

Research

## Interactive governance of whale ecosystem services: governability assessment of three case studies in the Arctic

Laura Malinauskaite<sup>1</sup> , David Cook<sup>1</sup>, Eduard Ariza<sup>2</sup>, Brynhildur Davíðsdóttir<sup>3</sup> and Helga Ögmundardóttir<sup>4</sup>

**ABSTRACT.** The social-ecological change in the Arctic is accelerated by the multifaceted effects of climate change and globalization. Among other things, this means changing human-ecosystem dynamics through altered availability, co-production, and governance of ecosystem services (ES). A group of species illustrative of this change are whales, migratory species that have played an important part in the culture and subsistence of Arctic communities for millennia. This study explores the changing human-nature interactions and whale ES governance by combining ES and interactive governance theories. A multi-method approach is applied to assess qualitatively the qualitative governability of whale ES in three Arctic coastal locations: Húsavík in Iceland, Andenes in Norway, and Disko Bay in Greenland. Based on a literature review, stakeholder mapping, observations, and analysis of 54 semi-structured stakeholder interviews, the study finds that whale ES governance involves multiple actors with differing preferences and values and that much of it happens outside of formal institutions, necessitating inclusive approaches to improve it. The study reveals some whale ES governance deficiencies and potentials, such as a mismatch between governance scales and a need for more formal governance practices based on scientific research and stakeholder inputs. Governance frameworks were present for provisioning whale ES related to whaling, but they were lacking for non-consumptive whale ES, such as whale watching. Addressing these issues can help to direct marine resource management toward sustainability by making it more inclusive, adaptive, and reflective of stakeholder needs and values. This goal could be advanced by applying the governance principles that view humans as an integral part of social-ecological systems, e.g., ecosystem stewardship and ecosystem-based management.

**Key Words:** *Arctic coastal communities; governability; interactive governance; social-ecological systems; whale ecosystem services*

### INTRODUCTION

It is increasingly evident that natural resource governance requires a holistic transdisciplinary approach because of the complexity of environmental problems (Primmer et al. 2015, Nunan 2019, Stephenson et al. 2021). This is certainly true in marine governance as it requires cross-border cooperation, long-term planning, active stakeholder participation, and an ecosystem-centered approach to ensure the ecosystems' health and their continuous supply of human well-being benefits, commonly referred to as ecosystem services (ES; Gelcich et al. 2019, Morf et al. 2019, Frazão Santos et al. 2021). ES occur at the intersection between the social and ecological domains of social-ecological systems (SES) through human-environment co-production (Spangenberg et al. 2014a, Palomo et al. 2016, Solé and Ariza 2019). This understanding of ES favors the view of societies and ecosystems as interdependent, coevolving, and mutually responsive (Gual and Norgaard 2010, Folke et al. 2016).

The Arctic ecosystems and societies are shaped by the complex phenomena of climate change and globalization, thus studying social-ecological dynamics is especially important when designing governance instruments in the region (Arctic Council 2015, 2016, Falardeau and Bennett 2019). The rate of climatic change in the Arctic is more than double the global average (IPCC 2019, 2021). At the same time, it provides habitats for some of the most iconic species on Earth that depend on presence of sea-ice, e.g., polar bears and certain species of whales (Laidre et al. 2015, Vacquie-Garcia et al. 2018). Although marine ecosystems around the world are impacted by climate change, those in the northern range of

the biosphere have fewer possibilities to adapt (Vincent 2020). Arctic communities dependent on local natural resources are especially vulnerable to climate change and increasingly affected by globalization (Huntington et al. 2019, Worden et al. 2020).

Whales supply Arctic coastal communities with a unique set of ES in terms of sustenance, culture, and tourism (Meek et al. 2011, Cook et al. 2020, Malinauskaite et al. 2021). These ES benefits extend beyond the Arctic in terms of the cultural significance of whales as symbols of the global conservation movement and their contribution to the biological functioning of ocean ecosystems (Roman and McCarthy 2010, Roman et al. 2014). The body of literature focused on marine and whale ES has been growing steadily, partly owing to the global focus on biodiversity conservation and nature-based solutions to climate change (Cunningham et al. 2012, Chami et al. 2019). Most studies to date have focused on different aspects of whale resource governance separately, e.g., ethics, law, or politics of whaling (Gillespie 1996, Higham and Lusseau 2008, Mattes 2017), effects and governance of whale watching (Ritter 2003, Salvadeo et al. 2013, Meynecke et al. 2017, Richards et al. 2021), and effectiveness of conservation measures (Zacharias et al. 2006, Hoyt 2011, Cook et al. 2019).

However, whale ES derive from social-ecological processes and their governance calls for a holistic analytical approach that addresses both, social and ecological, domains (Hinch and De Santo 2011, Meek et al. 2011, Cook et al. 2019, Malinauskaite et al. 2021). Moreover, the sectoral and jurisdictional fragmentation characteristic of Arctic marine research and governance also calls for an integrative analytical approach (Young 2016, Young et al.

<sup>1</sup>Environment and Natural Resources, Faculty of Environment and Life Sciences, University of Iceland, <sup>2</sup>Arctic Research Centre (CER-ARCTIC) and Interdisciplinary Studies in Environmental, Economic and Social Sustainability, Department of Geography, Autonomous University of Barcelona, <sup>3</sup>Environment and Natural Resources, Faculty of Economics and Faculty of Life and Environmental Sciences, University of Iceland, <sup>4</sup>Faculty of Social and Human Sciences, University of Iceland

2018). One such approach is the interactive governance (IG) framework, according to which natural resource governance implies a web of multi-layered interactions between co-evolving SES components, including human actors, formal and informal institutions, and ecosystems. The view of governance as a co-evolving, multi-actor, and multi-scale process makes it well equipped to account for social-ecological complexities (Kooiman and Bavinck 2013, Mahon and McConney 2013, Partelow et al. 2020).

Interactive governance is defined by Kooiman (2016) as a wide range of interactions aimed at solving societal problems and creating opportunities, and governability as the quality of governance and its ability to fulfil this aim. Systematic assessment of governability can reveal governance potentials that, if capitalized upon, can help to direct marine resource management toward sustainability (Chuenpagdee 2011, Jentoft and Chuenpagdee 2013). The present study uses case studies from the North Atlantic to examine the governance and governability of whale ES in the Arctic by focusing on three coastal communities: Húsavík in Iceland, Andenes in Norway, and Disko Bay in Greenland. Whale resource governance is a controversial topic rarely approached from an ES governance perspective, which combined with the case study method provides a unique opportunity to explore governability of whale ES and its effects on human well-being (Meek et al. 2011, Falardeau and Bennett 2019). Exploring multiple case studies provides an opportunity of get a fuller view of governability and discern what can be generalized and what is context dependent (Chuenpagdee et al. 2008, Ofei-Manu et al. 2018, Crona et al. 2019).

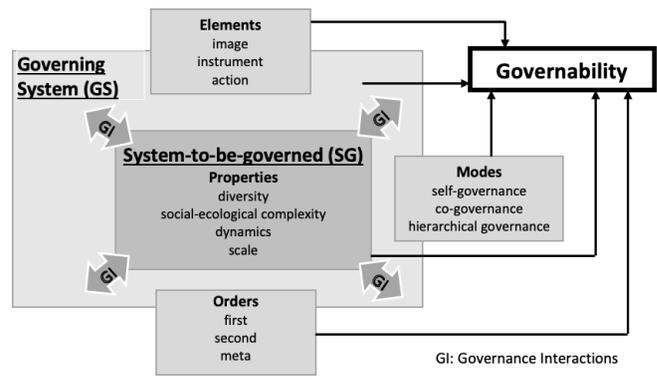
The paper combines the concepts of whale ES and their co-production (Cook et al. 2020, Malinauskaite et al. 2021) with the interactive governance and governability framework. The four aims are to assess the governability of whale ES by (i) designing a conceptual model that combines whale ES co-production and interactive governance frameworks; (ii) identifying the main components of IG of whale ES in the three case studies; (iii) assessing the governability of whale ES in the three SES using a framework developed by IG scholars for marine resources; (iv) discussing the findings in the context of Arctic marine governance and the needs and values expressed by stakeholders in the case study locations.

## THEORETICAL FRAMEWORK

### Interactive governance and governability

Interactive governance is defined by Kooiman (2016) as the whole range of interactions aimed at solving societal problems and creating opportunities, and governability, as the quality of governance and its ability to fulfil this aim. It refers to the “capacity of systems to cope with internal demands and to mediate and accommodate external drivers” (Jentoft and Chuenpagdee 2013:41). This capacity is an outcome of dynamic processes and interactions between different IG components in Fig. 1. The term “governability” is more inclusive than “policy” and “management,” which typically denote concrete governance tools, and implies a sum of governing activities carried out by public and private actors in accordance with their needs and values (Kooiman et al. 2005, Kooiman and Bavinck 2013).

**Fig. 1.** Linkages between interactive governance and governability. Adapted from Chuenpagdee et al. (2008).



IG has three main components: system to be governed (SG), which denotes the character of the SES under investigation; governing system (GS), which consists of formal and informal actors and institutions involved in governance of that system; and governance interactions (GI), which represents the interface between these two systems (Kooiman et al. 2008). Essentially, the GS aims to influence the interactions between the natural and socioeconomic sub-systems of SES (Jentoft and Chuenpagdee 2013). The interactive governance model consists of four main pillars: properties, elements, orders, and modes (Kooiman and Bavinck 2013), which are explained together with their components and definitions in Figure 1 and Appendix 1.

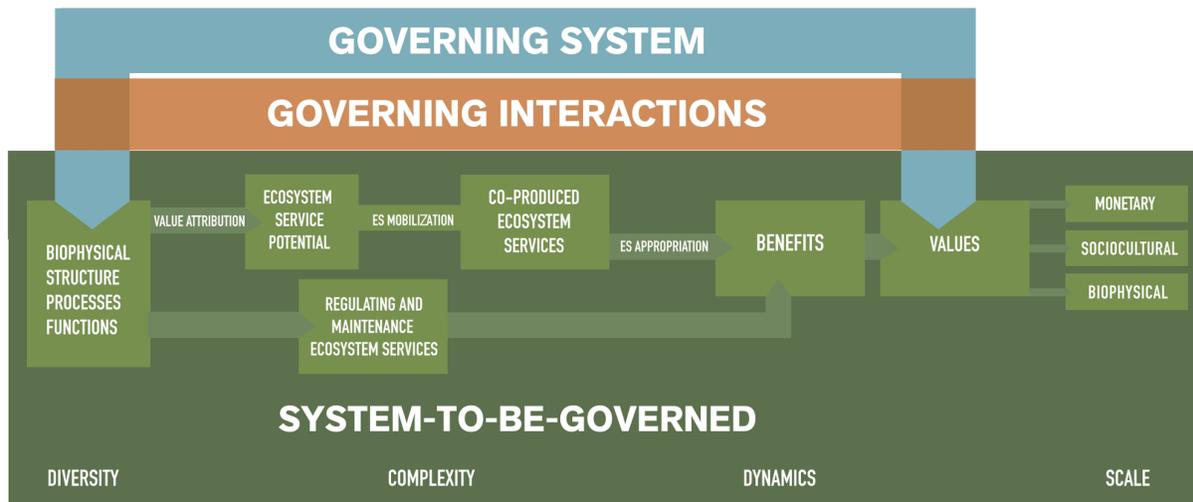
Figure 1 shows how the different components of the IG framework are interlinked through GI and how they contribute to governability. Figure 1 implies a close link between governability and interactive governance. Kooiman and Bavinck (2013:10) suggest that there is a close relationship between governance and governability: “An attempt to improve governance inevitably results in the need to explore and assess governability. Vice versa, the governability of societal systems can only be understood in/with reference to their basic qualities.”

GS comprises three main elements: images, instruments, and actions. Images guide governance, instruments enable it, and action puts instruments into practice. Images are concerned with the meta order of governance, i.e., values and principles that guide it; instruments relate to the second order and the institutional setting; and actions belong to the first governance order, which refers to concrete actions and tools applied in practice. In this model, governance can be top-down, collective, or self-directed, referring to the three governance modes. All three components of governance have characteristics of diversity, complexity, dynamics, and scale that affect the governability of a system.

### Whale ES co-production and interactive governance

Ecosystem services are commonly defined as contributions of ecosystems to human well-being (Corsi 2021), and ES values refer to the “perceived qualities of an environment that provide material and nonmaterial benefits to people” (van Riper and Kyle 2014:375). They are assigned by stakeholders to different whale ES and can be categorized into three value domains: biophysical, sociocultural, and monetary (Fig. 2; Martín-López et al. 2014).

**Fig. 2.** Whale ecosystem services (ES) co-production and interactive governance model. Adapted from Malinauskaite et al. (2021).



According to the Common International Classification of Ecosystem Services (CICES), whale ES can be divided into provisioning, regulating and maintenance, and cultural services (Haines-Young and Potschin-Young 2018, Cook et al. 2020). This ES classification system was chosen for this study because of its embeddedness in the ES cascade model (Haines-Young and Potschin 2010) that provides the basis for the whale ES co-production and governance model in Figure 2.

Provisioning whale ES include food products and raw materials; regulating and maintenance: enhanced primary productivity, biodiversity, and evolutionary potential, as well as climate regulation (carbon sequestration via whale carcasses); and cultural whale ES include but are not limited to tourism (whale watching), inspiration for arts, sacred, religious and spiritual beliefs, community cohesiveness and cultural identity, education, aesthetics, and existence and bequest values (Roman et al. 2014, Cook et al. 2020, Riisager-Simonsen et al. 2020).

The ES co-production model in Figure 2 stems from the observation that ES formation requires human-nature co-production (Spangenberg et al. 2014b, Fischer and Eastwood 2016, Bruley et al. 2021). The schema integrates the ES cascade model by Haines-Young and Potschin (2010) and incorporates ES co-producers and users into ES supply. The figure was adapted from the model of Malinauskaite et al. (2021) to include the elements of interactive governance theory. It presents the main whale ES co-production stages and the underlying social-ecological processes that enable their existence.

The resulting model illustrates how human actors benefit from whales through ES co-production and how their values feed into the governing system through governance interactions. The co-produced ES in the middle constitute a part of the SG, while co-production processes are affected by GS, GI, ES values, and stakeholder needs.

## METHODOLOGY

We use case study research to assess the governability of whale ES according to interactive governance theory. The case study method was chosen for this purpose because it allows for analysis of how a complex phenomenon plays out in practice (Gerring 2004, Flyvbjerg 2006, Yin 2017). The case study sites described below were chosen because of their proximity to the Arctic Circle, geographical and economic similarities, and presence of whale ES. The community-studies were chosen because a lot of whale ES occur and are governed on a community level, and although national governance is certainly important and has been studied, the IG perspective fits better with a local approach. All three SES examined in this study are located on Arctic and sub-Arctic coasts that support the presence of cetaceans (Malinauskaite et al. 2021). The three coastal communities depend on whale ES for their livelihoods and well-being, and they all face rapid biophysical and socioeconomic changes induced by climate change and globalization (Ford et al. 2015, Cole et al. 2016, Huntington et al. 2019, Stocker et al. 2020).

The case study sites have all experienced a partial shift in economic activities from extractive uses of marine resources to service-based economic activities, especially tourism, in the years leading up to the COVID-19 pandemic. To assess the governability of whale ES in the case studies according to the interactive governance model, a mixture of methods was used in the sequence in Figure 3: literature review; stakeholder mapping; semi-structured interviews and participant and non-participant community-based observations; deductive interview analysis; and assessment of whale ES governability.

First, a review of literature available on whale ES, their values, and management in the case study countries and the whole Arctic was conducted. Academic and grey literature was consulted for this purpose, and a snowball technique was applied to find more sources (Greenhalgh and Peacock 2005, Malinauskaite et al. 2019). Second, the results of literature review helped to identify the key actors in the interactive governance of whale ES in the

**Fig. 3.** The methods used in the whale ecosystem services governability assessment and the corresponding dates.



three case studies. Standard practice guidelines for stakeholder identification and mapping were used (Reed et al. 2009, Durham et al. 2014). The process was iterative and ongoing, and the stakeholder maps (Appendices 1, 2, and 3) were further developed in tandem with the data collection process as interviewees pointed to additional actors who could be interviewed. The resulting stakeholder maps were used to identify potential interviewees with knowledge of whale ES.

Third, semi-structured interviews with a wide range of actors were conducted using best practice guidelines in qualitative research methods (Hennink et al. 2020). The fieldwork for the case study research took place in Húsavík, Iceland, in June 2018 and August 2019, in Andenes, Norway, in September 2018, and in Disko Bay, Greenland, in August–September 2019. Representatives of stakeholder groups that were identified during stakeholder mapping were contacted to get as diverse a sample as possible. Fifty-four interviews with 57 people were conducted between June 2018 and September 2019: 19 interviews with 20 persons in Iceland, 15 interviews with 16 persons in Norway, and 19 interviews with 20 persons in Greenland. The interviewees represented an array of private and public sector institutions, NGOs, and communities identified in stakeholder maps (Appendices 2, 3, and 4).

The interview guide (Appendix 5) was designed to elicit the key ES provided by whales and their values, as well as management practices and needs. Each interview lasted around one hour, the shortest being around 30 minutes, and the longest around 90 minutes. The interviews were mostly conducted in the workplaces of the interviewees, but a few took place at other locations, such as respondents' homes and local cafés. The standard ethical practices in qualitative research, such as ensuring anonymity and offering an opportunity to opt out of questions, were followed (Esterberg 2002, Yin 2017). Community-based observations took place during fieldwork parallel to the interviews. Observations consisted of spending time in the case study communities and observing everyday activities related to whale ES. The observations resemble the ethnographic methods previously used in ES and interactive governance research (Pullin 2013, Song and Chuenpagdee 2013, Maestre-Andrés et al. 2016, Kaltenborn et al. 2017).

The interviews were recorded, transcribed, and coded deductively. As opposed to inductive coding methodologies, in deductive data analysis codes are predetermined in order to examine the key ideas of a theory on which it is based (Hyde 2000, Elo and Kyngäs 2008). This type of explanatory case study analysis is also known as “theory building” as it examines various components of a theoretical argument with the help of a case study (Yin 2017). Coding was initially based on the governability model by Kooiman et al. (2008), but the data suggested adding sub-codes for features of each case study. Qualitative data analysis software MAXQDA was utilized in the analysis, which allowed the

revisiting of codes and segments as the analysis progressed. The coding system is presented in Appendix 6 together with code frequencies.

Finally, the governability of the three case study SES was assessed using criteria from the framework by Chuenpagdee and Jentoft (2013), which are presented in Table 1. The assessment matrix serves as a guide for evaluating the governability of a resource system in accordance with the components of the IG framework. The criteria correspond with the main components of the IG model presented in Table 1. The denotations in brackets mark the effect that an increased score in each criterion has on governability, either enhancing or diminishing:

- the higher the degree of “wickedness” of the problem, the lower the governability and vice versa (opposite directions);
- the higher the intensity of properties (except system boundaries), the lower the governability (opposite directions);
- the better the fit of elements, responsiveness of modes, and performance of orders increase, the higher the governability (same direction);
- high quality of governance interactions has a positive effect on governability (same direction);
- and so does the presence of equitable and enabling power relations (same direction);
- while disabling power relations have an opposite effect (opposite directions).

#### CASE STUDY DESCRIPTIONS

The town of Húsavík is located in Skjálfandi Bay, northeast Iceland, and has just over 2300 inhabitants (Statistics Iceland 2021). The most typical cetacean species in the bay are humpback (*Megaptera novaeangliae*), minke (*Balaenoptera acutorostrata*), and blue whales (*B. musculus*) as well as harbor porpoises (*Phocoena phocoena*). Their abundance has been attracting visitors since the 1990s, and whale watching has since become the main tourist attraction in the town, drawing more than 100,000 visitors per year (Nicosia and Perini 2016). Following the decline of the local fishing industry, this trend has partly facilitated a shift from a resource- to service-based economy (Benediktsson and Karlsdóttir 2011, Karlsdóttir and Ingólfssdóttir 2011). In 2017, Skjálfandi Bay was declared a whale sanctuary where whaling is not permitted because of its importance as a whale watching area (Government of Iceland 2017).

Andenes in northern Norway is a town with around 2700 inhabitants (Statistics Norway 2019). The main species of whales are sperm (*Physeter macrocephalus*), humpback, minke whales, and orcas (*Orcinus orca*). Whale watching started in the late 1980s and has become an important part of the town's economy and

**Table 1.** Governability assessment criteria adapted from Chuenpagdee and Jentoft (2013).

Step	Governance component	Criteria	Points of focus
1	Whale ecosystem services (ES) governance problem definition	Degree of “wickedness” <sup>†</sup> of the problem: the extent to which whale ES are “governable”	- What is the main governance problem at hand? - Different perspectives on whale ES governance - Actors involved, their values, principles, interests - The end goal of whale ES governance - reachable?
2	System-to-be-governed (SG) Governing system (GS) Governance interactions (GI)	Intensity of properties: - Diversity  - Complexity - Dynamics  - Scale	- Levels of biophysical, socio-demographic, and economic diversity of system components - Complexity of systems and interactions - Short and long-term biophysical and socio-demographic change - Boundaries of natural and social system components and scale in which governance occurs
3	Governing system (GS)	Goodness of fits of elements Responsiveness of modes Performance of orders	- Behavior, decisions, mental models, institutional arrangements, implementation - Awareness, learning, sensitivity, conflicts - Consistency, effectiveness, transparency, justice
4	Governance interactions (GI)	Quality of interactions Enabling and restrictive role of power relations	- Information sharing, co-learning, adaptiveness - Inclusiveness, representativeness, participation

<sup>†</sup> A “wicked” problem is one that involves multiple actors with differing worldviews and preferences regarding possible solutions to it, and when it is not clear what the end goal of solving it will be, for example, a problem of achieving sustainability (Rittel and Webber 1973, Chuenpagdee and Jentoft 2013).

the whole Vesterålen region, yet fishing remains the main economic pillar (Cosentino 2016, Bertella 2017). There are plans to initiate a project known as The Whale in Andenes, which is designed to be a major whale-themed museum, science, and culture hub (<https://www.thewhale.no/en>). Norway is one of the three nations globally engaging in commercial whaling, together with Iceland and Japan. According to the interview data, minke whaling occurs in waters close to Andenes.

Disko Bay in Greenland is the largest open bay in western Greenland, measuring 150 km north to south and 100 km east to west. The main town, Ilulissat, is the third largest settlement in Greenland with around 4500 inhabitants (Statistics Greenland 2019). The Disko Bay area has become a popular tourist destination in the decade prior to the COVID-19 pandemic, offering various tourist activities, but fishing remains the most important economic activity. The main species of whales in Disko Bay are bowhead (*Balaena mysticetus*), humpback, minke, beluga (*Delphinapterus leucas*), and narwhal (*Monodon monoceros*). Contrary to people in the other case study sites, Greenlanders engage in indigenous whaling, which is important for the food security and cultural identity of the local population (Caulfield 1993, Tejsner 2014, Suydam and George 2021). Figure 4 shows the locations of the three case study sites.

## RESULTS

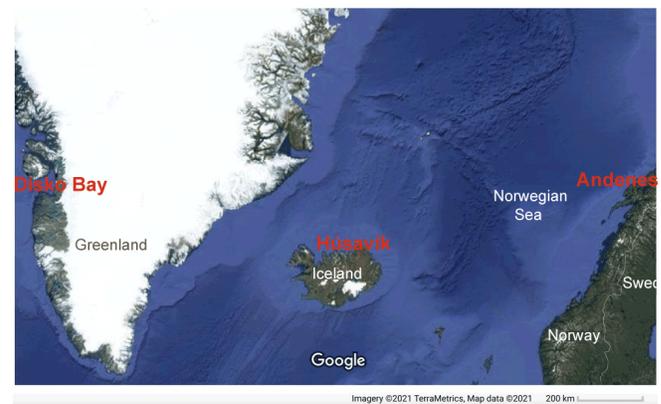
### Step 1: problem definition, whale ecosystem services, and their values

*Focus: different perspectives and the goal of whale ES governance, actors involved, their values, principles, interests*

The goal of governance in the case study SES is to ensure the continuous supply of whale ES and protect the whales and the marine ecosystems of which they are a part while sustaining and possibly increasing human well-being. This goal involves multiple stakeholders whose preferences and values often differ; it also does not have a clear endpoint, which potentially makes

sustainable whale ES governance a “wicked” problem (Rittel and Webber 1973, Chuenpagdee and Jentoft 2013).

**Fig. 4.** The geographical locations of the three case studies. Adapted from Google Maps (2021).



Stakeholder mapping and interviews revealed multiple interests, values, and views of actors who prioritize different whale ES and tools for their governance. Table 2 presents the main whale ES identified by the interviewees as well as the co-production activities and values associated with them, as demonstrated in Figure 2. The percentages of ES values in the bottom row are based on the respective number of mentions by the interviewees. The most discussed biophysical values were nutrition and food security; monetary values were mostly discussed in relation to whale-related economic activities; and socio-cultural values here refer to non-material and relational values held by actors, e.g., community identity and inspiration for arts.

In Húsavík and Andenes, the ES of recreation and tourism, education, and aesthetics were most often mentioned, whereas

**Table 2.** Whale ecosystem services (ES), co-production activities, and values.

	Húsavík	Andenes	Disko Bay
Key whale ES in each community	Recreation and tourism Education Aesthetics Ecosystem regulation and biodiversity enhancement	Recreation and tourism Education Aesthetics Ecosystem regulation and biodiversity enhancement Provisioning	Provisioning Recreation and tourism Aesthetics
Key co-production activities of whale ES	Whale watching operations Academic research Whale museum and school program Whale-inspired art	Whale watching operations Promoting local tourism The Whale museum project Academic research	Hunting activities Traditional cultural practices, such as food and art Whale watching operations Sharing whale pictures on community social media
Main values attached to different whale ES	Monetary (88.9%) Socio-cultural (55.6%)	Monetary (93.3%) Socio-cultural (80.0%)	Nutrition and food security (94.7%) Monetary (78.9%) Socio-cultural (78.9%)

provisioning ES related to hunting were most discussed in Disko Bay. The main ES values in the first two case studies stem from the local economic benefits of whale watching, followed by education, aesthetics, ecosystem regulation, and biodiversity enhancement, and the socio-cultural values associated with them. In Disko Bay, provisioning whale ES are mostly associated with nutritional and economic values, but they often also have a socio-cultural dimension, especially in terms of identity: “It’s a part of our identity, it’s how we see ourselves” (G2).

Note: The letters G, I, and N refer to the case studies countries, in which the interviews were taken: G, Greenland, I, Iceland, N, Norway. All interviewees were numbered randomly for each case study.

Key actors identified during the stakeholder mapping in the case studies include whale watching operators and guides, local authorities, citizens, visitors, scientists, and representatives of fishing, oil, and heavy industries. The Greenlandic case study stands out because here the most-discussed actors were hunters who are also fishermen, because there is no distinction between the two in Greenlandic culture. The problems and needs expressed by actors can be grouped into the categories of regulatory, tourism, research, societal, economic, and environmental (full list of actors, needs, and problems in Appendix 7). Among the regulatory issues, the lack of formal regulations and enforcement mechanisms for non-consumptive uses of marine resources emerged as the most pressing issue. In Húsavík and Andenes, the regulatory issues were discussed mostly in relation to whale watching and marine conservation, whereas in Greenland the weak enforcement of hunting rules, ineffective communication between scientists and hunters, and insufficient whaling quota came forward.

In terms of tourism, high seasonality, mass tourism and its unsustainable practices, lack of local tourism infrastructure, local workforce, and cooperation between actors were the most prominent issues. Lack of baseline research on local whale populations, anthropocentric effects, and research funding were the problems discussed in relation to research. Housing shortages and lack of work opportunities were the most often mentioned social issues in all case studies, whereas loss of traditional knowledge, outmigration of women, and government corruption

were specific to Greenland. Uncertainty caused by climate change was the most pressing environmental issue, together with a need for greater protection of local marine ecosystems. The need for more investment in the local economies and more locally residing year-round taxpayers were identified by stakeholders as the most pressing economic issues in the case study communities.

**Step 2: assessing intensity of interactive governance properties**

In this section, the properties of the three SES are discussed based on the findings of the interview analysis.

*Diversity*

*Focus: level of biophysical, socio-demographic, and economic diversity of system components*

All three SES present low to medium levels of complexity and diversity when compared with some more biologically and culturally diverse systems with more species and actors nearer the equator. There are typically a few key whale species observed and utilized in the case study locations. Humpback, fin (*Balaenoptera physalus*), minke, killer and pilot whales (*Globicephala melas*) are typical in all case study locations, depending on the season, while blue whales are more often observed in Skjálfandi Bay. Belugas, narwhals, and bowhead whales are found in Disko Bay, and sperm whales near Andenes.

The populations of the three case study communities are relatively homogenous, however, socio-demographic diversity is gradually increasing in Húsavík and Andenes in tandem with the expanding tourism sector. This was less the case in Disko Bay where foreign workers mostly come in the summer months and leave afterward, seemingly without much interaction with the locals. In all three SGs, local actors have diverse interests and a diversity of attitudes toward whales. The latter is true particularly in an intergenerational sense. Relatively low economic diversity was observed in all three communities, with a few main economic activities that stand out: tourism, fishing and hunting, heavy industry, the military, and public sector. In Disko Bay, a high diversity of hunters’ livelihood strategies in response to regulations and seasonal availability of resources was observed.

Governing institutions vary from informal interest groups, such as hunters, fishermen, whale watching guides, and researchers, to

representatives of regional tourism and economic development offices, national ministries, municipalities, agencies, and environmental organizations, as well as international organizations focused on whale management. The diverse interactions between them include expressions of power and enforcement, e.g., the International Whaling Commission (IWC) regarding whaling quotas; cooperation, e.g., scientific cooperation between whale watching companies and research institutions; and joint projects between actors, e.g., the Whale School in Húsavík organized by a local museum and schools.

#### *Social-ecological complexity*

##### *Focus: complexity of systems and interactions*

High levels of complexity were observed in the case study sites regarding human-nature and governance interactions. The complex ecological ties between whaling, fishing, and fish stocks are under-researched and not agreed upon between actors. Several activities take place in the marine environments of the case study locations, including whale watching, fishing, research, transportation, and shipping. The latter activity was especially pronounced in Húsavík in relation to the silicon plant, Bakki, where interviewees discussed the effects of tourism and heavy industry on whales.

The complexities mentioned in Andenes followed from the co-existing activities in inshore waters, including minke whaling, whale watching, and seismic exploration, and from differentiated effects of human activities on different whale species. High complexity was observed in Disko Bay because of multi-layered interactions between tourism, fishing, hunting, and shipping. Movement of whales along the coast of Greenland impedes the differentiation of whale populations and the assessment of impacts of human activities. Complex social issues related to the outmigration of women, gradual loss of traditions, and difficulties of matching the labor demand and supply were also discussed in Disko Bay.

The threats posed to whale populations by accumulative anthropogenic effects, such as climate change, bycatch, and pollution, were present in all case studies. The fast rate of biophysical change in the ocean causes sudden whale species shifts. The need for systematic research on accumulative anthropogenic effects and for baseline research on whale species was identified: “You need baseline data, you need to know what’s there, how many they are, what’s the trend of the populations, what do they eat and what’s important to protect and preserve these species” (N6).

#### *Dynamics*

##### *Focus: short- and long-term biophysical and socio-demographic change*

The level of SES change is high in all three locations, as is common in Arctic localities because of increased accessibility resulting from climate change and globalization. All three case study locations experienced rapid increases in visitor numbers in the last few decades prior to the COVID-19 pandemic. At the same time, local marine ecosystems are affected by changing whale migration patterns because of changing availability of prey and extent of sea ice: “All living resources are moving up, north, slowly moving. We are now forced to sail further up north to hunt, also because the ice in winter becomes thinner.” (G20)

In both Norway and Iceland, diminishing importance of whale meat as a source of nutrition was mentioned as well as changing public attitudes toward whales, partially due to the rapidly growing whale watching sector. In Húsavík, rapid changes in the economy and community identity were discussed as a result of the shift from a resource- to service-based economy. This change is also related to the increase in research activities in the town’s university center and influx of foreign workers. In Andenes, socioeconomic change was discussed mostly in relation to the closure of the local military base and increase in tourism.

In Disko Bay, social-ecological dynamics related to reduced whaling quotas, changes in formal hunting rules, and resultant reduction in availability of whale meat locally. Hunters also discussed the erosion of customary rules among the new generation of hunters, changing hunting methods, local effects of climate change, e.g., reduction in winter sea ice, and the shift from hunting to fishing in recent decades. Rapid change in the Greenlandic society in terms of lifestyle, culture, and economic opportunities indicates a high rate of social dynamics.

#### *Scale*

##### *Focus: boundaries of natural and social system components and scale of governance*

The focus on highly migratory cetaceans puts the study in a global context, and their longevity means that whale ES governance unfolds over large geographical and temporal scales. For instance, the whaling restrictions introduced by the IWC’s 1986 moratorium on whaling started to bring results decades later, e.g., through visible increases in humpback whale populations in the North Atlantic. However, actors tend to use short-term timescales to reach their immediate goals, and local institutions dealing with localized effects of global changes often have little power to influence long-term governance, which creates a scale mismatch.

The governance of whaling is determined largely on a global scale but plays out on national and local scales, which is especially evident in Disko Bay. International bodies have a lot of decision-making power, while indigenous whalers do not always feel that global governance reflects their needs, values, and interests: “IWC is a very powerful organization, and they tell us how many different kinds of whales we should shoot per year” (G16).

A similar sentiment was expressed about the climate change policy: “Greenlandic people talk about the climatic change: we can see it, we can feel it, we can mark it, but it’s a big policy in the world” (G16).

Even though, generally, the jurisdictions of governing institutions tend to be relatively well defined, the boundaries of SGs in the case of whale ES are less clear because of their migratory nature and the multitude of interests of actors involved. For instance, whale sanctuaries and codes of conduct in whale watching are successful in protecting whales to some extent in certain locations but have little effect on what happens outside of them. Another mismatch of scale occurs when the effects of global policies result in increased numbers of whales and decreased availability of food resources: “We can eat much more meat and mattak from the whales you find on Greenland’s coast. It’s a problem for the Greenlandic people that we must not shoot the whales in our coast. It’s a big problem” (G16).

### Step 3: assessing governing systems

#### *Governing institutions*

The local formal governing institutions in the case study SES include local municipalities, local and regional tourism offices, harbor authorities, and local economic development agencies. National formal institutions include ministries governing marine resources, industries and tourism development, marine-focused research institutes, transport authorities, whale watching operators' associations in Iceland and Norway, and fishermen and hunters' association in Greenland. Among the informal local governing actor groups, whale watching companies, the fishing industry and fishermen groups, hospitality sector, local business and citizen groups, researchers, whale watching guides and investors were the most prominent. In terms of national-level informal governing institutions, the media, political parties, environmental non-governmental organizations (ENGOS), and fishing, whaling, and tourism industries were the most discussed pressure groups affecting the governance of whale ES. The full list of local and national governing institutions in each case study can be found in Appendix 8.

The international organizations that affect whale ES governance in all case study sites include the IWC that provides recommendations for whale species monitoring and setting whaling quotas and methods; and the North Atlantic Marine Mammal Commission (NAMMCO), created by the North Atlantic whaling nations (Iceland, Norway, Faroe Islands, and Greenland), that uses soft governance tools to influence research and sustainable use of marine mammal resources. The Arctic Council acts as a platform for international dialogue on the issues related to the region, including biodiversity and marine resource governance, while the European Union (EU) and European Economic Area (EEA) are involved in environmental and trade agreements related to whale ES. The United Nations Convention on the Law of the Sea (UNCLOS) influences the legal framework, according to which marine-based activities are governed. International ENGOS, such as Greenpeace, Sea Shepherd, and the International Fund for Animal Welfare (IFAW), advocate for humane treatment of whales, most notably by banning whaling.

#### *Governance elements*

Table 3 lists the main elements of the three governing systems, vision, instruments, and actions, based on the interviews. In the following sub-chapters, goodness of fit of elements, responsiveness of modes, and performance or orders are assessed using examples from the case studies. The instruments in the table are split into formal and informal, and marked in the brackets as originating from state, market, and civil society, and education institutions.

#### *Goodness of fit of elements*

*Criteria: appropriateness of governing elements in moving toward governance vision*

*Focus: behavior, decisions, mental models, institutional arrangements, implementation*

The governance vision elements common to all three SES included protecting the local resources, at the same time as expanding the tourism sector and making it more sustainable, developing local infrastructure, and diversifying local economies (Table 3).

Protection of whale resources was a part of the governance vision in all three case studies: “the main concern here is: don't disturb the narwhals, don't disturb the belugas... don't disturb our food resource” (G1).

The education and involvement of the public was also emphasized: “the public should take care of this in an active way and manage the use of marine natural resources in a sustainable way” (I9).

In Disko Bay and Andenes, a vision of small-scale and high-end tourism was pronounced. However, in the latter this vision was supported by a regional tourism development strategy, whereas this was not the case in the former. Infrastructure development was ongoing in all case study locations but was described as slow. The governance objective of protecting whale resources and sustainable tourism is partially reflected in the existing instruments, especially whaling quotas and monitoring of whale populations, but there are very few binding regulations regarding non-consumptive whale ES.

Some of the governance actions, such as cooperation between actors, knowledge sharing, and voluntary improvements in whale watching methods, aim to bridge the gap between governance vision and reality, but the observed fit of elements does not suggest high governability in any of the case studies. The flexibility objective, however, was fulfilled to a large extent as actors often have space to manoeuvre in the absence of formal regulations. Adaptability and willingness to stay flexible in pursuit of the governance vision was an aspect of the governance vision common to the three case studies.

The identified lack of baseline research on whale populations makes the vision of science-based governance somewhat unrealistic. However, actor cooperation was present in all case study locations to achieve governance goals, which indicates an ability of actors to self-organize in pursuit of common goals. This was less true in Disko Bay where hunting rules are mostly decided outside of the communities and the tourism sector is more fragmented than in the other two case studies.

#### *Responsiveness of modes*

*Criteria: effectiveness of governance modes and ability to respond to challenges*

*Focus: awareness, learning, sensitivity, conflicts*

All three governance modes are present in the case studies, albeit to differing degrees. Self- and co-governance prevails in tourism, while hierarchical governance is dominant in whaling, fishing, heavy industry, and infrastructure development. The ability of these governance modes to respond to governance challenges varies between the cases. The most discussed governance challenges in Húsavík were related to the rapid and unregulated expansion of the tourism sector. These challenges were predominantly addressed via self-governance, notably through the code of conduct in whale watching. Despite the calls for stricter, binding rules in whale watching and the push for a local MPA, hierarchical governance was not the preferred governance mode by the local actors who mobilize to self- and co-govern. The harbor is managed by the local municipality that is subjected to pressures from local interest groups, which makes hierarchical governance difficult.

**Table 3.** The main governance elements of the three governing systems.

	Húsavík	Andenes	Disko Bay
Governance vision (meta order)	<p>“what”</p> <p>Sustainable tourism sector Protection of local resources Increased public awareness of local ecosystems and whale ES Diverse local economy Young, vibrant, and diverse community</p> <p>“how”</p> <p>Science-based governance Participatory co-governance Adaptive governance</p>	<p>“what”</p> <p>Small scale sustainable tourism Protection of local resources Coordinated regional development Four local economy pillars: fisheries, tourism, technology, and “good life” Increased public awareness of the local marine ecosystem Young and vibrant community</p> <p>“how”</p> <p>Flexible, adaptive, and research-based governance Local citizen-led innovation</p>	<p>“what”</p> <p>Protecting the local resources Respecting hunting traditions Coordinated regional sustainable tourism development Diverse local economy</p> <p>“how”</p> <p>Fewer hunting restrictions Environmental stewardship Science-based governance Holistic, inclusive, and cooperative local governance Inclusion of traditional ecological knowledge (TEK) in governance</p>
Governance instruments (second order)	<p>Formal (state) Whale sanctuary Whaling quotas Harbor fees Monitoring of whale populations</p> <p>Informal Code of conduct in whale watching (market) Educational campaigns (civil society and educational institutions)</p>	<p>Formal (state) Holistic local and regional economic development strategy Whaling quotas</p> <p>Informal Code of conduct in whale watching (market) Educational campaigns (civil society and educational institutions)</p>	<p>Formal (state) Whale watching rules set by the municipality Whaling quotas Hunting licences for free-time and full-time hunters Monitoring of whale populations Tax duty for tour operators</p> <p>Informal (civil society and educational institutions) Customary hunting rules Joint participatory research</p>
Governance actions (first order)	<p>Local actor-driven Actor cooperation Knowledge sharing, e.g., through Whale Congress Advocacy for a marine protected area (MPA) Making tourism operations more sustainable and diversifying its products</p> <p>Partially externally driven Scientific research Infrastructure and industrial development</p>	<p>Local actor-driven Actor cooperation Knowledge sharing internationally Making tourism sector more sustainable, reducing scale and diversifying its products Developing The Whale project Attracting investment</p> <p>Partially externally driven Scientific research Infrastructure development</p>	<p>Local actor-driven Actor cooperation Adapting to change by diversification of hunting and tourism activities</p> <p>Partially externally driven Scientific research Improving and limiting whaling methods Infrastructure development Freeing whales caught up in fishing gear</p>

The most pressing governance challenges in Andenes were related to uncertainty caused by climate change and the lack of baseline research on its effects on the local marine ecosystem, the absence of binding whale watching rules, and limited cooperation in the local tourism sector. The dominant governance mode in which these challenges were addressed was self-governance in the whale watching sector and increasing co-governance in the tourism sector, for which a strategy was being developed by the local government in cooperation with concerned actors. The research on local whale populations, however, remains sporadic and done by individual researchers that secure their own funding. In this area, self-governance has not been so effective in filling this governance gap.

The main whale ES governance challenges observed in Disko Bay relate to climate change, lack of infrastructure, limited involvement of locals in the tourism sector, and uneven distribution of tourism, both seasonally and geographically. Self-governance was the prevailing mode when addressing the

challenges in tourism, while all three modes were present in the co-production of provisioning ES through hunting activities governed by international bodies, state, and local actors. Development of a regional tourism strategy and inclusion of locals would necessitate increased co-governance, while hierarchical governance is required to address infrastructure needs. The top-down approach to hunting rules is not acceptable to all actors, some of whom advocate for more co-governance initiatives through joint projects, such as PISUNA ([http://www.pisuna.org/uk\\_project.html](http://www.pisuna.org/uk_project.html)).

*Performance of orders*

*Criteria: capacity of governing orders to function, operate, and lead to desirable outcomes*

*Focus: consistency, effectiveness, transparency, justice*

From the three governance orders—meta, second, and first—the latter is the most prominent in the GSs studied. The actors in all three case study locations manage whale ES through day-to-day

activities, which in the absence of a coherent governance framework that could ensure continuous supply of whale ES, was the dominant form of governance. The only comprehensive form of meta-governance regarding whale ES was related to whaling and populations monitoring, which are steered hierarchically on the global, regional, and national levels. An important regional actor in this regard is NAMMCO, which in the respondents' view was more responsive to local needs than, for instance, the IWC. The emphasis on sustainable uses of the ocean, science-based advice, and improvement of hunting methods to reduce animal suffering largely coincide with the local governance vision.

However, in terms of rules and regulations, NAMMCO is only an advisory body as national governments make their own rules regarding whale ES in accordance with the requirements by the IWC. The non-consumptive uses of whale resources, such as tourism, remain largely unregulated, which indicates a gap in the second order of governance. In terms of governance tools aimed at whale conservation, there are two whale sanctuaries in Iceland and two beluga sanctuaries in Iceland and Norway that both provide habitat for beluga whales previously kept in captivity. All three case study countries have marine research institutes that receive government funding for research activities focused on whales that can be used to guide policy. Additionally, various home and foreign research institutions with national and external funding engage in research in the case study locations, yet the link between these activities and governance tools seems to be limited.

In terms of whale ES values, monetary values sourced from whale watching prevailed in Húsavík and Andenes, together with cultural values related to community identity and education, while biophysical (nutritional) and cultural values were prominent in Disko Bay. These values are at least partly reflected in the decision of the Icelandic state to declare Skjálfandi Bay a whale sanctuary. Differing priorities of the institutions responsible for marine governance, especially fishing and tourism sectors, are reflected in the clash between the worldviews of fishermen and whale watching operators in Iceland and Greenland. An apparent clash was observed between the globally dominant and local worldviews related to whale ES in Greenland, where some of the whale resource users argued that their values and knowledge are overlooked in the second order of governance.

#### **Step 4: assessing governance interactions and conflicts**

*Criteria: existing forms and qualities of the governance interactions, including representativeness, effectiveness of communication and level of information flow*

*Focus: information sharing, co-learning, adaptiveness, inclusiveness, participation, conflicts*

The interviews reveal that much of whale ES governance happens through informal interactions between whale watching operators, researchers, hunters' groups, and community members. Because of the inability of the current institutional framework to fully address their needs, actors self-govern, and many of these interactions remain unrecorded and unrepresented in formal institutions. For instance, this is true for certain hunting and whale watching activities where hunters and captains cooperate to protect local marine ecosystems. Disko Bay stands out in this regard because of the presence of indigenous whaling: government-set and customary rules operate simultaneously.

Technological advances and recommendations by NAMMCO and IWC have resulted in improvements to hunting methods, and joint participatory research projects, such as PISUNA (Cuyler et al. 2020), and contribute to bringing about a more inclusive approach to species monitoring.

The most common governance interactions occur among whale watching companies at sea, research activities and communication of their results to actors and the public, and adaptation to social-ecological change by altering whale ES co-production processes, e.g., by diversification of tourism, hunting, and regional development planning. The information flow is generally effective between local actors participating in governance interactions, apart from Andenes where the two main whale watching companies were in conflict. Communication is somewhat less efficient between scales: there is some mismatch between national and local governance priorities, and this link is even more severed between local and global scales.

Several issues related to power relations were revealed in governance interactions in Húsavík, such as historical privilege of the fisheries' sector in Icelandic marine policy, regional inequalities resulting from consolidation of individual fishing quota in the 1990s, and the lack of integration of foreign workers into the local community. The inequalities typical of the Greenlandic context include an uneven whaling quota distribution based on political power within the country, the fact that tourism is mostly run by foreigners, and that whale meat is often unaffordable for the poorer sections of the society. On a large scale, the lack of political power globally regarding the use of local natural resources and historical whale overharvesting by foreign parties were the most discussed inequalities in Disko Bay.

In terms of gender issues, male dominance in whale ES co-production and the identity struggle of non-educated men as hunting loses its importance were discussed in Greenland, and the fact that female whale researchers were not always taken seriously in Iceland:

*There were mainly middle-aged white men there, and they [female researchers] asked questions like "Aren't you concerned about the whales?", and they were actually laughed at during the meeting, because it's not important... Because you're emotional and you're a woman and you're not... wearing a tie (I10).*

The conflicts and trade-offs between actors' activities and needs are listed in Table 4. The most often mentioned trade-offs were related to possible negative effects of whale watching on whales. Other conflicts include rivalry between actors for harbor space, negative effects of heavy industry, oil exploration, and military training on marine ecosystems, conflicts between the whale watching operators about resources and whale watching methods, and the negative effects of mass tourism on the environment and local quality of life, especially regarding cruise ship tourism.

Conflicts arise in Disko Bay between full-time and part-time hunters over whaling quotas and between old and young hunters over hunting customs, while climate change impacts and tightening hunting regulations make it increasingly difficult for hunters to make a living. Increasing numbers of whales in Disko Bay result in more frequent whale-boat collisions and more whales

**Table 4.** The most pronounced conflicts and trade-offs between stakeholders' needs and activities. ES, ecosystem services.

	Húsavík	Andenes	Disko Bay
Conflicts and trade-offs	<p>Tourism: some whale watching companies reluctant to pay local tax; locals getting tired of large numbers of tourists; housing crisis caused by expansion of tourism; some whale watching captain conflicts at sea; competition for harbor space; fishermen feel pushed out of the harbor and local economy by whale watching</p> <p>Whale ES trade-offs: whaling and whale watching debate in Iceland; negative effects of whale watching and marine traffic on whales</p> <p>Industry: disagreement between locals about industrial development</p>	<p>Tourism: the conflict between the two local whale watching companies; disagreements between actors about the code of conduct in whale watching</p> <p>Whale ES trade-offs: whale watching vs. whaling debate in Norway; inappropriate whale watching/ snorkelling can harm whales</p> <p>Whales vs. fishers: whales eating halibut off fishing lines; overfishing can cause outmigration of whales</p> <p>Industry: negative effects of marine traffic, military manoeuvres, seismic surveys on whales</p>	<p>Hunting: disagreement between hunters and government on quotas; distrust between hunters and scientists; conflicts among hunters over customs and quotas</p> <p>Tourism: competition for harbor space in Ilulissat; foreign tourism companies perceived as not giving enough back to community; local opposition to mass tourism</p> <p>Whales vs. fishers: trade-off between increased number of whales and fishing; whale-small boat collisions</p> <p>Local vs. foreign actors: international opposition to whaling affects local livelihoods; grievances over historical overharvesting by foreign parties</p>

being trapped in fishing gear, inevitably damaging it, and often dying. Local fishermen have been seen shooting at humpback whales that compete with them for polar cod used as bait for halibut. This is seen by some actors as damaging to local tourism. There are disagreements between hunters and the government about whaling quotas and distrust between local resource users and scientists about species' monitoring: "it must be possible to have more commitment or more understanding and more collaboration between the hunters and the government, because traditional knowledge is also very important" (G4).

Hostility was also expressed toward some environmental organizations: "If we think about our culture, Sea Shepherd, Greenpeace - they are the most respect-less people in the world, because no one can be vegetarian here" (G3).

## DISCUSSION

### Overall significance of the governability assessment

Governability assessment is a helpful exercise for thinking about multifaceted natural resource governance in a holistic way. The in-depth exploration of whale ES governance and governability, based on a rich dataset in this study, provides a more focused analysis than some of the previous studies of entire resource systems, such as fisheries (Kooiman and Bavinck 2005, Bavinck and Kooiman 2013, Jentoft and Chuenpagdee 2015) and forests (Derkyi 2012, Derkyi et al. 2013). Application of the IG framework in this study allowed for a holistic analysis of social-ecological interactions and assessment of whale ES governability that would not have been possible using a less comprehensive framework. This type of analysis tends to become extensive but brings forth important governance networks and interactions (Mahon and McConney 2013). Even though whale ES constitute a small part of marine resources in the case study sites, the assessment reveals social-ecological interplay relevant to marine resource governance that can be addressed through carefully designed governance tools. For instance, low responsiveness of governance modes could be addressed by facilitating better links

between actors at different governance levels. Similarly, if self-governance is insufficient for ensuring the sustainability of a resource, legally binding regulations could be considered.

The different stages of whale ES co-production activities discussed in the study involve numerous and multifaceted governance interactions, perspectives, and challenges. For instance, the value attribution stage of co-production (Fig. 2) depends to a large extent on the context: what is seen as an opportunity for tourism development in one location may be perceived as a food resource in another context, and as both in yet another. Moreover, whale ES present a unique and difficult-to-predict part of Arctic marine ecosystems because of their migratory nature and the uncertain yet pronounced effects of climate change (Tulloch et al. 2019, Worden et al. 2020). Most of the co-production activities discussed in the study are being altered by the biophysical, socio-cultural, and economic changes related to whale ES, the latter two of which are driven by globalization, especially in terms of the growing tourism sector.

It is evident that the case study communities are changing rapidly, becoming more globally oriented and accessible to visitors, foreign workers, and researchers. This, in turn, reduces governability of whale ES as the GS and SG become more diverse. It could also be argued that the demand for whale ES is altered as information about whale ES in different Arctic locations becomes more dispersed globally, providing human well-being benefits remotely, e.g., in terms of existence, educational and inspirational values (Roman et al. 2014, Cook et al. 2020, Malinauskaite et al. 2021), and regulating and maintenance ES (Chami et al. 2019).

Constant ocean dynamics reduce the governability of whale ES and imply that marine governance needs to be reflexive and adaptive (Koenigstein et al. 2016, Meyer-Gutbrod and Greene 2018, Richards et al. 2021). The stakeholder perspectives explored in the paper reveal the importance of considering local contexts in ES co-production and governance scale interplay, such as in

the case of whale hunting and monitoring in Disko Bay, despite the embeddedness of whaling in the global governance system.

#### **Extent to which stakeholder values and needs are reflected in governance**

The common goal in whale ES governance that emerged in the study comprises a vision of healthy marine ecosystems that can sustain local whale populations and human well-being. This goal can be potentially advanced by applying the principles of ecosystem stewardship and ecosystem-based management, both of which support a view of communities as an integral part of SES that are actively engaged in environmental protection within and outside formal governing institutions (Chapin et al. 2015, Folke et al. 2016, Roman et al. 2018).

In whale watching, the actors manage their activities according to company and customer values, while in whaling the rules are guided by science and imposed by governing institutions from outside of the SES. The values of these global institutions, such as the IWC, are globally formed and at times give little recognition of local perspectives. The values attached to healthy marine ecosystems are reflected to a limited extent in the case study locations, where marine ES conservation measures are very few.

Abundance of whales, perceived as a positive outcome globally, can create problems and result in conflicts locally (Bridgewater 2003), as was observed in this study. Strict whaling quotas resulting in large increases in humpback whale populations in Disko Bay demonstrates how a governance tool designed to solve one problem can create another, which is common in ES governance (Howe et al. 2014, Ceașu et al. 2019). In this case, the view of a whale as a majestic animal that should be protected is reflected in governance to a greater extent than the local perception of whale as a food source or competitor for fish (Kalland 1994, Einarsson 2009, Huijbens and Einarsson 2018).

Governance tools, such as whaling quotas, rarely respond to all actors' needs and values, inevitably creating compromises and ES trade-offs. This fact has been widely observed in the natural resource governance and ES literature, especially regarding trade-offs between environmental sustainability and poverty alleviation (Moynihan et al. 2011, McDermott et al. 2013, Alexander et al. 2016, Schreckenberget al. 2018). The ES lens makes this human-environment opposition less acute because of the anthropocentricity of the ES concept. Stakeholder participation and mobilization of local social capital has been found to have positive impacts on the effectiveness and sustainability outcomes of ES and marine governance (Alexander et al. 2016, Koenigstein et al. 2016, Triyanti et al. 2017, Friedrich et al. 2020).

It is also important to consider how ES benefits are distributed between actors and how power is shared in their governance (Berbés-Blázquez et al. 2016, Solé and Ariza 2019). For instance, tourism companies receive the largest economic benefits from recreational whale ES, but the local communities face the cost of rapidly expanding tourism, a phenomenon also witnessed in other Arctic locations (Stewart et al. 2015, Kaiser et al. 2018, Olsen et al. 2020). The historical injustices related to overharvesting of whales in Arctic waters by foreign parties are still pertinent (Caulfield 1993, Rud 2017). Some actors in Disko Bay felt that their communities' ability to ensure food security using local resources was compromised by the decisions made by external

actors without giving their needs and values a sufficient consideration. This view of the Arctic as a "periphery" that is best managed by presumably more competent outside parties has often been noted in the Arctic governance literature (Freeman 1993, Young et al. 1994, Nuttall 1998).

#### **Relevance for Arctic marine resource governance**

This governability assessment exercise provides an example of what to look for when examining the governability of a resource or a resource system, such as a SES (Jentoft and Chuenpagdee 2015). It is timely in the context of the Arctic, where governance tends to suffer from sectoral and jurisdictional fragmentation (Young 2010, 2016). The multifaceted governance of whale ES examined in this study confirms that the Arctic region is subject to dynamic social-ecological interactions and multiple interests (Hamilton et al. 2000, Vammen Larsen et al. 2019).

Successful governance of the region's marine ecosystems requires an acknowledgement of complexity and designing arrangements where all stakeholders' needs are considered, and cooperation is encouraged within, between, and outside the formal institutions (Young 2010, Arctic Council 2015, Barry et al. 2020). Ultimately, this implies governance of human activities related to whale ES co-production processes (Meek et al. 2011, Malinauskaite et al. 2021). The value of approaching this issue in a holistic manner lays in the potential to address sustainability concerns systematically instead of only mitigating their symptoms (Chuenpagdee 2011). Moreover, the latest Arctic Marine Strategic Plan 2015–2025 (Arctic Council 2015) advocates an emphasis on human well-being through provisioning of ES, in line with the focus of this paper.

Meta-level governance is concerned with values, and ES valuation has the potential to inform governance vision and the choice of instruments that are consistent with the requirements of the Arctic Marine Strategic Plan (Arctic Council 2015) and The Economics of the Ecosystems and Biodiversity Scoping study for the Arctic (CAFF 2015). ES valuation can aid governance by igniting a societal debate on its importance, integrating societal preferences and non-market ES in policy considerations, considering distributive effects, and encompassing behavioral insights in policy design (Lienhoop and Schröter-Schlaack 2018). ES valuation is known to aid marine governance, e.g., by weighing different options for ocean use against each other in marine spatial planning (Guerry et al. 2012, Lester et al. 2013), estimating public willingness to pay for management arrangements such as whale sanctuaries (Cook et al. 2019, Malinauskaite et al. 2020), or assessing benefits, such as the economic value of carbon sequestration by whales (Chami et al. 2019).

However, in ES valuation, value pluralism needs to be considered as both ES and interactive governance scholars warn against oversimplification of ES and their values (Chuenpagdee and Mahon 2013, Gómez-Baggethun and Martín-López 2015). The actor-centered approach applied here provides valuable insights about local resource users, which are relevant for inclusive policy making, especially in the context of mixed economies such as Greenland's where socio-cultural values concerning whale ES may be more prevalent for many actors than monetary, necessitating ES valuation approaches such as socio-cultural valuation (Cole et al. 2016, Vammen Larsen et al. 2019).

### Study limitations and further research

The governability assessment, which is based primarily on the interviews and observations, is potentially subject to researcher bias in interviewee selection, coding, and assessment of criteria (Gerring 2004, Yin 2017). Having said that, well-designed case study research can reveal some general insights into the phenomena that is being studied (Flyvbjerg 2006). The study is based on a series of interviews with actors that were willing to share their insights at a given point in time, yet much has changed since they were conducted, not least because of the COVID-19 pandemic, especially its ramifications for the tourism industry, which has experienced significant economic losses and redundancies (Cook and Jóhannsdóttir 2021). The results present snapshots in time in three North Atlantic Arctic locations, revealing how whale ES are governed, which is illustrative of the region but not necessarily generalizable to the entire Arctic. Future research should examine the governance and resilience of Arctic marine ecosystems and SES, focusing more extensively on synergies and trade-offs between different Arctic marine ES and their governance tools, and on the power and equity issues related to marine ES co-production and governance in different regions of the world.

### CONCLUSIONS

The study examines whale ES co-production processes embedded in an interactive governance model, providing the first governability assessment in this context. Its value also lies in its contribution to theory as it combines ES and interactive governance theories, providing a lens through which co-production and governance of whale ES are examined. All three case study countries, Iceland, Norway, and Greenland, have substantial state presence and formal governing frameworks within which interactive governance of whale ES happens. However, for cultural and regulating and maintenance ES, governance tools are not sufficient for addressing the social-ecological changes. This gap in governance is often filled by actors via self-governance, indicating a need to include this consideration into analysis and planning.

The complexity of stakeholders and their interests, multitude of governance interactions, and interplay between governance orders and scales identified in the study is relevant not only to the Arctic, but to marine governance in general. Marine ecosystems and resources are usually governed by multiple actors and jurisdictions, and their sustainable governance requires an ecosystem-based approach where natural system boundaries and stakeholder views are considered. The analysis of ES of migratory whale species highlights this fact because their governance necessitates joint efforts from actors locally and around the globe. Whale ES co-production and governance examined in the three case study sites reveal how global processes play out on regional and local scales, and how the social-ecological characteristics of a system and capabilities of stakeholders can be capitalized upon to improve governance and adapt to changes. Such analysis is therefore relevant to any dynamic resource system with multiple actors and governance scales.

The governability assessment has revealed multiple issues in whale ES governance that could be picked up by policy makers. The multitude of governance interactions related to ES provided by one group of species that is presented in this paper implies high

complexity of marine resource governance. This is a sobering realization but also one that has the potential to guide governance toward a more holistic direction that embraces this complexity. This is not an easy task, but it is neither an endeavor for one nor a few selected entities, but instead an invitation to view governance as an interconnected web of actors, including civil society, state, and markets, that are represented by formal and informal governance institutions. This view supports transdisciplinary inquiry and inclusiveness in governance research in the Arctic and beyond.

*Responses to this article can be read online at:*

<https://www.ecologyandsociety.org/issues/responses.php/13307>

---

### Acknowledgments:

*This paper is part of research that has received funding from NordForsk (grant number 76654) via their financial support to the Nordic Centre of Excellence project entitled ARCPATH (Arctic Climate Predictions - Pathways to Resilient, Sustainable Communities) and the Doctoral Grant of the University of Iceland Research Fund. The interdisciplinary ARCPATH project, a part of which is this research, aims to bridge natural and social sciences to inform pathways toward social-ecological resilience in the region. The collaboration with Eduard Ariza was facilitated by ERASMUS+ European student mobility grant that supported the research stay of the lead author at the Geography Department at the Autonomous University of Barcelona in 2019. The authors are very grateful to all the interviewees who took time to answer their questions and provided their valuable insights and to the anonymous reviewers for their thorough and insightful comments.*

### Data Availability:

*The original data collected for this research includes semi-structured interviews, which contain personal information and cannot be fully anonymized, and therefore cannot be shared in full. However, the code system, stakeholder maps generated for the research are included in the appendices, and anonymous quotations from the interviews can be made available upon request.*

---

### LITERATURE CITED

- Alexander, S. M., M. Andrachuk, and D. Armitage. 2016. Navigating governance networks for community-based conservation. *Frontiers in Ecology and the Environment* 14:155-164. <https://doi.org/10.1002/fee.1251>
- Arctic Council. 2015. Arctic Marine Strategic Plan 2015-2025. Arctic Council, Tromsø, Norway.
- Arctic Council. 2016. Arctic Resilience Report. Stockholm Environment Institute, Stockholm Resilience Centre, Stockholm, Sweden.
- Barry, T., B. Davíðsdóttir, N. Einarsson, and O. R. Young. 2020. How does the Arctic Council support conservation of Arctic

biodiversity? Sustainability 12:5042. <https://doi.org/10.3390/su12125042>

Bavinck, M., and J. Kooiman. 2013. Applying the governability concept in fisheries - explorations from South Asia. Pages 131-153 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. *Governability of fisheries and aquaculture: theory and applications*. Springer, Dordrecht, The Netherlands. [https://doi.org/10.1007/978-94-007-6107-0\\_8](https://doi.org/10.1007/978-94-007-6107-0_8)

Benediktsson, K., and A. Karlsdóttir. 2011. Iceland: crisis and regional development - thanks for all the fish? *European Urban and Regional Studies* 18:228-235. <https://doi.org/10.1177/09697-76411402282>

Berbés-Blázquez, M., J. A. González, and U. Pascual. 2016. Towards an ecosystem services approach that addresses social power relations. *Current Opinion in Environmental Sustainability* 19:134-143. <https://doi.org/10.1016/j.cosust.2016.02.003>

Bertella, G. 2017. Factors of peripherality: whale watching in northern Norway. Pages 130-139 in Y. S. Lee, D. B. Weaver, and N. K. Prebensen, editors. *Arctic tourism experiences: production, consumption and sustainability*. CABI, Wallingford, UK. <https://doi.org/10.1079/9781780648620.0130>

Bridgewater, P. 2003. Whaling or wailing? *International Social Science Journal* 55:555-559. <https://doi.org/10.1111/j.0020-8701.2003.05504004.x>

Bruley, E., B. Locatelli, and S. Lavorel. 2021. Nature's contributions to people: coproducing quality of life from multifunctional landscapes. *Ecology and Society* 26(1):12. <https://doi.org/10.5751/ES-12031-260112>

Caulfield, R. A. 1993. Aboriginal subsistence whaling in Greenland: the case of Qeqertarsuaq Municipality in West Greenland. *Arctic* 46:144-155. <https://doi.org/10.14430/arctic1336>

Ceașu, S., R. A. Graves, A. K. Killion, J.-C. Svenning, and N. H. Carter. 2019. Governing trade-offs in ecosystem services and disservices to achieve human-wildlife coexistence. *Conservation Biology* 33:543-553. <https://doi.org/10.1111/cobi.13241>

Chami, R., T. Cosimano, C. Fullenkamp, and S. Oztosun. 2019. Nature's solution to climate change. *International Monetary Fund*, Washington, D.C., USA.

Chapin III, F. S., M. Sommerkorn, M. D. Robards, and K. Hillmer-Pegram. 2015. Ecosystem stewardship: a resilience framework for arctic conservation. *Global Environmental Change* 34:207-217. <https://doi.org/10.1016/j.gloenvcha.2015.07.003>

Chuenpagdee, R. 2011. Interactive governance for marine conservation: an illustration. *Bulletin of Marine Science* 87:197-211. <https://doi.org/10.5343/bms.2010.1061>

Chuenpagdee, R., and S. Jentoft. 2013. Assessing governability. What's next. Pages 335-349 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. *Governability of fisheries and aquaculture: theory and applications*. Springer, Dordrecht, The Netherlands. [https://doi.org/10.1007/978-94-007-6107-0\\_18](https://doi.org/10.1007/978-94-007-6107-0_18)

Chuenpagdee, R., J. Kooiman, and R. Pullin. 2008. Assessing governability in capture fisheries, aquaculture and coastal zones. *Journal of Transdisciplinary Environmental Studies* 7:1-20.

Chuenpagdee, R., and R. Mahon. 2013. Approaches and tools for examining governability. Pages 265-278 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. *Governability of fisheries and aquaculture: theory and applications*. Springer, Dordrecht, The Netherlands. [https://doi.org/10.1007/978-94-007-6107-0\\_14](https://doi.org/10.1007/978-94-007-6107-0_14)

Cole, S. G., G. Kinell, T. Söderqvist, C. Håkansson, L. Hasselström, S. Izmalkov, E. Mikkelsen, M. Noring, A. Sandberg, E. Sjöberg, Å. Soutukorva, F. Franzén, and Y. Khaleeva. 2016. Arctic games: an analytical framework for identifying options for sustainable natural resource governance. *Polar Journal* 6:30-50. <https://doi.org/10.1080/2154896X.2016.1171001>

Conservation of Arctic Fauna and Flora (CAFF). 2015. *The Economics of Ecosystems and Biodiversity (TEEB) for the Arctic: a scoping study*. Stockholm Environment Institute and Stockholm Resilience Centre, Stockholm, Sweden.

Cook, D., and L. Jóhannsdóttir. 2021. Impacts, systemic risk and national response measures concerning COVID-19: the island case studies of Iceland and Greenland. *Sustainability* 13(5):8470. <https://doi.org/10.3390/su13158470>

Cook, D., L. Malinauskaite, B. Davíðsdóttir, H. Ögmundardóttir, and J. Roman. 2020. Reflections on the ecosystem services of whales and valuing their contribution to human well-being. *Ocean & Coastal Management* 186:105100. <https://doi.org/10.1016/j.ocecoaman.2020.105100>

Cook, D., L. Malinauskaite, J. Roman, B. Davíðsdóttir, and H. Ögmundardóttir. 2019. Whale sanctuaries - an analysis of their contribution to marine ecosystem-based management. *Ocean & Coastal Management* 182:104987. <https://doi.org/10.1016/j.ocecoaman.2019.104987>

Corsi, M. 2021. Ecosystem services and human well-being. In F. Maggino, editor. *Encyclopedia of quality of life and well-being research*. Springer, Cham, Switzerland. [https://doi.org/10.1007/978-3-319-69909-7\\_104679-1](https://doi.org/10.1007/978-3-319-69909-7_104679-1)

Cosentino, A. M. 2016. Effects of whale-watching vessels on adult male sperm whales off Andenes, Norway. *Tourism in Marine Environments* 11:215-227. <https://doi.org/10.3727/154427316X-14580612748560>

Crona, B., S. Käll, and T. Van Holt. 2019. Fishery improvement projects as a governance tool for fisheries sustainability: a global comparative analysis. *PLoS ONE* 14:e0223054. <https://doi.org/10.1371/journal.pone.0223054>

Cunningham, P. A., E. H. Huijbens, and S. L. Wearing. 2012. From whaling to whale watching: examining sustainability and cultural rhetoric. *Journal of Sustainable Tourism* 20:143-161. <https://doi.org/10.1080/09669582.2011.632091>

Cuyler, C., C. J. Daniel, M. Enghoff, N. Levermann, N. Möller-Lund, P. N. Hansen, D. Damhus, and F. Danielsen. 2020. Using local ecological knowledge as evidence to guide management: a community-led harvest calculator for muskoxen in Greenland. *Conservation Science and Practice* 2:e159. <https://doi.org/10.1111/csp2.159>

Derkyi, M. A. A. 2012. Fighting over forest: interactive governance of conflicts over forest and tree resources in Ghana's high forest zone. *African Studies Centre*, Leiden, The Netherlands.

- Derkyi, M. A. A., M. A. F. Ros-Tonen, B. Kyereh, and T. Dietz. 2013. Emerging forest regimes and livelihoods in the Tano Offin Forest Reserve, Ghana: implications for social safeguards. *Forest Policy and Economics* 32:49-56. <https://doi.org/10.1016/j.forpol.2013.03.005>
- Durham, E., H. Baker, M. Smith, E. Moore, and V. Morgan. 2014. *The BiodivERsA stakeholder engagement handbook*. BiodivERsA, Paris, France.
- Einarsson, N. 2009. From good to eat to good to watch: whale watching, adaptation and change in Icelandic fishing communities. *Polar Research* 28:129-138. <https://doi.org/10.1111/j.1751-8369.2008.00092.x>
- Elo, S., and H. Kyngäs. 2008. The qualitative content analysis process. *Journal of Advanced Nursing* 62:107-115. <https://doi.org/10.1111/j.1365-2648.2007.04569.x>
- Esterberg, K. G. 2002. *Qualitative methods in social research*. McGraw-Hill Higher Education, New York, New York, USA.
- Falardeau, M., and E. M. Bennett. 2019. Towards integrated knowledge of climate change in Arctic marine systems: a systematic literature review of multidisciplinary research. *Arctic Science* 6(1):1-23. <https://doi.org/10.1139/as-2019-0006>
- Fischer, A., and A. Eastwood. 2016. Coproduction of ecosystem services as human-nature interactions - an analytical framework. *Land Use Policy* 52:41-50. <https://doi.org/10.1016/j.landusepol.2015.12.004>
- Flyvbjerg, B. 2006. Five misunderstandings about case-study research. *Qualitative Inquiry* 12(2):219. <https://doi.org/10.1177/1077800405284363>
- Folke, C., R. Biggs, A. V. Norström, B. Reyers, and J. Rockström. 2016. Social-ecological resilience and biosphere-based sustainability science. *Ecology and Society* 21(3):41. <https://doi.org/10.5751/ES-08748-210341>
- Ford, J. D., G. McDowell, and T. Pearce. 2015. The adaptation challenge in the Arctic. *Nature Climate Change* 5:1046-1053. <https://doi.org/10.1038/nclimate2723>
- Frazão Santos, C., T. Agardy, F. Andrade, L. B. Crowder, C. N. Ehler, and M. K. Orbach. 2021. Major challenges in developing marine spatial planning. *Marine Policy* 132:103248. <https://doi.org/10.1016/j.marpol.2018.08.032>
- Freeman, M. M. R. 1993. The International Whaling Commission, small-type whaling, and coming to terms with subsistence. *Human Organization* 52:243-251. <https://doi.org/10.17730/humo.52.3.f12883h2r7ur6504>
- Friedrich, L. A., G. Glegg, S. Fletcher, W. Dodds, M. Philippe, and D. Bailly. 2020. Using ecosystem service assessments to support participatory marine spatial planning. *Ocean & Coastal Management* 188:105121. <https://doi.org/10.1016/j.ocecoaman.2020.105121>
- Gelcich, S., F. Reyes-Mendy, and M. A. Rios. 2019. Early assessments of marine governance transformations: insights and recommendations for implementing new fisheries management regimes. *Ecology and Society* 24(1):12. <https://doi.org/10.5751/ES-10517-240112>
- Gerring, J. 2004. What is a case study and what is it good for? *American Political Science Review* 98:341-354. <https://doi.org/10.1017/S0003055404001182>
- Gillespie, A. 1996. The ethical question in the whaling debate. *Georgetown International Environmental Law Review* 9:355-387.
- Gómez-Baggethun, E., and B. Martín-López. 2015. Ecological economics perspectives on ecosystem services valuation. Pages 260-282 in J. Martínez-Alier and R. Muradian, editors. *Handbook of ecological economics*. Edward Elgar, Cheltenham, UK. <https://doi.org/10.4337/9781783471416.00015>
- Government of Iceland. 2017. Reglugerð um bann við hvalveiðum á tilteknum svæðum. 1035/2017. Government of Iceland, Reykjavik, Iceland.
- Greenhalgh, T., and R. Peacock. 2005. Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. *British Medical Journal* 331:1064. <https://doi.org/10.1136/bmj.38636.593461.68>
- Gual, M. A., and R. B. Norgaard. 2010. Bridging ecological and social systems coevolution: a review and proposal. *Ecological Economics* 69:707-717. <https://doi.org/10.1016/j.ecolecon.2008.07.020>
- Guerry, A. D., M. H. Ruckelshaus, K. K. Arkema, J. R. Bernhardt, G. Guannel, C.-K. Kim, M. Marsik, M. Papenfus, J. E. Toft, G. Verutes, S. A. Wood, M. Beck, F. Chan, K. M. A. Chan, G. Gelfenbaum, B. D. Gold, B. S. Halpern, W. B. Labiosa, S. E. Lester, P. S. Levin, M. McField, M. L. Pinsky, M. Plummer, S. Polasky, P. Ruggiero, D. A. Sutherland, H. Tallis, A. Day, and J. Spencer. 2012. Modeling benefits from nature: using ecosystem services to inform coastal and marine spatial planning. *International Journal of Biodiversity Science, Ecosystem Services & Management* 8:107-121. <https://doi.org/10.1080/21513732.2011.647835>
- Haines-Young, R., and M. Potschin. 2010. The links between biodiversity, ecosystem services and human well-being. Pages 110-139 in D. G. Raffaelli and C. L. Frid, editors. *Ecosystem ecology: a new synthesis*. Cambridge University Press, Cambridge, UK. <https://doi.org/10.1017/CBO9780511750458.007>
- Haines-Young, R., and M. Potschin-Young. 2018. Revision of the common international classification of ecosystem services (CICES V5. 1): a policy brief. *One Ecosystem* 3:e27108. <https://doi.org/10.3897/oneeco.3.e27108>
- Hamilton, L. C., P. Lyster, and O. Otterstad. 2000. Social change, ecology and climate in 20th-century Greenland. *Climatic Change* 47:193-211. <https://doi.org/10.1023/A:1005607426021>
- Hennink, M., I. Hutter, and A. Bailey. 2020. *Qualitative research methods*. SAGE, London, UK.
- Higham, J. E. S., and D. Lusseau. 2008. Slaughtering the goose that lays the golden egg: are whaling and whale-watching mutually exclusive? *Current Issues in Tourism* 11:63-74. <https://doi.org/10.2167/cit335.0>
- Hinch, P. R., and E. M. De Santo. 2011. Factors to consider in evaluating the management and conservation effectiveness of a whale sanctuary to protect and conserve the North Atlantic right

- whale (*Eubalaena glacialis*). *Marine Policy* 35:163-180. <https://doi.org/10.1016/j.marpol.2010.09.002>
- Howe, C., H. Suich, B. Vira, and G. M. Mace. 2014. Creating win-wins from trade-offs? Ecosystem services for human well-being: a meta-analysis of ecosystem service trade-offs and synergies in the real world. *Global Environmental Change* 28:263-275. <https://doi.org/10.1016/j.gloenvcha.2014.07.005>
- Hoyt, E. 2011. *Marine protected areas for whales dolphins and porpoises: a world handbook for cetacean habitat conservation*. Second edition. Routledge, London, UK. <https://doi.org/10.4324/9781849771948>
- Huijbens, E. H., and N. Einarsson. 2018. Feasting on friends: whales, puffins, and tourism in Iceland. Pages 10-27 in C. Kline, editor. *Tourism experiences and animal consumption*. Routledge, London, UK. <https://doi.org/10.4324/9781315265186-2>
- Huntington, H. P., M. Carey, C. Apok, B. C. Forbes, S. Fox, L. K. Holm, A. Ivanova, J. Jaypoody, G. Noongwook, and F. Stammer. 2019. Climate change in context: putting people first in the Arctic. *Regional Environmental Change* 19:1217-1223. <https://doi.org/10.1007/s10113-019-01478-8>
- Hyde, K. F. 2000. Recognising deductive processes in qualitative research. *Qualitative Market Research* 3:82-90. <https://doi.org/10.1108/13522750010322089>
- Intergovernmental Panel on Climate Change (IPCC). 2019. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. H.-O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegria, M. Nicolai, A. Okem, J. Petzold, B. Rama, and N. M. Weyer, editors.
- Intergovernmental Panel on Climate Change (IPCC). 2021. *The Sixth Assessment Report. Working Group I - The Physical Science Basis. Regional fact sheet - Polar Regions*.
- Jentoft, S., and R. Chuenpagdee. 2013. Concerns and problems in fisheries and aquaculture - exploring governability. Pages 33-44 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. *Governability of fisheries and aquaculture: theory and applications*. Springer, Dordrecht, The Netherlands. [https://doi.org/10.1007/978-94-007-6107-0\\_3](https://doi.org/10.1007/978-94-007-6107-0_3)
- Jentoft, S., and R. Chuenpagdee. 2015. Assessing governability of small-scale fisheries. Pages 17-35 in S. Jentoft and R. Chuenpagdee, editors. *Interactive governance for small-scale fisheries: global reflections*. Springer International, Cham, Switzerland. [https://doi.org/10.1007/978-3-319-17034-3\\_2](https://doi.org/10.1007/978-3-319-17034-3_2)
- Kaiser, B. A., J. Pahl, and C. Horbel. 2018. Arctic ports: local community development issues. Pages 185-217 in N. Vestergaard, B. A. Kaiser, L. Fernandez, and J. Nymand Larsen, editors. *Arctic marine resource governance and development*. Springer International, Cham, Switzerland. [https://doi.org/10.1007/978-3-319-67365-3\\_9](https://doi.org/10.1007/978-3-319-67365-3_9)
- Kalland, A. 1994. Whose whale is that? Diverting the commodity path. Pages 159-186 in M. M. R. Freeman and U. P. Kreuter, editors. *Elephants and whales: Resources for whom?* Gordon and Breach Science, London, UK.
- Kaltenborn, B. P., J. D. Linnell, E. G. Baggethun, H. Lindhjem, J. Thomassen, and K. M. Chan. 2017. Ecosystem services and cultural values as building blocks for 'the good life'. A case study in the community of Røst, Lofoten Islands, Norway. *Ecological Economics* 140:166-176. <https://doi.org/10.1016/j.ecolecon.2017.05.003>
- Karlsdóttir, A., and A. H. Ingólfssdóttir. 2011. Gendered outcomes of socio-economic restructuring: a tale from a rural village in Iceland. *NORA - Nordic Journal of Feminist and Gender Research* 19:163-180. <https://doi.org/10.1080/08038740-2011.594029>
- Koenigstein, S., M. Ruth, and S. Gößling-Reisemann. 2016. Stakeholder-informed ecosystem modeling of ocean warming and acidification impacts in the Barents Sea Region. *Frontiers in Marine Science* 3. <https://doi.org/10.3389/fmars.2016.00093>
- Kooiman, J. 2016. Interactive governance and governability. Pages 29-50 in J. Edelenbos and I. van Meerkerk, editors. *Critical reflections on interactive governance*. Edward Elgar, Cheltenham, UK. <https://doi.org/10.4337/9781783479078.00007>
- Kooiman, J., and M. Bavinck. 2005. The governance perspective. Pages 11-24 in J. Kooiman, S. Jentoft, R. Pullin, and M. Bavinck, editors. *Fish for life: interactive governance for fisheries*. Amsterdam University Press, Amsterdam, The Netherlands. <https://doi.org/10.1017/9789048505326.002>
- Kooiman, J., and M. Bavinck. 2013. Theorizing governability - the interactive governance perspective. Pages 9-30 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. *Governability of fisheries and aquaculture: theory and applications*. Springer, Dordrecht, The Netherlands. [https://doi.org/10.1007/978-94-007-6107-0\\_2](https://doi.org/10.1007/978-94-007-6107-0_2)
- Kooiman, J., M. Bavinck, R. Chuenpagdee, R. Mahon, and R. Pullin. 2008. Interactive governance and governability: an introduction. *Journal of Transdisciplinary Environmental Studies* 7:1-11.
- Kooiman, J., S. Jentoft, M. Bavinck, and R. Pullin. 2005. *Fish for life: interactive governance for fisheries*. Amsterdam University Press, Amsterdam, The Netherlands. <https://doi.org/10.5117/9789053566862>
- Laidre, K. L., H. Stern, K. M. Kovacs, L. Lowry, S. E. Moore, E. V. Regehr, S. H. Ferguson, Ø. Wiig, P. Boveng, R. P. Angliss, E. W. Born, D. Litovka, L. Quakenbush, C. Lydersen, D. Vongraven, and F. Ugarte. 2015. Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century. *Conservation Biology* 29:724-737. <https://doi.org/10.1111/cobi.12474>
- Lester, S. E., C. Costello, B. S. Halpern, S. D. Gaines, C. White, and J. A. Barth. 2013. Evaluating tradeoffs among ecosystem services to inform marine spatial planning. *Marine Policy* 38:80-89. <https://doi.org/10.1016/j.marpol.2012.05.022>
- Lienhoop, N., and C. Schröter-Schlaack. 2018. Involving multiple actors in ecosystem service governance: exploring the role of stated preference valuation. *Ecosystem Services* 34:181-188. <https://doi.org/10.1016/j.ecoser.2018.08.009>
- Maestre-Andrés, S., L. Calvet-Mir, and J. C. J. M. van den Bergh. 2016. Sociocultural valuation of ecosystem services to improve protected area management: a multi-method approach applied to Catalonia, Spain. *Regional Environmental Change* 16:717-731. <https://doi.org/10.1007/s10113-015-0784-3>

- Mahon, R., and P. McConney. 2013. A network perspective on governing interactions. Pages 301-314 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. *Governability of fisheries and aquaculture: theory and applications*. Springer, Dordrecht, The Netherlands. [https://doi.org/10.1007/978-94-007-6107-0\\_16](https://doi.org/10.1007/978-94-007-6107-0_16)
- Malinauskaite, L., D. Cook, B. Davíðsdóttir, and H. Ögmundardóttir. 2021. Whale ecosystem services and co-production processes underpinning human wellbeing in the Arctic: case studies from Greenland, Iceland and Norway. Pages 181-202 in D. C. Nord, editor. *Nordic perspectives on the responsible development of the Arctic: pathways to action*. Springer International, Cham, Switzerland. [https://doi.org/10.1007/978-3-030-52324-4\\_9](https://doi.org/10.1007/978-3-030-52324-4_9)
- Malinauskaite, L., D. Cook, B. Davíðsdóttir, H. Ögmundardóttir, and J. Roman. 2019. Ecosystem services in the Arctic: a thematic review. *Ecosystem Services* 36:100898. <https://doi.org/10.1016/j.ecoser.2019.100898>
- Malinauskaite, L., D. Cook, B. Davíðsdóttir, H. Ögmundardóttir, and J. Roman. 2020. Willingness to pay for expansion of the whale sanctuary in Faxaflói Bay, Iceland: a contingent valuation study. *Ocean and Coastal Management* 183:105026. <https://doi.org/10.1016/j.ocecoaman.2019.105026>
- Martín-López, B., E. Gómez-Baggethun, M. García-Llorente, and C. Montes. 2014. Trade-offs across value-domains in ecosystem services assessment. *Ecological Indicators* 37:220-228. <https://doi.org/10.1016/j.ecolind.2013.03.003>
- Mattes, S. 2017. Save the Whale? Ecological memory and the human-whale bond in Japan's small coastal villages. Pages 67-81 in I. Werkheiser and Z. Piso, editors. *Food justice in US and global contexts: bringing theory and practice together*. Springer International, Cham, Switzerland. [https://doi.org/10.1007/978-3-319-57174-4\\_6](https://doi.org/10.1007/978-3-319-57174-4_6)
- McDermott, M., S. Mahanty, and K. Schreckenberg. 2013. Examining equity: a multidimensional framework for assessing equity in payments for ecosystem services. *Environmental Science & Policy* 33:416-427. <https://doi.org/10.1016/j.envsci.2012.10.006>
- Meek, C. L., A. Lauren Lovecraft, R. Varjopuro, M. Dowsley, and A. T. Dale. 2011. Adaptive governance and the human dimensions of marine mammal management: implications for policy in a changing North. *Marine Policy* 35:466-476. <https://doi.org/10.1016/j.marpol.2010.10.021>
- Meyer-Gutbrod, E. L., and C. H. Greene. 2018. Uncertain recovery of the North Atlantic right whale in a changing ocean. *Global Change Biology* 24:455-464. <https://doi.org/10.1111/gcb.13929>
- Meynecke, J.-O., R. Richards, and O. Sahin. 2017. Whale watch or no watch: the Australian whale watching tourism industry and climate change. *Regional Environmental Change* 17:477-488. <https://doi.org/10.1007/s10113-016-1034-z>
- Morf, A., J. Moodie, K. Gee, A. Giacometti, M. Kull, J. Piwarczyk, K. Schiele, J. Zaucha, I. Kellecioglu, A. Luttmann, and H. Strand. 2019. Towards sustainability of marine governance: challenges and enablers for stakeholder integration in transboundary marine spatial planning in the Baltic Sea. *Ocean & Coastal Management* 177:200-212. <https://doi.org/10.1016/j.ocecoaman.2019.04.009>
- Moynihan, D. P., S. Fernandez, S. Kim, K. M. LeRoux, S. J. Piotrowski, B. E. Wright, and K. Yang. 2011. Performance regimes amidst governance complexity. *Journal of Public Administration Research and Theory* 21:i141-i155. <https://doi.org/10.1093/jopart/muq059>
- Nicosia, E., and F. Perini. 2016. Ecotourism between theory and practice: empirical analysis of the tourism industry of whale watching in Húsavík (Iceland). *Almatourism: Journal of Tourism, Culture and Territorial Development* 7:60-105.
- Nunan, F. 2019. Working towards diverse, flexible and inclusive natural resource governance. Pages 226-244 in F. Nunan, editor. *Governing renewable natural resources: theories and frameworks*. Routledge, London, UK. <https://doi.org/10.4324/9780429053009-12>
- Nuttall, M. 1998. *Protecting the Arctic: Indigenous peoples and cultural survival*. Routledge, London, UK. <https://doi.org/10.4324/9780203989289>
- Ofei-Manu, P., R. J. Didham, W. J. Byun, R. Phillips, P. J. Dickella Gamaralalage, and S. Rees. 2018. How collaborative governance can facilitate quality learning for sustainability in cities: a comparative case study of Bristol, Kitakyushu and Tongyeong. *International Review of Education* 64:373-392. <https://doi.org/10.1007/s11159-017-9667-9>
- Olsen, J., G. K. Hovelsrud, and B. P. Kaltborn. 2020. Increasing shipping in the Arctic and local communities' engagement: a case from Longyearbyen on Svalbard. Pages 305-331 in E. Pongrácz, V. Pavlov, and N. Hänninen, editors. *Arctic marine sustainability: Arctic maritime businesses and the resilience of the marine environment*. Springer International, Cham, Switzerland. [https://doi.org/10.1007/978-3-030-28404-6\\_14](https://doi.org/10.1007/978-3-030-28404-6_14)
- Palomo, I., M. R. Felipe-Lucia, E. M. Bennett, B. Martín-López, and U. Pascual. 2016. Disentangling the pathways and effects of ecosystem service co-production. Pages 245-283 in G. Woodward and D. A. Bohan, editors. *Advances in ecological research*. Academic, London, UK. <https://doi.org/10.1016/bs.aecr.2015.09.003>
- Partelow, S., A. Schlüter, D. Armitage, M. Bavinck, K. Carlisle, R. L. Gruby, A.-K. Hornidge, M. Le Tissier, J. B. Pittman, A. M. Song, L. P. Sousa, N. Văidianu, and K. Van Assche. 2020. Environmental governance theories: a review and application to coastal systems. *Ecology and Society* 25(4):19. <https://doi.org/10.5751/ES-12067-250419>
- Primmer, E., P. Jokinen, M. Blicharska, D. N. Barton, R. Bugter, and M. Potschin. 2015. Governance of ecosystem services: a framework for empirical analysis. *Ecosystem Services* 16:158-166. <https://doi.org/10.1016/j.ecoser.2015.05.002>
- Pullin, R. S. V. 2013. Food security in the context of fisheries and aquaculture - a governability challenge. Pages 87-109 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. *Governability of fisheries and aquaculture: theory and applications*. Springer, Dordrecht, The Netherlands. [https://doi.org/10.1007/978-94-007-6107-0\\_6](https://doi.org/10.1007/978-94-007-6107-0_6)
- Reed, M. S., A. Graves, N. Dandy, H. Posthumus, K. Hubacek, J. Morris, C. Prell, C. H. Quinn, and L. C. Stringer. 2009. Who's

- in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management* 90:1933-1949. <https://doi.org/10.1016/j.jenvman.2009.01.001>
- Richards, R., J.-O. Meynecke, and O. Sahin. 2021. Addressing dynamic uncertainty in the whale-watching industry under climate change and system shocks. *Science of The Total Environment* 756:143889. <https://doi.org/10.1016/j.scitotenv.2020.143889>
- Riisager-Simonsen, C., O. Rendon, A. Galatius, M. T. Olsen, and N. Beaumont. 2020. Using ecosystem-services assessments to determine trade-offs in ecosystem-based management of marine mammals. *Conservation Biology* 34(5):1152-1164. <https://doi.org/10.1111/cobi.13512>
- Rittel, H. W., and M. M. Webber. 1973. Dilemmas in a general theory of planning. *Policy Sciences* 4:155-169. <https://doi.org/10.1007/BF01405730>
- Ritter, F. 2003. Interactions of cetaceans with whale watching boats-implications for the management of whale watching tourism. MEER eV, Berlin, Germany.
- Roman, J., V. DeLauer, I. Altman, B. Fisher, R. Boumans, and L. Kaufman. 2018. Stranded capital: environmental stewardship is part of the economy, too. *Frontiers in Ecology and the Environment* 16:169-175. <https://doi.org/10.1002/fee.1780>
- Roman, J., J. A. Estes, L. Morissette, C. Smith, D. Costa, J. McCarthy, J. Nation, S. Nicol, A. Pershing, and V. Smetacek. 2014. Whales as marine ecosystem engineers. *Frontiers in Ecology and the Environment* 12:377-385. <https://doi.org/10.1890/130220>
- Roman, J., and J. J. McCarthy. 2010. The whale pump: marine mammals enhance primary productivity in a coastal basin. *PLoS ONE* 5:e13255. <https://doi.org/10.1371/journal.pone.0013255>
- Rud, S. 2017. Colonialism in Greenland: tradition, governance and legacy. Springer, Cham, Switzerland. <https://doi.org/10.1007/978-3-319-46158-8>
- Salvadeo, C. J., S. E. Lluch-Cota, M. O. Maravilla-Chávez, S. T. Álvarez-Castañeda, M. Mercuri, and A. Ortega-Rubio. 2013. Impact of climate change on sustainable management of gray whale (*Eschrichtius robustus*) populations: whale-watching and conservation. *Archives of Biological Sciences* 65:997-1005. <https://doi.org/10.2298/ABS1303997S>
- Schreckenberger, K., G. Mace, and M. Poudyal, editors. 2018. Ecosystem services and poverty alleviation: trade-offs and governance. Routledge, London, UK.
- Solé, L., and E. Ariza. 2019. A wider view of assessments of ecosystem services in coastal areas: the perspective of social-ecological complexity. *Ecology and Society* 24(2):24. <https://doi.org/10.5751/ES-10883-240224>
- Song, A., and R. Chuenpagdee. 2013. The damage schedule approach. Pages 279-299 in M. Bavinck, R. Chuenpagdee, S. Jentoft, and J. Kooiman, editors. *Governability of fisheries and aquaculture: theory and applications*. Springer, Dordrecht, The Netherlands. [https://doi.org/10.1007/978-94-007-6107-0\\_15](https://doi.org/10.1007/978-94-007-6107-0_15)
- Spangenberg, J. H., C. Görg, D. T. Truong, V. Tekken, J. V. Bustamante, and J. Settele. 2014b. Provision of ecosystem services is determined by human agency, not ecosystem functions. Four case studies. *International Journal of Biodiversity Science, Ecosystem Services & Management* 10:40-53. <https://doi.org/10.1080/21513732.2014.884166>
- Spangenberg, J. H., C. von Haaren, and J. Settele. 2014a. The ecosystem service cascade: further developing the metaphor. Integrating societal processes to accommodate social processes and planning, and the case of bioenergy. *Ecological Economics* 104:22-32. <https://doi.org/10.1016/j.ecolecon.2014.04.025>
- Statistics Greenland. 2019. The population in districts and municipalities. Statistics Greenland, Nuuk, Greenland.
- Statistics Iceland. 2021. Population in urban areas. Statistics Iceland, Reykjavik, Iceland. [https://px.hagstofa.is/pxis/pxweb/is/Ibuar/Ibuar\\_mannfjoldi\\_2\\_bygdir\\_Byggdajarnar/MAN030101.px](https://px.hagstofa.is/pxis/pxweb/is/Ibuar/Ibuar_mannfjoldi_2_bygdir_Byggdajarnar/MAN030101.px)
- Statistics Norway. 2019. Population and land area in urban settlements. Statistics Norway, Oslo, Norway. <https://www.ssb.no/en/befolkning/statistikker/bef tett/aar>
- Stephenson, R. L., A. J. Hobday, E. H. Allison, D. Armitage, K. Brooks, A. Bundy, C. Cvitanovic, M. Dickey-Collas, N. de Miranda Grilli, C. Gomez, et al. 2021. The quilt of sustainable ocean governance: patterns for practitioners. *Frontiers in Marine Science* 8:120. <https://doi.org/10.3389/fmars.2021.630547>
- Stewart, E., J. Dawson, and M. Johnston. 2015. Risks and opportunities associated with change in the cruise tourism sector: community perspectives from Arctic Canada. *Polar Journal* 5:403-427. <https://doi.org/10.1080/2154896X.2015.1082283>
- Stocker, A. N., A. H. H. Renner, and M. Knol-Kauffman. 2020. Sea ice variability and maritime activity around Svalbard in the period 2012-2019. *Scientific Reports* 10:17043. <https://doi.org/10.1038/s41598-020-74064-2>
- Suydam, R., and J. C. George. 2021. Current indigenous whaling. Pages 519-535 in J. C. George and J. G. M. Thewissen, editors. *The Bowhead Whale*. Academic, London, UK. <https://doi.org/10.1016/B978-0-12-818969-6.00032-7>
- Tejsner, P. 2014. Quota disputes and subsistence whaling in Qeqertarsuaq, Greenland. *Polar Record* 50:430-439. <https://doi.org/10.1017/S0032247414000242>
- Triyanti, A., M. Bavinck, J. Gupta, and M. A. Marfai. 2017. Social capital, interactive governance and coastal protection: the effectiveness of mangrove ecosystem-based strategies in promoting inclusive development in Demak, Indonesia. *Ocean & Coastal Management* 150:3-11. <https://doi.org/10.1016/j.ocecoaman.2017.10.017>
- Tulloch, V. J. D., É. E. Plagányi, C. Brown, A. J. Richardson, and R. Matear. 2019. Future recovery of baleen whales is imperiled by climate change. *Global Change Biology* 25:1263-1281. <https://doi.org/10.1111/gcb.14573>
- Vacquié-García, J., C. Lydersen, R. A. Ims, and K. M. Kovacs. 2018. Habitats and movement patterns of white whales *Delphinapterus leucas* in Svalbard, Norway in a changing climate. *Movement Ecology* 6:21. <https://doi.org/10.1186/s40462-018-0139-z>

Vammen Larsen, S., E. K. Bors, L. Jóhannsdóttir, E. Gladun, D. Gritsenko, S. Nysten-Haarala, S. Tulaeva, and T. Sformo. 2019. A conceptual framework of Arctic economies for policy-making, research, and practice. *Global Policy* 10:686-696. <https://doi.org/10.1111/1758-5899.12720>

van Riper, C. J., and G. T. Kyle. 2014. Capturing multiple values of ecosystem services shaped by environmental worldviews: a spatial analysis. *Journal of Environmental Management* 145:374-384. <https://doi.org/10.1016/j.jenvman.2014.06.014>

Vincent, W. F. 2020. Arctic climate change: local impacts, global consequences, and policy implications. Pages 507-526 in K. S. Coates and C. Holroyd, editors. *The Palgrave handbook of Arctic policy and politics*. Springer International, Cham, Switzerland. [https://doi.org/10.1007/978-3-030-20557-7\\_31](https://doi.org/10.1007/978-3-030-20557-7_31)

Worden, E., T. Pearce, M. Gruben, D. Ross, C. Kowana, and L. Loseto. 2020. Social-ecological changes and implications for understanding the declining beluga whale (*Delphinapterus leucas*) harvest in Aklavik, Northwest Territories. *Arctic Science* 6:229-246. <https://doi.org/10.1139/as-2019-0027>

Yin, R. K. 2017. *Case study research and applications: design and methods*. SAGE, Los Angeles, California, USA.

Young, O. R. 2010. Arctic governance-pathways to the future. *Arctic Review* 1(2).

Young, O. R. 2016. Governing the Arctic Ocean. *Marine Policy* 72:271-277. <https://doi.org/10.1016/j.marpol.2016.04.038>

Young, O. R., M. M. R. Freeman, G. Osherenko, R. R. Andersen, R. A. Caulfield, R. L. Friedheim, S. J. Langdon, M. Ris, and P. J. Usher. 1994. Subsistence, sustainability, and sea mammals: reconstructing the international whaling regime. *Ocean & Coastal Management* 23:117-127. [https://doi.org/10.1016/0964-5691\(94\)90077-9](https://doi.org/10.1016/0964-5691(94)90077-9)

Young, O. R., D. G. Webster, M. E. Cox, J. Raakjær, L. Ø. Blaxekjær, N. Einarsson, R. A. Virginia, J. Acheson, D. Bromley, E. Cardwell, C. Carothers, E. Eythórsson, R. B. Howarth, S. Jentoft, B. J. McCay, F. McCormack, G. Osherenko, E. Pinkerton, R. van Ginkel, J. A. Wilson, L. Rivers, and R. S. Wilson. 2018. Moving beyond panaceas in fisheries governance. *Proceedings of the National Academy of Sciences* 115:9065-9073. <https://doi.org/10.1073/pnas.1716545115>

Zacharias, M. A., L. R. Gerber, and K. D. Hyrenbach. 2006. Review of the Southern Ocean Sanctuary: marine protected areas in the context of the International Whaling Commission Sanctuary Programme. *Journal of Cetacean Research and Management* 8:1.

## Appendix 1

*Definitions of the key components of interactive governance theoretical model as per Kooiman et al. (2008) and Kooiman and Bavinck (2013). The synonyms in the last column refer to the terms used interchangeably in this paper for these components.*

COMPONENT	DEFINITION	SYNONYMS
<b>Actor</b>	Any social unit possessing agency or power of action.	Stakeholder
<b>Sustainability</b>	Ability of an SES to sustain human wellbeing and ecosystems indefinitely or for a very long time.	
<b>System-to-be-governed (SG)</b>	A system connecting natural and social phenomena, where social processes depend on natural conditions and vice versa. Should be viewed as a part of a bigger system.	Social-ecological system
<b>Governing system (GS)</b>	Total set of mechanisms and processes stemming from state, market or civil society that are available for guidance, steering and control of a system-to-be-governed.	
<b>Governance interactions (GI)</b>	Mutually influencing relations between two or more entities or actors in a governance setting.	
<b>PROPERTIES</b>		
<b>Diversity</b>	Nature and degree to which entities within system differ.	Heterogeneity
<b>Complexity</b>	Quality or state of being complex or composed of interconnected parts. Expression of social-ecological interdependencies.	
<b>Dynamics</b>	Degree of change stemming from tensions which create flows of energy, materials, and information.	Change
<b>Scale</b>	Dimension of space and time of systems-to-be-governed and governing systems.	
<b>ELEMENTS</b>		
<b>Image</b>	Guiding lights of “how” and “why” of governance, including visions, knowledge, ideas, judgements, goals, convictions, theories, etc.	Vision
<b>Instrument</b>	A sum of available tools for governance, e.g. laws, regulations, guidelines, taxes, subsidies, etc.	Tool
<b>Action</b>	Implementation of instruments according to set guidelines or the taking of action by one actor or entity that is followed by others.	Problem solving
<b>ORDERS</b>		
<b>Meta order of governance</b>	Setting values and principles to guide policy.	Governance vision
<b>Second order of governance</b>	Institutional settings which enable, sustain and give focus to governance.	Institutional setting
<b>First order of governance</b>	Day-to-day activities by governing actors tackling problems and creating opportunities.	On-ground action
<b>MODES</b>		
<b>Hierarchical governance</b>	Implies a one directional flow from governing system to system-to-be-governed. Typical style of governance in which governments interact with their (groups of) citizens.	Top-down; policy; management
<b>Co-governance</b>	“Horizontal” collaborative and cooperative governance interactions where no one actor plays a dominating role.	Collaborative; co-management
<b>Self-governance</b>	Capacity of social entities to govern themselves. Implies participation by actors.	Participatory governance