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Building resilience through interlocal relations: Case studies of polar bear and walrus management in the Bering Strait

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ABSTRACT

Arctic coastal communities in the Bering Strait region of Alaska (USA) and Chukotka (Russia) share a close relationship with their natural environments that can be characterized as a social-ecological system. This system is complex, featuring changing ecosystem conditions, multiple jurisdictions, migratory animal populations, and several cultures. We argue that linkages between communities in both countries enhance the effectiveness of trans border polar bear and walrus conservation. We find that locally embedded bilateral institutions can provide effective management venues that persist despite slow or lacking processes of international law because they provide a better fit between rules for managing and the true system state.

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1. Introduction

Arctic coastal communities in the Bering Strait region of Alaska (United States) and Chukotka (Russia) share a close relationship with their natural environments that can be characterized as a social-ecological system (SES). Such a system consists of interactions between human communities and the surrounding ecosystems (e.g. marine mammals, sea ice, coastal landscapes) as well as the social institutions developed to sustain ecosystem services over time. The Bering Strait SES is complex, featuring changing ecosystem conditions, multiple jurisdictions, migratory animal populations, and several cultures. How should one evaluate the resilience of such an interdependent human and marine system faced with rapid change? What role can localized institutions play in promoting regional sustainable management practices? This article addresses these questions by evaluating the impact of contextual, cross-scale interactions in the Bering Strait SES through case studies of polar bear and walrus management. We specifically examine the ability of polar bear and walrus co-management institutions to foster resilience management where resilience is defined as the ability of a system to withstand disturbance and adapt to changing conditions. The authors

employ the concepts of interlocality and resilience to examine the evolution of resource management practices in the Bering Strait region of Alaska.

We argue that interlocal linkages between hunters in Chukotka and Alaska enhance the effectiveness of transborder conservation by providing a more complete understanding of not only ecosystem dynamics, but also the social complexities that affect resource management. These cross-scale institutions provide a framework within which participants coordinate actions among all parties and thus enhance the potential sustainable management of the Bering and Chukchi Seas. Importantly, the case studies demonstrate that such arrangements can provide effective management decision-making venues that persist despite slow or lacking processes of international law, because they are embedded in the SES and thus provide a better fit between rules for managing and the emergent state of the system.

2. Problem context: marine mammal co-management and resilience

Marine systems are regarded as complex [1–3]; thus, management is subject to significant levels of uncertainty. Recent institutional theorists have recommended collaborative, adaptive approaches to resource management in order to build flexible

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management systems responsive to the task of ecosystem management under incomplete information, multiple drivers of system change, and limited budgets [1,4–8]. Co-management, in principle the sharing of power for resource decision-making between the state and resource users [9–11], has emerged as one promising technique to build resource management institutions that are flexible, cross-scale, and equitable. Formal co-management institutions, however, are usually limited by political boundaries such as the border between the United States and Russia and usually function as vertical institutions between user groups and their governments.

Wilson [12] argues that mismatches between the spatial organization of complex marine systems and management approaches inhibit the collection of multi-scale feedback required for ecosystem management. Ecosystem-based marine management is best accomplished through decentralized, cross-scale approaches such as co-management so all scales of the system are considered in making decisions [12]. For instance, including long-term observations of environmental quality from particular places important in the life histories of animals can enhance understanding of large-scale population trends. At the present time, formal marine mammal management in the United States is organized around a single-species approach, largely driven by federal population assessment research and harvest monitoring programs. However, federal management agencies are not the sole *de facto* managers as remote subsistence-based communities in Alaska often follow traditional rules regarding harvests. Furthermore, in the North Pacific Ocean, as well as in the Bering, Chukchi, East Siberian and Beaufort seas, many marine mammals migrate between Russian and Alaskan waters presenting significant challenges to monitoring, managing, and conserving populations [13].

In this paper, we use cross-scale analysis [14–16] to examine how linkages between various organizations, government agencies and communities affect resource management of walrus and polar bears in the Bering and Chukchi Seas. These two species have historically been important in the subsistence debate in Alaska [17] and are now the primary subjects in cooperative discussions with Chukotka concerning bilateral marine mammal management. Berkes [6] argues that cross-scale linkages can speed learning and communication and thus foster resilience to uncertainty and surprises. Walker et al. [18] find that self-organizing elements in resource governance promotes resilience. In short, management practices that can increase the capacity for learning, adaptation, and self-organization enhance decision-making. In the following case studies of polar bear and walrus management, we examine the impacts that localized international interactions have upon the resilience of the Bering Strait SES. Furthermore, we argue that contextualized cross-scale co-management has resulted from the institutions in this region that are simultaneously interlocal and co-managed. Contextualized trans-border co-management represents a governance strategy that could foster resilience management in other complex international systems with high dependency on marine resources. The next sections discuss the concepts of resilience, co-management, and interlocality as they enhance our understanding of the SES; our analysis focuses on the latter two as institutional features that promote overall system resilience in our cases.

3. Managing for resilience

For the purposes of our discussion, we define the Bering Strait SES as an interconnected system of ecological, social, and institutional components. The components include the following: (1) the marine and coastal ecosystems adjoining the Bering Strait that support shared populations of people, polar bears and

walrus; (2) the human communities that use ecosystem services; and (3) social institutions developed to manage use of the system. Assuming most interested parties aim to sustain key components of the Bering Strait SES, actors practicing resilience management are expected to support and adopt policies that enhance a system's ability to reorganize after disturbance within acceptable limits of change [19].

The federal government of the United States has tried to manage polar bears and walrus in the past using a conventional approach, propagating regulations and increasing enforcement actions to support federal policies. These strategies were effective for polar bears in the early years of American marine mammal management when the regime was changing from a utilitarian management philosophy to a protectionist one under the Marine Mammal Protection Act. However, these strategies have not been successful enough to prevent population declines largely caused by changes in habitat availability and unknown harvest levels in the SES as a whole. Russia banned polar bear hunting in 1956 and was very successful in enforcing the ban until its economic collapse in the mid-1990s when illegal hunting became widespread, due to economic and material hardships [20]. In the United States, protectionist strategies initially successful for polar bears had the opposite effect on walrus, as the Bering/Chukchi population was showing signs of exceeding the carrying capacity of Bering Sea resources in the late 1970s while hunters were not allowed to increase harvests to reduce population pressure [21]. Combined with walrus hunting restrictions on the Russian side, the population swelled, prompting fears of a population collapse in Alaska villages dependent upon walrus for subsistence [21].

Faced with the complexities of managing human impacts to animal populations during a period of dramatic social and ecological change, Bering Strait resource governance [22] in the past decade has evolved to include horizontal (community to community) and vertical (community to governments) cross-scale collaboration, research and rule enforcement. In the present co-management regime cases, rule development and enforcement look unlike any of the previous regimes in their approach, as they are subject to significant institutional bargaining amongst user communities and the federal agencies. Co-management is burgeoning on both sides of the Bering Strait, to greater or lesser extent.

Neither the polar bear nor the walrus co-management regime in Alaska would fit Pinkerton's [8] definition of complete co-management, in which user communities are co-equals in both decision-making and operational resource management functions such as allocation, harvest assessment, enforcement and research. The American marine mammal regimes are, however, based on cooperative agreements founded on the recognition of Alaska Natives' exclusive right to harvesting. The cases we present share common conditions, where despite a lack of devolution of power, local norms continue to dominate the rule sets. The Russian co-management institutions are less stable than their American counterparts, as various government factions have interfered with Chukotkan Native self-representation and at times have installed their own representatives in leadership positions. However, the principle of cross-scale coordination between local hunters and the Russian federal government is implied in all of the management agreements with the United States, and will be required for implementation of the new polar bear treaty, as we will explain later on. Local norms also continue to dominate the Russian rule sets, as there is not yet a legal hunt for polar bears ¹ in addition to a largely unregulated walrus hunt.

¹ A legal subsistence hunt was recently authorized in Russia pursuant to the 2000 Agreement between the Government of the United States of America and the

Our method of analysis recognizes that effective institutions should " ... transform information about the state of the system into actions that influence the system" [23] in desired ways. As such, we examine the effectiveness of emerging cross-scale linkages to enhance the following aspects of resilience management: learning, the ability to self-organize, and rule congruence [6,23]. Anderies et al. [23] describe congruence as the extent that "rules in use" match "rules in force." The closer these rule sets parallel each other (e.g. problem definition, methods of information gathering, penalties for breaking the rules), the more likely all of the actors affecting the system will learn from feedback. For instance, if polar bear tagging rules are flexible enough to accommodate local norms involved in reporting harvested animals, they are more likely to be successful. Congruence should also be distinguished from "compliance," which infers a one-way transfer of responsibility. Rule sets may also be transferred up from the community, as was previously the case for the 1996 amendments to the Migratory Bird Treaty between the United States and Canada, at which time international protocols were changed to reflect ongoing traditional practices in Alaska and Northern Canada [24]. Below, we analyze each case for these features and argue that an interlocal structure can serve as a key intervening factor in institutional design between these aspects and effective outcomes.

In designing management for an SES, no design principles can guarantee success or avoid collapse of a desired state if the understanding of the system is fundamentally flawed, or all potential resource users are not party to the institutional framework [23,25,26]. For instance, the influx of outside whaling interests and decimation of the walrus herds preceded the 'great famine' on St. Lawrence Island between 1878 and 1880 when over 90% of the island's population died of starvation [27]. It is unlikely that any local institutional responses could have prevented the system from collapsing at that time.

The SES we describe in this article is undergoing an institutional shift towards interlocal co-management with a focus on understanding system dynamics-how many animals are needed for subsistence, how many animals can the changing environment support, how many animals are harvested each year? Thus, we describe the institutional shift and analyze its potential to enhance understanding of the system as an aspect of resilience management. We deliberately avoid an analysis of outcomes with respect to polar bear and walrus population levels. Because evaluating how an uncertain abundance of a long-lived animal population responds to management strategies is beyond the scope of this paper; we leave it to others to determine whether or not the institutional responses have succeeded or not after they have been in place long enough to evaluate their success. The lack of statistically defensible data to support trend analysis of both polar bear and walrus populations in the Bering Strait SES makes most efforts at evaluating institutional success difficult at the present time. However, the putative scientific consensus is that both polar bear [28,29] and walrus [30,31] populations are in, or vulnerable to, decline due to sea ice habitat reductions in the Bering Sea. Whether total harvest levels of both polar bears and walrus in the SES are above sustainable levels is unknown. The complexity of species management for these populations is reflected in the multiple jurisdictions that are party to collecting information and making decisions in the Bering Strait SES.

4. Co-management and resilience

Marine mammals management in Alaska has shifted over the past 50 years from a predominantly local knowledge-based regime to a scientific management system. This shift culminated in the Marine Mammal Protection Act of 1972 (MMPA), which restricted mammal harvests only to indigenous subsistence hunters in addition to other limited "takings" such as those incidental to commercial fisheries or other permitted coastal development, and for scientific research and public display. The primary operational goal of the MMPA is to maintain "optimum sustainable populations" (OSP) of marine mammals within the context of their native ecosystems.

Two federal agencies, the National Marine Fisheries Service (NMFS) and the US Fish & Wildlife Service (USFWS), hold federal management authority over marine mammals.³ However, today the conservation and subsistence harvesting of marine mammals in Alaska are regulated at many different scales, from local traditional rules governing use by Alaska Native communities, to tribal ordinances, to federal agency rules and environmental laws such as the MMPA, the Endangered Species Act, and numerous international treaties such as the International Convention for the Regulation of Whaling and the Convention on International Trade in Endangered Species (CITES). A key innovation in the federal system was the 1994 Amendment, Section 119, to the MMPA, which encouraged the two federal agencies to engage in cooperative resource management arrangements and co-management institutions with Alaska Native organizations and subsistence communities. Much of the day-to-day operations of both the Nanuuq⁴ Commission and the Eskimo Walrus Commission are funded through these Section 119 "cooperative agreements" negotiated with the Fish & Wildlife Service for the scope of work and specific projects. Unlike the Alaska Eskimo Whaling Commission's co-management agreement with NMFS⁵ based on international law, the Section 119 agreements do not devolve significant management functions or authority. On the ground or in the boat, however, *de facto* management lays with communities as federal agencies lack the capacity to monitor and enforce laws in many remote villages. A linked network of resource governance now exists across the state in co-management boards, municipal boroughs, Tribal offices, communities and regional Alaska Native non-profit organizations, and advocacy organizations such as the Indigenous People's Council for Marine Mammals.

Co-management institutions are touted as a counter-weight to the centralization of control of resources through the sharing of institutional resources and decision-making power [9,33]. Berkes [6] finds that co-management can bring information from multiple scales to bear on decision-making. Anderies et al. [23] find that enhanced local management authority has the potential to match rules-in-use to rules-in-force. Finally, Olsson et al. [34] illustrate how co-management institutions can fashion a network for adaptation and collective action. All of the above attributes support resilience management-trying to keep a system from degrading toward alternate, less desired states. Increasingly, co-management is playing a significant role in Bering Strait scientific studies, as researchers and agency staff seek to benefit from the contextualized traditional knowledge of local native users. Co-management leaders have also enhanced the capacity of local institutions for resource management through grants and training opportunities for local communities, as explained later in the text.

(footnote continued)

Government of the Russian Federation on the Conservation and Management of the Alaska-Chukotka Polar Bear Population (United States T. Doc. 107-10).

² Source: USFWS briefings at the Nanuuq Commission and Eskimo Walrus Commission annual meetings, 2005.

³ The split jurisdiction is a result of an anticipated marine resource agency never being formed after passage of the MMPA.

⁴ Nanuuq (also spelled nanuq) is an Iñupiaq word for polar bear.

⁵ See Ref. [32].

5. Interlocality and cross-scale interactions

The management of a contiguous trans boundary ecological commons presents a complicated nexus in which at least two forms of governance and culture characterize and attempt to solve commonly shared environmental problems [35]. Along the borders of Russia and the United States, there is a history of locally organized formal and informal cross-border environmental cooperation. However, in the last few decades, more bilateral transboundary institutions for marine resource management *have evolved*. Transboundary management in the Bering Strait SES is particularly interesting because the localities *have* similar, subsistence-based cultural heritage (Siberian Yup'ik, Central Yup'ik, Chukchi, and Inupiat), which provides a basis of shared experiences and *values*. In contrast, federal managers and other decision-makers on both sides of the border are embedded in not only national cultures but also varying bureaucratic and scientific cultures. They must artfully navigate these cultures in order to come to a legal agreement, subject to long, bureaucratic processes of negotiations and ratification by national legislatures.

We argue that interlocal relationships and collective action planning *have* established policy networks that have in turn changed the administrative landscape for policy implementation. For instance, the 2000 bilateral Agreement on Conservation and Management of the Alaska-Chukotka Polar Bear Population is the first treaty Russia has signed with indigenous peoples as parties to the negotiations and management functions. Significantly, the treaty requires consensus in decision-making, theoretically giving indigenous partners a "*veto*" over agencies". The treaty is also *very* different as compared to the 1973 Agreement on the Conservation of Polar Bears, in which management functions and enforcement were left to member states to design, all of whom later chose conventional top-down management models? [36]. A bilateral agreement between the United States and Russia for sharing aboriginal bowhead whaling quotas is effectively implemented through co-management and interlocal relationships. Another trans border institution is the National Park Service Beringia Program. This program was established in 1991 to help foster a holistic understanding and management of the Bering Strait region, in anticipation of an international park designation by both countries, currently stalled on both sides of the border. Finally, relations with non-governmental organizations such as the World Wildlife Fund are increasingly prominent in this region, as elsewhere [37].

Our marine mammal institution cases illustrate a growing trend among co-management arrangements in which cross-scale mechanisms for information sharing, decision-making, and regulation are created interlocally. Interlocal characterizes a situation in which local entities on either side of a contiguous border make agreements or reach working understandings across international boundaries to *solve* commonly shared problems [35]. The polar bear and walrus case studies demonstrate the development of an institutional capacity to re-conceptualize governance rooted in the local ecological space of a shared marine resource.

In the evaluation of the Bering Strait SES we consider the transnational management institutions for polar bear and walrus as holistic units of environmental administration that *have*

developed as a distinctive response to transboundary environmental concerns. The rule structures in these cases that make them interlocal include a requisite role of resource-user self-definition through the inclusion of *local* participants in defining appropriate management of the resource; as well as the actions that follow from such a definition. The existence of a cross-scale institution that is interlocal means that the interests of local people are communicated across a variety of intra-national vertical power structures as well among horizontally empowered international stakeholders. Early use of the concept as an analytical tool demonstrates that interlocal institutions can offer efficient and inclusive public design for the stewardship of shared resources across international boundaries [35,38,39]. Our analysis of the two cases presented here lead us to argue that interlocal relations can foster resilience because they can circumvent structural and political barriers to cross-scale cooperation and thus enhance efficiency of the management system in certain respects. Examples of improved management include more regular and direct communication between partners *via* radio and fax and the sharing of more sustainable and humane methods of harvesting amongst Alaskan and Chukotkan communities. The interlocal relations described in this paper link small, mostly indigenous communities along the coasts of the Bering and Chukchi Seas who constitute the primary marine mammal hunters (Fig. 1).

Many of these communities *have* maintained long-standing connections through culture and kinship irrespective of the political and physical boundaries that separate them [40]. A *varied* epistemic community of agency biologists, non-profit organizations, churches, academics and politicians are also *involved* in our case, but with an arguably lesser "stake" in the outcome.

6. Interlocal relationships in the Bering Strait SES

Exchange between indigenous peoples across the Bering Strait occurred for generations before the United States purchased Alaska in 1867. More recently the border became a national political impediment to collaboration, especially during the Cold War. Consequently, the United States and the *Soviet* Union signed an agreement in 1972 "On Cooperation in the Field of Environmental Protection and Natural Resources," as both countries had (and still maintain) extensive interests in environmental issues and especially strong Arctic science programs. After the dissolution of the *Soviet* Union, the agreement was renegotiated and signed in 1994 [41]. However, the social conditions on the Russian side of the Bering Strait became dire as the Soviet Union collapsed. Generous central subsidies for Siberian villages eroded and indigenous peoples found themselves relying on subsistence foods such as polar bears and walrus for an even greater share of their diet than previously, despite *harvest* bans [42].

In response to the political opening up on the one hand, and the desperate social circumstances of Chukotkans following the collapse of the *Soviet* Union on the other hand, many Alaskans sought to help their Russian counterparts in rebuilding *civil* society and distributing humanitarian aid. For instance, the North Slope Borough⁸ and the American-Russian Centre of the University of Alaska Anchorage developed a project in the mid-1990s entitled the "Alaska-Chukotka Program for the Encouragement of *Native* Involvement in Policy and Decision Processes." This project

⁶ The director of the Nanuq Commission, Charles Johnson, emphasized this point recently at a meeting of the Indigenous Peoples' Council for Marine Mammals.

⁷ Fikkan et al. [36] credit the lack of management prescriptions in the 1973 Agreement; however, for allowing a more effective regime than that of the International Whaling Commission, which the authors and others argue is often mired in contentious collective decision-making. See Ref. [36].

⁸ The North Slope Borough is a regional public government for the northern part of the State of Alaska. The majority of residents are Inupiat and the borough maintains an extensive wildlife management program dedicated to protecting subsistence resources.

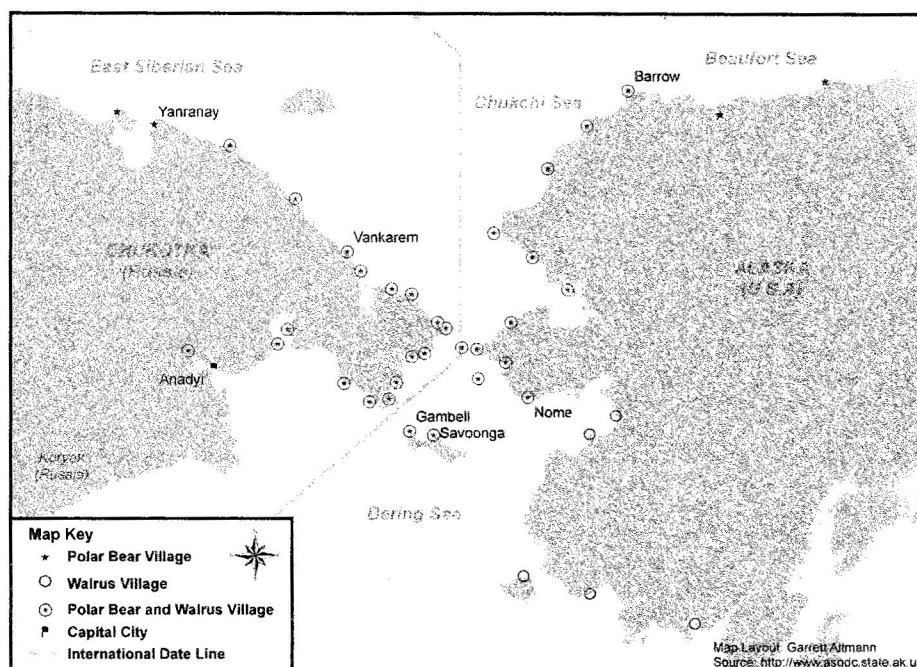


Fig. 1. Map of the Bering Strait social-ecological system. Identified villages have participated in interlocal institutions for polar bear and walrus management.

aimed to strengthen native organizations in Chukotka, encourage native hunters to participate in wildlife management policy-making processes, and to document local knowledge. One consequence of this and likeminded projects was a mobilization of indigenous Chukotkan marine mammal hunters to begin to assert aboriginal rights and participate in what has been throughout the 20th century a very hierarchical system of resource management. Whereas indigenous hunters may have been representing Russia in previous resource management fora, now they are more likely to represent their own interests and rights in marine mammal hunting.

Government programs on both sides of the Bering Strait wax and wane due to funding, changing national priorities, and agency directives. USFWS reported in 2002 that while several joint research and management projects have been undertaken in the past between national wildlife agencies of the USA and Russia, few projects are ongoing or are conducted unilaterally by Americans [43]. The Russian government has just begun to establish its implementation structures for the polar bear bilateral agreement. Unfortunately, the 2007 US Fish & Wildlife budget reduced funds for all marine mammal program activities. This reduction in funding is consistent with an across-the-board funding cut to the US Department of Interior, which administers programs and laws pertaining to resources, wildlife, Indian Affairs, agriculture and mineral extraction. In addition, the USFWS is contemplating listing the polar bear as a threatened species under the Endangered Species Act. Such a listing holds unknown consequences for bilateral co-management schemes designed to allow flexibility and local, contextual implementation. At the very least, it will make interactions among partners more bureaucratic, as requirements for permitting and documentation increase.

Collaborations directly between Alaska Native Organizations and Chukotkan partners, on the other hand, continue to flourish, funded in large part by internationally focused federal agency divisions (e.g. the US National Park Service), co-management bodies, the North Slope Borough and non-profit organizations. These collaborations have included joint walrus harvest monitoring, polar bear traditional knowledge and harvest studies, and

hunting weapons improvement programs to reduce the number of animals that are struck and lost (die without being caught). The partners cannot sustain these connections, however, without help from their governments. For instance, travelers across the Bering Strait need both states in order to maintain diplomatic relations to ensure border crossings, provide funding, and approve permitting for biological research and the transport of cultural items. Finally, local communities need federal partners to be on the same page as them when agencies develop new policies.

7. Case analyses

In the following sections, we examine the extent to which polar bear and walrus institutions are engaging in resilience management. Our indicators include the ability of management partners to self-organize, enhance learning, and foster rule congruence. We argue that interlocal relationships enhance these institutional characteristics by reinforcing cross-scale interactions and laying the groundwork for maintaining key SES functions in a time of change.

8. Bering strait SES: polar bears

8.1. Ability to self-organize

The hunting of polar bear was banned in the USSR in 1956 due to a perception of depletion due to over-harvesting [43]. The American harvest declined after passage of the 1972 Marine Mammal Protection Act, which only allowed for limited incidental takes from commercial interests and a subsistence harvest for Alaska Natives. The 1973 Multilateral Agreement on the Conservation of Polar Bears allowed subsistence harvests but banned commercial ones [44]. In 1989, USSR reclassified the polar bear as a recovered species and notified the USFWS that it wished to share in the harvest of the Bering and Chukchi seas population [45]. Few bears were reportedly harvested from the USSR side until the

early 1990s, when economic and social events in the country resulted in low capacity to enforce existing regulations and potentially hundreds of bears were taken per year [43], some of which were desperately needed for subsistence food [46].

With the possibility of increased and largely unregulated harvesting pressure from Chukotka, USFWS met with representatives of the Eskimo Walrus Commission, the North Slope Borough, Kawerak and Maniiliq Associations⁹ to discuss what joint management of the polar bear might entail. The Eskimo Walrus Commission jurisdiction overlaps with the polar bear hunting communities in the Bering Strait SES, so it was a natural collective action venue for beginning discussions of transborder polar bear management. The Alaska Native organizations were told that any joint management of the harvest would likely include quotas [45]. Johnson [45] reports that the groups demanded to be party to the negotiations with the Russian government as they were the only legally authorized hunters in the Chukchi and Bering Seas. In addition, they stated that any introduction and enforcement of quotas should be determined through a native-to-native agreement with Chukotkan subsistence hunters modeled on the Inuvialuit-Inupiaq Agreement on the Southern Beaufort Sea stock of polar bears¹⁰ [45]. By 1994, the Nanuq Commission was formed to represent village Tribal Councils residing in the polar bear range on the Alaska side. A sister organization in Russia was formed in 1997 in response to this and other marine mammal governance issues and is now known as the Association of Traditional Marine Mammal Hunters of Chukotka (ChAZTO in Russian).

Recognizing the need for joint stock management, in 2000, the United States and Russia signed an Agreement on the Conservation and Management of the Alaska-Chukotka Polar Bear Population (polar bear treaty), establishing a joint commission including Alaska Native and Chukotka Native hunters as representatives. Ratification by the United States Senate took another 6 years, reportedly due to Department of Justice concerns over the extent of power-sharing and due to a senator whose reasons for holding up the bill are unclear [48]. The eventually adopted institutional design was the result of negotiations and supported by findings from an environmental assessment process conducted by USFWS [49]. The agency determined that a four-way agreement (bilateral native and government interests) with interlocal co-management features would likely be more effective than national co-management agreements or national agreements alone because of the opportunity for coordinated management. In addition, Russian authorities indicated that their government would be unlikely to pursue or fund a co-management agreement with Chukotka hunters alone [49]. The new Commission is tasked with developing binding harvest limits and implementing conservation measures through a native-to-native agreement [50]. The Nanuq Commission provides a management hub to promote and coordinate implementation of conservation studies and practices such as the native-to-native agreement.

For their part, ChAZTO representatives have credited the co-management regimes in Alaska as a strong motivating force in their self-organization. In recent years, however, Russia has delegated some management responsibilities to another native organization, the Association of Indigenous Peoples of the North

(RAIPON) [51]. From initial negotiations to the present day, there have been three different Chukotka Native representative bodies party to the polar bear agreement: the Union of Marine Mammal Hunters, the Chukotka Native Marine Mammal Commission,¹¹ and ChAZTO. The Nanuq Commission and ChAZTO signed a native-to-native agreement in January 2008. However, it is unclear how the Chukotkan partners will interact with their commissioner, who at last report was not a member of ChAZTO. This uncertainty calls into some question the willingness of the Russian and Chukotkan governments to support democratic co-management processes. Russia is also dependent upon significant financial and logistical support from the World Wildlife Fund for its initial polar bear management program, which has influenced which villages and representatives are included in pilot projects and other polar bear management activities. It is, therefore, unclear to what extent Native Chukotkans are able to self-organize and choose their own representation. A key strength of the Alaska Native co-management organizations is their requirement for tribal authorizations from member hunting communities, creating a democratic feedback mechanism for villages to choose their own representatives. The introduction of legally binding quotas for polar bear hunting will significantly test the strength of these institutions. To date, self-organization in Alaska has allowed for more stable management partnerships and the potential for linking management partners to other forms of government in the villages, enhancing social resilience.

8.2. Enhance learning

In 1997, the Nanuq Commission applied for and received a grant from the National Park Service's Shared Beringian Heritage Program. The grant helped Chukotkans build capacity to engage in policy and management activities through a traditional knowledge (TEK) study of polar bear habitat use. The Nanuq Commission subcontracted the study to ChAZTO and provided technical assistance and training [45]. The TEK study has been key to mapping female denning sites as well as understanding traditional rules regarding the harvest of females and young.

In addition, in a presentation given to the Nanuq Commission in December 2005, Dr. Anatoly A. Kochnev described a variety of local rules across Chukotka, mainly remembered by elders, detailing the placement of polar bear bones after harvest for spiritual reasons. This presentation sparked a lively discussion among Nanuq Commissioners, some of whom remembered past stories, songs, and dances regarding polar bears in their regions. Through linking elder Alaskan polar bear hunters to their Chukotkan counterparts, the Nanuq Commission has helped to reconstruct past relationships and better understand cultural aspects of resource management [48]. Sharing the past enhances learning because it explains past social dynamics in the Bering Strait SES human-polar bear relationship. It also strengthens the connection between present hunters and the resource as they learn how communities have historically adapted to changing conditions.

8.3. Rule congruence

Rule congruence between all scales enhances resilience because partners invest limited management dollars based on the best set of information they have. More complete information allows more precise decision-making. Polar bear co-management

⁹ Maniiliq Association and Kawerak Association are not-for-profit Alaska Native regional organizations established prior to the Alaska Native Claim Settlement Act of 1971 for the purpose of providing health, social and technical services to tribes within their regions. ANCSA corporations largely grew out of the early organizing success of these associations [47]. Maniiliq, Kawerak and others across Alaska continue to provide public services to Alaska Natives, mainly through federal grants.

¹⁰ For more information on this agreement, see Brower et al. [52].

¹¹ This political organization was constituted by loyalists to the former governor of Chukotka, Alexander Nazarov, who "overthrew" the Umq'a in reportedly irregular elections [48].

has in Alaska and will likely in Chukotka improve participation in harvest assessment. Although no federal quotas exist regulating the subsistence harvest of polar bears in Alaska, the North Slope Borough and the Canadian Inuvialuit Secretariat have had a relatively successful voluntary agreement managing the shared Southern Beaufort Sea population [52]. The Chukchi and Bering Sea agreement is fashioned akin to the Beaufort agreement. One of the legacies of co-management in Alaska has been its success in bringing players to the table on a more equal footing than existed before 1994. Amendments to the MMPA in 1994 allowed federal agencies to negotiate and fund co-management relationships. The creation and funding of the Nanuq Commission created a new venue for policy discussions between USFWS and polar bear hunting communities, and has endured as a legitimate policy forum.

The interlocal institution between Alaskan and Chukotan hunters allows for a more comprehensive picture of polar bear hunting in the entire SES and has the potential to develop rule sets that are acceptable on both sides of the border for the shared population of bears. Additionally, the implementing legislation for the Bilateral Agreement stipulates that in order to be eligible for co-management powers including enforcement of US law, the Nanuq Commission must "... meaningfully monitor compliance ... " [50]. USFWS has not yet publicly stated which criteria would satisfy this requirement. Until a new reporting system for polar bear harvests is developed and implemented, the interlocal institution remains the primary institution for compiling and comparing population health indicators across the Bering Strait SES.

9. Bering Strait SES: Pacific walrus

9.1. Ability to self-organize

Government management of Pacific walrus harvests in Alaska did not begin until after the commercial exploitation of walrus had decimated their herds in the nineteenth century [53]. The American government banned commercial harvests in Alaska in 1909, but allowed a small harvest after World War I [21]. Federal fisheries regulation in 1937 and the subsequent Walrus Protection Act of 1941 finally ended all commercial harvests for walrus. The Walrus Protection Act provided for Alaska Natives to continue hunting walrus for clothing, materials, and crafts, although raw ivory was banned from export from the territory [54]. Intermittent walrus protections in the first part of the twentieth century and in the 1960s led to a recovery of the population. Federal and state management oscillated in Alaska, until 1979, when management authority was transferred back to the USFWS [55]. Native hunters also increased their participation in management decision-making when the communities of Gambell, Savoonga, Nome, Wales, Shishmaref, and Diomedes gathered in 1978 to form the Eskimo Walrus Commission (EWC), modeled after the successful Alaska Eskimo Whaling Commission [56]. During this period, the walrus population was thought to have grown to a point that exceeded the maximum viable population based on ecological conditions and fears grew of a population collapse. The EWC initially addressed several concerns including the need for involvement in collection and analysis of population data necessary to form a walrus management plan, the need to accomplish scientific studies on the health and status of the walrus population, and to address wasteful taking through education. The EWC also developed a model management plan, with policies prescribing allowable take, hunting protocols, and population monitoring, but which lacked enforceable policies and was never fully implemented [17].

The USFWS and the EWC signed a co-management agreement in 1997 to facilitate the participation of subsistence hunters in management of walrus stocks in Alaska as well as to improve communication. Specific activities carried out under this agreement have included the strengthening and expansion of harvest monitoring programs in Alaska and Chukotka, documentation of TEK and best hunting practices, as well as efforts to develop locally based subsistence harvest ordinances. The EWC has remained the primary venue for discussions between the USFWS and Alaska Native hunting communities. The first cooperative agreement between the USFWS and the EWC included mutually agreed upon co-management projects, such as the development of a native-to-native agreement with walrus hunters in Chukotka. Subsequently in 1998, the EWC participated in a USA-Russia bilateral agreement for the conservation of the Pacific walrus, where it drafted an agreement with the Association of Traditional Marine Mammal Hunters of Chukotka (ChAZTO).

The collapse of the Soviet Union in the early 1990s resulted in profound economic changes in Chukotka, most clearly manifested in the large out-migration of 100,000 people during the 1990s and an aggressive relocation policy for more people in the early 2000s [56]. An important consequence of the decline in economic vitality for Chukotka has been a significant return to a subsistence-based diet including walrus [42]. The Russian Federal government is still responsible for walrus management in Chukotka through the Fishery Department's Division of Fisheries Inspection [57]. However, like in Alaska, several non-governmental organizations including the Kaira Club (representing environmental concerns) and ChAZTO have shared in monitoring and management activities concerning the Pacific walrus.

International and interlocal discussions were initially held in 1994, in conjunction with the bilateral polar bear agreement. However, these discussions lacked the momentum of the polar bear treaty discussions and never assumed formal legal status. Because of this lack of formality, the interlocal relationship has persisted as the primary locus for Bering Strait SES walrus management coordination. In 1998, the EWC and the USFWS hosted a bilateral workshop concerning walrus harvest monitoring in Alaska and Chukotka. The workshop allowed for the sharing of information on harvest monitoring methods, recent walrus harvest data, US and Russian harvest regulation and enforcement program, overviews of management organizations and subsistence user groups, and the importance of walrus hunting to subsistence hunters on both sides of the border [58]. The workshop also identified information and management needs for harvest monitoring, and recommendations for improving walrus harvest monitoring programs. Another bilateral walrus "summit" was subsequently held in 2004 to exchange information (e.g. which organizations and villages are involved in management, where and when are most walrus hunted or otherwise taken, what the predominant uses of walrus meat, hides, and ivory are), establish an Alaska-Chukotka communications protocol, and develop goals for the group. As in the polar bear case, interlocal institutions such as the walrus summit allow for a broader and better understanding of walrus governance that increases the resource users' capacity to effectively manage their stocks.

9.2. Enhance learning

The Pacific walrus population ranges across the international border of the United States and Russia necessitating coordination between managers and scientists from both countries. Starting in 1975, several joint population studies of walrus were conducted under the 1972 bilateral *Agreement on Cooperation in the Field of*

Environmental Protection. More recently, with the cooperation of native groups, bilateral monitoring agreements are being developed to ensure the long-term health of the shared walrus population through the National Park Service Beringian Heritage Program and the Pacific Walrus Conservation Fund. These agreements have primarily focused on monitoring of Alaskan walrus harvests, and have focused on monitoring Chukotkan haul-outs to a lesser extent. Regulations were put in place in Chukotka in 1965 discouraging harvest of walrus on haul-outs which, when followed, were regarded as an effective conservation tool for walrus. In Alaska, only the Round Island haul-out in Bristol Bay receives significant protection. In a changing climate, new walrus haul-outs may develop or old ones recolonize. In these cases, walrus and subsistence users may benefit from protections, which reduce disturbance and encourage continued walrus usage. Interlocal institutions have allowed contacts to evaluate the success of both models and share strategies. However, the increase in monitoring of the Russian harvest is now paralleled with a significant reduction in local harvest monitoring of the Alaskan harvest, which is now accomplished largely through the US Marking, Tagging, and Reporting Program. Funding has been a difficult challenge, as US agencies have absorbed much of the costs for conservation work on both sides of the border but are now subject to budget cuts themselves. In addition, USFWS prioritized an expensive abundance assessment that engulfed much of its walrus program capacity over recent years.

9.3. Rule congruence

Walrus co-management has in Alaska, and will likely in Chukotka improve participation in harvest assessment and a wider understanding of walrus population health and threats to that health. The Federal agencies in both countries have focused much of their capacity on population assessment and harvest monitoring. In contrast, the EWC, Kaira Club, and ChAzro have invested much energy into other activities such as TEK studies and monitoring of haul-outs. Although no federal quotas exist regulating the subsistence harvest of walrus in Alaska, the bilateral harvest monitoring programs and agreements offer an opportunity to assess harvests, which are currently thought to be below recent historic levels [59]. However, there have been periods of greater or lesser compliance of hunter reporting, or marking and tagging requirements in both Alaska and Chukotka, as shown through comparisons with monitoring of actual harvests [60], with subsistence food surveys, or through interviews with local hunters and researchers. Reliance on harvest data for assessing conservation status, therefore, may not enable sufficient precautionary management.

As with the Nanuq commission, one legacy of walrus co-management has been its success in bringing players to the table on a more equal footing than existed before 1994. Amendments to the MMPA in 1994 directed agencies to negotiate and fund co-management relationships. The creation of the EWC in 1978, and later funding achieved through MMPA Section 119 funds created a new formal venue for policy discussions between USFWS and walrus hunting communities, and has endured as a legitimate policy forum. Future work with Chukotka is planned to involve a four-party co-management regime between government and native organizations of both countries following the model of the polar bear agreement.

10. Conclusions

In an SES, institutions potentially shape how people and governments interact with the ecosystem. In order to sustain a

particular ecosystem service, institutions must, at the very least, identify impacts to the resource that compromise sustainability and attempt to address them. Resilience-oriented institutions also provide opportunities for monitoring and active learning to better understand system dynamics and enable adaptive responses to signals of change in the ecosystem or social system. Co-management and interlocal management linkages have persisted in the Bering Strait SES while federal budgets for resource management decrease and formal international coordination waxes and wanes due to political and financial crises. Whereas co-management has improved cross-scale collaboration on the Alaska side, interlocal administration such as the polar bear native-to-native agreement has the potential to strengthen linkages that are embedded within the entire Bering Strait SES. To date, the Bering Strait SES is characterized by increased connectivity across scales and a broader understanding of system dynamics, particularly in terms of historical and current usage of polar bears and walrus for subsistence.

The capacity of local communities to self-organize elements of walrus and polar bear management regimes is strong on the US side, which has kept the same representative bodies since 1970s for walrus and 1990s for polar bears. With support from federal partners, the Alaska Native organizations have been able to connect and support Chukotkan efforts through various funding sources and charitable organizations. The current capacity of the Chukotkans to self-organize toward common goals associated with bilateral wildlife management, however, is less clear. It will perhaps depend upon the strength of other democratic institutions in Chukotkan villages, regional governance, and competing priorities. Their interlocal institutions have helped Chukotkans weather tremendous financial and humanitarian difficulties. In addition, they have provided a way for Alaska Native and Chukotka Native communities to learn organizational and conservation strategies from each other. Interlocal relations have added value to co-management and international management regimes through providing a more complete understanding of sources of mortality such as hunting or "defense of life" takes, and allowing both sides to re-learn traditional practices from each other. In this way, interlocal relations have enhanced learning. Trends in rule congruence are harder to analyze, as monitoring has been under funded in Russia and local communities in Alaska do not have the flexibility under federal law to develop enforceable local management plans recognized by American authorities. However, in the case of the polar bear, internationalized co-management reliant on native-to-native enforcement will test the ability of both community and federal actors to agree upon rules and implement them.

In summary, communities in the Bering Strait SES and their governments illustrate mixed indicators of resilience management, some positive and some ambiguous. Managing for resilience depends on developing institutional features that create feedback mechanisms so that actors in the system can more fully understand, learn, and respond to change. The current formal management configurations may not provide enough flexibility to withstand significant change to the system and experiment with new rule sets. This combination of rigidity in formal management and slow international processes has enhanced the importance of interlocal institutions. These institutions, in turn, have enabled more contextual resource management than have conventional management strategies. Improving coordinated management is important, as global warming has significantly shrunk summer sea ice habitat for ice-dependent species, culminating in a record low ice cover during the summer of 2007. This rapid loss of habitat will require significant ecological and social adaptations if the Bering Strait SES is to maintain key characteristics within a limit of acceptable change.

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