Institutional Change and Persistence in German Recreational-Fisheries Governance in Response to External and Internal Challenges

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Katrin Daedlow
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Präsident
der Humboldt-Universität zu Berlin
Prof. Dr. Jan-Hendrik Olbertz

Dekan
der Landwirtschaftlich-Gärtnerischen Fakultät
Prof. Dr. Dr. h.c. Frank Ellmer

Gutachter:

1. Prof. Dr. Dr. h.c. Konrad Hagedorn
2. Prof. Dr. Robert Arlinghaus
3. Prof. Dr. Volker Beckmann
4. Ass. Prof. Xavier Basurto, PhD
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**Paper I**

**Paper II**

**Paper III**

**Paper IV**
Daedlow, Katrin; Beckmann, Volker and Arlinghaus, Robert. Natural Resource Availability and Change of Property Rights Institutions: Insights from German Recreational-Fisheries Governance. *Manuscript (planned to be submitted to the Journal of Political Economy)*
Abstract (English)

New institutional economics (NIE) offers a vibrant research area of developed concepts and theories to explain institutional change and persistence in natural resource governance. However, two restrictions can be identified and are addressed in this work. First, the conceptualization of nature-related transactions requires more analytical and empirical attention in research about human motivations in institutional change processes than has previously been given by NIE studies. Second, the recent inclusion of systems-based analytical concepts from the resilience school to explain institutional change and persistence in natural resource governance is stressed, and researchers are encouraged to extend their research in this area. This enhanced NIE perspective is illustrated using German recreational-fisheries (GRF) governance, which is investigated in two contextual situations: 1) the differently arranged governance structures in East and West German recreational fisheries and 2) the various challenges (external shock vs. internal modest dynamics) prompting reactions such as institutional change for GRF governance. The results show that institutional change and alignment of governance structures can be differently organized and questions general determinism towards the organization of governance systems of natural resources. In detail, the results suggest that in situations with modest challenges common for GRF governance decision making, managers align their governance structures, based on changes in property rights institutions, with different properties of the nature-related transactions. For example, in cases of perceived resource scarcity and emerging rivalry among resource users, GRF managers tend to locally organize property rights institutions with strengthened exclusion and withdrawal regulations. However, my research has also revealed that multiple sets of reasons influence human decision making about institutional change and persistence. For example, when challenged by external fundamental shocks such as the German reunification in 1990, GRF managers tended to preserve customary institutions, minimize transaction costs of change, and maintain powerful positions. However, some exceptions in the results also demonstrate that the characteristics of the context can be leveraged by actors' motivations, revealing that actor-based theories from NIE are decisive for explaining institutional change and persistence in natural resource governance. The inclusion of system-based concepts from resilience thinking allows assessment of changes and persistence in structure and functions within the social system of GRF governance and identification of phases of reorganization after the external shock of German reunification. Yet, the combination of NIE and resilience thinking involve potential jeopardises if concepts are mixed without adequate clarification of meaning, necessitating careful conceptual and terminological bridging between the approaches. Therefore, I have developed a detailed analytical framework for studying institutional change and persistence in natural resource governance aimed at guiding future research.
Abstract (German)

Synthesis

1 Introduction

Which economic choices do people make within different contexts (Vatn 2005: 6)? This work investigates this core question in economics from the perspective of institutional change in natural resource governance, exemplified by German recreational fisheries (GRF). The contextual situation matters because it influences the outcomes of human decision making. The particular context studied in this work is twofold: 1) the different arrangement of governance structures in East and West German recreational fisheries and 2) the different challenges stipulating GRF governance for a reaction such as institutional change. Within a social system, institutions play an essential role in socially constructing decision making contexts (Vatn, 2005: 6). Understandings of institutions differ among the various social sciences (Ostrom, 2005: 178). The work being presented here follows primarily the meaning put forth by Douglas North, who defines institutions broadly as “the rules of the game in a society or, more formally [...] the humanly devised constraints that shape human interaction” (North, 1990: 3). These constraints include the prohibition of certain acts while, at the same time, conditioning the undertaking of allowed activities, possibly enhancing them (North, 1990: 4). Altogether, institutions delineate, among other factors, the parameters of behaviour for people and their economic interactions. Institutions emerge from human choices, but already established institutions impose constraints on their choice sets as well (North, 1990: 5).

In natural resource governance, institutions regulate human–nature interactions such as fishing activities. These interactions are part of the physical transactions related to natural goods, which are mediated through decision making about how to regulate human behavior in sharing particular resources (Hagedorn, 2008: 361). Thus, humans institutionalize nature-related transactions by for example defining property rights institutions (e.g., alienation rights) regarding natural resources and, therefore, constitute purely social relationships between the humans using them (Hagedorn, 2008: 363). For example, transferable fishing quotas are contracted by and between humans as an institutionalized transaction, with fishing activities themselves, as defined according to such contracts, constituting a domain of human–nature interaction. Contracts regarding natural resources are defined as property rights institutions regulating, for example, access to and use of natural resources by humans. In Western democracies such as Germany, such rights are enforced by the national state as the “unit of coercion” (Bromley, 1992: 3), where holders of property rights are protected and non-holders obliged to accept the rights of others. Therefore, Bromley defines property rights as “a benefit stream that is only as secure as the duty of all others to respect the conditions that protect” it (1992: 10). Institutions defining property rights consist often of a complex bundle of rules for variant holders of these rights to organize access, use, management, and alienation
of natural resources (Schlager and Ostrom, 1992: 250-251). Thus, contracting property rights is an important part of the governance of human–nature interactions such as fishing.

In economics, governance is described as undertaking economic activities in alternative means (Coase, 1937). Its structures comprise rules of decision making and forms of organization, of either individuals or groups of individuals, which are empowered by law or other group capacities to mold, change, maintain and eventually implement institutions (Williamson, 1998). Holders of property rights over natural resources are forms of organization within such structures (Schlager and Ostrom, 1992). Three classical, alternative modes of governance structures are market, hybrid contracting, and hierarchy (Williamson, 1996). An important issue in economics is to understand which governance structures are more appropriate for contracting and distributing particular economic transactions, known as alignment proposition (Williamson, 2000). However, there are more structural alternatives possible than these three distinct forms to organize, e.g. nature-related, transactions, because governance alternatives mediate in manifold ways between transactions to align structures that organize the allocation of natural resources (Hagedorn, 2008: 379). Applied to nature-related transactions, it is essential to identify what governance structures align with what particular properties of nature-related transactions (Hagedorn, 2008: 380). Thus, in order to explain institutional persistence and change in natural resource governance, an investigation of governance structures related to contracting economic activities and their decision making processes is crucial.

Institutional change can be roughly described as the process of changing existing institutions or establishing new institutions in a social system (Vatn, 2005: 169). There are different classifications of rules according to their defined objectives. For example, Ostrom distinguishes between operational rules, collective choice rules, constitutional rules, and metaconstitutional rules (Ostrom, 2005: 58-59). Operational rules are rules applied in day-to-day situations. Collective-choice rules affect operational situations and define who is allowed to participate in changing operational rules. Constitutional rules affect collective-choice situations and define who is allowed to participate in changing collective-choice rules. In natural resource use, often property rights holders are participants in constitutional situations. Finally, metaconstitutional rules underlie all others and can be related to cultural and habitual norms and rules (North, 1991; Denzau and North, 1994; Hodgson, 2004). This distinction of rules is helpful for understanding institutional change situations, in particular how collective choice rules affect institutional change or persistence at the operational and constitutional levels. However, at this point the question arises of why institutions are changing or why change is refused. As there are manifold understandings in the social sciences of what institutions are, there are also manifold explanations for institutional change in the literature. Vatn (2005: 169), for example, reviews four groups of theories explaining institutional
change: 1) spontaneous institutional change, 2) efficiency considerations, 3) the role of interests, value and power, and 4) reaction to crisis.

Spontaneous institutional change and institutional change as a reaction to crisis are – in contrast to efficiency considerations and the role of interests and power – situations where institutional change is not intended or not purposely initiated from below. That means that they are not the result of a collective design, elected boards or governmental authorities (Vatn, 2005: 171). Spontaneous institutional change emerges for example in daily procedures being carried out in a new way by some, which is then copied by members of a larger group. Such a spontaneous institution persists and is disseminated because, for example, it has been socially tested and approved in collective processes (Screpanti, 1995). Similarly, Vatn sees institutional change as a reaction to crisis as being unintended, because the crisis is playing the role of motivation for the institutional change (2005: 188). Crises in social systems, such as recessions or political upheavals, are a key focus of economics. Here, the speed and direction of compelled change are stressed as being crucial for the outcome of an institutional change process (Pierson, 2004). In addition, crises in ecological systems certainly trigger institutional change as well and are at the core particularly in studies of natural resource governance (Acheson, 2006).

In comparison, efficiency concerns and the protection of interests and power are explained as reasons for intentional institutional change in the literature (Vatn, 2005: 176). Institutional change enhances efficiency by economizing on transaction costs and as a response to technological change, respectively (North, 1990). As mentioned above, property rights, organizational forms, and state enforcement influence transaction costs in natural resource governance. Different forms of governance structures (e.g., based on private, common, or public property regimes) bear different transaction costs in governing natural resource use and require different enforcement (and other) costs for governmental authorities. Humans are likely to mediate institutional change if transaction costs of natural resource governance are perceived as being too high. Also, technical innovations often entail institutional change in order to make new technologies available for use with low transaction costs. In addition, institutional change can be also conducted according to power relations and protection of interests and values. In cases of natural resource governance, distribution of property rights over natural resources can be organized to protect the benefit streams of owners and their interests in maintaining them (Bromley, 1989, 2006) rather than to meet efficiency concerns (Platteau, 2000: 15). While securing such benefit streams, holders of property rights maintain powerful positions in natural resource governance.

All four groups of theories mentioned above can have great explanatory power when studying a particular process of institutional change, and relying on only one of the groups might conceal crucial insights in explaining how humans decide on and organize conflicting interests in natural resource use and governance. However, the emergence of conflict is
neglected in the above-mentioned groups of theories, and it should be noted that an initiation of institutional change about e.g., nature-related transactions is often based on emergent conflicts between different individuals or groups of individuals about the distribution of resources, increasing costs, or losing positions of power (Knight, 1992). Such conflicts, which need to be negotiated between opposing individuals or groups of individuals in ways that may lead to a decision on how to settle the conflict, are essential for understanding institutional change processes. Furthermore, when looking at institutional change the phenomenon of institutional stability requires similar attention, as it can help to explain why particular institutions or governance structures persist over time, despite emerging conflicts or increasing transaction costs, and why institutional change might not occur. Known as path dependency, a prominent approach in institutional economics has found evidence that actors tend to secure governance structures and institutions that bring them sufficient income and try to avoid costs of change, because future benefits from change are likely to be unknown (North 1990). In addition, economic traditions and customs have been considered very persistent because of deep-seated cultural roots and habits which influence actors’ positions and assets in using and governing natural resources. Thus, without recognition by or being based on the cultural and habitual contexts of people affected by it institutional change can be meaningless and even cause more conflicts than solving issues between negotiating parties, as described for example in fisheries management (de la Torre-Castro and Lindstrom, 2010: 77).

The previous review of new institutional economics’ (NIE) means of defining and explaining institutional change reveals a vivid research area with developed concepts and theories. However, when studying institutional change in natural resource governance, two restrictions can be identified, which will be addressed in this work. First, the study of human reasoning in institutional change processes based on the conceptualization of nature-related transactions requires more analytical and empirical attention than has previously been given by NIE studies (Hagedorn, 2008). Second, having a clear conception of the human interactions while using natural resources, the social-ecological system (SES) in question is important for studies about natural resource governance (Vatn, 2005: 231), and economists have, consequently started to incorporate a systems perspective into economic thinking (Daly, 1973; Norgaard, 1994). However, the recent inclusion of systems-based analytical concepts from the resilience school to explain institutional change and persistence in SES governance is stressed (Arrow et al., 1995; Herrfahrdt-Pähle, 2010; Herrfahrdt-Pähle and Pahl-Wostl, 2012). Also research communities from the ecological sciences now emphasize the importance of interdisciplinary work from the social sciences to study SES and are encouraging researchers to extend their research in this area (Walker et al., 2004; Folke, 2006; Lebel et al., 2006; Walker et al., 2006). Before developing an analytical framework addressing how to conceptualize these two margins for studying institutional change and
persistence in natural resource governance systems (Section 3), the case study of GRF governance will be introduced in the following section.

2 Case Study System: German Recreational-Fisheries Governance

The literature on fisheries governance and management stresses the decisive role of institutions, e.g., those defining property rights, in order to regulate human use and governance of fisheries resources (Hilborn et al., 2005). In addition, institutional change has been recognized as having the potential to improve poor fisheries governance, which often results in the collapse of fisheries (Costello et al., 2008). These institutions range from being very simple to complex, are highly diverse, and are subject to change. For example, Begossi (1998) identified that the design of fishing rights institutions may depend on density of fisheries, density of non-fisheries stakeholders on waters, diversity or availability of fisheries spots or mobility of technology. Other studies focus on the effect of different forms of ownership and property rights regimes on adaptation in fisheries management, e.g., changes in input and output controls, according to changing statuses of fish stocks (Sipponen, 1998; Young, 1999; Sipponen et al., 2010). Also, Wang (2001) has studied differences in adaptation of formal and informal institutions in transformations from common property to state property on fisheries at a lake in China. Meanwhile, Yandle (2007) investigated the consequences of property rights mismatches in marine fisheries triggering competition among resource users and negative impacts on fish stocks. These studies demonstrate that governance systems of fisheries resources are key figures in managing a particular SES and, thus, institutional economics can provide insights for understanding social conflicts in natural resource use and associated ecological problems.

Studies of recreational-fisheries governance and changes in e.g., property rights institutions are rare but emerging. For example, influences of different forms of ownership, i.e., property rights regimes, and institutional designs on recreational fisheries management has been studied in several countries such as Sweden (Almlöv and Hammer, 2006), Norway (Stensland, 2010), in the Pacific (Wood et al., 2013), in Japan (Ruddle and Segi, 2006), or in New Zealand (Kearney, 2001; McCormack, 2012). A few studies also emphasize reasons for institutional change. For example, Edwards (2003) has identified that information and transaction costs differ under distinct property rights regimes and, more particularly, increase in cases of unclear specification of property rights. Studies particularly focusing on institutional change in German recreational-fisheries governance are not yet present, and thus this work aims at partly closing this research gap. Given the importance of recreational fisheries as the main user of inland fisheries resources (Arlinghaus et al., 2002), research on governance and institutional change is required. Albeit, it needs to be stressed that this work

1 The difference between management and governance is difficult to define. In contrast to governance, in this work management is understood as day-to-day supervision and organization of resource use.
is not focusing on studying institutional change in order to enhance recreational-fisheries governance. Rather, it primarily seeks to investigate the case of German recreational-fisheries governance in order to a) enhance the understanding of institutional change processes and the underlying human reasoning in GRF governance when facing external and internal challenges and conflicts and b) analyse GRF governance with the help of an innovative analytical approach combining institutional economics and resilience thinking. Insights leading to the potential enhancement of GRF governance, however, would be a welcome additional benefit of this study.

Recreational fishing or angling is defined as “fishing of aquatic animals that do not constitute the individual’s primary resource to meet nutritional needs and are not generally sold or otherwise traded on export, domestic or black markets” (FAO, 2012: v). In 2002, there were about 3.3 million German anglers older than 14 years (Arlinghaus, 2006) and, as in most industrialized countries (Arlinghaus et al., 2002), anglers are currently the dominant users of inland fisheries resources in Germany (Arlinghaus, 2006). These fish resources provide numerous social, ecological, and economic benefits to society, such as fishing experience, fish consumption, relaxation in nature, enjoyment of the angling community, ecological education, environmental monitoring, and fishing tackle expenditures (Arlinghaus et al., 2002; Arlinghaus, 2004a, b). Recreational fisheries in Germany are relatively diverse, covering both freshwater and marine fisheries. Major geographical regions include the North German lowlands, Central German uplands, and the Bavarian Alps, which offer distinctive water bodies and associated fish communities. German recreational fisheries as an SES are defined as consisting of the water bodies and fish stocks within the borders of the German states and the institutions and governance structures managing the use of this natural resource by anglers.

There are three general types of formal institutions or regulations shaping fisheries governance. First, there are fisheries acts which define who is allowed to become fisheries-rights holders, i.e., who are allowed to manage and to use the resource and who is responsible for protection and conservation of fish stocks and habitats. There are in total 16 fisheries acts in Germany because fisheries are under each federal state’s sovereignty. Thus there is no common federal-level fisheries act in Germany. Second, in complementary fisheries ordinances, detailed minimum standards of resource management such as minimum-size limits, protected seasons, permitted and prohibited fishing and angling gear, fisheries monitoring rules, and possible actions regarding cases of administrative offence are delineated. Third, fisheries-rights holders establish compulsory copious bylaws for users of fish resources and regulate specific conditions for local fisheries. In these bylaws, fishing

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2 The term “state” refers to one of the 16 German states (also called German Länder) constituting the federal state Germany.
rights holders are allowed to strengthen the minimum standards of fisheries acts and ordinances. In Germany, angling clubs and angler associations are the dominant private fishing rights lease holders of freshwater fisheries resources (Arlinghaus, 2004a, 2006) – thus, as a group of people with private fishing rights, constituting a common property rights regime (Bromley, 1989: 205) that controls exclusion, management, withdrawal, and access rights regarding fish resources. Individual anglers buying fishing permits from fishing-rights holders obtain limited access and withdrawal rights (e.g., for one fishing season) and are not connected with management or exclusion rights.

Governance structures in German recreational fisheries are mainly angler associations or clubs that are holders of fishing rights and fisheries authorities in each of the German states. These two organizational constructions prevail in inland fisheries governance in Germany and are responsible for decision making concerning rules and their implementation in inland recreational fisheries. In the present work, they are defined as agents of the governance structure in distinction to other actors in GRF, such as users (i.e., anglers) of recreational fisheries or other stakeholders (e.g., water or land owners, animal welfare groups) who are not directly involved in decision making and governance of recreational fisheries. Under German law, clubs or associations are voluntary and permanent unions of natural and/or corporate persons (natürliche und/oder juristische Personen) who pursue a common purpose (such as angling). The purpose is independent from changes in membership, i.e., anglers quitting their membership lose all rights and duties with respect to the purpose of the club and new members take over their roles. Members of angling clubs are usually natural persons (i.e., anglers), and such clubs form a corporate person or body, i.e., a legal entity. Members of associations are usually corporate persons (i.e., angling clubs), but membership of natural persons (i.e., anglers) is also possible. Angling clubs and associations in Germany are so-called registered societies (eingetragener Verein) within German law, which includes the duties of non-profit operation (so-called Idealverein), serving the public interest (youth work, environmental care), and openness to interested affiliated members (i.e., anglers). In these clubs and associations, elected boards take over decision making on behalf of their members, usually elected or confirmed in annual meetings. Thus, anglers as club members are generally not directly involved in decision making processes.

Government fisheries authorities, as public entities, rather monitor the governance and law enforcement undertaken by angling clubs and associations, whereas angling clubs and associations, as property rights holders on recreational fisheries, assume liability and implement rules on recreational fisheries management. The government formally organizes the sector, but fisheries-rights holders make the day-to-day decisions with respect to planning

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3 This is only permitted as long as natural fish stocks are not threatened. The importance of habitat conservation and fish stock protection in German fisheries acts and regulations in the context of fish stocking is described in von Siemens et al. (2008).
and execution of fish stock management and conservation. Fisheries-rights holders are also involved in political decision making processes organized by public authorities relating to fisheries regulations and participate in formulating and changing fisheries acts and ordinances. Thus, angling clubs and associations are self-organized and non-market, horizontal co-ordination structures, on one hand, and fisheries authorities as governmental structures as hierarchies on the other. This work investigates mainly angling clubs and associations, because of their dominant role in GRF governance from state to local levels.

Institutional change and persistence will be studied in this work with particular focus on two contexts in GRF governance. First, governance structures are often differently organised, for example at the local, regional, or states levels, and these alternative structures are assumed to differ in terms of regulating fish resources over varying spatial scales. An exceptional feature of GRF is the existence of significantly different governance structures in East and West Germany. In West Germany, usually angling clubs on the local level constitute the governance structure, whereas in East Germany typically angler associations at the regional or state levels assume responsibility for recreational fisheries management (Herold, 1998; Mau and Müller, 1998; Grosch et al., 2000; Steffens and Winkel, 2002). Angling clubs in East Germany are organized within such angler associations and usually delegate decision making about resource use and management to their umbrella angler associations. The system of centralized fisheries governance in East Germany is based on large numbers of water bodies scattered throughout a region or state and was implemented on East German territory after the foundation of the GDR (German Democratic Republic) in 1949, which transformed the society into a socialist state with a centrally planned economy. At the same time, in West Germany the original recreational-fisheries governance system persisted: where angling clubs typically manage a small number of local fisheries in a decentralized way. This difference in the governance structures provides an exceptional opportunity to craft a comparative case study on institutional change (e.g., triggered by negotiations about emerging social conflicts in nature-related transactions) and alignment of governance structures in GRF.

Second, the recreational fisheries governance system in East Germany was challenged by a major external shock, i.e., during German reunification in 1990 the social system was transformed from a socialist system with a planned economy to a democratic system with a social market economy. This fundamental socio-economic change set East German angler associations under pressure to institutionally adapt their governance system to changes in the general socio-economic system. The specific term used in this work for this fundamental socio-economic change is “institutional environment”, particularly referring to political, judicial, and bureaucratic institutions as the formal institutions of a nation state (Williamson,

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The territory of the former German Democratic Republic (GDR) is referred to as East Germany, whereas the territory of the Federal Republic of Germany (FRG) before the reunification in 1990 is referred to as West Germany. Both parts together form current-day Germany.
2000: 598). This fundamentally challenging situation constitutes a different context for decision making processes than rather regularly emerging or more modest challenges for recreational-fisheries governance such as the regulation of access to recreational fisheries. In this context, it can be studied how humans decide about institutional change and persistence in reaction to fundamental social change or to typical circumstances of recreational-fisheries governance. The next section describes how this case study is framed by some analytical concepts from NIE and resilience thinking in order to explain institutional change and persistence in both historical and contemporary GRF governance.

3 Analytical Framework

Governance of social-ecological systems (SESs) such as fisheries is challenging because of their particularly dynamic and complex characteristics, which previous fisheries research have neglected (Mahon et al., 2008: 104). SESs are coupled systems of human (social) and natural (ecological) worlds, the analysis and understanding of which means emphasizing concepts such as non-linear dynamics, thresholds, uncertainty and shock, interplay of periods of gradual change with periods of rapid change and their interaction across temporal and spatial scales within the SES (Folke, 2006: 253). Research aimed at understanding governance of SESs needs, then, to include such characteristics. For doing so, initially, the SES’ components and traits need to be identified. System components of a social system are, for example, governance structures with embedded organizations deciding about the institutionalization of nature-related transactions in order to govern natural resource use by humans. The analysis of change or persistence of institutions based on human choices helps to understand the dynamic processes within a particular SES such as GRF, because institutions “regulate relationships among individuals and between the social and ecological systems, i.e. rights and duties as well as costs and benefits of actions. Therefore, institutions link social and ecological systems” (Gatzweiler and Hagedorn, 2003: 3).

In addition to system components, a conceptualization of SES behaviour is important. Today, the concept of resilience is becoming increasingly accepted in natural and, to a limited degree, in social sciences in order to describe SES behaviour. Resilience can be defined as the capacity of a system to self-organize, learn and absorb disturbances within itself (Lebel et al., 2006: 19), allowing it to remain within critical thresholds in order to survive (Folke et al., 2010: 20). However, to be able to explain the behaviour of components within a social system, inclusion of actor-based theories from the social sciences has been suggested (Lebel et al., 2006, Folke, 2006, Walker et al., 2006). The following sections will describe, first, how SES components are conceptualized in this work (Section 3.1) and, second, how system- and actor-based concepts of resilience thinking and NIE can be applied (Section 3.2) in order to examine institutional change and persistence in GRF governance.
3.1 Analyzing Social-Ecological Systems

The conceptualization of SES components in GRF will be done with the help of three analytical frameworks, namely the Social-Ecological Systems (SES; Ostrom, 2007), Institutional Analysis and Development (IAD; Ostrom, 1990, 2005), and Institutions of Sustainability (IoS) frameworks (Hagedorn et al., 2002; Hagedorn, 2008). These frameworks systematically structure the study of natural resource governance from a political and institutional economics perspective and, therefore, have a number of interfaces which make it possible to connect them for the analytical framing of the present research. Furthermore, they take into account relationships between social and ecological systems and particularly aim at explaining institutional change based on interactions between both parts of an SES. I propose that they complement each other for the research being presented here in the following way.

Ostrom proposed a nested SES framework for analyzing interactions and outcomes of linked SESs (2007) consisting of different components, also called variables, on different levels representing a SES. On the first level, surrounded by a particular social-economic-political setting and related to other SESs, the resource system with embedded resource units within the ecological system interact with a governance system and users organised in a social system (Ostrom, 2007: 15182). These interactions such as harvesting, which can result in conflicts among users, have particular outcomes which determine a particular state of the SES, such as its resilience, equity in resource use, or accountability of humans as decision makers within a governance system. On the second level, these four variables can be decomposed into so-called second-tier variables (Ostrom, 2007: 15183). For example, the resource unit can be decomposed into size, clarity of system boundaries, location, productivity and so on, or the governance system into government organizations, network structures, constitutional rules, operational rules, collective-choice rules etc. The advantage of this framework is clearly the conceptualization of different components within a SES and it enables scholars to organize how these different variables within a SES interact and affect each other.

Applied to my own research on GRF governance (Fig. 1), the above described property rights institutions (constitutional rules) and governance structures (angling clubs and associations within a particular set of decision making rules (collective-choice rules) constitute the governance system which lies at the centre of analysis in this work. Anglers are resource users and harvest fish stocks (resource units) in inland waters (resource system such as rivers or lakes) according to harvesting rules (operational rules) such as bag limits or size limits for particular fish species. Both the social and ecological parts of a SES are strongly connected by everyday human–nature interactions, specifically through multiple interplays between numerous components of the system. Both parts of the SES and the components within each part give feedback signals regarding their activities and can adapt to each other in
many forms. From such interactions, conflicts among resource users might emerge if, for example, the numbers of anglers having access to a fishery increase or technical improvements cause high catch rates. Feedback in this resource system would be reduction in fish stock abundance and changes in fish population structure or in the overall fish community structure. Most of all, lower catch rates from less abundant fish stocks may lead to immediate rivalry among anglers, who then start arguing about further use of reduced fish stocks (social conflict). At this point, managers in the governance structure, i.e. angling clubs and associations, potentially start negotiating such conflicts. They assess and evaluate the situation and are influenced by the attributes of the resource users (e.g., number of anglers) and the characteristics of the resource unit(s) and system (e.g., amount of fish stock population in a lake). Depending on the priorities set based on these influencing factors, decision makers adapt existing or mould new institutions e.g., restricting access rules for anglers or banning technologically advanced angling tackle in order to protect decreasing fish stocks. This example shows how the SES framework can conceptualize the interplay of different components within the GRF governance system that lead to institutional change.

Fig. 1 Components of and Linkages within the Social-Ecological System of GRF Governance

At the point of negotiating conflicts within a SES, however, Ostrom’s IAD framework (Ostrom, 1990, 2005) provides advanced guidance to analytically frame decision making regarding institutional change and persistence within a governance structure. Decision making takes place within a so-called action situation, which is influenced by three factors: resource characteristics (comparable to the ecological system in the SES framework above), attributes of the community affected by decision making, and the variety of rules, i.e., institutions existing in the social system), as described above (Ostrom, 2005: 15). However, the core of decision making lies in the action situation and is framed as follows. The participants or actors in an action arena are assigned to positions. These positions, such as being members of a board, managers, or club members, define the standing of the participant in that action situation: “the standing of a position is the set of authorized actions and limits on actions that
the holder of the position can take at particular choice set in the situations” (Ostrom, 2005: 41). Therefore, when analyzing an action situation it needs to be understood who makes decisions about resource use, what is the position of the participants or actors in the action situation, what are their resources, i.e., what kind of information is available to them, what are their abilities to control the action situation and their participants (power relations), and what kinds of perceptions about expected costs and benefits influence the potential outcomes of their decisions (Ostrom, 2005: 33)? Furthermore, the attributes of participants are supposed to influence their decisions as well, including their knowledge about a given resource, their negotiation skills, leadership abilities, experience in resource governance, perceptions and attitudes about resource management goals (e.g., priorities for deciding in favour of resource users or resource units), and levels of trust towards other participants and the angler’s community in general. Thus, the outcome of those decision making processes within an action situation depends highly on the particular arrangements within the action situation and the social capital among decision makers, and is influenced by external factors of the SES such as sets of existing rules, attributes of resource users, and resource characteristics.

Two more crucial aspects need to be considered when studying decision making on institutional change in a SES. First, an action situation does not take place in isolation or not always only at one point (Ostrom, 2005: 53-64). On the contrary, quite often more than one action situation is required for coming to a collective decision in resource governance. Such situations can be called networks of linked or adjacent action situations (McGinnis, 2011). Moreover, decisions about different management instruments require choices within different action situations. In addition, decision making processes are often repetitive, and their outcomes are likely to be re-negotiated in future decision processes. Thus, a future action situation in some respect ‘controls’ the possibilities for a current action situation. Second, an action situation can be embedded at different organisational levels. This is particularly relevant for the case study of GRF governance, because its governance structures are differently organized between East and West Germany, which might have varying influence on the outcome of decision making processes. Described in a bit more detail, in East Germany, where state or regional angler associations as property rights holders dominate action situations and decision making, angling clubs on the local level have no direct decision rights. In contrast, in West Germany, angling clubs have been major actors in action situations deciding about fish resource governance of the waters in their immediate proximity. Here, then, higher-level angler associations have no direct decision rights. It can be assumed that these differences in levels of decision making might influence the outcomes of action situations. Thus, this particular feature of GRF governance will be investigated with respect to institutional change and constitutes a central point of the research being presented here.

A vital complement to Ostrom’s frameworks is the work on institutionalization of nature-related transactions in SES by Hagedorn (2008), based on the Institutions of Sustainability
The IoS framework “focuses on how to regularise human action that leads to transactions affecting the relationship between natural and social systems” (Hagedorn, 2008: 359). And how institutions and governance structures are socially constructed depends on the specific properties of such transactions and the characteristics of the actors involved in them (Hagedorn, 2008: 359). The crucial point in this framework is the exact determination of nature-related transactions among humans being taken as the basis for human constructions of natural resource use and governance. That is, the properties of nature-related transactions between humans define the arrangement of institutions and governance structures, and also determine the possible modes of governance structures necessary for regulating particular properties of the nature-related transactions in question. For example, in cases of emerging rivalry over fish resources, angling as an activity is the physical link between humans and nature, and an emerging rivalry is the relevant property of the transactions between competing resource users. This rivalry can be institutionalized by the governance system by, for example, strengthening access rules or by implementing new governance structures which are deemed to be more adequate for managing such conflicts. Thus, the IoS framework stresses the concrete properties of nature-related transactions as the decisive component for analysing institutional change and persistence in SES governance, because they are understood as determining the ways in which humans mould institutions and, accordingly, (re)align governance structures (Hagedorn, 2008: 378). The concept of nature-related transactions can be connected to the concept of action situations within SES, where humans decide on institutional change or persistence in order to regulate human use of natural resources. Moreover, the concept of nature-related transactions takes into account the interdependencies of human–human interactions in using natural resources and, therefore, is well-suited for investigating governance of SES such as GRF.

3.2 Combining New Institutional Economics with Resilience Thinking

When studying governance of complex and dynamic SES, it becomes apparent that both systems-based and actor-based approaches alone are limited in terms of finding answers regarding how and why institutional change or persistence occurs in natural resource governance systems. Recent research, such as that deriving from the above-mentioned analytical frameworks for studying natural resource governance, has been trying to overcome this separation and provide a fruitful base for combining systems- and actor-based scientific approaches. Therefore, this kind of work is turning away from the segregated ways of thinking about structure (understood as systems of institutions) and agency (actors within a governance structure) that has been common in large areas of the social-science community.

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5 Other properties of nature-related transactions are, for example, spatial characteristics and mobility, dimensions of scale and time, coherence and complexity, limited standardisability and calculability, predictability and irreversibility or jointness and absence of separability (Hagedorn, 2008: 366).
stressing instead that both structure and agency are crucial for understanding SES governance and institutional change and persistence therein. For example, North (1990) found evidence that economic structures, such as governance structures and institutions, persist because of positive feedback mechanisms in social systems, such as when actors, who are embedded in sets of institutions which influence their behaviour and decision making, strive to maintain secure incomes and avoid potential costs of change because future benefits are unknown for them. Such trajectories of persistence in economic systems are well known as path dependency (North, 1990), as already discussed in the introduction.

Recently, among the most well-received and advanced approaches to merge systems-based concepts with actor-based theories is the resilience thinking school, originating from ecology (Holling, 1973), which calls for incorporating actor-based theories and concepts from the social sciences (Walker et al., 2004; Folke, 2006; Lebel et al., 2006; Walker et al., 2006). A major portion of the work being presented here applies systems concepts from resilience thinking to understand and explain institutional change and persistence in GRF governance, undertaken in following ways.

First, I rely on the resilience definition of Folke et al. (2010), introduced above, and aim to study persistence, adaptability, and transformability (Folke et al., 2010) in the East German recreational-fisheries governance. Accordingly, the maintenance of major components and relationships of a system after a disturbance indicates persistence of a resilient SES. Thus, resilience is a property of a system and persistence a result (Holling, 1973). Adaptability is defined as the capacity of a SES to absorb disturbances through incremental change while remaining in the same stability domain, whereas transformability is the capacity of a SES to create a new stability domain with new stable structures and functions that are fundamentally different from the previous system (Folke et al., 2010; Walker et al., 2004). While adaptability adjusts existing variables in a SES, transformability allows for the introduction of new components and is characterized by novelty in relation to the original system’s configuration (Folke et al., 2010; Walker et al., 2004). Both processes retain the major relationships of the system and, thereby, demonstrate its resilience. The following recognition criteria are defined for the study of GRF governance so as to be able to distinguish between persistence, adaptation and transformation of structure and functions within a resilient system.

Another path of research prefers working with the term robustness, instead of resilience, as a social system’s capacity to learn and adapt to changes in a SES (Janssen et al., 2007) because of the human ability to consciously design their system components in contrast to highly self-organized ecological systems, and therefore point to this difference by using robustness instead of resilience. However, those consciously designed system components can be still not prepared for surprising dynamics and interdependencies in a SES. Therefore, this work remains with the notion of resilience.

Another widely used definition of resilience is provided by Walker et al. (2004), who define resilience as “the capacity of a social-ecological system to absorb disturbances and to re-organize while undergoing change so as to still retain the same structure, function, identity and feedbacks” (Walker et al., 2004: 5). However, this definition does not comply with the definition of transformability which allows for novelty within the same system and its structure and function as described above, and is therefore not applied in this work.

System components are called variables within the resilience literature.
Persistence means preservation of the same component structure (e.g., centralized governance system) and function(s) (e.g., provisioning of access to fishing), adaptation is the transfer of system components, i.e., variables and their structure and functions, to lower organizational levels (e.g., from GDR territory to state level), and transformation is the appearance of new components and new structures (e.g., angling clubs in a decentralized governance system) and functions (e.g., restricted access to local fisheries) in the system.

In detail, structure and functions of system components of GRF governance can be assessed as follows. Major system components in social systems are individuals or groups of individuals (organisations) who govern natural resource use, such as in this case the angling clubs and associations in German recreational fisheries. The structure of the governance system were measured by looking at changes in the organizational levels of governance, property rights regimes, and levels of decision making regarding institutions (i.e., rules) such as fisheries acts and regulations. The governance structure and established rules of natural resource use and management provide the conditions for the functioning of this SES and the delivery of services for humans. The functions include the execution of management measures to regulate fish stocks (i.e., access restriction for anglers, use restrictions such as daily bag limits, and fish stocking measures) and the provision of social services (i.e., provision of angling opportunities, membership, rewarding of anglers involved in management, and providing benefits to the public).

Second, I have evaluated attributes of the disturbance characterising the case, such as speed (slow vs. fast), direction (e.g., external or internal to the SES to be analyzed or within the social or ecological system), and degree of disturbance (minor or fundamental changes, e.g., fundamental changes in constitutional laws) (Fleischman et al., 2010; Schoon and Cox, 2012). However, while the structure and functions of system components can be comparably straightforward when applied to a social system, the term disturbance is more challenging for accomplishing a bridging procedure from the ecological to the social sciences. When looking at the origin of this term from ecology, for describing surprising events such as fires or earthquakes, it becomes difficult to define similar surprising events in a social system. In the present work, the German reunification in 1990 is taken as a disturbance because of the fundamental characters of the uniting states, the high pressure to change governance structures and institutions, such as those in GRF in East Germany, and the quick responses required. Yet, some might argue that this event was not so surprising, because humans create such foundation-shaking events themselves. In case of German reunification, East Germans experienced discourses about a potential change in the social system in the years before the change, and East German recreational fisheries managers were, of course, embedded in this system. Nevertheless, fundamental events such as the German reunification trigger comprehensive and immediate human actions and decision making situations and, therefore, contrast strongly with modest changes or normal dynamics in a social system.
Third, I applied the adaptive cycle heuristic from resilience thinking to the East German recreational-fisheries governance system, which was under pressure to change during German reunification in 1990, in order to investigate phases of change in a social system. The adaptive cycle heuristic assumes that systems go through successive adaptive phases after being disturbed in order to deal with consequences of such disturbance. The four phases in this heuristic have been described as moving slowly from exploitation ($r$) to conservation ($K$) – maintaining the conservation stage for a prolonged period – then developing very rapidly from $K$ to release ($\Omega$), continuing rapidly to reorganization ($\alpha$) and ultimately back to exploitation ($r$) (Holling and Gunderson, 2002). Depending on the particular configuration of a system, it can then begin a new adaptive cycle or, alternatively, might transform into a new configuration. These phases are determined by two dimensions known as potential and connectedness. The adaptive cycle heuristic is claimed to be generally applicable to ecological and social systems as well as to coupled SESs (Gunderson et al., 2002). However, difficulties in assessing such phases in social systems are foreseen (Holling and Gunderson, 2002) and inclusion of disciplinary theories from the social sciences is needed in such studies (Abel et al., 2006; Carpenter et al., 2001). Yet, when looking at the phase of reorganization ($\alpha$), a connection to decision making concepts in social science can be established. As described above, an action situation (Ostrom, 1990, 2005) in a social system is a place where actors decide on potential institutional change and subsequent reorganization of their governance system. Thus, the attributes of the reorganization phase can be assessed by analyzing the positions, involvement, leadership and power assets of actors participating in this process and the (non-)influence of particular social groups in an action situation.

The connection between resilience thinking and NIE can be established via actor decision making regarding institutional change within a reorganization process of a social system. Their choices about changing or maintaining particular institutions in a governance system can be explained (among other factors) by property rights institutions and transaction costs economics as well as the roles of interests, value and power behind decision making, as described in detail above (Vatn, 2005). Thus, NIE enables the explaining of institutional persistence, adaptation, and transformation of a social system’s structure and functions and, therefore, can support the understanding of institutional resilience in a social system. Also, taken together the three aspects of a resilient system – persistence, adaptation, and transformation – are similar to North’ approach of path dependency (1990), where economic systems develop via institutional change but exhibit strong trajectories of persistence within a system’s key structures and functions over time.

Finally, before describing the detailed research objectives of the present work in the next section, I would like to differentiate my framework being developed here from the term adaptive governance as it is applied in many studies about SESs governance (Dietz et al.,

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9 Change in NIE addresses both adaptation and transformation, which are distinguished in resilience thinking.
Adaptive governance is, for example, defined as “institutional and political frameworks designed to adapt to changing relationships between society and ecosystems in ways that sustain ecosystem services” (Carpenter and Folke, 2006: 309). More detailed explanations of adaptive governance include the following principles: i) involving interested parties in informed discussions of rules (analytic deliberation), ii) allocating authority to allow for adaptive governance at multiple levels from local to global (nesting), and iii) employing mixtures of institutional types (institutional diversity) (Dietz et al., 2003). Social capital and learning are also central in adaptive governance:

Such governance connects individuals, organizations, agencies, and institutions at multiple organizational levels. Key persons provide leadership, trust, vision, meaning, and they help transform management organizations toward a learning environment. (Folke et al., 2005: 441)

However, these definitions can be only considered to a limited extent for the present research, because their discriminatory power regarding, for example, institutions and governance structures is fragile, which would impede my analytical purposes. In addition, some definitions reveal a rather normative bias in the direction how governance should be organized and adapted for a particular goal and rather assume a positive outcome, meaning that in cases where this concept is applied, problems in SES management will be automatically solved. This, however, makes it difficult in studying real-world phenomena, which very often do not follow such expected paths, even thought they were derived based on a number of previous case studies. In fact, humans often do not act according to such ideal concepts, but rather decide based on individual interests, which can emerge in social dilemmas where contrary positions exist and a solution might only be possible when one position loses ground. Thus, adaptation can also have a negative outcome e.g., from the perspective of sustainability. Consequently, in this work the term adaptive governance is not used at all, in order to avoid confusion with the above mentioned literature on this topic. How adaptation and governance (and other notions) have been conceptualized in this work has already been comprehensively described above.

4 Research Objectives

The four papers making up the research presented here are generally aimed towards understanding and explaining the 1) structure and functions of the German recreational-
fisheries governance system, 2) context of decision making of GRF managers concerning change or persistence of institutions shaping recreational fisheries activities, and 3) human motivations in decision making about institutional change (adaptation and transformation) and persistence in GRF governance. These three points were studied in two different contexts. On the one hand, I analysed how East German recreational-fisheries governance was challenged by the German reunification in 1990, which brought about a fundamental reorganization of the socio-political system (papers II and III). Here I showed how far and why East German recreational fisheries managers adapted their governance system to a new institutional environment while maintaining major traits of the former system at the same time. On the other hand, I also investigated how the two different governance structures in East and West Germany dealt with accustomed governance situations when facing modest dynamics in the relevant SES rather than fundamental changes, looking in detail at how property rights institutions on access to and use of recreational fisheries were adapted or maintained (paper IV). Furthermore, at a conceptual level, particularly papers II and III were aimed towards combining disciplinary approaches from NIE and resilience thinking in order to explain institutional change and persistence in natural resource governance systems. Finally, and more at a theoretical level, paper IV was aimed at augmenting institutional change theories by studying the influence of properties of nature-related transactions on institutional change and persistence in GRF governance. Meanwhile, paper I contains a theoretical discussion of differences in recreational-fisheries governance in Germany and the U.S.A., based on literature in this field. Therefore, I do not consider it to be a self-created empirical paper. The specific research objectives addressed in the four papers are as follows (also see Fig. 2):

1) Describing institutions and governance structures in German recreational fisheries governance (paper I)

All four papers being summarised here include a definition of the GRF governance system in order to lay the ground for the empirical analysis. However, paper I presents the most detailed definitions of the GRF governance system, including property rights institutions, governance structures and fisheries regulations in GRF. Therefore, it can provide a basis for further research on recreational-fisheries governance. The German common property rights regime, differentiated according to the East and West German governance approaches, is here compared with the public property rights regime in recreational fisheries in the U.S.A. in order to investigate different governance systems in recreational fisheries. Comparisons are done using established concepts from property rights theory (Schlager and Ostrom, 1992). Strengths and weaknesses of both types of regimes for fisheries governance and management are theoretically investigated according to the design principles facilitating robust common-pool resource governance (Ostrom, 1990).
Governance Structures and Institutions in German Recreational Fisheries (Paper I)

Response to Abrupt External Challenge

Institutional Resilience (Paper II)
Research Objective:
• Combination of disciplinary approaches from NIE and resilience thinking in order to explain institutional resilience.
Research Question:
• Why did the formerly centralized governance system in most East German states persist while, in one state, a decentralized system was implemented?
Main result:
• Managers preserved customary structures & functions, minimized transaction costs of change, and maintained powerful positions.

Response to Gradual Internal Challenge

Adaptive Cycle (Paper III)
Research Objective:
• Testing the application of a resilience heuristic, i.e., the adaptive cycle, to a social (human) system
Research Question:
• Can we assess the four phases of the adaptive cycle in the GRF governance system, under pressure to change after the German reunification?
Main result:
• In social systems, the adaptive cycle needs inclusion of disciplinary theories such as social identity theory.

Change of Property Rights Institutions (Paper IV)
Research Objective:
• Assessing human motivations in institutional change processes with particular consideration of properties of nature-related transactions.
Research Question:
• How far do properties of nature-related transactions, e.g., their degree of rivalry, influence human reasoning about change or maintenance of property rights institutions?
Main result:
• Humans tend to centrally organize property rights institutions in case of perceived resource abundance, and locally in case of perceived scarcity.

Figure 2: Schematic Representation of the Four Research Papers Included in this Synthesis.
2) Combining resilience thinking and institutional economics to explain institutional change and resilience in German recreational-fisheries governance (paper II)

Paper II combines disciplinary approaches from NIE and resilience thinking in order to explain the institutional resilience of the East German recreational-fisheries governance system after being disturbed by German reunification in 1990. Here I study in detail why in five out of six East German states the former governance system persisted while in one state a decentralized governance system was implemented. Based on resilience thinking and NIE, three analytical steps are developed to assess the (1) structure and functions of the governance system, (2) attributes of the disturbance and the reorganization process, and (3) human motivations to change or maintain a particular governance system.

3) Testing the application of a resilience heuristic, i.e., the adaptive cycle, to a social system (paper III)

Paper III contains an attempt to apply a resilience heuristic, in this case the so-called adaptive cycle, to a social system under pressure to change under a new institutional environment. The case is the same as in paper II, that is, the challenge of the German reunification process for GRF governance. However, the paper complements the results in paper II based on a novel approach to measuring the four phases of the adaptive cycle, using quantitative data from a content analysis of magazine articles.

4) Assessing human motivations in changes of property rights institutions with emphasis on properties of nature-related transactions (paper IV)

Paper IV focuses on the study of human reasoning in decision making about particular configurations of property rights institutions regarding natural resources. The influence of natural factor endowments, such as availability or abundance of natural resources and natural resource use regulations, is still not well understood (Brunschweiler and Bulte, 2008; Barbier, 2011). This paper seeks to contribute to this research gap by investigating patterns of change and persistence of property rights institutions (i.e., access and use regulations) in GRF at the local and regional levels. While doing so, it employs the analytical concept of properties of nature-related transactions (Hagedorn, 2008) in order to explain the influence of characteristics of natural resources on human transactions and the respective motivations to change or maintain property rights institutions.

The next section describes the overall methodological approach adopted during the work outlined here in order to meet the research objectives described above.
5 Methodological Overview

The research presented here applies a case study strategy, which allows the accumulation of knowledge from different analytical resources in order to explain complex social phenomena. The complex phenomena analysed in this work is GRF governance and the motivations of GRF managers in institutional change processes influenced by gradual internal challenges, on the one hand, and strong and abrupt external challenges on the other. Among the available strategies to analyse the development and performance of institutions and governance structures and to test and develop theories, the case study strategy is one of the most prominent approaches in NIE (Beckmann and Padmanabhan, 2009: 343).

A general understanding of the case study strategy is delineated by Yin (1994: 13), who writes that a case study is an empirical inquiry that

- “investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.”

And Yin (1994: 13) continues that the case study inquiry

- “copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result,
- relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result,
- benefits from the prior development of theoretical propositions to guide data collection and analysis.”

Among researchers, the understanding of the case study approach was and still is a source of misunderstanding and confusion, perhaps because of the complex nature of its reasoning regarding case selection and multiple uses of methods and data sources. For example, much depends on the ways in which cases are defined in order to obtain knowledge about a given case study. Therefore, Gerring (2004: 341) understands a case study as

an in-depth study of a single unit (a relatively bounded phenomenon) where the scholar’s aim is to elucidate features of a larger class of similar phenomena. [... C]ase studies rely on the same sort of covariational evidence [due for example to the grounding of case-selection criteria, KD] utilized in non-case study research. Thus, the case study method is correctly understood as a particular way of defining cases, not a way of analyzing cases or a way of modelling causal relations.

Several authors have made beneficial attempts to increase clarification about the case study strategy (Stake, 1995; Yin, 1994; Gerring, 2004; George and Bennett, 2005; Flyvbjerg, 2006; Diefenbach, 2009; Poteete et al., 2010). Since research strategies can greatly vary among case studies, scholars have tried to develop classifications but have arrived at very different outcomes (Yin, 1994; Gerring, 2004; George and Bennett, 2005). For example, Yin (1994: 3) distinguishes between explanatory, descriptive, and explanatory case studies, in addition to his general definition of a case study strategy cited above. Gerring differentiates between
seven dimensions (such as type of inference, scope of proposition, or causal relationship) to choose a case study strategy applied to single-case and cross-case studies (2004: 346). George and Bennett focus on the theory-building dimension of case study research and – based on Lijphart (1971) and Eckstein (1975) – differentiate between six different types of theory-building and -testing objectives (2005: 75): Atheoretical/configurative idiographic case studies, disciplined configurative case studies, heuristic case studies, theory-testing case studies, plausibility probes, and “building block” studies of particular type of phenomenon. This overview hopes to give an impression about the complexity and variation in this methodological approach. A classification following George and Bennett (2005) has been applied to the work outlined here, namely that this research covers a range of case-study types: from illustrating theory (paper II) through heuristic testing (paper III) to generating theoretical heuristics (paper IV). A detailed discussion of the disadvantages and weaknesses of a particular approach (e.g., selection bias, limited replication, lack of external validity or indeterminacy, see for example, Poteete et al., 2010: 35) is discussed, when applicable, in each empirical paper referred to here.

The particular methodological approaches chosen for investigating institutional change in GRF governance vary across the differently focused analyses in the empirical papers (i.e., II, III, and IV) and are explained in detail therein. However, as a general strategy, an information-oriented selection of samples and cases was chosen to maximize the utility of information from small samples and single cases (Flyvbjerg, 2006: 230) for the case study research undertaken. In addition to information-oriented selection, the analysis in paper IV seeks to encompass a case selection with maximum variation, in order to be able to obtain information about the significance of particular parameters in the case process and outcomes (Flyvbjerg, 2006: 230). The parameters chosen in paper IV are (a) differences in governance structure (local level in West Germany vs. regional/state level in East Germany) and (b) variation between geographical areas (North German lowlands vs. South German uplands). Based on the maximum variation of possible combinations of governance structure and geographical area, as two primary selection parameters, altogether four counties were selected (one county with a local governance structure in the North German lowlands and one with a local governance structure in the South German uplands; one county with state governance structure in the North German lowlands and one county with regional governance structure in the South German uplands). The cross-case selection of four counties allows for theory testing and theory development, because pattern matching among them is proposed to be an adequate tool to refute a theory or build new theoretical heuristics and propositions (Campbell, 1975) and can be confirmed by a larger number of within-case observations. Furthermore, the specific historical development of East German recreational fisheries governance – changing from a socialist country after World War II to something else after German reunification in 1990, while the recreational-fisheries governance system in West Germany more or less did
not change during that time – can be said to characterize the comparative study of East and West GRF governance in paper IV as like of a natural experiment (Dunning, 2008).

Within the above-cited literature, a clear distinction between a case study approach, cases and other areas of analysis is required (Gerring, 2004; George and Bennett, 2005). By referring to a particular set of propositions and corresponding analytical design, cases and areas of analysis vary within and among case studies (Gerring, 2004: 342). For the work outlined here, I have developed the following distinctions between case study, cases, and areas of analysis (Table 1).

Table 1: Composition of the Case Study, Cases, Areas of Analysis, and Methods of the Three Empirical Papers (papers II, III, and IV)

<table>
<thead>
<tr>
<th>Case study</th>
<th>Institutional change and persistence in GRF governance</th>
<th>Adaptive Cycle (Paper III)</th>
<th>Change of Property Rights Institutions (Paper IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case</td>
<td>Institutional change and persistence in GRF governance</td>
<td>Abrupt external challenge</td>
<td>Gradual internal challenge</td>
</tr>
<tr>
<td>Area of analysis</td>
<td>East German states (6 areas)</td>
<td>East Germany (1 area)</td>
<td>4 counties (4 areas)</td>
</tr>
<tr>
<td>Main Data Source</td>
<td>10 interviews</td>
<td>25 magazine issues</td>
<td>38 interviews, Survey (N=80)</td>
</tr>
<tr>
<td>Methods</td>
<td>In-depth qualitative analysis</td>
<td>Quantitative content analysis</td>
<td>In-depth qualitative &amp; descriptive quantitative analysis</td>
</tr>
</tbody>
</table>

Source: own graphic, N=number of respondents

The overall case study perspective of this thesis seeks to describe and explain institutional change and persistence in GRF governance. To guide the methodological approach taken by the case studies assembled here, an analytical framework has been developed that is being explained in this synthesis. This general framework has served as a basis for the development, conduction, and analysis of cases and areas aiming to give specific answers regarding institutional change and persistence in GRF governance in light of different study propositions and designs. The cases can be distinguished in terms of the abrupt external challenges (paper II and III) or gradual internal challenges (paper IV) that they examine, with the particular area of analysis varying according to the specific research questions of each paper. In paper II, an answer to the research question regarding why the central governance approach persisted to a large degree in East Germany after reunification is proposed through analysis of institutional change in each of the six newly-formed East German states. Paper III seeks to answer the research question of whether East German recreational-fisheries governance underwent an adaptive cycle based on analysis of the discourse of key GRF
managers on potential changes in the governance system existing on East German territory. Thus, East Germany constitutes the area of analysis in this paper. On the other hand, in paper IV the study centers on gradual change over time, focusing on comparison of East and West German recreational governance at the county level. For this paper, the four selected counties from East, West, North, and South Germany are the areas of analysis.

The main tools of data collection for these studies have been personal interviews with GRF managers at different organizational levels. For paper II, 10 interviews with GRF managers from the umbrella angler association and from state angler associations in East Germany were conducted. For paper IV, 38 angling clubs in the four selected counties were visited and, in interviews with the club representatives, information was collected about their fisheries resources (e.g., extent of waters covered, targeted species by anglers) and governance systems (e.g., club rules, information on organisation of meetings and decision making). To increase information collected on the regional- and state-level, four representatives of angler associations and four members of fisheries authorities were also interviewed. The interviews were complemented by information from the East German angler association’s magazine (paper III) and from a survey of 80 angling-club representatives who answered standardized questions about recreational-fisheries governance (paper IV). The particular data analysis techniques employed are explained and discussed in detail in each empirical paper.

6 Main Findings and Discussion

Paper I illustrates that differing property rights regimes can be developed for the same human–nature interaction of recreational fisheries, with varying advantages and weaknesses for fish resource governance. It shows that institutionalization and alignment of governance structures can be differently organized and questions general determinism towards the organization of governance systems of natural resources. The findings agree with Sikor’s (2008) observation of a false dichotomy between private and public property rights regimes regarding natural resources, because all here investigated regimes in Germany and the United States operated functionally on different levels and to different degrees. More specifically, the strengths of common property rights regimes, particularly if on a small scale such as in West Germany, include good possibilities for controlling, in this case, angling effort, fostering traditional ecological knowledge, and developing emotional attachments to local fisheries. Moreover, the high level of anglers’ involvement in local decision making facilitates intensive communication among anglers and between anglers and managers, which may result in timely conflict resolution, commitment to rules, and peer pressure towards rule compliance. The strengths of public property rights regimes for inland recreational fisheries, as in the United States, include a high professional standard for conducting monitoring and stock assessment activities along with the ability to develop a landscape perspective for recreational-fisheries management. This facilitates scale matching to solve problems based on scientifically
grounded planning of regulations and management intervention, which may help to avoid the pitfalls of “one-size-fits-all” policies. Irrespective of the governance system in place, a risk remains of pronounced rivalry emerging among users for access to common-pool resources, such as fish stocks within defined boundaries of either a state, anglers’ association, or angling club waters. This highlights the need for continued enforcement of rules and regulations along with continued communication with stakeholders. This is particularly challenging in large-scale governance systems, as in East Germany and the United States.

Paper II shows that the centralized system persisted in most East German recreational-fisheries governance systems at the states or regional level after the German reunification in 1990, because leading managers wanted to preserve customary structures and functions, minimize transaction costs of change, and maintain powerful positions. The outcome of the reorganization process in East Germany was possible because of the influential positions held by established managers in recreational-fisheries governance. The crucial role of established managers and their networks in governance of natural resources was also stressed in research about transformations in agricultural systems in Central and Eastern European countries after the end of the Cold War in the 1990s (Schlüter, 2001; Hanisch, 2003). Also, in line with e.g., North (1990), Roland (2004) or Walker et al. (2006), it was found that fast-changing institutions, such as those affected by the general socio-political changes that took place in East Germany, challenge slower-moving institutions such as the customs of recreational-fisheries managers. This resulted in path dependency in five states, where customary institutions persisted against the challenge of external and rapid change. Those patterns of path dependency in social systems are supported by deep-rooted habits of humans which are difficult to be changed (Hodgson, 2004). Moreover, according to Newman (2000), fast-changing institutions might also overwhelm human learning capacities when facing excessive demands for alteration by general socio-political change. This was supported by the results in five states where East German recreational-fisheries managers only adapted the existing systems in accord with inevitable alterations required by new constitutional laws at the federal level. Thus, situational conditions have (within limits) a certain influence on human motivations in decision making processes (Pierson, 2004; Ross and Nisbett, 2011) such as the attributes of the disturbance and the conditions in the reorganization phase in this case study.

Similarly to paper III, the results suggest that in externally induced, fundamental, and rapid disturbances, decision makers tend to prevent transformations in their governance system. Moreover, the positioning and influence of particular powerful actors in the decision making process can seen as necessary conditions determining particular outcomes from this process, in line with the actors’ motivations. However, key managers in the sixth state faced the same disturbance and underwent a reorganization process, but their lacking leadership and an emerging rivalry for fishing rights facilitated a transformation to decentralized governance. Thus, attributes of disturbances can be leveraged by actors’ motivations in the reorganization
process and the motivations of actors constituted sufficient conditions for explaining outcomes of a system’s reorganization. Also, the relevance of social capital among actors – meaning shared attitudes and networks, their interest in maintaining powerful positions, and leadership abilities in influencing the outcomes of the reorganization process – concurred with insights from studies on common pool resource management (Ostrom, 1990; Pretty, 2003; Gutiérrez et al., 2011). Furthermore, three analytical steps developed in paper III helped in assessing the institutional resilience of East German recreational-fisheries governance following the German reunification “disturbance.” In particular, assessment of the system’s characteristics and definition of recognition criteria aided identification of which particular structures and functions persisted, adapted, or were transformed in the governance systems of each of the six East German states after reunification. In this context, it is important to understand that a system’s stability in the same (adaptability) or in another domain (transformability) is a dynamic notion, as constant forces of change underlie any system.

Paper III holds that, contrary to assumptions in the adaptive cycle heuristic, the predicted combinations of high or low levels of connectedness and potential defining the four phases of the cycle could not be identified, and it was not possible to unambiguously delineate the four phases of an adaptive cycle based on these two dimensions (high and low). However, the insertion of an in-group (East Germans) and out-group (West Germans) dimension representing the two governance alternatives in the analysis helped to identify the specific time frames for all four phases. These findings suggest that an ecological heuristic such as the adaptive cycle cannot be simply transferred to social systems. Inclusion of theories coming from other disciplines such as social identity (i.e., intergroup relation theory) to assess different phases of adaptation in social systems is, therefore, recommended. Thus, in future studies, it could be fruitful to focus on the character of relationships such as trust, friendship, and respect to assess potential and on strength of self-conception in organizational matters and meetings of networks and groups to assess adaptation processes. Other studies have also emphasized the essential role of people’s preferences in policy decision making processes related to cases of implementation of new governance structures (Trosper 2003; Olsson et al., 2004, 2008). My research illustrates the persistence of customary governance structures based on managers’ preferences after an externally induced, severe, and rapid system disturbance. Regardless of the outcome of policy decisions in a transition process, meaning here the transformation or adaptation of a governance system’s characteristics, the general importance of identifying common social values among players in a new system is acknowledged by frameworks for studying transition processes and systemic transformation or transition (Adger et al., 2002; Anderies et al., 2004; Folke et al., 2005; Lebel et al., 2006; Olsson et al., 2006, 2008; Walker et al., 2006; Janssen et al., 2007; Biggs et al., 2010; Chapin et al., 2010). The results here confirm that identity, norms, and tradition of different social groups can play a major role in decision making about institutional change and persistence.
Difficulties with empirically testing the adaptive cycle heuristic in social systems have already been stressed by Holling and Gunderson (2002), who emphasized that the very general properties of the adaptive cycle are supposed to help in developing frameworks for assessing adaptation and are rather more of a metaphor to interpret events and their causes than a fully developed theory. The results from paper III confirm this perspective. In addition, the adaptive cycle heuristic, with its four phases, is reminiscent of the policy cycle heuristic from political science, which includes several steps for describing policy processes related to a particular policy issue (Windhoff-Hériter, 1987; Jann and Wegrich, 2003). The policy cycle heuristic was strongly criticized, however, primarily for the fictional character of its artificial stages and lack of a theoretical basis, so a progressive approach for analyzing policy was developed (Sabatier, 1999). This approach, known as the advocacy coalition framework, has a strong theoretical orientation (Weible et al., 2009). This example from the political sciences confirms my finding of a necessity to include actor-based theories in heuristics describing systemic behavior. Moreover, as shown in paper III, analyzing communication processes such as in leading professional magazines provides insights for understanding human motivations in reorganization processes, as similarly described in discourse-analysis studies of environmental policy making (Feindt and Oels, 2005).

Paper IV demonstrates that humans rather centrally organize property rights institutions with generous access and withdrawal regulations in cases of perceived resource abundance, and locally organize property rights institutions with strengthened exclusion and withdrawal regulations in cases of perceived resource scarcity. As suggested by the results, the influence of resource characteristics – here the perceived abundance or scarcity of fish resources – affected relationships between anglers, e.g. emerging rivalry, and prompted a reaction by the governance system to regulate this nature-related transaction. In the case of resource scarcity, this meant that anglers started to feel the costs of the fishing activities of other anglers, mainly reductions in their own catches, and rivalry among anglers emerged. This rivalry was a property of the nature-related transaction and initiated a reaction by the governance structure, resulting in a change of property rights institutions. However, in the case of resource abundance, anglers did not see themselves directly affected by the fishing activities of other anglers, because there seemed to be sufficient resources to be shared. While the results support previous economic insights on the importance of scarcity on decision making and establishing of property rights institutions (Demsetz, 1967; North, 1981; Libecap, 1989; Anderson and McChesney, 2003), they also confirm the importance of abundance in this context. Here, other resource characteristics, such as fish stocks migrating in a larger water body, affected the properties of nature-related transactions within GRF governance, i.e., the complexity of the resources challenged resource management, and the governance structure was centralized to lower existing enforcement and management costs while taking advantage of economics of scale, i.e., lower per unit costs.
For the analysis in this paper, the concept of bundles of property rights from Schlager and Ostrom (1992) greatly assisted the study of change and persistence in property rights institutions. With respect to the analysis of human reasoning in decision making processes about change in property rights institutions, this study found that decision making is a complex response of group members to internal problems under particular external conditions. Here, fair and equal distribution among authorized users, i.e., anglers who invest in the resource by paying membership and permit fees, was a major motivation for changing property rights institutions (Wang, 2001; Libecap, 1989, 2012). Moreover, this study has shown that contracting related to property rights institutions is influenced by the properties of nature-related transactions. While contracting the organization of angling activities, along with their associated costs, at particular water bodies, angling clubs maintained a common property regime instead of, for example, establishing a private property one (Eggertsson, 2003). The costs of contracting would have been lower than the benefits gained after a change in property rights institutions (Demsetz, 1967). These results also clarify that the simple distinction between three forms of governance structures suggested by Williamson (1996) – namely, markets, hierarchies, and hybrids – are analytically and practically too rough and needs finer graduations, specifically for governance of natural resources. Thus, the alignment of governance structures depends among other reasons on the particular properties of the nature-related transactions which are being negotiated (Hagedorn, 2008), as reflected in gradations of organizations of property rights holders, i.e., common property regimes at different organizational levels such as those in East and West German recreational-fisheries governance.

7 Conclusions

Three main conclusions can be drawn from the work that has been synthesized here. First, institutional change in the governance system of German recreational fisheries (GRF) is influenced by the properties of nature-related transactions arising from fisheries activities of anglers, and governance structures are aligned accordingly. However, this work has also shown that e.g. in the context of a fundamental and abrupt challenge to change, other factors such as preservation of customary structures and functions, minimization of transaction costs of change, and the protection of powerful positions are more relevant in decision-making about institutional change and persistence in GRF governance.

Second, it is important to consider the particular context of reorganization when analyzing human decision making about institutional change and persistence. For example, in case of a fundamental challenge with strong pressure to change, GRF decision makers have tended to hinder institutional change only allowing inevitable adaptations within the system. In contrast, in accustomed situations of decision making about recreational-fisheries governance GRF managers do conduct fundamental institutional change when required. However, attributes of
the disturbance and the reorganization process can be leveraged by actors’ motivations. This finding supports the explanatory power of established theories in new institutional economics (NIE), and is seen as a decisive aspect for explaining institutional change and persistence in GRF governance.

Third, the combination of actor-based and system-based theories and concepts from NIE and resilience thinking has been demonstrated to be fruitful for explaining institutional change and persistence in GRF governance. In detail, the systemic concepts of resilience thinking help to conceptualize human interactions within dynamic, living systems under particular social and ecological contexts and provide new perspectives for analyzing human behavior in SES governance, providing relevant results for this work. However, the combination of NIE and resilience thinking involves potential jeopardy if concepts are mixed without adequate clarification of meaning, thus requiring careful conceptual and terminological bridging between different the approaches.

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APPENDIX

Paper I

Katrin Daedlow, T. Douglas Beard, Jr. and Robert Arlinghaus

A Property Rights-Based View on Management of Inland Recreational Fisheries: Contrasting Common and Public Fishing Rights Regimes in Germany and the United States.

A Property Rights-Based View on Management of Inland Recreational Fisheries: Contrasting Common and Public Fishing Rights Regimes in Germany and the United States

KATRIN DAEDLOW*

Department of Biology and Ecology of Fishes
Leibniz-Institute of Freshwater Ecology and Inland Fisheries
Müggelseedamm 310, Berlin 12587, Germany

and

Division of Resource Economics, Faculty of Agriculture and Horticulture
Humboldt-Universität zu Berlin, Philippstrasse 13, Haus 12, Berlin 10115, Germany

T. DOUGLAS BEARD, JR.

U.S. Geological Survey, National Climate Change and Wildlife Science Center
Mail Stop 301, 12201 Sunrise Valley Drive, Reston, Virginia 20192, USA

ROBERT ARLINGHAUS

Department of Biology and Ecology of Fishes
Leibniz-Institute of Freshwater Ecology and Inland Fisheries
Müggelseedamm 310, Berlin 12587, Germany

and

Inland Fisheries Management Laboratory, Humboldt University of Berlin
Philippstrasse 13, Haus 7, Berlin 10115, Germany

Abstract.—In this paper, we describe and contrast the features of common and public fishing rights regimes in inland recreational fisheries management, using Germany as an example of a common property rights regime and the United States as an example of a public property rights regime. The German case is further distinguished into a common property rights regime at the regional level in “East Germany” (conducted by angler associations) and at the local level in “West Germany” (conducted by angling clubs). Comparisons are done using established concepts from property-rights theory and common-pool resource literature followed by a discussion of strengths and weaknesses of sustainable resource management for the different property-rights regimes examined. The strengths of common property rights regimes, particularly if on a small scale such as in West Germany, include good possibilities for controlling angling effort, fostering traditional ecological knowledge, and developing emotional attachments to local fisheries. Moreover, the high level of anglers’ involvement in local decision making facilitates intensive communication among anglers and between anglers and managers, which may result in timely conflict resolution, commitment to rules, and peer pressure towards rule compliance. Strengths of public property rights regimes for inland recreational fisheries, as in the United States, include a high professional standard for conducting monitoring and stock assessment activities along with the ability to develop a landscape perspective for recreational fisheries management. This facilitates scale matching to solve problems based on science-based planning of regulations and management intervention, which may better avoid the pitfalls of “one-size-fits-all” policies. Irrespective of the governance system in place,
a risk of pronounced rivalry among users for access to common-pool resources, such as fish stocks within defined boundaries of either state, angler association, or angling club waters, remains. This highlights the need for continued enforcement of rules and regulations along with continued communication with stakeholders. This is particularly challenging in large-scale management systems, as in East Germany and the United States. Our paper forms a basis for further research on recreational fisheries governance to identify suitable property-rights regimes for specific cultural, social, and ecological settings.

Introduction

Recreational anglers constitute the major user of fish stocks of most inland waters in industrialized societies (Arlinghaus et al. 2002). The potential influence of recreational anglers on fisheries resources seems to be underestimated in many areas of the world (Post et al. 2002; Cooke and Cowx 2006; Lewin et al. 2006). Intensive recreational fishing mortality is known to affect fish population abundance and size and age structure (Coleman et al. 2004; Lewin et al. 2006). In addition, anglers can impact fish populations through ecologically harmful stocking practices with genetically maladapted fish, introduction of nonnative fish, and disturbance of habitats (Post et al. 2002; Lewin et al. 2006, 2008; Cowx et al. 2010). Moreover, the growing scarcity of once-abundant fish stocks causes distributional conflicts among anglers and other users or stakeholders (e.g., commercial fishers or conservationists; Aas and Ditton 1998; Arlinghaus 2004, 2005, 2006a; Ditton 2004). In ecological terms, however, anglers are not only a source of potentially undesirable change of fish populations, but are also among the most important advocates for the preservation and enhancement of fish resources and have positively contributed to fish population conservation globally (Bate 2001; Granek et al. 2008; Cowx et al. 2010).

To manage the potential for stakeholder conflicts and management dilemmas associated with the common-pool resource nature of many renewable natural resources, such as fish (Ostrom 1990, 2005; Ostrom et al. 1999; Dietz et al. 2003), varying resource governance structures, such as private, common, or public fishing rights regimes, have been implemented in many countries worldwide (Young 1999; Hilborn et al. 2005; Hoel and Kvålsvik 2006). Even though many fishing-rights regimes still produce an overexploitation of fish populations or effect other ecological and social issues such as inequitable access to resources and distributional conflicts (Begossi 1998; Kearney 2001; Edwards 2003; Almlöv and Hammer 2006; Yandle 2007), some form of property rights on fisheries resources or implementation of other form of harvest rights (e.g., appropriation rights for parts or the entire resource stock) is seen as important to manage recreational and other fisheries for sustainability (Ostrom et al. 1999; Hilborn et al. 2005; Costello et al. 2008). To better understand the various features as well as strengths and weaknesses of existing recreational fisheries property rights regimes, a comparative approach contrasting the United States and Germany is presented in this paper.

Property Rights Regimes and Agents of the Governance Structure

Any form of use or access rights to natural resources such as fisheries is defined in the present paper and elsewhere (Demsetz 1967; Libecap 1989; Hanna et al. 1996) as “property rights.” Property rights are assigned to individuals or groups of people who acquire different rights or duties associated with the property rights of natural resources. For example, property rights holders can have harvest rights and, at the same time, be responsible for resource management, including execution and enforcement of fisheries regulations. In some situations, fishing rights normally, but not automatically, include holding the resource owner accountable for maintaining a sustainable resource stock (Bromley 2009). Other people interested in access to fish stocks obtain, usually from the property-rights holders, restricted rights, such as access and withdrawal rights to the resource (e.g., by anglers buying permits). These permits are usually not connected with the responsibility of resource management. Thus, property-rights holders, such as private people, fishing associations, or the state,
FISHING RIGHTS REGIMES IN GERMANY AND THE UNITED STATES

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govern the use of fish stocks (i.e., decide and contract on recreational fisheries management) and can be defined as agents or organizations of the governance structure (Williamson 2002).

Vatn (2005) distinguishes between four different property-rights regimes associated with natural-resource use such as fisheries: (1) private (individual) property; (2) common property, which is private property of a group of people (Bromley 1991); (3) public (state) property; and (4) open access (no property rights assigned). Depending on the property-rights regime, owners of fishing rights make decisions individually (1) or collectively (2, 3) about recreational fisheries management. Except open access, all property rights regimes can be identified for recreational fisheries in Germany in inland waters, but private property of fishing rights by a group of people (hereafter referred to as “common property” for simplicity) is the most salient form (e.g., when angling clubs and associations are the fishing-rights holders). In the United States, public property rights regimes exist for almost all inland waters; private property (individual or common) of inland waters occurs only rarely in some fee-based fishing ponds on private land and in other limited situations.

All property-rights regimes can be classified into five categories, each connected to particular rights and duties related to natural resource management and use (Schlager and Ostrom 1992):

- Access—the right to enter a defined physical area and enjoy nonsubtractive benefits (e.g., enjoying the waterside nonextractively).
- Withdrawal—the right to obtain resource units or products of a resource system (e.g., catch fish, divert water).
- Management—the right to regulate internal use patterns and transform the resource by making improvements (e.g., stocking of fish).
- Exclusion—the right to determine who will have access rights and withdrawal rights and how those rights may be transferred (e.g., selling angling permits).
- Alienation—the right to sell or lease management and exclusion rights.

Hereafter, we apply these five categories to characterize property-rights regimes in Germany and the United States for recreational fisheries in inland waters.

Germany

Fishing rights in inland waters, which are all waters in the territory of Germany, are automatically assigned to ownership of the body of water and possibly sold or leased out to third parties (e.g., commercial fisheries, angling clubs, and associations). Fishing rights unrelated to the ownership of water bodies through heritage since the medieval times when land barons declared themselves owners of fisheries resources (Wolter et al. 2003) also exist. These fishing rights are called autonomous fishing rights and they are commonly found today on larger water bodies (e.g., large river systems) in some regions of Germany. They often result in the coexistence of multiple fishing rights holders on the same body of water, some of which have only restricted fishing rights (e.g., for particular gear types, Wolter et al. 2003). Typically, however, ownership of the water body guarantees fishing rights, which includes alienation and all four subordinated rights (exclusion, management, withdrawal, and access) to fisheries management and use (Table 1). Owners of fishing rights are either public or private entities. Waters of major public interest, such as large rivers for transportation or freshwater storage reservoirs for the provision of drinking water, are generally held under public ownership (e.g., on state or federal level) and are governed by public authorities. For other inland waters such as many natural lakes and gravel pits, or smaller rivers and brooks, ownership is often held either by municipalities, cities, private individuals, or nongovernmental organizations. Yet in almost all situations, fishing rights are leased out or sold to commercial and recreational fisheries stakeholders. Fishing rights are usually transferred from water body owners by contract for 12 years to fisheries-rights holders, such as angling clubs, angler associations, or commercial fishing enterprises, who take over exclusion, management, withdrawal, and access rights of the fish stocks. In Germany, angling clubs and angler associations are the dominant private fishing rights lease holders of freshwater fisheries resources (Arlinghaus 2004, 2006a), and as a group of people, they constitute a common
Table 1.—Five categories of property-rights bundles (Schlager and Ostrom 1992) applied to property rights regimes in inland waters in East and West Germany and the USA. The description summarizes the prototypical situation, but exceptions exist. NGO = nongovernmental organization.

<table>
<thead>
<tr>
<th>Property rights categories</th>
<th>Property rights holders</th>
<th>Stakeholder</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>West Germany</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Alienation</td>
<td>Water owners</td>
<td>Public (federal, state, municipalities)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private (individuals, NGOs, etc.)</td>
</tr>
<tr>
<td>• Exclusion</td>
<td>Fishing rights holders</td>
<td>Angling clubs (common property)</td>
</tr>
<tr>
<td>• Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Withdrawal</td>
<td>License and permit holders⁷</td>
<td>Members of angling clubs and all people issuing permits</td>
</tr>
<tr>
<td>• Access</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>East Germany</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Alienation</td>
<td>Water owners</td>
<td>Public (federal, state, municipalities)</td>
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<td>Private (individuals, NGOs, etc.)</td>
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<tr>
<td>• Exclusion</td>
<td>Fishing rights holders</td>
<td>Angler associations (common property)</td>
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<td>• Management</td>
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<tr>
<td>• Withdrawal</td>
<td>License and permit holders⁷</td>
<td>Members of angler associations and all people issuing permits</td>
</tr>
<tr>
<td>• Access</td>
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<tr>
<td><strong>USA</strong></td>
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<td></td>
</tr>
<tr>
<td>• Alienation</td>
<td>Water owners</td>
<td>The public</td>
</tr>
<tr>
<td>• Exclusion</td>
<td>Water owners</td>
<td>State agencies on behalf of the public (public property)</td>
</tr>
<tr>
<td>• Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Withdrawal</td>
<td>License holders⁷</td>
<td>Licensed anglers</td>
</tr>
<tr>
<td>• Access</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

⁷ Note that in Germany, anglers need both a public angling license from state authorities that is pending passing an angling examination and a private angling permit from the fishing rights holder to be allowed to access and withdrawal fish in inland waters. In the USA, anglers only need to obtain a public angling license from state fisheries authorities to get access and withdrawal rights to waters under the license.

property rights regime. Individual anglers buying fishing permits from fishing-rights holders obtain only access and withdrawal rights (e.g., for one fishing season) and are not connected with management or exclusion rights.

Obtaining fishing rights depends on several prerequisites in Germany. Accordingly, before being able to lease a fishing right, the interested parties (e.g., commercial fishing enterprises or legal entities for recreational fisheries such as angling clubs and associations) have to prove to the fisheries authorities that the individual (commercial fishing enterprises) or leading member(s) of angling clubs and associations has conducted some sort of appropriate fisheries-education program (e.g., fisheries apprenticeship, attendance of seminars on fisheries management). This shall demonstrate their appropriate qualification for the execution of fisheries-management actions. There can also be supplementary prerequisites for obtaining fishing rights. For example, in some German states, before being allowed to lease a fishing right, angling clubs and associations have to prove that they serve the public interest (Gemeinnützigkeit) as a registered society, which includes, at the very least, nonprofit operation and openness to all interested affiliated mem-
bers (i.e., anglers). In addition, before fishing permits are issued, in most states anglers have to pass an examination proving their knowledge in ichthyology, aquatic ecology, legislative matters, and fish handling and killing processes in line with sophisticated fish welfare principles (von Lukowicz 1998). This angler examination is the basis for obtaining a public fishing license and becoming a member of an angling club or association. Consequently, with few exceptions, anglers in Germany need two authorizations to be allowed to go fishing: a public fishing license (issued by the state) and a fishing permit (issued by the fishing-rights holder) (Steffens and Winkel 2002).

An important feature in German recreational fisheries is the distinct governance structure in “East Germany” and “West Germany” (Figure 1). In West Germany, angling clubs on the local level constitute the major leaseholders of fishing rights and are thus users and managers of local fisheries at the same time, assisted by fisheries agencies and occasionally by a fisheries biologist employed by angler associations (Arlinghaus 2006a). In contrast, in present East Germany, the fishing rights are typically, but not always, held by state angler associations at the regional or state level (DAV 2004); angling clubs in East Germany are organized within those angler associations and usually are not fishing-rights leaseholders or owners of water bodies. Thus, the system of largely centralized fisheries management in East Germany is based on large numbers of water bodies scattered throughout the state, while in West Germany, angling clubs typically manage a small number of fisheries in a decentralized way. The reason for this difference originates from the separated governance structures and legislative environments existing in West and East Germany before the reunification of Germany in 1990 (Herald 1998; Mau and Müller 1998; Grosch et al. 2000). Throughout this paper, we use the term “East Germany” to designate the territory of Germany that constituted the former German Democratic Republic (GDR) before the reunification in 1990 with West Germany (named Federal Republic of Germany [FRG]). Current Germany (also named FRG) is still characterized by a distinct governance structure in recreational fisheries (decentralized in “West Germany” and centralized in “East Germany”), and the two separate territories are pictured in the background of Figure 1.

In most German states, the major objective of the officials in the state fisheries authorities is...
to supervise and support recreational and commercial fisheries activities and management in inland waters in agreement with the rules prescribed in fisheries legislation (see below). In doing so, they enforce public interests in this policy field. In different states, public fisheries agencies take a more or less active role in supervising management actions of fishing-rights holders, (e.g., by controlling management plans developed by fishing-rights holders, so-called Hegepläne, Mau 1996; Wetzlar 2000). Fisheries authorities are well staffed in some states, while in other states, only a handful of people are responsible for fisheries issues for an entire state. One reason for this disparity might be that fishing-rights holders, such as angling clubs and associations, are supposed to deal sufficiently with major management issues on the local level, such that state authorities’ involvement in fisheries management is not needed. A further reason is that inland fisheries are not considered overly important in current Germany (Rosenthal and Hilge 2000); thus, investments by public agencies into fisheries management are not a top priority.

The funding of the inland water management measures by fisheries authorities in German recreational fisheries is mainly provided by a tax system (based on angling license income, Fischereiabgabe, and other tax money) that varies in scope and magnitude from state to state. Additional funds originate from the fishing permits and membership fees, which are under the control of private fishing rights holders, such as angling clubs and associations. Larger projects, such as large-scale habitat management, are funded by general tax money from state agencies. The majority of the money raised through angling permits in angling clubs and associations is spent for fish-stocking measures, the renting of fishing rights, and other activities (e.g., youth work and clean-up operations at watersides).

United States

The U.S. property-rights regimes of inland water resources are much less complex than in Germany because in almost all instances, fisheries resources are considered public property (Table 1). Inland waters of the United States can be defined as all waters wholly within the boundaries of the country, excluding the Great Lakes. The ownership of fisheries is thus held by the public (i.e., the state has the alienation right and all other four subordinated rights [exclusion, management, withdrawal, and access], although there may be exceptions with certain trust species, etc.). State and sometimes federal fisheries agencies are involved in all issues surrounding management and use of the fisheries resources. In nearly all inland fisheries, anglers get access and withdrawal rights to fisheries resources by purchasing fishing licenses from state agencies (although some are purposely exempted, such as youth and others). Given this property-rights regime, the agents of the recreational fisheries governance structure are mainly state fisheries authorities. In some limited instances (largely as a result of treaty rights retained by Native Americans), there will be co-management relationships between state and tribal governments (Lamb and Coughlan 1993). Anglers in the United States only acquire access and withdrawal rights by obtaining fishing licenses but generally do not have the legal opportunity to acquire management or exclusion rights as do angling clubs and associations in Germany.

The funding of recreational fisheries management in the states is mainly provided through the sales of fishing licenses and other assorted fishing permits, an excise tax on recreational fishing equipment, and tax from gasoline used by recreational boaters (Radonski and Loftus 2008). Larger projects, such as large-scale habitat management, may also be funded by tax money from other state or federal agencies (Ross and Loomis 1999). These sources of funding allow most state fisheries programs to maintain extensive staff to fit within these dedicated funding streams. In addition, funding for federal fisheries programs is obtained primarily through the general budget of the United States. Generally speaking, the fisheries management agencies in the United States have much more staff than their counterparts in Germany because of the public ownership regimes and the associated management and enforcement duties.

Legal Frameworks and Common Management Actions

A legal framework for fisheries consists of formal institutions governing fisheries. Informal
institutions such as taboos, norms, or codes of conduct (North 1990) also exist, affecting fisheries outside of the legal framework. All institutions can be defined as “rules-in-use” (Ostrom 2005). Their purpose is to regulate the relationship between humans as they utilize the common natural resource base (Vatn 2005). One major objective of formal institutions such as fisheries legislation and regulations is to regulate who is assured the property rights to use the resource and, potentially, which management duties and behavioral rules are connected to this right (Gordon 1954; Hilborn et al. 2005; Huppert 2005; Grafton et al. 2007). Another objective of fisheries regulations is the determination of minimum standards in resource management, such as size-based harvest limits, seasonal and spatial fisheries closures, or daily bag limits. The enforcement of property rights and harvest regulations for inland fisheries is usually guaranteed throughout the industrialized world by the state as the “unit of coercion” (Bromley 1992). However, in some fisheries governance structures, state responsibilities are further supplemented by granting fishing rights and associated management duties to private entities, such as in Germany. This results in differences in legal frameworks as well as operational management actions as a function of the property rights regime in place, as exemplified by the situation in Germany and the United States.

Germany

Germany is a federal republic currently consisting of 16 states (Länder) after the reunification in 1990. Accordingly, 16 unique fishery acts and complementary ordinances exist because the sovereignty for inland fisheries is assigned to the state level in Germany (Mau and Müller 1998; Braun 2000). Regardless of the distinct features of property rights regimes in East and West Germany, the legal framework for inland fisheries management is similarly constructed in all states in Germany at the present time because of their origin in the Prussian fisheries law of 1916, which was the first in modern form in German territory (Herold 1998; Mau and Müller 1998). However, many specific details vary among the 16 fisheries laws (Braun 2000), such as the minimum age to be allowed to go fishing. The minimum age varies between 7 and 12 and either requires assistance by a licensed angler or a special children’s license (Steffens and Winkel 2002).

Generally, in Germany, three major types of formal regulations exist in all states; they are organized in three hierarchical levels and are binding for recreational and commercial inland fisheries management and thus for all fishing rights holders. First, as mentioned earlier, every state has a fisheries act, which defines who is allowed to use (i.e., catch) fish resources and who is responsible for protecting and conserving fish stocks and fish habitats. Note that for wild fish stocks, this does not mean that the fish stocks are owned by the fishing-rights holder (res nullis), but they are the only stakeholders to have the right to catch and to manage them. Second, detailed minimum standards of resource management such as minimum-size limits, and protected seasons, permitted and prohibited fishing and angling gear, fisheries monitoring rules, and actions in case of administrative offenses are delineated in complementary fisheries ordinances. Third, bylaws are often established by private fishing rights holders (e.g., angling clubs, associations, or commercial fishing enterprises, see Table 1); they are not official laws, but nevertheless regulate specific conditions of local fisheries and are binding for angling club and association members. Except those water bodies used for aquaculture purposes, all inland waters are subject of the same general management duty (Hegepflicht) prescribed by fisheries acts in each German state (Mau and Müller 1998). This duty declares that all fishing rights holders are required to protect and enhance a species-rich, healthy, native, and natural or “near-natural” (naturnah) wild fish community, including all other aquatic organisms, in agreement with local ecological conditions in terms of habitat quality and structure. Thus, angling clubs and associations have the duty to manage not only game fish, but also nongame fish for conservation reasons (Salva 2008). Accordingly, fishing rights holders are allowed to strengthen the minimum standards of fisheries regulations in bylaws for waters under their management regime if these regulations are considered necessary to maintain sustainable exploitation levels and restore or protect a native fish community locally (Braun 2000).
Fisheries regulations in acts and ordinances in each of the 16 German states are the result of comprehensive negotiations between public fisheries authorities, representatives of elected parties, various stakeholders, and their interest groups. The policy decision process in most states is organized by the agricultural ministries, in particular by their fisheries officials. In addition, different interest groups with a stake in inland waters, such as recreational fishers, commercial fishers, environmental protection groups, and animal welfare groups, as well as scientists, have a say in this process. The results of this process—the modified fisheries acts and ordinances—have to be followed by private and public owners of waters and the respective fishing-rights holders in consistency with other laws in Germany (e.g., the Federal Animal Protection Act or the Federal Nature Conservation Act).

The above-mentioned framework in Germany can be characterized as a delegated co-management system (see McConney et al. 2007 for other forms of co-management) where many operational management duties are delegated from the state to the fishing-rights holders. In this approach, the government formally organizes the sector, but stakeholders in fisheries make day-to-day decisions with respect to planning and execution of fish stock management and conservation (Arlinghaus et al. 2002; Arlinghaus 2006a). To fulfill the obligation of sustainable use of fish stocks, all typical fisheries management measures (except voluntary catch and release, which is not officially used as a tool, see Arlinghaus 2007) are found in both East and West German inland recreational fisheries management (Table 2).

Despite the generally similar legal framework for recreational fisheries governance across Germany, some differences in the application of selected operational management tools can be identified in the distinct governance structures in East and West Germany (Table 2). In terms of access regulations, small angling clubs in West Germany carefully regulate the number of users to align with the usually restricted availability of fishing area. In addition, some fisheries authorities in West Germany prescribe a fixed number of allowable fishing permits per hectare of water area in fishing rights lease contracts or in management plans (Harsányi 1996; Klupp 2002). By contrast, recreational fisheries management in East Germany is, by far, more open and less constrained in terms of access. In particular, angler associations in East Germany at state and regional levels deliberately do not restrict the number of permits on their usually abundant waters (DAV 2004). This also may limit the necessity to use closed fishing areas to control anglers’ effort on intensively fished water bodies. Besides this difference in access “philosophy” (DAV 2004), all other input control measures (Morison 2004), such as closed fishing seasons, and rod and tackle restrictions (which also may serve an output control rule if the restrictions constrain catches) are similarly applied in East and West Germany. Typical output control measures (Morison 2004), such as bag limits or minimum-size limits, are regularly used throughout Germany (Arlinghaus et al. 2002). In general, there is a limited use of special size-based harvest regulations (e.g., protected or inverse slot-length limits, maximum-size limits, Arlinghaus 2006b; Arlinghaus et al. 2010). Instead, across Germany, harvest regulations are generally confined to protected species and minimum-size limits as prescribed in fisheries legislation and occasionally strengthened in local bylaws developed by angling clubs and associations, thus following a “one-size-fits-all” policy (Carpenter and Brock 2004) across entire states.

In terms of management measures directly targeting fish stocks and habitats, further differences between East and West Germany are apparent (Table 2). In West Germany, fish stocking measures tend to be conducted regularly in most water bodies governed by local angling clubs to maintain and increase fish stocks (Klein 1996). Similarly, in East Germany, fish stocking is regularly conducted by angler associations, but it appears to be conducted somewhat less intensively. In addition, in both East and West Germany, there is management of unwanted species (e.g., removal of zooplanktivorous fish supposed to reproduce uncontrolled and impacting negatively on water clarity; Mehner et al. 2004; Meinelt et al. 2008). Finally, habitat management measures such as enhancing spawning habitat or installation of fish migration facilities (Cowx and Welcomme 1998) and installation and maintenance of fishing sites are regularly conducted in German inland recreational fisheries management (Lauterbach 1998; Bartmann 1998).
Table 2.—Prototypical input and output controls, fish stock management, and habitat management measures in inland recreational fisheries management in East and West Germany and the USA.

<table>
<thead>
<tr>
<th>Dominant governance structure</th>
<th>West Germany</th>
<th>East Germany</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope of regulation</td>
<td>Angling clubs</td>
<td>Angler associations</td>
<td>State fisheries authorities</td>
</tr>
<tr>
<td>Input control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Access regulation</td>
<td>Membership and license/permit</td>
<td>Membership and license/permit</td>
<td>State license</td>
</tr>
<tr>
<td>• Closed fishing area</td>
<td>Sometimes</td>
<td>Rarely</td>
<td>Rarely</td>
</tr>
<tr>
<td>• Closed fishing season</td>
<td>Always</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>• Rod limits and tackle restrictions</td>
<td>Always</td>
<td>Always</td>
<td>Often</td>
</tr>
<tr>
<td>Output control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bag limits</td>
<td>Always</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>• Minimum-size limits</td>
<td>Always</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>• Special size limits</td>
<td>Rarely</td>
<td>Rarely</td>
<td>Often</td>
</tr>
<tr>
<td>• Protected species</td>
<td>Often</td>
<td>Often</td>
<td>Often</td>
</tr>
<tr>
<td>• Voluntary catch &amp; release</td>
<td>Not officially approved</td>
<td>Not officially approved</td>
<td>Sometimes (species-specific)</td>
</tr>
<tr>
<td>Fish stock management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fish stocking</td>
<td>Always</td>
<td>Often</td>
<td>Often</td>
</tr>
<tr>
<td>• Reduction of unwanted species</td>
<td>Often</td>
<td>Often</td>
<td>Often</td>
</tr>
<tr>
<td>Habitat management</td>
<td>Sometimes</td>
<td>Often</td>
<td>Always</td>
</tr>
</tbody>
</table>
United States

Legislation for recreational fisheries management in the United States is dependent on their location and the government jurisdiction under which these fisheries operate. Similar to Germany, the United States is a federal republic consisting of 50 individual states and the District of Columbia. In general, sovereignty for inland fisheries is reserved for the states, and each state has separate rules under which these fisheries operate. In some limited instances, recreational fish species are deemed “trust species” and, as such, fall under federal jurisdiction, regardless of where these species are located (Lamb and Coughlan 1993; Buck 1999). In the United States, fisheries resources are held in trust by either the state or federal government for use by all citizens (Lamb and Coughlan 1993; Buck 1999). Responsibility for management of inland recreational fishing and management generally resides with the state or Native American governments or, in a few limited cases, with the federal government. A common objective of fisheries agencies is to manage the recreational fisheries resources for public use today and for perpetuation of the resource for future generations. Management includes development of regulations, monitoring and assessment programs, public education, habitat and stock enhancement, and regulation of access to recreational fisheries resources. The detailed minimum standards of resource management, such as minimum-size limits and protected seasons, are delineated in state or federal laws or regulations. Federal jurisdiction over direct management of resources is limited to treaty rights and trust species, and recreational users have no direct rights to change fisheries regulations (outside of participating in a public comment process).

Comparable to Germany, many parts of the regulations for fisheries in the 50 states are rather similar in wording, generally to meet the intent of the ruling of U.S. Supreme Court (Illinois Central Railroad v. State of Illinois, 146, U.S. 387 [1892]), which has held that states have a duty to exercise protection of wildlife resources within the borders as a trust benefit of the people (Meyers 2003). However, there is considerable variance in specific regulations implemented by each state for each recreational fishery, and in practice, regulations may differ from one fishery to another (Paukert et al. 2001; Radomski et al. 2001; Carlson and Isermann 2010). In most states, anglers over a minimum age (commonly 16) will need to purchase a fishing license, even though all citizens have the right to fish, regardless of age. There are few requirements to purchase general fishing licenses in a given state, effectively constituting an open-access situation. The cost of a fishing license varies by state and water types, and generally these licenses must be purchased every year.

Fisheries regulations in the United States are developed by the government agency with jurisdiction over the fishery, generally working through extensive public comment and input processes. Groups with an interest in the fishery provide written, oral, or formal input to proposed regulations, and these comments are integrated into the final regulations. In many instances, statutorily mandated commissions, commonly comprised of citizens of the states, have the final rule-making authority for recreational fishing regulations. Angling clubs, associations, and species-specific interest groups can influence regulations in recreational fisheries activities through lobbying and public input, although these voices are often specific to the group and may not be representative of all anglers (Hunt et al. 2010). Their interest might also disagree with the duty of fisheries agencies to weigh game and nongame fish management (Clarkson et al. 2005). However, the resulting regulations must be followed by all individuals participating in recreational fishing. Thus, a consultative co-management system (McConney et al. 2007) exists in the United States in which the government formally interacts with stakeholders in fisheries (e.g., angler groups) but retains the authority to make decisions with respect to day-to-day fish resource management. The management of inland waters in the United States is therefore conducted primarily by state fisheries agencies and by staff trained mainly in fisheries biology and less in the human dimension of management (Fulton and Adelman 2003).

Because recreational fishing property rights are publically held in the United States, management is centralized (i.e., the state agency is responsible for management authority). Direct input and output control measures (Morison 2004)
are generally not fixed in fishery legislation; the managers of inland waters are responsible for the development and implementation of these rules to manage each fishery, and in some states, there are many fishery-specific regulations (Pereira and Hansen 2003). Various forms of output control measures (i.e., harvest regulations, including also voluntary catch-and-release angling practices) are used extensively in the United States (Table 2) and are generally more common to use for management of recreational fish species than input control limiting effort (Cox and Walters 2002). Common harvest regulations as output regulations include protected species, daily bag limits, and various types of size-based harvest limits (Paukert et al. 2001; Radomski et al. 2001). By contrast, input controls such as direct limitations on angling effort (e.g., through closed fishing areas or entry limitations; Pereira and Hansen 2003) are rarely used in inland waters, except for seasonal closures on some species and rod limits and tackle limitations (Table 2). Most recreational fisheries management regimes in the United States do not limit the number of anglers or the amount of time that they can fish but rely on the concept of “self-regulation” or the idea that angling effort and subsequent harvest declines toward zero as fish population’s densities decline (Post et al. 2002). Thus, angling effort regulations are generally not seen as necessary, although there are recent papers calling into question the idea of self-regulation (Cox and Walters 2002; Post et al. 2002). Other management strategies such as fish stocking, removal of unwanted species, or habitat management are also used intensively in the United States (Table 2). They are usually developed by the fisheries agencies as part of an overall management strategy for recreational fisheries (see Épifano 2000; Radomski et al. 2001; Radomski 2003; Sullivan 2003; Clarkson et al. 2005).

Fit of Common and Public Fishing Rights Regimes with Institutional Design Principles for Robust Common-Pool Resource Management

In the final section, we discuss potential consequences of the various fishing rights regimes described earlier for sustainable resource management by comparing the fit of each of the property-rights regimes with eight design principles for crafting robust institutions (Table 3) identified by the recent (2009) Nobel Prize Laureate in Economics Elinor Ostrom and her colleagues (Ostrom 1990, 2005). These design principles are thought to facilitate sustainable management and governance of local common-pool resources such as fish stocks.

1. Clearly Defined Boundaries

The focus of the first design principle for institutions capable of managing natural resources sustainably is that boundaries of the resource systems as well as institutional boundaries in terms of individuals or groups with full or restricted property rights (e.g., access and withdrawal rights) are clearly defined. The boundary rules are related to the assumption that if resource users can determine their own membership, including harvest, management, and exclusion rules, they are likely to develop higher levels of trust and cooperation among “insiders” of the group that are entitled to use and possibly manage the resource base (Ostrom 2005).

For inland waters in Germany and the United States, this principle is well addressed by a fully established public license or private permit system that facilitates identification of legitimate users of resources. However, in situations when fishing rights for particular (typically large scale) water bodies are held by multiple fishing rights holders or mobile fish move between river sections or across state borders, the identification of property rights is difficult. This might influence the incentives of managers to invest into the resource facing the situation that stocked fish in a river section of one fishing-right holder might be harvested by another fishing-right holder. Generally, in both the United States and Germany, managers and anglers experience clear and legally fixed boundaries of access, use, and management responsibility on their waters, although each country has numerous interjurisdictional waters. Notwithstanding, the identification of “outsiders” might be easier in small user groups fishing on a small number of water bodies, either because of personal knowledge of peers or local enforcement of rules and licenses by authorized enforcement personnel. Thus, the principle of clearly defined boundaries in terms of the possibility to identify “insiders” and “outsiders” seems to be particularly well addressed in com-
Table 3.—Fit of property rights regimes in West and East Germany and the USA, with eight design principles for crafting sustainable resource management institutions (Ostrom 2005). The description summarizes the prototypical situation, but exceptions exist.

<table>
<thead>
<tr>
<th>Design Principles</th>
<th>West Germany (angling clubs)</th>
<th>East Germany (angler associations)</th>
<th>USA (fisheries authorities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clearly defined boundaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>License and permit system</td>
<td>Restricted</td>
<td>Clearly defined with few exceptions</td>
<td>Not restricted</td>
</tr>
<tr>
<td>Number of permits/licenses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water boundaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effort limitation on particular waters</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Place attachment</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>2. Equivalence between benefits and costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investments into fish results in exclusive benefits for users</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Free riding and rivalry in consumption</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3. Collective-choice arrangements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User involvement in the establishment of local rules</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>User commitment to local rules</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Involvement of science-educated staff</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>4. Monitoring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific support</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Scientific data quality</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Local knowledge</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>User involvement</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>5. Graduated sanctions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enforcement among users</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Peer pressure for rule compliance</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Perception of severity levels for offences</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>6. Conflict-resolution mechanisms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication intensity</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Speed of conflict resolution</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>External support</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>7. Recognition of rights to organize</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local user rights</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>External recognition</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>8. Nested enterprises</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to deal with local issues</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Networks and political power on regional and states level</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>
common fishing rights systems at local levels in West Germany, followed by East Germany and then the United States.

The principle of clearly defined boundaries is also related to the number of waters available to anglers. This affects both anglers’ access and their emotional relationship to a given local water body (called “place attachment,” Kyle et al. 2004; Jorgensen and Stedman 2006). The number of waters under a particular governance regime differs substantially in West Germany and East Germany/United States. Accordingly, effort control measures are more regularly implemented in West Germany (to align number of users with the availability of water) than in East Germany or in the United States, where state or regional level governance of large-scale fisheries with a “quasi-open-access” policy to local fisheries is common. In this situation, the idea of clearly defined boundaries is violated from the perspective of unregulated access of license and permit holders within association or state waters. Facing other anglers harvesting the same fish stock might strongly reduce the willingness of an individual angler to sacrifice personal harvesting because others might free-ride on the personal conservation investment. This quasi-open access may enhance risk of overexploitation for particular water bodies (e.g., those that are close to cities and large aggregations of angling effort, Cox and Walters 2002; Post et al. 2002, 2008). Quasi-open access might also reduce the development of the so-called attachment to place and the associated environment stewardship among anglers towards local fisheries (Epifano 2000; Jorgensen and Stedman 2006; Moore and Sowles 2010). The degree of clearly defined boundaries and the associated benefits for sustainable exploitation and management seems to be expressed strongest in West Germany, intermediate in East Germany, and lowest in the United States.

2. Proportional Equivalence between Benefits and Costs

The second design principle facilitating the development of sustainable natural resource governance relates to the proportional equivalence between benefits and costs. Under this principle, rules specifying the amount of resource products (e.g., fish harvest) that a user or user group is allocated is related to local conditions (e.g., productivity, scarcity of the resource) and is proportional to the inputs (e.g., labor, materials, money, energy, time, and monitoring costs) needed to produce the benefit. The design principle of proportionality of benefits and costs also relates to the likelihood that users feel the rules they are exposed to be equitable and fair.

Due to the license and permit system in both Germany and United States and the reinvestment of funds into fisheries resource conservation and management, a proportional equivalence between benefits (fish extraction, angling experience) and costs (permits and licenses) exists to some degree within the angling community. Therefore, the principle of equivalence of benefits and costs might be perceived to align particularly well with access-restricted management systems, such as in West Germany. Indeed, the limited number of waters and accordingly restricted number of anglers managed by angling clubs might also be perceived as costly and inequitable by the excluded angler community. However, a generally well-balanced equivalence between angling activities and permit system collapses when external drivers, such as nonfishing-related habitat loss, strongly impact fish stocks, as is often the case (Cowx et al. 2010). In such situations large investments by angling clubs and associations in Germany or the state fisheries agencies in the United States do not result in equivalent benefits for the angler constituency. Irrespective of the fishing-rights regime in place, this may undermine the incentives of fisheries stakeholders to invest into natural resources via fisheries conservation and management measures.

In addition, the principle of proportional equivalence between benefits and costs is violated under certain conditions, in particular if individual angler behavior does not correspond with social interests of the angling club or association community. The argument runs as follows: access to fish is typically common to all fishing license and permit holders in all three governance structures. While each angler receives the immediate benefits of catching the limited resource, the individual angler might not internalize the potential costs of taking the fish, which may result in overfishing (Post et al. 2002), and these overfishing costs are shared among all anglers. This phenomenon is called free-riding. Thus, because the social costs of overfishing are
not necessarily part of the economic thinking of each individual angler, it is economically rational for the individual to take a fish before another resource user harvests it (Hardin 1968). Quasi-open access within defined resource boundaries occurs in both the United States and Germany and may, in turn, create social dilemmas known as the “tragedy of the commons,” where selfish behavior impacts on the collective well-being (Hardin 1968, 1998).

The rivalry among license or permit holders to harvest fish resources is supposed to be controlled or reduced by bag limits or other harvest regulations in order to distribute harvests more equally in both the United States and Germany (Radomski et al. 2001). However, harvests in recreational fisheries are nearly always unequally distributed among anglers (Smith 1990; Baccante 1995) because harvest success of the individual is strongly affected by angler skills and an individual angler’s investments in fishing in terms of time and financial resources (Arlinghaus and Mehner 2003). The principle of proportional equivalence of benefits and costs, applied to the individual angler perspective, implies that those anglers who invest more time in fishing, and possibly also into maintenance of fisheries, should receive more benefits (e.g., higher annual harvests). This is usually not the case, which might fuel rivalry in consumption and a “race for fish” among the angling community. This situation can be oriented along a gradual continuum of risk among the difference governance approaches for inland fisheries, depending on the intensity to which anglers’ harvest activities are monitored. For example, the possibility for intensive regular interaction among individual anglers in small-scale, local angling clubs in West Germany may enhance mutual surveillance and build friendships and trust. This may, in turn, facilitate the formulation of informal rules of commonly agreed conservation behavior, reducing the risk of free-riding (Moore and Sowles 2010). By contrast, in East Germany, the potential of individual anglers to influence fisheries-management decisions is more difficult because anglers need to overcome up to three internal organizational levels to initiate changes in the angler associations’ bylaws, usually determined by a limited number of association leaders. Yet, collective choice by recreational anglers is generally possible across most inland fisheries in Germany.

By contrast, in the United States, the possibility for collective choice of management
regulations by local anglers is more constrained, despite the existence of intensive public input processes (Hennessey and Healy 2000; Fayram et al. 2009). This can be either an advantage or a disadvantage, depending on whether anglers’ opinions align with broader societal goals. For example, the planning and implementation of fish stocking practices to maintain or enhance stocks of recreationally highly valued species, which might have harmful genetic effects or may contribute to the spread of diseases (Lewin et al. 2008), are under the control of scientifically trained experts in fisheries agencies in the United States and are not left solely to anglers. Similarly, people educated in fish and fisheries biology are routinely employed by angler associations in East Germany to guide fisheries-management decision making. From a conservation perspective, this is an advantageous situation compared to West Germany where voluntary fisheries managers in local angling clubs make decisions about stocking practices largely independently and with little scientifically trained expert assistance and may occasionally do so unsustainably to comply with peer pressure by local anglers (Arlinghaus 2006a).

4. Resource and Resource-User Monitoring

The fourth design principle emphasizes the importance of monitoring both the condition of the resource as well as the resource user. This entails gathering knowledge about fish stocks and harvesting activities, as well as monitoring rule compliance and other dimensions of anglers’ behavior (EIFAC 2008). In addition, monitors should be accountable to fishing-rights holders and the resource-user community.

In Germany, depending on the size and importance of the water body, monitoring of fish stocks in angling clubs and associations is conducted with the assistance of authorities and state fisheries research organizations (Klupp 2002; Rümmler 2007). However, in most situations, fish stocks are self-monitored by angling clubs and associations, mainly using catch diaries (total catches at the species level and the water body, Mau 1996), and anglers are monitored by officers. Fishery-independent surveys are rare in smaller water bodies in German angling clubs and associations. Moreover, diaries and fishery-independent surveys are not standardized across clubs or associations. The return rate of anglers’ diaries is often low (Brämick 2008), and diary information is supposedly biased towards more avid anglers (Bray and Schramm 2001). In addition, because diaries usually collect catch information without corresponding data on effort, a reliable assessment of population trends is not possible (Murawski et al. 2005; Brodziak et al. 2008). The situation is particularly relevant in angling clubs in West Germany. They usually do not conduct standardized stock assessments and only occasionally engage professional fisheries biologists. The situation is more professional in angler associations in East Germany (which are typically larger and therefore financially better equipped). These associations usually can afford to hire one or more professional fisheries biologists for coordinating monitoring and assessment activities and advising local angling clubs. This is in stark contrast to the situation in the United States where the monitoring and assessment of fisheries is exclusively conducted by professional fisheries biologists and managers in fisheries authorities. They regularly monitor the status of fish stocks changes and, to a lesser extent, the catch and harvest by, and the human dimensions of, anglers (Fulton and Adelman 2003). In addition, fisheries managers in the United States regularly publish peer-reviewed reports and papers using agency-derived data of high quality, whereas there is no similar professional documentation and publication outlet for recreational fisheries management results in Germany.

These different professional standards in the United States and Germany can be explained by the public versus private monitoring mandate in both systems. In Germany, private fishing rights holders are largely responsible for overseeing their fisheries and are not required by law to collaborate with fisheries biologists outside fisheries agencies. In the United States, monitoring activities are based on scientific principles (e.g., creel surveys, angler surveys, see Pollock et al. 1994, 1997; for standardized fish sampling, see Bonar et al. 2009). Additionally, a condition for accepting a major source of funding for public agencies in the United States (Sport Fish Restoration Program) requires state agencies to maintain professional staff. Therefore, it is safe to assume that the quality of monitoring data is higher in the United States.
Sanctions can be imposed by any person or public officials accountable to users. In the United States, there are detailed regulations as well as graduated sanctions for inland waters, and they are enforced by state (and, in some cases, federal) fisheries authorities. The intensity of law enforcement and the severity of the sanctions for identical offenses (e.g., illegal stocking), however, vary widely among jurisdictions (Johnson et al. 2009). In Germany, graduated sanctions that depend on the frequency and severity of noncompliance with rules are formally detailed in all three types of formal regulations (fisheries acts and ordinances and angling club or association bylaws). Rule infractions are mainly divided into administrative offenses, which include infractions such as using more rods than allowed, keeping an undersized fish, or infringement of stocking regulations such as introduction of nonnative species, and statutory offenses such as larceny or poaching (e.g., harvesting fish without a private angling permit from the fishing-rights holder). In the German state Thuringia, as an example, administrative offenses graduate from on-the-spot fines at very low levels (generally below 50 euros) versus penalty charges at notably higher levels (e.g., in case of recurrence, with a maximum limit of 5,000 euros). Statutory offenses are more strongly punished and are regulated in the German Criminal Code (e.g., §293 for poaching of wild fish). They are sanctioned with prison up to 2 years or monetary penalties up to several hundred or thousand euros.

In Germany, property-rights offenses are regarded much more severely than stocking regulations violations, although the latter can have serious and potentially irreversible ecological consequences (e.g., release of a nonnative fish, Johnson et al. 2009). For example, in Thuringia, stocking regulation offenses are punished with fines of 100–500 euros in the first offense and 200–2,500 euros in case of recurrence. Illegal stocking in the United States is punished with a maximum fine of $10,000 and a year in jail, but the typical penalty is about $2,000 (Johnson et al. 2009). The rather small penalty for violating stocking regulations does not convey the seriousness of the crime. This can be considered “not graduated” in both the United States and Germany because the introduction of nonnative species or genotypes not
native to particular habitats can cause severe damages to aquatic biodiversity and may result in large restoration costs that easily exceed the penalty charge by several million U.S. dollars (Johnson et al. 2009). Bylaws of German angling clubs and associations usually do not compensate these and other loopholes in fisheries acts and ordinances. They instead focus on violation of club- or association-specific regulations. Here, the most severe sanction is exclusion from the angling club or association, which regularly happens in case of repeated or severe violation of club rules. Despite the existence of graduated sanctions in Germany and the United States, execution of graduated sanctions is challenging because of difficulties in enforcement. Yet, due to the small scale of many West German angling clubs, enforcement of rules and rapid execution of club-specific sanction are likely to be easier than in East Germany and the United States. Moreover, the small size of the angling clubs probably may result in greater transparency of rules and regulations, greater peer pressure, and less rule-breaking behavior.

6. Conflict-Resolution Mechanisms

The sixth institutional design principle refers to a conflict-resolution mechanism that shall be rapid, low-cost, and locally tailored to ensure that rules are understood by all resource users and officials. Conflicts in recreational fisheries encompass user and management conflicts. User conflicts refer to relationships among anglers or between anglers and other resource users while management conflicts relate to issues of acceptability of fisheries-management issues or impacts on fisheries resources originating from outside the fisheries sector (compare Arlinghaus 2005). Solving conflicts demands good communication of rules and regulations to users and involvement of users in decision-making processes (Krueger and Decker 1999). Many conflicts can be avoided a priori when rules are clear to everybody and agreed upon by all (Ostrom 2005).

Comparing the different property-rights regimes and their ability to deal with user conflicts, the West German decentralized management approach may provide more rapid access to low-cost local processes to conflict resolution because anglers and managers know each other well and communicate intensively. By contrast, anglers in East Germany and the United States often do not know and never meet the fisheries officials on the regional or state level. Thereby, conflicts or misunderstandings about regulations might accumulate over time and might not be resolved quickly. Similarly, user-conflict resolution among anglers and between anglers and managers are more challenging at the local level in quasi-open-access fisheries in East Germany and the United States where anglers are largely disconnected from decision makers in agencies and regularly meet “strangers” (unknown anglers) at their local fisheries. Conflicts in the United States are generally resolved by the fisheries agencies after listening to concerns of the conflicting agents through processes such as formal commission meetings or through other official processes.

As mentioned before, the close and regular contact probably facilitates rapid conflict resolution mechanisms in West Germany. However, this assumption is fraught with uncertainty and depends on the type of conflicts. For example, many interpersonal conflicts might emerge because people regularly interact with each other in small angling clubs (e.g., conflicts between two anglers over an angling site, Arlinghaus 2005). Some additional management conflicts are more difficult to solve and address in small-scale West German angling clubs, relative to East Germany and the United States. For example, due to the usually small number of fisheries and fishing opportunities managed by angling clubs in West Germany, satisfaction of diverse angler types might be more difficult than in East Germany and the United States. Moreover, many threats and challenges exist in inland recreational fisheries that originate from external impacts on freshwater resources (Cowx et al. 2010). These challenges are more difficult to solve in West Germany’s local angling clubs because of little financial and political power. Indeed, in contemporary German society, recreational fisheries are often perceived as a minor policy field and thus have been neglected or ignored by policy makers (Arlinghaus 2006a). In turn, hydropower development, flood prevention, or nature protection measures, excluding recreational fisheries, are often given higher priority compared to development of recreational fisheries (Arlinghaus 2006a). In these situa-
tions, larger organizational bodies such as angler associations in East Germany, or fisheries agencies in the United States, may have greater financial and political power to engage in, and potentially resolve, the resulting management conflicts through cooperative partnerships and political lobbying (Arlinghaus 2005). Finally, some specific forms of conflict (e.g., claims by nature conservationists that angling is depleting stocks) demand access to sophisticated knowledge and scientifically solid data. These data are often lacking in small-scale angling clubs in West Germany and are more likely to exist under public governance in the United States or in East Germany. These governance regimes may thus offer better mechanisms to resolve such “science-based” knowledge conflicts.

7. Minimal Recognition of Rights to Organize

The seventh design principle for robust institutional design refers to the importance of retaining a minimal recognition of rights of users to devise their own institutions in the long term, which involves the precondition that users of resources have long-term tenure rights to the resource.

This principle is well established in Germany’s inland fisheries. Here, angling clubs and associations as fishing-rights holders are entitled to devise their own regulations in by-laws to guarantee sustainable use and management of local fisheries. These rules and regulations can be established largely independently of any other body or stakeholder. In addition, 12-year lease contracts for fishing rights secure long-term access and management rights, and these rights are well recognized by governmental authorities (Braun 2000). By contrast, in the United States, while there is a strong societal-level support for recreational fisheries, individual anglers or angling clubs cannot devise fisheries regulations independently of public agencies. However, anglers in the United States retain the right to organize into groups. These groups may then import their interests into fisheries management decisions, although these interests often vary among different anglers’ organizations (Churchill et al. 2002). In limited instances, within some U.S. states, umbrella organizations have formed to purportedly represent the interests of all angling groups, similar to the East German angler associations. This organization level may become politically important when recreational fisheries are threatened by groups who aim at restricting or even banning angling activities (Arlinghaus et al. 2009).

8. Nested Enterprises

The last design principle of importance for sustainable governance of natural resources held in common refers to situations where common-pool resources transcend large spatial scales, potentially crossing jurisdictional boundaries (e.g., a large river). In these situations, governance activities regarding appropriation, provisioning, monitoring, enforcement, and conflict resolution shall be organized in multiple layers of nested enterprises.

Both governance approaches for fisheries in East and West Germany developed multiple layers of organization (clubs, state associations, national umbrella associations, and state fisheries authorities) to deal with recreational fisheries challenges on all spatial and temporal scales. However, this does not necessarily assure scale matching to deal with pertinent issues impacting fisheries resources. For example, local angling clubs in West Germany have low capacities to influence a water power plant impacting fisheries resources because of the mismatch of institutions and because fisheries and water management issues are dealt with in separate ministries. Even fisheries agencies in Germany have difficulties enforcing fisheries interests because of the generally low priority of fisheries in the context of water and nature conservation management activities (Steffens 2006). Similarly, in many situations, habitat management rather than fish stocking might be the most sustainable management action in the face of large anthropogenic impacts on freshwater fisheries (Arlinghaus et al. 2002). However, large-scale habitat management cannot be conducted and financed by anglers alone, necessitating partnerships with various agencies, landowners, and stakeholders (Arlinghaus 2006a; Cowx et al. 2010). The principle of nested enterprises is better addressed in East Germany than West Germany because dealing with these scale mismatches can be easier for large angler associations with management responsibilities and advanced social and political networks at regional or state levels (Sutinen and Johnston 2003). It is particularly well addressed in the
United States because management responsibility here resides with centralized governmental authorities and therefore there is more financial and political ability to match the scale of the problem for fisheries resources with appropriate management responses (Radomski et al. 2001; Roni et al. 2002; Cooke and Cowx 2006). Despite this positive potential in the United States, there is some agreement that a more regional perspective is needed for sustainable exploitation of inland fisheries in North America (Lester et al. 2003; Fayram et al. 2009). However, issues arising at the local level might be easily overlooked under this “broad-scale management” (Lester et al. 2003) because of less consideration of local anglers and local ecological conditions in the planning and design of regulations. This, however, may only be possible through rigorous nesting of enterprises and organizations from local to state levels. For the future, all existent property-rights regimes should be evaluated in terms of how well organizations for fisheries governance are nested from local to regional and states levels and if they are sufficiently capable of solving both large-scale and small-scale issues.

Conclusions

We have described one public and two common property rights regimes of inland recreational fisheries management by drawing on the United States and Germany as case studies. These regimes have a unique set of strengths and weaknesses when analyzed against eight design principles for robust institutions in sustainable resource management put forward by Ostrom (1990, 2005). The literature on common-pool resource management stresses the importance of user participation in day-to-day management decision making for sustainable resource management (Ostrom et al. 1999; Dietz et al. 2003).

As we have shown in our analysis, the degree of participation and involvement of local anglers in fisheries-management decision making constitutes a major difference between the United States and Germany. The difference is that German anglers’ representatives in clubs and associations have a direct ownership stake in the inland fisheries and therefore generally make the actual management decisions (e.g., on fish stocking). In contrast, U.S. anglers have an ownership stake as members of the general public, and their involvement in fisheries management is generally restricted to the policy level. This difference may affect the functionality of the fisheries governance systems. The strengths of common property rights regimes, particularly if small-scale such as in West Germany, are built on regular communication and trust among local users and include (1) increased acceptability of effort controls to manage local fisheries, (2) fostering and use of traditional ecological knowledge, and (3) strong place attachment by anglers resulting in timely conflict resolution and peer pressure towards rule compliance. Major downsides in Germany’s inland fisheries, which are particularly pronounced in West Germany, are the restricted access for anglers to a limited number of fisheries under angling club management, including comparatively high angling permit prices, and the lack of scientific monitoring data and science-based expert assistance in fish stock assessment activities and management planning. This induces the risk that potentially unrealistic anglers’ expectations and perceptions dominate management activities, resulting in nonsustainable management practices such as intensive stocking. This risk is much less pronounced in the public fishing rights system in the United States, whose strength includes the existence of high-quality fisheries-dependent and fisheries-independent data. These data provide the base for management decisions implemented through comparatively well-staffed fisheries agencies. U.S. managers may therefore better deal with potentially ecologically unrealistic expectations by the local angler constituency and they can develop a landscape perspective for recreational fisheries management. Such perspective facilitates the possibility to manage for diverse fishing opportunities across the landscape avoiding pitfalls of one-size-fits-all policies (Carpenter and Brock 2004). Based on the review presented in this paper, we can conclude that the United States is providing a more structured and science-based system to recreational fisheries management, whereas the German system is based more on user self-organization and, to some degree, trial-and-error management based on anecdotal evidence and experience by local managers (Arlinghaus 2006a). However, the science-based system in the United States comes at the cost of local anglers having comparably little direct involvement in management decisions.
compared to their greater involvement in West Germany. In addition, researchers recommend that U.S. fisheries managers incorporate more angler knowledge and information about anglers’ behavioral patterns in their management processes (Ditton 1996; Hunt and Ditton 1997). Depending on the quality of communication between U.S. fisheries agencies and the fishing public, this may challenge management credibility (Sutinen and Johnston 2003; Fayram et al. 2009) and affect compliance with regulations (Gigliotti and Taylor 1990; Pierce and Tomcko 1998; Sullivan 2002; Walker et al. 2007). The East German management and governance approach can be located somewhere in between West Germany and the United States, although it is clear that the quality of science-based data is weaker compared to the United States.

One issue that may be a common threat to all fishing rights regimes is the risk of pronounced rivalry among anglers for fisheries resources within defined boundaries of state, angler association, or angling club waters. This calls upon the need for continued enforcement of rules and regulations (Walker et al. 2007) and thorough and continued communication of the rationale of all changes to regulations to the local anglers. This is particularly challenging in large-scale management systems such as in East Germany and the United States where users are dispersed throughout the landscape and not personally known to the managers.

Each of the three distinct governance structures described in the present paper has inherent strengths and weaknesses. Our findings agree with Sikor’s (2008) observation of a false dichotomy between private and public property rights regimes for natural resources because both regimes operate functionally on different levels and to different degrees. Similarly, the three fishing-rights regimes examined in this paper are functional and do not necessarily result in more or less sustainable trajectories. To be functional, property rights should be appropriate to both the attributes of the resource and the resource user and are therefore always specific to a particular cultural and ecological setting (Ostrom et al. 1999; Anderies et al. 2004; Paavola and Adger 2005). A functioning management system for natural resources generally depends on well-established and well-defined property-rights rules (Schlager and Ostrom 1992; Radomski et al. 2001; Yandle 2007). This is given in both the United States and Germany, and due to lack of comparative biological and social science data, we cannot conclude which of the governance regimes examined is more or less likely to assure sustainable exploitation. By carefully reflecting on the weaknesses of each system, institutional change can be initiated to improve the future functionality of the recreational fisheries governance and management systems.

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Paper II

Katrin Daedlow, Volker Beckmann, Maja Schlüter and Robert Arlinghaus

Explaining Institutional Persistence, Adaptation, and Transformation in East German Recreational-Fisheries Governance after the German Reunification in 1990.

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Analysis
Explaining institutional persistence, adaptation, and transformation in East German recreational-fisheries governance after the German reunification in 1990

Katrin Daedlow a,b,⁎ Volker Beckmann b,c, Maja Schlüter a,d, Robert Arlinghaus a,e

⁎ Corresponding author at: Division of Resource Economics, Department of Agricultural Economics, Humboldt-Universität zu Berlin, Unter den Linden 6, D-10099 Berlin, Germany. Tel.: +49 30 2093 6183; fax: +49 30 2093 6497. E-mail addresses: daedlow@agrar.hu-berlin.de (K. Daedlow), volker.beckmann@uni-greifswald.de (V. Beckmann), maja.schlueter@stockholmsgresilience.su.se (M. Schlüter), arlinghaus@igb-berlin.de (R. Arlinghaus).

1 The territory of the former GDR (German Democratic Republic) is referred to as East Germany, whereas the territory of FRG (Federal Republic of Germany) before the reunification in 1990 is referred to as West Germany. Both parts together form Germany.
to a decentralized governance system on local level as it is common in West Germany. Accordingly, we formulated the following research question: what are the reasons explaining the different outcomes of the reorganization process in the six East German states?

We combined system-based resilience thinking with the explanatory power of actor-based new institutional economics (NIE) to answer the research question. Resilience and SES literature call for interdisciplinary studies, and provide initial frameworks to study SESs from a social science perspective (e.g., Andereis et al., 2004; Hunt et al., 2013; Ostrom, 2007; Walker et al., 2006). However, we did not find an analytical framework explicitly including NIE theories into resilience concepts that also stressed the importance of the attributes of disturbances in reorganization phases. Thus, based on both research branches, we developed three analytical steps for the present case study.

The first two steps (assessment of the structure and function of the governance system, and of attributes of the disturbance and the conditions in the reorganization phase) were derived from resilience concepts. The third step (evaluation of actors’ motivations in reorganization processes) was based on concepts from NIE. Resilience thinking allows for an in-depth understanding of the components and dynamics of non-linear, interlinked and multi-scale changes of SESs, while NIE provides actor-based analytical concepts such as social capital and transaction cost economics to explain human behavior and motivations, e.g., in institutional change situations (North, 1990). We developed these three analytical steps from the literature with the aim to understand each part as interactive component similarly influencing the resilience of the specific social system studied here.

There are numerous studies on institutional change and persistence in NIE covering all kinds of aspects explaining those processes (Libecap, 2007; North, 1991; Paavola, 2007). The strength of the present paper is the interdisciplinary combination of NIE with resilience thinking, and the provision of a three-step analytical framework to explain institutional change and persistence exemplified by the SES of East German recreational fisheries governance. As suggested by Ostrom (1990, 2007), the application of analytical frameworks enables researchers to identify patterns of interactions between the framework-embedded concepts explaining a particular outcome such as persistence or change in governance systems. Besides the analytical novelty in this paper, the case study of East German recreational fisheries governance provided a comparative analysis of six cases (East German states) under the condition of a unique natural experiment situation. Being in the same situation of a fundamental socio-political change after the reunification in 1990, one state showed a different outcome after the reorganization process than the other five states in East Germany. By applying the three-step analytical framework, we were able to explain the difference in the outcome and to assess which of the applied concepts had explanatory power.

The remaining of the paper is structured as follows. Section 2 introduces the case study of German recreational fisheries in more detail and explicates the phenomenon of change and persistence in the governance system. Section 3 describes concepts and theories of resilience thinking and NIE that formed the conceptual basis of our analysis. Section 4 presents the analytical approach, the operationalization process, and data and methods. Section 5 contains the results, and Section 6 the discussion.

### 2. Persistence and Change in German Recreational Fisheries Governance

Recreational fishing or angling is defined as “fishing of aquatic animals that do not constitute the individual’s primary resource to meet nutritional needs and are not generally sold or otherwise traded on export, domestic or black markets” (“FAO, 2012, p. v”). In 2002, there were about 3.3 million German anglers older than 14 years (Arlinghaus, 2006) and as in most industrialized countries (Arlinghaus et al., 2002) anglers are currently the dominant users of inland fisheries resources in Germany (Arlinghaus, 2006). Recreational fisheries in Germany are diverse covering freshwater and marine fisheries. Major geographical regions include the North German lowlands, Central German uplands, and the Bavarian Alps, which offer distinct water bodies and associated fish communities (Fig. 1).

The SES of East German recreational fisheries is defined as consisting of the water bodies and fish stocks in the East German states, and the institutions and governance structures managing the use of this natural resource by anglers. Within the social system, institutions are (bundles) of rules which shape human interactions (North, 1990) such as access regulations in recreational fisheries. Moreover, those institutions of natural resource use link social and ecological systems in a SES. Governance structures comprise rules of decision-making and forms of organizations, either individuals or groups of individuals, which are empowered by law to mold, change, maintain and eventually implement institutions (Williamson, 1996). These organizations with decision-making power are often holders of property rights (Schlager and Ostrom, 1992). In German recreational fisheries it is usually angler associations or clubs that are the holders of fishing rights. Such fisheries constitute a common property rights regime, i.e., groups of private people organized in angling clubs or associations, own or lease fishing rights and are thus involved in recreational fisheries management (Daedlow et al., 2011a).

Angling clubs and associations in Germany are users and managers of the resources at the same time. Fisheries authorities supervise and support inland fisheries activities and management according to rules prescribed in fisheries legislations but usually do not take an overly active role in site-specific management initiatives by angling clubs and associations (Arlinghaus, 2006). However, there are marked differences between recreational fisheries governance in West and East Germany (reviewed in Daedlow et al., 2011a). In West Germany, angling clubs on the local level are the major leaseholder of fishing rights and often manage a limited number of water bodies in the proximity. The angling clubs are organized in associations, which engage in public outreach and lobbying at the political level. By contrast, in East Germany fishing rights are typically held by large state or regional angler associations, which centrally manage large numbers of water bodies scattered throughout the state territory. Here, angling clubs and anglers as members of angler associations only support the associations in fisheries-management activities, but do not take a decision-making role. Hence, in East Germany, angler associations, not angling clubs, are fisheries-management decision-makers.

The reason for the difference in governance in East and West Germany originates in the history of East Germany. Before 1990, under the socialist regime of the GDR, East German recreational fisheries were centrally governed by an umbrella angler association called DAV (Deutscher Anglerverband der DDR = German Angler Association of the GDR). Founded in 1954 (Winkel, 1998), the DAV was responsible for all management regulations on the GDR territory up to local level, supported by its lower-level organizations, namely associations on district level (in total 14 on GDR territory), associations on county level, and clubs on local level (Fig. 2, the figure reflects the prototypical situation). The 14 district associations were connected to 5 “economic sections”, which mainly produced fish for lake and river stocking programs. Recreational fisheries governance was regulated by a single fisheries act applied throughout GDR territory. Because fishery authorities focused on commercial fisheries in the GDR, the main decision-making in recreational fisheries was delegated to the umbrella angler association DAV. Private ownership of individuals, and groups of people (common property) of water and fisheries resources were mostly not exercised in the socialist economy of the GDR.

In the course of the German reunification in 1990, the centralized governance system of the GDR was heavily disturbed by the reorganization of the socio-political and economic structures during the German reunification (Sinn and Sinn, 1993). The change opened a window of opportunity to reorganize the centralized recreational fisheries governance system, for example to a local governance system of angling...
clubs, which is and was dominant in West Germany (Daedlow et al., 2011b). East German recreational fisheries managers, however, generally did not take this opportunity but maintained a centralized governance system throughout the disturbance and reorganization phase (Daedlow et al., 2011b). The East German managers also refused to become members of the West German umbrella association at this time, and only very recently (in March 2013) the recreational fisheries governance leaders in East and West Germany decided to merge their

Fig. 1. Topographic map of Germany with the six East German states. Source: accessed via Wikimedia commons; Permission is granted to copy, distribute and/or modify this map under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; Modified as follows by the authors: The white solid line mirrors the former border between the GDR (East Germany) and the FRG (West Germany) before the reunification in 1990. The white dashed lines show the borders of the East German states which were newly implemented after the reunification in 1990.
umbrella associations at the national level after a long and highly contentious process of negotiations over multiple years (Connolly, 2013; Daedlow et al., 2011b).

After the reunification in 1990, former districts were aggregated to six newly constituted states on the territory of East Germany, namely Mecklenburg-Western Pomerania (M-V), Brandenburg, Saxony-Anhalt, Saxony, Thuringia and the reunified capital Berlin (Fig. 2). Three states in the North (Mecklenburg-Western Pomerania, Berlin, and Brandenburg) kept the former centralized governance system on state level. In the South-East German states Saxony-Anhalt and Saxony the centralized governance system was kept on regional level (= former GDR district level), i.e., in each of these two states three regional associations became the main holders of fishing rights (Fig. 2). Only very rarely angling clubs obtained fishing rights for local water bodies in these five states. By contrast, in the South-East state Thuringia the centralized governance system dissolved after the reunification, i.e., here it was the angling clubs on local level not the angler associations that acquired fishing rights and are now responsible for fisheries-resource management similar to the situation in West Germany (Fig. 2). After introducing East German recreational fisheries governance in this section, we explain the theoretical basis for the analysis of this case study in the next section.

3. Resilience Thinking and New Institutional Economics

3.1. Resilience Thinking

Folke et al. (2010) defines resilience as “the capacity of a SES to continually change and adapt yet remain within critical thresholds” (p. 20). These thresholds separate alternative basins of attraction, defined as a state in which a system tends to remain while actors in this system hesitate to transform to other basins of attraction (Walker et al., 2004). For example, the two different governance systems in German recreational fisheries – decentralized versus centralized – represent such potential attractors in terms of governance of fisheries resources.

Three different aspects are important for a resilient SES: persistence, adaptability, and transformability (Folke et al., 2010). The maintenance of major variables and relationships after a disturbance indicates persistence of a resilient SES. Thus, resilience is a property of the system and persistence the result (Holling, 1973). Adaptability is defined as the capacity of a SES to absorb disturbances through incremental change to stay in the same stability domain, whereas transformability is the capacity of a SES to create a new stability domain with new stable structures and functions that are fundamentally different from the previous system (Folke et al., 2010; Walker et al., 2004). While adaptability adjusts existing variables in a SES, transformability allows for introducing new variables and is characterized by novelty in relation to the original system’s configuration (Folke et al., 2010; Walker et al., 2004). Both processes retain major relationships of the system and therefore indicate its resilience. In the present study, we looked for all three aspects (persistence, adaptation, transformation) in the reorganization of East German recreational fisheries.

While persistence, adaptability and transformability are important components of the resilience thinking framework, these processes alone cannot fully explain the resilience of a system. Other properties of the system and its components such as the attributes of the disturbance, the consecutive stages of a system’s reorganization while changing, or cascading effects within subsystems and over different scales are also relevant (Walker et al., 2004, 2006). In particular, we focused on the attributes of the disturbance and the conditions in the reorganization phase in the analysis. Explaining resilience in SESs also requires research approaches that combine actor-based concepts from social sciences with system-based concepts of resilience thinking (Daedlow et al., 2011b; Lebel et al., 2006; Walker et al., 2006). In this paper, we particularly focused on actor-based, behavioral theories of NIE to complement concepts of resilience thinking.

3.2. Integrating New Institutional Economics and Resilience Thinking

NIE aims at understanding and explaining processes of persistence and change in social systems. Hence, NIE can complement the more system-oriented resilience thinking approach by focusing on the reasoning behind actors’ decision-making within institutional change situations (Lebel et al., 2006; North, 1990; Vatn, 2005). Change in NIE involves both adaptation and transformation as distinguished in resilience research. Similar to resilience thinking, North (1990) departs from the traditional discrete economic equilibrium approach based on individual maximization of possible net-gain by investigating continual trajectories of persistence in evolving economic systems, known as path
attributes of the disturbance and the conditions of the reorganization based on resilience thinking approach, we assumed that the particular attributes governance in most of the states examined. Following the systems (North, 1990). Similarly, most people seem to be risk-averse in choices striving to secure income and avoid costs of change because future benefits are unknown. In addition, economic traditions and customs have been considered very persistent because of the deep-seated cultural roots that underlie many informal constraints to human behavior (North, 1990). Similarly, most people seem to be risk-averse in choices involving sure gains in situations of high uncertainty because losses are perceived as being more severe (Tversky and Kahneman, 1992). Thus, path dependency in an economic system is the result of actors' decisions to maintain rules and governance structures because of their past experiences and customs, and risk-averse behavior.

Three additional factors emphasized in NIE are important for explaining institutional persistence or change in the present case study. First, it takes resources to transform or adapt a system into another state, and these resources are defined as the transaction costs of institutional change (North, 1990). Transactions can be broadly understood as use and exchange of (natural) resources between actors according to agreed institutions, and the potential change of those institutions. Transaction costs of institutional change include, for instance, search and information costs, bargaining and decision costs, and monitoring and implementation costs (Richter and Furuboth, 1999). These costs may hinder institutional change if they are perceived by decision-makers as too high (North, 1990). In addition, the frequency of a management activity, the specificity of knowledge and skills for certain actions developed over time through learning, and the perceived uncertainty and complexity of an activity determine individual transaction costs of change (Williamson, 1996), and thus, influence decision-making in times of reorganization.

Second, social capital is likely to be very important for explaining change or persistence of institutions. The general "capacity of social groups to act in their collective interest" has been defined as social capital (Paavola and Adger, 2005, pp 363). The concept of social capital includes aspects such as leadership, networks, common values, attitudes, and shared mental models on the one hand, and professional and learning skills of actors as human capital on the other hand. Also other aspects of social capital such as trust, information availability, and power relations among actors or groups of actors, and their common experience and knowledge in management influence transaction costs in decision-making of institutional change. Thus, social capital among actors is one important feature from NIE that is needed for studying persistence, adaptability and transformability in resilience research (Walker et al., 2006).

Third, human decisions in relation to natural resource governance are likely influenced by the properties of the resources to be governed such as their stocks and flows, and the corresponding properties of transactions in resource use such as rivalry between and excludability of users of the resource (Hagedorn, 2008). The expected benefit stream from resource use secured by rules of e.g., fair and secured distribution among authorized users, might compensate for transaction costs invested in institutional change establishing those rules (e.g., Liscow, 2013; Nolte et al., 2013). Reciprocal interactions of ecological and social systems based on institutions represent key links in a SES, and understanding these might provide insights into how far the characteristics of the ecological system (e.g., scarcity or abundance of resources) affects the overall resilience of a SES and the social system in particular.

3.3. Implications and Propositions for the Case Study

Based on the theoretical background we formulated propositions supposed to explain the persistence of East German recreational fisheries governance in most of the states examined. Following the systems-based resilience thinking approach, we assumed that the particular attributes of the disturbance and the conditions of the reorganization influenced East German recreational fisheries managers' decision-making about institutional persistence and change. Accordingly, we formulated the following propositions:

- 1) The specific attributes of the disturbance (e.g., speed, severity) to the system facilitated the persistence of centralized governance of recreational fisheries in most East German states.
- 2) The specific conditions of the reorganization process (e.g., position of decision-makers) influenced the actors' ability to maintain a centralized governance system in most East German states.
- 3) Past shared experiences and customary rules had a major impact on the persistence of the centralized governance system in most East German states.
- 4) High social capital among key East German managers supported the maintenance of the centralized governance system.
- 5) The transaction costs of keeping the centralized governance system were lower as the costs of the alternative of changing to a decentralized system, in turn reinforcing the persistence of the centralized governance system.
- 6) Perceived abundance of water bodies and fish resources supported the maintenance of the centralized governance system in East Germany.

Finally and again in line with NIE, we considered the properties of transactions in natural resource use potentially decisive for the outcome of the reorganization in East German recreational fisheries governance. For example, the perceived scarcity of fish resources might have influenced the decision-making of fisheries managers to invest in changes of the future governance system in place. Conversely, we assumed that:

- 6) Perceived abundance of water bodies and fish resources supported the maintenance of the centralized governance system in East Germany.

We developed a three-step analytical framework to test whether these propositions were supported in the present case study explaining the persistence of the centralized governance system in most of East Germany, and the decentralization towards local governance in one state (Thuringia).

4. Analytical Approach, Operationalization, Data Sources, and Coding

4.1. Three Analytical Steps and Operationalization of Theoretical Concepts

Based on central concepts of resilience thinking and NIE, we derived three analytical steps (Fig. 3) we found best to explain the variation in outcomes of the reorganization phase in East German recreational fisheries:

- 1) An assessment of system's characteristics (i.e., structure and function) of the East German recreational fisheries governance system before and after the reunification in 1990.
- 2) A characterization of the attributes of the disturbance and the conditions in the reorganization process.
- 3) An evaluation of the motivations of East German recreational fisheries managers involved in the decision-making process.

The rational for the three steps and their operationalization for the analysis are explained as follows. The first step allowed us to identify the type of change (adaptation and transformation) or persistence in the recreational fisheries governance system in each of the six East German states by investigating the system's characteristics before and after the disturbance of the German reunification in 1990. We focused on the system's characteristics of social variables and their structure and function. Variables in social systems are individuals or groups of individuals (organizations) who govern natural resource use such as...
angling clubs and associations in German recreational fisheries. We measured the structure of the governance system by looking at changes in the organizational levels of governance, in the property rights regimes, and in the level of decision-making regarding institutions (i.e., rules) such as fisheries acts and regulations. The governance structure and established rules of natural resource use and management provide the conditions for the functioning of the SES and the delivery of services for humans. The functions of the SES, beyond the provision of recreational fishing as mentioned above, include the execution of management measures to regulate fish stocks (i.e., access restriction for anglers, use restrictions such as daily bag limits, and fish stocking measures), and the provision of social services (i.e., provision of angling opportunities, membership, rewarding of anglers involved in management, and providing benefit to the public).

We defined the following recognition criteria to be able to distinguish between persistence, adaptation and transformation of structure and function. Persistence is the preservation of the same structure (e.g., centralized governance system) and function (e.g., provisioning of access to fishing), adaptation is the transfer of variables and their structure and function to lower organizational levels (e.g., from GDR territory to state level), and transformation is the appearance of new variables and new structures (e.g., angling clubs in a decentralized governance system) and functions (e.g., restricted access to local fisheries) in the system.

The second analytical step revealed attributes of the disturbance and of the reorganization process that influenced the outcomes of the reorganization process. The importance of the disturbance in resilience research is shown for example by Schoon and Cox (2012) and Fleischman et al. (2010) who provide first typologies of disturbances in SESs. We assessed disturbances (proposition 1) by measuring attributes such as speed (slow–fast), direction (e.g., external or internal to the SES to be analyzed), degree of the disturbance (minor or fundamental changes, e.g., fundamental changes in a constitutional laws), or whether the disturbance occurred in the social or ecological system and at which organizational level, and which actor group caused the disturbance (Pierson, 2004). Attributes of the reorganization phase (proposition 2) were assessed by analyzing the position, involvement, leadership and power assets of actors participating in this process and the (non-) influence of particular social groups. These aspects are also prominently considered in analytical frameworks of the common-pool research literature (Ostrom, 1990, 2005), where they determine the structure of the action situation of actors producing outcomes of decision-making processes.

The third step was based on NIE theories and explained the observed outcomes through the motivations of humans for designing rules of natural resource use and the structure of property rights that determine economic behavior. We measured the motivations of actors by searching for statements describing the preservation of customary institutions and organizations (proposition 3), the (non-)existence of social capital such as presence or absence of leadership, trust among managers and anglers, common experiences and understanding about how recreational fisheries should be governed, power relations and consolidation, and the individual human capital of long-term management skills or learning ability (proposition 4). Transaction costs were mainly assessed by looking for statements on learning efforts, and time and money investment during the reorganization of recreational fisheries governance (proposition 5).

Finally in the third step, we searched for the potential influence of resource properties (availability of waters for fishing, quantity of fish stocks) with respect to decision-making about future governance systems (proposition 6). This factor allowed bringing the ecological dimension into the analysis of East German recreational fisheries that was restricted to data captured from the social system. The fact that fishing activities went on indicated that the ecological system continued to provide fish stocks for anglers and access to water bodies. Yet, we did not have ecological data to analyze significant changes or persistence in the ecological system. Therefore, we measured the perceptions of decision-makers in East German recreational fisheries governance related to this aspect.

The three steps together enabled us to explain institutional persistence and change in the SES of East German recreational fisheries governance and test the explanatory power of the six propositions introduced above. This analytical approach was based on an abductive research strategy as an alternative to inductive or deductive reasoning. Abduction starts with an empirical phenomenon (e.g., institutional change or persistence) and tries to explain this phenomenon with existing theories and concepts, and therefore alternates between the case and the theory (Douven, 2011; Paavola, 2004). The units of analysis in our case study to test the six propositions were the six East German states.

4.2. Data Sources

We used a qualitative research method to collect information. We conducted ten in-depth interviews with key managers (either executive secretaries or association presidents) who were in charge of recreational fisheries governance during the reunification in East Germany. These interviews were the units of observation. The interviewees were chosen to meet the following requirements: they needed to be involved in governance decision-making before and after the reunification and during the time of reorganization, and they needed to represent one of the six East German states, which were constituted after the reunification on former GDR territory (interviewees 1 to 6). We selected managers from each state because after the reunification the sovereignty in inland fisheries was subrogated from GDR territory to state level as required in the constitution of the FRG, and managers operating on organizational levels lower than the national level became important to govern the reorganization process. In addition, we interviewed two managers from the East German umbrella angler association in Berlin (called DAV = Deutscher Anglerverband, interviewees 7, 8). We also interviewed two managers from the West German recreational fisheries umbrella association (called VDSF = Verband Deutscher Sportfischer) to obtain a West German perspective on the reorganization process (interviewees 9, 10). Interviewee 9, the VDSF president, was also leader of an East German angler association in the state Saxony before and after the reunification.

The interviews were carried out between October 2006 and August 2007 and lasted between 2 and 4 h each. Supplementary materials
such as anniversary publications, booklets, minutes of meetings or contracts of the time around 1989, mainly provided by the interviewees, were considered as well but did not systematically provide data for the study. The questionnaire guiding the interviews (Table 1) was developed according to the three analytical steps introduced above. The open questions had the purpose to obtain a narrative and complete picture of the historical process. We also avoided mentioning terminology from NIE or resilience thinking aiming to generate scientifically unbiased information about the historical process and the belief system of the interviewees (Gläser and Laudel, 2006).

4.3. Data Coding

The interviews were recorded, transcribed and then content analyzed. The analysis followed a structural approach (Mayring, 2010), where the data was extracted and structured according to categories derived from the three analytical steps described in the previous sections. The categories were: “structure,” and “function” for system’s characteristics, “attributes of disturbance,” “actors’ position and influence,” and “change situation conditions” for the reorganization process, and “path dependency,” “transaction costs,” “social capital,” and “resource properties” for different motivations of actors. The analysis was conducted by a single coder. The extracted information was summarized for each interview and was tabulated according to the mentioned categories (Tables 2, 3, 4). One example of coded information for the category “structure” is the statement “formerly everything was centrally governed by Berlin” (interviewee 8) because it refers to the centralized governance structure of the DAV in the GDR, whose head office was located in East Berlin (Table 2). The statement “within the hearing procedures for the new state fisheries acts we overran the clerks with arguments to defend our interests and to influence the decision-making and it ended advantageous for us” (interviewee 7) is an example for the category “actors’ position and influence” in the reorganization process because it provides evidence of how East German managers were able to control decision-making (Table 3). The statement “the anglers had high confidence that we will do the right thing” (interviewee 3) is an example for the category “social capital” because it describes a close relationship between anglers and angler association managers and their common goal to keep the centralized governance system (Table 4). The categories were not revised during the analytical procedure.

5. Results

5.1. System Characteristics before and after the Disturbance

5.1.1. Structure

All East German interviewees described the structure of recreational fisheries governance in the GDR and its persistence and change after the reunification in a similar way (Table 2). During the reorganization process new fisheries acts and additional regulations were negotiated and implemented in each of the six newly formed East German states. Recreational fisheries governance was subrogated from GDR territory to state level to conform to the German constitution. The new civil law allowed acquiring private ownership of fishing rights for individuals or groups of people under particular conditions and this opened the opportunity for local angling clubs to acquire fishing and associated management rights similar to the situation in the West Germany. This opportunity was realized by angling clubs in Thuringia were the centralized governance structure was transformed to a local one. Note that in the GDR, for many fisheries the DAV did not hold ownership in the legal sense of a civil law such as in West Germany. Instead, waters were often left for “free use” by DAV members. The DAV did not pay rents to the government or other (previous) owners of fishing rights but still had the more or less exclusive right to use water bodies for fishing. This common practice of access was secured by the socialist regime. Institutional adaptation of the angler associations on state level occurred in response to the newly implemented civil laws. Institutional transformation in the governance structure occurred only in Thuringia, where angler associations were largely substituted by angling clubs in terms of fishing rights. Hence, angling clubs appeared as new actors (or variables in resilience terminology) with fishing rights in the governance structure on the local level in Thuringia, but not in the other five states were angling clubs were members of state associations without any independent fishing rights.

5.1.2. Function

All East German interviewees stressed that the governance system was generally well functioning under the conditions of a socialist regime (Table 2). Most important were the social services provided by the DAV for their members including an angling permit for all prey fish (i.e., non-predatory fish) fisheries, and access to the “common pool of waters” that were managed on East German territory by the DAV. The main functions of fisheries governance, i.e., to secure access and provide management of fisheries, generally persisted after the reunification (Table 2). Most angler associations for example maintained large-scale access for their members to a “common pool of waters” on state or regional level and continued to implement fishery resource use regulations and fish stocking to manage the fish stocks. Furthermore, local angling clubs without fishing (and management) rights kept their functional tasks such as local support for observation and monitoring of water bodies, and controlling of anglers to ensure rule compliance. Fisheries authorities maintained their monitoring position and mandate to support angler associations in resource management. The East German umbrella angler association “DAV” adapted its functions to some degree by focusing on political lobbying and representation in national and international public relations. In addition, the formerly DAV-owned fish hatcheries, managed by five economic sections, changed to commercial business companies because it became too costly to maintain their own hatcheries. In Thuringia, angling clubs did not adapt but transformed by obtaining new functions in resource management. These angling clubs not only started to manage fisheries but also sell locally valid permits in angling club waters. Here, angler associations transformed to representative entities with mainly informational and lobbying tasks.

Table 1

Guiding questions from the questionnaire. The first and third part provided mainly information for the first analytical step (system characteristics). The second part provided data for the second and third analytical steps (attributes of the disturbance, conditions of the reorganization phase, and motivations in decision-making).

1. Part: recreational fisheries governance before and after 1990
   - How was recreational fisheries management organized?
   - Who was responsible for fisheries management?
   - What were major objectives of the umbrella angler association in the GDR?
   - What were major problems in fisheries management?
   - What were major successes in fisheries management?

2. Part: decision-making during and after the reunification
   - What were the first reactions directly after the fall of the Berlin Wall in 1989?
   - What were hopes and worries of East German anglers in that time?
   - Which problems needed to be solved?
   - Who decided about the future design of governance and management?
   - In how far did the DAV influence the new formulation of fisheries laws and regulations?
   - Which positions were acquired by state angler associations?
   - Which regulations became dispensable or needed to be changed?
   - Which alternatives of management existed?

3. Part: recreational fisheries governance in East Germany today
   - How is recreational fisheries management organized?
   - Who is responsible for fisheries management?
   - What are major objectives of the present umbrella angler association in East Germany?
   - What are major problems in fisheries management?
   - What are major successes in fisheries management?
5.2. Attributes of the Disturbance and the Reorganization Process

Based on the recollections of the interviewees (Table 3), the externally caused disturbance caused by the reunification process was perceived as a fundamental shock to the general socio-political system in East Germany. This also affected the sub-system of recreational fisheries governance to a large degree. Not being the initiators of this change, recreational fisheries managers were unwillingly forced to respond fast to inevitable changes in the sociopolitical system. Thus, the key attribute of an externally motivated disturbance and change situation were found to facilitate the maintenance of a centralized governance structure in most East German states in line with proposition 1.

The conditions during the reorganization phase were as follows. The newly implemented West German civil laws and the West German approach to govern recreational fisheries locally through angling clubs were unfamiliar to East Germans. East German fisheries managers were concerned about clarifying the property rights on fisheries, which had to be transferred to rent-based lease contracts as soon as possible to secure future benefit streams from the fish resources to anglers (Table 3, interviewees 1, 3, 4, 5). In all East German states, fisheries stakeholders were pro-actively involved in this decision-making and reorganization process on the state level and contributed their long-term experiences of fisheries management in the GDR (Table 3, interviewees 1 to 9). Some interviewees reported difficulties in the negotiations with civil servants from West Germany, who helped to build the new fisheries governance system in East Germany (Table 3, e.g., interviewee 2). Over time, East German managers were able to use the strong position of East German recreational fisheries associations and implemented features of their customary centralized governance system into the new legal fisheries framework, such as large-scale lease contracts for fishing rights at state waters. The West German angler associations did not directly influence the East German managers’ decision-making process (Table 4, interviewee 10). Some East German managers considered following the West German example and transferring fishing rights to angling clubs. However, these managers were in minority, and either lost their influence or were excluded from the DAV angler associations as happened in the state Thuringia. These conditions of the reorganization process, i.e., involvement and powerful influence in decision-making processes, prompted East German recreational fisheries managers to keep to the centralized governance system in most states (proposition 2).

5.3. Actors’ Motivation

5.3.1. Reasons for Persistence

The majority of the East German managers decided to keep the customary governance system because they simply saw no reason to stop a well-functioning resource management system (Table 4, e.g., interviewee 8). In particular the maintenance of the “common pool of waters,” their customary large-scale management, and the provision of affordable angling permits for all anglers (Table 4) were seen as major achievements of the former East German governance system. This result supported proposition 3 that customary rules had a major impact on the persistence of centralized governance systems in five out of six states.

With respect to the available social capital we found that anglers feared future changes, and that the common historical background of anglers and managers influenced the decision to keep a centralized system. One executive secretary also stressed the strong influence of the personal and leading skills of several recreational fisheries managers on the outcome of the decision-making process on district level in Saxony (Table 4, interviewee 5) resulting in the foundation of three regional angler associations in this state. There was notable mistrust of some East Germans towards West German recreational fisheries managers, and a strong common sense and trust within their own peer group. Moreover, feelings of pride of common achievements developed during the GDR facilitated the decision of most East German managers to maintain a centralized governance system. The motivation of leading managers to maintain powerful positions in recreational fisheries governance was only mentioned by one interviewee in the position of executive secretaries (Table 4, interviewee 5). It can be assumed that this reason played a decisive role to attain a centralized system, even though the interviewed presidents did not mention this reason by themselves. Thereby, these results supported proposition 4 in that high social capital inherent in East German managers facilitated the maintenance of the centralized governance system. But also other reasons played a role. It was for example stated that a change to a decentralized approach would have been too risky because the transfer of management responsibility to the local level would have overcharged inexperienced angling clubs in independently running their fisheries (Table 4, interviewee 9). Also, conducting such an additional fundamental change would have been too vigorous considering the already ongoing costs of adaptation in recreational fisheries governance and in the personal life of managers and anglers. Such factors supported proposition 5 because the costs of keeping the centralized governance system was perceived lower than changing the system fundamentally.

5.3.2. Reasons for Adaptation

Adaptations in governance structure and function including the establishment of rent-based lease contracts of fishing rights and the redesign of clubs and associations as legal entities of the new civil law, were mainly driven by external forces. In particular, the new civil laws involving the alterations in fisheries sovereignty from GDR territory to state level necessitated some inevitable change in governance that could not be prevented by East German recreational managers. These changes were reluctantly accepted as evidenced by some of the interviewees stressing the “needlessness” of six state fisheries acts to substitute a single well-functional fisheries act that existed on the East German territory before (Table 4, e.g., interviewees 4, 5). Despite the successful conduct of the reorganization process, its transaction costs in terms of investment of money, time, collection of information and learning in after-work hours was perceived as high by many respondents (Table 4, interviewees 2, 3, 4, 6, and 9).

5.3.3. Reasons for Transformation

To clarify reasons for transformation we can only draw on information from the exceptional case of Thuringia (interviewee 6), were the centralized governance system in recreational fisheries collapsed and angling clubs established a local governance system similar to West Germany. The main reason for this transformation was that none of the former managers exhibited leadership skills and were unable to deal with the enormous task to adapt the centralized governance system to the requirements of a new civil society. Instead, personal differences between the leading managers in Thuringia, and an emerging rivalry and competition for fishing rights among association members based on a perceived scarcity of fish led to the establishment of angling club ownership of fishing rights and the liquidation of the “common pool of waters” formerly governed by the DAV angler association. Thus, the lack of social capital and leadership among state managers as well as perceived scarcity of resources resulted in a transformation into small-scale governance of usually a few water bodies managed by angling clubs similar to Western Germany (Table 4, interviewees 6, 9).

5.3.4. Influence of Resource Properties

The influence of the resource properties (beyond the effect of perceived scarcity in Thuringia) and the corresponding properties of transactions on governance changes (proposition 6) remained somehow unresolved. None of the interviewees mentioned resource-related aspects such as a perceived abundance of water bodies and fisheries as a reason for the outcome of the reorganization process (Table 4). We asked at the end of the interviews specifically for a potential influence
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<tr>
<th>Interviewee</th>
<th>Before 1990</th>
<th>After 1990</th>
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<tr>
<td><strong>1. Mecklenburg-Western Pomerania President</strong></td>
<td>Centralized governance structure on GDR territory (UA); GDR fisheries act; Fishing rights were ceded for free to the UA ensured by socialist regime.</td>
<td>Centralized governance structure on state level (1 Ass.); State fisheries act; Lease contract according to civil law but still a number of unsettled license agreements; DAV fish farms were closed.</td>
</tr>
<tr>
<td><strong>2. Brandenburg President</strong></td>
<td>Centralized governance structure on GDR territory (UA); GDR fisheries act; Fishing rights were mostly ceded for free to the UA ensured by socialist regime.</td>
<td>Centralized governance structure on state level (1 Ass.); State fisheries act; Today majority lease contracts, but there are still fishing rights to be clarified.</td>
</tr>
<tr>
<td><strong>3. Berlin Executive secretary</strong></td>
<td>Centralized governance structure on GDR territory (UA); GDR fisheries act; Fishing rights were mostly ceded for free to the UA ensured by socialist regime.</td>
<td>Centralized governance structure on state level (1 Ass.); State fisheries act; Today lease contracts according to civil law.</td>
</tr>
<tr>
<td><strong>4. Saxony-Anhalt President</strong></td>
<td>Centralized governance structure on GDR territory (UA); GDR fisheries act; Fishing rights were mostly ceded for free to the UA ensured by socialist regime.</td>
<td>Centralized governance structure on regional level (2 Ass.); State fisheries act; Today lease contracts according to civil law.</td>
</tr>
<tr>
<td><strong>5. Saxony Executive secretary</strong></td>
<td>Centralized governance structure on GDR territory (UA); GDR fisheries act; Fishing rights were mostly ceded for free to the UA ensured by socialist regime.</td>
<td>Centralized governance structure on regional level (3 Ass. established on former district level); State fisheries act; Lease contract according to civil law for fishing rights; DAV fish farms were closed.</td>
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<th>Before 1990</th>
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<tr>
<td><strong>Provision of angling opportunities on entire GDR territory (1 permit with access to the “common pool of waters”); NAPs distributed according to voluntary engagement in mgmt.; Centralized fish stocking measures; Clubs: local monitoring of waters and other support at local mgmt.</strong></td>
<td><strong>Provision of state-wide angling opportunity (1 permit with access to “pool of waters” on state level); Access agreement with other East German state ass.; Ass.: access, use &amp; stocking mgmt.; Clubs: local monitoring of waters; Stocking material purchased from commercial fish farms.</strong></td>
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<tr>
<td><strong>Provision of angling opportunities on entire GDR territory (1 permit with access to the “common pool of waters”); in 1989 525,000 anglers and 36,000 ha; NAPs and permits for predatory fish were distributed according to voluntary engagement in mgmt.; DAV involved in socialist politics.</strong></td>
<td><strong>Provision of state-wide angling opportunity (1 permit); today 67,000 members and 14,500 ha “pool of waters” Access contracts with other East German state angler ass.; Similar to previous functioning: centralized mgmt., clubs &amp; county ass. provide local support.</strong></td>
</tr>
<tr>
<td><strong>Provision of angling opportunities on entire GDR territory (1 permit with access to “common pool of waters”); Fishing rights were mostly ceded for free to the UA ensured by socialist regime. Today majority lease contracts, but there are still fishing rights to be clarified.</strong></td>
<td><strong>Today lease contracts according to civil law. Mandatory membership in UA for anglers. Provision of angling opportunities on entire GDR territory (1 permit with access to “common pool of waters”); NAPs distributed according to voluntary engagement in mgmt.; Clubs: local monitoring of waters and other support at local mgmt.</strong></td>
</tr>
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<td><strong>Provision of angling opportunities on entire GDR territory (1 permit with access to “common pool of waters”); Fishing rights were mostly ceded for free to the UA ensured by socialist regime. Today lease contracts according to civil law.</strong></td>
<td><strong>Provision of regional-wide angling opportunity, i.e., 2 “pools of waters” with separate permits; Ass. has now to pay for fishing rights, stocking material, maintenance of facilities etc.</strong></td>
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<td><strong>Centralized governance structure on regional level (3 Ass. established on former district level); State fisheries act; Lease contract according to civil law for fishing rights; DAV fish farms were closed.</strong></td>
<td><strong>Provision of regional-wide angling opportunities, i.e., 3 “pools of waters” with separate permits; Much less participation of anglers in mgmt.; Social acknowledgement is low: e.g., little support from anglers’ employers or from the state; Clubs: local monitoring of waters and supervision of stocking activities.</strong></td>
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<td>Position</td>
<td>Governance Structure</td>
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<tr>
<td>6. Thuringia Executive secretary</td>
<td>Centralized governance structure on GDR territory (UA);</td>
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<td>7. UA DAV President</td>
<td>Centralized governance structure on GDR territory (UA);</td>
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<tr>
<td>8. UA DAV Executive secretary</td>
<td>Centralized governance structure on GDR territory (UA);</td>
</tr>
<tr>
<td>9. UA VDSF President, also president of regional ass. in Saxony (East Germany)</td>
<td>Centralized governance structure on GDR territory (UA), 16 district ass. &amp; a great no. of county ass. &amp; clubs; GDR fisheries act; Fishing rights were mostly ceded for free to the UA ensured by socialist regime; 5 economic sections, controlled by UA, in charge of fish farms &amp; stocking.</td>
</tr>
<tr>
<td>10. UA VDSF Executive secretary</td>
<td>Very little knowledge about governance structure.</td>
</tr>
</tbody>
</table>

* UA = Umbrella Association, Ass. = Association, mgmt. = management, NAPs = night angling permits, / = no information.
of resource properties. In this context, most interviewees reported that such considerations were not a reason to maintain the centralized governance system on state level (Table 4, interviewee 1, 2, 3, 4, 5, 9). Only later it was acknowledged that a centralized governance system has advantages in terms of economies of scale in natural resource use and management, i.e., in terms of easier transactions in establishing lease contracts for fishing rights and in supply of fish stocking material at a large number of water bodies.

6. Discussion

The three analytical steps in our study enabled us to assess the institutional resilience of East German recreational fisheries governance after the disturbance caused by the German reunification in 1990. With respect to the first step, the assessment of the system’s characteristics and the definition of recognition criteria helped us to identify which particular structures and functions persisted, adapted, or
Table 4
Information extracted from interviews according to the third analytical step “human motivations in decision-making”.

<table>
<thead>
<tr>
<th>3. Analytical step</th>
<th>Actors’ motivation</th>
<th>Transaction costs</th>
<th>Social capital</th>
<th>Resource properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mecklenburg- Western Pomerania President</td>
<td>Excellent achievement of the DAV was the nation-wide “common pool of waters”; “We should try to get it back in East Germany”; Anglers wanted centralized governance because they were used to it; The historical development provided the way for a centralized system.</td>
<td>Problems with legal succession process of properties &amp; fishing rights; Anglers feared costs of West German local permit system which only allow angling at some waters in the proximity of angling clubs; General change to West German local system would have been very expensive.</td>
<td>Mistrust between state and UA representatives; we left DAV but kept centralized system; Anglers charged &amp; trusted leaders of state angler ass. to maintain centralized governance system.</td>
<td>Non influence on decision-making; The advantages of a centralized system for lease contract negotiations &amp; purchase of stocking material was only later understood.</td>
</tr>
<tr>
<td>Brandenburg President</td>
<td>Preservation of achievement of the GDR: cheap angling &amp; many fisheries available; “Among all these general changes we wanted to maintain as much as possible at least for angling”.</td>
<td>Redesign of ass. &amp; clubs was highly work consuming; e.g., the ass. had to redesign 43 county ass. and 1300 clubs as legal entities of the new civil law which included non-profit status, tax exemption, financial self-organization, internal elections of boards etc.; “This was a pile of work and we invested a lot of time and energy;”; Successful adaptation but with high effort; High insecurity about price levels of lease contracts for fishing rights.</td>
<td>It was important to convey a sense of home for anglers within our ass. Everything is as always: we provide secure feeling for anglers Large majority of anglers supported our decision for keeping the customary system; DAV can be proud of its success in the GDR, we survived after 1990.</td>
<td>No influence on decision-making.</td>
</tr>
<tr>
<td>Saxony-Anhalt President</td>
<td>“We just continued as before”; Relied on experiences from GDR but also tried to improve mgmt. DAV anglers were not used to decentralized mgmt. and voted for the centralized system; “Common pool of waters” was &amp; is the spine of DAV ass., supports cohesion among members.</td>
<td>No support in knowledge building, extensive self-study required; Difficulties &amp; long process of club &amp; ass. redesign under new laws; Pool of waters is the ideal mgmt. form for many anglers: provides many fishing grounds; Difficult &amp; long process of club &amp; ass. redesign under new laws; 16 different fisheries acts in Germany complicates angling a lot: costly to observe different rules, to buy different permits in each state; Decentralized governance weakens collective action on regional level.</td>
<td>Anglers preferred the pool of waters system, so we kept it on states level; Anglers trust their managers that they will do the right thing. “Important was to work with reliable people who we knew from previous times”; Anglers were afraid to lose angling opportunities &amp; feared high costs of local permit system; Anglers voted for the same leaders and trusted them to keep the centralized system; “As long as I have a say this shall continue”.</td>
<td>No influence on decision-making.</td>
</tr>
<tr>
<td>Saxony Executive secretary</td>
<td>Regional ass. tried to maintain all what existed before; If the “pool of waters” would be destroyed, it won’t come back again.</td>
<td>Pool of waters is the ideal mgmt. form for many anglers: provides many fishing grounds; Centralized mgmt. has lower costs of decision-making on regional level, e.g., stocking decision on rivers; Initial incapabilities of East Germans in a new society &amp; many unknown rules caused that ass. decided for self-governance.</td>
<td>Three leaders on regional (former district level) level with firm hand were not able to unify to a state ass., wanted to maintain their powerful positions; Sat together with anglers in club meetings &amp; discussed the future: agreed on maintaining pool of waters.</td>
<td>No influence on decision-making; The advantages of a centralized system for sustainable mgmt. of large water areas were only later recognized.</td>
</tr>
<tr>
<td>Thuringia Executive secretary</td>
<td>/</td>
<td>Much change in thinking was necessary; No orientation about functioning of the West German local system; Financial problems of district ass. before 1990 influenced decision-making on reorganization; Big problems to establish new lease contracts, e.g., owner of water bodies unknown.</td>
<td>No leadership of district ass. presidents, but panic behavior about future &amp; insolvable differences between former leaders; High competition for fishing rights among ass. &amp; club representatives.</td>
<td>Had an influence: scarcity of waters, in particular of standing waters, influenced the run for fishing rights of clubs, which preferred to lease fishing rights at small local water bodies (ponds).</td>
</tr>
<tr>
<td>DAV President</td>
<td>Protection of former mgmt. rules important. We saw no reason to stop the centralized system.</td>
<td>/</td>
<td>Success of DAV mgmt. convinced officials in fisheries authorities. Pride of ability to save customary structures and functions; Delegates of state ass. wanted to keep centralized system &amp; DAV. Conflicts between managers of East German UA about reunification with West German UA; Transformation in Thuringia; leaders of as. wanted clubs to take over angling duties including mgmt. duties.</td>
<td>No influence on decision-making; The advantages of a centralized system for sustainable mgmt. of large water areas were only later recognized.</td>
</tr>
<tr>
<td>DAV Executive secretary</td>
<td>Because managers of DAV were trained in centralized mgmt. they continued the same way.</td>
<td>Difficult &amp; long process (years) of club &amp; ass. redesign under new laws; Clubs didn’t have expert knowledge &amp; financial resources; would have been overloaded with local mgmt.; Regional ass. hindered competition for fishing rights between clubs.</td>
<td>VDSF was not able to help in this reorganization process, had no idea how to adapt East German centralized mgmt. on new rules.</td>
<td>Problems between DAV &amp; VDSF UA; unsolved issues, e.g., on finance; Clubs &amp; ass. which joined VDSF were insulted as betrayers.</td>
</tr>
</tbody>
</table>

* UA = Umbrella Association, Ass. = Association, mgmt. = management, /= no information.
transformed in the governance systems in each of the six East German states after the disturbance. In this context it is important to understand that a system's stability in the same (adaptability) or in another domain (transformability) has a dynamic notion as the system is exposed to constant forces of change. In the present case study, external processes of change in the overall socio-political system (reunification) were identified as centrifugal forces to recreational fisheries governance by challenging its internal structure and function to reorganize. Centripetal forces were identified in actors' motivations that wanted to maintain recreational fisheries in the same stability domain (i.e., persistence and adaptation in five states) and lead to another system's configuration in one exceptional state (i.e., transformation in Thuringia).

With respect to the second step, we found that the attributes of the disturbance and the conditions of the reorganization phase mattered for the outcome of the reorganization process (propositions 1 and 2). Specifically, the results suggested that in external, fundamental, and rapid disturbances with high uncertainty and incomplete information about future social dynamics, the room for innovation can be restricted and decision-makers tend to rely on customary governance rules to avoid transaction costs of change. These results were in accordance with established research in NIE (Alchian, 1950; North, 1990) and more recent research about institutional resilience (Herrfahrt-Pählle and Pahl-Wostl, 2012). However, the results might be different if actors have more time to decide or when disturbances occur in the ecological system that requires a direct response in changing resource governance.

The position and influence of particular powerful actors in the decision-making process were seen as necessary conditions to determine a particular outcome of this process in line with the actors' motivations. Without being included in the reorganization process of East German recreational fisheries governance, the managers would not have had the opportunity to successfully implement their customary centralized governance system after the reunification. However, we found that the motivations of actors can leverage attributes of the disturbance and conditions of the reorganization process because of the outcome of the reorganization process in the sixth case Thuringia (transformation to another basin of attraction, i.e., local governance system). Here, key managers faced the same attributes and conditions like the managers in the other states but their lack of leadership abilities and an emerging rivalry for fishing rights facilitated that angling clubs started to establish a decentralized governance system on local level. Thus, for explaining the outcomes of a system's reorganization after a disturbance the motivations of actors constituted sufficient conditions as assessed in the third analytical step.

Overall, the third analytical step enabled us to explain the different outcomes of the reorganization phase in the six East German states (propositions 3 to 6). In line with e.g., North (1990), Roland (2004) or Walker et al. (2006), we found that fast changing institutions such as those affected by the general socio-political change in East Germany challenge slower moving institutions such as customs of recreational fisheries managers. This resulted in path dependency in five states where customary institutions persisted against the challenge of external and rapid change (proposition 3). Moreover, according to Newman (2000) fast changing institutions might also overwhelm humans' ability to learn because of the excessive demand for alteration by general socio-political change. This was supported by the results in five states where East German recreational fisheries managers only adapted the system to an inevitable degree as required by new constitutional laws. Thus, situational conditions, such as the attributes of disturbances and the conditions in the reorganization phase, have (within limits as described above) influence on human motivations in decision-making processes (Pierson, 2004; Ross and Nisbett, 2011).

The importance of social capital among actors, i.e., shared attitudes and networks, their interest to maintain their powerful positions, and leadership abilities in influencing the outcomes of the reorganization process in our study (proposition 4) concurred with insights from studies on common-pool resource management about the importance of social capital and actors' behavior for natural resource management (Gutiérrez et al., 2011; Ostrom, 1990; Pretty, 2003). This causality has been confirmed by studies in social psychology that indicated that humans tend to rely on views of their peer group in situations of uncertainty because they have proved their usefulness in the past or because disagreement with the group would cause uneasiness for the individual (Ross and Nisbett, 2011). We also found that next to general transaction costs of change, individual transaction costs (satisfaction, experience, and specificity in management skills and knowledge of managers with the former customary governance system) determined their reluctance to change the system fundamentally because it would be non-substitutable in a new governance system and previously invested resources would be sunk costs (proposition 5). However, in the exceptional case Thuringia both the missing social capital among key managers and the properties of the ecological system caused a major change in the governance system. Hence, in line with other studies (e.g., Becker and Ostrom, 1995; Oldekop et al., 2012) the perceived scarcity of resources were identified as a reason for institutional transformation in Thuringia (proposition 6).

Independent of the research question, we found an interesting scale-effect when looking at the outcome of the reorganization process on the entire territory of East Germany (Fig. 2). This scale-effect is a pattern of decentralization in recreational fisheries governance systems from North-East Germany to South-East Germany where the Northern states kept the centralized system on state level, whereas towards the South the states either kept the centralized system on regional level or even transformed to a local-level system. This pattern was not anticipated by the interviewees. Such scale-effects are difficult to anticipate in advance or from a perspective of lower organizational levels because of humans' restricted perceptions and knowledge about complex systems and their various scales (Berkes, 2006; Cash et al., 2006). Therefore, it is essential to differentiate between the extracted information given by the individual interviewees, and our own synthesizing interpretation of the results.

Limitations of this study are that we did not investigate the perceptions of local anglers of the reorganization to compare them with the perceptions of leading managers. For example, instead of being supported by anglers to keep a centralized governance system, influential managers might have rather persuaded anglers to maintain a centralized governance system in cases where local angling clubs were interested in leasing their own fishing rights. In addition, the perceptions of the interviewed managers might be affected by recall bias and cognitive dissonance in terms of their own role during the reorganization process. For example, the interviewed presidents of angler associations did not directly mention that they wanted to keep their own powerful positions in governance whereas an interviewed executive secretary mentioned consolidation of power and leadership of managers as a decisive factor for the persistence of centralized governance. It can thus not be ruled out that more factors than the ones identified in the present study were decisive to shape the outcome of the reorganization process.

In conclusion, this study took advantage of the conceptual strength of two traditionally separated research branches to fully dissect the macro-level and micro-level reasons of change and persistence in East German recreational fisheries governance. This approach could be also applied to study pure social systems (e.g., health care system), not only SES such as recreational fisheries. Note that our motivation to combine resilience concepts with an institutional economics analysis resulted from the need to develop a novel scientific perspective to understand institutional change from a holistic angle taking dynamic and macro level aspects into account. It was not the aim and beyond the scope of this research to carry out an in-depth ecological analysis. For example, an analysis of the resilience of the ecosystem services, e.g., the provisioning of fish, provided to the users by the ecological system would complement the given study. However, in this study we took ecological characteristics relevant for understanding institutional
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Assessing an Adaptive Cycle in a Social System under External Pressure to Change: The Importance of Intergroup Relations in Recreational Fisheries Governance.

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ABSTRACT. The adaptive cycle constitutes a heuristic originally used to interpret the dynamics of complex ecosystems in response to disturbance and change. It is assumed that socially constructed governance systems go through similar phases ($K$, $\Omega$ [omega], $\alpha$ [alpha], $r$) as evident in ecological adaptive cycles. Two key dimensions of change shaping the four phases of an adaptive cycle are the degree of connectedness and the range of potential in the system. Our purpose was to quantitatively assess the four phases of the adaptive cycle in a social system by measuring the potential and connectedness dimensions and their different levels in each of the four phases. We assessed these dimensions using quantitative data from content analysis of magazine articles describing the transition process of East German recreational fisheries governance after the fall of the Berlin Wall in 1989. This process was characterized by the discussion of two governance alternatives amenable for implementation: a central East German and a decentralized West German approach. Contrary to assumptions in the adaptive cycle heuristic, we were unable to identify the four phases of the adaptive cycle in our governance system based on quantitatively assessed levels of connectedness and potential alone. However, the insertion of in-group (East Germans) and out-group (West Germans) dimensions representing the two governance alternatives in our analysis enabled us to identify the specific time frames for all four phases of the adaptive cycle on a monthly basis. These findings suggest that an unmodified “figure-eight model” of the adaptive cycle may not necessarily hold in social systems. Inclusion of disciplinary theories such as intergroup relation theory will help in understanding adaptation processes in social systems.

Key Words: adaptive cycle; connectedness; content analysis; East Germany; intergroup relation theory; potential; recreational fisheries; social system

INTRODUCTION

Recreational fisheries governance in East Germany was under enormous external pressure to change after the fall of the Berlin Wall in November 1989. The following reunification process of East and West Germany disrupted the entire social and political system in East Germany, which was developed in the former German Democratic Republic (GDR). In particular, the large-scale fisheries management system of the GDR, in which a large number of water bodies were centrally governed by one nation-wide angler association, was at risk of being dissolved when the socio-political and economic environment rapidly altered from a centrally planned to a social market economy with a democratic constitution after the reunification with the Federal Republic of Germany (FRD). A decentralized recreational fisheries governance alternative existed in the FRD (West Germany) and was available to be implemented in the East. This alternative was characterized by locally self-organized angling clubs, which usually govern a small set of fisheries on a restricted number of local water bodies. A policy discussion and negotiation process started with the proactive participation of East German recreational fisheries managers. As a result, the central governance approach persisted in most parts of East Germany, despite the window of opportunity for angling clubs.
to obtain independence in governance and management of local water bodies. This phenomenon attracted our interest because we wanted to evaluate whether the social system of East German recreational fisheries governance went through distinct phases of change amendable to the adaptive cycle heuristic (Holling and Gunderson 2002).

The adaptive cycle was originally conceptualized by Holling (1986, 2001) to interpret the dynamics of complex ecosystems in response to disturbance and change (Fig. 1). In terms of its dynamics, the adaptive cycle has been described as moving slowly from exploitation ($r$) to conservation ($K$), maintaining the conservation stage for a prolonged period, then developing very rapidly from $K$ to release ($Ω$), continuing rapidly to reorganization ($α$) and back to exploitation ($r$; Holling and Gunderson 2002). Depending on the specific configuration of the system, the system can then begin a new adaptive cycle or alternatively it might transform into a new configuration, shown as an exit arrow in the popular “figure eight model” (Fig. 1). The adaptive cycle, which is one of five heuristics used to understand social-ecological system (SES) behavior (Walker et al. 2006), the other four heuristics being resilience, panarchy, transformability, and adaptability, is of considerable conceptual appeal, and it is claimed to be generally applicable to ecological and social systems as well as to coupled social-ecological systems (Gunderson et al. 2002).

For social systems, the adaptive cycle has been characterized by Holling and Gunderson (2002) as follows: in the phase of conservation ($K$) the system is hierarchically consolidated by tight organization and control, which precludes management or policy alternatives. In case of internal or external disturbances, the system progresses toward destruction ($Ω$), and the loss of control leads to the release of the accumulated capital, e.g., money, skills, mutual trust, and experience in organizations. In the following $α$ phase, a competition among entrepreneurial pioneers and/or surviving leaders occurs and leads to the reorganization of the system. In this phase, humans have the greatest chance for innovation and change. However, if the system and its entrepreneurial pioneers do not have the capacity to deal with the disturbance, the system will transform into a different configuration and enter a new adaptive cycle. If the system is resilient, i.e., capable of controlling the disturbance, the cycle proceeds to the exploitation phase ($r$) when a policy plan is chosen among the various alternatives discussed during the $α$ phase. In the $r$ phase a progression toward the next $K$ phase occurs as the winners of the political game restructure processes and policies for conservation. At this stage the system evolves into a $K2$ phase with ongoing functions and controls similar to those of the original $K$ phase ($K1$). The succession of the four phases is assumed to be generally applicable to all social systems (Gunderson et al. 2002) and thus, should have occurred also after the disturbance of East German recreational fisheries governance in 1989.

The two salient dimensions determining change in an adaptive cycle are connectedness and potential (Holling and Gunderson 2002). The connectedness dimension, represented by the horizontal axis in the visual depiction of the adaptive cycle (Fig. 1), stands for the ability of a system to internally control its own destiny (Holling 2001). It “reflects the strength of internal connections that mediate and regulate the influences between inside processes and the outside world – essentially the degree of internal control that a system exerts over external variability” (Holling and Gunderson 2002:50). The potential dimension, represented by the vertical axis of the cycle (Fig. 1), stands for the “inherent potential of a system that is available for change” (Holling 2001:393). Social or cultural potential can be characterized by the “accumulated networks of relationships – friendship, mutual respect, and trust among people and between people and institutions of governance” (Holling and Gunderson 2002:49). Furthermore, potential can be thought of as the range of accumulated resources such as knowledge, inventions, and skills that are available and accessible. According to the adaptive cycle heuristic, the levels of both dimensions differ during the course of the cycle along the four phases (Fig. 1). The adaptive cycle heuristic thus predicts that the four phases of the cycle can be distinguished based on distinct combinations of high or low potential and connectedness.

The objective of this study was to quantitatively assess the four phases of the adaptive cycle by measuring the potential and connectedness dimensions and their respective levels in the social system of East German recreational fisheries governance while undergoing transition and change. For the purpose of this study, we defined the structure of recreational fisheries governance as the arrangement of property rights holders and fisheries regulations for inland recreational fisheries
in Germany. Holders of property rights for inland fisheries in Germany usually have both the right to catch fish and the duty to manage the resource sustainably (Arlinghaus 2006, Daedlow et al., in press). Thus, property rights holders govern the use of fish stocks within the legal limits defined by fisheries regulations. Furthermore, they decide and contract on recreational fisheries management, and can thus be defined as agents of the governance structure (Williamson 2002). Currently, angling clubs and angler associations are the dominant leaseholders of inland fishing rights for German freshwater ecosystems (Arlinghaus et al. 2002) and constitute common property rights regimes on fish resources (Daedlow et al., in press). The management boards of clubs or associations are therefore major agents of recreational fisheries governance in Germany. As mentioned above, the governance structure of recreational fisheries varies between East and West Germany because of a different institutional and cultural background before 1989 (Mau and Müller 1998, DAV 2004). During 40 years of separate historical developments, the East Germans constituted a group of recreational fisheries managers who were accustomed to top-down decision making in terms of operational management practices over large geographical areas. By contrast, West German recreational fisheries governance was locally organized in small angling clubs while West German angler associations mainly fulfilled representative, lobbying, and information tasks. We assumed that the different historical backgrounds of East and West Germans in recreational fisheries governance would play a major role in our attempt to delineate the adaptive cycle based on the connectedness and potential dimensions in East German recreational fisheries governance after the socio-political disturbance in 1989.

LITERATURE REVIEW AND THEORETICAL BACKGROUND

The very general properties of the adaptive cycle shaped by the distinct levels of the two dimensions, i.e., potential and connectedness, are supposed to provide a framework for assessing and describing adaptive change in ecological, social, and coupled SES (Holling and Gunderson 2002). A few studies stressed that some systems do not necessarily follow the adaptive cycle (Cumming and Collier 2005,
Walker and Lawson 2006, Bunce et al. 2009). Most studies, however, have generally found the adaptive cycle heuristic to be useful for explaining changes in SES (Brunk 2002, Alcorn et al. 2003, Cocks 2003, Seixas and Berkes 2003, Abel et al. 2006). Most of these studies were explaining specific cycle phases such as the reorganization phase. However, some studies described and quantified the whole adaptive cycle in a SES. From a methodological point of view, most available studies used retrospectively qualitative reasoning (Peterson 2000, Bohensky 2008, González et al. 2008), or ecological, e.g., nutrient supply, and/or socioeconomic variables, e.g., timber harvest rates (Allison and Hobbs 2004, Beier et al. 2009), as well as dynamic models (Carpenter et al. 2001, Cumming and Collier 2005) to describe the adaptive cycle in SES. These studies thus exhibit a variety in methodological and analytical approaches and theoretical foundations while focusing on describing change in SES. Studies on adaptive cycles in social systems rather than SES are rare, however, and to our knowledge no research has attempted to quantitatively operationalize the different levels of the connectedness and potential dimensions as descriptors of particular phase transitions in a social system.

Two studies have explicitly focused on the two dimensions of connectedness and potential within an adaptive cycle when studying change in social systems. In the first study, Nkhata et al. (2008) provided a conceptual framework to represent the distinct phases of an adaptive cycle by analyzing long-term social relationships. They distinguished the connectedness and potential dimensions by considering trust and commitment as the two key attributes of the potential dimension, with trust referring to a state in which a party in a relationship adopts a belief that the other parties will not act against its interests (Luo 2002), and commitment referring to the energies and resources bonded by parties in long-term relationships (Ford et al. 1998). Similar to Holling and Gunderson (2002), the second dimension, i.e., connectedness, was defined by Nkhata et al. (2008) as the degree to which actors in social relationships are linked and the degree to which the strength of these links mediate change in social relationships. Based on a literature review, Nkhata et al. (2008) stressed the importance of both dimensions for facilitating the understanding of resilient social relationships. Their study revealed important concepts that should be included in quantitative analyses of phase shifts in social systems. In the second study, Abel et al. (2006) emphasized that “connectedness, e.g. in social networks, can imply the potential to, e.g. manage common property resources” (Abel et al. 2006:17), but both connectedness and potential in social systems can fall under the same category “capital.” They also defined various subcategories such as social, human, natural, physical, and financial capital and assessed different levels of these subcategories of capital based on interpretations of case studies in regional SES in Zimbabwe and Australia (Fig. 6 in Abel et al. 2006). When applying their framework to the case studies, Abel et al. (2006) were unable to identify the sequential passages of the phases that the adaptive cycle heuristic implies and concluded that greater inclusion of disciplinary social science theories is needed to describe transitions between various system stages in social systems. These studies indicate that applications of the adaptive cycle to social systems are limited, and it has remained a challenge to measure the dimensions of the adaptive cycle in social systems (Carpenter et al. 2001, Gunderson et al. 2002) and to assess similarities and differences of this cycle in SES and social systems (Westley et al. 2002, Davidson 2010). In general, studies on social, ecological, and/or coupled SES acknowledged the key role that social groups, actors, and institutions play in explaining social system behavior and change (Westley 1995, Berkes and Folke 1998, Adger et al. 2002, Gunderson and Holling 2002, Westley et al. 2002, Lebel et al. 2006, Walker et al. 2006, Janssen et al. 2007). Research frameworks that incorporate social groups, actors, and institutions have been developed to understand dynamics in social systems when dealing with natural resource management issues (Andries et al. 2004, Folke et al. 2005, Olsson et al. 2006, 2008, Biggs et al. 2010, Chapin et al. 2010). Folke et al. (2005), for example, highlighted the social sources of adaptation in SES and emphasized that actors draw on various knowledge systems and experiences for the development of a common understanding and policies. The interplay of actors and institutions is seen as central in transitions and transformations of SES (Olsson et al. 2006, 2008). In this context, the role of social groups in policy decision processes and their outcome for ecosystem management have been highlighted (Chapin et al. 2010) and decision making by humans is generally seen to be rooted in previous cultural experience and customary institutional environments (Smit and Wandel 2006). Furthermore, Holling and Gunderson (2002:49-50) pointed to the likely.
importance of different social groups in a social system going through an adaptive cycle by including terms like “inside processes,” “outside world,” “among people,” and “between people” in their definitions of connectedness and potential. However, to our knowledge, the influence of systematic differences among social groups based on distinct cultural and institutional backgrounds, such as possibly existing between East and West German recreational fisheries managers, has not been explicitly investigated in adaptive cycles or resilience studies. Thus, we extended our analytical approach to include intergroup relation theory when studying phase shifts in adaptive governance cycles.

Intergroup relation theory is a research field that investigates social group behavior while assuming systematic differences between distinct social groups that reflect group-based goals and orientations (Tajfel 1982, Fischer et al. 2007, Dovidio et al. 2009). Culture and identity are assumed to have major explanatory power in intergroup processes among different groups. Culture includes history, language, religion, preferences, beliefs, and attitudes. People who share a common history, language, or religion share the same identity and are members of the same group, usually defined as in-group (Worchel 2005). Consequently, a group of people who do not share this cultural background and who experienced different shared histories and customs form another belief system that can be defined as out-group (Worchel 2005). Tajfel and Turner (1979) argued that the social identity of individuals is partly based on the groups to which they belong and that individuals tend to provide advantages to their own group and discriminate against the out-group. Social identity studies revealed that East and West Germans can be treated as distinct social groups based on their socialization that occurred in completely different socioeconomic systems (Fuchs-Schündeln and Schündeln 2005, Kessler and Hollbach 2005, Alesina and Fuchs-Schündeln 2007, Fischer et al. 2007). These findings point to the importance of intergroup relations for human decision making in social systems in general, and for studies of policy decision processes involving East and West Germans in particular. Thus, in our analytical design, we assessed the progression of four phases of an adaptive cycle, based on connectedness and potential, and considered that the two governance alternatives in East and West Germany existing before 1990 represented distinct social groups with their own identities and customs in recreational fisheries resource governance.

METHODS AND MATERIAL

Our analysis of potential changes in East German recreational fisheries governance as an adaptive cycle was confined to the two dimensions potential and connectedness. The adaptive cycle heuristic includes the third dimension resilience (Holling and Gunderson 2002). The resilience dimension, defined as the capacity of the whole system to absorb disturbances and still maintain its ongoing functions and controls, captures system properties rather than explaining change as do the potential and connectedness dimensions (Holling and Gunderson 2002). Focusing on the potential and connectedness dimensions enabled us to sufficiently characterize the different phases of change in a potential adaptive cycle in East German recreational fisheries governance after the fall of the Berlin Wall in 1989. To be able to test the predicted levels of potential and connectedness in particular phases of the adaptive cycle (Fig. 1), we followed closely the definitions given by Holling and Gunderson (2002) and conceptualized both dimensions similar to Nkhata et al. (2008). Accordingly, we defined the connectedness dimension as the degree to which East German recreational fisheries managers were able both to control the processes in their management system and the corresponding angler community, i.e., internal connections, and to control for the influences from potential alternatives such as the West German governance approach, i.e., external variability. The potential dimension was defined as the value of connections within and between social groups by assessing the level of trust, respect, and/or friendship expressed by East German recreational fisheries managers toward their own community and toward the West German recreational fisheries community. We considered the effects of intergroup relations (Tajfel 1982, Worchel 2005, Dovidio et al. 2009) within and among different social groups in our analysis as in-group, i.e., internal connectedness and potential within the group of East-Germans, and out-group dimensions, i.e., external connectedness and potential toward the group of West-Germans.

To assess all four dimensions, i.e., connectedness, potential, in-group, and out-group, we applied a novel approach using quantitative data from content analysis of articles in an angling magazine published by the East German umbrella angler association. These articles were assumed to be indicative of the values and opinions of leading managers in East German recreational fisheries governance during the transition process around
The traditional name of the East German angling magazine was *Deutscher Angelsport* (German Sport Angling). From October 1989 to April 1990 its publication was discontinued because of the revolutionary events in East Germany. From May 1990 onward, the magazine was published as a supplement in several angling magazines (*Fisch und Fang* until August 1991; *Rute und Rolle* until December 1996; *Esox* until December 2008; and since January 2009 in *Blinker*) and was renamed *Angeln und Fischen* (Angling and Fishing) in 1997. We evaluated the content of 25 cover articles from May 1990 to November 1994 (four in 1990, four in 1991, nine in 1992, five in 1993, and three in 1994) because the major discussion regarding the reorganization of recreational fisheries governance took place during that time period. From 1994 onward, the topic only appeared occasionally to substantiate the policy choice made in the early 1990s (one in 1995, three in 1996, four in 1997, one in 2000, and one in 2003). The choice to focus the analysis on cover articles rested on their prominent position to inform the readers of the magazine, assuming that the most important issues are positioned on the first page.

We used content analysis to evaluate the cover articles (Früh 2007). We developed a coding scheme representing four facets of analytical importance: the potential and connectedness dimensions and the in-group and out-group dimensions (Table 1). In our case, the in-group dimension represented positive statements by East German managers about their own central governance approach as well as negative or critical perceptions toward West German managers and their local governance approach, which in turn indirectly emphasized positive statements about their own peer group and governance approach. The out-group dimension represented positive perceptions of East German managers toward the West German managers and their local governance approach and included negative perceptions about their own customary central system. In all codes, in-group and out-group were always connected to the dimensions connectedness and potential. The connectedness and potential dimensions were measured separately (Table 1). Similar to the definition of Holling and Gunderson (2002:50) and Nkhata et al. (2008), Pretty and Ward (2001) defined connectedness in social systems as different types of connections among groups and organizational levels; it is regarded as linkages developed for reciprocity and exchange processes within or among groups such as exchange of information, common meetings and celebrations, or trading of goods. Connectedness can also help to increase trust and friendship among groups or individuals (Pretty and Ward 2001). However, the causality between connectedness and trust is sometimes unclear (Rowley 1999). Trust, friendship, and respect are, by contrast, fundamental elements of Holling and Gunderson’s (2002) definition of potential. Trust can be defined “as the belief that others will not deliberately or knowingly do us harm, if they can avoid it, and will look after our interests, if this is possible” (Newton 2007:343). It represents the value of a relationship, not the intensity of its connections. We followed this description and terminology when defining potential in our case study. In addition to trust, friendship, and respect, we also considered perceived skills of group members as an indicator of potential (Holling and Gunderson 2002).

We developed five subcategories to measure the potential dimension: abilities, group support, trust, respect, and friendship (Table 1). These different subcategories showed the perceived value of the relationship within the group of East German managers, i.e., in-group, and their relationship to West German management, i.e., out-group. For example, the abilities of East German recreational fisheries managers were emphasized in an article in April 1991: “There is no reason to discard all skills, which were developed in the former GDR even though this state does not exist anymore” (Schwandt
Table 1. Coding scheme for the evaluation of the cover articles: five subcategories for the connectedness and the potential dimension (number of coded statements in brackets) were developed. Examples of identified statements for each subcategory and in-group and out-group dimensions are provided. Note: DAV = Deutscher Anglerverband, the East German umbrella association for anglers; VDSF = Verband Deutscher Sportfischer, the Association of German Sport Fisheries in the West.

<table>
<thead>
<tr>
<th>Dimensions and subcategories</th>
<th>Examples of statements supporting in-group (East)</th>
<th>Examples of statements supporting out-group (East towards West)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connectedness:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>“The simultaneous membership in DAV and VDSF is not possible” (Apr 1992)</td>
<td>“Cooperation between DAV and VDSF develops well” (Jun 1990)</td>
</tr>
<tr>
<td>(28 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>“Protection of the achievements of the DAV” (Apr 1991)</td>
<td>No code assigned</td>
</tr>
<tr>
<td>(8 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-conception</td>
<td>“We – the DAV provide a home for all anglers” (Jan 1993, Apr 1992)</td>
<td>No code assigned</td>
</tr>
<tr>
<td>(55 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meetings</td>
<td>“Suggestions for cooperation were not answered” (Oct 1992)</td>
<td>“Four working groups are going to meet every three month” (Jun 1990)</td>
</tr>
<tr>
<td>(42 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unification</td>
<td>“VDSF is not interested in an equal and proportional unification” (Sep 1992)</td>
<td>“On the way to an unified umbrella organization” (Dec 1990)</td>
</tr>
<tr>
<td>(31 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Potential:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abilities</td>
<td>“There is no reason to discard all skills, which were developed in the former GDR even though this state does not exist anymore” (Apr 1991)</td>
<td>“The VDSF will not blind itself when help and advice is needed” (Dec 1990)</td>
</tr>
<tr>
<td>(8 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group support</td>
<td>“Association meeting was a clear and convincing vote for the continued existence and legal capacity to act” (Apr 1991)</td>
<td>“Despite different starting points a common understanding was created very fast” (Jun 1990)</td>
</tr>
<tr>
<td>(3 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(24 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respect</td>
<td>“We do not have fears about contact but we must be treated fair” (Aug 1992)</td>
<td>“Convergence without fears about contact” (Feb 1990)</td>
</tr>
<tr>
<td>(52 statements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friendship</td>
<td>“We do not have any hopes for a partnership with the VDSF” (Aug 1992)</td>
<td>“Consultations in very jovial atmosphere” (Jun 1990)</td>
</tr>
<tr>
<td>(12 statements)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1991:1, our translation). An example of out-group support was provided, by Deutscher Anglerverband (DAV), the East German umbrella association for anglers, of an East German manager valuing the relationship between East and West Germans as follows: “Despite different starting points, a common understanding was created very fast” (DAV 1990:1, our translation). An example of losing trust between DAV in the East and their West German equivalent, Verband Deutscher Sportfischer (VDSF) was, “VDSF defamed DAV board members in public” (Mikulin 1992:1, our translation), which indicated that verbal insults between both groups took place. We coded this statement under the in-group category because it had a negative connotation toward the West German
managers and likely unified the East German group. A high frequency of statements about potential indicated the importance of certain relationships either within or between the two groups of East and West Germans.

To measure connectedness we developed five subcategories: organization, control, self-conception, meetings, and unification (Table 1). The subcategory ‘organization’ measured the level of control over group joining, i.e., being a member in either one or both of the East and West German groups. Statements were similar in the subcategory ‘unification’ in which East German managers expressed their opinion about a potential connection or union with the West German angler association. Under the subcategory ‘meetings’ we coded statements about actual or envisaged meetings between the groups or the refusal of meetings from one or the other group. With the subcategory ‘self-conception’ we aimed to capture statements that stressed common issues in fisheries governance either within one group or between groups. For example: “We – the DAV provides a home for all anglers” (DAV 1992:1, our translation), showing support for the East German angler association (Table 1). With ‘control’ we measured statements that indicated the achievements of a certain governance approach and were worth continuing. The frequency of statements about connectedness to one or the other group was assumed to indicate how rigid (high frequency) or loose (low frequency) the control of internal or external processes was.

Coding of statements was completed by two independent coders. When agreement could not be found, codes were excluded from the analysis (11% of all assigned codes). The data analysis included 263 coded statements. The codes were assigned to each paragraph (coding unit), with each paragraph being treated as a single unit of information. This was considered appropriate because treating sentences or even words as the basic unit of information breaks information into many small pieces and does not necessarily provide the full suite of meaning with respect to the writer’s perceptions or opinions (Gläser and Laudel 2004, Früh 2007). Note that the examples of statements given in Table 1 to illustrate the subcategories are half sentences or sentences because they serve as anchors for the primary information coded in the particular paragraph. After the coding of the first five articles, the exploratively assigned codes were compared and discussed between the two coders. An adjustment of the four main dimensions and their subcategories was not deemed necessary at this point. The average total intercoder reliability (0.76) was estimated following Holsti (1969) and ranged between 0.71 and 0.81 for the four dimensions (in-group connectedness: 0.81; in-group potential: 0.81; out-group connectedness: 0.71; out-group potential: 0.72). The calculation of the intercoder reliability was based on the precondition that the codes referred to a specific paragraph in the text (our coding unit), not to the entire article (Früh 2007).

After the completion of the coding process, all codes assigned to a paragraph were summarized on a per article basis that was defined as the unit of analysis, according to the four dimensions of the coding scheme. We decided not to subdivide the analysis regarding individual subcategories such as ‘friendship,’ ‘trust,’ etc., because the distribution of the subcategories within the connectedness and potential dimensions did not influence the results. In addition, for two subcategories no statements were coded (‘control’ and ‘self-conception’ for out-group, see Table 1). Thus, we analyzed data in pools related to the two dimensions, potential and connectedness, and further partitioned into the in-group and out-group dimensions. To compare trends over time, we calculated the relative frequency of coded statements per dimension and article. After the calculation of the relative frequency of coded statements, we first looked for trends in the relative frequency of potential and connectedness statements over time. To test for temporal patterns, we first plotted the time series of the relative frequency of connectedness and potential statements with the in-group and out-group information pooled. This was done because the adaptive cycle heuristic does not distinguish between in-group and out-group (Fig. 2). In a second step, we plotted connectedness and potential separately for the in-group and out-group dimensions (Fig. 3). Finally, we pooled the connectedness and potential dimensions together and plotted only the relative frequency of in-group and out-group statements separately (Fig. 4). Only in the last step of the analysis we were able to identify the four phases of the adaptive cycle. To help in understanding and interpreting our results, we added the four phases of an adaptive cycle identified in this last step to all figures in the results (Figs. 2 and 3).

As a supplementary data source, we also conducted 10 semistructured, in-depth interviews with
contemporary recreational fisheries managers to obtain insights into the historical sequences of decision making during the transition process in recreational fisheries governance after the fall of the Berlin Wall. Almost all interviewees were key members of East German recreational fisheries associations on the national or district level and were responsible for resource management and decision making during the transition process. The semistructured, open questionnaire used for the interviews was divided into three parts that covered the following subject areas: (1) recreational fisheries governance in the former GDR, (2) decision making during and after the reunification, and (3) recreational fisheries governance in East Germany today. Historical facts were similarly described by all interviewees. Based on these data, we collected qualitative information about adaptation and persistence in the governance structure and about the actual sequence of the transition process, e.g., when the decision for adapted central governance in large parts of East Germany took place. We structured and headlined the system narrative based on the information given in the interviews according to phases and key attributes of the adaptive cycle heuristic. Providing the qualitative information first facilitates the understanding of the patterns visible in the quantitative analysis of the magazine articles.

RESULTS

System origin and growth of internal connections: connectedness

After the Second World War, in 1949, the new GDR state was founded on East German territory. The central socialist government broke with the tradition of recreational fishing rights tenures by local angling clubs that existed prior to the end of the Second World War. In the 1960s, the GDR established a central fisheries management system with a nation-wide fishery law for inland waters regulating recreational and commercial fishing rights, fish production, and fish resource use such as size-based harvest limits and closed seasons. Recreational fisheries management was mainly organized by the national angler association, called “DAV of the GDR” (Deutscher Anglerverband der DDR), which was founded in 1954 (Winkel 1998, DAV 2004). The DAV played a paramount role in recreational fisheries governance and management, and fisheries authorities focused on commercial fisheries. The DAV, authorized by the national government to use and manage all recreational fisheries, was responsible for the planning and execution of local and regional management measures such as fish stocking or determination of
access and use regulations. The umbrella association in the capital Berlin appointed all recreational fisheries managers on the district or county level. Associations on the district or county level in collaboration with the angling clubs on local levels supported the umbrella association inter alia in terms of fish stocking measures, guarding of waters, anglers’ education, monitoring of fish resources, and anglers’ behavior. Thus, the DAV angler association controlled the entire system and mediated and influenced decision making for recreational fisheries management.

Accumulation of internal system resources: potential

From the recreational fisheries managers’ perspective, fisheries governance in the GDR was generally well functioning under the conditions of a planned economy (Winkel 1998, DAV 2004). Angler desires were thought to be generally satisfied because of exceptionally low fees for membership and fishing permits, and the easy access to angler-association waters nationwide. The number of fishing permits for nonpredatory fish was not restricted by the DAV or fisheries authorities. The DAV also ran several fish production facilities to produce fish for stocking programs. The recreational fisheries management system in the GDR highly depended on voluntary work, but the people in charge had several benefits from voluntary engagement, e.g., days off from work, and the managers’ work was highly appreciated by society. For instance, stocking programs and recreational fisheries in general were considered important by political decision makers because they assisted fish supply in the GDR, provided valuable forms of recreation, and facilitated social cohesion and social capital. Management problems arose from a number of external factors, for example, from supply limitations for angling tackle and other technical equipment, from limited access to production facilities for desired fish species other than the abundantly available carp (*Cyprinus carpio* L.) for stocking programs, or from industrial pollution that endangered fish stocks in rivers and lakes. Nonetheless, based on mutual experiences and work relationships, it was perceived by the interviewees that recreational fisheries governance developed into a generally well-functioning *K* state after the implementation of a centrally planned economy in the GDR, with notably high internal potential and connectedness levels.
The governance alternative in West Germany: external variability in the background

The governance alternative of West German recreational fisheries was, and is characterized by a decentralized governance approach in which local angling clubs rather than umbrella angler associations own or lease fishing rights (Arlinghaus et al. 2002, Arlinghaus 2006). Since about 125 years ago, recreational fishers started to lease or buy fishing rights for local lakes and rivers from water owners such as state authorities or counties (Haase 2000). This historically emergent governance approach continued to exist in West Germany after the Second World War. The duties and rights of resource management, particularly regarding the planning and execution of fish stocking measures and the implementation of specific access and use regulations, e.g., size-based harvest limits, were usually held by angling clubs at the local level as long as they were in line with the minimum standards set by the state-specific fisheries legislation. This can create comparatively expensive and restrictive memberships in angling clubs in areas with high population density where competition for scarce waters held by angling clubs is high. Moreover, angling activity on other waters from neighboring angling clubs requires new membership and angling permits. This small-scale governance approach, which was and is still functional today in West Germany, has advantages because of local monitoring of water bodies and local accountability to fisheries management (Daedlow et al., in press). Any contact or cooperation between East German and West German recreational fisheries managers before 1989 was forbidden by the GDR.

Externally induced disturbance in 1989 and system reorganization

The rapid reunification process that started in 1989 was a heavy disturbance and externally motivated “surprise” for the East German recreational fisheries community that initiated a release phase (Ω) from the K state. A need for a major change in recreational fisheries governance was not originally perceived in the East German angling community and among its managers. In this emerging window of opportunity, discussions about potential improvements to the customary governance approach started on local, regional, and national levels, such as the question whether small angling clubs rather than large associations should become owners or leaseholders of fishing rights similar to West Germany. Some East German recreational fisheries managers and anglers seriously considered implementing this alternative during the α phase after the fall of the Berlin Wall in November 1989.
to replace the more centralized approach to recreational fisheries governance of the GDR. In addition, West German civil servants, who were used to local level fisheries governance, were delegated to support the East German fishery administration and stakeholders in the formulation and implementation of new fishery laws and administrative regulations. With the fast change of the political and economic system, the East German recreational fisheries managers were forced to rapidly adapt to the newly implemented West German Civil Law Code. However, the majority of managers argued against the local governance approach questioning the success of inexperienced angling clubs in East Germany. This suggested a lack of out-group potential and a lack of belief in the skills and experience of local angling clubs to manage fisheries independently of a large umbrella angler association. Furthermore, numerous East German anglers on the local level were highly insecure about future developments, and tended to welcome customary decision making by regional and national managers, suggesting high in-group potential and connectedness. The historical changes and policy decision processes were under enormous time pressure and were perceived as highly challenging for East German recreational fisheries policy makers and managers because of their unknown character. This caused transaction costs in terms of time, money, and learning as evidenced by all contemporary witnesses.

**Persistence of central governance characteristics after 1989**

At a major angler association meeting held in February 1991 in Pätz with representatives from all states in East Germany, the East German recreational fisheries managers decided to maintain the customary central governance approach developed in the former GDR (DAV 2004). This date marked the decision for a policy plan (r) and the legally required adaptations were executed, e.g., the subrogation of fisheries sovereignty from the federal to the state level. Elections were held in clubs and associations to assign managers in charge, and fishing rights were re-leased to the newly founded state angler associations, which replaced the national umbrella association as former management decision maker. In general, East German managers opted against the implementation of the West German governance alternative. In terms of the adaptive cycle heuristic, an option for the West German approach would have meant a system transformation moving fisheries governance into a new configuration. Instead, the similar pattern in structure and function indicates the resilience of recreational fisheries governance in East Germany. However, one can now also find some independently organized angling clubs with their own fishing rights, in particular in southern parts of East Germany. Today, two independent umbrella angler associations exist on the national level in Germany representing the different governance approaches for recreational fisheries between East and West, the DAV in the East and the Association of German Sport Fisheries (VDSF) in the West, with associated members in both parts of Germany. Overall, the East German recreational fisheries governance system exhibited a high degree of institutional persistence (K. Daedlow, V. Beckmann, M. Schlüter, and R. Arlinghaus, unpublished data).

**Content analysis of cover articles**

To test for the sequences of the four phases of an adaptive cycle along with their time frames, we quantitatively evaluated the two dimensions, potential and connectedness, together with the in-group and out-group dimensions by using content analysis of magazine articles published by the East German angler association. The results of the first step of our content analysis, i.e., time series of pooled connectedness and potential statements, did not show any obvious pattern (Fig. 2b). Thus, the time series trends for connectedness and potential did not support the assumptions derived from the adaptive cycle heuristic (Fig. 2a). For example, in the α phase, potential should be high and connectedness low, but this was not visible in the pooled relative frequencies of the potential and connectedness dimensions. When we then looked at connectedness and potential statements separately for the in-group and out-group (Fig. 3), we were able to see one trend over the whole time period: the codes assigned to the connectedness and potential dimensions in the out-group category were decreasing from the Ω to the K2 phase (Fig. 3, top panel), whereas the codes assigned to the connectedness and potential dimensions in the in-group category were increasing (Fig. 3, bottom panel). Although we were able to identify these distinctive trends of increasing in-group and decreasing out-group statements (Fig. 3), we were still unable to completely trace the theoretically
assumed combinations of low and high levels of connectedness and potential as predicted in the adaptive cycle heuristic (Table 2). Aside from the dominance of connectedness over potential statements regardless of the in-group and out-group dimensions, we ascertained three main differences from theoretical assumptions. First, the release phase ($\Omega$) showed both a low degree of connectedness and potential in the social group, which had to face the change (in-group), and a high degree of connectedness and potential toward a social group, which offered an alternative in recreational fisheries governance (out-group). Second, in the reorganization phase ($\alpha$) we saw in both the in-group and out-group dimension a high frequency of connectedness statements, which were inversely related to the prediction of the adaptive cycle heuristic (Table 2). Third, the assumed low frequency of connectedness and potential in the exploitation phase ($r$) could only be affirmed for the out-group category, whereas in the in-group category connectedness and potential were already high. The same pattern occurred in the $K1$ and $K2$ phases (Table 2). In summary, the level of in-group and out-group connectedness and potential varied substantially over time with no obvious pattern clearly demarcating the four phases of an adaptive cycle.

The four phases of an adaptive cycle emerged clearly once we grouped connectedness and potential dimensions together and plotted the trend only with the relative frequencies of in-group and out-group statements from the pooled data (Fig. 4). The first two articles (May and June 1990) contained a high frequency of supporting statements regarding the West German (out-group) governance alternative (Fig. 4). Taking the externally induced disturbance as an opportunity for change, articles in both May and June 1990 pointed to a critical rethinking of the customary central governance approach by the East German anglers’ community in the $\Omega$ phase. A phase of discussion about the two policy alternatives ($\alpha$ phase) started, indicated by marked up and downs of the in-group and out-group statements in the three cover articles from July 1990, December 1990, and February 1991 (Fig. 4). The discussion halted in April 1991 when in-group statements started to dominate all articles. This dominance continued until November 1994 (Fig. 4). In the article from April 1991, the board of the national umbrella association declared the maintenance of the central governance approach at the state and regional level in East German recreational fisheries (Schwandt 1991) after the decision was made at the extraordinary association meeting in February 1991 (start of policy plan phase $r$). Some out-group statements were still expressed until October 1992. Growing self-confidence was represented by high in-group frequencies of connectedness and potential during the $r$ phase (Fig. 4), which stabilized on a high level from December 1992 onward ($K2$ phase). Thereafter, out-group statements almost completely disappeared. This was a clear signal of in-group identity and the perceived superiority of one’s own customary governance approach. In summary, the distinct examination of the in-group and out-group dimensions revealed the strongest patterns in the results regarding the demarcation and development of the different phases of the adaptive cycle in the East German recreational fisheries governance system (Fig. 4).

### The time frames of the four phases synthesized from interviews and cover articles

Our findings from the content analysis of cover articles in conjunction with the narrative of the transition process can be stylized as the four phases of an adaptive cycle of East German recreational fisheries governance after 1989 (Fig. 4, Table 3). The $K1$ phase represented the central governance approach in East Germany, which was implemented from the early 1950s onward and worked sufficiently for 35 years until the start of the transition process in 1989. The beginning of the $\Omega$ phase could be traced to the discontinuation of the publication of the East German anglers’ magazine from October 1989 to April 1990. The public discussion about the future of East German recreational fisheries governance started with the publication of the first magazine issue in May 1990. Accordingly, the $\Omega$ phase of the adaptive cycle was estimated to have taken about nine months from October 1989 to June 1990. The $\alpha$ phase, which started around July 1990, lasted for about eight months. As assumed in the adaptive cycle heuristic, the $\Omega$ and $\alpha$ phases were faster than the others phases of the adaptive cycle. The $r$ phase continued for 1.5 years after the final policy plan was agreed upon in February 1991 and published in April 1991. The policy plan was implemented from December 1992 onward ($K2$). Thus, the full progression of adaptation from the end of the $K1$ phase (October 1989) to the start of the $K2$ (December 1992) lasted about three years.
Table 2. Level of connectedness (C) and potential (P) as predicted by the adaptive cycle heuristic (Holling and Gunderson 2002) and assessed in our case study in total and for the in-group and out-group dimensions for each of the four phases. (+) indicates high level and (-) indicates low level of connectedness and potential.

<table>
<thead>
<tr>
<th>Prediction from the adaptive cycle heuristic</th>
<th>Results from the case study system</th>
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<tbody>
<tr>
<td></td>
<td>total</td>
</tr>
<tr>
<td>C</td>
<td>P</td>
</tr>
<tr>
<td>K</td>
<td>+</td>
</tr>
<tr>
<td>Ω</td>
<td>+</td>
</tr>
<tr>
<td>α</td>
<td>-</td>
</tr>
<tr>
<td>r</td>
<td>-</td>
</tr>
<tr>
<td>K2</td>
<td>+</td>
</tr>
</tbody>
</table>

DISCUSSION

The objective of our study was to demarcate the four phases of an adaptive cycle in the East German recreational governance system after the fall of the Berlin Wall based on measures of connectedness and potential dimensions in historical cover articles (Figs. 2 and 3). We were unable to unambiguously delineate the “figure-eight model” of the adaptive cycle using our quantitative approach to predict the assumed combinations of high or low potential and connectedness dimensions (Table 2). However, we found that time series trends of in-group and out-group statements, not distinguished into separate connectedness and potential dimensions, enabled us to navigate through the four phases of an adaptive cycle on a monthly basis (Fig. 4). The speed of phase shifts was found to confirm with the predictions of the adaptive cycle heuristic (Holling and Gunderson 2002). Our findings from the content analyses were supported by the narrative information about the transition process in East German recreational fisheries governance generated from in-depth interviews with contemporary witnesses (Table 3). A combination of analytical and methodological aspects help to explain this finding, as discussed below.

One reason for our assessed patterns of incongruity to the prediction from the adaptive cycle heuristic using quantitative connectedness and potential indicators alone (Table 2), might reside in the analytical challenge of identifying and unambiguously measuring indicators representing the degree of potential and connectedness in social systems because of their similarity to the overarching concept of social capital (Abel et al. 2006). Indeed, the subcategories we developed to assess the connectedness and potential dimensions (Table 1) by following the definitions by Holling and Gunderson (2002) and Nkhata et al. (2008), appear in the literature as varying conceptualizations of social capital such as relations of trust; reciprocity and exchanges; common rules, norms, and sanctions; and connectedness in networks and groups (Coleman 1988, Pretty 2003). The varying frequency of our assigned statements per subcategory to assess the connectedness and potential dimensions points to the difficulty of unambiguously distinguishing the two dimensions. Although all subcategories of connectedness codes were assigned with similar frequency (except control with only 8 statements), the codes to measure potential were mostly assigned to the subcategories ‘respect’ (52 statements), ‘trust’ (24 statements), and ‘friendship’ (12 statements). ‘Abilities’ (8 statements) and ‘group support’ (3 statements) were only sparsely assigned in the potential dimension. One reason for the low number of codes assigned to the subcategories ‘abilities’ and
Table 3. The phases of the adaptive cycle exemplified by East German recreational fisheries governance over the course of 50 years.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$K_1$</td>
<td>1954 – 1989 (35 years): Policy implementation and conservation of central recreational fisheries governance in the former GDR</td>
</tr>
<tr>
<td>$\Omega$</td>
<td>October 1989 – June 1990 (9 months): Disturbance &amp; policy release of the $K_1$ system</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>July 1990 - April 1991 (8 months): Opportunity of change for a new governance approach in East Germany in the reunification process, discussion of policy alternatives</td>
</tr>
<tr>
<td>$r$</td>
<td>April 1991 - October 1992 (18 months): choice of policy plan (pattern of persistence)</td>
</tr>
<tr>
<td>$K_2$</td>
<td>From December 1992 on: Implementation of the current governance approach in East Germany with high institutional persistence in comparison with the “$K_1$” status</td>
</tr>
</tbody>
</table>

‘group support’ within the potential dimension might lie in the challenge of separating them clearly from the ‘self-conception’ and ‘control’ subcategories of the connectedness dimension. In future studies, we therefore suggest focusing on the character of relationships such as trust, friendship, and respect to assess potential, and on strength of self-conception in organizational matters and meetings of networks and groups to assess connectedness.

Alternative explanations for our findings might be related to the particular characteristics of our case study. A reason for the low explanatory power of connectedness and potential in our analysis might lie in the exceptional situation of an externally induced disturbance to East German recreational fisheries rather than an internally induced motivation of agents of the governance structure to adapt their system. East German managers likely tried to avoid unintended changes in the governance transition process, which might be reflected by the high level of in-group connectedness revealed in our content analysis of cover articles (Table 2). This characteristic was supported by the fact that East German managers exhibited high capabilities for self-organization to deal with the socio-political and legal challenges in the comparatively minor policy field of recreational fisheries governance after the external and surprising “disturbance” of the German reunification. These people were empowered to largely control the reorganization of recreational fisheries governance and the majority of traditionally thinking, politically influential, and vocal East German managers likely impeded supporters of the West German governance alternative. These features might explain the low levels of out-group potential and high levels of in-group connectedness we revealed in the analysis of cover articles (Table 2). The majority of East German fisheries managers seemed to have followed a “controlling strategy” (Holling and Gunderson 2002:52) for dealing with external variability, i.e., resources and knowledge from West Germany, to maintain the customary, centralized Eastern fisheries governance approach. These case characteristics altogether likely increased the clarity of the in-group and out-group dimensions helping to demarcate the four phases of an adaptive governance cycle.

Further limitations of our approach to assess the potential and connectedness dimensions can be traced to the methodology of a quantitative content analysis of newspaper articles. One source of error is the degree of subjectivity that was associated when assigning codes to coding units. We tackled this by using two coders. The average total intercoder reliability of 0.76 was generally high indicating a valid quantification approach (Früh 2007). Another limitation was that the cover articles constituted a single source of information reflecting mainly one perspective, i.e., the one from particular East German recreational fisheries managers in charge of policy decision making who were influential enough to become an author. It is likely that not every opinion was published. As a result of the data availability in monthly published magazines, a single author’s opinion in a given year strongly influenced the time series trends in our study. However, the people expressing their
opinions in the media were surely key players and in charge of implementing adaptations in East German recreational governance after 1989. Thus, their written material may be perceived as a suitable source for analyzing decision making dynamics in the East German recreational fisheries governance system. Furthermore, our coding system did not distinguish between information about the actual process taking place at a particular point in time and the intended strategies of actors influencing and directing the public discussion in a particular direction. We balanced this bias by conducting interviews, but using other written data sources was difficult because of the lack of information and access to historical documents. Other data indicative of the connectedness dimension such as actual number of meetings, network data analysis of key managers, etc., was thus impossible to generate in the face of the loss of most written documents after 20 years. Such data should be collected or stored when a given transition process is actually happening, as it will help to better assess and quantify the connectedness and potential dimensions in various phases of an adaptive cycle after a system’s disturbance.

Facing the above mentioned limitations, the question arises whether an adaptive cycle in the spirit of Holling and Gunderson (2002) actually happened in East German recreational fisheries governance after 1989, because a lack of a cycle would also explain why we were unable to delineate it using connectedness and potential dimensions inferred from our quantitative analysis of cover articles. Based on the information from the interviews and our historical reconstruction of the case, we contend an adaptive cycle did occur in East German recreational fisheries governance in response to the socio-political disturbance caused by the German reunification (Fig. 4, Table 3). However, it is likely that our content analysis captured an underlying adaptive cycle representing shifting communication dynamics between in-group and out-group relations among different preferences of social groups when negotiating policy changes. This may be interpreted as indicative of a nested “communicative adaptive cycle” within an overarching “governance adaptive cycle.” Our data analyses thus may have been less representative of the actual transition and adaptation of the governance system as much as a function of a system’s connectedness and potential dimensions.

The clarity of the in-group and out-group dimensions describing the four phases of adaptation in East German recreational fisheries governance (Fig. 4) emphasizes the importance of intergroup relations for social transition processes and for the understanding of reorganization and decision making prior to the choice of a policy plan. Other studies have also emphasized the essential role of people’s preferences in policy-decision making processes in cases of implementation of new governance structures (Trosper 2003, Olsson et al. 2004, 2008). Our case study is an example for the persistence of customary governance structures based on managers’ preferences after an externally motivated, severe, and rapid system disturbance. Regardless of the outcome of policy decisions in a transition process, i.e., transformation or adaptation of a governance system’s characteristics, the general “importance to identify common social values among players of the new system and to empower key stakeholders to participate in decisions that legitimize relationships and interactions of the new regime” (Chapin et al. 2010:247) is acknowledged in frameworks to study transition processes and system’s transformation or transition (Adger et al. 2002, Anderies et al. 2004, Folke et al. 2005, Lebel et al. 2006, Olsson et al. 2006, 2008, Walker et al. 2006, Janssen et al. 2007, Biggs et al. 2010, Chapin et al. 2010). Our case study in recreational fisheries governance confirms that identity, norms, and tradition of different social groups play a major role in governance adaptation processes.

Finally, in the context of the importance of studying transition processes in social systems where key actors have the opportunity to change or maintain governance structures in natural resource management (Olsson et al. 2008, Chapin et al. 2010), our empirical finding of high levels of connectedness in all four phases of the adaptive cycle of East German recreational fisheries governance (Table 2) is insightful. The high level of internal control (in-group connectedness) that the East German recreational fisheries managers exerted over external variability and alternative options might have constrained the development of shared abilities, trust, mutual respect, or friendship in intergroup relations with the West Germans (out-group potential). Thus, despite our inability to demarcate the four phases of the adaptive cycle based on quantitatively measured connectedness and potential dimensions, it still seems valuable to
distinguish between both dimensions in social systems because it gives insights into the ability of particular social groups to influence the policy decision process for preferred governance approaches (Olsson et al. 2008, Chapin et al. 2010). This idea corresponds with that of Nkhata et al. (2008) who highlighted the importance of both dimensions for analyzing long-term social relationships. Our result of high levels of connectedness in all phases despite disagreement with theoretical predictions of low connectedness levels in $\alpha$ and $r$ phases by Holling and Gunderson (2002) are likely explained by the ability of humans to consciously control the future shape of a SES, which is supposed to be a major difference from entirely self-organized processes in ecological systems (Gunderson et al. 2002, Westley et al. 2002).

CONCLUSION

Difficulties with empirically testing the adaptive cycle heuristic in social systems were stressed by Holling and Gunderson (2002) who emphasized that the very general properties of the adaptive cycle are supposed to help to develop frameworks for assessing adaptation and are rather more of a metaphor to interpret events and their causes than a fully developed theory. Based on our difficulties in assessing the predicted levels of connectedness and potential dimensions using quantitative content analysis, we agree with this perspective. Additionally, our results point to the likely importance of social identity and intergroup dynamics for shaping and understanding reorganization and adaptation processes in social systems where distinct groups of people are debating policy choices. However, it is important to remember that our case study focused on recreational fisheries governance and did not involve ecological change and the interaction of ecology and society. Thus, comparisons with previous studies on adaptive cycles in SES (Peterson 2000, Brunk 2002, Cocks 2003, Seixas and Berkes 2003, Allison and Hobbs 2004, Bohensky 2008, González et al. 2008, Beier et al. 2009) are challenging. Nevertheless, we suggest that in cases similar to ours, conceptual refinements of the adaptive cycle heuristic based on disciplinary social science theories, e.g., social identity theory, may help to better understand transition and transformation in social systems (sensu Abel et al. 2006). Future research is needed in terms of development of indicators of connectedness and potential in social systems and how different or similar these dimensions are to the overarching concept of social capital. Overall, we think that the adaptive cycle heuristic remains useful to describe processes of change in social systems and we recommend other applications to social systems to assess the connectedness and potential dimensions based on other data sources than cover articles, e.g., investigation of actual governance change processes and associated indicator variables instead of focusing on published communication dynamics only.

Responses to this article can be read online at: http://www.ecologyandsociety.org/vol16/iss2/art3/responses/

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Paper IV

Katrin Daedlow, Volker Beckmann and Robert Arlinghaus

Natural Resource Availability and Change of Property Rights Institutions: Insights from German Recreational-Fisheries Governance.

Manuscript
Natural Resource Availability and Change of Property Rights Institutions: Insights from German Recreational-Fisheries Governance

Katrin Daedlow*,1,2, Volker Beckmann2,3, and Robert Arlinghaus1,4

1Department of Biology and Ecology of Fishes, Leibniz-Institute of Freshwater Ecology and Inland Fisheries Berlin, Müggelseedamm 310, D-12561 Berlin, Germany.
2Division of Resource Economics, Department of Agricultural Economics, Humboldt-Universität zu Berlin, Unter den Linden 6, D-10099 Berlin, Germany.
3Law and Economics Faculty and Institute of Botany and Landscape Ecology, Ernst-Moritz-Arndt-University Greifswald, Soldmannstr. 15, D-17487 Greifswald, Germany.
4Chair of Integrative Fisheries Management, Department of Crop and Animal Sciences, Humboldt-Universität zu Berlin, Unter den Linden 6, D-10099 Berlin, Germany.

*Corresponding author: daedlowk@agrar.hu-berlin.de

Abstract
The relationship between natural resource availability and natural resource use regulation lacks understanding. This paper contributes to research on the topic by applying the concept of nature-related transactions, which determines transactions among humans influenced by their activities in natural resource use. Properties of nature-related transactions such as rivalry define the constraints, which need to be institutionalized by governance structures. Crucial for natural resource governance are property rights institutions, which define rights on natural resources for particular rights holders. The study is exemplified by German recreational-fisheries (GRF) governance, which is studied over 40 years in the 20th century. Four selected counties from different areas in Germany are compared. The main data collection methods are in-depth interviews with board members of angling clubs and associations including visits at water bodies. A pattern of change and persistence in property rights institutions and governance structures was identified which revealed that GRF managers rather centrally organize property rights institutions with generous access and withdrawal regulations, prevailed in case of perceived resource abundance. When resources were scarce and rivalry among resource users emerged, governance structures organized property rights institutions
locally with strengthened exclusion and withdrawal regulations. Our findings suggest that nature-related transactions affect (among other factors) decisions on institutional change and persistence and accordingly governance structures are aligned to nature-related transaction properties.

1 Introduction

Over the last decades the importance of natural factor endowments for economic development became increasingly apparent (Sokoloff and Engerman, 2000; Barbier, 2011). Nevertheless, natural factor endowments receive little attention in economic studies (Barbier, 2011). In particular, the relationship between natural resource availability and natural resource use regulations remains poorly understood (Brunnschweiler and Bulte, 2008). Yet natural resource degradation is often resulting in social-economic conflicts (Brunnschweiler and Bulte, 2008). To analyze governance of natural resources, we apply the concept of nature-related transactions (Hagedorn, 2008), which helps to exactly determine nature-related transactions among humans influenced by their activities in natural resource use. For example, when rivalry for fish resources is emerging, the fishing activity is the physical link between humans and nature, and the emerging rivalry, depending on perceived availability of resources, is the property\(^1\) of the transaction between competing resource users. Such rivalry can be institutionalized by the governance system for example by strengthening access rules or by implementing new governance structures, which are more effective in managing such conflicts. Thus, the properties of nature-related transactions define the constraints, which need to be institutionalized by governance structures and they affect the way, how humans mould institutions and accordingly align governance structures (Hagedorn, 2008: 378).

Human use of natural resources is usually regulated by property rights institutions, which define various rights of privileged people or groups of people on natural resources regarded by other people and under the protection of an authority such as the nation state (Bromley, 1991; Vatn, 2005). Differences in property rights institutions affect economic activity (Libecap, 1986). Property rights institutions of natural resource use are coordinated among involved parties. When economic activities between different parties are determined by conflict, mutuality, and order, they are defined as transactions (Commons, 1932: 4). Such transactions inherit costs emerging from negotiation, decision-making, monitoring or enforcement efforts for example. Governance structures, i.e., their agents, are concerned with decision-making about those transactions and their costs (Williamson, 2000). According to the discriminating alignment hypothesis (Williamson, 1996, 2000) certain governance

\(^1\) Other properties of nature-related transactions are for example spatial characteristics and mobility, dimensions of scale and time, coherence and complexity, limited standardisability and calculability, predictability and irreversibility or jointness and absence of separability (Hagedorn, 2008: 366).
structures are performing better with respect to decision-making and conduct of economic transactions and their costs than other governance structures. Depending on specific situations adaptations of governance structures to properties of nature-related transactions are deemed necessary and may actually be undertaken in practice. Accordingly this paper investigates in how far properties of nature-related transactions influence humans to change and maintain property rights institutions. Answers to the research question will be explored by studying German recreational-fisheries\(^2\) (GRF) governance, as it provides the opportunity to compare different governance structures (i.e., in West and East Germany) regulating human transactions related to natural resource use of angling.

There are two major schools in economic theory explaining the choice for particular property rights institutions. One postulates that humans decide following an efficiency maxim and the other argues that humans distribute economic costs and benefits among particular social groups or individuals within a group. The first school needs to be treated with caution, because efficiency is difficult to reach in incomputable natural resource settings used by rationally bounded actors (Wang, 2001). Also, in our study such classical efficiency analysis is not conducted, because we can not compare a particular allocative point with a point inside a different institutional structure in the past, present, or future (Bromley, 1982: 838). Yet, if we leave aside classical economic decision-making and understand efficiency as a situation where negotiating parties find sufficient reason within a set of particular conditions (e.g., available information, property rules, preferences), than a more applied type of “efficiency” may be used.

The focus of this study, however, lies on the second school, which stresses the importance of distributional implications of property rights institutions influenced by the identity and preferences of the bargaining parties (Libecap, 1989). Since property rights institutions imply the allocation of scarce resources among privileged people or groups of people (Anderson and McCchesney, 2003: 4) under protection of a sovereign, the question of who gets how much and why is crucial in economic decision-making on distributional bargaining. Reasons for those bargaining and distribution decisions could be fairness among privileged users (Wang, 2001), prevention of economic, social, cultural or ecological losses (Libecap, 1989), or the decrease of transaction costs and increase of benefits streams for privileged property rights holders (North, 1990; Libecap and Lueck, 2011). In addition, while studying the persistence or change of property rights institutions it needs to be considered that when particular institutions already exist, a change will cause definition and enforcement cost (Libecap and Johnson, 1979). A change of property rights institutions is likely to convert negative rents

\(^2\) Recreational fishing or angling is defined as “fishing of aquatic animals that do not constitute the individual’s primary resource to meet nutritional needs and are not generally sold or otherwise traded on export, domestic or black markets” (FAO, 2012: v). In 2002, there were about 3.3 million German anglers older than 14 years (Arlinghaus, 2006). As in most industrialized countries (Arlinghaus et al., 2002) anglers are currently the dominant users of inland fisheries resources in Germany (Arlinghaus, 2006).
(e.g., low catch rates per angler) into positive rents, when the costs of decision-making, definition and enforcement are lower than the expected rent (e.g., secured or increased catch rates per angler). Against the backdrop of these explanations of institutional change, this study will investigate the influence of properties of nature-related transactions (Hagedorn, 2008) on decision-making about institutional change and persistence in GRF governance.

The remainder of the paper is as follows: The next section provides some background on the development of property rights institutions in East and West German recreational-fisheries governance during the 20th century. In a subsequent methodological section, we discuss conditions of a natural experiment situation as a supportive research strategy in this study, and describe case selection, data collection methods and the operationalization of dependent and independent variables. The fourth section contains the results, which are discussed in the final fifth section.

2 Property Rights Institutions in German Recreational Fisheries

To be able to investigate property rights institutions in German recreational-fisheries (GRF) governance, we apply the concepts of Schlager and Ostrom (1992) who differentiate between the following bundles of property rights institutions: alienation, exclusion, management, withdrawal, and access rights. The owner of a natural resource holds all of those five bundles of property rights; on the next “lower” level a proprietor holds exclusion, management, and withdrawal and access rights; a claimant holds management, and access and withdrawal rights; and a authorized users holds withdrawal and access rights to natural resources. Today in Germany, the ownership of water bodies is connected to the ownership of fishing rights (Mau and Müller, 1998). The owners of water bodies can be both public entities such as the federal state or municipalities, and private entities such as individuals, monasteries or angling clubs. Owners of water bodies have the right to lease all other bundles of property rights to the resource. Very often, owners of water bodies transfer their fishing rights to leaseholders (proprietors or claimants), who have to proof specialized knowledge in fisheries management, as it is required by German fisheries regulation. Today, the main owners or leaseholders of fishing rights in inland water bodies are angling clubs and angler associations in Germany (Arlinghaus et al., 2002) as part of common property regimes, i.e., private property of a group of individuals to fish resources. These groups constitute the governance structure deciding about exclusion, management, withdrawal, and access rights in GRF (Daedlow et al., 2011a). Anglers purchase fishing permits from their clubs or associations and obtain withdrawal and

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3 The form of ownership depends on the status and use of water bodies: large lakes, reservoirs, and rivers of importance, e.g. for water traffic, drinking water production or landscape hydrology are in state ownership whereas smaller and less important water bodies can be also in private or common ownership.

4 A limited number of commercial fishermen still hold fishing rights, but their number is constantly decreasing because of limited viability.
access rights usually for one year. The actual decisions of angling clubs and angler associations are therefore decisive for governance of German inland recreational fisheries.

At present, German fisheries acts and complementing ordinances define general property rules on the constitutional level to fish stocks, i.e. they define who owns fish stocks, has the right or duty to manage fish stocks and is allowed to access and withdraw fish from water bodies (Mau and Müller, 1998; Daedlow et al., 2011a). Complementing ordinances delineate detailed management, access and withdrawal rules for property rights holders. Nevertheless, within these legally defined property rights institutions property rights holders are allowed to set minimum standards of fisheries regulation according their needs in fisheries management.

For example, exclusion rules define membership in clubs and associations and who is allowed to go fishing in water bodies of clubs or associations, withdrawal regulations define how many fish anglers are allowed to catch, and access regulations define at which time and water body angling activities are allowed. Thus, angling clubs and associations govern relationships between anglers through decisions on property rights institutions in natural resource use.

General property rules on constitutional level, the detailed property rights institutions negotiated by governance structures, and the governance structures themselves changed in GRF governance during the 20th century. Recreational fisheries activities emerged from the 1860th on in all parts of Germany (Haase, 2000). Private property, based on constitutional rules of an aristocratic society, was the dominant general property regime in inland fisheries, in this time. Fisheries were under sovereignty of the aristocratic society, e.g. the Prussian kingdom or the church, which dominions were split up all over German territory (DAV, 2004). As owners of water bodies they possessed the full bundles of property rights institutions. The dominant authorized users of fish resources were commercial fishermen (Wolter et al., 2003). Fisheries laws were established in those aristocratic dominions. The Prussian kingdom, for example, developed its own fisheries law in 1874 (Mau and Müller, 1998). It also served as the basis for newly established fisheries acts after the World War II in Germany. Recreational fisheries started when middle class people looked for leisure activities in nature while enhancing the nutritional status of their families (Haase, 2000). United in angling clubs, anglers started to lease withdrawal and access rights from owners of water bodies. Depending on the financial resources of angling club members, purchase of water bodies was possible as well. In those cases, they became owners of the fish stocks and held full bundles of property rights. They also defined access and withdrawal regulations for

\[\text{footnote}5\] Germany of today is a federal state of 16 states, so called “German Länder”. Since fisheries are under sovereignty of the individual states, there are 16 fisheries acts and ordinances in Germany. A federal, i.e. national, fisheries act is not existing.

\[\text{footnote}6\] State and regional fisheries authorities focus on monitoring of management activities of angling clubs and associations, and together they enforce fisheries regulations.

\[\text{footnote}7\] This is only permitted as long as natural fish stocks are not threatened. The importance of habitat conservation and fish stock protection in German fisheries acts and regulations in the context of fish stocking is described in von Siemens et al. (2008).
angling club members who had to pay a membership fee including the permission to withdraw fish from the club’s water bodies. From the early 20th century onwards also working class members were able to afford fishing rights and established angling clubs (Haase, 2000). The emergence of angling clubs represented a new governance structure at the local level besides the still dominating commercial fishing. Over time, the increasing numbers of angling clubs were unified in regional angler associations, which, however, usually did not obtain fishing rights and were not directly involved in governance of fish resources. Thus, they were not agents of the governance structures being able to decide about fisheries management or institutional change therein. At this time, angler associations were generally commissioned to lobby and to provide informational services for their members (DAV, 2004).

From the time of the Weimar Republic, the aristocratic dominions mostly lost property on inland fisheries and fisheries sovereignty was transferred to 24 German Länder as constituting entities of the new national state. In aftermath of World War II the two different social-economic systems of the GDR and the FRG followed different paths in recreational-fisheries governance (Herold, 1998; Mau and Müller, 1998; Daecklow et al., 2011a). In the GDR, private property of water bodies and fisheries was generally banned and a public property rights regime represented by the socialist government was established (Herold, 1998). In addition, several fisheries acts from different regions existing before the end of the World War II were replaced by one fisheries act centrally guiding commercial and recreational-fisheries governance on GDR territory. For recreational fisheries, an umbrella association called “DAV der DDR” (Deutscher Anglerverband der DDR = German angler association of the GDR) was founded and established in 1954. This association was responsible for recreational-fisheries governance, e.g. by defining access and withdrawal rights and conducting fish stocking measures. Lower level organizations such as angling clubs or associations at regional level supported management measures but were generally excluded from decision-making. As a consequence of compulsory expropriation in the GDR, property rights institutions to water bodies became highly contingent on the decision-making of the socialist regime, and legal contracting between private entities at the local level was prohibited. In general, the socialist government provided gratuitous access for angling activities to many inland water bodies. The DAV did often not hold formal fishing rights based on lease contracts with private or state entities according to a civil law. Instead their exclusion and management rights were secured by order of the socialist regime. For example, the DAV exercised very loose access regulations. The number of anglers was not restricted and with the DAV membership fee they obtained access and withdrawal rights to all DAV water bodies on GDR territory, usually valid for one year. At the end of the 1980s the DAV managed 36,000 ha water area and had about 525,000 members (DAV, 2004). In summary,

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8 The Weimar Republic is the time from 1919 to 1933 in Germany where a representative democracy was established to replace the previous imperial form of government, i.e. the aristocratic society.
East German recreational fisheries developed a centralized governance system on GDR territory and it existed in this form until the German reunification in 1990.

The FRG implemented a constitutional democracy based on a civil law as a federal republic consisting of ten newly established states (German Länder) as governmental units on supra-regional level. Inland fisheries’ sovereignty was held by a state. Instead of a single federal act ten different fisheries act were established in West Germany (Mau and Müller, 1998). Similarly, recreational-fisheries associations were implemented at state or regional level representing anglers’ interests in the political arenas. Private property to water bodies was still allowed and angling clubs continued recreational-fisheries governance as in previous times. Self-organized angling clubs could either act as owner of water bodies or as leaseholders of fishing rights (Daedlow et al., 2011a). Thus, the FGR is still dominated by a local governance structure, where angling clubs manage a limited number of water bodies in the close proximity. However, exceptions exist. For example a few angler associations obtained fishing rights to larger water bodies in recent decades. Popularity of recreational fishing increased from the 1960th until today while at the same time commercial fishing was decreasing and is no longer dominant in Germany (Arlinghaus et al., 2002).

The German reunification in 1990 did not affect West German local recreational-fisheries governance but the East German centralized governance structure was disputed and a potential transformation of the centralized governance into a localized approach was discussed (Daedlow et al., 2011b). Outcomes of this reorganization in East Germany were different for the angler associations and angling clubs. The governance structure in general had to adapt to the constitutional property rules of the West German civil society. For example, fisheries sovereignty was transferred from GDR territory to state level in the newly established six new East German states. Accordingly six fisheries acts were implemented with complementary ordinances. The umbrella association DAV was excluded from recreational-fisheries governance and angler associations at the state or regional levels became property right holders. Private property was permitted again and angler associations had to clarify old contracts and to establish new contracts for fishing rights according to the new civil law. With exceptions in South-East Germany, today mainly state and regional angler associations obtain alienation and management rights in East Germany and decide about property rights institutions in recreational fisheries. Angling clubs support their management activities, but are excluded from decision-making.

The historical development resulted in two main patterns in present GRF governance. In East Germany the leaseholder of fishing rights are mainly angler associations at the regional or states levels centrally regulating fisheries management at many water bodies. In West Germany, the angling clubs at the local level mainly lease fishing rights to a small number of water bodies in proximity. Their umbrella associations on higher organizational level are generally not involved in management decision making of angling club boards. However, in
both systems today the organization of common property rights regimes rests with angling clubs and angler associations (Daedlow et al., 2011a) monitored by fisheries authorities.

3 Analytical Strategy, Case Selection, and Data Collection

This section first discusses the natural experiment approach as a supportive research strategy in this study. Second, it describes the case selection according to the selection parameters of governance structure and geographic location, the data collection methods, and the analytical procedures.

3.1 Natural Experiment

The different development of governance systems in German recreational fisheries can be seen as an “as if” natural experiment (Dunning, 2008). Natural experiments have their roots in experimental approaches. Randomized controlled experiments can be characterized by “first, the response of experimental subjects to a ‘treatment’ (...) is compared to the response of other subjects to a ‘control’ regime, often defined as the absence of a treatment. Second, the assignment of subjects to treatment and control groups is done random. Third, the application or manipulation of the treatment is under the control of the experimental researcher” (Dunning, 2008: 282, based on Freedman et al., 1997: 4-8). A natural experiment differs from this definition in the following way. Since natural experiments are not under the control of a researcher, they are in fact observational studies, and the data used come from naturally occurring phenomena (Dunning, 2008: 282-283). However, in contrast to non-experimental approaches, one can claim that observational studies with a defined treatment and control condition are “as if” random (Dunning, 2008: 283) because “outcomes are compared across treatment and control groups, and both a priori reasoning and empirical evidence are used to validate the assertion of the randomization” (Dunning, 2008: 283). The assignment to treatment or control conditions is effected by the instrumental variable, which not under the control of the experimental researcher and thus, constitutes the defining feature of an “as if” natural experiment (Dunning, 2008: 283).

In this study the fundamental changes in constitutional property rules on East German territory constitute the instrumental variable of the natural experiment. The first change happened in 1954, when the GDR established a centralized governance system of recreational fisheries based on public property, in which angling clubs must not independently and directly govern local fisheries as it was tradition in all German territory before 1954. The second change happened in 1990, when this legal prohibition was lifted and the new civil laws permitted local angling clubs again to obtain full property rights to recreational fisheries. Thus, the governance structure in East German recreational fisheries was “treated” two times by these fundamental changes in constitutional property rules, whereas West German
recreational-fisheries governance did not receive such “treatments” and constitutes the “control” group.

Natural experimental designs are increasingly applied in economics as parts of comparative approaches (Angrist and Pischke, 2010; Imbens and Wooldridge, 2009; Libecap and Lueck, 2011). Qualitative research in combination with natural experiments facilitates theoretical inferences explaining human behaviour such as it is recommended for political sciences (Dunning, 2008). In addition, comparisons of cases over time stress linkages between past and now and are seen as important to understand economic performance from a historical perspective (North, 1994; Nunn, 2009; Barbier, 2011). But such historical case comparisons imply methodological issues, as for example the instrumental variable defining the treatment should affect the outcome under investigation as slightly as possible. Given the intertwined complexity of social and natural components in the real world the separation of treatments from cases is an almost impossible task. However, requirement ways to overcome such concerns at least in parts is providing detailed definitions of the instrumental, dependent and independent variables of the study while discussing their differences and potential interactions. It would strengthen the inferential validity of research.

3.2 Case Selection

To be able to compare reasons for changing property rights institutions under varying conditions we selected four areas of analysis at the county level according to two parameters (Figure 1). The first parameter is the difference in the governance structure in East and West Germany and representing the “treatment” and “control” group in the historical development of GRF governance. The second parameter reflects different geographical parts in Germany, namely the North German lowlands and Central German uplands with distinct water and fish resource properties such as types and abundance of water bodies, fish community structure with variation in pilot fish species, and distance to coastal waters. Central German uplands have mostly tributary river systems, small ponds and larger reservoirs, whereas North German lowlands are characterized by large flatland river basins, canal systems, natural lake systems and proximity to the Baltic and North Sea. This way we select counties, which vary in governance structures and fisheries resource characteristics, and therefore have a basis to compare change and persistence in property rights institutions in different contexts.
Four counties were chosen as study areas (Figure 1). In a first step, particular states in Germany were identified according to the two selection parameters. The states Brandenburg (East Germany) and Lower Saxony (West Germany) were selected from the North German lowlands. Saxony (East Germany) and Bavaria (West Germany) were selected from the Central German uplands. Brandenburg and Saxony, located in East Germany, are

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9 Source: accessed via Wikimedia commons: Permission is granted to copy, distribute and/or modify this map under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; Modified as follows by the authors: The black line mirrors the former border between the GDR (East Germany) and the FRG (West Germany) before the reunification in 1990. The different governance structure in both parts of Germany represents one case selection parameter next to the second parameter of the geographical territory (North German lowlands and Central German uplands). Black and write fonts for cases are chosen for illustrative purpose depending on the background color.

10 The other East German states were sorted out in the selection process because: a) the northern state Mecklenburg-Western Pomerania kept a central governance approach but resigned the East German umbrella anglers association, b) Berlin (East and West) are cities and difficult to compare with area states, and c) in the southern states Saxony-Anhalt and Thuringia the central governance approach dissolved to a large degree after the reunification and a number of local angling clubs took over fishing and management rights.
characterized by a centralized governance structure overseen by regional and state angler associations, and Lower Saxony and Bavaria, located in West Germany, represent a decentralized governance structure of local angling clubs. In a second step, a single county in each of the four identified states was selected. The counties chosen from the two states in the same geographical area are located at the state border, i.e. they share the same border (Figure 1). This was to cater for similar resource characteristics at the local level. The county “Prignitz” in the East German state Brandenburg shares a border with the county “Lüchow-Dannenberg” in the West German state Lower Saxony and both are located in the North German lowlands. The two other counties are “Hof” in the West German state Bavaria and “Vogtland” in East German state Saxony, which share state borders in the Central German uplands.

An advantage of case selection on traditional administrative and general geographical confines is independent determination of the two dominant governance structures in East and West Germany at the local level. The organization and interactions of individuals at the local level are unknown and the particular method of implementation of management measures is assumed to be random. The approach prevents case selection biases due to certain local governance structures and management instruments at the local or regional levels and enables the discovery of additional not yet anticipated governance problems or property rights changes along the course of the investigation.

3.3 Data Collection Methods (Interviews, Local Visits, Survey)

Data is sourced from angling clubs in the four selected counties and their higher-level angler association. The main data collection methods are in-depth interviews with board members of angling clubs and associations including visits at water bodies. Additional data comes from standardized questionnaires, which were answered by angling club representatives from the four counties (Table 1). The data from each interview and the survey are related to a particular angling club. Information on the angling clubs is aggregated at the level of the respective county as it is the area of analysis of this study. Thus, there are four areas of analysis in this study.

In-depth interviews were chosen in order to receive comprehensive information about recreational-fisheries governance in general and about decision-making about property rights institutions within angling clubs in particular. Of major interest was also, whether there were any changes in property rights institutions and if yes, when and why they occurred. In each county nine to ten interviews with angling club board managers, including personal visits to club and association water bodies were conducted. The number of angling clubs varies notably between East and West German counties (Table 1). All interviewed clubs are members of the regional or state angler association., which provided the contact information to the angling clubs in the county. From the complete list of angling clubs in each county ten
angling clubs were randomly chosen. In both West German counties only nine out of all angling clubs agreed to be interviewed. In addition, in each county one to four interviews were conducted with managers or board members of the regional or state angler association (Table 1). The scope of qualitative information varies among the four counties. There are angling clubs in all counties, which are not members of the regional or state angler associations but their number is small as reported by angling club representatives in the counties. In each of the two North-German counties one commercial fisherman exists who owns private property rights to very large water bodies and sells fishing permits to anglers. Both, non-member angling clubs and commercial fishermen were excluded from the study because of the different property rights regimes of commercial fisheries and the difficulty to identify angling clubs, which are not members of the regional association.

The interviews were conducted in two time periods from March to July 2008 and from February to March 2009. They lasted between one to four hours and covered questions about ownership and property rights institutions (i.e. exclusion, management, withdrawal, and access regulations) (Table 2). In addition, interviewees were asked to report on fish stocking measures, the management decision-process, the state of the fish resources, and on potential problems and conflicts among anglers or with other resource users. With respect to the fish resources, information was collected about the type of water bodies (e.g. flowing or standing water bodies), on fish stock quantity and quality from the perspective of the interviewees, and their preferred angling activities. Throughout we targeted information about changes in property rights institutions in the past, and if yes, why those changes occurred, and how the changes were conducted.

As a complement standardized questionnaires on recreational-fisheries governance at local levels were distributed by post among all angling clubs representatives in the four counties. Representatives were reminded twice to answer the survey, which helped to increase the response rate (Table 1). On twelve pages, angling club representatives were asked to report their views on various topics in recreational-fisheries governance by responding to 5-point Likert scales items specifying their level of agreement and disagreement, satisfaction or dissatisfaction, importance or non-importance. Of relevance for this study were the following ten items: a) satisfaction with fish stocking, access, and withdrawal regulations in their region, b) observations of resource scarcity or conflicts about fish stocking, c) reasons for conducting fish stocking, access, and withdrawal regulations, and d) judging whether local or higher level governance is more suitable for recreational-fisheries. For statistical analysis these items were summarized in a problem and a management dimension (Tables 5, 6).
<table>
<thead>
<tr>
<th>Geographical area</th>
<th>West Germany (control group)</th>
<th>East Germany (treatment group)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>County 1</td>
<td>County 2</td>
</tr>
<tr>
<td></td>
<td>North-West</td>
<td>South-West</td>
</tr>
<tr>
<td>Name of the selected state&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Lower Saxony</td>
<td>Bavaria</td>
</tr>
<tr>
<td>Name of the selected county</td>
<td>Lüchow-Dannenberg</td>
<td>Hof</td>
</tr>
<tr>
<td>Water area in % of land area: county/state&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.5/2.4</td>
<td>1.0/2.0</td>
</tr>
<tr>
<td>Inhabitants per km² county/state</td>
<td>40/166</td>
<td>112/179</td>
</tr>
<tr>
<td>General recreational-fisheries governance approach in the state</td>
<td>local</td>
<td>local</td>
</tr>
<tr>
<td>State/regional association has fisheries rights</td>
<td>No&lt;sup&gt;c,d&lt;/sup&gt;</td>
<td>No</td>
</tr>
<tr>
<td>No. of clubs/anglers in the state&lt;sup&gt;f&lt;/sup&gt;</td>
<td>452/145.000</td>
<td>800/130.000</td>
</tr>
<tr>
<td>No. of association representatives interviewed</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>No. of clubs in the county&lt;sup&gt;f&lt;/sup&gt;</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>No. of clubs interviewed &amp; visited/coverage in %</td>
<td>9/64</td>
<td>9/82</td>
</tr>
<tr>
<td>No. of questionnaires returned/response rate in %</td>
<td>10/71</td>
<td>9/82</td>
</tr>
</tbody>
</table>

Note: <sup>a</sup>=State is a part of the German Federal State which consists altogether of 16 states (so called German Länder); <sup>b</sup>=average water area Germany is 2.4 percent; <sup>c</sup>=there are two independent angler associations in this state; <sup>d</sup>=exception: one association has fishing rights to three large lakes (together 4275 ha) and two stretches at the river Elbe (together 137 km); <sup>e</sup>=there are four independent angler associations in this state; <sup>f</sup>=only angling clubs and anglers who are association members, independent angling clubs are not considered in the study; No.=number, %=percentage
3.4 Analytical Procedures

The dependent variable is the change or persistence of property rights institutions (alienation, exclusion, management, withdrawal, access) over time in each of the four counties selected. It is further specified in the detailed arrangement of exclusion and withdrawal regulations (Table 2), which can be summarized as centralized or decentralized governance structures managing recreational fisheries at local or higher level. Data representing the dependent variable were generated from the interviews with the angling club board members. The reasons explaining change or persistence of property rights institutions are the independent variables and were extracted from the interviews as well. Dominant motives of property rights holders to change property rights institutions were detected from the interviews (Table 3). Those reasons for change or persistence constitute the cluster of independent variables, among, which we particularly looked for the connection of resource characteristics, such as availability of fish resources, with properties of nature-related transactions among anglers, such as rivalry. In addition data on parameters such as water body type (standing, flowing) or size (hectare, kilometers) were collected.

Data from the survey was included in the analysis of the qualitative data from the interviews (Tables 5, 6). A higher number of angling club representatives was able to express their attitudes about recreational-fisheries governance and management measures, in particular in the two East German counties (Table 1). These data are descriptively analysed and include the assessment of numbers of respondents (n) and mean per item and county (Table 5). In addition, the Shapiro-Wilk test was used because of its high power for small n to test normal distribution at item and county (Table 5). P-values higher than the value 0.05 indicate normal distribution. Variances between each pair of the four counties were compared according to the selected items from the questionnaire (Table 6). Because the four counties represent non-repeated independent samples and the selected items are measured on ordinal scale and many of them are not normally distributed, we use a non-parametric test to check for significant variances between the counties. The Mann-Whitney U-test was applied as a two sample non-parametric test to compare the medians of two groups. It is rather insensitive to small samples and to different samples sizes among the groups compared. P-values lower than 0.05 indicate significant differences in medians between two groups and that variances are too different to be from the same population.

In this study the dependent and independent variables are not linked to the instrumental variable of changing constitutional property rules in recreational fisheries on East German territory between 1954 and 1990, which defines the natural experiment setting. In addition, the case selection parameters (different governance structure and geographical area) of this study are not connected to the dependent and independent variables and therefore are not affecting the results. The analytical conception of this study enables us to derive the results in
two analytical steps: first the evaluation of the empirical data distinguished in dependent and independent variables in each of the four counties and, second, the a priori comparison of the outcome of the empirical evaluation across the four selected counties representing “treatment” and “control” groups over time (Dunning, 2008: 283).

4 Results

The fisheries in the counties are average not exceptional in a sense that they would be extraordinary attractive for many or particular types of anglers. The four selected counties show typical differences between North and South Germany. (Table 1) Notably the population density of inhabitants is higher and the proportion of water area measured by land area in South Germany is lower than in North Germany. The analysis of the four counties revealed a particular pattern of change and persistence of property rights institutions as described in the first four sub-sections. Changes occurred in county one (North-West) and county four (South-East), whereas in the other two counties persistence in property rights institutions was discovered. The last sub-section summarizes the results from the four counties, including findings from the survey.

4.1 County 1: Up-Scaling to Regional River Governance (North-West)

The North-West county is part of the control group. The majority of the nine angling clubs investigated are owners or leaseholders of fishing rights and provide access and withdrawal rights for their members, i.e. their affiliated anglers (Table 2). Only one angling club did not have any alienation, exclusion, and management rights to water bodies. This club buys withdrawal and access rights via angling permits from other angling clubs in the county. The number of leased standing water bodies by the nine angling clubs range between two to 13 standing water bodies per angling club (altogether 27). Four angling clubs leased fishing rights to spots at one of the two largest rivers in the region: the regional river Jeetzel and the national river Elbe. The withdrawal regulations consist of closed seasons and size limits. They are generally not strengthened, i.e., higher as the standards in fisheries acts and ordinances, and the standards of legal requirements are assumed by angling clubs. However, for almost all water bodies daily bag limits were set, e.g. to ensure an equal distribution of fish stock resources among authorized anglers as explained by angling club board members. Annual bag limits were only established for standing water bodies, not for the rivers Jeetzel and Elbe. Access to the fisheries by anglers is not restricted as long as anglers are qualified to go fishing.\textsuperscript{11}

\textsuperscript{11} Before permits are issued to anglers, in most German states they have to pass an examination about their knowledge in ichthyology, aquatic ecology, legislative matters, fish handling and killing processes in line with fish welfare principles.
A change in the governance structure took place. The angling clubs with fishing rights at the river Jeetzel decided in 1959 to establish a cooperative to commonly manage and use the fish stocks in this river. Seven out of the 14 angling clubs in the county have fishing rights on different stretches along the river Jeetzel (four of them were included and interviewed in this study), which together cover about 25 miles (40 km) fishing grounds. Since then they commonly decide on exclusion and management such as fish stocking measures in the river. Fishing permits sold to anglers are valid for all river stretches pooled by the individual angling clubs. The cooperative did not strengthen catch or size limits. Also, the number of fishing permits is neither restricted for angling club members nor for guests anglers. The reasons for the change in the property rights institutions were mainly to reduce management costs, e.g. buying one permit instead of seven for the river Jeetzel and to enhance fishing opportunities for local anglers (Table 3).

4.2 County 2: Persistence of Local Governance (South-West)

The South-West county is part of the control group. Like in the north-western county, the local angling clubs are owners or leaseholder of fishing rights and provide access and withdrawal rights for their members (Table 2) to angling club water bodies. Angling club’s water bodies in this county are mainly numerous ponds between 0.5 and two hectare size, two large water reservoirs (62 and 110 ha), and several mountain streams, which mainly contribute to the river Saale, the main regional river. All clubs hold fishing rights on several ponds in their local setting. Seven of these angling clubs also manage individual stretches on rivers, four of them at the river Saale. Daily and annual bag limits are established for standing and flowing water bodies. But state fisheries authorities restrict the number of permits depending on size and nutrient status of water bodies. Thus, angling clubs are not allowed to sell more permits than a certain number defined by state fisheries authorities. We did not find any changes in traditional fisheries governance by angling clubs from the beginning of recreational fisheries at the end of 19th century. Angling clubs with fishing rights at the river Saale, which cover similar scales like the river Jeetzel in the North-West county, still separately stock their river stretches\textsuperscript{12} and sell fishing permits only for their own water bodies. When one angling club representative was told the example of the river Jeetzel cooperative in the North-West county, he replied that it would be not possible in their region because clubs do not want to share power and influence in decision-making about their fisheries management.

\textsuperscript{12} Angling clubs usually stock non-migrating species at river stretches to ensure that they exclusively benefit from their investment in the resource.
Table 2: Evaluation of Interviews: Resources and Property Rights Institutions per County

<table>
<thead>
<tr>
<th></th>
<th>West Germany (control group)</th>
<th>East Germany (treatment group)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>County 1 North-West</td>
<td>County 3 North-East</td>
</tr>
<tr>
<td></td>
<td>County 2 South-West</td>
<td>County 4 South-East</td>
</tr>
<tr>
<td>Data base</td>
<td>9 clubs</td>
<td>Association</td>
</tr>
<tr>
<td>Total no. of members/average no. per club</td>
<td>843/94</td>
<td>1221/136</td>
</tr>
<tr>
<td></td>
<td>2606/53</td>
<td>1600/67</td>
</tr>
<tr>
<td>Average costs of membership including full angling permit in €</td>
<td>53</td>
<td>76.9</td>
</tr>
<tr>
<td></td>
<td>151.67</td>
<td>193.5</td>
</tr>
<tr>
<td>Average costs of annual permit in €</td>
<td>48</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>98</td>
<td>160</td>
</tr>
<tr>
<td>Club governance</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>… of ponds</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>… of rivers</td>
<td>No since 1959</td>
<td>Yes</td>
</tr>
<tr>
<td>Exclusion &amp; management rights:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water bodies in total no.</td>
<td>31(11)</td>
<td>52(11)</td>
</tr>
<tr>
<td>Standing waters in ha</td>
<td>98.94</td>
<td>409.74</td>
</tr>
<tr>
<td>Average no. of anglers per ha</td>
<td>8.52</td>
<td>6.36</td>
</tr>
<tr>
<td>Stretches on flowing waters in km</td>
<td>137.30</td>
<td>148.00</td>
</tr>
<tr>
<td>Average no. of anglers per km</td>
<td>6.14</td>
<td>19.51</td>
</tr>
<tr>
<td>Withdrawal regulations:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily bag limits for game fish</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Annual bag limits for game fish</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Access regulations:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restriction of permits depending on water area by fisheries authorities</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>No. of permits limited</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: own data from interviews and visits in 2008/2009 (values rounded);
Note: ¹=for county 4 we separate 6 clubs with own fishing and management rights at local ponds, these clubs are also members of the regional angler association and buy permits for association waters; ²=not all angling club members buy angling permits, proportion of those members vary among clubs; ³=water bodies include standing water bodies and stretches at flowing water bodies, no. of flowing water bodies are given in brackets; ⁴=not existing in clubs interview, but interviewees reported about independent angling clubs, i.e. not members of the regional angler association, managing stretches of rivers in the region; ⁵=among these standing water bodies are two reservoirs with one 62 ha and the other 110 ha water area, each managed by a local angling club; ⁶=only for standing water bodies, not for flowing water bodies; ⁷=except salmonid species, which are rare in the North German lowlands; no.=number, ha=hectare
Table 3: Evaluation of Interviews: Reasons for Changes in Property Rights Institutions – Counties 2 and 4

<table>
<thead>
<tr>
<th>County 1: North-West</th>
<th>County 4: South-East</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Club</strong></td>
<td><strong>Club</strong></td>
</tr>
<tr>
<td><strong>Reasons for the foundation of a cooperative for the river Jeetzel</strong></td>
<td><strong>Reasons to lease fishing rights at local ponds</strong></td>
</tr>
<tr>
<td>1 d</td>
<td>1</td>
</tr>
<tr>
<td>• Want to provide common access for all regional anglers to this large resource, provides better angling opportunity for small angling clubs</td>
<td>• Catch rates too low in association’s water bodies &amp; unsatisfactory fish stocking by the regional angling association &gt; at their own pond they secure catches for everybody</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>• Founding member: little opportunity to go angling in close proximity except at their stretch of the river, this was a reason to start common use and management of the river</td>
<td>• Too low catch rates in associations water bodies after the reunification in 1990 &gt; unsatisfactory fish stocking of the angling association</td>
</tr>
<tr>
<td>• Cooperation increases power and financial resources</td>
<td>• Increase of catch rates especially for young anglers &gt; fish stocking conducted by angling clubs</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>• Little opportunity to go angling in the close proximity except at their stretch of the river &gt; becoming a member of the cooperative</td>
<td>• Want to realize own ideas of management separately, e.g. stocking of larger fish</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>• Observing borders between leased stretches of different angling clubs was difficult</td>
<td>• Habitat of small local water bodies requires close management by angling clubs</td>
</tr>
<tr>
<td>• Do not see good reason to use the river separately, i.e. each angling club at their own stretch</td>
<td>• Dissatisfaction with access &amp; withdrawal regulations of association’s water bodies (too open: everybody can become a member)</td>
</tr>
<tr>
<td>• Cooperation enhances activities such as habitat management</td>
<td>• Low satisfaction with fish stocking in association’s water bodies</td>
</tr>
<tr>
<td>• Lease contracts easier to negotiate with water owners about</td>
<td>• Retreat for their club members &gt; undisturbed by nature protection and animal welfare groups, no cormorant</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>• Own fish stocking measures secures catches for club members</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>• Wanted to realize own ideas of management, e.g. stocking of more fish at their own pond secures catches for club members</td>
</tr>
</tbody>
</table>

Source: own data from interviews and visits in 2008/2009;
Note: a=order of reasons do not mirror the importance of the reason for decision-making of angling clubs, reasons are listed in order of appearance in the interviews; b=among the nine clubs interviewed were 4 clubs members of the Jeetzel river cooperative; c=among the ten clubs interviewed were 6 clubs with fishing rights on own local ponds; d=board chairman of this club is also board chairman of the Jeetzel river cooperative, this club is leaseholder of the longest stretch on the river
4.3 County 3: Persistence of Central Governance (North-East)

The North-East county is part of the treatment group, which had centralized governance during the time of the GDR. The state angler association is one of the largest in East Germany. As fishing rights owner and leaseholder it is responsible for all management measures in the association’s water bodies (about 50,000 hectare all over the state) such as fish stocking and access and withdrawal regulations (Table 1). The state association is subdivided into regional associations at county level, which support management activities closer to the local level and keep contact to the local angling clubs. Both county associations and angling clubs are not directly involved in decision-making. Anglers as members of the association are authorized to go fishing at all association’s water bodies in the state. In the selected county there are 49 angling clubs, which are members of the state angler association\textsuperscript{13}. The association manages 12 stretches on flowing water bodies, among them the river Elbe, and 40 standing water bodies in the county. Except for salmonid species there are daily but not annual bag limits and restriction on the number of permits or angling club members are not established (Table 2). Satisfaction with quantity and quality of catches was generally great among anglers. We did not find changes in the governance structure although it is legally permitted for angling clubs to lease their own fishing rights since 1990. The interview with the association manager revealed that a bylaw of the association declares that angling clubs, which lease exclusive fishing rights at own water bodies are expelled from the association. Only when they open those water bodies to all association members it might be tolerated, but not appreciated. However, there is no such as case in this state and the interviewees from the angling club boards stressed that they do not see a reason to become fishing rights holders themselves. This would cause unnecessary competition for fishing rights together with an increase in lease costs and potential disagreements in management decision-making processes among many angling clubs. Furthermore, an exclusive angling club pond would contradict with the association management objective to provide cheap, open and equal access for all anglers to all water bodies in their sphere of influence. This objective is inherited from recreational-fisheries governance in the former GDR, which intended to ensure that as much people as possible could equally benefit from freshwater resources. Born and raised in the former GDR, many of the interviewed angling club representatives showed a high identification with those management objectives.

\textsuperscript{13} In this county, there are also three independent self-organized angling clubs with exclusive waters, i.e. each of them manages one pond. But they were established after 1990 and were never members of the state angler association.
4.4 County 4: Down-Scaling to Local Pond Governance (South-East)

The South-East county is part of the treatment group. The regional angler association holds fishing rights to 16 water bodies (reservoirs, ponds, mountain streams) in this county and in total to 140 water bodies in the south-western region of the state Saxony. The association regulates access of anglers, size and bag limits, and fish stocking measures. The number of fishing permits, which regulate access to the resources, is not restricted but daily bag limits are established. The county has the highest average costs for angling permits and number of anglers per water area (Table 2). In contrast to the North-East county a change in the governance structure occurred after the reunification in 1990, i.e. here angling clubs started to lease their own fishing rights at local water bodies. Additionally to their membership in the associations, six out of the ten angling clubs visited were also lease-holder of fishing rights at exclusive angling ponds in the proximity where only angling club members are allowed to go fishing. Those exclusive water bodies are not under the governance of the angler association and are only governed by the angling club. Also, angling clubs conduct fish stocking at those water bodies individually. Their management includes very detailed access and use regulations for the angling club members. For example, they introduced daily and annual bag limits and occasionally established time slots for anglers to access a club’s water bodies. The bag limits per angling club member and year are exactly defined according to the stocking rates of the previous year. The new Saxon fisheries act in 1990 on states level permitted private people (individuals and groups) with an educational degree in fisheries management (fishery license) to lease fishing rights from water owners or to by water and fishing rights. Reasons for angling clubs to lease their fishing rights were little catches in association’s water bodies and low quantity of fish stocking measures at association’s water bodies (Table 3). Accordingly to the interviewees this was better co-ordinated in GDR times. Thus, the leasing of an exclusive pond aims mainly to ensure satisfaction of local angling club members with catch success.

After 1990 angling clubs started to openly compete with the regional angler association for fishing rights on ponds and rivers. The larger the water bodies of interest the stronger the conflict. Angling clubs, which maintained their competitive bids, were excluded from the association. The exact number of independent angling clubs is unknown, but there are several existing on flowing water bodies in the region. However, to alleviate a potential major decline of angling club memberships in the regional angler association, the association established a non-written compromise: the association accepts that angling clubs establish exclusive fishing rights to small ponds, whereas the association mainly leases fishing rights to larger standing water bodies and flowing water bodies. However, also before 1990, when the centralized governance approach existed on GDR territory and anglers from all places in the GDR were allowed to go fishing in this region, local angling clubs found non-official ways to expel non-
local anglers. According to two interviewees from East German angler associations, angling clubs in South-Eastern part of the GDR, which were authorized to control anglers for rule compliance, e.g. validity of permits, angling tackle, or caught fish, intensified the examination of unknown non-local anglers. They did not stop until they found a reason to expel an angler from their local water bodies. By using this informal strategy they made sure that fish stocks in local water bodies were mainly exploited by familiar and local anglers.

4.5 Summary and Complementary Information from the Survey

Comparing the results from the four counties, an obvious pattern among the North and South German counties emerges (Table 4). Angling clubs in the North German lowlands a) established independently a centralized governance on flowing water bodies (county 1), and b) kept centralized governance of standing and flowing water bodies after the reunification (county 3). In turn, angling clubs in the South German uplands a) kept the traditional local governance of standing and flowing water bodies (county 2), and b) re-established local governance at standing water bodies after the reunification (county 4). The change in the South-East county (county 4) was a reaction to perceived overfishing (low catch rates) and rivalry between all anglers at the association’s water bodies. To secure benefit streams from fish resources, angling clubs started to lease their own fishing rights with strong exclusion regulations for ponds, which are easy to monitor and in close proximity of the angling club’s home town. Similar to the other Southern county in West Germany (county 2), they gained full control of rivalry between angling club members by establishing annual bag limits and restricting the number of permits to their water bodies. In both counties (counties 2 and 4), angling club board members stressed the importance of fish stocking measures to secure catch rates at water bodies. In contrast, the North-West county (county 1) wanted to facilitate management and fishing activities by lowering the costs of a decentralized permit systems and fish stocking measures while at the same time increasing the benefits for anglers by easier access to larger fishing grounds. Fish stocks were perceived as rather abundant and anglers were generally satisfied with catch rates as reported by the angling club board members in this county. Thus, the common governance of the regional river increased the benefit streams for all angling clubs and their members. It seems that the perceived scarcity of fish resources encourages decentralized governance by local angling clubs, whereas the perceived abundance of fish stocks encourages centralized governance (Table 4).

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14 This estimation is similar to the other Northern case in East Germany (case 3). Here, angling club board members also stressed the good fishing opportunities in a water rich region including the national river Elbe.
### Table 4: Summary of Change and Persistence in Property Rights Institutions and Governance Structures in the Four Counties

<table>
<thead>
<tr>
<th></th>
<th>West Germany (control group)</th>
<th>East Germany (treatment group)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local governance</td>
<td>Regional/state governance</td>
</tr>
<tr>
<td>North German lowlands</td>
<td>North-West County</td>
<td>North-East County</td>
</tr>
<tr>
<td></td>
<td>• Up-scaling to regional river governance</td>
<td>• Persistence of pond and river governance at state level</td>
</tr>
<tr>
<td></td>
<td>• Persistence of pond governance at local level</td>
<td></td>
</tr>
<tr>
<td>Central German uplands</td>
<td>South-West County</td>
<td>South-East County</td>
</tr>
<tr>
<td></td>
<td>• Persistence of pond and river governance at local level</td>
<td>• Down-scaling to local pond governance</td>
</tr>
<tr>
<td></td>
<td>• Persistence of river governance at regional level</td>
<td>• Persistence of river governance at regional level</td>
</tr>
</tbody>
</table>

Source: own graphic
The findings from the interviews are supported by the survey. The angling club representatives from the South-East county (county 4) showed on average the lowest satisfaction with fish stocking and access regulations in comparison to the other counties (Table 5). They also agreed highest on average that there are conflicts in fish stocking and a decrease in fish resources because of intensive angling. In contrast, the angling club representatives from the North-West county (county 1) showed the lowest agreement on those conflicts while at the same time confirm the highest satisfaction with fish stocking (item 1) from all groups (Table 5). They also rather disagree with reasons for stocking, and access and withdrawals regulations, which involve catch compensation, exclusion of non-members, and guaranty of similar catches for anglers. In turn, the angling club representatives from the South-East county (county 4) tend highly agree that fish stocking is undertaken to compensates for catch and access regulation is used to exclude non-members. The views on local and regional management are less obvious. At the most, we see that angling club representatives from the South-East county agree more strongly with local decision-making than the representatives from the North-East county (Table 5), which concurs with the different development in recreational fisheries governance after the reunification in both counties. Furthermore, the analysis of variance between each pair of the four counties shows that the highest differences between two groups can be found for catch compensation as a reason of stocking (Table 6). The difference is particularly strong between the North-West and South-East counties (counties 1 and 4), where opposing changes in property rights institutions took place (p-value of .006). This finding relates to the observation that angling clubs in the North-West county conduct fish stocking for other reasons such as enhancement of fish stocks maintenance of the resource and that compensation for catches by anglers seems to be a minor issue for stocking in contrast to the other three counties (Table 6). The highest difference between the two East German counties is found for the question whether fish stocking causes often conflict among anglers (p-value of .029). In the North-East county, where the central governance system persisted, angling clubs rather disagree, while in the South-East county, where governance was changed to regional and local level, angling clubs agreed more than in all other counties that stocking causes conflict (Table 6). In any case the analysis of this survey data needs to be treated with caution because of the small sample size and regional limitation.
Table 5: Evaluation of Survey Questionnaire: Descriptive Information and Test of Normal Distribution

<table>
<thead>
<tr>
<th>Items problem dimension:</th>
<th>West Germany (control group)</th>
<th>East Germany (treatment group)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>County 1</td>
<td>County 2</td>
</tr>
<tr>
<td></td>
<td>North-West</td>
<td>South-West</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
</tr>
<tr>
<td>Satisfaction with fish stocking</td>
<td>10</td>
<td>3.60</td>
</tr>
<tr>
<td>Satisfaction with access regulations</td>
<td>10</td>
<td>3.20</td>
</tr>
<tr>
<td>Satisfaction with withdrawal regulations</td>
<td>10</td>
<td>3.90</td>
</tr>
<tr>
<td>Intense angling causes decrease in fish resources</td>
<td>10</td>
<td>2.50</td>
</tr>
<tr>
<td>Fish stocking measures cause often conflicts among anglers</td>
<td>10</td>
<td>2.8</td>
</tr>
<tr>
<td>Items management dimension:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for stocking: compensating game fish caught by anglers</td>
<td>10</td>
<td>3.10</td>
</tr>
<tr>
<td>Reason for access regulations: exclusion of non-members</td>
<td>10</td>
<td>2.50</td>
</tr>
<tr>
<td>Reason for withdrawal regulations: Guarantying all anglers similar catches</td>
<td>10</td>
<td>2.40</td>
</tr>
<tr>
<td>Local fish stocking decisions meet anglers desires easier than regional decision-making</td>
<td>10</td>
<td>4.10</td>
</tr>
<tr>
<td>Regional access and withdrawal regulations guaranty fairer distribution of fish among anglers than local rules</td>
<td>10</td>
<td>3.90</td>
</tr>
</tbody>
</table>

Source: own data from angling club survey in 2008/2009;
Note: Items 1 to 3 are measured by a 5 point scale ranging from 1 = unsatisfied to 5 = very satisfied; Items 4 to 10 are measured by a 5 point scale ranging between two poles from 1 = do not agree to 3 = unsure to 5 = agree; n = number of population; n = number of observations; S-W = Shapiro-Wilk test for normal distribution, *p < .05, **p < .01 (** upper level of absolute significance)
### Table 6: Evaluation of Survey Questionnaire: Analyses of Variance (Mann-Whitney U-Test)

<table>
<thead>
<tr>
<th>Items: problem dimension</th>
<th>Counties 1+2</th>
<th>Counties 1+3</th>
<th>Counties 1+4</th>
<th>Counties 2+3</th>
<th>Counties 2+4</th>
<th>Counties 3+4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Satisfaction with fish stocking</td>
<td>.489</td>
<td>.185</td>
<td>.053</td>
<td>.509</td>
<td>.091</td>
<td>.144</td>
</tr>
<tr>
<td>2. Satisfaction with access regulations</td>
<td>.068</td>
<td>.944</td>
<td>.447</td>
<td>.023*</td>
<td>.025*</td>
<td>.398</td>
</tr>
<tr>
<td>4. Intense angling causes decrease in fish resources</td>
<td>.898</td>
<td>.972</td>
<td>.130</td>
<td>.912</td>
<td>.292</td>
<td>.076</td>
</tr>
<tr>
<td>5. Planning and handling of fish stocking measures cause often conflicts among anglers</td>
<td>.639</td>
<td>.799</td>
<td>.131</td>
<td>.647</td>
<td>.277</td>
<td>.029*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Items: management dimension</th>
<th>Counties 1+2</th>
<th>Counties 1+3</th>
<th>Counties 1+4</th>
<th>Counties 2+3</th>
<th>Counties 2+4</th>
<th>Counties 3+4</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Reason for stocking: compensating game fish caught by anglers</td>
<td>.044*</td>
<td>.048*</td>
<td>.006*</td>
<td>.450</td>
<td>1.000</td>
<td>.306</td>
</tr>
<tr>
<td>7. Reason for access regulations: exclusion of non-members</td>
<td>.580</td>
<td>.826</td>
<td>.318</td>
<td>.612</td>
<td>.112</td>
<td>.082</td>
</tr>
<tr>
<td>8. Reason for withdrawal regulations: Guarantying all anglers similar catches</td>
<td>.797</td>
<td>.486</td>
<td>.326</td>
<td>.296</td>
<td>.176</td>
<td>.663</td>
</tr>
<tr>
<td>9. Local fish stocking decisions meet anglers desires easier than regional decision-making</td>
<td>.288</td>
<td>.350</td>
<td>.501</td>
<td>.044*</td>
<td>.699</td>
<td>.076</td>
</tr>
<tr>
<td>10. Regional access and withdrawal regulations guaranty fairer distribution of fish among anglers than local rules</td>
<td>.306</td>
<td>.034*</td>
<td>.063</td>
<td>.294</td>
<td>.279</td>
<td>.564</td>
</tr>
</tbody>
</table>

Source: own data from angling club survey in 2008/2009;

Note: Items 1 to 3 are measured by a 5 point scale: 1 = unsatisfied to 5 = very satisfied; Items 4 to 10 are measured by a two pole 5 point scale from 1 = do not agree to 3 = unsure to 5 = agree; *p < .05, **p < .01 (** upper level of absolute significance)
5 Discussion

The findings suggest that the influence of resource characteristics, i.e. the perceived abundance and scarcity of fish resources, affected the relationship between anglers and caused a reaction by the governance structure to regulate the nature-related transaction. In case of resource scarcity, anglers started to feel the costs of fishing activities of other anglers in terms of catching less themselves and rivalry among anglers emerged. This rivalry can be seen as a property of the nature-related transaction (Hagedorn, 2008). It initiated a reaction by the governance structure resulting in a change of property rights institutions. However, in case of resource abundance, anglers do not see themselves directly affected by fishing activities of other anglers because there seem to be sufficient resources for all. While the results support previous economic insights on the importance of scarcity on decision-making and establishing of property rights institutions (Demsetz, 1967; North, 1981; Libecap, 1989; Anderson and McChesney, 2003), they also confirm the importance of abundance in this context. Other resource characteristics such as migrating fish stocks in a larger water body affect properties of nature-related transactions within German recreational-fisheries (GRF) governance, namely the complexity of resources challenge resource management. Consequently in the North-West county (county 1) the governance structure was centralized to lower management costs.

The pattern of changes in property rights institutions in the North-West and South-East counties is supported by the pattern of persistence in property rights institutions in the South-West and North-East counties. While the South-West county (county 2) never implemented a centralized governance structure to manage fish stocks, the North-East county (county 3) kept a centralized governance structure after the enforced up-scaling of recreational-fisheries governance in the GDR and angling clubs and associations refused to re-implement traditional local governance when the property rules on constitutional level again allowed for private property after the German reunification in 1990. The cross-country comparison suggests that anglers in both counties in the North German lowlands generally perceive fish stocks and fishing opportunities as more abundant, and anglers in the South German uplands perceived scarcity in fish resources. This pattern is supported by a higher angler density per water area and higher costs of annual permits in the South German counties (Table 2). Thus, the governance structures these two counties seem to be required to stronger regulate a potential rivalry for fish resources.

The study found that decision-making is a complex response of group members to internal problems under particular external conditions. In both counties with changes in property rights institutions, angling clubs were confronted with an externality problem. First, in the South-East county (county 4) angling clubs faced a negative externality while using fish resource at association’s water bodies, because the perceived scarcity of resources increased rivalry and competition within the group of authorized users. This conflict could not be
internalized by the regional angler associations, because of their inability to increase stocking rates or to strengthen exclusion rules. Thus, angling clubs internalized this problem by themselves, through purchase of fishing rights to local water bodies. The investment in fish stocking of their own water bodies was safeguarded by the strong exclusion rules for non-members of the local angling club. Detailed withdrawal rules for each authorized user per year, day, and fish species secured equal distribution of fish resources among them. Also, in small clubs and with local water bodies monitoring and enforcement of rules seems less costly than for large-scale water bodies of regional association.

In the North-West county (county 1) angling clubs experienced costs in the separate governance of flowing water bodies. Separate stocking and permit systems for the same water body were perceived as costly and restrictive for anglers. Angling clubs merged management, withdrawal, and access rights to take advantage of economics of scale, where centralization leads to lower per unit costs. This also facilitated access and distribution of resources to authorized users. Thus, these results support the finding that equal distribution among authorized users is a major motivation to change property rights institutions (Wang, 2001; Libecap, 1989, 2012). This reasoning is supported by the North-East county (county 3), where angling clubs and associations kept the centralized governance system after the reunification, because in the water-rich North German lowland catch rates are satisfying for anglers and fish stock perceived rather abundant. Thus, there was no need to internalize rivalry among users in this county through change in the governance structure. Complex resource systems were already managed by a centralized governance structure providing easy access for authorized users to association’s water bodies.

This study confirms that nature-related properties of transactions play a decisive role in change and persistence in property rights institutions (Hagedorn, 2008). Also, in the two counties with institutional change, the costs of decision-making appeared lower than the benefits gained after the change in property rights institutions. However, a simple distinction between governance structures of markets, hierarchies, and hybrids as suggested by Williamson (1996) seem analytically and practically too rough and need refinement for example including common property regimes on different organizational levels as hybrid governance structures, in particular for natural resources. It was shown how anglers align their governance structure to problems emerging from properties of nature-related transactions and from management costs. This alignment is characterized by a detailed differentiation in property rights institutions as shown by the complex set of rules defining access and withdrawal rights on fish resources in German recreational-fisheries governance. The refinement of property rights institutions in this study was facilitated by using the concept of bundles of property rights by Schlager and Ostrom (1992). In natural resource governance, they depend on the particular transactions negotiated by property rights holders. Bromley (1992) gets to the heart of this matter when he writes that the choices of property rights
institutions “must be based on the characteristics of the natural resource under consideration, and the characteristics and objectives of the human associations that interact with these natural resources” (1992: 15). Likewise this study indicates that a multiple reasons exist when governance structures decide about changes and persistence of property rights institutions regulating natural resource use. For example, the powerful position of state and regional angler associations in the East German counties can limit the influence of properties of nature-related transactions. In both East German counties selected for this study, the angler associations established rules to prevent changes in the governance structure from state/regional to local level. Also, besides preferences of property rights holders about a particular design of property rights institutions, social and economic conditions such as number of anglers in a region (Table 2) can influence the outcome of decision-making about institutional change.

Further research should meet some limitations of this study. First, future studies could focus on how other properties of nature-related transactions, e.g. based on land use or use of coastal and marine resources, influence property rights institutions. Also, the influence of resource characteristics on properties of nature-related transactions could be studied more extensively. For example, in another study we found that resource characteristics such as standing or flowing water bodies have an effect on angling club and associations’ decisions on fish stocking (van Poorten et al., 2011). Second, the focus of this study was a leisure time activity and the question is whether a change or persistence in property rights institutions is significantly different when property rights holders earn a living from natural resource use. For example, one could assume that because of higher dependence on the resource in combination with investment in the resource, the will to strengthen access and withdrawal rights might be higher among property rights holders or even private property becomes an option. However, a comparison for example with commercial marine fisheries and their diverse quota systems for marine fish stocks as private property rights regimes in fisheries governance (Barnes, 2009) is challenging, because of major differences in characteristics of marine and inland water bodies. Third, measurements of indicators for resource characteristics and properties of nature-related transactions could be improved. We relied on interview and survey information about perceived resource abundance and scarcity based on catch (dis-)satisfaction. However, those views are biased for example in memories of expected and realized harvest levels of anglers (van Poorten et al., 2011) and other sources of information might alleviate such a bias. Finally, this study measures only one time point but extracts information for a longer time horizon.
Acknowledgement

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