a formal co-management institution, the ABWC wanted to demonstrate local management capacity and avoid regulation by outside groups such as the IWC. From its inception, the ABWC included beluga hunters; local, state, tribal and federal government personnel; and scientists.

In 1994, the MMPA was amended (Section 119), so that the US federal government could enter into cooperative agreements with ANOs to conserve marine mammals and provide co-management of subsistence use by Alaska Natives. An ANO was defined as a group designated by law or formally chartered, which represents or consists of Indians, Aleuts or Eskimos residing in Alaska. Section 119 further stated that cooperative agreements with ANOs could include collecting and analysing data, monitoring harvests, participating in research and developing co-management structures with federal and state agencies. It provided a formal, legally based structure for incorporating the knowledge and perspectives of Alaska Natives into the research and management of marine mammals they harvest for subsistence. Shortly after the Section 119 became law, the ABWC began to develop a formal co-management agreement with the NMFS, and in 2000, it signed an agreement for the co-management of the western Alaska beluga whale population. The ABWC now focuses its efforts on four officially recognized stocks: Bristol Bay, EBS, eastern Chukchi Sea and Beaufort Sea. It also co-manages belugas in Kotzebue Sound (Fig. 1).

The objective of this paper is to describe how the ABWC works and why it remains strong and effective after more than 30 years. We do not attempt to frame a theoretical process or provide an academic description of co-management. Instead, we offer explanations for why participants engage in candid discussions about difficult subjects, refer to "our studies" (not "theirs") and above all, respect and engage with each other in a meaningful way even when opinions differ. Although success may differ in the eyes of the beholder (Nadasdy 2003), the ABWC has succeeded in creating an environment conducive to the open exchange and discussion of information and ideas between users and managers and to blurring the distinctions between the two.

ABWC structure and function—why it is what it is

The ABWC includes tribally appointed delegates from beluga hunting communities in northern and western Alaska; regional representatives; representatives (i.e., scientists and managers) of federal (NMFS), state (ADFG) and regional (NSB) governments; and others as determined by the committee (Adams et al. 1993; Fernandez-Gimenez et al. 2006). All of these are full members who vote on committee decisions, with the exception that only hunters may vote on hunting-related matters. All regular business is conducted during the meetings, with all members present. The ABWC meets annually, usually in November, after most beluga hunting has ceased for the year, to facilitate collection of harvest data. The

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Fig. 1 Summer ranges of beluga stocks in Alaska. (Courtesy of J. Crawford, ADFG.)

decision to include scientists and managers as well as beluga hunters as members was a formative decision that has shaped the ABWC for the ensuing 30 years (Adams et al. 1993). This differs from other Alaska marine mammal ANOs, which include only Alaska Natives as voting members. At its first meetings, participants discussed whether the group would be a commission of Native hunters with associated non-voting scientific government advisers or a committee made up of hunters, scientists and agency managers sitting as full voting members and with equal status. After extensive discussion, the group unanimously passed a resolution, stating that voting members would include representatives of coastal beluga hunting communities, the NMFS, the ADFG, the NSB and others as determined and voted on by the committee.

At a recent ABWC meeting, when NMFS personnel expressed concern that it might be perceived as a conflict of interest if they were full voting members of the ABWC, ABWC Chairman Tom Gray stated that "We need to be addressing issues together. The scientists and managers should be sitting with us at the table making decisions, not on the sidelines. This group is very different with NMFS at the table. It is easier to work together and to come up with solutions." Another ABWC delegate said, "Everyone has to have a stake in this, or it doesn't mean anything. The ABWC isn't so different from the other Alaska Native Organizations by accident. It is because we're all members."

Most marine mammal ANOs consist of relatively small boards with regional representation. In contrast, the ABWC includes hunter-delegates from many villages. Each hunter-delegate reports harvest data for his community, as well as any unusual observations and concerns. Having representatives of many communities familiar with the science and the issues, not just a handful of people from regional centres, facilitates constructive discussions of potential problems, enables communication of local observations and Traditional Knowledge about belugas, encourages discussion of beluga issues within beluga hunting communities, and facilitates local involvement in research and harvest monitoring. The ABWC has found that having hunter-delegates, rather than professional 'meeting-goers,' fosters communication, collaboration and positive dynamics among members. The tone of discussions is different when hunter-delegates are in the majority and when scientists and managers are engaged and respectful listeners. When a management issue arises, the ABWC benefits greatly from having an informed group of local hunter-delegates who understand how the ABWC works and trusts the research because they were involved in the

projects and know the scientists. The dynamics and dialogue are also positively influenced by mutual respect among the delegates; everyone has an opportunity to express his thoughts and is involved in decision-making. All delegates are invested in the process and outcomes of ABWC projects and efforts.

The ABWC has benefited from substantial stability and the long tenure of many of its delegates. Four of five current members of the Executive Committee, six of eight agency representatives and scientists and 40% of the current regional and community delegates have served for 10 or more years. ABWC membership has grown from about 20 in the early years to its current 35–40, largely in response to limited but reliably available funding from NMFS and to increased emphasis on regional management planning. At its inception, ABWC meetings generally included 10 or fewer hunter-delegates. In 2019, 28 hunter-delegates attended.

The ABWC, unlike most other marine mammal ANOs, does not have an executive director. Early on, delegates decided that the business of the organization would be conducted by its members rather than by hired staff. As a result, many people from different communities and organizations have worked together to organize ABWC meetings, plan research, prepare proposals, collect harvest information, attend meetings and provide input on issues related to belugas. This has created a collective 'ownership' of ABWC activities. The downside of this approach is that what the ABWC can accomplish is limited by the time people have available to volunteer their efforts and contribute. The ABWC has repeatedly revisited the decision not to have an executive director, and the decision has always been the same: the committee is stronger and more effective when its members, who volunteer their time, do the work.

Funding

The ABWC is fortunate to have had reliable funding since soon after its formation. It has received approximately 200 000 USD annually since 1992. This funding, as well as cooperation among members and the decision not to employ an executive director, has made it possible for the ABWC to conduct its own research in addition to holding annual meetings. Stability in funding has allowed the ABWC to plan ahead and be proactive about research and management needs.

Prior to 1992, funding (mostly for meetings, a newsletter and attendance at the IWC) was from the NSB and the Bureau of Indian Affairs, with additional support from the ADFG, the NMFS, the Fisheries Joint Management Committee and the Department of Fisheries and Oceans Canada. In 1991, the ABWC Executive Committee submitted a programme description and budget document to Alaska's Senator Ted Stevens that was successful in securing funds for an annual meeting, attendance at the annual IWC meeting, harvest studies, genetics analysis for stock identification and aerial population surveys. From 1992 to 2000, ABWC continued to receive annual funding through special Congressional earmarks, which bypassed the competitive allocation process. Beginning in 2001, ABWC funding was added as a line item expense in the NMFS budget. To receive Congressional funds from 1992 to 2010, the ABWC prepared simple proposals detailing priority projects and a general budget for each.

In 2011, earmarks were no longer allowed, and the federal funding process was changed in response to increased requests for federal funding by marine mammal ANOs. The ABWC is now required to compete directly with other Alaskan co-management groups for funds. Since implementation, ABWC funding has declined approximately 25% to an annual average of 167 000 USD, and this has reduced its ability to conduct management-related research. Typically, the ABWC requests funding for both research and management. This is unlike most other ANOs, which typically seek only management-related funding because species research is conducted by NMFS. However, the NMFS does not have a developed research programme for belugas in northern and western Alaska, in large part because the ABWC has coordinated, conducted or supported most beluga research through its cooperative model.

The post-2011 competitive funding process for ANOs is cumbersome. It resembles the competitive 'request for proposal' process for research proposals and is not tailored for co-management groups that share management and, in the case of the ABWC, research responsibilities, with NMFS. The NMFS now acts as a funding agency rather than as a partner with shared needs and responsibilities. Instead of a simple and flexible description of what will be done, proposals must include components on design and management, objectives, project and administrative milestones, project and budget narratives, benefits and/or expected results, need for assistance, government activities that might be affected and the ABWC's relationship with those activities, curricula vitae, letters of endorsement and qualifications of personnel involved in projects. Prior to implementation of this competitive process, ABWC proposals (narrative and budgets) were about 10 pages; with all required documentation, they now average about 75 pages. Budgets require federal budget forms, listing of every anticipated expense and must be accompanied by a full budget narrative describing and justifying every line-item expenditure. Such budgets do not

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acknowledge the limited capacity and flexibility required to operate in village situations, with volunteer participants and challenging logistics.

Applicants for co-management support from NMFS may not request assistance or funds for proposal preparation because the NMFS is the funding agency. This presents a conundrum because co-management groups exist solely to co-manage a specified resource with NMFS and because their primary—and usually sole—source of funding is NMFS.

Co-management proposals are reviewed by technical advisory panels assembled by NMFS. Funding decisions are made based upon the recommendations of reviewers and NMFS staff and are not collaborative or transparent. Past reviewers, for example, have recommended eliminating newsletters (no reason given), even though newsletters were a top priority of the ABWC delegates. In another example, rather than a general recommendation to reduce the proposed ABWC meeting budget, reviewers specified (for reasons not shared with the ABWC) a reduction in the number of Bristol Bay delegates. There was no discussion with the ABWC about the rationale for determining regional representation and the ABWC's efforts to maintain regional balance as a means to address and avert future, often unanticipated, regional issues and problems.

Another substantial downside of the current funding process is that because NMFS personnel are voting members of the ABWC and the ABWC receives financial support through NMFS contracts and grants, the NMFS is concerned that there could be the appearance of conflict of interest or undue influence by the ABWC on NMFS decision-making. The ABWC has proposed to remedy this issue by amending its bylaws to state that: "To avoid the appearance of a conflict of interest, NMFS Alaska Region delegates will not vote on matters of personnel, budgets and grant application related matters." This issue is as yet unresolved. To address the same issue, NMFS Marine Mammal Laboratory scientists are no longer able to review ABWC co-management grant funding proposals.

Harvest monitoring

The ABWC collects annual harvest data for approximately 50 communities, from Bristol Bay to the Beaufort Sea (Frost & Suydam 2010). The data on beluga harvests in Alaska are sent annually to the NMFS for use in stock assessments. Formal acknowledgment of the ABWC as the source of beluga harvest data by the NMFS has provided credibility to both the data and the ABWC. The ABWC also provides annual harvest information for use by the IWC, of which the United States is a member. Currently, the harvests of belugas, by stock, generally do not exceed 2% of estimated abundance (Table 1). For bycatch of cetaceans in commercial fisheries, the NMFS generally authorizes a maximum take of no more than 2% of the population. This level of bycatch, referred to as the Potential Biological Removal, is considered sustainable for cetaceans (Wade 1998) and consistent with the goals and mandates of the MMPA. Although this Potential Biological Removal 'rule' was not intended to be applied to subsistence harvests by Alaska Natives, it, nonetheless, serves as a precautionary guideline.

Committee members understand the need to have accurate harvest data by stock to sustainably manage the hunt. They also recognize that this information could be 'used against them' by anti-whaling or animal protectionist groups. However, the ABWC members concluded early on that there was strength in collecting and providing the best possible harvest data themselves, replacing inaccurate or misleading information from 'outsiders.' ABWC policy requires that anyone using ABWC harvest data must acknowledge the ABWC as the source.

Most harvest information is reported at the ABWC annual meeting. The ABWC distributes harvest report forms to delegates and a variety of tribal and regional associations before the meeting. At meetings, delegates report on the harvest in their own communities and, when possible, on harvests in other nearby communities. This information is augmented by inquiries from the ABWC Executive Committee. Information from different sources is reconciled to produce the most accurate estimate of harvest.

Table 1 Landed subsistence harvest of belugas in Alaska by beluga stock, 2007–2019 (ABWC, unpubl. data).

Stock	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Recent pop. est.[a]	% of est.[b]
Beaufort Sea	62	50	13	70	42	91	34	24	43	43	10	13	18	19 629	0.20
Chukchi Sea	121	73	50	32	32	48	81	50	71	14	38	65	29	20 752	0.26
Kotzebue Sound	151	1	3	2	32	4	6	10	1	9	2	15	6	No data	
EBS	230	119	170	174	190	183	213	236	190	176	183	187	213	9242	2.05
Bristol Bay	18	19	21	26	21	27	27	26	22	19	10	11	19	2040	1.00

[a]Most recent point estimate for population size. See Table 2 for more details. [b]Percentage of average harvest, 2007–2019, relative to the most recent point estimate of population.

Some information about the number of 'struck-and-lost' belugas (animals struck but not landed) is provided by ABWC delegates. Where netting or drive hunting is the method of take, most, if not all, belugas are retrieved. When belugas are hunted from boats in deep water, struck-and-lost belugas are more likely to occur. The ABWC is working to raise awareness about the importance of collecting struck-and-lost information and encourages delegates to obtain better information. While it is unknown how many unsuccessful strikes result in mortality, struck and lost whales must be considered if the harvest is near the sustainable level.

The ABWC considers hunter-delegate harvest reports, verified through questionnaires, reports and other sources, to be adequate for documenting harvests of stocks that are healthy, abundant and harvested within the sustainable range. A great deal more money could be spent to conduct elaborate harvest surveys in each community, but the ABWC believes the current effort is sufficient to evaluate sustainability of current harvests. Because harvest monitoring has been affordable and done by the delegates, the ABWC has a 31-year uninterrupted record of harvest data. Such a long-term record makes it possible to detect harvest trends or unusual harvest events. When an unusual harvest event occurs, help can be requested from member agencies to support additional sampling or investigation of the event.

Because the Alaska beluga harvest occurs in approximately 50 communities (many of which harvest only a few belugas annually), it has been difficult for the ABWC to coordinate collection of biological samples. The only in-depth scientific beluga harvest study for an ABWC community is the long-standing effort conducted by the NSB at Point Lay (Suydam 2009). Its main purpose has been to collect biological and health-related data. Instead of extensive bio-sampling in other locations, the ABWC has prioritized research concerning the basic information needed for management: genetics for stock identification, aerial surveys to determine abundance and satellite tagging to document habitat use. The ABWC's genetics stock identification studies have been conducive to sampling because only a small piece of skin is required, and sufficient sample sizes can be accumulated over multiple years. Skin samples, which have been collected since 1992, can be brought to meetings or are easily mailed. In contrast, samples required for studies of reproduction or diet are much larger, harder to preserve in the field and more complicated to obtain and transport.

The ABWC and research

All stocks of belugas co-managed by the ABWC are harvested for subsistence. To sustainably manage this subsistence harvest, it is necessary not only to monitor and report harvest data but also to understand stock structure, abundance, population trend, reproduction and mortality. The climate in northern Alaska is changing rapidly, particularly the extent and duration of sea-ice cover (Stroeve & Notz 2018; Huntington et al. 2020). This may substantially impact beluga habitat in some areas. Activities such as oil and gas exploration and commercial shipping are occurring at an accelerating pace in beluga habitat, belugas and humans eat the same commercially valuable salmon, and anthropogenic noise is being introduced into beluga habitat, with unknown consequences. To evaluate potential impacts of such activities and mitigate them where possible, it is necessary to have better information about habitat use, feeding, migration routes and overwintering areas.

The basic research needs for most Alaska marine mammal species covered by co-management agreements are being addressed by local, state and federal agencies. The US Federal government, through the NMFS, supports research on ice seals (Phocinae), harbour seals (*Phoca vitulina*), bowhead whales, sea lions (*Eumetopias jubatus*), fur seals (*Callorhinus ursinus*) and Cook Inlet belugas. Comparably, there is a much smaller NMFS research programme for belugas in northern and western Alaska, and there was no consistently funded research programme before the ABWC was established (Hazard 1988).

Since its inception, the ABWC has served as a forum for prioritizing and coordinating beluga research in Alaska and sharing data, results and ideas that provide the basis for informed management. Soon after it was formed, the ABWC initiated a scientific research programme to acquire information needed for management: population size, stock identity and reproduction. The absence of an existing federal beluga research programme and the cooperative and inclusive nature of ABWC membership facilitated development of shared priorities, joint research and an 'ABWC research programme.' Coastal hunters, who hold a large body of Indigenous Knowledge about beluga distribution, diet and movements, contributed—and continue to do so—their information and ideas about what studies were important and how they could be accomplished. The collaboration and cooperation among its many members, sustained funding from the federal government (i.e., the NMFS, the Bureau of Indian Affairs and Mineral Management Service [called the Bureau of Ocean Energy Management since 2010]) and support from the NSB, the ADFG and every member, plus independent researchers, has ensured its success.

Meaningfully involving hunters in beluga research and management requires more than verbal commitments at meetings on the part of all parties. Researchers who seek hunter participation must obtain funding to compensate

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involvement and take the time to train and integrate local participants into projects. Hunters must not only express the desire to be involved in projects but must also follow through by being available to participate, even when it interferes with other activities. All parties must be honest—and realistic—about what is practically attainable and what is desirable but less likely to occur.

The ABWC has supported a variety of research, but three programmes make up the core of its research activities: aerial abundance surveys, genetics stock identification and satellite tagging. Genetic stock identification and satellite tagging have been fundamentally important to the ABWC, not only for the scientific information they produce but also because of the shared participation by hunters and scientists and their contribution to the 'we' part of science. Neither project could have succeeded without the contributions of both.

Genetics stock identification

In the formative years of the ABWC, the use of molecular genetics to investigate stock identity was new and rapidly evolving. At an ABWC meeting in 1989, just a year after it was formed, a proposal was made to use new genetics techniques to investigate stock structure of belugas. Intrigued by the idea and undeterred by the lack of funding, hunter-delegates at the meeting proposed spending 'leftover' per diem money (weather had prevented some members from travelling) to support a trial genetics study.

In 1992, the ABWC began funding a beluga genetics study based at the NMFS Southwest Fisheries Science Center. Conducted by Greg O'Corry-Crowe and his colleagues (1997, 2002, 2016, 2018, 2020), with broad participation by beluga hunters throughout coastal Alaska, the research programme that developed from that study is among the ABWC's most successful research endeavours. Almost 30 years later, hunters have provided more than 2000 skin samples for genetic analysis. Previously provisional stocks are now determined to be genetically discrete, and hunters are developing regional management plans for several stocks based on the information from the samples they provided.

When biologists were initially considering summer concentration areas as putative stocks, hunters proposed that 'spring' and 'fall' belugas in Norton Sound might belong to more than one stock. This suggestion was based on their observations of differences in size and behaviour. Although Norton Sound and Yukon belugas are now considered to be part of a single EBS stock, analysis of samples from some years indicates that incursions of other stocks do, in fact, occur in fall (O'Corry-Crowe et al. 2016).

Satellite tagging and tagger training

The other signature project for the ABWC has been satellite tagging and hunter-tagger training. The ABWC first participated in and helped to facilitate successful satellite tagging of belugas at Point Lay in 1998 (Suydam et al. 2001). Since then, it has been involved in the tagging of 101 belugas: 33 at Point Lay, five in the EBS and 63 in Bristol Bay.

Catching and tagging belugas in Alaska requires a federal research permit. The ABWC does not have its own permit but operates under the ADFG's permit. Prior to the ABWC's efforts to work with and train local hunters, only scientists were listed on research permits. That changed when ABWC's delegate Charles Saccheus Sr. participated in beluga tagging at Point Lay in 1999, and later in Cook Inlet and Bristol Bay. The ADFG subsequently listed Saccheus on its beluga tagging permit. He was the first Alaska Native to be so authorized. Since then, hunter-taggers have been trained (with community consent) at Point Lay, Stebbins and Bristol Bay, and the ADFG has worked with the federal permitting office to include 10 other trained beluga hunter-taggers on its permit.

ABWC tagging has occurred in three forms in response to local circumstances. At Point Lay, belugas have been tagged by scientists primarily using their own logistics but with strong community cooperation, support, input and occasionally direct involvement. This is because tagging occurs in conjunction with the annual Point Lay drive hunt, in which effectively all community members are involved either in the harvest itself or processing the harvest afterwards. The methods used by scientists require cooperation and communication between hunters and scientists during the hunt and real-time agreement about when tagging may occur. Scientists attend a hunter meeting to discuss their plans and seek input into how tagging should be coordinated with the drive.

Tagging by integrated crews of scientists and local hunters has occurred in Bristol Bay (Citta et al. 2016) and Norton Sound. The two groups work together to develop and refine methods for catching belugas. Extensive local knowledge about local conditions and beluga behaviour has been essential to success.

Independent tagging by an ABWC-trained hunter–tagger first occurred in 2012. That hunter–tagger, who was trained in Bristol Bay, netted and satellite-tagged a beluga from the EBS near Nome. The five tags deployed by this hunter–tagger since then have provided the only telemetry data on the movements, migration and overwintering areas of EBS belugas (Citta et al. 2016). Satellite tagging of EBS belugas was not successful before the ABWC hunter–tagger programme began, despite multiple efforts to catch and tag belugas. This was largely due to the unpredictable

presence of belugas, weather, limited time of scientists for tagging and the high cost of such programmes. When local hunters conduct tagging, it occurs opportunistically when conditions are right and is not restricted to a time slot when scientists are present. Hunter-tagging is cost-effective because it does not require complicated logistics or salaries, travel and per diem for scientists from regional centres. The extensive local knowledge of hunters increases the chances for successful tagging. Perhaps most importantly, the hunter–tagger programme builds local capacity by involving hunters in fundamental aspects of research and makes them true collaborators in beluga research, management and outreach. These projects and the derivative science become 'our' projects and 'our' science. As more local hunter–taggers are trained and more belugas are tagged, local capacity increases as well as knowledge about these beluga stocks.

Abundance estimates

Abundance estimates are important for assessing whether harvests are sustainable. The ABWC has supported abundance surveys for Bristol Bay, EBS and eastern Chukchi Sea stocks since 1992. Lowry et al. (2020) provided a thorough description of the most recent abundance and trend data (also see Table 2). Since the mid-2000s, surveys have been less frequent for a variety of reasons. The ABWC is currently working with the NMFS to ensure that in the future, each stock is surveyed every 5–8 years, so that updated abundance information is available. Abundance estimates generated through ABWC-funded surveys or surveys conducted in cooperation with the ABWC have been used by the NMFS to develop stock assessment reports. The NMFS has credited the ABWC for its efforts, granting recognition of the ABWC's role in providing information necessary to ensure sustainable harvests.

The ADFG, with support from the ABWC, conducted an innovative genetic mark–recapture abundance study in Bristol Bay from 2002 to 2011. The goal was to provide an independent abundance estimate. The genetic abundance estimate, which does not depend on estimating correction factors for belugas not at the surface, was consistent with aerial survey estimates (Citta et al. 2018). Like other ABWC activities, this was a collaborative undertaking in which local beluga hunters worked together with ADFG scientists to collect biopsy skin samples. Hunters were familiar with the mud bars and the extreme tidal fluctuations in Bristol Bay and knew where to find belugas and how to approach them to obtain samples. Hunter–scientist teams were able to collect as many as 150 skin samples in only a few days.

Management planning

ABWC management plan

Creation of a beluga management plan was an ABWC priority from the earliest meetings. A team was appointed

Table 2 Summary of the population estimates and trend for western and northern Alaska beluga stocks. The 2011 Bristol Bay survey was a genetic mark–recapture estimate. All others were conducted using line-transect approaches. Aerial surveys were flown in Bristol Bay in 1993–94, 1999–2000, 2004–05 and 2016; in the EBS in 1992–95, 1999–2000 and 2017; and in the eastern Chukchi Sea in 1989–1991, 1996–98, 2001–03 and 2012. Surveys of the Beaufort Sea stock have been conducted by Canadian biologists.

Stock	Year	Population size	CV[a]; CI[b]	Trend	References
Bristol Bay	2011	1928[c]	CI = 1611 – 2337		Citta et al. 2018
	2016	2040	CV = 0.26; CI = 1541 – 2702	+4.8% (1993–2005; 2016)	Lowry et al. 2008; Citta et al. 2020
EBS	2000	6994	CV = 0.37; CI = 3162 – 15 472		Lowry, Zerbini et al. 2017
	2017	9242	CV = 0.12	Trend unknown, estimates not comparable	Ferguson et al. 2018; Lowry et al. 2020
Eastern Chukchi Sea	2012	20 752	CV = 0.70		Lowry, Kingsley et al. 2017
	2012–16 (partial)[d]	Range of est. = 6813 – 16 598	Range of CV = 0.47 – 0.51	Stable	Givens et al. 2020
Beaufort Sea	1992[e]	19 629 Expanded to 39 258 (Allen & Angliss 2015)	CV = 0.229	No surveys since 1992[e]	Harwood et al. 1996

[a]Coefficient of variation. [b]95% confidence interval. [c]Genetic mark–recapture estimate. [d]These estimates account for approximately 50% of the area for the Lowry, Kingsley et al. (2017) estimate. [e]Two independent surveys were flown again in 2019; analyses are underway by Canada Department of Fisheries and Oceans and the NMFS.

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to draft the first version of an Alaska Beluga Whale Management Plan in 1989. The plan included sections on goals (the same as those of the ABWC), conservation, harvesting, use, reporting and monitoring, public involvement, research and enforcement. It was reviewed at multiple ABWC meetings, and delegates from more than 25 Alaska communities were part of the review process. A draft plan was adopted unanimously by the ABWC delegates in late 1990.

The ABWC's efforts to develop a management plan were voluntary and self-initiated. For this reason, there was no need to rush the review process. The draft plan was distributed by newsletter to beluga-hunting communities and tribal councils. Meetings were held to discuss the plan and propose revisions. In November 1995, five years after the draft plan was adopted, the ABWC unanimously adopted a revised Alaska Beluga Whale Management Plan. During the next two years, tribal entities from 27 beluga hunting communities ratified the plan. Twenty years later, the ABWC asked the original signatory communities to reconfirm their support of the plan. Since 2016, 23 communities have passed new resolutions of support, and eight new communities have ratified the plan (available online at http://www.north-slope.org/departments/wildlife-management/co-management-organizations/alaska-beluga-whale-committee).

Co-management agreement

At the ABWC's first meeting in 1988, a regional delegate recommended that at some time in the future, a cooperative agreement (i.e., co-management agreement) was needed between the agencies and the users for managing belugas. At that time, the only cooperative agreement between users and the federal government was for bowhead whales. Shortly after the MMPA was amended to allow ANOs to enter into cooperative agreements for the co-management of subsistence use, the ABWC began to formally discuss a co-management agreement between the ABWC and the NMFS. The ABWC was envisioned as the umbrella organization concerned with statewide, national and international affairs. Regional groups would later develop local management plans, hunting guidelines and means of enforcement.

The development of the ABWC co-management plan began in 1994 and continued over the next six years. There were no beluga management or conservation 'crises' at the time, so planning did not need to respond to an external time line. The ABWC distributed questionnaires and held co-management workshops to address questions about the role of the ABWC as a statewide organization, the role of regional and local groups and plans, coordination among villages, and how the ABWC should deal with research, allocation, regulation and enforcement. Early participants agreed that an ABWC co-management plan would include Bristol Bay, Yukon/Kuskokwim, Norton Sound, Chukchi Sea (including Kotzebue Sound) and the Beaufort Sea. In 1997, ABWC legal counsel developed a draft agreement between the ABWC and the NMFS that was reviewed and modified by the ABWC Executive Committee and distributed to all members with suggestions about how to encourage discussions in their communities. Subsequently, drafts were distributed and discussed at multiple ABWC meetings and a special ABWC Science Workshop. A newsletter including the draft agreement and a plain English version explaining what the legal text meant was mailed to over 2000 beluga hunters. While the ABWC and its member communities reviewed the draft, the NMFS conducted an in-house review and then met with the ABWC Executive Committee to finalize the agreement.

The ABWC Executive Committee and ABWC delegates signed the final Agreement between the National Marine Fisheries Service and the Alaska Beluga Whale Committee for Co-management of the Western Alaska Beluga Whale Population at the 1999 ABWC meeting, and the NMFS was signed in December 1999. By November 2000, 22 villages had ratified the agreement, and an additional 10 have ratified it since then.

Regional plans

The ABWC's co-management agreement with the NMFS specifies that "Each Management Region within the ABWC shall have responsibility for preparing, in consultation with the ABWC, a Regional Management Plan for the management of the beluga whale subsistence hunt within that region." Regional plans can provide more detail about hunting guidelines than the quite general ABWC Management Plan and the Cooperative Agreement with the NMFS and can accommodate regional differences in hunting methods and approaches to management. Funding and time constraints preclude conducting planning activities for all stocks at once, so the ABWC has prioritized two areas it considers of greatest concern: Kotzebue Sound and the EBS.

ABWC hunter-delegates have been supportive of regional planning efforts, cautioning that it is necessary to proceed slowly, with adequate consultation along the way. They remind the ABWC that many hunters in the villages have less exposure to ideas about management planning and may be hesitant to move forward with a formal plan until they learn more about it and why it is needed. Some of the reluctance may result from fear that such a plan would reduce management flexibility (Fernandez-Gimenez et al. 2008). Developing and

writing down specific guidance could also lead to the perception of increased enforcement. When ABWC delegates and hunters were interviewed in 2002, they favoured an educational approach that would include information about belugas as well as proper hunting practices, safety and traditional values. The erosion of respect for elders, community, tradition and the animals themselves was a major concern (Fernandez-Gimenez et al. 2008). At the ABWC meetings and planned workshops, participants regularly cite the lack of respect for elders, who are often the ones involved in developing plans, as one of the greatest impediments to the acceptance and implementation of planning efforts. More education and improved communication with communities and especially with young hunters are considered essential to any planning effort.

Kotzebue Sound. Belugas were once abundant in Kotzebue Sound (Lowry et al. 2020). They became less abundant beginning in the 1960s and 1970s. Hunters observed that they became less common near Kotzebue when jet planes began to land there in the early 1980s. Until the 1970s and early 1980s, they were regularly harvested by the communities of Kotzebue, Noatak and Kivalina in northern Kotzebue Sound and by Buckland and to a lesser degree Deering in Eschscholtz Bay to the south. As belugas became less abundant and hunting became more difficult in the northern Sound, many Kotzebue hunters began to harvest belugas in southern Kotzebue Sound and Eschscholtz Bay. In 1983, after multiple years of high harvests by hunters from all over the Sound (up to 130 per year), the number of belugas using Eschscholtz Bay declined precipitously, and the hunt was no longer feasible. This decline also roughly coincided with a large entrapment of belugas in the Soviet Far East in late 1984, but the stock identity of those animals was never determined (Ivashin & Shevlyagin 1987).

There are no reliable pre-decline abundance estimates of Kotzebue Sound belugas. Since 1983, belugas have occurred in such low numbers that conventional abundance surveys are impractical. Genetics information indicates that belugas harvested there in the 1980s, prior to the collapse of the hunt, constituted a separate stock (O'Corry-Crowe et al. 2018; O'Corry-Crowe et al. 2021 [this special cluster]). The stock identity of belugas currently using Kotzebue Sound is unclear since few samples are available (O'Corry-Crowe et al. 2021).

> Thirty to forty years ago we saw things happening to belugas but we didn't really notice them. We had the opportunity in the past to do things differently but we didn't … now we are working on it. The beluga plan is important. The hunters have to leave belugas alone for a while so they can come back. It is important to save them so they will be here for the grandchildren in the future. (Tribal elder, Native Village of Buckland)

Elders and beluga hunters began meeting in 2015 to discuss what can be done to help Kotzebue Sound belugas recover to their former abundance. The Native Village of Buckland obtained grant funding for a Buckland Beluga Project to examine both Traditional Knowledge and science to develop a beluga plan. The ABWC became a partner in the Kotzebue Sound planning process in 2016 and has supported meetings and newsletters since the Buckland Beluga Project ended.

The first Kotzebue Sound Beluga Management Plan was drafted by elder hunters, with input from scientists, at a workshop in 2016. That plan was reviewed and revised at subsequent community outreach meetings and at regional meetings and workshops. Draft and final plans were distributed by newsletter. The plan includes hunter guidelines about when not to hunt, safe zones, not hunting females with calves, no netting (because it disproportionately catches females with young), minimizing loss, and sections on Traditional Knowledge, science, communication and education.

The Kotzebue Sound Beluga Plan has been ratified by tribal councils of four of the five affected communities (a near-final copy of the plan in newsletter form is available on the ABWC website). Implementation of the plan, despite the care with which it was developed, is problematic. Local hunters and subsistence leaders are faced with a dilemma: they know there are not many belugas left in Kotzebue Sound, and they know it is necessary to agree to limit hunting to foster recovery. At the same time, hunters, their families and communities long for beluga meat and *muktuk* (skin and blubber) on their tables. Throughout the management planning process, meetings and workshops were well-attended by elder hunters who worked hard to develop solid ideas about restoring belugas to Kotzebue Sound. However, young, active hunters generally did not participate. In 2018, the summer after the draft management plan was approved by the planning team and distributed by newsletter, the Kotzebue Sound beluga harvest was the highest it had been since 2011.

The situation is discouraging to all concerned. Belugas reproduce slowly. Even if all hunting stopped tomorrow, it could be decades before there are enough belugas to support a sustainable harvest in Kotzebue Sound. For older hunters, this could mean they would never again participate in harvesting belugas, once a mainstay of their traditional subsistence lifestyle. There has been no hunting of a similarly depleted beluga stock in Cook Inlet since 1999, and it has still not begun to recover (Shelden & Wade 2019). The Kotzebue Sound situation is compounded by uncertainty about whether the remaining

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'Kotzebue Sound belugas' are part of the original Kotzebue Sound stock (see O'Corry-Crowe et al. 2021) or are intermittent migrants from other stocks, particularly the Beaufort Sea stock.

Compliance with the Kotzebue Sound Tribal Beluga Management Plan is voluntarily. While the MMPA allows for the development of federal regulations to limit harvest, this can only occur if a stock is designated as depleted. Although the historical stock of Kotzebue Sound belugas is greatly reduced, ambiguity about the stock identity of remnant belugas has resulted in no such designation. Thus, there is no 'weight of law' behind the plan. Hunters do not want federal regulation or for the government to get involved in local beluga management, but without it, the process appears to be at a standstill. Elder hunters on the Kotzebue Sound beluga planning team express their concerns in these words:

> (We need) a regional plan, stating that our people have to work together. Some of the young people have lost respect for the elders. We need to have strong hunt leaders again.
>
> A solution has to be built on cooperation, with everybody helping each other as we used to do. The region could work together to address the issue as a tribally led solution, rather than relying on the federal regulators to do it.
>
> We don't talk, we don't work it out, but we need to.
>
> If we don't cut back there will be no belugas in the future. Imagine no more belugas. If we don't act now, this is coming. We need to cut back on hunting so belugas can come back….

EBS. Before the ABWC's co-management agreement specified that the ABWC would develop regional management plans, three villages in Norton Sound developed a beluga plan for Norton Bay. The Elim-Shaktoolik-Koyuk Hunter Bylaws were adopted in 1994. For the next 20 years, in large part, because the EBS beluga stock was considered healthy and without significant management issues, there was no effort to develop a broader regional EBS plan.

This changed as ABWC members realized how difficult it is to recover depleted beluga stocks and to implement remedial plans in times of duress. In Alaska, the Cook Inlet stock (listed as endangered under the Endangered Species Act in 2008) and that of Kotzebue Sound stand as examples of situations gone bad. Actions were not taken soon enough to curtail the harvest as beluga populations declined, and developing remedial actions was contentious and/or ineffective. ABWC delegates have learned the details of these difficulties at ABWC meetings and have made a concerted decision to try to avoid this situation for other currently healthy stocks.

Belugas from the EBS stock, unlike Kotzebue Sound, are abundant, with a recent population estimate of 9242 (Ferguson et al. 2018; Lowry et al. 2020). A 2% harvest level (Wade 1998) would be 185. The retrieved harvest for 21 EBS villages for the 13 years spanning 2007–2019 averaged 194 belugas annually (range 174–236) or 2.05% (Table 1).

It is timely that EBS hunters are beginning to discuss how to keep harvests at a sustainable level. However, this discussion is complicated by the number of villages involved (>20) and because two culturally and socially distinct regions (Norton Sound and Yukon Delta) harvest from the EBS stock. Without facilitation by the ABWC, it is unlikely that communities would address this issue, or that Norton Sound and Yukon Delta communities would interact about a beluga plan. In fact, when an EBS plan was first discussed, the hunters initially proposed having two separate plans.

ABWC members are committed to proactively developing an EBS management plan while the stock is healthy and the harvest sustainable. The ABWC has initiated the process by holding EBS workshops in conjunction with its last two annual meetings and distributing a newsletter to EBS hunters describing abundance, harvest information and the need for management planning. Meetings, with presentations by both ABWC officers and scientists, are scheduled to occur in major beluga hunting villages in the near future. The intent is to initiate widespread discussions in the EBS region, provide many opportunities for hunter and community input and, when there is general acceptance, to put a plan in place that will prevent future problems. About 50% of ABWC delegates from the EBS are young active hunters who encourage and support a planning process, unlike Kotzebue Sound, where active young hunters did not participate. Too often plans are precipitated by crisis, and 'crisis management' is rarely smooth or effective. Through proactive discussions, education and planning the ABWC hopes to ensure the beluga harvest in the EBS remains sustainable and to avoid a management problem.' The following statements from hunters reflect this concern:

> With the EBS beluga stock recently counted we need to manage it to the best of our ability. Filling our freezers is important but not at the risk of overharvesting the population. The yearly take of belugas today is nearing our harvestable surplus. It is up to us as hunters to manage our beluga resource responsibly so we can pass this hunting tradition on to our children and grandchildren. Kotzebue Sound and Anchorage belugas are in big trouble. We don't want to end up like that. (Tom Gray, ABWC Chairman and Nome beluga subsistence netter)

We want a beluga plan so belugas will be here for our kids. (Albert Simon, ABWC Vice Chairman and beluga subsistence hunter)

The plan must come from our people. (Marvin Okitkun, ABWC Member-at-Large and beluga subsistence hunter)

Capacity building and succession planning

Meaningful co-management depends on commitment to common goals, but it is also hugely dependent on individuals, personalities and working relationships. The ABWC has relied on a core of key individuals who have been part of the ABWC for decades to conduct the committee's work. Because the ABWC does not hire an executive director, several Executive Committee members and delegates have accepted responsibility for tasks such as organizing and holding meetings, facilitating the collection of harvest data, drafting management plans and newsletters, implementing research plans, drafting and submitting funding requests and managing awards. The ABWC has been fortunate that its agency members (NSB, ADFG and NMFS) have assisted with the organization of annual meetings, transport and archival of samples and applying for and receiving additional funding for research. Additionally, the NSB has assisted the ABWC by submitting proposals, managing grant funds and helping to coordinate research. In the not-too-distant future, the ABWC leadership—hunters, managers and scientists—is likely to change. Key individuals will retire or step down, and replacements with similar commitment to the ABWC's mission and the time to commit will have to be found. There is a need to train and prepare for that transition.

In theory, capacity-building is a straightforward concept. In reality, it is more difficult to implement. Government agencies and universities fund full-time positions to conduct research and management activities. Scientific personnel receive salaries. In contrast, hunters participate in both research and management activities mostly on their own time. Their 'payment' for attending meetings and serving as officers is reimbursement for travel and per diem. In the best of circumstances, they may be paid a daily stipend for participation and the use of their boats or reimbursement for collecting samples. Consequently, many, if not most, participants are elder hunters who are retired and no longer have young growing families to feed.

Collectively, the ABWC recognizes the need to bring in young people—both scientists and hunters. They will be the ones who must implement management plans and abide by decisions about harvesting and who will be the future leaders. However, young staff and young delegates or research participants require predictable funding, someone to pay their salaries, and some assurance that there will be work for them in years to come. Each year, some of the ABWC's younger delegates cannot attend meetings because they cannot get away from their jobs or family responsibilities. An EBS tagger-training programme did not take place in two consecutive years because salmon fishing was poor and participants needed to work fighting fires to support their families. In 2019, 30% of the ABWC delegates, and 50% of those from the EBS, were younger than 40. These young hunters invigorated discussions and contributed new ideas, but the time they have available for ABWC activities is limited by the practicalities of earning a living.

The capacity needs of communities extend from bureaucratic aspects of managing grants to conducting research. Capacity-building must match not only the needs of agency managers and the scientific community but must be compatible with local needs, practices, capacity limitations and interests of beluga hunting communities. For example, the conduct of aerial surveys is not research, in which ABWC delegates generally want to participate or build capacity. It is attractive to only a few professional career biologists and is becoming less so as new, safer, technology-intensive methods become available. It is not surprising that hunters accustomed to being outside and on the water do not want to spend 1–2 weeks of long days confined in a small aircraft surveying mostly empty water. Furthermore, surveys often take place during commercial fishing season, when people are busy with fishing and other seasonal economic activities. Although they do not want to participate, hunter-delegates are nonetheless strongly supportive of beluga aerial surveys. In contrast, participation in satellite tagging hunter-tagger programmes is a form of capacity building that is a 'good match.' Catching and tagging belugas utilizes the skills and equipment beluga hunters have acquired through their daily lives and activities. The timing is flexible and does not require large blocks of time that preclude seasonal subsistence or other economic activities.

Communication

Communication among scientists, beluga hunters, beluga hunting communities and managing agencies is essential for successful co-management. Even though this is an obvious statement, communication can be challenging in a group with broad representation, which includes elders who may not use e-mail or social media, scientists who have been trained to speak technically and often do not have skills or experience necessary to use plain language, individuals with cultural differences (e.g., Yupik, Inupiat and Western) and those with diverse backgrounds in education and experience.

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A foundation of the ABWC's success has been effective communication among its members. At ABWC meetings, scientists provide up-to-date information about belugas. Since the first meetings, they have been required to speak in jargon-free English and to explain scientific terms. One effective technique at ABWC meetings has been to do 'roundtables' at the end of meeting sessions, in which each delegate comments on the subjects under discussion. This ensures that less outspoken members have an opportunity to provide input.

The ABWC's communication about genetics and stock structure is a good example of how it has fostered communication between hunters and scientists. In an iterative process, hunter delegates worked closely with scientists to help them develop reports and graphics that were readily understood (see Fig. 2). As a result, an active dialogue developed about concepts of stock identification. The result was an outpouring of samples that continues today and broad appreciation about the need for information about stock identity. A previous ABWC Chairman, Ross Schaefer, pointed out that "O'Corry-Crowe's presentation was a perfect example of what the ABWC had done together. Every single person in the room had contributed and the study utilized all information from all people."

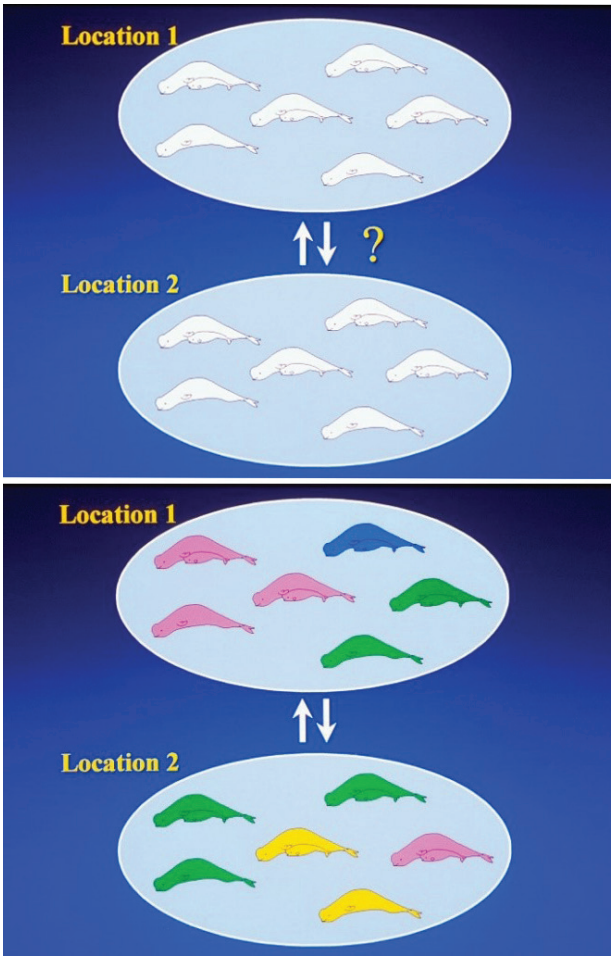

Fig. 2 Presented at an early ABWC meeting, this infographic shows how knowledge of genetic hapolotype frequencies can be used to define beluga stocks and is a good example of an effective tool of communication between scientists and non-scientists. (Courtesy of Greg O'Corry-Crowe, Florida Atlantic University.)

The removal of the 'scientific language barrier' results in extensive questioning of speakers at ABWC meetings and workshops. Because scientists are required to talk in plain English and because ABWC delegates are accustomed to and at ease communicating with scientists, ABWC delegates provide significant input into the design and interpretation of studies. When everyone understands a project, everyone can contribute to making a better, more logistically feasible project with results that are broadly accepted. Reports by hunters at annual meetings, and interchange among hunter-delegates and other ABWC members allow managers and scientists to better understand the environmental conditions in western and northern Alaska, provide observations about possible changes in beluga behaviour and habitat use, and raise concerns related to climate change, oil and gas activities, or other human activities. This, in turn, may provide the foundation for future research proposals to better understand these things.

The ABWC and its scientists have published more than 40 articles in the peer-reviewed literature since 1993, and more than 20 since 2015 (http://www.north-slope.org/departments/wildlife-management/co-management-organizations/alaska-beluga-whale-committee/abwc-publications). These publications have reported on work conducted with the involvement and support of beluga hunters throughout the ABWC regions. Genetics publications reported findings from samples collected almost entirely by hunters. Similarly, publications about diet, health and contaminants were based largely on hunter-provided samples. Satellite-tagging studies relied on community support, hunter participation and hunter tagging to catch as well as tag belugas. Acoustics studies and aerial surveys were prioritized by ABWC members and supported by ABWC co-management funding. These publications are directed at a scientific audience, but plain-English summaries are included in the ABWC's meeting packet for delegates to read and take home to their communities.

Residents of small rural communities in coastal Alaska experience meeting fatigue because so many agencies and projects hold meetings to report their findings or solicit opinions. To avoid 'yet one more meeting,' and in an attempt to reach a broad cross-section of coastal residents, the ABWC has distributed 15 plain-English printed newsletters since 1991. The newsletters have facilitated

development of the ABWC–NMFS Co-management Plan and, more recently, the Kotzebue Sound and EBS beluga plans. Special newsletters dealt in-depth with issues such as Kotzebue Sound belugas and how genetics is used to study beluga stocks. ABWC hunter-delegates have repeatedly emphasized newsletters as a good way to reach a diverse audience of both elders and youth. The ABWC has a Facebook page where it can communicate information directly to the hunters, and where hunters from around Alaska can communicate directly about belugas, but most delegates still consider newsletters more broadly useful than social media. The ABWC has held five science workshops to address broad, and often international, aspects of beluga biology and management. The workshops have allowed time for more in-depth discussions of topics and facilitated information exchange and cooperation between Alaskans and participants from elsewhere, especially Canada. More recently, the ABWC held two women's beluga workshops in conjunction with annual ABWC meetings. In prior years, it was apparent that some ABWC delegates were accompanied to meetings by their wives, and that some of them attended all or part of the ABWC meetings. When approached, they were enthusiastic about attending a Women's Beluga Workshop and meeting other women interested in belugas and beluga hunting and were active participants when the workshops occurred. Participants shared information about processing and sharing belugas; using, preparing and storing belugas; and medicinal uses.

Communication remains a challenge. As in society in general, people are deluged with information, and many entities compete for their attention. The ABWC continues to seek better ways to communicate information and involve more people in beluga research and management.

Differences between the ABWC and other co-management groups

The marine mammal co-management ANOs in Alaska are numerous. There is approximately one co-management organization per marine mammal species used for subsistence, with the exception of four ice seal species, which are all included under the Ice Seal Committee. The other Arctic ANOs include the ABWC, the Alaska Eskimo Whaling Commission, the Eskimo Walrus Commission and the Alaska Nannut Co-management Council. There are other marine mammal co-management organizations in southern Alaska. They were all created under the MMPA and receive funding from either the NMFS (whales and seals) or the US Fish and Wildlife Service (walruses and polar bears).

The Alaska Eskimo Whaling Commission, the Eskimo Walrus Commission, and the Alaska Nannut Co-management Council each request and receive annual funding (from the NMFS, the Fish and Wildlife Service or other organizations) for an executive director and sometimes support staff for the operation of the organization. The Alaska Eskimo Whaling Commission and the Alaska Nannut Co-management Council also receive funds for legal counsel. The NSB provides a varied amount of scientific support for each of the organizations, as do the ADFG, the NMFS and the Fish and Wildlife Service (dependent on the species). The ABWC and the Ice Seal Committee receive bureaucratic support (e.g., grant administration, travel) from the NSB.

The ABWC membership structure is unique among marine mammal co-management organizations in Alaska. The delegates/commissioners for all other ANOs include only Alaska Native hunters or their regional representatives. Some may have scientists, legal counsel and other support staff, but agency managers and scientists serve as advisors or partners and not members. The ABWC is the only marine mammal ANO that includes agency managers and scientists as voting members.

The ABWC is more similar to the co-management boards in Canada than to other Alaska ANOs. In Canada, land claim agreements created co-management boards. Under the land claim agreements, the federal government provides regular funding to the Inuvialuit, the Nunavut and the Nunavik for the management of belugas and other subsistence species. With federal funding, each region created Hunters, Fishers and Trappers Associations that, in turn, appoint members to a regional organization (e.g., the Inuvialuit Game Council). The regional organization, in turn, appoints members to co-management boards that also have appointees from the federal government and, in many cases, the relevant provincial or territorial government. One of the main objectives of those organizations is to provide Inuit with a greater role in making management decisions about the resources that are critical for helping to meet nutritional and cultural needs. The co-management boards have had variable success at meeting that objective.

The ABWC is distinctive in the breadth and inclusion of its membership and its deliberations. No other group includes such broad community representation combined with members from government agencies. Some observers, and indeed some participants, view this feature as a drawback because they believe it dilutes the role of Alaska Native tribes. For others, the broad and inclusive representation means that the ABWC's decisions are binding not only on the Alaska Native representatives but also on the government agencies, thus elevating the ABWC above the level of an advocacy group.

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Discussion

The goal of co-management is to achieve sound resource conservation through an equal partnership between hunters and tribal representatives on one hand and government managers and scientists on the other hand. Many Inuit in Alaska and Canada are distrustful of federal governments for many reasons but are also hopeful that co-management will provide a more equal footing (Tyrrell 2008). Many factors can promote or inhibit such a partnership, ranging from the quality of personal relationships (Huntington 2011) to the structure of the organization. Co-management is hindered by poor communication, lack of a common system of belief (e.g., similar management goals), the undermining of Inuit systems of management, insufficient funding, insufficient sharing of power and decision-making and, in some cases, complex administrative structures (Gombay 2019).

Co-management was a nascent idea when the ABWC was formed. There were no real examples of what co-management should—or could—be. Over the course of 30 years, the ABWC has developed its own model for what it thinks co-management is—a true partnership between beluga subsistence hunters, managing agencies and scientists. Long-standing participation of members has been fundamental to the ABWC's success. It has facilitated communication and cooperation, improved the outcome of research projects and increased the acceptance of results. Through this structure, research and management priorities have been discussed freely, disagreements stated and solutions developed in a non-antagonistic forum.

The inclusion of scientists and hunters together in the ABWC did not guarantee success. As Toomey (2016) noted, working with indigenous people in Bolivia, "in such spaces of encounter or misencounter between scientists and local people, knowledge can be exchanged or hidden away, worldviews can be expanded or further entrenched, and scientific research can be welcomed or rejected." Fernandez-Gimenez et al. (2006: 7) summarized the ABWC's success as growing from lengthy relationships between hunters and scientists who were established in a "variety of different settings for interaction and an organizational culture that allowed for candid exchanges in a mutually respectful environment" that nurtured the exchange of ideas and knowledge and allowed for "challenges to each other's beliefs and world views." Involvement of hunters in ABWC research and research decisions has fostered social interactions and situations that build trust, mutual understanding and novel ecological insights (Huntington 2011). When complementary threads of knowledge weave together, innovation and new insights may follow (Huntington et al. 2004; David-Chavez 2019). This research model produces results that are scientifically valid and locally accepted. Because hunters as well as scientists are involved in the design, conduct and interpretation of studies, the results and conclusions become 'ours' not 'theirs.'

It is critical that hunters be integrally involved in managing their subsistence resources. Hunting is more than harvesting. For many Indigenous people, it is about being connected to the environment, spending time together and teaching youth and is integral to cultural continuity and identity. Hunting elevates their spirits, grounds them or makes them feel whole (Inuit Circumpolar Council Alaska 2020). The failure of beluga conservation in Cook Inlet and Kotzebue Sound threatens this crucial aspect of Indigenous culture and well-being and has strongly motivated the ABWC to prioritize regional management planning. Planning is, however, a complicated process that entails more than ABWC delegates conceiving and adopting a plan: official approval by a leadership council will not ensure local support (Toomey 2016). People at many levels must 'buy in' to implement the plan and to change their own behaviour. Cultural reluctance to tell others what to do, generational gaps in communication and the absence of an external motivator (such as legal mandates) make voluntary self-management difficult. Whether Kotzebue Sound beluga hunters and the ABWC can navigate these difficulties to implement the Kotzebue Sound Beluga Plan and start the long recovery process for Kotzebue Sound belugas is not yet determined. In the EBS, the relatively high abundance of belugas and their occurrence in pods or large groups when they are encountered bring other management challenges: even as the harvest is approaching the calculated sustainable level, the hunters do not perceive a decline. The importance of implementing proactive measures is not clear to everyone.

To be successful, regional management plans must be developed locally. When the ABWC engages villages in management planning, it must communicate that the plan is a hunter-generated plan, not a government plan. It must explain why a plan is a good idea and convince communities to join in. Many attempts to engage indigenous communities in resource management require the villagers to fit their knowledge and customs into Western moulds, which is hampered by fundamental philosophical and practical differences (Gadamus & Raymond-Yakoubian 2015). Regional plans are further complicated because hunting guidelines are traditionally enforced within communities, not across broad areas (Fernandez-Gimenez et al. 2008), and the transition from local norm-based systems to a more formal regional plan will almost certainly be difficult. Although it is treading new ground, the ABWC hopes it can

develop regional plans that are culturally appropriate and can influence hunter behaviour and promote sustainability of the beluga harvest at a time when the human population is growing, and environmental conditions for belugas are changing. The ABWC approach of combining Alaska Native values of respectful human and animal relationships and community traditions with scientific knowledge will hopefully result in a long-term sustainable harvest. As expressed by a previous ABWC Chairman, Roswell Schaeffer, of Kotzebue:

> Today I am very proud to say that ABWC is truly co-management at its best. Those who attend our meetings are sober, very active in our discussions, and instrumental in our decision-making about issues, policies and research. The positive energy is infectious. Our meetings reflect this sense of working together with the same spiritual energy, like a whaling crew and its people pulling up a huge bowhead whale. It takes this kind of positive energy and commitment to our work to preserve the rights of our people to continue to harvest the belugas and to also make sure we have these beautiful creatures for those to come in the future. I applaud all our members who contribute in every meeting.

Consistent funding has contributed greatly to the ABWC's success. Federal funding has supported annual meetings, science workshops, newsletters, management planning, collection of harvest data and a variety of management-related research projects. The ABWC has leveraged those funds with in-kind contributions of research equipment, logistical support and laboratory analysis from ADFG, the NMFS, the NSB, Alaska Native tribes and other Native organizations, and the many individuals associated with the ABWC who have volunteered their time as well as grant funds from other funding organizations.

The implementation of the NMFS ANO Co-management Funding Program in 2011 fundamentally altered the co-management relationship between the ABWC and the NMFS. Until then, funding decisions were collaborative and responsive to ABWC priorities. Now, a review panel makes decisions about project priorities, allocation among projects and funding reductions across ANO proposals. There is no opportunity for input from co-management organizations. A better approach would be for the NMFS to set aside specific funds to support co-management of belugas annually and then to work with the ABWC to develop priorities and a spending plan together.

Conclusions

The ABWC has succeeded because it has dared to be different. Members are proud of how they work together. Other ANOs have sometimes disapproved of the ABWC's inclusion of non-Native scientists and agency managers as members. Agency personnel are sometimes uncertain about how they 'fit.' But the ABWC considers this as its greatest strength. The knowledge of hunters and scientists has not been put into separate bins, but instead combined, drawing from each to get the project or the job done in the best possible way. The ABWC has not focused on theoretical concepts of what co-management should be, but on what works—and what does not. Members discuss difficult subjects openly at the meeting table, not only with like-minded colleagues in private conversations.

> None of the ABWC progress would have happened without the first meeting when the group had to choose a model for its organization. There were some wise people at that meeting who understood that direct contact between hunters and researchers was essential. Under the ABWC model, the Committee sets the priorities and these priorities are then adopted by NMFS and ADFG. With an annual budget of $200,000, it wouldn't be possible to accomplish all the ABWC does without bringing NMFS, ADFG and others to the table to help and contribute to its efforts. Because everyone works together, there is huge support for ABWC programs and everyone follows up on their commitments. The hunters and researchers are in handshake reach. Through the ABWC format, the federal government is accountable to its citizens, the beluga hunters. Through the ABWC, everyone speaks out and shares opinions and knowledge. The ABWC has the government's blessing. It has a management plan and a research plan. It doesn't need outside regulation because regulation comes from inside. (Marie Adams Carroll, an ABWC founding member)

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