

Developing multi-level institutions from top-down ancestors

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Abstract: The academic literature contains numerous examples of the failures of both top-down and bottom-up common pool resource management frameworks. Many authors agree that management regimes instead need to utilize a multi-level governance approach to meet diverse objectives in management. However, many current operating systems do not have that history. This paper explores the conversion of ancestral top-down regimes to complex systems involving multiple scales, levels and objectives through the management of the polar bear (*Ursus maritimus*) in its five range countries. The less successful polar bear management systems continue to struggle with the challenges of developing institutions with the capacity to learn and change, addressing multiple objectives while recognizing the conservation backbone to management, and matching the institutional scale with biophysical, economic and social/cultural scales. The comparatively successful institutions incorporate these features, but reveal ongoing problems with vertical links that are partially dealt with through the creation of horizontal links to other groups. This case study suggests that it is possible to convert top-down institutions into multi-level governance structures, but that particular attention must be paid to the lower levels of the institutional scale. These lower, often less formal, levels also need different types of support than higher, more bureaucratic levels.

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1. Introduction

Many authors have expounded on the problems with top-down management of natural resources (c.f. Baland and Platteau 1996; Acheson 2006). Such approaches may

meet certain national and international objectives, but they have done little to promote equity for local people and as a result often fail to meet conservation objectives (c.f. Peluso 1993). Community-based approaches were meant to improve sustainable use of resources through improved equity, but many researchers find that the pendulum has swung too far in the other direction, favouring bottom-up approaches at the expense of upper levels of management and thus also failing to meet certain objectives, especially regarding sustainable resource use (Barrett et al. 2001; Bradshaw 2003; Schaik and Rijkssen 2002). Failures in both top-down and bottom-up approaches to natural resource governance have taught us that institutions need to accommodate different levels (from the local to the global) and also different scales.

There is growing support for management that recognizes multiple scales, including biophysical, economic, and social/cultural scales and assigns appropriate authority to institutional levels which allows them to interact effectively with other scales (Berkes 2006; Cash and Moser 2000; Ostrom et al. 2002). As several researchers note, resource management systems need to better employ the law of comparative advantage, namely, that the division of labour according to relative ability improves outcomes (Barrett et al. 2001; Young 2002). By assigning the different levels of governance appropriate responsibilities (i.e. those that correspond to similar levels on the scales to be managed), outcomes should improve. This multi-level perspective allows for more objectives to be met and should lead to more efficient, equitable and sustainable resource use.

One of the main issues in the conservation discourse concerns how to construct multi-level regimes. The singular importance of the community level organization and its complexity has been recognized, and it is considered by some to be the starting place for regime formation (Berkes 2004; Brown 2002; Agrawal and Gibson 1999). However, many resource management regimes are already functioning, albeit often poorly, and are candidates for modification rather than dismantling for the construction of new regimes. Thus the focus in this paper is to give an overview of how some ancestral top-down regimes have begun the transformation to multi-level systems and to suggest how they might be further developed. The discussion is based on the transformation of national and sub-national wildlife management regimes to deal with polar bears. This species became the subject of overt management from the top down in all five of the countries in which it is found through an international agreement signed in 1973. The international agreement drew attention to the need to manage the resource, but allowed much latitude in the development of governance among the signatory nations, several of which already had some form of management institution in place. The paper will examine the interaction of the management regimes in the various range countries with the biophysical, economic and social/cultural scales. In reality these scales often overlap. However, for the purposes of analysis they will be considered separately. Each scale will be considered to consist of different

levels from the bottom, or smallest units, to the top, or largest units. The paper will first examine the incorporation of multiple objectives into national polar bear management institutions. These may be from different scales as well as different levels on these scales. This leads to a discussion on the benefits of matching the institutional scale to other scales. Two examples are given, the first involving the biophysical scale and the second involving the economic scale.

Next I explore the historic development of the institutions through an evaluation of the strategy of taking small steps before large ones (McCay 2002; Ostrom 1990). This method allows for learning within the institution without paying high costs (such as economic or political) until they are understood to be necessary. The final section examines some linking problems that have arisen at the lower levels of the governance scales as the systems have evolved. Finally, the lessons learned from the conversion of top-down polar bear management regimes will be summarized.

I turn first to the initial development of the top-down polar bear management regimes.

2. The international polar bear management regime

Natural resource management regimes are often formed due to the perception of a crisis (Fikkan et al. 1993; McCay 2002). In the case of polar bear management a perceived crisis developed during the 1960s, which sparked the creation of an international level of governance involving all five polar bear range states – the United States, Canada, Denmark, Norway and the USSR.

The first formal polar bear management regimes were formed during the mid-twentieth century, before the international agreement, in order to control the commercial harvest of the species. They were primarily top-down institutions at the national or sub-national levels and only one country, the USSR, imposed a complete hunting ban (U.S. Department of the Interior and University of Alaska 1966). The formation of these early institutions was not sufficient to alleviate growing international fears about the conservation of the species, and many citizens and interest groups encouraged their countries to enter into negotiations to create an international conservation agreement (Fikkan et al. 1993).

At the time of the first international meeting in 1965, scientific research on polar bears was in its infancy and species population estimates ranged from 5000 to 20,000 animals (Delegation of Canada 1966). The total harvest of polar bears had increased throughout the twentieth century, and was approximately 1300-1500 animals per year by 1965 (Fikkan et al. 1993). Increased use of firearms, mechanized transportation, rising fur trade prices, and increased access to the Arctic by non-local hunters were all given as reasons for the growing harvest (U.S. Department of the Interior and University of Alaska 1966). The fear about increasing harvests was not the only issue for citizens of the range countries. Discussions around hunting ethics and harvesting rights also encouraged international cooperation.

The ethical discussion focused on hunting in Alaska and in Norway's Svalbard Archipelago. In Alaska, trophy hunting was carried out using small aircraft that chased bears towards waiting hunters (Fikkan et al. 1993). This hunting method accounted for 85-90% of the total harvest for Alaska between 1950 and 1972, while Native subsistence hunting made up the remainder (Lentfer 1976). In the Svalbard Archipelago, Norwegian trappers killed or wounded bears indiscriminately using set guns (rifles triggered by an animal touching the bait) (Fikkan et al. 1993). At the same time, sport hunters in the archipelago killed high numbers of swimming bears, which had no opportunity for escape (Stirling 1998). These methods were considered distasteful and unsportsmanlike by many people.

The question of harvest rights was a concern in three ways. First the polar bear countries did not want non-range countries to begin their own harvests in international waters (Fikkan et al. 1993). Second, polar bears were thought to belong to one international population, and therefore high harvests in any one area were a concern to all. Finally, in Canada, Denmark and the United States there was strong interest in recognizing the rights of indigenous people to continue hunting polar bears.

After several meetings between the five range countries, the Agreement for the Conservation of Polar Bears and their Habitat was signed in Oslo, Norway, in 1973 (Stirling 1998). The agreement prevents signatories from taking polar bears except where done traditionally by local people. The articles of the International Agreement are intentionally vague, allowing a wide range of interpretations by the range countries (Fikkan et al. 1993). The agreement also lacks provisions to ensure compliance. However, the countries are requested to conduct and share research on polar bear ecology and management and to consult with each other on the further protection of polar bears. They meet every 3-5 years as the Polar Bear Specialist Group of the IUCN/Species Survival Commission. This group, arising in 1968 from the international negotiations, has developed a culture of peer pressure to encourage compliance among the signatory nations. Further incentives to conserve polar bears come from other international agreements and national laws, such as CITES (Convention on International Trade in Endangered Species signed in 1973, enacted in 1975) and the Marine Mammal Protection Act of the United States (1972), which both restrict trade in polar bear products from populations that do not meet conservation guidelines.

The International Agreement met the main objective of conservation. It aimed to match the biophysical scale of the resource, which was perceived to be a single, circumpolar population of polar bears. Objectives relating to the social/cultural scale, such as hunting ethics (a national concern in several countries) and the harvesting rights of local people, were also considered and included to varying degrees. Other objectives were dealt with at the national or lower institutional levels.

3. Multiple objectives

The basis for common pool resource management is to ensure a flow of benefits into the future. This implies that the backbone of management regimes must be conservation, and the regime must be related appropriately to the biophysical scale. In the case of polar bears the hypothesis that polar bears belonged to one circumpolar population shared by all five nations was the impetus for international cooperation.

However, the International Agreement also allowed for countries to meet objectives on other scales. Fikkan and colleagues (1993) explored some of the international objectives of the polar bear range countries in attending the international meetings and negotiating the agreement. They argue that the meetings and agreement were used as an opportunity to 'lessen international tensions and improve circumpolar and international relations' (p. 96). As an example of the range of objectives held by the various countries, some of the political objectives attributed to Canada's participation include recognizing the rights of indigenous people, reassuring citizens that unethical American hunting in Alaska would stop, building Canada's conservation reputation, increasing its international presence in arctic affairs and strengthening its sovereignty over the Arctic Archipelago and surrounding waters. The period of negotiations for the agreement, and the agreement itself, were also used to meet certain national and regional within-country objectives.

In Alaska, polar bears were under state jurisdiction until, using the International Agreement as justification, the federal government placed polar bears under the Marine Mammal Protection Act (MMPA) in 1972 (Fikkan et al. 1993). By the time this occurred, the state had already passed laws on several issues of international concern. It had prohibited aircraft-assisted sport hunting, controlled harvest levels, and protected cubs and females with cubs (Lentfer 1976). Alaska was also promoting more Native involvement in sport hunt guiding to meet the objective of the recognition of Native rights. The move to federal jurisdiction overrode these developments, but met two objectives of main national lobby groups, Alaskan Native people and wildlife preservationists. Preservationists gained federal legislation promising protection for polar bears and banning aircraft assisted trophy hunting (although these were already met under the new state laws). The second lobby group, Native Alaskans, was granted the right of sole harvesters, but most uses of polar bears in the monetary economy were outlawed. The MMPA also removed all harvesting restrictions, in essence dismantling the state system, which had taken considerable effort to build, and which had been in line with the best conservation practices of the time. These federal laws lacked the nuances of the state laws and resulted in a regime that met only a few higher-level objectives and left little room for change.

Canada was faced with similar objectives from its citizens, but handled the inclusion of multiple objectives in a way that provided more room for the maximi-

zation of benefits at different levels. At the international negotiations Canada had argued for the rights of indigenous people to continue to use polar bears within conservation guidelines and to allow them to use the resource according to their own objectives, including economic ones (Fikkan et al. 1993). In Canada polar bears remained under provincial and territorial jurisdictions and indigenous people were recognized as the resource user group. Further institutional development was left to the provinces and territories.

Denmark also incorporated several objectives into the Greenland management system. It limited hunting to Greenland residents and also implemented various regulations and protected areas, but stopped short of imposing harvest limits in order to meet local objectives of access and economic use. Placing socio-cultural and economic objectives ahead of conservation objectives proved to be the major weakness of the system and is further discussed below.

The final two nations, the USSR and Norway, chose to focus on only national and international objectives and banned polar bear hunting in 1956 and 1973 respectively (Fikkan et al. 1993). The ban in Russia is an example of how the use of narrow objectives in management leads to weak institutions. Although conservation was the objective of the hunting ban, economic change and the erosion of authority after the dissolution of the USSR has led to poaching and illegal trade of unknown levels (Lunn et al. 2002). Recent negotiations with the United States and Native Alaskans over co-management of shared populations, shows promise of a new and more robust Russian system that will provide better protection of the resource and also allow for other objectives to be met.

All five countries moved to reduce the harvest of polar bears and/or to implement other conservation measures. A second set of objectives from the social/cultural scale, most notably the rights of aboriginal people, were incorporated in the United States, Denmark/Greenland, and Canada. Only the latter two left space in their institutions for objectives on the economic scale to be identified by lower levels of governance. In general, the polar bear management institutions that were founded on conservation, but also included objectives from other scales, have been more sustainable as institutions because they promote conservation at all levels and engage resource users in the system through considerations of other scales which leads to more equity and efficiency in resource use.

4. Matching scales

Developing effective natural resource management institutions involves matching the authority of levels of the institutional scale to similar levels on a variety of other scales including the biophysical, social/cultural, and economic scales. It is expected that the most efficient management systems will involve nested sets of institutions, responsible for management at appropriate levels. Holling (2001 p.390) states that a level should be 'allowed to operate at its own pace, protected from above by slower, larger levels but invigorated from below by faster, smaller

cycles of innovation'. In this view an institutional level is held to general rules and incentive structures managed by higher levels, but is responsible for manipulating rules and incentives of lower levels. To illustrate how different institutional levels can contribute to efficient scale interactions, I shall examine two examples of matching scales for polar bear management, one involving the biophysical scale and one the economic scale.

Mismatch between the biophysical scale of the resource and management institutions has been the subject of much discussion (Berkes 2002; Cash and Moser 2000). One of the main problems is that fugitive resources, such as polar bears, range over a large area and cannot be managed by a single community; rather they require a higher governance level to coordinate management (Barrett et al. 2001). The need for some type of coordination for polar bear management was recognized during the international discussions in the 1960s when all polar bears were thought to belong to one circumpolar population. Under the international agreement the range countries were encouraged to improve research and monitoring in their own areas and report back to the group. One of the outcomes of the research and monitoring projects was the discovery that polar bears do not all belong to a single circumpolar population, but are divided into 20 discrete populations (Lunn et al. 2002). Monitoring and research has since moved to focus mainly on the population level.

Only one jurisdiction, the Northwest Territories of Canada (NWT) dealt with the original concerns over the conservation of polar bears by limiting the harvest through a quota system which it instituted in 1968 (Macpherson and Jonkel 1970). To meet its need to set reasonable quotas, the NWT quickly developed a multi-level system of monitoring the resource. At the community level information on each harvested bear is collected for statistical analyses, while at the polar bear population level the territorial government conducts ecological research and population surveys. This system was inherited by Nunavut Territory, which became a separate territory from the NWT in 1999, but began developing new wildlife management systems after the Nunavut Land Claim was signed in 1993 (NTI 2000). In Nunavut, surveys on each polar bear population are carried out on a 15 year rotating schedule. The territorial Minister of the Environment and the Nunavut Wildlife Management Board (the co-management board instituted under the land claim) use the information to decide on the maximum number of animals that can be harvested for each polar bear management area (which approximately match polar bear population areas). Regional Wildlife Organizations (RWOs), made up of community representatives then divide the resulting quota amongst the communities.

In the past, community level Hunters' and Trappers' Organizations (HTOs) were consulted on decisions, but not legally provided with a place at the quota setting table. However, since 1993 the de facto system has been a series of negotiated agreements between the HTOs, RWOs, the Minister, and the co-management

board. The co-management board has authority over non-quota limitations, while the Minister retains authority over the total allowable harvest to ensure conservation. Pressure from Inuit political organizations has recently caused a major change in the quota setting system.

Beginning in 2005, scientific data will now be used to set quotas for the first seven years of the 15 year management period, and Inuit Qaujimaqatuqangit (Inuit traditional knowledge) will be used to modify these quotas for the next eight years or until new scientific data are collected on the population. In theory the new system should be more accurate because it includes scientific procedures where accuracy can be quantified, but which are constrained in the frequency of their population estimates, and local knowledge which provides frequent, but less precise, observations of population trends.

Since 2005 Hunters' and Trappers' Organizations (HTOs) and other Inuit groups have negotiated quota increases for several polar bear populations based on hunter perceptions of polar bear population growth (cf. Anonymous 2005). The increase in quotas has sparked discussion at higher institutional levels of 'leaving the fox to guard the hen house', but of course the real test of this new system is whether the lower level institutions will report observed decreases in polar bear numbers and limit the harvest accordingly.

One such situation occurred before this new system became formally institutionalized. During the early 1990s a scientific population estimate of 700 bears in the M'Clintock Channel resulted in quotas of approximately 37 bears a year (Taylor et al. 2006). Inuit hunters reported a decline in the bear population during the late 1990s and preliminary scientific surveys supported their observations. The territorial government and co-management partners reduced quotas and then imposed a moratorium on harvesting in 2001 to allow scientific studies to be completed. The quota was reinstated in 2006 at only 3 bears per year, well below the maximum sustainable yield of 13 (PBTC 2006). The quota was a compromise by community Hunters' and Trappers' Organizations (HTOs), the territorial government and co-management partners in order to meet the need for natural population growth and the desires of hunters. This example illustrates that there can be a commitment at the local level to manage polar bears for long-term benefits.

Nunavut's new monitoring system is in fact a double feedback system. It links the monitoring system to the biophysical system twice, first at the territorial level through scientific surveys of polar bear populations, and second at the community level through population monitoring. This system provides institutional redundancy and hopefully strength, by using both a fast, though blunt, feedback loop at the local level and a slow, but more precise, feedback loop at the territorial level.

The second example of matching scales involves the economic scale. In the case of polar bear management in Nunavut territory, Canada, this scale involves two economies. At the local level, Inuit participate in a mixed economy, relying on both a subsistence hunting economy and the monetary economy through wage

labour and the sale of renewable resource products. The remote location of these Inuit communities limits access to markets and they therefore rely on territorial and national governments to facilitate market access as well as structure economic incentive frameworks.

The power of economic incentives is often given as a reason for resource collapse, but in the case of polar bear management in the Canadian territories, it has strengthened the management system. This is at least partially because conservation was originally given priority, but both the conservation and economic systems interact and strengthen each other. In order to offset the loss of fur trade income suffered by hunters through the implementation of the quota system, the Northwest Territories of Canada (NWT) developed programs to increase economic efficiency in polar bear use (MacPherson and Jonkel, 1970; Stirling and Macpherson 1972). The two main economic uses are the sale of hides and the sport hunt industry. Individual hunters have the opportunity to sell their hides privately or through an international auction. The auction typically provides a higher return than private sales, but is difficult for hunters to access. The territorial governments of NWT and Nunavut facilitate the flow of hides to auction and the flow of cash back to the hunters.

Sport hunting of polar bears is coordinated at the community level and again supported by the territorial governments. Since 1970, communities may develop a sport hunt industry for non-natives using tags from their annual quota (Stirling and Smith 1980). The Hunters' and Trappers' Organizations (HTOs) have full authority over how to develop this industry, subject to certain regulations. When the sport hunt was first institutionalized, few Inuit communities chose to take part. Territorial government programs increased local capacity through the 1970s and 1980s, but it was not until the mid 1980s that HTOs developed sport hunting in earnest (Wenzel 2005). The impetus to develop the industry in the eastern Arctic came when the local mixed economy was destroyed through the European Economic Community's ban on seal products in 1983 and narwhal products in 1984. The proportion of the quota devoted to sport hunts varies by community, but accounts for an average of about 20% of the total polar bear harvest of the NWT and Nunavut.

The government has played a coordinating role in the fur trade and the sport hunt by enacting legislation to support the industries and creating an economic framework. In the fur trade it has gone further, facilitating the trade and improving economic efficiency. In the sport hunt, initially there was government support in training and development, but in recent years the territorial government has been less involved than it was previously. In both cases the hunters were hindered by lack of access to markets. The territorial government formed a link between the bottom level of the economic scale (hunters) and the higher levels (national and international markets), which increased economic efficiency in resource use.

These examples of matching the institutional scale with the biophysical and economic scales illustrate how systems can operate more efficiently, while also improving equity for users and sustainability for both the resource and the institutions governing its use. The territorial institutions provided both individuals and communities with the opportunities to develop and meet their own economic objectives within the conservation framework of the quota system, and to experiment with a new management system involving two monitoring systems rather than just one. The understanding that developing harvest controls is necessary to ensure conservation forced the territorial governments to invest considerably in the entire management system and encourage hunters to engage in the system through the development of the economic framework. This has strengthened links both within the institution and between the institutional scale and other scales.

5. Institutional evolution

An incremental approach to problem solving is advantageous since each change in rules affects interactions with other scales and incentive structures (McCay 2002). When inexpensive solutions do not solve problems, then more costly solutions can be employed. The evolution of the polar management institutions, from top-down towards multi-level institutions, illustrates this approach of taking small, inexpensive steps and examining the outcomes before taking large, expensive ones. In the Canadian territories relatively small changes in their quota systems have thus far proved sufficient to deal with problems, while in Greenland small steps did not prove sufficient to control harvest levels and a large step of quota implementation was eventually taken.

The first quotas in the Canadian Northwest Territories were assigned to communities based on the average number of hides they had sold in recent years (Macpherson and Jonkel 1970). The quota setting method was considered reasonable by the government because harvest levels had increased through the 1960s and there were some concerns about conservation. However, there was little scientific data to support a serious curtailment of the harvest, or to define quotas more precisely (Schweinsburg 1981). The early quotas were not strict. For example, communities were frequently able to increase their quotas by simply asking the territorial government (Macpherson and Jonkel 1970; Stirling and Macpherson 1972). The main benefits of these early quotas were to formalize the harvest system. The institution allowed for the collection of harvest statistics and improved communication with hunters regarding resource management.

Over the subsequent decades many incremental changes occurred in the system through protracted negotiations and development of the co-management system. Quotas in what was the eastern part of the Northwest Territories (now Nunavut territory) are set for polar bear populations through a process involving both scientific and local information. The quota is flexible in that the number of tags available to a community increases or decreases based on past over- or under-harvests.

The system maximizes the harvest based on biological parameters by favouring the harvest of males over females and protecting family groups, but allows the taking of cubs under certain restrictions to meet cultural objectives. Although scientific methods have played a key role in quota setting, social/cultural objectives have also been incorporated to some extent. Discussions about changes to the system and the cultural acceptability of the system to Inuit continue (Dowsley and Wenzel, forthcoming). Changes to the system can be dealt with using the small-step approach; however, the question of the acceptability of the system itself is a deeper concern and could potentially result in a large step to a new system.

Greenland has recently taken the large step of implementing a quota system. During the 1970s and 1980s there was no strict harvest control. Changes in the polar bear management system tended to be low cost because conservation concerns were low compared to some other range countries, and the economic and cultural value of bear hunting was strongly defended politically (Fikkan et al. 1993; Rosing 1998). Various voluntary methods to report the harvest were employed, but reporting under each system degraded with time and had to be replaced with a new and stricter system, while harvest levels appeared to be rising (Born 2005; Rosing 1998). The relatively small, but incrementally more expensive adjustments did not create a regime to promote sustainability in either resource use or in the institution itself. Finally, a large change was undertaken when the benefits of instituting a quota system were seen to outweigh the political and financial costs, and the first quotas were introduced in 2006 (PBSG 2005).

The new quota system in Greenland increases the institutional investment at all levels and drastically alters the economic incentive structure for hunters. This change in the system has also opened the door for two new opportunities to be explored. The first is the development of co-management plans with other jurisdictions over shared populations of polar bears, with the goal of improving conservation. The second arises from economic interests expressed by resource users. Without quotas there was little possibility of developing a sport hunt that could attract international clients, but now a sport hunt industry is possible and could improve economic efficiency in resource use.

The governments of Denmark and the Canadian territories made initial investments in their polar bear systems that they considered appropriate at the time. Small changes were subsequently implemented to adjust the systems. In the Northwest Territories of Canada (NWT), and later Nunavut, the gradual development of the quota system reduced hardship on hunters that might have resulted from a strict system vigorously enforced from the start. It allowed for linkages between scales and levels to develop so that feedback could guide further change. It also reduced initial costs by spreading costs out over a longer time period and avoided over-investing in expensive changes. The development of the management regime in Greenland first involved several relatively inexpensive changes (in terms of political capital, time investment and economic outlay), but when

these were not successful, a major change in the system was undertaken that will hopefully provide a better set of pay-offs in the long term. Both Greenland and the Canadian territories have now developed harvest control systems necessary to meet conservation objectives while remaining alert to the changing dynamics of the entire system.

6. Building relationships

Improving linkages between governance bodies is an important step in moving towards a multi-level system (Berkes 2006). While vertical links are obviously important for successful governance, horizontal links are seen as ways to strengthen institutional levels through knowledge sharing and other forms of support. Two examples, one from Alaska and one from Nunavut, reveal problems with ancestral top-down polar bear management systems that relate to weak vertical links. In an effort to overcome these problems, organizations representing the resource harvesters have developed new horizontal linkages.

The first example is from the American polar bear regime. In 1972 the Marine Mammal Protection Act (MMPA) granted sole user rights for polar bears to coastal dwelling Native Alaskans, but prohibited the sale of polar bear parts (except as manufactured handicrafts). Before the MMPA came into effect, nearly all polar bear hides taken by Native Alaskans were sold (Lentfer 1976). Thus, while Natives received recognition of their rights, they were dealt a serious economic blow. They also lost the economic opportunity to develop a sport hunt, which provides significant amounts of cash to many Canadian Inuit communities (Wenzel 2005).

During the 1980s, interest in modifying the Marine Mammal Protection Act (MMPA) was one factor that led Native Alaskans of the North Slope Borough to engage in negotiations with their Canadian counterparts, the Inuvialuit Game Council, regarding sharing management of the polar bear population they both hunted (Schliebe 1991). In 1988 the Polar Bear Management Agreement for the Southern Beaufort Sea (also known as the North Slope Borough/Inuvialuit Game Council (NSB/IGC) Agreement) was ratified. The two sides created a Joint Commission to set sustainable harvest limits (with outside technical assistance) and divide these between the two user groups. The system has been very successful from a conservation perspective even though compliance by the Alaskans is voluntary (Brower et al. 2002). The agreement also outlined various other economic and cultural objectives, in particular to reopen the American market for Alaskan polar bear skins and sport hunting in Alaska. An effort was made in 1993 to meet the economic objectives of the agreement when the US Fish and Wildlife Service, Alaska Region, requested changes to the MMPA (Schliebe and Evans 1995). In 1994 the MMPA was modified to allow Canadian polar bear parts from the Southern Beaufort Sea population to be imported to the US, but did not meet the economic objectives of the Native Alaskans, in particular to develop sport hunting

(Schliebe et al. 1998). Despite this setback the NSB/IGC agreement continues to function effectively as a conservation tool and to meet other cultural objectives as well.

The North Slope Borough/Inuvialuit Game Council (NSB/IGC) agreement, as a protocol between indigenous groups, has had an enormous impact on co-management in the Arctic (Brower et al. 2002; Johnson 2002). In terms of polar bear management, several new links were formed and the entire system for management of Alaskan polar bear populations has improved. In 1994 the Alaska Nanuq Commission (ANC) was formed to link all Alaskan polar bear harvesters for management and research projects. The ANC later became an equal partner with the U.S. Fish and Wildlife Service (USFWS) in the development of the US/Russia Polar Bear Treaty (signed in 2000). During negotiations for the treaty, the ANC and the USFWS insisted on the inclusion of the Chukotka Native peoples of Russia as equal partners with Russia. The ANC has been working with its counterpart in eastern Russia to implement the treaty through an enforceable native-to-native agreement. The horizontal link between users of the Southern Beaufort Sea polar bear population, formalized through the North Slope Borough/Inuvialuit Game Council (NSB/IGC) agreement, and the institutions that arose in the wake of that agreement, have made remarkable progress in adjusting the top-down regime of the United States, and promoted equity not just for Alaskan Natives, but Russian indigenous groups as well. The horizontal link forged by the NSB/IGC agreement shows that hunters can choose to limit their harvests and can do so through social rather than legal incentives. Perhaps most importantly, the NSB/IGC agreement demonstrates that while economic objectives are not irrelevant, failure to meet them has not impeded other developments in management.

The second example of a weak vertical link, which has encouraged horizontal links, comes from the Canadian territorial institutions. It should be expected that in the case of top-down regimes, links and institutions at the lower levels will be weaker than upper level institutions and links, because the original investments in governance focused on upper levels. Even in community-based natural resource management cases, lower level institutions and their linkages have generally been poor (cf. Agrawal and Gibson 1999; Baland and Platteau 1999). Lower levels on the institutional scale often function under fundamentally different types of relationships than their upper level counterparts. For example, they often use social pressure rather than formal incentives (as seen in the North Slope Borough/Inuvialuit Game Council (NSB/IGC) case), and utilize different forms of knowledge to make decisions (Young 2006). Therefore, the development of governance at lower levels requires not just more input from upper levels, but very different types of assistance than those given to higher levels. It should come as no surprise then that low-level links are weak in Nunavut's polar bear management system.

In Nunavut Territory the lowest-level formal institution for polar bear management is the Hunters' and Trappers' Organization (HTO) of each community

which represents all local hunters. HTOs are responsible for developing rules and managing wildlife harvesting amongst their members (NTI 2000). Each HTO has the right to decide how and when to distribute the hunting tags that make up its polar bear quota and to decide if it will hold a sport hunt. The sport hunt uses tags from the community quota and represents the potential for an increase in the monetary return per bear for the community on the scale of 1000% (Dowsley 2004). Sport hunts are held in most communities, and decisions regarding the level of sport hunting, disbursement of profits, employment opportunities and cultural concerns are on-going (Dowsley 2004; Wenzel 2005). The Hunters' and Trappers' Organizations (HTOs) have developed a wide range of rules for local hunting (NTI 2000; Anonymous 2005). In most communities, a lottery system is used to distribute tags to hunters, a minimum eligible age is set, and hunting is open to both men and women. Some communities have tag holding periods of one or two days, after which point the tag passes to the next person whose name is drawn in the lottery.

Since their inception in the 1970s, Hunters' and Trappers' Organizations (HTOs) have become important players in the wildlife management system, slowly assuming more responsibilities as their capacity increased. This capacity has not increased uniformly across all HTOs. For example, in the community of Pond Inlet, HTO meeting minutes are posted in public places and summarized on public radio (M. Anaviapik, pers. comm., October 2006), while in nearby Qikiqtarjuaq communications are poor. In 1999-2000, a federally sponsored community based narwhal management program was implemented which involved both Pond Inlet and Qikiqtarjuaq hunters. Both HTOs received the same information and training from higher levels of government, but Qikiqtarjuaq hunters harvested, wounded, and lost narwhal to such an extent compared with other communities that federal authorities had to temporarily close their hunt (Armitage 2005). Reasons for the failure of the Qikiqtarjuaq HTO to successfully implement the new narwhal management system included lack of communication and lack of social cohesion and sanctioning within the community. The lack of communication between Hunters' and Trappers' Organizations (HTOs) and their constituents was also apparent in the community of Arviat on the coast of Hudson Bay, where Tyrrell (2006) received incorrect information from informants regarding who was responsible for setting polar bear hunting rules. Tyrrell was told that the territorial government set rules such as requiring women to enter the lottery draws for tags and mandating that hunters abide by short tag-holding periods, when, in fact, these rules are the result of local HTO decisions.

The lack of communication between hunters and their representative organization was one in a long list of Hunters' and Trappers' Organization (HTO) weaknesses exposed in a report commissioned in 2004 by the Nunavut land claim organization, Nunavut Tunngavik Inc. (NTI) (Younger-Lewis 2004). One outcome of the report was that NTI developed a wildlife secretariat in 2005 to build capac-

ity at the HTO level for wildlife management (NTI 2006). That this development should come as an outside intervention by NTI rather than from within the wildlife co-management structure suggests the system is not yet functioning fully as a multi-level institution. Furthermore, Armitage's analysis of HTOs with regards to narwhal management underscores the need to examine the social incentive systems operating at the community level and seek ways to build upon these.

The nature of links along the institutional scale changes dramatically from upper, formal structures to local, less formal, but highly contextualized, relationships. Institutional design or rehabilitation must recognize these differences and work at the lower levels to promote appropriate behaviour patterns rather than merely enact rules. Further, assumptions about the existence of local norms for monitoring and enforcement need to be investigated rather than assumed. And, finally, community-level resource management institutions are often new, non-traditional forms of governance. They require extra capacity building compared to higher levels of the institutional scale where government staff engage in a variety of institutional arrangements as a matter of course.

The weak vertical links between institutional levels in the United States and Nunavut left holes in the management systems that user groups are attempting to address. Both situations illustrate that the original top-down institutions did not adequately deal with the needs of lower levels. The different set of incentives and interactions operating at lower levels need to be further considered in institutional development. More, and potentially quite different, efforts are required to develop lower levels of governance and improve their links to other levels and scales.

7. Modifying top-down systems: lessons from polar bear management

The polar bear management institutions illustrate the importance of developing multi-level regimes rather than focusing on one level. Top-down regimes have been most successful in promoting equity, efficiency and sustainability where the upper levels limited their own authority to similar levels on the social, biophysical and economic scales (such as securing harvesting rights, coordinating harvesting, and developing economic frameworks), and assisted in institutional development at lower levels to allow for devolution of appropriate responsibilities. Through an examination of the transformation of the top-down regimes into multi-level regimes several lessons emerge.

Carlsson and Berkes (2005) stress the importance of viewing resource management systems as iterative processes. The polar bear case studies show that, while management of the resource has been iterative, so has the structuring of the whole management system. In Nunavut changes in management of the resource occurred in small steps over time through advancements in science and through inclusion of different objectives (most notably those from the local level). Further, as harvesters gained a stronger voice in management, a new co-management

system developed as part of land claim negotiations, which transformed the Nunavut system into a multi-level institution. Information feedback from small steps in development of the management system in Greenland eventually led managers to take the more drastic step of implementing harvest controls. We should not expect the management institutions themselves to stabilize because objectives change with time and each change in the system alters its interactions with other scales. For example, in Greenland the new quota system restricts harvests, but opens opportunities for new economic uses of the resource.

The second lesson concerns local level institutions. The examples show that even the evolving multi-level institutions that were relatively successful, in terms of sustainability of resource use, efficiency of economic use and equity, have weaknesses at the local level. Relationships among participants at the lower level of the institutional scale are much more nuanced and multifaceted than the bureaucratic, rules-based relationships among participants at the higher levels. The culturally foreign nature of wildlife management systems is often an obstacle for aboriginal peoples (White 2006). Local social norms are not necessarily compatible with the management system, and although certain forms of interaction can be learned and used in the management setting, these interactions may continue to be at odds with other relationships among participants. The high specificity of local relationships and objectives should be recognized and examined in the development of local institutions and in interactions between the different institutional levels.

Horizontal linkages proved very useful in the case study examples for filling in gaps left by the formal resource management institutions. The power of these horizontal linkages is not just in the support they give to lower levels of the institutional scale (as in the wildlife secretariat developed by NTI), but also in their ability to create new links and instigate change in the whole system as seen in the Alaska case study.

The case study of polar bear management illustrates that top-down institutions can be transformed rather than dismantled to create multi-level institutions. However, the transformation is a long and, at times, jarring process as a new system emerges from the old. Unlike the creation of completely new systems, the history of the top-down ancestral institutions provides a basis for participants to make changes and observe their effects on the entire system. The value of these lessons may well outweigh the baggage of historic institutional failings; moreover, they serve as a reminder of the struggles and successes of previous participants. Polar bear management institutions in none of the five member countries have yet fully transformed into a multi-level institution, but most are well on their way.

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