Governing knowledge

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01.G0VERNING KN0WLEDGE: INTR0DUCTI0N

1.1 THE DUTCH WADDEN SEA: CONSERVATION, CONFLICT, AND COLLABORATION

The Wadden Sea area, with its tidal flats, salt marshes, and islands stretching from the northern coast of the Netherlands to the western coast of Denmark, is widely recognized as a valuable area in both ecological and social-economic terms. One of the main indicators of its ecological value is that each year it provides an important foraging and resting place for 10-12 million migratory birds; moreover, the area provides "rich nurseries for fish and shrimp" and hosts about 10,000 species of plants, animals, and fungi (Reise et al., 2010: 9). Social-economic activities in the area include fisheries, recreation, gas and salt mining, and shellfish harvesting and cultivation.

The widespread appreciation of the value of the Wadden Sea as a nature area is a relatively recent phenomenon. The rise of nature conservation in the Netherlands started in the late 19th century, but the Wadden Sea did not become a center of interest to conservationists until much later (Van der Windt, 1995). During the 1960s, governmental plans for large-scale embankments and land reclamations incited both scientific and societal conservation initiatives. For instance, in 1965 a scientific working group was started, which aimed at creating knowledge and stimulating awareness of the allegedly unique and conservation-worthy character of the Wadden Sea (Van der Windt, 1995). In the same year, the Wadden Sea Society was established as a reaction against plans to build embankments between the mainland and the island of Ameland.[1] This organization grew out to be a prominent nature conservation NGO.

During the same period, the Dutch government started reconsidering its plans regarding the Wadden Sea. For instance, the Second Memorandum on Spatial Planning in the Netherlands (1966) stated that "an all-round study […] is to show whether land reclamation plans for parts of the Wadden Sea area or for the entire Wadden Sea are indeed desirable".[2] This call for a study resulted in the institution of a Wadden Sea Committee, which concluded in 1974 that reclaiming large parts of the Wadden Sea would be unfeasible for various reasons, including its negative impact on fisheries and the lack of an urgent need for more land; moreover, land reclamations were deemed undesirable because "the Wadden Sea in its current state is a valuable nature area".[3] For this latter reason the committee urged the Dutch government to improve the public administration, management, and conservation of the Wadden Sea.

1 http://www.waddenvereniging.nl/vereniging/oprichting (last accessed on 7-1-2016).
2 Tweede nota over de ruimtelijke ordening in Nederland (1966): 64.
3 Rapport van de Waddenzeecommissie, Advies inzake de principiële mogelijkheden en de voor- en nadelen van inpolderingen in de Waddenzee, uitgebracht door de commissie, ingesteld bij beschikking van de Minister van Verkeer en Waterstaat en de Minister van Volkshuisvesting en Ruimtelijke Ordening van 22 september 1970, nr. Z 58355 (Stcrt. 1970, 234): 290.

Since the 1970s, the conservation of the Wadden Sea by means of regulations and management initiatives has gradually gained prominence. Since 1978, Denmark, Germany, and the Netherlands have collaborated in the conservation and management of the Wadden Sea in the context of the Trilateral Wadden Sea Cooperation (Wolff et al., 2010). The Dutch Wadden Sea was designated as a "wetland of international importance" under the Ramsar convention in 1984.[4] Furthermore, in 2009 the Dutch Wadden Sea was officially designated as a Natura 2000-site, which implies that it officially became a protected area under the European Birds and Habitats Directives.[5] Finally, large parts of the Dutch and German Wadden Sea were inscribed on the UNESCO world heritage list in 2009; five years later, the inscribed area was extended across the Dutch, German, and Danish Wadden Sea.[6] Thus, the Wadden Sea is nowadays managed under a multitude of international conservation regimes.

On a national level, two main instruments regarding the management and conservation of the Dutch Wadden Sea are the Wadden Sea Memoranda and the Nature Conservation Act. The Wadden Sea Memoranda (1980, 1994, 2007) are policy plans of the Dutch government that outline the general national policy on the Wadden Sea. The most recent Memorandum of 2007 states that its main policy goal is "the sustainable protection and development of the Wadden Sea as a nature area and the conservation of the unique open landscape" (VROM, 2007a: 9). The Nature Conservation Act (NCA) is an important legal framework for nature conservation in the Netherlands; a large part of the Wadden Sea has been designated as a protected area under this act. The NCA provides competent authorities with several nature conservation instruments, including the right to temporarily or permanently close off parts of the Wadden Sea to humans. Moreover, it demands scientific impact assessments of plans and projects that do not directly contribute to the management of the area.[7] Such plans or projects are only permitted if an assessment proves that they have no significant adverse effect on achieving the legal nature conservation objectives.

This rise of the conservation of the Wadden Sea has been accompanied by a rise of controversy and conflict between governmental agencies, nature conservation NGOs, economic sectors, and societal organizations. In the last decades, several conflicts emerged about the possibly negative impact of human activities on nature in the Wadden Sea area. Two of these conflicts that have notably been in the societal, political, and scientific spotlights concern gas mining and the cockle fishery. The controversy on gas mining started in the 1970s; central issues in this case included the

4 RAMSAR Conference, May 7th 1984, Summary report of the plenary session.
5 Ministerie van Infrastructuur en Milieu (2015) Ontwerpplan Natura 2000 – beheerplan Waddenzee, periode 2016-2022.
6 Various documents and maps related to the inscription and extension can be found at http://whc.unesco.org/en/list/1314 [last accessed on 7-8-2016].
7 Nature Conservation Act, Article 19f.

possible ecological effects of soil subsidence caused by gas mining, and how such effects could be prevented. After a moratorium and many societal protests, political debates, and scientific assessments, gas mining was allowed in 2004 under the condition that an adaptive management approach called "hand on the tap" would be applied. This approach entails that the gas extraction volume can be reduced if the land or seabed subside too quickly. This controversy has been described and analyzed in detail in several publications (e.g., Verbeeten, 1999; Turnhout et al., 2008; Runhaar & Van Nieuwaal, 2010). The controversy on the cockle fishery started around 1990 and revolved around the detrimental impact of the large-scale mechanical cockle fishery on the Wadden Sea ecosystem. A combination of societal protests, political deliberations, research and advisory reports, and legal rulings resulted in a ban on the mechanical cockle fishery on the Wadden Sea in 2004. Like gas mining, the cockle fishery controversy has been extensively analyzed in several publications (e.g., Steins, 1999; Swart & Van der Windt, 2005; Imeson & Van den Bergh, 2006; Swart & Van Andel, 2008; Turnhout et al., 2008; Hanssen et al., 2009).

The literature cited above indicates that knowledge has played crucial and sometimes problematic and contested roles in these controversies (see also Floor et al., 2013). For instance, the decision-making on the permissibility of both the cockle fishery and gas mining in part relied on ecological monitoring, impact studies, and expert judgement. However, uncertainty on the effects of these activities and a lack of scientific consensus complicated decision-making processes (Hanssen et al., 2009). Moreover, several authors have identified disconnections between knowledge creation and decision-making, for instance because of limited interactions between researchers and policy-makers and because of a mismatch between scientific knowledge and dominant policy discourses (Hanssen et al., 2009; Runhaar, 2009; Floor et al., 2013). Furthermore, both in the cockle fishery and gas mining controversies competing actor coalitions have used uncertainties and knowledge gaps "to undermine knowledge claims put forward by the competing coalitions"; reports, experts, and institutes were "actively discredited" (Turnhout et al., 2008: 235). Finally, scientific experts have sometimes played controversial roles. Some scientists have for instance been criticized for taking a too political and activist stance in conflicts on the management and conservation of the Wadden Sea (Steins, 1999; Swart & Van Andel, 2008).

Various research and advisory reports have addressed the knowledge conflicts between actor coalitions and the crucial role of knowledge in the management of the Wadden Sea (e.g. Adviesgroep Waddenzeebeleid, 2004; Toonen & Staatsen, 2004; Kabat et al., 2009a; Klostermann et al.,

2009). These reports have identified several shortcomings in the knowledge and research infrastructure of the Wadden Sea, such as a lack of integrated knowledge management, inadequate collaboration between research institutes, a lack of interdisciplinary integration, and disconnections between scientific information and public decision-making. In recent years, various initiatives have been taken with the aim of improving this situation, such as the institution of the Wadden Academy in 2008. This organization focuses on research programing, knowledge exchange across science-policy boundaries, and scientific collaboration and integration (Kabat et al., 2009a). Furthermore, initiatives are being implemented to integrate various monitoring efforts and to make monitoring data more easily accessible to actors involved in management practices.[8] These various initiatives indicate that improving the knowledge infrastructure and the interactions between knowledge and management of the Wadden Sea are currently high on the agenda.

From the above may be inferred that the relations between knowledge and policy on the Wadden Sea have already been addressed quite extensively, including in the scientific literature, in advisory reports on the public administration, and in initiatives to improve the knowledge and research infrastructure. However, a relatively recent development in the Wadden Sea area that has not yet received much attention is that in various policy domains new collaborative arrangements have emerged, which aim at settling conflicts between actor coalitions that have sometimes been engaged in lengthy disputes. A common characteristic of these arrangements is that they intend to balance the conservation and utilization of nature by means of a form of governance that involves ongoing deliberation between governmental agencies, nature conservation NGOs, and other societal actors. Given the crucial role of knowledge in the management of the Wadden Sea, this emergence of collaborative governance arrangements raises several questions. For instance, what has been the role of knowledge in their establishment? Does this new form of governance pose new requirements to knowledge creation and exchange? How do the participants deal with the contestation of knowledge that often occurs in conflicts on the conservation and utilization of nature?

These questions about the interactions between knowledge and governance are not just relevant for the management of the Wadden Sea area. In many places around the world, nature areas are under pressure of human activities. Moreover, in several of these areas governance practices have emerged that aim at finding a balance between the utilization and conservation of natural resources, and that in the pursuance of this aim are confronted with knowledge-related issues such as uncertainty, complexity,

8 An example of this is the WaLTER project, which was started in 2011: http://www.walterwaddenmonitor.org/ [last accessed on 7-5-2016].

and contestation (Ellis, 2005; Evans, 2010; Clarke et al., 2013; Trimble & Berkes, 2013; Bixler, 2014). Consequently, the interrelations between environmental knowledge and governance have been identified as an important topic in the environmental management literature (Van Buuren, 2009; Bremer & Glavovic, 2013a; Plummer et al., 2013).

1.2 RELATIONS BETWEEN ENVIRONMENTAL KNOWLEDGE AND GOVERNANCE

This section outlines some key lines of research on the interrelations between knowledge and governance that can be found in the environmental management literature. As a way of ordering the literature it distinguishes between two main ways of conceptualizing knowledge-governance relations: in terms of divisions and in terms of intertwinements. This distinction draws inspiration from the literature that has used similar concepts in order to characterize various kinds of science-policy interactions. This literature includes the work of Hoppe (2002), who has argued that science-policy arrangements may be characterized in terms of either divergence or convergence between science and politics. In the former case, science and politics are perceived to be separated and functionally differentiated; in the latter case, they are much more seen as two sides of the same coin. Moreover, a source of inspiration for using this distinction is the work of the Stuurgroep Toekomstonderzoek en Strategisch Omgevingsbeleid (2001), which has used the distinction between "interwoven" and "disentwined" relations between research and policy. Unlike these sources, my aim is not to use the categories of divisions and intertwinements for classifying particular science-policy arrangements. Rather, I use these categories to distinguish between different strands of literature that focus on different types of interactions between environmental knowledge and governance. The literature that I assign to the category of divisions predominantly focuses on the differences and boundaries that may occur in knowledge-governance relations. The literature in the category of intertwinements predominantly focuses on ways in which environmental knowledge and governance may be interwoven or amalgamated.

1.2.1 Divisions

A first line of research that can be situated in the category of divisions focuses on the differences between the various knowledges that may be relevant for environmental governance. In this approach, environmental governance is seen as a process in which various knowledgeable actors

such as conservationists, citizens, and resource users (should) participate. Such actors with different backgrounds may bring different insights and experiences to the table (e.g., Birkenholtz, 2008; Edelenbos et al., 2011; Mauelshagen et al., 2014). Several scholars of environmental governance have referred to such differences in terms of the various forms of knowledge that may be of value to environmental governance, such as scientific, local, and indigenous knowledge (Ellis, 2005; Birkenholtz, 2008; Berkes, 2009; Crona & Parker, 2012; Taylor & De Loë, 2012). Furthermore, various notions have been used to signify the different social and normative configurations in which the knowledge of various actors may be embedded, such as the notion of the "knowledge system" (Evans, 2010; O'Toole & Coffey, 2013). From this perspective, performing environmental governance requires connecting or integrating the disparate knowledge systems of different actor groups (King, 2004; Robinson & Wallington, 2012). Other authors have used the notion of "ways of knowing" to denote such epistemic and normative differences (Janssen et al., 2015). Different ways of knowing "give rise to different understandings of precisely which factual knowledge is valid and relevant; they feed different world views, problem perceptions, and values", and they "encompass different sets of organizing capacity" (Van Buuren, 2009: 209).

A second approach within the category of divisions focuses on the divisions that may exist between knowledge and policy-making. Within this approach, such divisions are often conceptualized in terms of boundaries and interfaces. The notion of the science-policy interface is a concept that has been widely applied (Pihlajamäki & Tynkkynen, 2011; Bremer & Glavovic, 2013a; Janssen et al., 2015). Alternatively, scholars of environmental governance have applied the notion of a "science-society-policy" interface (Buizer et al., 2011). Within the governance literature the open, dynamic, and negotiated character of such interfaces is generally acknowledged, for instance by conceptualizing the science-policy interface as a "governance setting" that encompasses the dialogue between and the inclusion and integration of disparate knowledges (Bremer & Glavovic, 2013a). Besides the concept of interfaces, knowledge-governance relations are also conceptualized in terms of the "utilization" of knowledge. In this case, an analytical distinction is made between the production of knowledge and its use or application in decision-making (Giebels et al., 2013; Lemos, 2015).

The literature focusing on interfaces between environmental knowledge and policy seeks strategies for improved governance in bridging or managing these interfaces. The concept of "boundary work" and related concepts are often applied to issues regarding the management of

science-policy interfaces. The term boundary work was coined in the field of Science and Technology Studies as an analytical concept that denotes the social construction work that is performed to grant epistemic authority to scientific knowledge, to demarcate it from non-scientific knowledges and activities (Gieryn, 1983). However, in the environmental governance literature it is often applied as a management concept that refers to joint knowledge production, coordination work among experts and policy-makers, and translating knowledge into action (Robinson & Wallington, 2012; Turnhout et al., 2014; Wyborn, 2015b). Closely connected to this managerial interpretation of boundary work is the concept of boundary organizations; such organizations "play an intermediary role between knowledge production and decision-making (in different domains and levels), with a view to achieving co-operation in relation to a shared objective (Clarke et al., 2013: 94). Finally, the concept of "boundary objects" is used in the environmental governance literature to denote objects or concepts that may facilitate collaborations across science-policy interfaces (Star & Griesemer, 1989; Wyborn, 2015b). They are able to do so because they are flexible enough to be of value to actors with various backgrounds and concerns, yet robust enough to maintain a stable identity in different social contexts (Star & Griesemer, 1989). The collaborative creation of boundary objects is seen as a means of translation across boundaries of knowledge and governance (Robinson & Wallington, 2012).

It should be noted that the literature that employs these various concepts concerning boundaries and interfaces usually does not conceive of knowledge and governance as being strictly divided. I have categorized this literature under "divisions" because its main focus lies on how divides between knowledge and governance are created, bridged, or managed. The processes, objects, and institutions by which such work may be performed usually combine social, epistemic, and political elements (Miller, 2001). In this sense, the distinction between the categories of divisions and intertwinements that I use here is not completely clear-cut.

1.2.2 Intertwinements

A first body of literature that conceptualizes knowledge-governance relations in terms of intertwinement is the one that focuses on adaptive governance. Adaptive governance has been argued to be a fruitful way of dealing with the uncertainty and change that are associated with the governance of complex and dynamic natural systems (Folke et al., 2005). It involves the capacity to "understand environmental change", "use this understanding to inform decision making", and "act on decisions" in

a manner that promotes desirable system states (Evans et al., 2011: 21). Moreover, it involves the capacity to "review and adapt decisions as new information becomes available" (Cvitanovic et al., 2015: 26). Thus, gaining insight into and learning from both ecosystem change and the effects of human interventions in nature are seen as integral and vital aspects of governing (Termeer et al., 2010; Weiss et al., 2012).

A second body of literature that conceptualizes knowledge-governance relations in terms of intertwinement and hybridity is associated with, or draws inspiration from, interpretive and critical studies of policy and politics. This body of literature includes research in the tradition of interpretive policy analysis (e.g., Wesselink et al., 2013) and governance studies inspired by the work of Michel Foucault (e.g., Van Assche et al., 2011). In this line of thought, power and knowledge are thought to imply each other; for instance, wielding power inevitably involves knowing, while knowledge creation takes place in a context of power relations (Van Assche et al., 2011; Winkel, 2012). Environmental governance studies have for instance explored this power-knowledge nexus through studying environmental discourse. A discourse is defined as "a specific ensemble of ideas, concepts, and categorizations that are produced, reproduced and transformed in a particular set of practices and through which meaning is given to physical and social realities" (Hajer, 1995: 44). Discourses shape the objects of knowledge and the interpretive frameworks through which those objects can be known; at the same time, they construct social reality by shaping social order, including social subjects and relationships (Arts & Buizer, 2009; Rajão, 2013).

Finally, a third approach that can be situated in the category of intertwinements focuses on the coproduction of knowledge and social order. In the environmental governance literature the term coproduction has various denotations. Firstly, it is used to signify collaborative processes in which various groups of actors produce knowledge together. Secondly, it is used to give expression to the idea that knowledge and social order do not come about separately but are produced together in social practices (Jasanoff, 2004). This latter notion of coproduction has, for instance, been employed to conceptualize adaptive governance initiatives as settings in which knowledge, social processes, and normative visions are produced together (Wyborn, 2015a). Furthermore, it has been applied in studying the interplay between knowledge and power that may occur in governance practices (Muñoz-Erickson, 2014). These examples illustrate that both adaptive governance practices and knowledge-power interactions in governance arrangements can be understood to be processes in which knowledge and social order are coproduced. In this sense, there may be

some overlap between the three conceptual approaches that I assign to the category of intertwinements.

The different approaches and strands of literature on knowledge-governance interactions that I outlined above can be interpreted in various ways. Firstly, they can be seen as different conceptual frameworks that may provide different ways of theorizing or reasoning about the relations between knowledge and governance. In this sense, they provide different interpretive lenses to investigate knowledge-governance interactions. Secondly, these different strands of literature suggest that environmental knowledge and governance may interact and be interrelated in highly diverse ways. In this thesis I intend to both reflect on ways of conceptualizing knowledge-governance relations and to gain insight into the diversity of such relations that may occur in practice.

1.3 CONTRIBUTION AND FOCUS OF THIS THESIS

In the Dutch Wadden Sea area and many other areas around the world, environmental governance arrangements have emerged in which governmental and non-governmental actors collaborate in managing the natural environment. Knowledge has been argued to be crucial for managing nature in a sustainable way. Yet, it may be difficult to fruitfully connect environmental knowledge and governance, for instance because of uncertainty, conflicting perspectives of involved actors, and the complexity of natural and political-administrative systems.

A first aim of this thesis is to gain understanding of the interactions between knowledge and governance that may occur in the emergence and operation of collaborative governance arrangements. From the literature on the relations between environmental knowledge and governance (see section 1.2) may be inferred that such interactions can be diverse. Little research has investigated the full scope and diversity of such interactions in collaborative governance arrangements. This thesis intends to contribute to the literature by producing insight into the plurality of interactions between knowledge and governance that may play a role in building collaborations between actors towards the sustainable management of natural resources. I assume that this plurality of interactions may include both divisions and intertwinements between knowledge and governance. Accordingly, in this thesis I do not choose one explicitly divisions- or intertwinements-oriented conceptual framework. Rather, I use a combination of concepts that enables me to identify and signify both the divisions and the intertwinements that may occur in the cases that I study.

A second aim of this thesis is to translate the findings on these interrelations into practical recommendations on how to enable well-informed governance arrangements. The latter term signifies arrangements that are able to produce, mobilize, and draw upon the knowledge that is needed for governing human-environment interactions in a sustainable way. With these recommendations, I aim to provide ideas that are relevant to current developments in the Wadden Sea area regarding the improvement of the knowledge infrastructure and the interactions between knowledge and management. Moreover, these recommendations may be relevant to other areas and settings in which improving the interactions between knowledge and governance is a matter of interest. The research questions that have guided my research in working towards these two aims are:

1. How do environmental knowledge and governance interact in the context of collaborative governance arrangements?
2. What recommendations for enabling well-informed governance arrangements can be derived from insight into such interactions?

The first research question will be further specified and addressed in chapters 2-5. Chapter 6 will provide main conclusions on knowledge-governance interactions, as well as recommendations on enabling well-informed governance arrangements.

1.4 KEY CONCEPTS

Four of the chapters in this thesis have come about as separate papers. They have been written with the main research questions provided above in mind, but they also each have their own internal logic. With this I mean that each paper addresses a particular question and uses a particular conceptual and analytical framework in doing so. My reasons for using such a case-specific approach, i.e. for refraining from using a single analytical framework for all papers, are the following. Firstly, a certain level of conceptual openness helps to avoid that the analysis of empirical materials becomes overly structured by preconceived categories; thus, it facilitates an in-depth understanding of the particularities of the various cases. Secondly, the avoidance of overly structuring preconceived categories and the adjustment of conceptual frameworks on a case-to-case basis provide favorable conditions for a learning process that is informed by both empirical research and the literature. As a consequence of this approach, the analytical frameworks that are used to analyze the cases shift from chapter to chapter. These shifts in part are motivated by the particularities of the

cases, and in part reflect progressing theoretical insight. That being said, this thesis does sustain a degree of conceptual stability in order to achieve comparability of the cases and the substantive coherence of the research as a whole. This section gives an overview of the key concepts that form the conceptual "backbone" of the thesis.

1.4.1 Knowledge

With respect to knowledge, the focus of this thesis lies on the environmental knowledge that may be relevant for utilizing, managing, or conserving the environment. Such knowledge encompasses the experiences, insights, and factual beliefs regarding the state of the natural environment, whether or not in relation to human activities (Haas, 1992; Corburn, 2003; Edelenbos et al., 2011). I assume that the knowledge that is potentially relevant for particular governance efforts may be held by any actor who has a role or stake in those efforts. Such actors may include scientists, consultants, policy-makers, conservationists, citizens, and representatives of societal groups and economic sectors. Furthermore, this may include both formal and informal manifestations of knowledge. The former for instance includes scientific reports, assessments, and monitoring efforts, the latter includes knowledge that is based on local and practical experience (Fabricius et al., 2006; Raymond et al., 2010; Giebels et al., 2015).

A key matter of interest in this thesis concerns the ways in which knowledge is embedded in social practices and settings, particularly in relation to governance. A central concept that is used to capture this embedment is that of the knowledge system, which is defined as a social system that combines a set of experiences, insights, and factual beliefs with particular ways of creating and mobilizing knowledge (Reid et al., 2006; O'Toole & Coffey, 2013; see also section 1.2.1). The concept of the knowledge system as I use it in this thesis does not impose strict dichotomies between forms of knowledge. Rather, it takes as its point of departure the idea that different knowledges, scientific or other, may co-exist in various configurations (Wynne, 1996). Moreover, this concept privileges neither primarily science-based nor other knowledge systems "in terms of producing true or good knowledge"; it is impartial towards different epistemologies (Watson-Verran & Turnbull, 1995: 136).

1.4.2 Governance

In this thesis the term environmental governance signifies the measures, institutions and processes of collective decision-making and action

that are deployed to protect the environment and resolve conflicts over natural resources (Paavola, 2007; Tacconi, 2011; Driessen et al., 2012). Furthermore, a key characteristic is that it involves a plurality of governmental and non-governmental actors, often in a participative or deliberative manner (Wallington et al., 2008; Klinke, 2012; Bixler, 2014).

A key matter of interest in this thesis is how governance efforts in particular domains stabilize and get organized. A central concept in this respect is the governance arrangement, which is defined as a temporary stabilization of the content and organization of a specific governance domain (Arts et al., 2006; Driessen et al., 2012). Governance arrangements may be characterized by different ways of governing; this variation is highlighted in terms of different "modes of governance" (Driessen et al., 2012). Such modes are particular ways in which governance arrangements are structured in terms of the division of roles and competences among actors. They include *centralized governance* in which national governments "take the lead", *decentralized governance* in which regional or local governments are in the lead, *interactive governance* in which governments and societal actors "collaborate on equal terms", and *self-governance* in which societal actors "enjoy far-reaching autonomy" (Driessen et al., 2012: 145, 148).

1.4.3 Coproduction

As a general interpretive framework for studying the interactions between knowledge and governance this thesis uses the notion of coproduction, in the sense of the combined construction of knowledge and social order (see section 1.2.2). Coproduction in this sense is "shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it" (Jasanoff, 2004: 2). From this perspective, "knowledge and its material embodiments are at once products of social work and constitutive of social life; society cannot function without knowledge any more than knowledge can exist without appropriate social supports" (Jasanoff, 2004: 2-3). Thus, knowledge and social order are understood to be mutually constitutive.

Research in the field of Science and Technology Studies indicates that this notion of coproduction provides a useful way of interpreting and analyzing the interactions between knowledge and social order that emerge in the context of practices of democratic engagement (Chilvers & Kearnes, 2015). However, how environmental governance can be understood in terms of the coproduction of knowledge and social order has received relatively little attention in the literature. One of the aims of this thesis

is to further explore the ways in which environmental governance can be understood in terms of the coproduction of knowledge and social order.

1.5 METHODOLOGICAL CONSIDERATIONS

The empirical part of this thesis encompasses three case studies of domains of coastal governance that are strongly, albeit not exclusively, related to the Dutch Wadden Sea. As a first step towards the selection of cases a broad investigation was made of issues and developments regarding the management of the Dutch Wadden Sea, which resulted in a long list of 14 candidate cases. These candidate cases were explored on the basis of sources such as newspaper articles, reports, and websites. Subsequently, I assessed which of the candidate cases appeared to best match the scope and aims of this research. The main criteria in making this assessment were the following. Firstly, I gave preference to cases in which conflicts between various groups of actors on the utilization and conservation of the Wadden Sea were manifest. Secondly, I decided to focus on cases in which knowledge-related issues such as confrontations between divergent knowledge systems appeared to play a role. Thirdly, I gave preference to cases in which a form of governance had emerged that aimed at dealing with these conflicts. Fourthly, I aimed at covering some of the breadth and variety of Wadden Sea governance through the selection of the cases. Therefore, I selected cases in different domains of human-environment interactions that on the basis of a first exploration appeared to be characterized by different modes of governance. These considerations resulted in the selection of the mussel fishery, recreational boating, and dynamic coastal engineering as cases.

In all three case studies, semi-structured interviews were a main method of data collection. I tried to interview as many actors as possible who were actively involved in the deliberations connected to the selected cases. These actors mainly include civil servants, researchers, and representatives of economic sectors, societal interest groups, and environmental protection NGOs. Candidate respondents were identified on the basis of both written sources and snowball sampling. The interview questions were fine-tuned for each case; however, all the interviews focused on a common set of main topics. These topics are: actors' perspectives on key issues regarding the case, interactions between the actors involved, the emergence and workings of governance arrangements, and the roles of knowledge in governance. The 69 interviews were recorded, transcribed verbatim, and analyzed on a case-to-case basis with software for qualitative data analysis (NVIVO 10). In all three cases I combined two coding strategies. Firstly,

I used setting-specific codes that were constructed on the basis of the issues that were brought up by the respondents; secondly, I used analytical codes that were based on the analytical frameworks that I operationalized for the various cases (Lofland et al., 2006). In the case studies on the mussel fishery and recreational boating I used focus groups as an additional data collection method. The set-up of the focus groups was based on the methods of the Reflexive Monitoring in Action approach (Van Mierlo et al., 2010). A more detailed description of these focus groups and their roles in the data collection is provided in the chapters concerned. Furthermore, as a validation mechanism I performed methodological triangulation in all three cases (Stake, 1995). For this triangulation I combined the interview and focus group data with written sources such as legal texts, agreements and covenants, policy reports, workshop and meeting reports, and research and evaluation reports.

1.6 OUTLINE OF THIS THESIS

Chapter 2 spotlights the mussel fishery in the Dutch Wadden Sea. It aims to answer the question how it is possible that a long-standing and often heated conflict between the mussel sector, nature conservation NGOs, and the Dutch government could be transformed into a collaborative transition process towards sustainable mussel fishery. In answering this question, it focuses on the interplay between knowledge creation, power, and rules; the latter include legal rules and collaborative agreements. Chapter 3 explores the case of recreational boating to investigate how changes towards interactive and participatory forms of governance may come about over the course of several decades. It analyzes such changes in terms of the interconnected shifts of governance modes and knowledge systems. The third case study, which is described in chapter 4, focuses on the domain of coastal engineering to investigate the tensions and synergies that may occur in joint knowledge creation for coastal governance. Such tensions and synergies may occur in efforts to simultaneously achieve scientific quality, relevance for decision-making, and legitimacy with respect to the concerns of stakeholders. Subsequently, chapter 5 aims to contribute to insight into the intertwinements of knowledge and governance by investigating the ways in which knowledge can be understood to be a constitutive element of environmental governance. In order to do so, it conceptualizes the various capacities that are needed to perform environmental governance in terms of the coproduction of knowledge, values, and social order. This framework of governance capacities is used to synthesize the findings of the three case studies. Finally, chapter 6 draws conclusions on the interac-

tions between environmental knowledge and governance, reflects on the theoretical frameworks used, and provides recommendations on how well-informed governance arrangements may be enabled.