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**Reconciling Social Justice and Ecosystem-Based Management in the Wake of
a Successful Predator Reintroduction**

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Draft

Abstract

The reintroduction of a previously-extirpated predator can engender conflict when the reintroduced species depletes customary fisheries to which Indigenous communities have constitutionally-protected rights. In the case of sea otter (*Enhydra lutris*) recovery on the west coast of North America, not only is Canada's *Species at Risk Act* in conflict with Indigenous rights, but it also illuminates gaps in the principles of ecosystem-based management (EBM), such as equity and social justice. Broadly, this paper asks how EBM might be advanced if Indigenous communities were viewed as components of ecosystems having rights to a sustainable future equal to other components. Specifically, we explore evidence of sea otter management among pre-contact Northwest Coast societies and a contemporary co-managed system proposed by the Nuu-chah-nulth First Nations that would combine research with refinement of traditional hunting practices. We show that barriers persist through lack of knowledge of past controlled hunts, ignorance of recent experiences of successful community-based clam management, distrust of Indigenous capacity to self-manage or co-manage a hunt, and divergent values among actors.

44 **Introduction: the need for conceptual and policy balance**

45 The conception and development of ecosystem-based management (EBM) has transformed the
46 thinking behind natural resource management and conservation, yet opportunity exists to
47 advance this management approach to truly achieve biological, economic, and social objectives.
48 As a place-based approach to natural resource use, EBM recognizes the full array of interactions
49 within an ecosystem, including humans (McLeod et al. 2005) and aims to restore and protect the
50 health, function and resilience of ecosystems for the benefit of all organisms (Halpern 2008).
51 While EBM, like many Indigenous management systems, considers humans as part of
52 ecosystems, rarely do EBM plans directly address issues of social justice such as food security,
53 poverty, and human rights (Allison et al. 2012), particularly when it comes to small-scale
54 Indigenous natural resource users. The livelihood and lifestyle objectives of these parties are
55 typically undervalued relative to those of large-scale resource users (Plaganyi et al. 2013) and the
56 broader conservation community (Kittinger et al. 2017). Moreover, contemporary goals of EBM
57 are often in conflict with the mandate of older natural resource and conservation legal acts that
58 underpin modern day management and policy imperatives. In these cases, ecosystems may not
59 even be conceptualized as including humans such as Indigenous coastal communities, who have
60 co-evolved for millennia with surrounding natural resources (Berkes and Folke 1998). This is
61 particularly evident in the case of well-intentioned predator re-introductions and the early legal
62 acts that surround them today. We explore such as case in North America in order to illustrate
63 the opportunity to make EBM a more meaningful concept.

64 To do this, it is necessary to look back to the 1970s, an era in which bold new legislation such
65 as the 1973 US *Endangered Species Act* aimed to halt the rapid erosion of biodiversity. Although
66 the 1992 *International Convention on Biological Diversity* and the 2002 Canadian *Species At*

Risk Act followed later, the Canadian Department of Fisheries and Oceans (DFO) and the British Columbia Fish and Wildlife Branch, in collaboration with the Alaska Department of Fish and Game, acted in advance of these protections. Eighty-nine sea otters were translocated in 1969-72 from Alaska to Checleset Bay on the west coast of Vancouver Island to re-introduce a predator which had become ecologically extirpated from the British Columbia (BC) coast by the 1850s through commercial fur trade hunting that began with Canada's earliest colonizers in the 1770s, only to end in 1911 (Kenyon 1969; Sloan and Dyck 2015).

As the reintroduced sea otter made a successful recovery—growing at a rate of 19% per year between 1977 and 1995 (Nichol et al. 2015)—and expanding its range up and down the coast, a conservation conflict quickly became apparent: the language of the acts above had not envisaged the impact on humans, nor conceptualized coastal human communities as part of ecosystems past or present, or containing people with any rights or roles in designing conservation objectives, targets, or the strategies to meet them. The Nuu-chah-nulth, into whose traditional territory the sea otter were re-introduced, were not duly consulted or informed about the reintroduction (NTC 2012).

The failure to imagine the impact on humans was evident, for example, in a 1992 report on the Checkleset Bay Ecological Reserve established in 1981 to protect sea otters and their habitat. The report acknowledged that the Ka;'yu;'k't'h' Che:k'tles7et'h' Indigenous people (the northern-most Nuu-chah-nulth Nation) into whose territory the sea otter had been reintroduced held constitutionally-protected rights to Food, Social, and Ceremonial (FSC) fisheries (Blood 1992). However, it did not foresee that FSC shellfish would be profoundly reduced in numbers and size and that sustained FSC shellfisheries would become essentially non-viable with the

reintroduction of sea otters as a protected species (Figure 1), one that could not be hunted by coastal First Nations as it had been in the past.

Yet by the 1970s the sea otters' role was well documented elsewhere as a keystone predator capable of dramatically depleting clams in soft sediment habitats (Stephenson 1977) and herbivorous sea urchins, among other benthic invertebrates, on rocky reefs, causing the latter to switch from sea urchin dominated to kelp forest dominated systems (Estes and Palmissano 1974; Simenstad et al. 1978). In Alaska, these cascading indirect effects of sea otters enhance the abundance of at least one kelp forest fish (Reisewitz et al. 2006), increase the amount of particulate organic carbon, thereby doubling the growth rates of filter feeding mussels (Duggins et al. 1989) and alter the diets of Glaucous winged-gulls (Irons et al. 1986) and bald eagles (Anthony et al. 2008). They also cause a reduction in commercially (Larson et al. 2013) and culturally important shellfish (Kvitek et al. 1992; Salomon et al. 2007) -- a socio-ecological story foretold in Alaska (Salomon et al. 2007; 2010), which is currently playing out on the west coast of Vancouver Island (Watson and Estes 2011; Singh et al. 2013; Markel and Shurin 2015) and British Columbia's central mainland coast (Stevenson et al. 2016; Lee et al. 2016).

With the sea otter population growth rate slowing to 8.4% per year from 1995 to 2008 and 7.12% per year from 2009 to 2013 on the west coast of Vancouver Island (Nichol et al. 2015), this species was down listed from 'endangered' to 'threatened' status in 1996 and to a species of 'special concern' in 2007 (DFO 2014). With its numbers estimated at 5,612 as of 2013, sea otter recovery on the west coast of Vancouver Island can be lauded as a conservation success story and simultaneously examined in the context of contemporary forms of environmental governance striving to be both ecologically sustainable and socially just (Dearing et al. 2014; Raworth 2012). This paper uses this case to consider the larger issue of how to balance

productive and diverse ecosystems and the rights of Indigenous coastal communities when protecting endangered or re-introduced predators that were once hunted, managed and conserved via Indigenous governance systems. Among the Nuu-chah-nulth, the First peoples of this area, Uu-a-thluk (looking after), Isaak (a respect for all things living and non-living), Hishuk-is-tsawalk (acknowledging all things are connected) and a 7-generations approach had guided this governance.

Theory and Methods

To address this question of balancing ecological sustainability and social justice, the authors combined their disciplines of anthropology/political ecology and applied marine ecology/conservation science and took a social-ecological systems approach, considering what is required for this coupled human-ocean system to be resilient and adaptive. The issues of food security, poverty, and human rights in vulnerable fishing-dependent communities, largely ignored in fisheries management paradigms (Allison et al. 2012), are relevant to ecosystem-based management. Allison and co-authors argue that only through such attention to distributional justice issues can fisheries management be improved, and research on legitimacy supports this contention (Jentoft 2000; Pinkerton and John 2008). We therefore invoke these social justice considerations in examining how an Indigenous community has been affected and how their rights to food and livelihoods could and should be better protected.

In considering what social-ecological balance is desirable, we start by hypothesizing what social-ecological system might have existed before European contact. Because the ethnographic and archeological evidence from Northwestern North America shows that, relative to today, some marine species in some areas were likely more abundant (e.g., clams, Pacific herring) and

others less abundant (e.g., sea otters, seals, sea lions) at the time of first contact (McKechnie et al. 2014; Lepokfsky et al. 2015; Braje and Rick 2011) and that complex governance protocols were in place to regulate their use (Brown and Brown 2009; Trosper 2002; 2009; Powell et al. 2012), we start with the assumption that Indigenous societies, through experimentation and learning, developed sea otter hunting strategies and governance protocols that maintained both persistent shellfish and persistent sea otter populations (Stewart 2006; Cannon & Burchell 2009; Salomon et al. 2015), just as they did for salmon and other species. For example, the technology for the extirpation of salmon clearly existed in weirs which could completely block the passage of salmon to their upstream spawning grounds, yet the harvest was managed ritually and politically in a sustainable way (Sweezy and Heizer 1977; Langdon 2007). Equally, the technology for the extirpation of sea otters existed with hunting being significant and widespread among coastal Indigenous people (Corbett et al. 2008; Fedje et al. 2001; Szpak et al. 2012; McKechnie and Wigen 2011); they used sophisticated ocean going canoes, archery gear, spears, clubs, and training from an early age (Salomon et al. 2015) that could have decimated otter populations. Yet sea otter harvests were tightly controlled by chiefs in their territories before contact (Drucker 1951; Uu-a-thluk 2011; Salomon et al. 2017).

Archaeological evidence suggests that throughout the Holocene, sea otters in coastal Alaska and British Columbia occupied a patchy spatial distribution, with reduced numbers of individuals in the vicinity of village sites and greater numbers along coastlines in between human settlements (Corbett et al. 2008; Simenstad et al. 1978; Szpak et al. 2012). Sea otters could have been excluded from centers of human occupation via a combination of mortality from hunting, human avoidance behavior due to fear, and competition with humans for their shared shellfish prey (Salomon et al. 2015). There is also modern day evidence that southeast Alaska Native

villages (who are permitted under the Marine Mammal Protection Act to hunt sea otters for purposes of subsistence and for selling significantly altered pelts) today employ “perimeter defense strategies” in which sea otters are hunted at adjacent beaches where communities protect critical nearby intertidal resources--clams and Dungeness crab--but are not hunted outside these perimeters (Ibarra, Eckert, and Langdon 2017). A Kyuquot 2016 interviewee (see below) believed that in pre-contact times, there were 5-10 mile zones around villages where sea otters were harvested, and that in zones between villages, sea otters were undisturbed. Similar spatial hunting and stewardship practices have been described by Haida and other Nuu-chah-nulth knowledge holders (Salomon et al. 2015; Salomon et al. 2017). Therefore, we hypothesize that sea otter hunting in pre-contact times was focused on perimeter defense, since shellfish were an important winter food consistently identified in Northwest coast ethnographies of traditional use, in addition to being a key winter food and year-round social and ceremonial food today. Because sea otter fur was highly valued and used for chiefly regalia and to demonstrate high ranking societal status and good standing among First Nations (Salomon et al. 2015; Salomon et al. 2017), we surmise that chiefs had an incentive to maintain a viable population of sea otters in part of their territory.

Thinking has changed since the 2002 Canadian *Species at Risk Act* (SARA) and related policies were introduced without requiring an ecosystem or social-ecological approach, and without conceiving of human rights as within their purview. More integrated conceptions and social justice concerns have entered natural resource policy discourse in force, both globally and nationally. For example, at the global scale, the bio-physically based planetary boundaries framework has been combined with the concept of social boundaries to define an ecologically safe and socially just operating space for humanity (Raworth 2012; Steffen et al. 2015). This

181 combined framework has been developed to guide the United Nations sustainable development
182 goals (Raworth 2012). The twin goals of ecological sustainability and social justice
183 are guided pragmatically in the world's oceans, where the 2015 United Nations Food
184 and Agriculture Organization (FAO) *Voluntary Guidelines for Small-Scale Fisheries* considers
185 fishing rights as human rights to traditional livelihoods, and numerous international and national
186 policies support such rights (Jentoft et al. 2017). Finally, most countries are signatories to the
187 *United Nations Declaration on the Rights of Indigenous People* (UNDRIP), including Canada.
188 At the regional scale, on the west coast of Canada, the 2013 Gulf Islands National Park Reserve
189 “Key Strategy 1: Restoring Ecological Integrity - Connecting Land, Water and
190 People” explicitly recognizes people as part of ecosystems and re-introduces
191 traditional human interventions as ways of restoring traditional ecosystems, in
192 this case through the restoration of ancient clam gardens (GINPR 2013).

193 This discussion combines a consideration of these policies and conceptual divides with a
194 decade of ethnographic fieldwork on clam management and more recently on sea otter impacts in
195 Kyuquot, British Columbia, a remote community inhabited by the Ka;’yu;’k’t’h’
196 Che:k’tles7et’h’people on the northwest coast of Vancouver Island adjacent to where sea otters
197 were re-introduced five decades ago. The first author spent two weeks in Kyuquot in February
198 2016 with master’s student Gwyn Thomas, jointly interviewing 16 residents about how they
199 were affected by and felt about sea otters, and also meeting with a local committee to discuss
200 their concerns about sea otters (Thomas 2018). This field site is particularly appropriate because
201 of its traditional and contemporary dependence on marine resources, particularly clams, for both

subistence and livelihoods, and its having the longest history of sea otter occupation and thus associated ecological, socio-cultural and economic impacts, in Canada. As such, this site represents a bellwether of what will soon play out in coastal communities up and down British Columbia's coast as this keystone predator and conservation icon expands its range. Hence the reintroduction of sea otters, which radically eroded both shellfish-based livelihoods and subsistence, poses a social justice question. How can community rights and diverse ecosystems be balanced in the wake of a successful predator re-introduction? Can traditional sea otter hunting practices and governance protocols be revitalized to support viable shellfish, diverse and resilient ecosystems and healthy sea otter populations?

The complexity of this question can be illustrated by considering the following. Recovery of sea otters in British Columbia has been shown to cause a 16-fold decline in the SARA-listed abalone (*Haliotis kamtschatkana*), part of their shellfish diet (Lee et al. 2016). Although sea otters and abalone can co-exist (Lee et al. 2016), and likely have done so for millennia (Estes et al. 2005), abalone abundance permitting an FSC fishery would require sea otter exclusion from some places. Viable FSC abalone fisheries should also be considered part of a desirable resilient social-ecological system.

Historical Context

In the same decade that the first national act protected endangered species in the US, Canadian fisheries policy began a radical removal of small-scale commercial fishermen from the BC fishery. Between 1969 and 1979, all vessels which had delivered less than \$2,500 worth of fish annually during three qualifying years lost their licenses. Single-gear area licensing, license buy-backs, allocations to the sport fishery, reduced allocations to the West Coast of Vancouver

Island, costly federal requirements to upgrade fishboat holds, and finally Individual Transferable Quotas took their toll on the access rights of fishing-dependent communities such as Kyuquot (Ecotrust 2004; Pinkerton and Davis 2015) which in 2016 had only one community member with a fishing license. Previously, and during most of the 20th century, every family had a fishboat and in the 1970s, despite these factors there were still over 30 licensed commercial fishboats in the Ka;’yu;’k’t’h’ Che:k’tles7et’h’ community of Houpsitas at Kyuquot, many employing a deckhand or two. An unlicensed “mosquito fleet” of small boats fished inshore and delivered their fish through the licensed vessels (Pinkerton 1987; Lewis 1977). But as the licensed vessels disappeared, so did the mosquito fleet and the community became completely dependent on commercial clam digging, with 61 clam licensees operating in the early 21st century. The community put considerable and successful effort into developing a sustainable wild clam commercial fishery in their whole territory, with a particular focus on communal licenses on their two major beaches (Pinkerton and John 2008), although they were persuaded to convert these to commercial clam aquaculture farms in 2004-2005. They continued to manage at least one of these beaches (Malksope) sustainably, however, meeting their 20% sustainable harvest rate objective until about 2006 when sea otter predation on clams began to visibly affect what was available to humans (Pinkerton and Silver 2011; Ladell et al. 2014).

Today almost no harvestable sized clams are available except on one large beach dedicated to local clam harvest for Food Social and Ceremonial (FSC) purposes (a constitutionally protected right to fish of Canadian Aboriginal people after conservation needs are met). At this beach, half an hour’s travel from the community, some vigorous efforts have been made to discourage sea otters (Ladell et al. 2014). Clam biomass on nearby small beaches accessed for FSC purposes was profoundly reduced by 2014 and other shellfish such as sea urchins and crab which provided

daily food have also been reduced to such low numbers and sizes that they are not easily harvested for food: many youth under age 25 have never tasted them. Of 14 residents interviewed in 2016 about their perceptions of sea otters, most appreciated the ecological benefits of increased kelp (because the otters' preferred food was sea urchins which ate kelp), but were angry at the loss of their traditional foods and believed reinstating spatially explicit traditional hunting practices was, among many proposed solutions, the primary one by which to both maintain sea otter populations and also have some shellfish available to them. The depth of their resentment stemming ultimately from their lack of power in making decisions about where and how they can access food can be imagined in the conjecture of one interviewee that the sea otter had been re-introduced with the deliberate intention of forcing people to buy their food from supermarkets that require 4.5 hours of travel each way from the community. Similar findings emerged from 40 Ka; 'yu; 'k't'h' Che:k'tles7et'h' and other Nuu-chah-nulth interviewees in a second study (Burt et al. in prep). These interviews revealed the type of hidden power inequities driving many social and environmental justice situations--in this case being exercised by government's failure to negotiate a sea otter management plan which would allow a sufficient hunt to protect even one clam beach (DFO 2014).

Discussion: the collision of two schools of thought

Two opposing objectives are codified in two Canadian policies: (1) that ecosystems do not include humans and do not need to be protected vs (2) that ecosystems do include humans and some of them have rights. Clearly, the Canadian constitutional guarantee of access to fisheries for Food Social and Ceremonial (FSC) purposes has been violated by the *Species and Risk Act* (SARA) policy which protected sea otters at the expense of people's access to subsistence

shellfish (NTC 2012). In addition to simply ignoring these rights, the logic of SARA seems to be that this is possible because Indigenous people are not part of ecosystems. Section 67 of SARA states that “The competent minister *may* adopt a multi-species or an ecosystem approach when preparing the management plan *if* he or she considers it appropriate to do so.” This wording invokes ministerial discretion, showing that EBM is not mandatory (whether it includes humans or not) and communities do not have the right to demand it. Even after sea otters were reclassified as a species “of special concern” in 2007 and managed under the Fisheries Act, Indigenous communities have lacked power in sea otter management and decision-making.

Despite this situation, the Ka;’yu;’k’t’h’ Che:k’tles7et’h’ made an effort to introduce broader thinking into SARA negotiations. Since the mid-1990s, they had been proposing that they enter into joint management of the sea otter and traditional seafoods in treaty negotiations with the federal and provincial governments, emphasizing their constitutionally-protected right to FSC fisheries. A controlled sea otter hunt would not only protect some adjacent shellfish beaches on which they depend for food, but it would also allow them access to ceremonial regalia traditionally worn by chiefs (sea otter furs). Since 1999 they have been working on a draft Sea Otter Management Plan, vetted with other Nuu-chah-nulth Nations through workshops, at one of which the Ka;’yu;’k’t’h’ Che:k’tles7et’h’ accepted the responsibility of spearheading the sea otter issue for all Nuu-chah-nulth territory. Since the Ka;’yu;’k’t’h’ Che:k’tles7et’h’ made no progress through treaty talks, they responded to the invitation to participate in the Sea Otter Recovery Team (SORT) process operating under SARA, hoping to raise these issues there. Operating in both a policy and a technical capacity, they participated in SORT meetings 2002-2003. They ceased participating when it became clear that there would be no consideration of FSC needs, human health needs or governance aspirations of the Ka;’yu;’k’t’h’ Che:k’tles7et’h’

First Nations. This outcome occurred despite feedback from groups consulted on the draft recovery plan that a multi-species and a region-specific approach was needed (because sea otters had already recovered in the northern region, and because other species were so dramatically affected). Concerns were also expressed about the health of Indigenous elders and value of including Indigenous people in the solution to this complex problem, i.e., that they had something to offer toward a solution. The 2003 report of the National Recovery Strategy for the Sea Otter in BC, stated that the single-species approach it had taken was limited, but the only possible one under the time pressure of a single year. It acknowledged that there was “concern expressed about the impact of sea otters on shellfish resources for First Nations’ food, social, and ceremonial purposes and for commercial shellfish fisheries,” but these were obviously not permitted to be considered relevant to the SARA-defined recovery process.

Instead, the DFO 2014 Sea Otter Management Plan, mandated by SARA, addressed eight classes of threats to sea otters: environmental contaminants (oil spill), illegal kill (poaching), entanglement in fishing gear, environmental contaminants (persistent bio-accumulating toxins), disease and parasites, vessel strikes, human disturbance, and directed harvest (legal kill). Directed harvest was estimated to be the least threat by far, but even the greatest threat, oil spills, was not thought to be large. The threat considered the second most important, illegal kill, is one which could become community-regulated in the context of a legal Indigenous sea otter hunt. When government policies are considered highly illegitimate, as they are in Kyuquot in the case of sea otters, community will to adhere to such policies and their ability to control illegal activities is far lower (Pinkerton and John 2008). In adhering to a school of thought that people are not part of ecosystems, and thus failing to negotiate a sea otter hunt considered reasonable by

the Ka:’yu:’k’t’h’ Che:k’tles7et’h’ First Nations, DFO is forfeiting an opportunity to regulate what it considers the second most important threat to sea otters.

Nor does the DFO plan acknowledge in any other way the connection between disallowing a reasonable hunt and FSC rights to shellfish. The plan only mentions anticipating a FSC harvest of sea otters, which are not considered edible and are primarily valued for pelts which are used mostly as chiefly regalia. In so doing, the DFO plan also fails to acknowledge the poverty and food insecurity which threatens Kyuquot, a situation that is emblematic among BC’s coastal First Nations. It should be acknowledged that DFO’s small boat licensing policy mentioned above violated the original social contract allocating very small reserves to Indigenous people because they were promised continued access to their fisheries as their livelihood (Pinkerton 1987; Ommer 2007). Five Nations of the Nuu-chah-nulth Tribal Council have received recognition by the Supreme Court of Canada of their right to fish all species of fish except geoduck commercially (Ahousaht et al. vs. Canada 2013), a decision reconfirmed in 2018.¹

Therefore, policies such as those emanating from SARA currently violate both the requirements of a resilient social-ecological system and also legally and socially just treatment of Indigenous people whose territory was appropriated on the grounds that they would be able to sustain themselves by fishing. Stewart (2006) provides data which offers some insights into why this situation persists. Four of the five “conservation professionals” interviewed by Stewart were aware of these negative effects of sea otters on coastal communities, but still opposed a

¹ The Maa-nulth First Nations (5 Treaty Nations of the Nuu-Chah-Nulth Tribal Council—including the Ka:’yu:’k’t’h’/Che:k’tles7et’h’ First Nations) also have a “Me-Too” clause in the Maa-nulth Treaty: 10.2.3 If the highest domestic court that considers the Litigation determines that one or more of the plaintiffs has an aboriginal right to fish for salmon, halibut, rockfish, roe herring, sablefish, prawn or crab and to sell the fish caught under that right on a commercial basis, upon the written request of the Maa-nulth First Nations provided within eight years of such determination, the Parties will amend this Agreement and the Maa-nulth Harvest Agreement as described in the Maa-nulth Harvest Agreement.

sustainable sea otter hunt on moral grounds. Some of the conservation professionals worked either directly or indirectly for DFO. Others had scientific knowledge of sea otter biology and ecology, or were considered “experts” on sea otters or “are conduits for policy and public information about sea otter recovery” or had first hand knowledge of sea otters and the efforts for their recovery. They included aquatic conservation scientists, marine ecologists, marine species-at-risk biologists and managers, conservation biology and ecology educators, marine species-at-risk educators and academics active in marine biological conservation in BC. They worked for government (DFO, Parks Canada, Environment Canada, BC government), educational organizations, environmental NGOs, consulting companies, Tribal Councils or aquatic management organizations.

In addition, of the 50 additional conservation professionals Stewart surveyed, 66% agreed with the statement “I believe that it is okay to put sea otters’ rights ahead of human rights to shellfish”, suggesting that this collision of modes of thought is deeply ideological, and that many conservation professionals (a) have little confidence in the possibility of a sustainable hunt and/or (b) give little weight to the rights of Indigenous people, and/or (c) have not even considered and/or have no awareness of their poverty and food security needs. One interviewee suggested that they “should switch to deer” [from seafood], and was apparently unaware that deer populations in KCFN territory are at a historical low point (for a number of reasons, including clearcut logging of the deer’s winter range and more roads increasing access to deer). Another interviewee remarked that it is “impossible to regulate and enforce a hunt,” suggesting that some were unaware of either the real situation or the history of this area. Conservation professionals also were 96% in agreement with the statement “I believe that there was a balanced marine ecosystem that included sea otters before the commercial sea otter hunt that fully

removed sea otters from B.C.” This agreement also suggests that they were unaware that there was a regulated sea otter hunt before European contact and/or that they thought of the “balanced marine ecosystem” as not including the humans who did hunt sea otters.

Balancing the needs of people and nature

There are multiple sources of archeological, ethnographic, and biological evidence from Alaska and BC on how sea otter hunting was managed in pre-contact times (Corbett et al. 2008; McKechnie and Wigen 2011; Salomon et al. 2015), from the strict protocols of chiefs in parts of Alaska and BC (Salomon et al. 2017) to the perimeter defense strategies documented in Southern Southeast Alaska (Ibarra et al. 2017), in addition to the currently acknowledged practicality of using it today in BC. These sources suggest that a sea otter hunt limited to specific areas, in addition to the active human occupation of these areas, could meet the dual objectives of shellfish and sea otter conservation. Spatially-explicit simulation modeling of sea otter demography, dispersal, and their effects on benthic shellfisheries would be an important first step in exploring the possible consequences of spatially allocating traditional sea otter hunting and conservation zones. Adaptive experimentation in protecting particularly valued shellfish beaches adjacent to villages, and the continued monitoring of sea otter populations beyond those beaches could support resilient social-ecological systems. Ecologically, experimenting with and monitoring such a policy could lead to a spatial mosaic of kelp-dominated and shellfish-dominated rocky reefs and soft sediment bays that varied in their shellfish production. Socially, this would enhance local access to shellfish, supporting both local food security, food sovereignty and Indigenous lifestyle and livelihood objectives. Finally, re-establishing traditional marine tenure systems, and the authority to manage access and enact stewardship protocols

within chiefly territories (locally known as Ha'houlth among the northern Nuu-chah-nulth Nations), would be a major step towards aligning Canadian environmental laws with the Canadian constitution, recent court cases re-establishing Indigenous rights to self determination, and Canada's international commitment to supporting Indigenous rights (i.e., UNDRIP). Ultimately, this would call for the revival of the territorial management roles of First Nations in this area in combination with co-designed, co-managed and co-tested ecosystem-based management plans, such as those currently being developed (Nuu-chah-nulth Draft Sea Otter Management Plan 2012). A window of opportunity exists to test drive this idea, given the multilateral government Marine Protected Area planning processes currently underway in British Columbia (see Marine Plan Partnership (MaPP) for the North Pacific Coast <http://mappocean.org/> and The Northern Shelf Bioregion Marine Protected Area Network <https://mpanetwork.ca/bcnorthernshelf/>).

The Ka:'yu:'k't'h'/Che:k'tles7et'h' First Nations have already experienced a well-managed clam fishery in which their local Fisheries Department did all the monitoring and enforcement of harvest rules, including enforcement of unpopular Environment Canada closure of beaches presumed to have high fecal coliform counts in winter. (People ate clams and did not get sick, so they assumed Environment Canada data to be inaccurate). Over an 18-year period the Ka:'yu:'k't'h'/Che:k'tles7et'h' (K-C) Fisheries department developed scientific, regulatory, political, and moral legitimacy in a co-management arrangement of which the community became strongly supportive. Part of the reason for its high level of legitimacy and therefore compliance with the harvest rules was that well-attended meetings with harvesters happened twice a year at which rules were discussed and revised in a way which won the community's confidence in their transparency, fairness, and contribution to sustainability. The community-

based rules also re-created the traditional husband-wife joint digging, and happened as a traditional winter harvest, a time of traditional and modern scarcity and need. K-C Fisheries also convinced harvesters to obey government rules they did not agree with in order to keep their fishery open and operating in an orderly manner (Pinkerton and John 2008). Clams were also of key importance in winter as food security, and were dug for this purpose on FSC beaches, with all ages participating. This experience demonstrates that the community is capable of self-regulation and collaboration with government, with the appropriate institutional arrangements, leadership, training, and financial support.

The Nuu-chah-nulth Draft Sea Otter Management Plan (2012), in which the Ka:'yu:'k't'h'/Che:k'tles7et'h' First Nations are acting as the pilot project for development and implementation, illustrates the nature of the self-regulation envisioned by the Nuu-chah-nulth, which we consider a significant proposal to balance the needs of people and nature. In the plan, Nuu-chah-nulth communities propose to establish localized management regimes created by each community and their Ha'wiih (chiefs), which meet their specific community needs within the identified harvest limits for all Nuu-chah-nulth. The goal is to maintain healthy marine resources, including a healthy and sustainable sea otter population, while providing ceremonial use of the otter. Thus, planning in each of the 14 Nuu-chah-nulth nations would include how to integrate sea otter harvest in that area with protection of selected clam beaches for FSC purposes. Planning would also include coordinating and supporting ongoing research on sea otter population biology, population status, habitat, and ecosystem interactions.

The Nuu-chah-nulth plan begins with establishing an overall sustainable harvest level and how this would be adapted as monitoring and research reveal needed adjustments over time.

The plan then outlines the specifics of allocation of harvesting opportunity, harvest regulations, monitoring and enforcement of harvest regulations, annual data collection and analysis, and coordination with the Department of Fisheries and Oceans (DFO) office in Port Alberni, which is also the location of the Nuu-chah-nulth Tribal Council (NTC) administrative headquarters. Each of these is described in the Appendix.

In contrast to the 2012 Nuu-chah-nulth Draft Sea Otter Management Plan, the 2014 DFO Sea Otter Management Plan makes no mention of humans in its Management Objectives section. Under its “Conservation Measures”, it identifies “Support oversight and monitoring of any future First Nation harvest of Sea Otters” as one of six “Broad Strategy: Management” conservation measures, with a “to be done” timeline. Also to be done under “Broad Strategy: Research and Monitoring” is DFO’s “Assess the potential impacts of fisheries including competition for prey resources, bycatch and entanglement in fishing gear, and illegal mortality”. This suggests that DFO may deem First Nations’ FSC fisheries on clams, which reduce available food for sea otters, as a potential threat to sea otter population persistence.

There are additional conservation practices, management strategies, and governance approaches that could support the capacity of coastal communities to adapt to the abrupt ecological and social transformations triggered by sea otter recovery. Ancient clam gardens, intertidal rock-walled terraces constructed by people in the late Holocene along BC’s coast, have been shown to double the production of clams (Groesbeck et al. 2014). Ethnographies and Traditional Ecological Knowledge suggest that this ancient form of mariculture was accompanied by governance protocols such as contingent proprietorship by chiefs and reciprocity between chiefly territories which would have contributed to the resilience of the regional social-ecological system (Lepofsky et al. 2015; Jackley et al. 2016). Opportunities for

clam gardens exist in small pocket beaches near Kyuquot. Moreover, supporting small-scale artisanal fisheries in line with Indigenous world views and traditional practices would be an additional means of supporting alternative livelihoods, increasing food security and alleviating poverty. Recent research nearby investigating the ecosystem-level consequences of a small-scale artisanal kelp fishery (*Macrocystis pyrifera*) found minimal impacts on kelp recovery rates, survival, and biomass dynamics, and abundances of associated commercial fish species (Krumhansl et al. 2017). These results suggest that the small-scale harvest of giant kelp causes minimal trade-offs for the other economic benefits provided by these ecosystems, and their inherent, spiritual, and cultural value to humans. Thomas (2018) provides additional evidence for the possible establishment of a small-scale kelp harvesting industry in Kyuquot which, if successful, might support the livelihoods of two or three people.

Of course, all of these alternative resilience-based strategies are not immune to global forces such as climate change and shifting international markets, nor local or regional disturbances such as shellfish disease epidemics, harmful algal blooms and elevated occurrences of Paralytic Shellfish Poison. These realities call for governance structures that can respond quickly to external disturbances. We need to embrace the kind of alternatives which allow social and environmental justice to co-exist (Shoreman-Ouimet and Kopnina 2015), by having governance structures which allow both scientific monitoring of actions and local forms of governance with high legitimacy and thus strong compliance, such as existed earlier in Kyuquot clam management (Pinkerton and John 2008). Our premise is that it is possible for an Indigenous community such as Kyuquot to conduct locally-controlled perimeter defense-based hunts today without endangering the re-introduced sea otter, and that this could be the basis for a resilient social-ecological system. This would require a re-negotiated sea otter management plan which

took into consideration the need to protect adequate adjacent clam beaches in addition to the need to protect sea otter populations and the diverse and productive ecosystems they foster. Biodiversity can be compatible with food security as long as the specific context and key connections are well understood (Billé et al. 2012) and conservation strategies are continually monitored and updated.

In conclusion, navigating the trade-offs between protected species, ecosystem conservation and social justice issues such as food security and poverty alleviation presents one of the greatest challenges of our time. These trade-offs are heightened in coastal Indigenous communities where food insecurity is growing (Turner & Turner 2008) and economic opportunities are constrained (Mackey & Strathdee 2015). Tackling the question of hunting a once endangered, charismatic predator brought back from the brink of extinction on the basis of social justice places EBM scientists and managers in uncomfortable territory. It forces us to democratize the concept of ecosystem-based management by addressing the issues of social justice head on (Salomon et al. 2018). Only by doing so will we truly achieve resilient social-ecological systems where power and authority in decision making around ecological, economic and socio-cultural objectives, and how best to achieve them, are shared. This paper had made the case that traditional sea otter hunting practices and governance protocols can be revitalized to support viable shellfish, diverse and resilient ecosystems and healthy sea otter and Indigenous populations.

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Figure 1. Clam landings and sea otter population estimates in Ka;’yu;’k’t’h’ Che:k’tles7et’h’ territory (Area 26) from 1951 to 2012. Clam landings include manila (*Venerupis philippinarium*), littleneck (*Leukoma staminea*), and butter (*Saxidomus gigantea*) clams. Data sources: DFO; Nichol et al. 2009; Jane Watson (pers. comm.)

Appendix. Key components of 2012 Draft Nuu-chah-nulth Sea Otter Management Plan

Establishing and adapting a spatially explicit sustainable harvest level

Each First Nation conducts sea otter surveys in its territory, which are regionally coordinated by the NTC and used to compliment DFO surveys. Collaboration between the NTC Fisheries department and DFO guides population assessments which determine harvest limits. The limits estimate ‘total allowable harm’ from all human sources for the 2008 Vancouver Island population of 4,110 as 185 animals per year. After three precautionary adjustments, the harvestable number is 74, which allows each of the 14 nations about five sea otters each. However, limits will be based upon the proportion of the sea otter population that occurs in each Nation’s chief’s (Ha’wiih) territory (Ha’houlth) as determined by the most recent population assessment (Nichol *et al.* 2009, 2015), which will be updated every five years.

Harvest allocation

An Aboriginal Communal License (ACL) issued by DFO for harvest of sea otters for ceremonial purposes within allowable limits is required. Hunters are required to apply in person for a two-week harvest permit from their Nation’s fisheries department. A Nuu-chah-nulth hunter must be issued a harvest permit by his/her First Nation after receiving the approval of the appropriate Ha’wiih.

Harvest regulations

Harvest limits, seasons, and areas are divided according to Nuu-chah-nulth territories as specified on the communal licenses, and hunters holding permits are notified that harvests are terminated when the allowable harvest has been reached. Hunters inform their nation’s Fisheries

Department prior to, and after participating in a hunt. The First Nation's Fisheries Department informs the DFO Port Alberni Fisheries Office that a hunt will be occurring and the approximate location and timing of the hunt. A \$50 tagging deposit is paid by the hunter, and returned upon presentation of the pelt to the First Nations Fisheries Department.

Harvest monitoring and enforcement

First Nations Fisheries Departments monitor the in-season harvest. All sea otters taken in the management area must be submitted to a designated harvest monitor in the harvester's community to ensure the required management data is collected and can be analyzed in a timely manner. The Nuu-chah-nulth Nation's Fisheries Departments report sea otter kills to the DFO Port Alberni Fisheries Office. Pelts are tagged by the bio-sampling monitor in order to ensure reliable harvest information and tracking. The First Nations' Fisheries Department compiles the tagging information monthly and provides that information to the DFO Port Alberni Fisheries Office. Weekly harvests are also monitored in-season relative to harvest limits by the First Nations' Fisheries Departments. The First Nations' representatives and DFO Fishery Officers jointly enforce the requirements of the hunt through the tripartite stepped approach to enforcement principles (i.e., graduated sanctions).

Annual data collection and analysis

All hunters are required to submit carcasses for bio-sampling and tagging within 72 hours of a kill. A bio-sampling program collects age, sex, and other variables from all harvested sea otters that are useful for tracking population characteristics. NTC Fisheries department biologists and First Nations Fisheries Guardians will be trained and designated as bio-sampling monitors. The

47 NTC Fisheries department manages the tagging and bio-monitoring operation (supplying tags,
48 training monitors, etc.). Pelts that have been cleaned and prepared can have tags removed once a
49 unique numbered tattoo has been administered. Post season review of these events will occur
50 annually between DFO, NTC Fisheries, and Nuuchahnulth Nations. The WCVI Aquatic
51 Management Board (AMB) will work with NTC Fisheries to establish the management program
52 and research projects. As information is gained and assessed, management policies will be
53 adjusted to better meet the ecological and social management objectives specified jointly by
54 NTC and DFO. This will ensure that the hunt facilitates adaptation to lessons learned throughout
55 the process of implementing and assessing this innovative management strategy experiment.

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