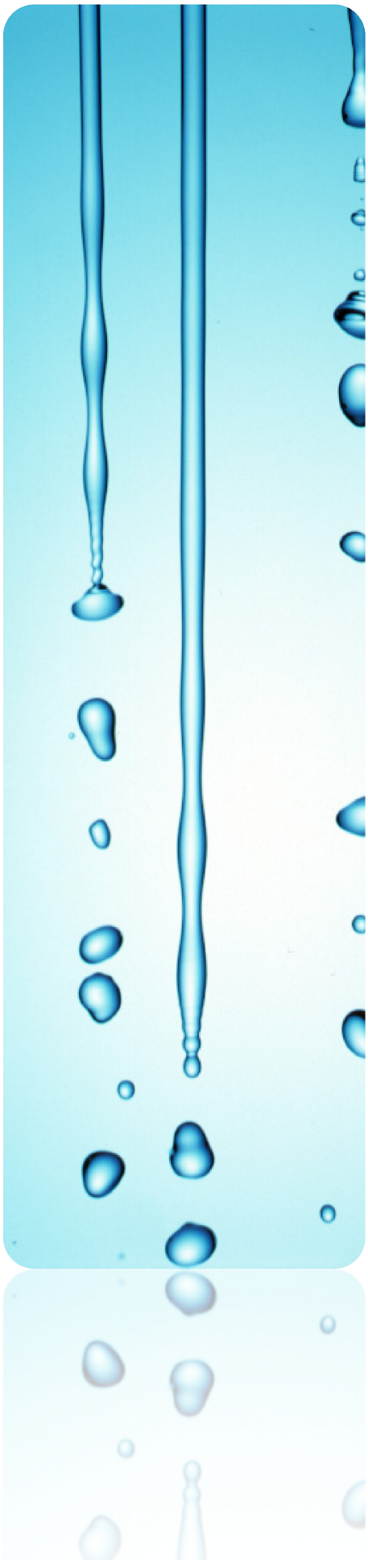

Assessing the Ecological Science-Policy Interface in River Basin Restoration

Lessons from the Meuse and the Rhine

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Preface

This is a thesis written for the Master Programme Sustainable Development at Utrecht University, where I started this master in 2009. Before that I studied at University College Utrecht, where I obtained my bachelor in environmental sciences, anthropology and human geography. Within the broader study of Sustainable Development, I chose the Environmental Policy and Management track. Within this track I am especially interested in ecology and river management, which is why I chose to do my master thesis on river basin management in Western Europe.

With the implementation of the Water Framework Directive the inclusion of ecology in the policy of the international bodies is safeguarded, however that does not mean that this guarantees the improvement of the ecological status of the rivers. With this research I hope to contribute to the already existing literature on science incorporation in policy, specifically for river basin management.

I would like to thank my supervisor CarelDieperink for his support and constructive feedback, without which this research would probably not have been complete. In doing my research I have conducted interviews with some members of both the Rhine and the Meuse Commission. I very much enjoyed talking to these key informants, who were in general incredibly enthusiastic, kind and helpful, without whom this research would not have been as insightful. Furthermore, I would like to thank my father for talking with me and helping me with my research, without which I would still be looking for a topic today. Moreover, I would also like to thank my mother for the hours which she put in reading this thesis, without which this thesis would not be nearly as readable. Lastly, I would like to thank my computer for not breaking down, crashing or deleting my hard disk; without which I would have no thesis at all.

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Summary

This research has investigated the conditions that promote or inhibit ecological knowledge incorporation in river basin restoration in the rivers of Western Europe. It focuses on two case studies, namely the river basin restoration of the rivers the Rhine and the Meuse. Conditions found in these case studies are confronted with conditions found in literature on the science-policy interface, political opportunity structures and scientific ecological knowledge.

Authors investigating the science-policy interface have found a gap between science and policy making. In the case of ecological knowledge in river basin management, it prevents optimal use of this science. As such policy is less capable of protecting biodiversity and ecosystem restoration in the river basin. This research looks at the conditions under which this gap is bridged and ecological knowledge is thus used effectively.

Literature research yielded a list of conditions, which were confronted with conditions identified by key informants from the Meuse and the Rhine regimes. On the basis of semi-structured interviews (based on the conditions from the literature), the informants indicated the relevance and whether the conditions are met for their respective river basin.

The successfulness of ecological knowledge incorporation is tested by using three indicators, namely the structure of the information flow through the regime, the documents published and the number of species monitored. Based on these indicators, the Rhine is found to be more successful in incorporating ecological knowledge into policy than the Meuse Commission.

Key conditions causing this difference are that in the Meuse regime consensus on scientific knowledge is not always reached before uniting the science and policy stream. Furthermore, no focusing events which have cause public opinion trends have taken place in the history of the Meuse regime. However, in both regimes the presence of resources is an important condition and the presence of a legal framework for the inclusion of ecological knowledge (Water Framework Directive).

Key words: Ecological Knowledge, Science-Policy Interface, River Basin Restoration, Meuse, Rhine

1.0 Introduction

1.1 Background

Science-Policy Interface

As a response to claims that many issues related to sustainable development call for a new type of knowledge generation for policy,interest in the Science-Policy Interface is increasing. Often a gap between the policy makers and the scientists investigating the subjects at hand exists (Heggeret *al*, 2010). Policy and science are two different areas with different principles, causing differences in time horizons, goals, means and evaluation structures (ibid; Breeet *al*, 2007). Many researchers point out that in researching the science-policy interface it is important to look at the different stages/situations of the policy problem at stake in order to identify what role science could play in this. Engels (2005) identifies different functions for science, depending on the policy problem at hand, for example 'scientific warning and awareness creation', which would come into play when a problem has not yet gained public awareness; or 'problem definition' when problems are fairly unstructured. In this research talking about the science-policy interface means talking about cooperation between science and policymakers. The difference between the science-policy interface and other areas of studies relating to science or policy making is that even though in the other study areas some collaboration might take place, in the literature on the science-policy interface there is an emphasis on the interaction that (should) take place.

Ecological Knowledge

Many different definitions of science exist, many involving some form of knowledge acquisition through scientific methods. Often people refer to observation and experimentation in order to explain a specific phenomenon; however, it can also be used to describe the organized body of knowledge that has been acquired through that system. In this research, the term 'science' has beenusedaccording to the same criteria as described above: scientific knowledge is knowledge acquired through a research process that is defined as such by other scientists (Heggeret *al*, 2010). Ecological knowledge specifically isthe knowledge type of knowledge relevant for this research. Ecology is a difficult field of research to understand for non-scientists, in this case policy makers, in the sense that the ideas about nature and restoration of nature that ecologists have frequently differ from the ideas that policy makers have (de Nooijet *al*, 2006). Often, when using ecological knowledge for policy, ecological indicators and thus (indirectly) key species are used. People who are not trained to be ecologists often argue that a specific type of plant or animal is 'natural' to a specific area and that the occurrence of that species contributes to restoring the natural state of the environment. Ecologists however recognize that there are many steady states in an ecosystem and the ecosystems have changed many times over the centuries without human intervention. Also, ecologists acknowledge that man-made ecosystems exist which may as wellhave an importance for biodiversity, and the conservation of these ecosystems may have an intrinsic value. Examples of such ecosystems are fen landscapes, heath ecosystems, but also inner-city sidewalks or pieces of land on the sides of roads or railways. Even more difficult is the fact that river basin ecosystems are often characterized by a dynamic nature. Therefore it is hard to talk about 'natural' states or restoration in an ecological context. Ecology as a science is important in providing the necessary knowledge of the anthropogenic effect on species and their habitats. There is a need for using ecological knowledge in legal instruments and decision-making concerned with nature protection. Gaining insight into the relation between policy making and decision-making is essential for the optimal implementation of nature conservation methods (Backes, 2004).

Political Opportunity Structures

Opportunities and constraints are put upon political actors by institutional arrangements and patterns in political powers. These arrangements, patterns and powers form the framework in which political action operates. These structures are often referred to as 'political opportunity structures' and represent the circumstances under which a specific political action can take place. Princen and Kerremans (2008) have looked at how groups on the outside of the political system gain access to actors within the political system, and as such how they can influence these actors. Political opportunity structures are widely used (implicitly or explicitly) in the processes they examine. They define political opportunity structures as the set of characteristics that an institution has, which determines the possibility of groups on the outside of this institution to influence the decision-making within the institution (Princen and Kerremans, 2008). In this research political opportunity structures

have been looked at from two perspectives. The first perspective is the endogenous perspective, in which a political opportunity structure is the outcome of processes in which interest groups play a role. The second perspective is the exogenous perspective in which opportunity structures are barriers fixed from the outside upon the interest groups. Both approaches are relevant in the sense that political actions have an effect upon political opportunity structures (endogenous) and political opportunity structures have an effect on political actions (exogenous). In this way there is a dialectic relationship between the interest group and the political opportunity structure (Wahlström and Peterson, 2006). Political opportunity structures are normally used in order to describe the emergence and decline of social movements. Here, political opportunity structures have been used in order to consider how scientists have (or have not)been able to influence policy making. Political Opportunity Structures are relevant to this in examining how claims to scientific or social-scientific knowledge become influential and uncontested, whereas others cause political or social conflict. Often policy networks use technical and scientific knowledge to narrow down the scope of practices and to build consensus around specific preferred policies. Especially authoritative knowledge (either from the social or natural sciences) is used by all kinds of agencies (governmental actors, economic actors or NGOs) to identify problems and preferred solutions in many policy areas (Herring and Roberts, 2006).

Epistemic Communities

Epistemic communities are networks comprised of experts or groups of experts who lay claim to knowledge that is relevant to the issue at hand. Within this community a set of beliefs and values is likely to develop over time. These likeminded experts can influence policy making by providing information on the policy issue at hand. Epistemic communities are important consideringthe gap between science and policy, because research on these communities has shown that science is not directly converted into policy. These epistemic communities play a role in translating science and making it acceptable to policy makers (Haas, 1992).

River basin restoration in Western Europe

From the moment a river originates somewhere to the point it ends in the sea, the whole river is actually one big interconnected system. It is fed by many streams along the way, and these streams are in turn fed by rain fall and/or melted ice. In order to understand all the interactions concerned with life in the river, it is important to regard the whole river basin. Rivers in Western Europe include Rhone, Loire, Tagus, Danube, Po, Thames, Rhine and the Meuse. Most of the big river basins of Western Europe have seen improvements in controlling flood risk and decreased pollution in the last decennium. However, measures taken in floodplains (in order to decrease flood risk) can, in some cases, have a negative effect on nature conservation in river management. The ambition of the European Union and the Commissions of the rivers for the upcoming years now also include the improvement of the ecological status of these basins (De Nooij, 2006).

The Role of Ecological Knowledge in River Basin Restoration

Most of the literature on the science-policy interface, river basin restoration, ecological knowledge use and production is rather fragmented. No clear causes or circumstances can be pointed out from the literature that can directly account for successful or failed incorporation of ecological knowledge in river basin restoration. Considering the available literature about the role that ecological knowledge can play in river basin restoration, it is clear that most of this literature is focused on whether tools from the ecological sciences should or should not be used for policy making. Examples of this include which models to use (Rekolainen*et al*, 2003; Mouton *et al*, 2009; Callisto*et al*, 2009), or whether a specific ecological model or strategy is effective (Lieth*et al*, 2006; Hedelin, 2007). Furthermore, most of the literature is focused on flood prevention or pollution abatement (Volk *et al*, 2008; Barceló, 2007; Slob *et al*, 2007; Freitas*et al*, 2009). Even though some research has been done on the role of scientific knowledge in river basin restoration, hardly any research can be found on ecological knowledge specifically. Literature concerning the science-policy interface, and frameworks to assess this isavailable (Hegger*et al*, 2010), however not with regards to river basis restoration or ecological knowledge. Furthermore, some literature about ecological knowledge in river basin restoration and models to increase its incorporation in the legislative and political system is available(De Nooij, 2006), and even though de Nooij focuses on the Meuse and the Rhine, his research dates from before the implementation of the Water Framework Directive and does not deal with ecological knowledge specifically.

1.2Knowledge Gap

The Commissions for the rivers and the European Union have -next to reducing flood risk and pollution- made the recovery and/or rehabilitation of the ecological state of the basins a priority. However, it is not clear where knowledge used in the ecological rehabilitation of the areas comes from, and what its relation to the main institutions within the EU and national frameworks is. The literature shows that often a gap exists between (ecological) knowledge and policymaking, which means that knowledge is not optimally used in designing policy for the rehabilitation of river basins. This is a fact, even though ecological knowledge is crucial to understanding ecosystems, which is in turn necessary to develop effective measures for river basin restoration. On the one hand the legislation and policy is set up too widely for ecologists to provide all the information necessary for lawmaking, and the ecologists in turn do not understand the legal framework in which their knowledge should operate. On the other hand the decision makers often do not pay enough attention to the complexity of ecological science and cannot fit the knowledge into their policy measures. In the case of the river basins of Western Europe it is not clear whether there exists such a gap between ecological scientists and policy makers at the national and regional level. However, the nature and existence of this gap is especially unclear at level of the commission (EU) on the regimes of the rivers.Thereforeit is useful to study the knowledge use and (co-)production in the science-policy interface in river basin restoration, to find out whether such 'miscommunications' between scientists and policy makers exists. In many instances a gap between ecological knowledge and policy making can be identified and it is not clear under which conditions this gap can be bridged. This research has tried to shed a light upon the conditions that can bridge the gap between (ecological) science and policy making.

1.3 Research Objective and Relevance

By investigating who provides the scientific (ecological) knowledge for the management of river basins in WesternEurope and when, where and how this knowledge is implemented, this research hopes to shed a light on the conditions under which ecological knowledge is used in the actual policy making, concerning the ecological status of the river basins. Having given an insight into the conditions, ecological knowledge may be more effectively used in policy making and as such may benefit the policies made for the basins. In turn this will hopefully lead to a more integrated policy which may profit the ecological status of the basin, increasing the biodiversity in these areas. The causes for this biodiversity loss are mainly anthropogenic pollution, habitat disappearance, fragmentation and exploitation of species. Policy making can provide administrative-legal protection for these areas, since biodiversity loss can lead to a loss in ecosystem goods and services (Netherlands Environmental Assessment Agency, 2008; Heywood and Watson, 2005). However, in order for policy making to be successful, ecological knowledge is necessary. Therefore an insight into the conditions under which this knowledge is used and (co-)produced is valuable to nature conservation in river basins, specifically biodiversity conservation.
The objective of the research program *Environmental governance for sustainable development* is to improve understanding of how and why modes of governance do or do not lead to sustainable outcomes (Universiteit Utrecht, 2010). Specifically, the research program aims to make a contribution by formulating recommendations about interventions that can potentially make governance outcomes more sustainable (ibid). Science plays an important role in making governance outcomes more sustainable, and this research contributes to the research program by shedding a light on the conditions under which ecological scientific knowledge is used and produced. This insight can then be used in order to promote incorporation of ecological science in policy and as such have a beneficial effect on biodiversity conservation in river basins.

1.4 Research Questions and Framework

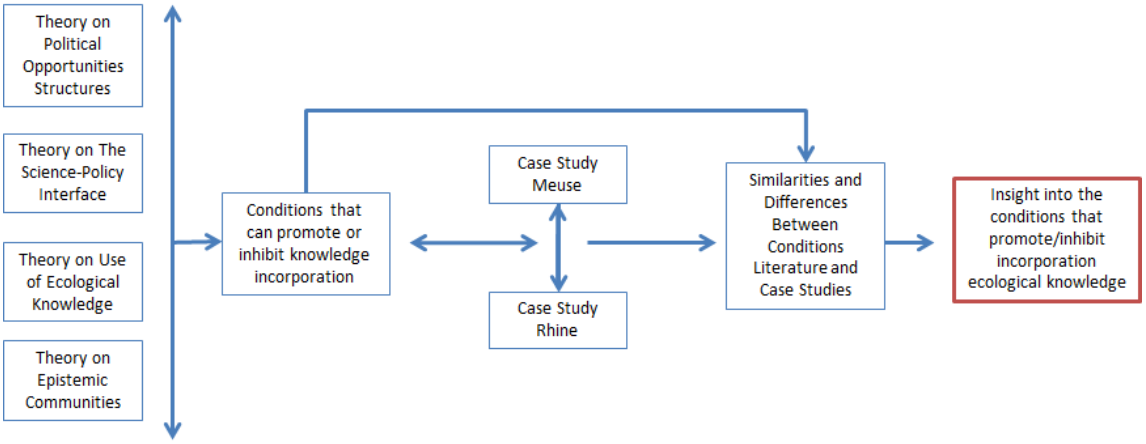
In order to realize the research objective the following central research question has been posed:

Central Research Question:

What are the conditions that promote or inhibit successful incorporation of ecological knowledge in policy making in the basins of big rivers in Western Europe?

Research Framework

In order find an answer to the above research question the framework as described below has been used:



First off, a literature search using theory on the science-policy interface, theory on the use of ecological knowledge in legislation and policy making, theory on political opportunity structures and theory on epistemic communities has been performed. This literature yields conditions under which ecological knowledge incorporation is promoted or inhibited. In order to determinewhether these conditions are likewise applicable to river basin management in Western Europe, two case studies have been done. The reason for choosing case studies is that the issue at hand is complex and needs an in depth, holistic study into the different actors and connections between actors. By having done two case studies with different institutional frameworks, one can hopefully determine to what extent the conditions under which ecological knowledge is incorporated differ or are alike. After comparing the two case studies with each other, this information has been confronted with the conditions found in the literature on political opportunity structures, the science-policy interface and the use of ecological knowledge. As such, this has hopefully yielded relevant conditions for incorporation of ecological knowledge in river basin management in Western Europe. This research is mainly testing the conditions from the literature with findings from key informants. However, it is also partly exploratory; as such key informants can also offer their own conditions, not included in the literature.

Case Study Motivation

The reason for looking at Western European Rivers has been that the institutional circumstances are fairly uniform in the sense that the European Union has a framework (the EU Water Framework Directive) which focuses on ecological recovery as well as on other elements of river basin management. It means that the rivers in Western Europe have an action plan on ecological recovery; however what the exact nature of this plan entails depends on the river in question. The Rhine and the Meuse have been the two case studied used to unravel the science-policy interface in river basin restoration. The river basins of these rivers are representative for other river basins due to the species and habitats that are situated in the basins of the Meuse and the Rhine. These are also present in other river basins in Western Europe and are often seriously threatened or have already disappeared. Furthermore, the Rhine regime is an older regime than that of the Meuse and has therefore been chosen. Lastly, the research has focused on the level of the river basin, due to the fact that a river basin is one ecological unit, whereas the river itself is only part of it.

Sub Questions:

1. What are conditions for promoting or inhibiting successful incorporation of scientific knowledge in policy for sustainability issues, as identified by other authors writing on political opportunity structures, the science –policy interface, the use of ecological knowledge in policy-making and epistemic communities?
2. What do the political structures in the regimes of the Rhine and the Meuse that are concerned with the production of policy concerning ecological rehabilitation look like and how have these developed?

3. What are the conditions for promoting or inhibiting successful incorporation of ecological knowledge in the river basins of the Meuse and the Rhine?
4. What are the main similarities and differences concerning these conditions between the Meuse and the Rhine, and how do they relate to the conditions identified in literature?

1.5 Methods

Sub questions

The first sub question is concerned with conditions for promoting or inhibiting success of scientific knowledge in policy making regarding sustainability issues as identified by other authors. In order to answer this question different theories have been studied, specifically those on the science-policy interface (Hegger*et al*, 2010) and political opportunity structures (Tarrow, 2001). Conditions found may relate to different types of issues, which may or may not have a relation to ecological knowledge in river basins (Haas, 1992; De Nooij*et al*, 2006). Furthermore attention has been paid to ecological knowledge by considering its use in policy making and legislation in nature restoration (de Nooij*et al*, 2006). Literature has been retrieved from sites such as Scopus and Omega and the University library. Selecting authors and articles has been done on the basis of which articles and books were most cited by other authors.

The second sub question deals with thedevelopment of the regimes of the Meuse and the Rhine, with regards to the production and use of ecological knowledge. The research for this sub question has primarily been desk research into the emergence of the two regimes; in order to do this different theories on regime emergence have been used (e.g. Hasenclever*et al*, 2004; Osherenko and Young, 1993). This sub question has yielded an overview of what the regimes look like, how they have emerged and what role (ecological) scientific knowledge has played in this (IMC, 2007; ICPR, 2009). Information on the regimes has been found on the respective websites of the Meuse and Rhine Commissions, furthermore theories on regime emergence have come from Scopus and Omega (also selected on basis of most cited).

The third sub question involved most of the field work, and has tried to identify the conditions that facilitate ecological knowledge use and production in the regimes of the Meuse and the Rhine. This sub question has also involved some desk research on the (current) structure and agencies of these regimes (IMC, 2007; ICPR, 2009), but most of the research consisted of conducting interviews with actors from either policy or science agencies in the regime of the Meuse and the Rhine. The first interviews were held with people from the Netherlands whohave played a role in these regimes. The method used to speak to other people in this network was snowballing. The questions were open and the interview was semi-structured.This structure was based on the conditions found in the second sub question, but left room for informants to offer their own input on conditions as well. Interviewees were asked whether they considered a specific condition relevant and whether they believed it had occurred in the history of the regime they are involved with. As such both presence and relevance of conditions from literature are discussed. Key informants for the Rhine Commission were Bob Dekker who is head of the Delegation for the Netherlands in the Rhine Commission; Eddy Lammens, who is a member of the Working Group Ecology and Expert Group Fish; Natalie Plum, who works at the secretary of the commission in Koblenz; Willem Mak, who is active in the expert group Fish and Monitoring; Tom Buijse, who has also been active in the expert group Fish, but is now external advisor. For the Meuse the key informants were Marc the Rooy, who is secretary of the Dutch Delegation in the Meuse Commission and has previously briefly worked in the Rhine Commission as well; Max Linsen, who is a member of the working group on the Water Framework Directive; and lastly Wendy Liefveld, who has worked for the RIZA (now Waterdienst) and who was active in the project group Ecology.
Sadly, the number of interviews held was limited by the difficulty and time it took to reach people still active in the Meuse Commission; this was easier for the Rhine Commission.

The fourth sub question discusses the main differences between the relevant conditions that were found in the literature, and the ones identified from the interviews and research of the two case studies. As such, relevant conditions for the incorporation of ecological knowledge in river basin restoration in Western Europe have been identified.

Report Structure

The first sub question is answered in Chapter 2, which shows the literature search per research field (Science-policy interface, Political Opportunity Structures, Ecological Knowledge and Epistemic

Communities). The second and third sub questions have been answered in Chapter 3 and 4. Chapter 3 discusses the Rhine Commission and conditions named by the interviewees related to ecological knowledge incorporation in the Rhine Commission. Chapter 4 does a similar thing with the Meuse Commission. The last sub question (four) is answered in Chapter 5, which compares the results of Chapters 3 and 4. The main question is answered in Chapter 6, together with a discussion of the found results.

2.0 Conditions for incorporation of knowledge; a literature review

2.1 Introduction

This chapter tries to uncover what the conditions are for promoting or inhibiting successful incorporation of scientific knowledge in other policy making for sustainability issues as identified by other authors. In order to answer this question different bodies of literature are examined; first of all literature on the science-policy interface, secondly, literature on political opportunity structures, furthermore, literature focusing on the use of ecological knowledge and lastly literature focusing on epistemic communities is discussed.

In the first paragraph the indicators for successful incorporation for ecological knowledge are discussed. Afterwards, the gap between science and policy is discussed and conditions for bridging this gap (and thus conditions for the incorporation of ecological knowledge into policy) are explained, according to literature by authors writing on the science-policy interface. In the third paragraph on political opportunity structures the definition of these structures and its relevance to research on the conditions for incorporation of ecological knowledge is explained. Afterwards conditions for successful incorporation of ecological knowledge in policy coming from this body of literature are discussed. In the third paragraph literature on ecological knowledge and its use is discussed, primarily highlighting the differences between ecology and other types of science, and the problems that are associated with the incorporation of specifically ecological knowledge. Then the conditions under which ecological knowledge is successfully used in policy are discussed. Lastly, literature on epistemic communities is examined, in this part the definition of epistemic communities is described and how and under what conditions epistemic communities can contribute to the successful incorporation of ecological knowledge into policy.

At the end of the chapter one can find an overview of the different conditions found in the four bodies of literature. These are divided into four categories, depending on the condition, rather than the body of literature the condition originated from. The four categories are science related, policy related, issue related and context related conditions.

2.2 Indicators for Ecological Knowledge Incorporation

When comparing regimes on how successful ecological knowledge is incorporated into policy in this research, three indicators are used. The first indicator is the structure of the information flow through the regime. This structure is evaluated by looking at the route the ecological knowledge needs to travel before it is (possibly) incorporated into policy. Ecological knowledge incorporation is more successful when the route that the knowledge is clear and straightforward. The length of the route (number of agents involved) is not necessarily a problem, a clear mandate for each of these agents is. The second indicator is the number of ecological publications by the Commission. Here, the absolute number is indicative of successful incorporation. However, also the type of document is important, as only different types of publications indicate that ecological knowledge is actually used. For example, only exploratory research, with no follow up on research on targets, means and effectiveness probably indicates that the research has not been used or noticed by policy makers. Lastly, the number of species and type of species monitored is an indicator for the successful incorporation of ecological knowledge. When more information is available on the ecosystem and its functioning, the importance of specific species is shown. When this importance is also clear to policy makers, chances are that this reflects in the number of species monitored and, indirectly, present in the system.

2.3Science-Policy Interface

Many authors writing on the science-policy interface have identified a gap between science and policy. These authors have suggested a variety of reasons for the existence of this gap. Most of them deal with the translation from science to policy and how during the translation different values, worldviews and objectives clash. Specifically, the following reasons have been identified: dialogue between science and policy agencies is lacking, scientific research cannot be easily translated into policy measures, there is no platform for scientists and policymakers to meet and insufficient structuring and coordination measuresare taken (Runhaar and van Nieuwaal, 2010; Quevauviller, 2005). The reason for the difficulties with translating scientific research into policy measures is the differences in time horizon, goals, process cycles, evaluation structures, and vocabulary (Hegger*et al*, 2010; Bree*et al*, 2007). Furthermore, without sufficient dialogue between science and policy, one can see that scientific

knowledge is often used in a different way than was intended by the scientist. However, on the other hand, the scientific knowledge produced is not always appropriate to what actors in the policy domain want (or need) to know (ibid, Raadgever*et al*, 2008). One important aspect and example of this is scientific uncertainty. Whereas scientists are often familiar with scientific uncertainty, policy actors and the wider public may seek certain and deterministic knowledge (Bradshaw and Borchers, 2000).

Conditions

This leads us to what conditions can be attributed to aiding the bridging of the gap between science and policy. Authors writing on the science policy interface have suggested many different types of conditions. These conditions can roughly be divided into three categories. The first category is solutions dealing with improving the science in order to fit policy (these authors try to answer the question: how can science be relevant for policy?). The second category is focused on the type of problem at hand (what is the influence of the topic at hand on the science-policy interface?). The third category focuses on the framework in which policy operates (how can science be better adopted by policy makers?).

Relevant Science for Policy

Elements in this first category exist of two elements, on the one hand the knowledge gathered must be scientifically sound. On the other hand, it is equallyimportant that stakeholders can trust and accept this knowledge (Runhaar and van Nieuwaal, 2010). Resulting from the problems causing the science-policy gap and the aforementioned two elements, a few logical recommendations can be made to make science relevant for policy: first of all knowledge should be gained through a scientifically sound way. Secondly, within scientific knowledge publications scientists should actively seek to incorporate policy options. Furthermore, the research should be widely set up in focus. Lastly, in order to make stakeholders trust and accept scientific knowledge, research should be done by trusted scientist, stakeholders should be involved and the process of science should be transparent (ibid, 2010; Willems and De Lange, 2007).

The Type of Problem

Another category of proposing solutions for bridging the gap between science and policy is the nature of the policy problem. Turnhout*et al* (2007) have found that if all the participating actors have or develop a shared understanding of the nature of the policy problem and the type of results that they are expecting, then this will benefit the co-production process, and in turn the bridging of the gap between science and policy. Problems can have different kinds of structures that influence the working of the science policy interface. When problems are well-structured it is possible to work on solving issues, when problems are moderately structured the scientists can provide knowledge as arguments for one or the other policy options. However, when problems are unstructured or badly structured it is not clear what purpose scientific knowledge can play. The most important thing in that case is to reach a consensus on the goals and means between the policy actors and scientific actors (Hegger, 2010).

Framework of Policy

In this category many contextual and policy factors are covered that can contribute to the incorporation of ecological knowledge into policy. Runhaar and Nieuwaal (2010) emphasize the importance of taking a broad perspective on the policy-science interface, in the sense that one should not only look from the perspective of the scientists and science. Even though this is an importantpoint of view, policy aspects and the political context are equally important. They have shown this in the case of cockle fisheries and gas mining in the Wadden Sea (ibid). One important factor, especially when interests diverge, is the inclusion of all the important stakeholders. However, the importance of not only the inclusion of actors with a direct stake or responsibility in the outcome or process, but also actors that have a bridging function are often ignored. These actors can play an important role in the integration of science into policy. Other conditions as identified by Runhaar and Nieuwaal (2010) are the legal framework (and whether it requires the policy makers to conduct an environmental assessment or not), the arrangement of research in relation to decision making procedures, determination of the scope of the environmental research and stakeholder involvement and the availability of enough resources for research.

2.4Political Opportunity Structures

Political opportunity structures are patterns and arrangements that are both imposed upon and created by political actors and which determine the framework in which political action operates. Political opportunity structures are the set of characteristics which determine the possibility of groups outside of an institution to influence the decision making within this institution (Princen and Kerremans, 2008). In this case the issue is the conditions under which scientists (group on the outside of the institution) are able to influence the policy makers (inside institution). Usually, political opportunity structures are used to describe the emergence and decline of social movements; however these structures can also be used to (partly) explain why some claims to (social-) scientific knowledge become influential and others cause political or social conflict. One of the reasons for this is that policy makers use scientific knowledge to narrow down the scope of practices and to build consensus around specific policies (Herring and Roberts, 2006).

Conditions

Political Opportunity Structures are specific to different locations and vary from time to time; the structures can be characterized in their degree of openness (the possibility of outside groups to influence the institution). Furthermore a political opportunity structure can be described in terms of how strong the political entity is in producing policy making (Wählstrom and Peterson, 2006). Most of the literature on political opportunity structures deals with the structure of the political institution at play; therefore some authors have proposed to include cultural aspects in the termpolitical opportunity structure. However, they have been heavily opposed by authors claiming that it would make the concept too broad and that the term would lose its analytical touch (ibid, 1996). Wählstrom and Peterson (2006) propose a different type of model for political opportunity structures which in effect includes this cultural aspect, and gives us three types of structures, namely: cultural, political and economic structures. These structures can all have an effect on whether an outside group gets access to an institution and as such can influence input and output of this institution.Wählstrom and Peterson (2006) divide the term political opportunity structure into these three separate terms, which allow for cultural aspects to be taken into account, but still keep the terms analytically sharp. This leaves us with three types of structures: SOS (state opportunity structures), COS (cultural opportunity structures) and EOS (economic opportunity structures).

The conditions that are thus identified by various scholars writing on political opportunity structures are not as easily identified in different situations, as these structures differ over time and space. Especially when using the three different types of opportunity structures (state, cultural and economic), it is difficultto take into account the interactions and relationships between institutions in these domains and their effectsas well. However, this research considers scientists as being a group on the outside, and triesto identify what structures (either state, cultural or economic) can promote or inhibit their access to policy making. Authors writing aboutpolitical opportunity structures identify several aspects, which determine the openness and strength of a political opportunity structure, i.e. how much influence an outside institution can have on the input and output of the political process.

The first aspect is the degree of closeness or openness of the political system, i.e. what the receptiveness of the institution to outside groups and ideas is. The second element is the stability of the underlying elite alignments in the political arena, the more divided the elites are, the more chance exists that a specific (scientific) idea is picked up by one or the other side. A third element is the existence of allies from the outside groups within these elites,access can increase if members of the elite have a connection is some way or another to the subject at hand. This depends largely on the personal preferences of the government officials. The fourth element is the institution's tendency and capacity for repression, the more this tendency occurs, the more difficult it becomes for outside groups to influence the institution (McAdam, 1996). A fifth element is the public opinion trends that may put focus on the subject that the outside group (in this case the scientists) also deal with. In turn increased public attention may lead to more attention within the political system for this subject. The sixth element is the occurrence of focusing events, i.e. events that can shift the attention of the public and the political institution from one subject to another (Princen and Kerremans, 2008). The last element is the relative independence and authority of the legal system (Wählstrom and Peterson, 2006).

2.5Ecological Knowledge

Many of the issues that have been named to cause the gap between science and policy are also applicable for ecological science and policy for ecological restoration specifically. The main problems

as identified by de Nooij*et al* (2010) are the differences in the definition of biodiversity, the focus of legislation on the individual, provisions for prohibition (e.g. for building) are limited in an ecological sense and other problems where there is a mismatch between the ecological knowledge on the one hand and policy and legislation on the other.

One of the problems associated with incorporating ecological knowledge into policy is the different approaches of the term biodiversity. One of the biggest problems in river systems is the decline of compositional, structural and functional biodiversity due to anthropogenic influence. The two different approaches relevant to this research are the ecological-scientific and the political-legal approach. The ecological-scientific approach tries to objectively investigate the biosphere and interaction taking place in the biosphere. Within the political-legal approach biodiversity represents ecological, economic and social values; conservation of biodiversity is therefore an activity that results from assignment of values by humans. Biodiversity cannot be quantified, only certain aspects are quantifiable. Within the ecological-scientific perspective biodiversity is divided into three different types (composition, structure and functional) of which compositional and structural diversity are the ones that are quantified. This can be done by studying the abundance of species, focal species (also called key-stone species), indicator species or umbrella species. However, often it is highly contested within research what species are to be used and whether this species is a good measure of biodiversity. Structural biodiversity is determined by examining the heterogeneity in the landscapes and ecosystem. In the political-legal approach a number of species is selected and is given a legal status, within this process simplification often takes place. But not only the term biodiversity differs between policy makers and ecological scientists, other terms that are associated with ecology often fit poorly into policy or legislation. These terms (e.g. 'natural habitat' and 'favorable conservation status') cause conflicts between the legal and ecological conceptual framework, and are caused by the same reasons as stated earlier in this chapter on the causes for the science-policy gap (van den Brink *et al*, 1996). Furthermore, on the one hand policy and legislation areso widely set-up that ecological science has difficulties providing all the information that is needed. On the other hand, the way in which species and conservation are approached by policy makers is too narrow (De Nooij, *et al*, 2010). Furthermore, knowledge of the legal framework and policy processes is often lackingamongst ecological scientists. The quality of the ecological data is another problem; the knowledge on abundance of species is often limited, as is the exact impact of anthropogenic processes and the fact that no unambiguous method exists for doing environmental impact assessments (Bakes, 2004).

Conditions

Some conditions, i.e. ways to overcome these problems have been mentioned. First of all there is the necessity to restrict the species selection. Due to the complexity of ecological sciences it is not possible to implement measures on all the species occurring in the Netherlands or incorporating all the relevant ecological aspects of all ecosystems within policy. Having toconsider too many aspects will result in an overly complex legal system. Furthermore, when making these choices, policy makers should try to account for the uncertainty inherent in ecological science.
Secondly, policy makers should take the different kinds of biodiversity into account (compositional, functional and structural) and step away from the focus on compositional biodiversity (the number of species in an area). Also, key geological processes can influence biodiversity and should be included into the policy and therefore be heeded by policy makers.

2.6 Epistemic Communities

Some conditions for the incorporation of scientific knowledge in policy are proposed by scholars writing on epistemic communities. Epistemic communities are networks that consist of experts or groups that make claims on the knowledge relevant for the issue at hand. Within these communities there is likely to be a set of common beliefs of shared notions of validity. An epistemic community can influence state interest and/or policy making by providing information on the causes and effects, help to frame issues, shed a light on the interactions in nature and help to formulate policies (Haas, 1992).

As was also noticed by the scholars writing on political opportunity structures, often science is not objective, even though scientists strive to be as objective as possible. It also cannot be unmediated; scientists themselves are often part of a broader cultural discourse. As such they are influenced by their environment, beliefs, practices and language. Furthermore, they are part of a scientific discourse as well, which has its own sets of beliefs and values, thus excluding certain other forms considered 'science' by some (e.g. traditional medicine). However, in this research the definition given to science in the first chapter (1.1, Hegger*et al*, 2010) specifically excludes any forms of 'science' outside the

scientific discourse. This discourse is also one of the reasons for scientist to form (epistemic) communities, as they have shared ideas and values. Whereas science used to be seen as objective and neutral, it is clear that nowadays science has become politicized, and thus truth claims are politically suspect. However, for science to be incorporated into policy it is important that science is developed independently, authoritatively and accurately. Political meddling into the process of knowledge development can decrease the acceptability of the knowledge production (Haas, 2011).

Conditions

Knowledge must be 'usable' (Haas, 2011), meaning that it must be accurate, accessible and contribute to the achievement of collective goals. Furthermore it must represent consensus and be provided through a medium that is politically acceptable. Constructivist research on policy analysis suggests that science must be developed authoritatively, with which in Europe one often means doctors, scientists and engineers as being the most highly valued professions in science. An epistemic community is often comprised of like-minded people from these professions. Because science must be as autonomous and independent as possible for it to have the greatest influence (Andresen *et al,* 2000), epistemic communities can build consensus in isolation, thus building value and integrity. Epistemic communities can increase their measure of value, integrity and accuracy if: the members from this epistemic community are not chosen by governments but by international organizations and if they are individuals who are known as active researchers rather than policy advocates or science administrators. Furthermore accuracy can be reached through peer review, interdisciplinary research teams and independency from funding sources, concretely to make sure that not one national institution provides funds or research. Knowledge development should be free of political interference. Moreover, it is important that the experts in epistemic communities are experts in their field, but are also able to talk to experts from other disciplines. Furthermore, professional outlets should be organized (e.g. conference) so the knowledge gained by the epistemic communities can be displayed. Time should be made to familiarize policy makers with the scientific knowledge gained for incorporation of knowledge into legislation and policy. The use of scientific knowledge can be increased through the occurrence of shocks and crises. However, even if momentum is not naturally maintained, projects should be continued in order to keep the community existing. On a broader scale, it is important to only unite the streams of policy and science after consensus has been achieved. Overall it may be useful to separate the processes in the epistemic community from policy activities and debates as much as possible (Haas, 2011).

2.7 Conditions for the Incorporation of Ecological Knowledge into Policy

Some of the conditions identified in this chapter are mentioned by several different authors writing in different areas. Other conditions have only been mentioned by authors from one stream of literature. Below they are grouped in four different types of conditions.

Table 1.Conditions for the Incorporation of Ecological Knowledge into Policy

Categories	Chances for incorporation ecological knowledge are bigger when..
Science Related (Conditions related to the form, content or source of the science used)	..Knowledge is scientifically sound
	..Knowledge is trustworthy
	..Scientists actively incorporate policy options in research
	..Science is transparent
	..Research is widely set up in focus and interdisciplinary in nature
	..Science is autonomous from national interests and political debates
	..Consensus in epistemic community is reached before uniting science and policy streams
	..Scientists are experts in their fields, but are able to communicate with scientists from other disciplines
	..Peer review is applied
	..Epistemic communities have more than one sponsor, not all from the same country
	..Scientists are chosen by international institutions rather than governments
Policy Related (Conditions related to	..There is consensus on goals and means
	..The legal framework incorporates need to use scientific knowledge
	..Alignment of research in relation to decision making procedures takes place

the policy framework and actors)	..Enough resources are available
	..Maximal openness of the institutionalized political system occurs
	..Little to no stability in elite alignments in polity is the case
	..Allies within elites exist
	..Stakeholders are involved in the process
	..Stakeholders without direct power or interest are also included
	..There is no tendency and capacity for repression within the institution
	..Time to familiarize policy makers with scientific knowledge is available
	..Policy makers are aware of inherent uncertainty in science
	..Policy makers are aware of different types of biodiversity
	..Policy makers are aware of influence of geological processes
	..There is a restricted species selection in policy
Issue Related (Conditions related to the characteristics of the issue at stake)	..The type of science used is adapted depending on whether the problem is structured or unstructured.
	..Stakeholders have shared understanding of the consequences of a structured/unstructured problem
Context Related (Conditions related to the historical, political and economic context)	..Public opinion trends favor specific scientific knowledge claims
	..Focusing events occur
	..The authority of the legal system is relatively independent

3.0 The Rhine Case Study

3.1 Introduction

The Rhine is a river of over 1200 kilometers long, originating in the Gotthard Massif in Switzerland. From Switzerland it flows through Liechtenstein, Austria, Germany, France and the Netherlands, to end in the Dutch North Sea near Rotterdam. In total there are nine countries dependent on the river Rhine (riparian states) next to the countries the Rhine flows through (mentioned above) Italy, Belgium and Luxembourg are considered riparian states. Twenty million people depend on the Rhine for drinking water (Hofstra, 2010). In this chapter the structure of the Rhine Regime is discussed, answering two of the sub questions. This chapter will shed a light on the political structures dealing with production of policy concerning ecological rehabilitation in the regime of the Rhine and their development.Furthermore, the conditions for promoting or inhibiting successful incorporation of ecological knowledge in the river basin of the Rhine are discussed. These questions are answered by first examining the creation and development of the Rhine regime. Secondly, the route that ecological knowledge has to travel to be incorporated in Rhine Commission policy is shown and elaborated upon, this is done with the use of an example (i.e. re-introduction of salmonoid species in the Rhine). Furthermore, the research investigates the publications by the Rhine Commission dealing with ecological policy to show what kind of contribution scientists have had. Lastly the conditions for promotion or inhibition of successful incorporation of ecological knowledge in the river basin of the Rhine according the interviews held with the key informants of the Rhine Commission. First the conditions found in Chapter two are contrasted with the view of informants; later the conditions informants identified next to the conditions from the literature are discussed. Informants will discuss both the relevance and presence of conditions from the literature and conditions.

3.2 Regime Development

The Rhine regime can be classified in several stages, the first cooperation concerning the Rhine was already taking place in the 1800s, and this cooperation was primarily concerned with shipping and transportation on the River Rhine. The second phase occurred after World War II, due to concern over the water quality with regards to drinking water, leading to more international cooperation. This led to the establishment of the International Commission for the Protection of the Rhine in 1950, which was ratified in 1963 (Treaty of Bern) (Dieperink, 1998). Conventions were held and especially the chloride levels in the river Rhine were a major concern for the countries depending on the Rhine for drinking water. The other treaty that has been ratified is the Rhine Chloride Treaty, which was designed to reduce the levels of salt discharged in the Rhine. The third phase started after a major fire broke out and the extinguishing water washed into the Rhine, containing pesticides (Sandoz Incident). This gave the Rhine ministers incentive to adopt the Rhine action program in 1987 (Hofstra, 2010). The Rhine action program included guarantees on drinking water, reduction of contamination, construction of basins to store fire extinction water, warning systems and ecological rehabilitation. At present the legal basis for the Commission is the ‘Rhine Convention’ signed in 1999 in Bern; which meant a broadening of the mandate and responsibilities of the Commission. This phase is the current and fourth phase of the regime development. In this stage of expansion, the Water Framework Directive has come into play and has been incorporated in the goals and statements of the Rhine Commission.

Ecology and Regime Development

The first step to ecological recovery was made with the Rhine Action Program, in this program there was also room for improvement of ecological values in the Rhine River. One of the focusing points of the program was the return of the salmon to the Rhine. In order to achieve this, water quality had to improve and physical barriers for the salmon to trek up the river were removed or circumvented (Frijnters and Leenvaart, 2003).

With the Rhine Convention and the implementation of the Water Framework Directive the focus is directed more generallyto ecological recovery and improvement of water quality and not on the water quantity and flood prevention. Furthermore, a broader view is taken on ecological recovery, going further than the Rhine Action Plan. The action plan that incorporates the Water Framework Directive also incorporates the EU directive on prevention of flooding and is called Rhine 2020. As the name suggests, the targets it sets itself should have been achieved by the year 2020. Next to the return of the salmon, the action plan also focuses on the connection and creation of biotopes. The Water Framework Directive may be useful in coordinating the national plans with the overall plans of the European Union and Rhine Commission. One of the issues with ecological recovery in the Rhine

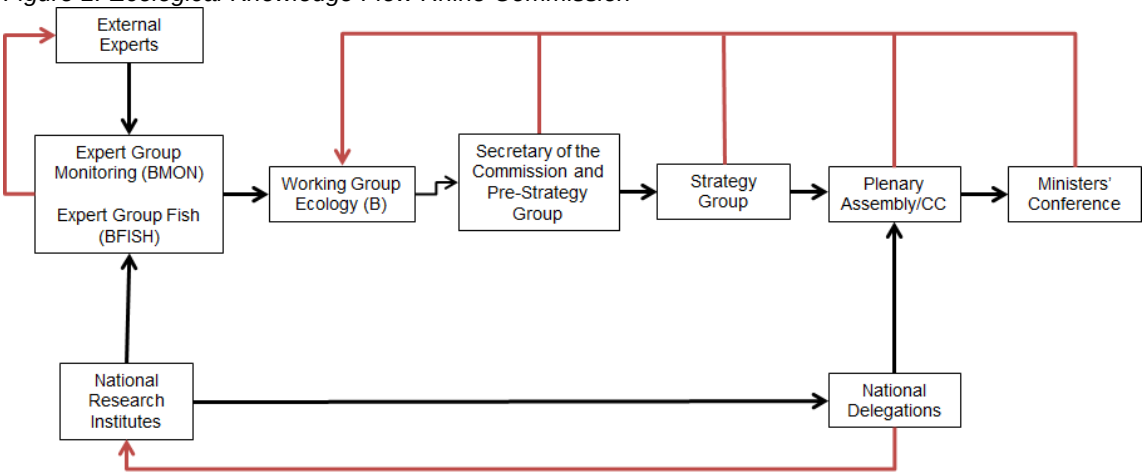
Action Program was that every country had a different interpretation of the plans (varying in the decree of ambition) (Nienhuis*et al*, 2002).

Ecological Policy Making in the Rhine Commission

The interests and power involved in the Rhine issue are skewed. Thee downstream countries (e.g. The Netherlands) are most effected by both pollution and flooding, whereas they are most reliant on the water of the Rhine for drinking.

Within the Rhine Commission there are several relevant levels when talking about the transfer of ecological knowledge. Even though the general structure that is used is not only applicable to ecological knowledge, only the agencies relevant to ecological knowledge incorporation are included in figure 1. The transferring of ecological knowledge is a two-way process: on the one hand the higher levels can ask the lower levels for input on a specific plan or idea. On the other hand the higher levels discuss what issues could not be resolved in the lower levels as can be seen in the figure below.

Figure 1: Ecological Knowledge Flow Rhine Commission



On the first level one can find the expert groups that consist of scientists from the national institutions of the member states. In case of the Rhine there are two expert groups, one in the field ofmonitoring and one in the field offish. These expert groups consist of, as the name suggests, people who are considered experts in their specific field of knowledge. In general these experts have a university degree and work at the national government institutes. They may also have other functions within the Rhine Commission; they can work in other expert groups, but can also have a function on higher levels of the Commission (such as the working group, strategy group or plenary assembly). Any issues that are still under discussion after the expert group has met are to be discussed in the working group for ecology. The people in this group are mostly experts with knowledge of both ecological research and experience with policy making.

Recommendations that are made and issues on which no consensus has been reached then go on to the pre-strategy group. Together with the Secretary of the Commission, this group prepares the topics of discussion for the strategy group.This group consists primarily of people who are concerned with making policy and have experience with politics Most of the members are policy makers, but this group consists also of the presidents of the working group(s). In the strategy group the unresolved issues from the working group and pre-strategy group are discussed. The members of the strategy group are as wellmostly (experienced) policy makers, andthe heads of the working groups are again included in the group. The strategy group prepares the documents and topics of discussion for the

plenary assembly and discusses and prepares the mandates of the working groups for the plenary assembly.

The next level where the last unresolved issues are discussed is the plenary assembly, of which the members are the delegations of the nine different countries. On this level hardly any members have knowledge or a background in ecology. If expertise is needed to support arguments in the meeting of the plenary assembly, expert employees of the national institutes are guest speakers for the different countries. So, next to requesting information from the expert groups and working group, it is also possible for the delegation to request information from their respective national research institutions. Whichever of the two is used depends on the issue at hand, in general if it is something that the delegation of a country wants to put on the agenda or something controversial,then research is directly requested from the national institutions. If this is not the case then a general request from the plenary assembly to the working groups and expert groups is made. In principle the general assembly resolves any remaining issues coming from the lower levels. Furthermoreit has the power to adopt the mandates for the working groups. However, if there are any issues that cannot be resolved within the plenary assembly or if a completely new plan (like the 'masterplan on migratory fish' in 2010 or 'salmon 2000') has to be adopted, which requires significant effort from the member state countries, the bi-annual minister's conference has the final say. In this meeting only politicians are present (ministers from the member states) and they discuss only the most contested issues (Frijnters and Leenvaart, 2003).

3.3 Ecological Debate in the Rhine Commission

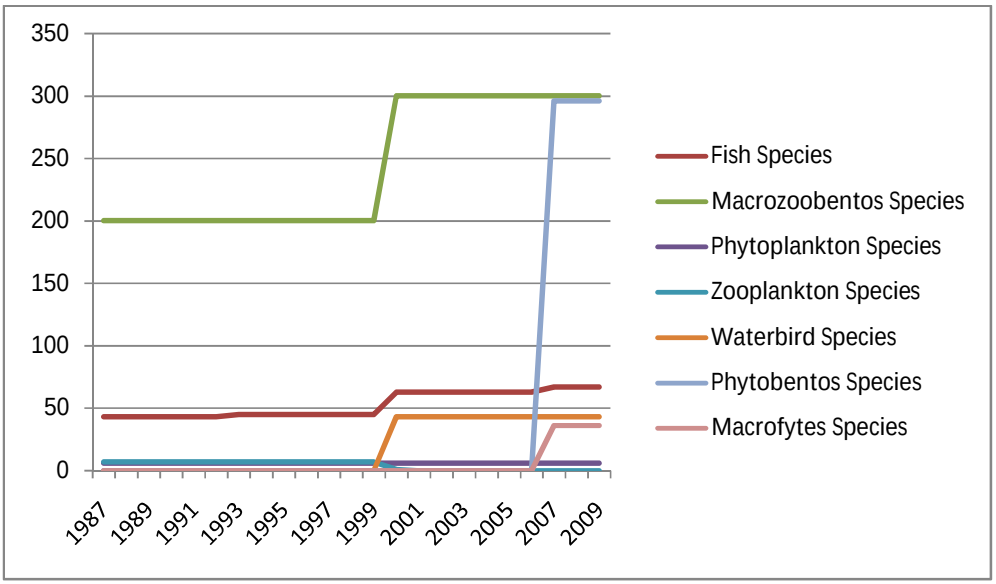
Table 2. Ecological Publications Rhine Commission 1987-2010

	total	Inventory	Target	Effectiveness	Means	Monitoring
1987	3	2	3			
1988	1			1		
1989	1	1	1		1	
1990	1		1			
1991	3	1	2	1	1	
1992	1			1		
1993	2	1	1	2	1	
1994	3		1	3	1	
1995	1			1		1
1996	3			3		2
1997						
1998	3		1	2		
1999	2			2		2
2000	2			2		2
2001	2		2		2	
2002	6	2	1	5	1	5
2003	2		1	1	1	1
2004	3	1		3		1
2005	1			1		1
2006	2			2		2
2007	6		1	5		6
2008	1		1	1	1	1
2009	4			3	2	2

Aboveis an overview in a table of how the ecological debate within the commission has developed. The various rapports published since 1987 arecategorized by type of document. The first column represents the total amount of rapports published in that year. The documents can have different functions (sometimes more than one), which are categorized as following: (1) making an *inventory* of ecological conditions present; (2) setting *targets* for the Commission to realize; (3) assessing the *effectiveness* of past measures; (4) proposing *means* to reach the targets set by the Commission; (5) *monitoring* species and number of species.

As one can see the sheer amount of documents published on ecological matters has increased over the time period 1987-2010. In the early stages one can see that inventory is one of the most prominent functions of these documents. The current amount of species, numbers and other biological qualities are examined before setting new targets etc. One can see that this happened in the years 1987-1993, but also around 2000. This last peak is due to the introduction of a new management plan after the conclusion of the Rhine Action Program/Salmon 2000. After taking stock, targets are set for the Rhine Commission to achieve. Here one can see an increase of the function target setting in the early period after 1987, around 2000 with the introduction of Salmon 2020 and the introduction of the Ecological Master Plan around 2007. In 2007, new targets for the Salmon 2020 plan were set. After the Commission has identified their targets they select the means and measures to achieve these targets. After identifying the means one can see that monitoring takes place, together with monitoring (but not always) evaluation of effectiveness of measures takes place.

Graph 1: Monitoring of number of Species in the Rhine 1987-2009



The graph above shows the number of species measured in the Rhine Basin between 1987 and 2009. One can see that in 1987 only macrozoöbentos, fish, zooplankton and phytoplankton are species measured. At the evaluation of the Salmon 2000 one can see an increase in the number of fish and macrozoöbentos species measured. Furthermore, in that year water birds were first monitored as well. Later, the commission also included phytobentos and macrofytes species to be measured.

3.4 Salmonoid Species in the Rhine

The Salmon plan officially appeared in the Rhine Action Program of 1987, however it had first to be pitched by someone in order to be included in this. This was done by the Dutch Minister present at the Minister's Conference following the Sandoz Incident in 1986. Minister NeelieKroes suggested the reintroduction of the Salmon in order to increase the ecological quality of the river Rhine. This was in turn suggested to her by the National Research Institution of the Netherlands, which was at that time called the RIZA. The RIZA relayed the idea to the Dutch Minister of the Public Works Department, NeelieKroes. Once this idea was pitched in the Minister's Conference the national research institutions of the different countries were instructed by the delegations to research the implications of this proposal. In 1986 the delegation leaders met in Rotterdam to prepare for the introduction of the Rhine Action Program; here this idea of reintroducing the Salmon was discussed among the delegations. The implication of this reintroduction was then further investigated by the national research institutes, and also by the project group working on the preparation of the Rhine Action Program. Then at the Minister's Conference in 1987 it was decided that native migratory fish (like the Salmon) should have returned by the year 2000 in the Rhine. In order to effectively do research on the Salmon and what was needed for it to return for the Rhine the (at that point temporary) working group on ecology was established; it was an expert group and reported to the working group dedicated to monitoring. It focused at that point primarily on fish and what conditions were necessary for the Salmon and other

migratory fish to return to the Rhine (e.g. physical barriers, spawning grounds, water quality). However, the expert group does not always do all the research by itself, often external parties are hired to do either research into subjects that the expert group has no expertise or for which there is no time or opportunity to have it executed by the expert group. This outside party is often connected to a university from one of the member states; the discussion and decision on the hiring of an external party is done by the working group, pre strategy group or strategy group (depending on the degree of controversy of the decision). When the commission added the reintroduction of migratory fish to its target, it became important to monitor progress as well. Not only monitoring of these fish should take place, also other parameters should be measured (in this case primarily water quality and monitoring of other organisms in the Rhine). In order to create a measuring network the working group on monitoring was instructed to include biological indicators to their measuring network. It focused on what species should be monitored, with what frequency and where. At first, together with the migratory fish species only macrozoöbentos and two types of plankton were monitored. After the conclusion of Salmon 2000 three other groups of organisms were permanently added to the monitoring network: water birds, macrophytes and phytobentos. One of the species of plankton (zooplankton) was not monitored anymore though. The reason for both the adding and dismissal of these species is the introduction of the Water Framework Directive, which required measuring of macrophytes and phytobentos, but not zooplankton. At that point in time the organizational structure of the committee was reshuffled by making ecology a permanent working group and in charge of two expert groups: one on monitoring and one for fish. At the conclusion of the Salmon 2000 program, monitoring showed that 180 adult salmon had been able to return to their spawning grounds. Even though this was deemed an improvement and promising, new targets had to be set as a population of 180 salmon is not sustainable without human intervention (InternationaleCommissieterBescherming van de Rijn, 2002). This was concluded after an external research done by a German fish expert hired by the Rhine Commission. This prompted the design of the Salmon 2020, in which the target is explicitly set at creating a sustainable population of Salmon and making the Rhine accessible up to Basel. Next to this, the Salmon 2020 also aims to decrease the number of exotic species in the Rhine and aims for the return of the last missing indigenous migratory fish.

3.5 Relevance and Presence of Science RelatedSuccess Conditions in the Rhine

Table 3.Relevance and presence of Science Related Conditions
x = relevant; x = present

Chances are bigger when..	B. Dekker	E. Lammens	N. Plum	W. Mak	T. Buijse
..Knowledge is scientifically sound	x x	x x	x x	x x	
..Knowledge is trustworthy	x x	x x	x x	x x	
..Scientists actively incorporate policy options in research					x
..Science is transparent		x x	x x	xx	x x
..Research is widely set up in focus and interdisciplinary in nature	x x		x x		
..Science is autonomous from national interests and political debates		x x	x x	x x	
..Consensus in epistemic community is reached before uniting science and policy streams	x x	x x	x x	x x	x x
Scientists are experts in their fields, but are able to communicate with scientists from other disciplines		x x	x x		
..Peer review is applied					
..Epistemic communities have more than one sponsor, not all from the same country					
..Scientists are chosen by international institutions rather than governments					

Most interviewees stated that one important premise for the incorporation of ecological knowledge into river basin policy is that knowledge must be *scientifically sound*. Papers or research are always carefully scrutinized by both the expert groups and the working group. Several expertsin these groups can judge the soundness of the research. This also reflects in the careful process that precedes the hiring of an external party for doing research. It is very important for the external party's research to be scientifically sound, as during the discussion of the research in the expert groups any flaws will be discovered and the research could be discarded because of this.

Furthermore, next to the soundness of the research, interviewees claimed that knowledge should also be *trustworthy*. This primarily reflects in the care that is taken in selecting the person(s) who execute the external research that is sometimes commissioned. This is discussed in the expert group and working group, and may occasionally also be discussed in the higher levels such as the (pre) strategy group.

One interviewee mentioned the importance of *scientists incorporating policy options in their research*. However, the interviewee could not name any examples of when this condition was or was not met in the Rhine Commission.

However, most interviewees did agree that it is important that*science is transparent*, which was not the case before all documents were translated into Dutch. The documents from the Rhine Commission were usually only translated in German and French. This posed no problem for the Dutch members of the expert or working groups, since they often spoke both languages. However, it did pose a problem for Dutch national policy makers or politicians, who often received reports from the commission (e.g. with recommendations for policy) in German or French. In some cases these reports were not incorporated in policy because the national policy maker/politician could not or would not read the report at all.

Some interviewees mentioned the importance of *research that is widely set up in focus* in order for it to be optimally used for policy making. One example is the (recent) research on climate change and the effect on ecology. The idea is that with the introduction of a new subject in the commission, first a thorough but widely set up research is performed by the expert group or external experts. Then the working group and secretary narrow it down and make it understandable for the policy makers on higher levels.

Another condition, which was named by many interviewees, is that science should be *autonomous from national interests and political debates*. Even though the research qualities of the external experts are important in selecting one, the experts should also be independent from corporations or national interests/politics.

Another important condition that all interviewees agreed upon is that *consensus in the epistemic community must be reached before uniting science and policy streams*. In the case of the Rhine commission the scientific (not political) discussion is concluded when the issues move from the working group to the (pre) strategy group. There might be requests for further research or gaps in knowledge but any issues on methodology and the scientific aspects of the research are discussed in the expert groups and sometimes in the working groups. Any political discussion often takes place in the working group, (pre) strategy group, plenary assembly or ministers' conference.

With the choice of experts, the research they produce should also be *autonomous from the country's delegation's opinions or interests.*One interviewee mentioned that it autonomy was possibly more important than soundness of the research produced. The interviewee expressed the feeling that this could be because research is not peered reviewed by people outside the Rhine Commission and standards are not as high as it is for scientific research from other sources. Effectively, the experts need to meet three conditions: they need to be able to deliver good quality research, they should be trustworthy and they should be seen as independent, not only from national interests but also from opinions of other stakeholders with an interest.

Some interviewees state that for the scientists working in the working group or the secretary it is especially important that they are *experts in their field but are also able to communicate with scientists from other disciplines.* They must be able to gather the information from the expert groups and put it

together, but also make it understandable for the policy makers on the higher levels (strategy group and onwards). As such they must have a thorough understanding of the material; however, they must also be able to see beyond their specific field of science in order to be able to add all the different pieces together.

None of the interviewees mentioned the importance of *peer review*, possibly because review within the Commission is not seen as actual peer review. One interviewee mentioned that not having to strictly abide to the 'rules of science' (i.e. in this case peer review) does allow the Commission to act faster upon the information delivered (rather than having to wait for the results of the peer review and publication).

Furthermore, none of the interviews thought that it was *important for epistemic communities to have more than one sponsor* or *that scientists are chosen by international rather than national institutions.* In both cases most interviewees mentioned that sponsoring is not done by the Commission and thus must come from the national sources, but that this is not disadvantaging to the incorporation of ecological knowledge. Moreover, scientists in the Rhine regime are chosen by the national institutions, but none of the interviewees could think of an example in which this hampered the uptake of ecological knowledge in any way.

3.6 Relevance and Presence of Policy RelatedSuccess Conditions in the Rhine

Table 4.Relevance and presence of Policy Related Conditions
x = relevant; x = present

Chances are bigger when..	B. Dekker	E. Lammens	N. Plum	W. Mak	T. Buijse
..There is consensus on goals and means	x x		x x	x x	x x
.. The legal framework incorporates need to use scientific knowledge	x x	x x	x x	x x	x x
..Alignment of research in relation to decision making procedures takes place					
..Enough resources are available	x x	x x	x	x x	x
..Maximal openness of the institutionalized political system occurs			x		x x
..Little to no stability in elite alignments in polity is the case					
..Allies of within elites exist					
..Stakeholders are involved in the process	x x	x x	x x	x x	x
..Stakeholders without direct power or interest are also included			x		
..There is no tendency and capacity for repression within institution					
..Time to familiarize policy makers with scientific knowledge is available		x		x	
..Policy makers are aware of inherent uncertainty in science			x x	x	x x
..Policy makers are aware of different types biodiversity			x x	x	x x
..Policy makers are aware of influence geological processes			x x	x	x x
..There is a restricted species selection in policy	x x				x x

The first important condition for effective incorporation that most interviewees agreed upon is that there should be a *consensus on goals and means.* This is provided for by the mandate that is set by the commission for the working and expert groups. The strategy group discusses the mandate of the groups in question every few years, and as such before any research or discussion is carried out the members of the group are in agreement upon what they can do (means) and what they should do (goals).

All interviewees agreed that a possible element for better incorporation is a *legal framework which incorporates the need to use scientific knowledge.* This can be seen in the introduction of the Water Framework Directive, but also on a national level in which the countries in which there is a need for the incorporation of ecological knowledge often leads to a better and completer adaption of the material provided by the Rhine Commission.

None of the interviewees thought that *alignment of research in relation to decision making procedures* was a relevant condition. No interviewee could think of any examples of failures or successes in relationship to this condition.

All interviewees agreed that it is beneficial for the incorporation of ecological knowledge if the *availability of resources is not an obstacle*for carrying out plans or measures suggested by scientific research. When research has proven a certain problem to exist, this does not always lead to action by the Commission and/or national government. This is not necessarily because the research that is done is not deemed solid; it can also mean that there is either no solution to the problem or that this solution is too expensive. One example of the latter in the Rhine is the existence of hydro-electric power stations in the Rhine, which take in the water and generate green energy. However, in order to generate this green energy many fish die in the process. Especially the young migratory fish and eel suffer. One of the solutions for this is to divert the stream with the fish in it, so they don't have to pass through the hydroelectric power station. However, in order to divert these fish a roster is needed to block all the fish from entering the power station. This roster is expensive, not only in purchase but also in maintenance. In new hydroelectric power plants it is mandatory; but the existing plants already have their permits, making it difficult to force them to do it. Again here the owners of the plants, national governments and the Commission agree on the scientific facts in the matter (hydro-electric power plants kill fish) but they cannot agree on the responsible party (i.e. who is paying for the bypass of the river). Some interviewees believed that enough funds were available and referred to the fact that even though the construction of fish ladders had taken some time, it had happened in the end. Other interviewees argued that the delay in itself signified that incorporation of ecological knowledge was inhibited.

One of the interviewees also mentioned the importance of *openness of the political system*; he believed that communication (e.g. website, flyers),open international conferences and transparency in general were important for the incorporation of ecological knowledge in policy.

None of the interviewees thought that *little or no stability in elite alignments* and *allies within elites* were relevant conditions. Some interviewees mentioned that because of the rather open political system these were conditions that have never been necessary for knowledge to reach the system. Other interviewees had problems with identifying an elite within the Commission and as such could not relate to the two conditions.

An important condition according to the information from the interviews for the incorporation of ecological knowledge into policy is the *involvement of stakeholders into the decision making procedure*. National stakeholder groups can play an important role in both driving and blocking certain plans from the Rhine Commission by pressuring the national government. Interest groups are allowed to voice their opinions in the working group discussions but do not get any power within the Rhine Commission. They are primarily being kept up to date on developments that may harm or benefit their respective interests. The discussions that are being held within the working groups are often based on scientific facts (rather than power-based arguments) and it does happen that parties can change the outcome of the discussions in this way. Especially nature conservation organizations often bring forward new research, either recently published or commissioned by them. Next to nature conservation organizations who often try to change the outcome of the policy process by joining in the

discussion in the working groups there are two groups that use their power and interest outside of the negotiations and discussions in the working groups and put pressure on their national government against certain plans of the Rhine Commission; these are the farmers and fisheries. In the first case, research by Imares has shown that fish do suffer from (hobbyist and professional) fisheries. In order to decrease the pressure from interest groups the Rhine Commission has asked professional fisheries them to help monitor the fish they catch. They voluntarily count the catch of certain fyke nets; they receive a small compensation for doing this from the Rhine Commission. The goal is primarily to sustain a collaboration which is to convince the fishermen of the importance of what the Rhine Commission is doing and to share information with the Commission. Whereas the professional fisheries are partly dependent on the Rhine Commission and national governments (since they have the power to restrict fishing in certain areas, affecting their livelihood), sport fishing is not. The Dutch sporting fishermen association has lobbied against measures from the Rhine Commission to catch away some of the larger predatory fish (they inhibit the growth of certain water plants). This interest group is different in the sense that they do not emphasize the monetary side of the argument but use their own scientific arguments to propose their own resolution in the Dutch national government. They argue that the Rhine Commission is endangering the predatory fish species that are targeted, and that this is ethically unacceptable. When the resolution is accepted, the Rhine Commission does have to adapt their actions to this pressure from national interests. Lastly, before any migratory fish species can enter the Rhine, they need access the Kier in HollandsDiep, which gives leads from the North Sea to the Rhine. Due to pressure from farmer interest groups on the national government, the national government had decided to shut the Kier off completely. The interest group (mainly farmers) argues that they will lose profit from the extra infiltration of salt water that will take place if the Kier is left (partially open). The National government has agreed with them because they are afraid to lose votes and support from this interest group. That is why they prioritized this element and suffered the mounting international pressure.In short, these examples show the importance of including stakeholders in policy making.

Furthermore, one interviewee mentioned the importance of*stakeholders without direct power or interest, who should be included***.** The influence of these stakeholders can have a mediating function within the discussion in the working groups.However, the interviewee could not mention any examples of this from within the Rhine Commission.

None of the interviewees mentioned the importance of that there should be *no tendency and capacity for repression within the system*. Here most interviewees mentioned that this could be the case for other systems, but that they had never seen an example of it within the Rhine Commission so they could not validate this condition.

Next to monetary issues in incorporating or acting upon scientific knowledge/discoveries,some interviewee argued that*time should be available for policy makers to familiarize themselves with the scientific knowledge available* as well*.* On the one hand this can happen because many of the policy makers from the working group and strategy group are in the commission for a longer time (several years). And as such know what is going on in the relevant scientific areas. On the other hand some research and facts on the ecological quality of the Rhine basins are already known by the expert groups, working groups and often the strategy groups and plenary assembly as well, however still nobody has acted upon this knowledge. An example of this is the action taken against the accumulation of harmful substances in fish, especially in eel. Only five years later action has been taken by the Rhine Commission, when at a certain point in time other projects are finished and time is available. However, time is often not the sole reason for inhibiting ecological knowledge incorporation; often it is the combination with other conditions that hampers the incorporation. However, most interviewees agreed that in the Rhine Commission this condition was not present, because the secretary and the (small) strategy group prepare the scientific documents for policy makers on the higher levels.

Another set of conditions that some interviewees mentioned is that *policy makers are aware of uncertainty in science, of the different types of biodiversity and of the influence of geological processes* on ecological status of an area. Here again the time that policy makers have been in the commission helps them to be aware of these processes and concepts. Often the members of the working group and strategy groups have had previous experience (mostly on national level) with the boundary work between ecological research and policy making and as such are aware of these concepts and principles.

Lastly, one other factor, as mentioned by one interviewee, can be the fact that *there should be a restricted species selection* in policy for ecological knowledge to be incorporated. At the moment there are several types of organisms that are monitored and protected by the Rhine Commission. However, this did not use to be the case, in fact when the Rhine Action Plan was initiated only the salmon and other diadrome fish were included, as was assumed that these fish would give a good impression of the overall condition of the Rhine, in terms of chemical and ecological condition. Only gradually did this focus on fish expand, when experts realized and signaled to the working group that more elements would be needed for effective return of the salmon into the Rhine. As such gradually more species were added to the monitoring list. Once a species is added to the monitoring list, this means that when a decline or shortage of a specific species is noticed, the Rhine Commission cannot simply ignore this, seeing as they have already agreed upon monitoring it. If this species needs extra protection or reintroduction measures then these are more likely to be taken by the commission if this species is on the monitoring list (as such arguments to support these measures are better). The Rhine Commission started with a restricted species selection but gradually expanded to include macrofytes, phytobentos and macrofauna as well. The commission certainly did not set out to include these species into the monitoring plan when they started the Salmon 2000 (or Rhine Action Plan). If this development would have been predicted, it would have been much harder for the delegations to agree upon this plan, seeing as more species would mean spending more money and time.

3.7 Relevance and Presence of Issue and Context Related Success Conditions in the Rhine

Table 5.Relevance and presence of Issue Related Conditions
x = relevant; x = present

Chances are bigger when..	B. Dekker	E. Lammens	N. Plum	W. Mak	T. Buijse
..The type of science used is adapted depending on whether the problem is structured or unstructured.					
..Stakeholders have shared understanding of the consequences of a structured/unstructured problem					

None of the interviewees recognized a condition from the issue related category. Some interviewees mentioned that these conditions could very well be relevant but that they could not think of any examples of situations in which the condition was (or was not) met which influenced the outcome of the process.

Table 6.Relevance and presence of Context Related Conditions
x = relevant; x = present

Chances are bigger when..	B. Dekker	E. Lammens	N. Plum	W. Mak	T. Buijse
..Public opinion trends favor specific scientific knowledge claims	x x	x x	x x	x x	x x
...Focusing events occur	x x	x x	x x	x x	x x
..The authority of the legal system is relatively independent					

All interviewees agreed that it is important for the incorporation of ecological knowledge in Rhine Basin Policy is the *occurrence of a focusing event*. One of the clearest examples of how a focusing event can cause ecological knowledge to be incorporated or ecological subjects to be put on the agenda, is the Sandoz accident in 1986. This huge chemical spill caused for the riparian states to reevaluate the areas of concern in the Rhine. The fact that there was such massive fish and other macrofauna death in the Rhine caused the possibility of putting ecology on the map for the Rhine Commission. The fact that there were fish left at all in the Rhine was for some officials a surprise already, and prompted to take action to preserve what was left of the fish population in the Rhine. Furthermore, related to this are*the public opinion trends*. This is relevant in the sense that when a focusing event takes place,

public opinion trends will also start to matter (and action must be taken). This is less relevant in other scenarios for the Rhine Commission as a lot of the research is not as appealing or accessible for the public.

None of the interviewees mentioned the importance of *a relatively independent authority of the legal system*. Most interviewees argued that this is less relevant due to the use of soft law. Only with the implementation of the Water Framework Directives fines and other consequences were implemented. Not all interviewees believed that that was beneficial for getting things done and believed more in the power of soft law.

3.8 Relevance and Presence of Other Success Conditions in the Rhine

In the interviews a few other conditions were deemed to be important by the interviewees, which were not already covered in the conditions from literature.

Table 6.Relevance and presence of Other Conditions
x = relevant; x = present

Chances are bigger when..	B. Dekker	E. Lammens	N. Plum	W. Mak	T. Buijse
.. Leadership is present	x x				x x
..International Pressure is applied	x x	x x	x x	x x	x x
..High Ambitions are combined with soft law	x x				x x
..CulturalDifferences are heeded			x x	x x	x x

One interviewee mentioned that in some cases*personal leadership* may be a cause for some elements to be put on the agenda. Two examples of this are: first of all, the proposal of the Salmon 2000 idea and secondly the research into the accumulation of harmful substances in fish. The Salmon 2000 was thought of by national research institutes in the Netherlands, who transferred this knowledge to the minister of that time going to the conferences of the Rhine Commission (NeelieKroes). She proposed and argued for the Rhine Commission to have as a goal that the salmon return to the Rhine. Of course this was not the only element at play; also the aforementioned focusing event (Sandoz incident) has played a role in the acceptance of this plan by the other riparian countries. The other example was put on the agenda partly by the fact that time was available, but also because there were people within the Rhine Commission who had heard rumors of the toxicity of the fish and who started asking question. These two elements made for a request to the expert group on fish for a report on the levels of harmful substances in fish.

Moreover, most interviewees stated that it may also be the case that other laws and policy made at the European Level forces the Rhine Commission to take certain actions (for example the Water Framework Directive). This condition differs from a law that requires ecological knowledge to be incorporated into policy in the sense that most of the European Law is soft law (see below). As such *international pressure*is also a factor in actually executing the soft law in the European Union and the Rhine Commission. These laws are supported by the scientific knowledge coming from the expert groups and working group ecology. Two examples of this are the Water Framework Directive and the Eel Directive. The first has primarily forced the Rhine commission to reevaluate their monitoring structure, but has not caused major adaptation in ecological sense. The Eel Directive has actually solved the problem caused by the discussion on the resource availability for power plants. Research done by the European Union had shown that many eel die in hydroelectric power plants, causing the European Union to set up this directive, obligating hydroelectric power plants to place such a roster and bypass. The European Union and several of their member states have pressured national governments to adapt their hydroelectric power plants in favor of migratory fish. Here a problem that could not be solved within the Rhine Commission has reached a conclusion by international pressure. Another example where international pressure may in the future be the determining factor is the re-opening (or permanent closure) of the Kier. Other member states (of both the Rhine Commission and the European Union) are pressuring the Dutch national government to partly reopen the Kier.

One of the reasons named for the success of the Salmon 2000 plan was the *combination of a very ambitious plan with soft (non-binding) law.* On the one hand was the return of the Salmon a great

symbol for the recovery of the Rhine, it was catchy, visible to the public and said something about the recovery of the whole ecosystem. However, it was a very ambitious goal, in fact in the beginning it was thought to be impossible to reach the goal before 2000. On the other hand, even though the Rhine Commission riparian states had set out to achieve this goal in 1987, there were no legal consequences (e.g. fines) if they did not fulfill their goals by 2000. These two elements combined made for the fact that all the riparian states agreed to the Salmon 2000 plan. Not only was it thus possible for the Salmon to return to the Rhine, but also did it pave the way for other species to be gradually included into policy concerning ecological rehabilitation of the Rhine.

Two other conditions that can influence the use of ecological knowledge in policy making that were deemed important by the interviewees are the *cultural and language differences between the riparian countries*. These conditions are related to the transparency of science in which differences in languages can cause research not to be incorporated into policy. However, cultural differences can also play a role; on the one hand it can be a discouraging factor if a specific research is written from a specific cultural vantage point or in another language. This is not related to the quality of the ecological data. On the other hand, the long terms of office that most of the members of the working and expert groups have,gives them the advantage of having experience with the respective cultures and as such can overlook these differences and still extract the relevant scientific information from these documents.

3.9 Conclusion

This chapter discussed the political structures dealing with production of policy concerning ecological rehabilitation in the regime of the Rhine and their development. Furthermore, the conditions for promoting or inhibiting successful incorporation of ecological knowledge in the river basin of the Rhine were examined.

The three indicators of successful incorporation of ecological knowledge were the structure of information flow, number of publications and the number of species monitored. The political structure of the Rhine Commission dealing with ecological rehabilitation was described first. Ecological knowledge is generated in the national research institutes, after which it is discussed in an expert group. After the expert group has discussed the research it travels up to the working group. The pre-strategy group and secretary put together the science and prepare it for the strategy group and plenary assembly. The latter is the level at which most important decisions are taken. At the higher levels one will find only policy makers, at the lower levels only scientist and the pre-strategy group, strategy group and secretariat consist of a mix of scientists and policy makers. Every group gets a mandate from the plenary assembly. The number of ecological publications by the Commission has risen steadily since 1987, moving slowly away from inventory and target setting to measuring and effectiveness. Lastly, monitoring for more types of species has been introduced over the years and of these types, an increase in different species has been monitored.

Most of the conditions that were thought to be relevant were also present in the Rhine regime (according to the interviewees). This is not the case with all conditions though; interviewees indicated the availability of resources and time availability were two inhibiting factors in the Rhine Commission, as these conditions are not always met. Moreover, some conditions were considered relevant, but interviewees could not name any specific examples. These were the inclusion of stakeholders without direct power or interest and scientist incorporating policy options in their research.Lastly, it is striking that hardly any of the conditions coming from literature on political opportunity structures was found relevant or deemed present by the interviewees.

4.0 The Meuse Case Study

4.1 Introduction

The Meuse is about 900 kilometers long, and more than nine million people live in its Basin. It flows through France, Belgium and the Netherlands and has tributaries from Germany and Luxembourg. These countries all use the Meuse for drinking water and transport. The Meuse is primarily fed by rainfall, which is relevant, because large areas in the middle stream of the basin have animpermeable soil, which leads to a higher risk of flooding in the lower areas of the basin. The Meuse originates from Pouilly-en-Bassigny in France and ends in the Haringvliet in the Netherlands. In order to control the water quality and quantity and flood risk the riparian states have agreed upon several treaties. The two most important agreements are the Meuse Treaty of 1994 and the 2002 International Agreement on the Meuse (InternationaleCommissievoorBescherming van de Maas, 1997).This chapter will shed a light on the political structures dealing with production of policy concerning ecological rehabilitation in the regime of the Meuse and their development. Furthermore, the conditions for promoting or inhibiting successful incorporation of ecological knowledge in the river basin of the Meuse are discussed. These questions are answered by first examining the genesis and development of the Meuse. Afterwards, the route that ecological knowledge has to travel to be incorporated in Meuse Commission policy is shown and elaborated upon, this is done with the use of the same example as in the chapter on the Rhine Commission (i.e. re-introduction of salmonoid species in the Meuse). Furthermore, the research investigates the publications by the Meuse Commission dealing with ecological policy to show what kind of contribution scientists have made. Lastly the conditions for promotion or inhibition of successful incorporation of ecological knowledge in the river basin of the Meuse according to the interviews held with the key informants of the Meuse Commission. In this part first the conditions found in Chapter two are contrasted with the view of informants, later the conditions informants identified next to the conditions from the literature are discussed. Informants will discuss both the relevance and presence of conditions.

4.2 Regime Development

Roughly four phases can be identified in the development of the Meuse regime; the first one of which is from the 1800s to 1963. During this period there was early bilateral cooperation between the Netherlands and Belgium, focusing primarily on transport issues. With the onset of the First World War, stagnation in the cooperation took place. The phase from 1963 to 1993 is one of reengagement in which attempts are made to form a multilateral agreement. However, the treaty that resulted out of this was never ratified. This changed after major flooding events of the Meuse in 1993, which resulted in the launching of an international regime (1994-2002). Negotiations on the multilateral agreement were concluded in 1994 and this multilateral agreement was ratified in 1998. During this phase the emphasis was primarily put on pollution abatement and flood control. The fourth and current phase ranges from 2002 onwards, and signifies the consolidation of the regime, in which the EU Water Framework Directive is implement and the riparian states Luxembourg and Germany are integrated, next to France, Belgium and the Netherlands (Bouman, 1996). In this last phase ecological recovery begins to play a role; in the next section only the last two stages are considered, since earlier stages are not relevant for the incorporation of ecological knowledge into policy.

Ecology and Regime Development

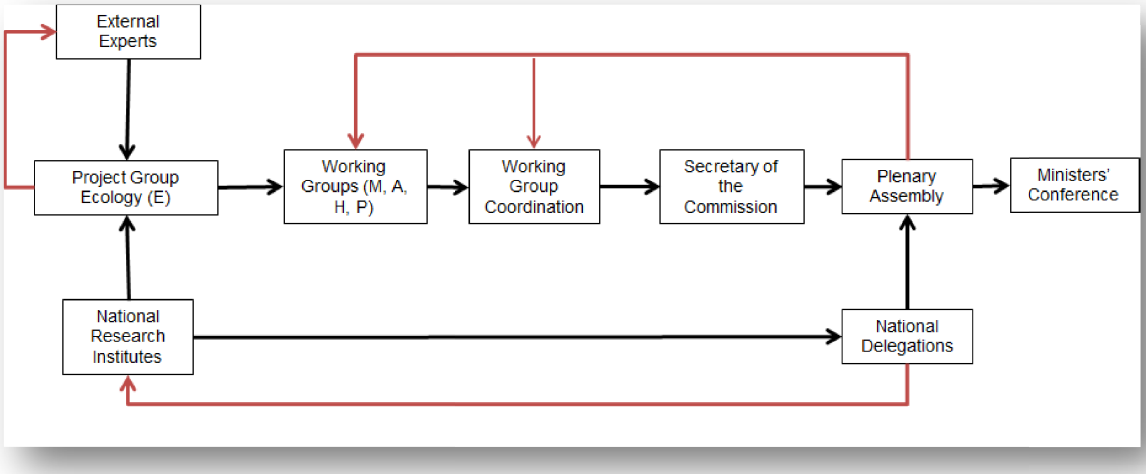
At the onset of the regime (the third phase), the focus was primarily on flood risk reduction and water quality improvement. The flooding of the Meuse in 1993 and 1995 provided a strong motivation for setting up the regime and controlling flood risk. Pollution abatement was another key point in the regime, due to the Meuse's importance as source of drinking water. However, only with the implementation of the EU Water Framework Directive a new focus on ecological restoration has emerged. The framework provides legislation for the management of water systems within the EU; it says that a good ecological status for natural rivers and ecological potential for heavily modified ones must be achieved by 2015.

Ecological Policy Making in the Meuse Commission

Different stakeholders are involved in the creation and consolidation of the Meuse regime. The most important players are the European Union, France, the Netherlands and the Flemish and Walloon part of Belgium at a national and supranational level. As with most river regimes, the interests and power are skewed. The downstream countries (especially the Netherlands) are most affected by pollution

and flooding. The upstream riparian countries have thus a greater power (Bastings, 2002). Quite interesting is that with ecological recovery the interests are somewhat different. Especially with the attempts to reintroduce migratory fish the balance of power is skewed, but the other way around. If fish cannot migrate through the downstream countries (the Netherlands) they will never reach the upstream countries either.

Figure 2 Ecological Knowledge flow Meuse Commission



= request for knowledge
= (possible route of) transfer of knowledge

The lay out of The Meuse Commission is roughly the same as that of the Rhine Commission in terms of the transfer and request process of ecological knowledge. The highest level in this case is also the minister's conference and then the plenary assembly. Before the plenary assembly the delegation leaders confer amongst themselves to prepare for the assembly. They get their information from the working groups (monitoring, Water Framework Directive, hydrology and pollution), who in turn collect their information from the experts in the project groups (chemical, ecology, groundwater and GIS). As in the Rhine Commission the members of the project group are experts in their field and prepare documents for the working groups (often at the request of the working groups). The working groups, together with the secretariat and the working group on coordination prepare the documents for the delegation leaders and the plenary assembly. In general, the delegation members do not have a background in ecological research, only in policy making and international relations. Different from the Rhine Commission is the fact that the project groups are directly linked to one specific working group. All working groups can request knowledge from each of the project groups and all project groups can supply information to any of the working groups. As far as ecological knowledge goes, most of the information comes from the project group ecology and is transferred to the groups working on the Water Framework Directive and monitoring.

4.3 Ecological Debate in the Meuse Commission

Table 7. Ecological Publications Meuse Commission 1998-2010

	Total	Inventory	Target	Effectiveness	Means	Monitoring
1998	2	2	1		1	1
1999	1	1				
2000						
2001	2			2	1	1
2002	4	3	1	2	1	1

2003	2		2	2	2	1
2004	2	2	1			
2005	2		1	2	2	1
2006	2		1	1	1	1
2007	3		1	2	1	2
2008	1			1		1
2009	2		1	1	1	1
2010	1			1	1	1

In the table above there is an overview of the way in which the ecological debate within the commission has developed, this is establishes by considering the different reports published since 1998 and categorizing them by type of document. Only documents from after 1998 are used because this indicates the first phase of the Action Program of the Meuse (primarily dealing with gathering information). Before 1998 little to no attention has been paid to the ecological quality of the Meuse, apart from the 1994 document dealing with the quality of the Meuse (CommissieterBescherming van de Maas, 1994). Here the first mention of improving ecological status of the Meuse is made, but not until the start of the Action Program has it been included in any other document. In 1998-1999 most of the documents dealt with making an inventory of the existing situation and proposing means and ways for measurements. Only after 2000 (with the start of the second phase) do the documents move away from inventory and towards deciding on ecological targets, means and monitoring. Also, effectiveness of measurements that were already taken is kept track of.

4.2 Salmonoid Species in the Meuse

In the case of the Meuse the idea originated from the Belgian national research institute In turn this idea was pitched by the Walloon delegation in the plenary assembly where it was agreed upon by the delegation leaders that this was indeed desirable. Therefore some research on the macrofauna and fish species in the Meuse was published in the rapport on the quality of the Meuse in 1994, following the agreement of Charleville-Mézières, again in 1994. It is explicitly mentioned that the return of migratory fish is an indicator for the health of the ecosystem. The rapport on the status of the Meuse in 1994 was published by the commission and the research institutes of the national delegationsindicated national problematic areas. This information was relayed to the plenary assembly, where a new three-phase plan was agreed upon. A short-term phase (1998-2003), the long-term phase (2003-2010) and the next generation phase (2010-onwards) were included. In the first phase the focus lay primarily on reducing the pollution in the Meuse and on designing a flood-warning system. In this phase some monitoring of the fish and macro fauna was done, but it was assumed that the chemical properties of the water needed to be improved first. Besides, drinking water preservation was at that point a bigger concern for the member states than improving the ecological status of the Meuse. After evaluation in 2003 the Commission stated during the plenary assembly that it was difficult to compare the performance of the different areas of the Meuse due to the differences in measuring systems. It was agreed upon by the assembly that a working group on creating a homogeneous measuring network for the Meuse should be set up. This network was finished by 2005, after which ecological progress could be measured. One of the reasons for this sudden interest was the looming introduction of the Water Framework Directive by the European Union, in which such a network was required (adopted in 2000). However, the migratory fish species were not a necessary component of the Water Framework Directive, so next to the obligatory measures as prescribed by the European Union's Water Framework Directive, the Meuse Commission decided to strive for the return of the salmonoid species. In 2005 the delegations agreed upon improving the spawning grounds and physical accessibility of the river for migratory fish. The latter is at this point one of the biggest problems, because the fish cannot migrate up and down the Meuse freely. In the meantime some of these blockades have been worked around. With the Dutch government threatening to permanently close the Kier, the negotiations on overcoming other barriers in the river Meuse temporarily stalled. After mounting international pressure the Dutch government reopened the Kier, which puts the negotiations back on the table.

4.5 Relevance of Science Related Success Conditions in the Meuse

Table 8.Relevance and presence of Science Related Conditions
x = relevant; x = present

Chances are bigger when..	M. De Rooy	M. Linsen	W. Liefveld
..Knowledge is scientifically sound	x x	x x	x x
..Knowledge is trustworthy	x x	x x	x x
..Scientists actively incorporate policy options in research		x x	
..Science is transparent		x	x x
..Research is widely set up in focus and interdisciplinary in nature			
..Science is autonomous from national interests and political debates	x x	x x	x x
..Consensus in epistemic community is reached before uniting science and policy streams		x	x
Scientists are experts in their fields, but are able to communicate with scientists from other disciplines	x x	x x	x
..Peer review is applied			
..Epistemic communities have more than one sponsor, not all from the same country			
..Scientists are chosen by international institutions rather than governments			

One important element named by the interviewees is the accuracy of the scientific findings. These findings are extensively discussed in both the project groups and working groups. Most of the discussions on these levels concern themselves with the *soundness of the scientific research.*

Another important element for successfully incorporating ecological knowledge is the *trustworthiness*of the knowledge. On the one hand it is important that the method chosen is the best for the specific task at hand, on the other hand it is equally important that the method in question is a well-known one with little scientific controversy surrounding it. One issue concerning the trustworthiness of the knowledge in the Meuse commission is that many of the Walloon representatives working for the working group and/or in the delegation also work for Walloon universities. As such, the national interests could get mixed up with the scientific outcome, furthermore, even if this is not the case, the other national delegations could suspect this and so the trustworthiness of the science could be damaged.

One interviewee mentioned it can be important for scientists to *actively incorporate policy options in their research*, especially in the sense that scientists should be aware of the fact that their knowledge will eventually be used to create a specific policy, and as such their research should be useful for that purpose. Both scientists and policy makers should be aware of the fact that different principles and values are applied respectively to the policy and science arena.

Furthermore, two of the key informants stated that *transparency* of science can be important in helping to incorporate ecological knowledge. However, one interviewee claimed that it does sometimes present itself as a trade-off with *trust*. When the science is too transparent it can lead to issues of blame. If a specific research shows that the ecological status is not yet optimal, then too much transparency can lead to asking and finding out the answer to the question whose fault it is. This placing of guilt is a severe hindrance for trust building and can as such be counterproductive to incorporating ecological knowledge. This interviewee stated that in the case of the Meuse this trust had sometimes been damaged by the transparency of science.

None of the interviewees mentioned the importance of *research that is widely set up and interdisciplinary*. Some interviewees stated that his might be important in some cases, but would be counterproductive in others. In essence, that it dependent upon the topic that is researched whether it would yield results that are easier incorporated.

Most interviewees stated that an important element for successful transfer of ecological knowledge is that *scientific knowledge should be independent from national interests*. Interviewees mentioned that with this in mind, *scientists who are experts in their fields and are able to communicate with other disciplines* can be instrumental in getting certain topics on the agenda. One example of this is the way migratory fish became a subject of interest to the Meuse Commission. One of the Walloon scientists at the time, called Philipart, pushed for the incorporation of migratory fish species protection in the Meuse Commission policies. Knowledge was needed for this, which he could in turn provide, since he was an expert in that field. His delegation allowed himto spend time on researching migratory fish, providing scientific knowledge for the Walloon delegation. The interest to incorporate migratory fish was probably present within the delegation, however not openly and no knowledge was present. When Philipart requested to research this subject it came on the agenda of the Walloon delegation and in turn on the agenda of the Meuse Commission.

Another important condition named in the Meuse Commission is the fact that the *epistemic community often could not reach consensus before uniting the science and policy stream***.** This hinders effective discussion and policy making in a later stage, because scientific debates are held during meetings that are reserved for policy debates (e.g. plenary assembly).

None of the interviewees mentioned the importance of *peer review*, reviewing is done within the Commission itself, which does not pose problems according to the interviewees. Moreover, none of the interviewees recognized the importance of *epistemic communities having more than one sponsor* or the fact that *scientists should be chosen by international institutions rather than governments*. Both conditions are not the case in the Meuse Commission and none of the interviewees could see any problems arising from them.

4.6Relevance of Policy Related Success Conditions in the Meuse

Table 9.Relevance and presence of Policy Related Conditions
x = relevant; x = present

Chances are bigger when..	M. De Rooy	M. Linsen	W. Liefveld
..There is consensus on goals and means		x x	x x
..Legal framework which incorporates need to use scientific knowledge	x x	x x	x x
..Alignment of research in relation to decision making procedures takes place		x x	
..Enough resources are available	x x	x	x
..Maximal openness of the institutionalized political system occurs			
..Little to no stability in elite alignments in polity is the case			
..Allies within elites exist			
..Stakeholders are involved in the process	x x	x x	x x
..Stakeholders without direct power or interest are also included			
..There is no tendency and capacity for repression within institution			
..Time to familiarize policy makers with scientific knowledge is available	x		
..Policy makers are aware of inherent uncertainty in science		x x	x x

..Policy makers are aware of different types biodiversity		x x	x x
..Policy makers are aware of influence geological processes		x x	x x
..There is a restricted species selection in policy	x x	x	x x

Among these conditions several are identified as relevant by the interviewees. First of all, interviewees deemed it important that the different stakeholders and members of the commission reach *consensus on the goals and means* of the commission.

Another very important condition named was the fact that there was a *legal framework which incorporates the need to use scientific knowledge*. In this case that was the Water Framework Directive, which obligated the Meuse commission to pay more attention to ecological recovery. The WFD was implemented in the year 2000 and was one of the reasons for the sudden increase in policy making surrounding ecological recovery of the Meuse. The only element that was already in place and was not dropped with the implementation of the WFD was the goal of bringing back migratory fish in the Meuse.

Furthermore, interviewees stated that on the one hand it is important for *research to be aligned to the decision making procedures taking place*, in the sense that policy making decision are not always based on scientific truth. Therefore, scientific research should not only be geared towards finding that scientific truth but be adapted to the goal of the policy in question.

For the successful incorporation of scientific knowledge in policy, one interviewee mentioned it is also important that enough *resources are available*. Whereas resources are obviously present in the different member state countries, this is not so in the Meuse Commission itself (costs are born by the member states). As such member states can deliberately delay the process by refusing to pay for their part in a specific project (i.e. fish ladders). Another interviewee mentioned that resources are not important in the sense that there is always money available, however, the question is whether the *interests of the countries* are big enough for them to spend the money (see 'other conditions' below).

None of the interviewees recognized the importance of *maximal openness*, *little to no stability in elite alignments* and *presence of allies within elites*. The interviewees could not relate these conditions to experiences with the Meuse Commission.

In the Meuse regime *national interest groups can cause ecological topics to be put on the agenda* or not. In this case the sport fishing association actually supported putting migratory fish on the agenda of the Meuse Commission. Therefore the Walloon delegation had two reasons for looking into this, firstly, the expertise in the form of a prominent researcher (Philipart),secondly an important national interest group requesting attention for the subject. However, here the same story applies as in the Rhine, the young salmon and other young migratory fish species that are raised and set loose in the Meuse first need to reach the sea before they can migrate back upstream to their spawning grounds. The problem is, is that the Kier is currently closed by decree of the Dutch National Government under pressure of Dutch Interest groups (mainly farmers).

None of the interviewees recognized the importance of *including stakeholders without direct power or interest* and *no tendency or capacity for repression is present.* Again, the interviewees could not relate their experiences with the Meuse Commission to these conditions.

One interviewee indicated that it is necessary for *policy makers to have the time to familiarize themselveswith scientific principles*. The interviewee mentioned that time is a crucial element in determining whether a specific scientific topic reaches the agenda or not. As an example he mentioned the build-up of toxins in fish, which was a problem with which the scientists were familiar. However, time shortage prevented the policy makers to study the subject and thus from policy to be formed.

On the other hand it is also imperative that *policy makers are aware of the different properties of science*, for example the inherent uncertainty in science in general. Specifically in the case of ecological knowledge it is important that policy makers are aware of the different types of biodiversity and the influence that geological processes can have on biodiversity and ecological recovery.

Whether a *restricted species selection* helps in incorporating ecological knowledge into policy making depends on the cultural preferences of the different countries, according to two interviewees. One interviewee mentioned that some countries conduct a broad research and prefer not to narrow it down in an early stage; other countries do work with a restricted species selection. One interviewee argued that it was relevant for the successfulness; the other believed that one method was not superior to the other.

4.7Relevance of Issue and Context Related Success Conditions in the Meuse

Table 10.Relevance and presence of Science Related Conditions
x = relevant; x = present

Chances are bigger when..	M. de Rooy	M. Linsen	W. Liefveld
..The type of science used is adapted depending on whether the problem is structured or unstructured.			
..Stakeholders have shared understanding of the consequences of a structured/unstructured problem			

None of the interviewees recognized a condition from the issue related category. Some interviewees mentioned that these conditions could very well be relevant but that they could not think of any examples of situations in which the condition was (or was not) met which influenced the outcome of the process.

Table 11.Relevance and presence of Context Related Conditions
x = relevant; x = present

Chances are bigger when..	M. de Rooy	M. Linsen	W. Liefveld
..Public opinion trends favor specific scientific knowledge claims	x	x	x
...Focusing events occur	x	x	x
..The authority of the legal system is relatively independent			

All interviewees agreed that an important factor in incorporating ecological knowledge into policy is the *occurrence of focusing events.*These events could put the focus of the Commission on a specific problem. Also *public opinion trends* can be important, but will most likely be caused by the occurrence of a focusing event. As such, these two conditions are related and are difficult to separate. All interviewees agreed on the relevance of the conditions; however no example could be named. As such the conditions are not present in the Meuse regime.

The *authority of the legal system* was not considered relevant by the interviewees as up until the Water Framework Directive everything was soft law. Furthermore, interviewees believed that whether or not consequences were attached to non-compliance was less important than the interest of the countries and the trust between them.

4.8Relevance of Other Success Conditions in the Meuse

Table 12.Relevance and presence of Other Conditions
x = relevant; x = present

Chances are bigger when..	M. De Rooy	M. Linsen	W. Liefveld
.. There are no economic differences	x		x
..Interests are comparable	x x		
..Interest Linking is successful	x	x	x
..International Legislation is in place	x x	x x	x x

In the interviews a few other conditions were considered to be important, which were not already covered in the literature. The first condition mentionedare the *economic differences* between the different riparian countries. Next to the internal political turmoil in Belgium up until the 1980s, one of the regions (Walloon region) is economically still not up to the same level as the other regional authorities and the other riparian states. Therefore they are not as willing to cooperate in putting ecology on the agenda and especially paying for measures to improve the ecological quality.

Another important condition named is the *interests in riparian countries*, one of the reasons why the Meuse Commission started up later than the Rhine Commission.Not all the riparian countries expressed an interest in joining the Meuse Commission. Belgium was troubled by its own political turmoil in the forming of the different regional authorities. Furthermore the stakes were not as high in the riparian countries of the Meuse compared to the riparian countries of the Rhine, where more people depended on its drinking water.

Furthermore, *interest linking* is claimed to be a condition which was an inhibiting factor for incorporating ecological knowledge and starting up the Meuse Commission in general. One of the things that were done at the onset of the creation of the Meuse Commission was for the Dutch delegation to couple the negotiations on the Meuse to those of the Scheldt. The idea was that in the case of the Scheldt the Netherlands were in a position of power, and in the case of the Meuse, the upstream countries had more power. However, it turned out that this was not such a prudent decision, because the Netherlands didn't consider the fact that Belgium was divided between the Flemish and the Walloon part. The Flemish parties had an interest in opening up the Scheldt and the Walloon part was responsible for delaying the negotiations on the Meuse. By linking these two interests the Netherlands could not make headway in either of the two cases. Only after they started seeing it as two separate entities after the political reorganization of Belgium, could they achieve more.

Another important condition named by the interviewees is the presence of *international legislation.*In the case of the Meuse the implementation of the Water Framework Directive has been important in putting ecology on the agenda. Furthermore, the Helsinki Convention was instrumental in forming the Meuse Commission in general. In the latter case the Belgian government refused for a long time to ratify the Meuse treaty, making it difficult to achieve any improvement in water quality, ecology or other measures. However, with the Helsinki Agreement in 1992, Belgium realized there was no way out of forming a treaty (the Helsinki Convention stated that every river should have some form of international cooperation organization). As for the Water Framework Directive, it has prompted thinking and discussion on the ecological status of the river Meuse. It already provided a framework for the Meuse Commission to monitor their improvement.

4.9 Conclusion

This chapter discussed the political structures dealing with production of policy concerning ecological rehabilitation in the regime of the Meuse and their development. Furthermore, the conditions for promoting or inhibiting successful incorporation of ecological knowledge in the river basin of the Meuse were examined.

The three indicators of successful incorporation of ecological knowledge were the structure of information flow, number of publications and the number of species monitored. The political structure of the Meuse Commission dealing with ecological rehabilitation was described first. Ecological knowledge is generated in the national research institutes, after which it is discussed in an expert group. After the expert group has discussed the research it travels up to the working group, however

the expert groups are not specifically linked to any of the working groups (and can thus report to any of them). The working group Coordination and the Secretary of the Commission put together the science and prepare it for the plenary assembly. The latter is the level at which most important decisions are taken. At the higher levels one will find only policy makers, at the lower levels only scientist and the Coordination working group and secretary consist of a mix of scientists and policy makers. Every group gets their mandate from the plenary assembly. The number of ecological publications by the Commission has stayed roughly the same since 1998, but has slowly been moving away from inventory and target setting to measuring and effectiveness. Lastly, no new species were added to the monitoring list from 2003 onwards. It is not clear yet whether the number of species present in the Meuse ecosystem has increased since 1998, since the evaluation of the Action Plan on the Meuse (ended 2010) has not been published yet. The year reports indicate that progress has been made, but numbers are not known.

Most of the conditions that were thought to be relevant were also present in the Meuse regime (according to the interviewees). This is not the case with all conditions though; interviewees indicated problems arise when consensus is not reached among scientists in the lower levels before the issue moves on to higher levels. Furthermore, the availability of resources, economic differences between riparian countries and unsuccessful interest linking inhibit successful incorporation in the Meuse Commission, as these conditions are not always met. Moreover, some conditions were considered relevant, but interviewees could not name any specific examples. These were two context related conditions: the occurrence of focusing events and public opinion trends. Lastly, it is striking that hardly any of the conditions coming from literature on political opportunity structures was found relevant or deemed present by the interviewees.

5.0 Comparing Conditions between the Rhine and the Meuse

5.1 Introduction

In this chapter the similarities and differences between the conditions that were identified by the people that were interviewed on respectively the Rhine and Meuse are discussed. Some of the interviewees already identified some differences between the Rhine and Meuse regimes with regards to the incorporation of ecological knowledge due to experiences with both commissions. Furthermore this chapter discusses whether and how ecological knowledge is used differently by people operating in the Meuse and Rhine regime.

Firstly, the organizational and physical similarities and differences between the two regimes are evaluated with which, the incorporation of ecological knowledge in the Rhine and the Meuse is compared. The text discusses why this is the case using the indicators from chapter 2.2. Furthermore, possible reasons for this are discussed using the differences between the conditions from the Rhine and the Meuse. Lastly, a short reflection on what is striking when looking at answers from the interviewees is given.

5.2Comparison of the Incorporation of Ecological Knowledge

In both regimes the rivers flow through Western Europe, they originate from the Alps and both end in the Haringvliet (in the Netherlands). Furthermore, species living in the Meuse and the Rhine are quite comparable, due to similar physical characteristics the same types of organisms can (potentially) be found in both the Meuse and the Rhine. One of the two most obvious differences between the Rhine and the Meuse Basin Regime physically speaking is the difference in riparian countries. In the Rhine Commission the countries included in the actual committee are the Netherlands, Germany, France, Luxembourg, Switzerland and the European Commission. They work together with Austria, Liechtenstein, the Walloon region in Belgium and Italy (however the latter have a different status within the commission and only decide upon matters dealing with the Water Framework Directive). In the Meuse Commission the countries that signed the 2006 agreement are Germany, Belgium (and the governing bodies of its different parts), France, Luxembourg and the Netherlands. They are included in the commission.

Both Commissions have a structure in which the intention is to let the science stream reach a consensus before uniting the science and policy streams. It is an approach which goes from lower levels (where science is performed and discussed) to higher levels (where policy decisions are made). Another organizational similarity is the national to international relay system, in which the national delegation get there information from their respective national research institutes (there is no international research institute for either the Meuse or the Rhine). In fact, within the national research institutes in some cases the same experts work on their subject for both the Rhine and the Meuse (often specialists in a specific type of species, e.g. fish, water birds, macrophytes).One difference between the two regimes is the organization of the working groups in relation to the expert/project groups. In the Rhine Commission there are expert groups that report to a specific working group, which is its only way of transferring knowledge up (through the working group, pre-strategy group, strategy group and plenary assembly). In the Meuse Commission there are (temporary) project groups that can report to any of the four working groups, depending on the questions asked by the project groups. Logically some of these project groups have more to do with some than others (e.g. project group ecology is more likely to give input to the 'Water Framework Directive' than to the 'hydrology' working group). In the Meuse Commission there are four working groups dealing with the physical subjects of the Meuse (monitoring, Water Framework Directive, hydrology and chemical) and there is one extra working group that is officially placed at the same level, but which in fact receives information from these working groups and passes it on to the secretary and plenary assembly. This is the working group coordination. The route for the transfer of ecological knowledge is more clear in the Rhine Commission, it leads from the expert groups, to the working group, pre-strategy group, strategy group, plenary assembly and if necessary minister's conference. The order is more set than that of the Meuse commission, in which it is not clear what the exact position of the coordination working group is. In part this is the case because it has not been in place for that long yet and evaluation of its performance still needs to take place.

As such the first indicator for incorporation of ecological knowledge indicates that the Rhine is doing a better job in organizing a clear structure for the transfer of ecological knowledge. Furthermore the total

number and types of documents published by the Rhine Commission indicate that the incorporation of ecological knowledge is more successful in the Rhine than in the Meuse. Not only have more documents been published, the Rhine also has already published more documents on effectiveness and monitoring. Lastly, the Rhine is at this point monitoring more types of species than the Meuse. Concerning the number of species, no comparison can be made, as the Meuse has not published any evaluation on the actual monitoring yet.
When looking at the three indicators for the incorporation of ecological knowledge, one can see that the Rhine is more successful in doing this than the Meuse. In the next chapter possible reasons for this difference are discussed, using the results from chapter 3 and 4.

5.3 Differences and Similarities in Conditions

Table 13.Relevance and presence of Conditions per Regime expressed in %
x = % relevant; x = % present

Categories	Chances for incorporation ecological knowledge are bigger when..	% Rhine	% Meuse
Science Related (Conditions related to the form, content or source of the science used)	..Knowledge is scientifically sound	80% 100%	100% 100%
	..Knowledge is trustworthy	80% 100%	100% 100%
	..Scientists actively incorporate policy options in research	0% 20%	33% 33%
	..Science is transparent	80% 80%	33% 66%
	..Research is widely set up in focus and interdisciplinary in nature	40% 40%	0% 0%
	..Science is autonomous from national interests and political debates	60% 60%	100% 100%
	..Consensus in epistemic community is reached before uniting science and policy streams	100% 100%	66% 0%
	..Scientists are experts in their fields, but are able to communicate with scientists from other disciplines	40% 40%	100%66%
	..Peer review is applied	0% 0%	0% 0%
	..Epistemic communities have more than one sponsor, not all from the same country	0% 0%	0% 0%
	..Scientists are chosen by international institutions rather than governments	0% 0%	0% 0%
Policy Related (Conditions related to the policy framework and actors)	..There is consensus on goals and means	80% 80%	66%66%
	..The legal framework incorporates need to use scientific knowledge	100% 100%	100% 100%
	..Alignment of research in relation to decision making procedures takes place	0% 0%	33%33%
	..Enough resources are available	100% 60%	100% 33%
	..Maximal openness of the institutionalized political system occurs	20% 40%	0%0%
	..Little to no stability in elite alignments in polity is the case	0% 0%	0% 0%
	..Allies within elites exist	0% 0%	0% 0%
	..Stakeholders are involved in the process	80% 100%	100% 100%
	..Stakeholders without direct power or interest are also included	20% 0%	0% 0%
	..There is no tendency and capacity for repression within the institution	0% 0%	0% 0%
	..Time to familiarize policy makers with scientific knowledge is available	40% 0%	33%0%
	..Policy makers are aware of inherent uncertainty in science	40% 60%	66%66%
	..Policy makers are aware of different types of biodiversity	40% 60%	66%66%
	..Policy makers are aware of influence of geological processes	40% 60%	66%66%

	..There is a restricted species selection in policy	40% 40%	66%100%
Issue Related (Conditions related to the characteristics of the issue at stake)	..The type of science used is adapted depending on whether the problem is structured or unstructured.	0% 0%	0% 0%
	..Stakeholders have shared understanding of the consequences of a structured/unstructured problem	0% 0%	0% 0%
Context Related (Conditions related to the historical, political and economic context)	..Public opinion trends favor specific scientific knowledge claims	100% 100%	100% 0%
	..Focusing events occur	100% 100%	100% 0%
	..The authority of the legal system is relatively independent	0% 0%	0% 0%
Other Conditions	.. Leadership is present	40% 40%	n/a*
	..International Pressure is applied	100% 100%	n/a*
	..High Ambitions are combined with soft law	40% 40%	n/a*
	.. Cultural Differences are heeded	60% 60%	n/a*
	.. There are no economic differences	n/a*	66% 0%
	.. Interests are comparable	n/a*	33% 33%
	.. Interest Linking is successful	n/a*	100% 0%
	..International Legislation is in place	n/a*	100% 100%

*not applicable; not all interviewees have been asked about these conditions due to the sequence of interviews.

In the case of both the Rhine and the Meuse, interviewees highlight the importance of *transparency, autonomy of research* and *soundness of research*. In short, knowledge must be 'usable' (Haas, 2011), with which is meant that it must be accurate, accessible and contribute to the achievement of collective goals. However, knowledge must also be *trustworthy* and *independent from national or corporate interests*. Even though almost all interviewees mentioned the importance of accuracy and soundness of research, one must keep in mind (as one of the interviewees mentioned) that research is not tested according to standards as they are in the academic world, but rather are tested within the framework of respectively the Rhine and the Meuse Commission and by the people working within this framework..

In the context of both the Rhine and the Meuse commission interviewees indicated that a *consensus on goals and means* (through mandates), *awareness of policy makers of the different properties of ecological science* and a *legal framework* were important in incorporating ecological knowledge into policy making. The latter was in both cases the Water Framework Directive, however in the case of the Rhine more headway was already made in recovery of the ecological status than in the case of the Meuse. Some conditions originating from literature on the political opportunity structure were deemed non-applicable by the interviewees from both the Meuse and the Rhine Commission. These conditions were that it is beneficial for the incorporation of ecological knowledge if *maximal openness occurs, no stability in elite alignments is present* and *allies within elites exists*. Interviewees indicated that these conditions were not relevant because it was not a problem for knowledge to enter the system, primarily because much knowledge was either gathered by the Commission itself or by some affiliated to national research institutes or by people working within the Commission. Furthermore, as was indicated by some interviewees, when discussing the conditions within policy, there is a general *consensus on goals and means* within the Commission. If any censoring or selection in knowledge does take place, this is at the national level, as interviewees from both the Rhine and the Meuse Commission mentioned. At the national level it is possible for a delegation to request an investigation from its national research institute. If the outcome is not favorable, the decision can be made not to use it or relay it to its respective Commission. In both regimes *resource availability* can be a restricting factor.

In both the Meuse and the Rhine regimes the interviewees did not specifically indicate any importance of*issue related conditions*. This is probably because the interviewees are not actively aware of applying problem structures to a specific problem, and as such cannot identify situations in which this was done incorrectly. Furthermore, the question whether stakeholders have a shared understanding of the policy problem at hand or not was stated to be less relevant because stakeholders from outside

the Commission do not have any decision power within the Commission. The commission itself however often does operate under the condition that a consensus on goals and means is present.

The *autonomy of the legal system* was less relevant primarily due to the use of only soft law in commission policy both of the Meuse and the Rhine. Two other conditions dealing with the *occurrence of a focusing event* and the subsequent rise of *public opinion trends* were often seen as being one and the same condition in both the Meuse and the Rhine Commission.In all the examples named of a focusing event, the public opinion trend was a result of this focusing event and did not take place independently from it. All examples deal with the Rhine rather than the Meuse.

When comparing the Meuse and the Rhine regimes in whether specific conditions are present some differences can be named. Within the category of conditions many of them were recognized by interviewees related to both the Meuse and the Rhine Commission. One of these was the need to *reach consensus before uniting the science and policy streams* within the commission. In the Meuse Commission this often does not happen, hampering the decision making process because the science is questioned or preventing an effective scientific discussion because policy matters are being discussed. Another element that was mentioned by interviewees from the Meuse Commission was that *transparency was a trade-off with trust* between the member states (there is the fear that too much transparency will lead to looking for whose fault it is). This was not recognized by the interviewees from the Rhine commission, they indicated that trust was cemented by the fact that most of the people working for or with the commission are familiar with each other. Another difference mentioned by interviewees from the Rhine and the Meuse Commission was the need for *scientists to be able to communicate with scientists from other disciplines*. In the Meuse Commission all interviewees mentioned this, whereas with the Rhine only some did. One of the interviewees mentioned that this could be because the Meuse has a different organizational structure than the Rhine. In the Meuse the members of the working groups are more diverse, because the topic of the working group is much broader. Rather than having an ecological working group, which is above two project groups dealing with monitoring and fish, the Meuse has an ecological project group which can feed into several working groups (i.e. monitoring, Water Framework Directive, hydrology and pollution). Furthermore, within the Rhine Commission history a *focusing event* and the following *public opinion trends* have taken place (Sandoz Incident), whereas in the Meuse this is not the case.

5.4 Evaluation of Conditions

Some conditions were not considered relevant. The condition that *peer review should be applied* is probably incorrect because most interviewees indicated that peer review was often not applied to science used in policy making with the Commissions. They claimed that internal review was enough. Another condition that was not relevant because in both Commission the countries supply and pay for their own scientists and research is that the *epistemic community should have more than one sponsor*. For the same reason *scientistsshould be chosen by institutions rather than governments* is not relevant. *Little to no stability and allies within elites should exists* is a condition deemed irrelevant because key informants could not identify a clear elite (as separate from scientists). Furthermore, *no tendency and capacity for repression are present in the system*, are conditions which none of the interviewees could relate to. At the level of Commission, no repression takes place, it is possible for a national delegation not to bring information gathered by their national research institute to the Commission. Lastly, the *authority of the legal system should be relatively independent*, is a condition which all interviewees thought to be incorrect, as since the creation of the commissions only soft law has been applied, and this worked quite well. This condition is linked to the importance of *international pressure*, which causes countries to fall in line despite the presence of only soft law.

It is clear that various conditions that originated from the literature on political opportunity structures were found less relevant by the interviewees. The cause of this may lie in the fact that these conditions originate from research on specific scientific topics. These topics are often highly controversial and contested among scientists (e.g. genetic modification). Research used in the Commission is rarely as controversial as that. As such, the conditions arising from research on political opportunity structures (*maximal political openness, divided elite alignments, allies within elites* and *no tendency/capacity for repression in the system)* are found irrelevant by almost all interviewees.

Conditions dealing with applying a proper *problem structure* (issue related conditions) were considered irrelevant by all interviewees. It is possible that the conditions itself are not faulty, but that this process of identifying a problem structure and using the correct function of science is something that goes

automatically. Should a problem arise from not meeting these issue related conditions, the interviewees will possibly attribute the failure to something else

Conditions that were *not* in the original list from the literature are harder to discuss as some interviewees may not have thought of the conditions themselves, but may have agreed if they were presented with them. In any case, the conditions mentioned in the interviews highlight the importance of physical and organizational characteristics. For example *cultural differences are heeded, no economic differences are present, interests are comparable* and *interest linking is successful* are conditions related to the difference between countries in the Commission. Other conditions specifically have to do with the European Union and the way the Union is organized: e.g. *international legislation is in place, international pressure* and *high ambitions combined with soft law*.

Something that cannot be gathered from examining the information from the interviews is the age difference between the Rhine and the Meuse Basin regimes. This could be an underlying reason for the difference in successfulness in the incorporation of ecological knowledge between the Rhine and the Meuse. The establishment of the Meuse Commission only took place in 1994, making the Rhine Commission with its establishment in 1950 (ratification in 1963) the Meuse's clear senior. Some of the conditions mentioned in the next chapters may as such be caused by this age difference. Obviously the Rhine Commission has had more time in resolving any imperfections and obstacles. This age difference can be the cause for at least one of the conditions which is not met in the Meuse Commission (long periods of office for members in commission of the Rhine, see cultural differences), if only because of its shorter existence.

6.0 Conclusions and Discussion

6.1 Conclusions

This paragraph will try to give an answer to the main question of this thesis: What are the conditions that promote or inhibit successful incorporation of ecological knowledge in policy making in the basins of big rivers in Western Europe?

In order to answer this question the conditions that are, according to this research, (partly) causing the differences between the better incorporation of ecological knowledge in the Rhine as compared to the Meuse, will be discussed first. These conditions will be referred to as key conditions. Afterwards, additional conditions are discussed. These conditions have been considered relevant by the key informants, but do not cause the differences between the more successful incorporation of ecological knowledge in the Rhine as compared to in the Meuse.

Key Conditions

- *Consensus on scientific knowledge* should be reached *before uniting it science and policy streams*. This condition is met in the Rhine Commission but not in the Meuse Commission. It sometimes causes trouble in the latter.

-The presence of enough *resources*; in both the Rhine and the Meuse Commission this can be a constricting factor. Especially in the onset of the Meuse Commission this was an issue as *economic differences* were big. Furthermore, this condition is often not met when discussing fish ladders.

- The presence of *focusing event* which can cause a *public opinion trend.* Scientists and policy makers are suddenly aware of the problem and that action is often taken. However, part of the reason for taking action (especially on the part of the policy makers) is the associated public opinion trend, putting pressure on them. In the case of the Rhine Commission this happened after the Sandoz Incident. In the history of the Meuse Commission no such event takes place.

- *Legal framework* with the requirement to *include ecological knowledge* is present. Within both regimes the introduction of the Water Framework Directive was very important for the incorporation of ecological knowledge. Even more so in the Meuse than in the Rhine, it forced the Commission and national delegations to incorporate ecological knowledge. This condition has brought the level of successful incorporation of ecological knowledge in the Meuse closer to that of the Rhine.

Additional Conditions

- S*cience considers policy procedures and options, time is available to policy makers for familiarization with science, policy makers are aware of properties of science* and the presence of *scientists that are experts in their field and are able to communicate with scientists from other discipline.* One reason for these conditions to be in this category is the existence of the secretaries of the Commissions, which handle the translation between science and policy. Therefore the rest of these conditions are not of key importance.

- Research should be *broad and interdisciplinary* but also have a *restricted species* selection. As the situation at hand decides which of the two is the better choice both may be relevant conditions, but are not key conditions.

- Science should be *independent from national interests or debates*, *scientifically sound* and *trustworthy.*These conditions are usually present within the science of the Commission, but sometimes come into play when external experts need to be chosen.

- *Stakeholders are involved* in the decision making process as stakeholdershave influenced the decision making procedures in their respective regimes and involving them can prevent them from trying to obstruct the Commissions in their plans.

- A *consensus on goals and means* should be realized. This is more relevant on the higher levels of the Commission than the lower, as they decide upon the mandates for the rest of the Commission agencies.

6.2 Discussion

This research tried to give an insight into the conditions under which ecological scientific knowledge is incorporated into policy of the big river basins of Western Europe. After examining the two case studies several conditions from literature on the science-policy interface, political opportunity structures, ecological scientific knowledge and epistemic communities were thought to be relevant. Striking was that most of the literature on political opportunity structures did not raise any relevant conditions, whereas other literature did.

Other research has shown that a gap between knowledge and policy making often exists. Therefore, knowledge is not optimally used. This research has tried to shed a light on the conditions under which this gap can be closed. Next to discussing relevant conditions, this report also shows that more research is needed. This research has made a start with categorizing and validating conditions from other literature. However, more research is needed to investigate whether these conditions hold true for other river basins as well, also outside Western Europe. Furthermore, the conditions mentioned by the interviewees as an addition to the ones from the literature need attention by future research to prove their validity.

Moreover, next to the other conditions mentioned by the key informants, future research should especially pay attention to the length of existence of the Commissions, both in relation to the conditions, but also as a condition in itself. At the very least it is a factor which can amplify certain conditions or weaken them. In this research it was more difficult to validate some of the conditions for the Meuse, partly because not as many examples were available as for the Rhine. This could be due to the shorter time of existence for this Commission.

Drawbacks in the research process were the difficulty to find the right number of relevant key informants in time. This proved more difficult for the Meuse than for the Rhine, one of the reasons for this may be the fact that the Rhine Commission has been longer in existence than the Meuse Commission and as such more interviewees are available. Another restriction was a financial one, which did not allow for at least one key informant from every riparian state to be interviewed. Most interviewees were therefore from the Netherlands.

Lastly, as one interviewee mentioned, Commission policy is not completely new policy as it is based on the policies from the riparian states. As such, the country that does the least in the area of ecology is leading (lowest common denominator). Therefore the policy of the Commissions is almost always less ambitious than that of the individual countries. It might be interesting for future research to investigate how ecological knowledge is used on a national level and to see whether conditions differ or not.

References

Andresen, S., T. Skodvin, A. Underdal and J. Wettestad (eds.) (2000) Science and Politics in International Environmental Regimes Manchester: Manchester University Press

Bradshaw, G.A. and J.F. Borchers (2000) 'Uncertainty as information: Narrowing the Science-Policy Gap' *Conservation Ecology*Volume 4; Issue 1: 7 [online] URL: http://www.consecol.org/vol4/iss1/art7/

Backes, Ch. (2004) 'Bescherming van soorten in Nederland – of: Bescherming van Nederland tegen soorten?' In: Ch. Backes, J.H.G. van den Broek, A.J. Durville, M. van Geilswijk and J.A.M. van Spaandonk *Flora en Fauna wet. Verslag van de 79e ledenvergadering van de vereniging voor Milieurecht pp:* 11-50 Boom Juridische Uitgevers, Den haag (Dutch)

Barceló, D. (2007) 'Effect-Directed Analysis of Key Toxicants in European River Basins. A Review' Environmental Science and Pollution Research Volume 37; Issue 6: pp. 30-38

Bastings, S. (2002) 'Cooperation in the Meuse River Basin; the sharing of water between Belguim and the Netherlands' *Presentation by Ministry of Transport, Public Works and Water Management* Poland, Miedzyzdroje 21-24 april, 2004.

Bouman, N. (1996) 'New Regime for the Meuse' *Review of European Community and International Environmental Law* Volume 5, Issue 2, page 161-168

Bree, van L., N. Fudge, J.T. Tuomisto, B. Brunekreef (2007) 'Closing the Gap Between Science and Policy on Air Pollution and Health" Journal of Toxicology and Environmental Health Part A Volume 70: pp. 377-381

Brink, van den, F.W.B., G. van der Velde, A.D. Buijse and A.G. Klink (1996) 'Biodiversity in the Lower Rhine and Meuse river-floodplains: its significance for ecological river management' *Netherlands Journal of Aquatic Ecology* Volume 30; pp. 129-149

Broekhoven, A.L.M. (1987) Interim Rapportage t.b.v. Ministersconferentie. RIZA, Nederland

Broekhoven, A.L.M. (1987) Status Rijn Anno 1987. RIZA, Nederland

Callisto, M., Moreno, P., França, J.S., Ferreira, W.R., Paz, A.D. and Monteiro, I.M. (2009) 'Use of the BEAST model for biomonitoring water quality in a neotropical basin' Hydrobiologia, Volume 630, Issue 1: pp 231-242

CIM-IMC-IMK (2011) La Commission Internationale de la Meuse <<www.cipm-icbm.be>> accessed at 11-02-2011

Commission Internationale de la Meuse (1998) 'Traitement des résultats du monitoring international de la faune de macroinverté' Liege.

Commission Internationale de la Meuse (2001) 'Biomonitoring international de la Meuse: analysespatio-temporelle des peuplementsmacroinvertébrésbenthiquessur la période1998-2001'Liege.

Dieperink, C. (1998) "From open sewer to salmon run: lessons from the Rhine water quality regime" Water Policy Volume 1, Issue 5; pp. 471-485

Freitas, de, D.M., S. Kininmonth and S. Woodley (2009) 'Linking Science and Management in the Adoption of Sensor Network Technology in the Great Barrier Reef Coast, Australia' Computers, Environment and Urban Systems Volume 33; pp 111-121

Frijters, I.D. and J. Leentvaart (2003) 'Rhine Case Study' UNESCO-IHP, PCCPSeries Publication

Haas, P. (1992) 'Introduction: Epistemic Communities and International Policy Coordination'International Organization Volume 46, Issue 1: pp 1-35

Hasenclever, A., Mayer P. and Rittberger, V (2004), *Theories of International Regime*, Palgrave, The European Union Series.

Hedelin, B. (2007) 'Criteria for the Assessment of Sustainable Water Management' Environmental Management Volume 39; Issue 2: pp 151-163

Hegger , D., C. Dieperink and M. Lamers (2010) 'Knowledge co-production: a framework for researching science-policy interfaces' Unpublished Paper

Herring, R.J. and K.M. Roberts (2006) „Contentious Politics: Science, Social Science and Social Protest *Theme Proposal* Cornell University

Hofstra, M. (2010) 'From Open Sewer to a Living River Rhine' MRC Summit 2010 Published Online

International agreement on the Meuse (2002) Gent. Retrieved on 5 February 2011 from: <<http://www.cipm-icbm.be/files/files/accord_gand_d.pdf>>

International Commission for Protection of the Rhine (2007) Technical Report Monitoring Rhine Fish, Koblenz

International Commission for Protection of the Rhine (2007) Technical Report Monitoring Macrozoobentos, Koblenz

International Commission for Protection of the Rhine (2007) Technical Report Monitoring Phytobentos, Koblenz

International Commission for Protection of the Rhine (2007) Technical Report Monitoring Phytoplankton, Koblenz

International Commission for Protection of the Rhine (2007) Technical Report Monitoring Macrophytes, Koblenz

International Commission for Protection of the Rhine (ICPR) (2009) <<www.iksr.org>> [accessed on 02-12-2010]

International Meuse Commission (1994) Agreement on the protection of the River Meuse.Charleville-Mézières. Retrieved on 8 February 2011 from: <<http://www.cipm-icbm.be/page.asp?id=46&langue=NL>>

International Meuse Commission (2005) *International River Basin District Meuse – Analysis, Roof Report*, Liege.

International Meuse Commission (2006)The International River District Meuse, a Status Assessment. First Step in the Implementation of the Water Framework Directive.Liège

Internationale Commissie ter Bescherming van de Maas (1994) 'De Kwaliteit van de Maas in 1994' Luik.

Internationale Commissie ter Bescherming van de Maas (1998) 'Actieprogramma "Maas" 1998-2003' Luik.

Internationale Commissie ter Bescherming van de Maas (1999) 'Trekvissen in de Maas, Stand van zaken 1999' Luik.

Internationale Commissie ter Bescherming van de Maas (2001) 'Tussenrapportage 2001' Luik.

Internationale Commissie ter Bescherming van de Rijn (1999) 2e internationale Rijn-Symposium "Zalm 2000" Rapport. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2000) Rijn en Zalm: Programma voor Trekvissen in het Rijnsysteem. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2001) Rijnministersconferentie 2001: Rijn 2020. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2002) Das Makrozoobenthos des Rhein 2000: 68e Plenaire Vergadering 2/3 Juli Luxemburg. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2002) ICBR-Inventarisatie 2000. ZusammenfassendeBewertung de BiologischenUntersuchungen. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2002) KontaminationvonRheinfischen 2000: 68e Plenaire Vergadering 2/3 Juli Luxemburg. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2002) Plankton imRhein 2000: 68e Plenaire Vergadering 2/3 Juli Luxemburg. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2002) Vergleich des Istzustandes des Rheins 1990 bis 2000 mit den Zielvorgaben - 68e Plenaire Vergadering 2/3 Juli Luxemburg. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2003) Plan herintroductie trekvissen in de Rijn. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2003) Stroomopwaarts: Balans Rijnactieprogramma. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2004) Haalbaarheids onderzoek herintroductie trekvissen in de Rijn. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2005) Rijn zonder Grenzen: Inventarisatie 2004 in het stroomgebiedsdistrict Rijn. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2006) Rijn 2020: Programma voor de duurzame ontwikkeling. Balans 2000-2005. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2007) Zalm 2020. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2008) De Rijn: Stroom met Relaties. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2009) Effectiviteit van Maatregelen voor een succesvolle en duurzame herintroductie van trekvissen in het Rijngebied – samenvatting van de totaalanalyse. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2009) Kwaliteitselement visfauna – monitoring van de visfauna in de Rijn 2005/2006. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2009) Masterplan trekvissen Rijn. Koblenz

Internationale Commissie ter Bescherming van de Rijn (2011) <<www.iksr.org>>Retrieved on 15-2-2011

Internationale Commissie voor de Bescherming van de Maas (1997) '*De Kwaliteit van de Maas in 1994*' , Luik

Internationale Kommission zumSchutz des Rheins (1999) Lachs 2000 – Ist der Rhein wieder einFlussfürLachse?. Koblenz

Internationale Kommission zumSchutz des Rheins (2000) Tätigkeitsbericht 1999/2000. Koblenz

Internationale Kommission zumSchutz des Rheins (2001) Rijnministersconferentie Straatsburg – Zustand des Rheinsgestern – heute – morgen. Koblenz

Internationale Kommission zumSchutz des Rheins (2002) Rheinfischfauna 2000 – Was lebtzwischendemRHeinfall bei schaffheusenund der Nordsee. Koblenz

Internationale Kommission zumSchutz des Rheins (2004) AuswirkungenvonWasserkraftwerken in den Rheinzuflüssenauf den Wanderfischabstieg. Koblenz

Internationale Kommission zumSchutz des Rheins (2004) Tätigkeitsbericht 2003/2004. Koblenz

Internationale Kommission zumSchutz des Rheins (2006) Tätigkeitsbericht 2005/2006. Koblenz

Internationale Kommission zumSchutz des Rheins (2009) Tätigkeitsbericht 2008/2009. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1987) Das AktionsprogrammRhein. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1988) Progress Rapport for 9thminister's conference. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1989) Bericht Symposium Ökologische Stand. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1990) Tätigkeitsbericht 1990. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1991) Tätigkeitsbericht 1991. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1991) Statusbericht Rhein: Chemisch-Physikalischeund Biologische Untersuchungen bis 1991. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1991) ÖkologischeGesamtkonzeptfürRhein. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1992) Tätigkeitsbericht 1992. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1993) Tätigkeitsbericht 1993. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1994) Tätigkeitsbericht 1994. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1994) Zalm 2000. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1994) De Rijn op weg naar ecologische herstel. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1995) Tätigkeitsberiht 1994/1995. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1996) Tätigkeitsbericht 1995/1996. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1996) Das Macrozoobentos des Rheins 1990-1995. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1996) Lachs 2000: Stand der ProjekteAnfang 1996. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1998) Tätigkeitsbericht 1997/1998. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1998) Rhein-Atlas, ÖkologieundHochwasserschutz. Koblenz

Internationale Kommission zumSchutze des RheinsGegenVerunreinigung (1998) Lachs 2000 – Wanderfische als Erfolgsindikatorenfür die ökologischeWiederherstellung der Habitateundder Durchgängigkeit des Rheingebietes. Koblenz

InternationaleMaascommissie (2002) 'First International Scientific Symposium on the Meuse, Proceedings' Maastricht, The Netherlands.

Internationale Maascommissie (2002) 'Hindernissen voor de Vistrek' Luik.

Internationale Maascommissie (2002) 'Inventaris van het Ecologisch Herstel van de Maas' Luik.

Internationale Maascommissie (2002) 'Jaarverslag 2002' Luik.

Internationale Maascommissie (2003) 'Jaarverslag 2003' Luik.

Internationale Maascommissie (2003) 'Rapport over de Kwaliteit van de Maas' Luik.

Internationale Maascommissie (2004) 'Belangrijke Waterbeheerskwesties in het ISGD Maas' Luik.

Internationale Maascommissie (2004) 'Jaarverslag 2004' Luik.

Internationale Maascommissie (2004) 'Internationaal Stroomgebied van de Maas, Analyse: Overkoepelend Rapport' Luik.

Internationale Maascommissie (2004) 'Internationale Stroomgebied van de Maas, een Toestandsbeschrijving' Luik.

Internationale Maascommissie (2005) 'Jaarverslag 2005' Luik.

Internationale Maascommissie (2005) 'Verslag 2e internationale Maas Symposium' Luik.

Internationale Maascommissie (2006) 'Jaarverslag 2006' Luik.

Internationale Maascommissie (2006) 'Rapport over de Coördinatie van de toestand en trendmonitoring in het internationaal stroomgebiedsdistrict van de Maas' Luik.

Internationale Maascommissie (2007) 'Jaarverslag 2007' Luik.

Internationale Maascommissie (2007) 'Ontwerp van het overkoepelend deel van het beheersplan voor het International Stroomgebiedsdistrict van de Maas' Luik.

Internationale Maascommissie (2008) 'Jaarverslag 2008' Luik.

Internationale Maascommissie (2009) 'Jaarverslag 2009' Luik.

Internationale Maascommissie (2009) 'Schone Beken en Rivieren voor Iedereen' Luik.

Internationale Maascommissie (2010) 'Third International ScientificMeuse Symposium' Luik.

Internationale Maascommissie (IMC) (2007) 'Rapport over de coördinatie van de toestand- en trendmonitoringprogramma's in het international stroomgebied Maas'<< http://www.cipm-icbm.be/files/files/Rapport_faitier_monitoring_Mmonitor_07_1_n_def2_.pdf>> [accessed on 02-12-2010]

Klobucký, R. and K. Strapcová (2004) 'Knowledge Utilization in Public Policy: the Case of the Roma Population Research in Slovakia' International Social Science Journal Volume 56: Issue 179

Lieth, H., Schlüter, M., Rüger, N., Savitsky, A.G., Novikova, N.M. and Matthies, M. (2006) 'TUGAI: An Integrated Simulation Tool for Ecological Assessment of Alternative Water Management Strategies in a Degraded River Delta' Environmental management Volume 38; Issue 4: pp 638-653

McAdam, D. (1996) 'Conceptual Origins, Current Problems, Future Directions', in D. McAdam, J. D. McCarthy and M. N. Zald (eds) Comparative Perspectives on Social Movements. Political Opportunities, Mobilizing Structures and Cultural Framing. Cambridge: Cambridge University Press.

Mouton, A.M., De Baets, B. and Goethals, P.L.M. (2009) "Knowledge-based versus data-driven fuzzy habitat suitability models for river management' Environmental Modeling and Software Volume 24; Issue 8: pp. 982-993

Nederlandse Rijkswaterstaat (1993) Onderzoeksrapport Rijkswaterstaat RIVM/RIZA/RIVO-DLO

Netherlands Environmental Assessment Agency, 2008, "Costs of Policy Inaction on Biodiversity" Published online <<http://www.planbureauvoordeleefomgeving.nl/en/publications/2008/CostofPolicyInactiononBiodiversity.html>>

Nienhuis, P.H., A.D. Buijse, R.S.E.W. Leuven, A.J.M. Smits, R.J.W. de Nooij and E.M. Samborska (2002) 'Ecological Rehabilitation of the Lowland Basin of the River Rhine (NW Europe)' *Hydrobiologica* Volume 478; Issue 1: pp. 53-72

Nooij, de, R.J.W., T.E.P.A. Lam, R.S.E.W. Leuven, H.J.R. Lendersand S. Pieters „Hoe Ecologisch is de Natuurbeschermingswetgeving? *Milieu en Recht* Volume 33; pp. 8-15

Osherenko, G. And O.R. Young (1993) 'The formation of international regimes: hypotheses and cases' in: G. Osherenko and O.R. Young (1993) *Polar Politics, Creating International Environmental Regimes* Cornell University Press, Ithaka and London, pp 1-20

Princen, S. and B. Kerremans (2008) „Insitutions and Interest Groups: Opportunity Structures in the EU Multi-Level System *West-European Politics* Volume 31; Issue 6: pp. 1129-1146

Quevauviller, Ph. Balabanis, C. Fragakis, M. Weydert, M. Oliver, A. Kaschl, G. Arnold, A. Kroll, L. Galbiati, J.M. Zaldivar and G. Bidoglio (2005) 'Science–policy integration needs in support of the implementation of the EU Water Framework Directive' *Environmental Science & Policy* Volume 8; Issue 3: pp. 203–211.

Raadgever, G.T., E. Mostert, N.C. van de Giesen (2008) ' Identification of Stakeholder Perspectives on future flood management in the Rhine basin using Q methodology' *Hydrology and Earth System Sciences*Volume 12; Issue 4: pp. 1097-1109

Rekolainen, S., J. Kämäri, M.Hiltunen and T.M. Saloranta (2003) 'A conceptual framework for identifying the need and role of models in the implementation of the Water Framework Directive', International Journal of River Basin Management Volume 1; Issue 4: pp. 347 - 352

Runhaar, H. and K. van Nieuwaal (2010) ' Understanding the Use of Science in Decision-Making on Cockle Fisheries and Gas Mining in the Dutch Wadden Sea: Putting the Science-Policy Interface into Wider Perspective' *Environmental Science & Policy* Volume 13; Issue 3: pp. 239-248

Slob, A.F.L, M. Rijnveld, A.S. Chapman and P. Strosser (2007) 'Challenges of Linking Scientific Knowledge to River Basin Management Policy: AquaTerra as a case study' Environmental Pollution Volume 148; Issue 3: pp. 867-874

Sterk, B., P. Carberry, C. Leeuwis, M.K. van Ittersum, M. Howden, H. Meinke, H. van Keulen and W.A.H. Rossing (2009) 'The Interface between land use systems research and policy: multiple arrangements and leverages' Land Use Policy Volume 26; Issue 2: pp 434-442

Tarrow, S. (2001) 'Transnational Politics: Contention and Institutions in International Politics.' Annual Review of Political Science Volume 4, Issue 1: pp. 1-20

Turnhout, E, M. Hisschemoller, H. Eijsakkers (2006) 'Ecological Indicators: Between two fires of science and policy' Ecological Indicators Volume 7; Issue 2: pp 215-228

Universiteit Utrecht (2010) 'Research: Environmental Governance for Sustainable Development' <<http://www.uu.nl/faculty/geosciences/EN/research/institutesandgroups/researchgroups/esp/research/Pages/default.aspx>> [accessed at 31-12-2010]

Volk, M., Hirschfeld, J., Dehnhardt, A., Schmidt, G., Bohn, C., Liersch, S. and Gassman, P.W. (2008) 'Integrated ecological-economic modelling of water pollution abatement management options in the Upper Ems River Basin' Ecological economics, Volume 66; Issue 1: pp 66-76

Wahlström, M. and A. Peterson (2006) 'Between the State and Market: Expanding the Concept of 'Political Opportunity Structure'ActaSociologica Volume 29, Issue 4: pp 363-377

Weiss, C. (1977) *Using Social Research in Public Policy Making* Mass: Lexington Heath

Weiss, C. (1999)'Factors that Improve the Use of Research in Social Policy. Case Studies.'*MOST Working Document*. Paris: UNESCO

Willems, P. and W.J. de Lange (2007) 'Concept of Technical Support to Science-Policy Interfacing with Respect to the implementation of the European Water Framework Directive' *Environmental Science and Policy* Volume 10; Issue 5: pp. 464-473