Global participation in and public attitudes towards recreational fishing: international perspectives and developments

Robert Arlinghaus¹, Øystein Aas², Josep Alós³, Ivan Arismendi⁴, Shannon Bower⁵, Steven Carle¹, Tomasz Czarkowski⁶, Kátia M.F. Freire⁷, John Hu⁸, Len Hunt⁹, Roman Lyach¹⁰, Andrzej Kapusta⁶, Pekka Salmi¹¹, Alexander Schwab¹², Jun-ichi Tsuboi¹³, Marek Trella⁶, Daryll McPhee¹⁴, Warren Potts¹⁵, Arkadiusz Wołos⁶ & Zi-jiang Yang⁸,¹⁶

¹ Department of Biology and Ecology of Fishes, Leibniz-Institute of Freshwater Ecology and Inland Fisheries & Division of Integrative Fisheries Management, Humboldt-Universität zu Berlin, Berlin, Germany, arlinghaus@igb-berlin.de

² Norwegian Institute for Nature Research (NINA) & Norwegian University of Life Sciences (NMBU), Faculty of Environmental Sciences and Natural Resource Management

³ Instituto Mediterráneo de Estudios Avanzados (CSIC-UIB), C/ Miquel Marqués 21, 07190, Esporles, Spain

⁴ Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR, 97331, USA

⁵ Fish Ecology and Conservation Physiology Laboratory, Carleton University, Canada

⁶ The Stanislaw Sakowicz Inland Fisheries Institute, ul. Oczapowskiego 10, 10-719 Olsztyn, Poland

⁷ Departamento de Engenharia de Pesca e Aquicultura, Universidade Federal de Sergipe, Brazil

⁸ Department of Plant and Environmental Protection Sciences, University of Hawaii at Manoa, 3190 Maile Way, Honolulu, Hawaii 96822, USA

⁹ Centre for Northern Forest Ecosystem Research, Ontario Ministry of Natural Resources and Forestry, Thunder Bay, Canada
Recreational fisheries are prime examples of strongly coupled social-ecological systems (SESs) where humans and ecological systems interact intimately across scales (Arlinghaus et al. 2017). The tight linkage of people and nature in coupled SESs is not new to fisheries scientists and managers. Despite the early recognition of the importance of the social aspects in fisheries science (Gordon 1954; Larkin 1978; Aas and Ditton 1998), there has nevertheless, been a tendency among freshwater recreational fisheries scholars and managers to take a “piscicentric” (Cowx et al. 2010), “reductionistic” (Aas 2002) and overall “narrow” (Pope et al. 2016) view that tends to focus on local biological and social issues and particular target species. For example, many studies in recreational fisheries science deal with how much recreational harvesting a local exploited fish population can withstand or descriptively describe the human dimensions (e.g., demographics and motivations) of a regional or state-level population of anglers. Although such “case-study” based research is certainly valuable, particularly in early phases of the scientific study of recreational fisheries in specific regions, the perspective omits the complex social and economic dimensions that typically drive local- or regional-scale...
features and patterns such as cumulative fishing effort or the size of a regional angling population (Arlinghaus et al. 2008; Fenichel et al. 2013; Hunt et al. 2013; Pope et al. 2016). Moreover, all local or even regional recreational fisheries are embedded in other higher-order social-ecological systems, such as land use systems and society at large (Hunt et al. 2013; Arlinghaus et al. 2015, Pope et al. 2016). Changes and developments in the ecological and social fabrics of this broader SES will almost always exert effects, directly or indirectly, on a particular fishery and create many trade-offs related to a range of ecosystem services provided by ecosystems (Pope et al. 2016). Relatedly, a local recreational fishery will be sensitive to changes in regional ecological factors, technology, communication channels, and altered norms and expectations of society about what fisheries managers and anglers ought to do (e.g., fish welfare debate in central Europe; Arlinghaus et al. 2012), or altered fishing participation in response to urbanization and demographic change (Arlinghaus et al. 2015). Therefore, a “reductionistic” perspective risks missing important cross-scale effects. For example, if one is interested in for seeing developments of angling participation in a given society, it is worthwhile to not only examine narrow ecological questions, but to ask general questions about societal-level developments that shape the values and interests of members of society to engage in fishing relative to other leisure activities. Similarly, when a fisheries manager is designing management interventions, it may not be sufficient to be alert to the expectations of local resource users because decisions about actions such as fish stocking or introduction of fish are very likely to affect stakeholders and their interests well beyond the core fisheries circle. In many western countries, biodiversity conservation has become an important societal goal (Arlinghaus et al. 2002; FAO 2012; Rahel 2016), and thus the appropriateness of a given management action is likely affected by cultural values and the way society thinks about desirable states of nature, even in abstract terms. Recreational science is well advised to capture these systematic effects of the social embedding of recreational fisheries. This chapter is an attempt to reach towards this goal.

The aim of this chapter is to take a wider perspective on societal-level influences on recreational fisheries. We do so by reviewing data and studies on fishing participation rates and determinants of the rates and by reviewing philosophical and ethical perspectives on
recreational fisheries. We follow the outline by describing the social embedding of recreational fisheries based on a range of case studies in several areas of the world. Given shared historic backgrounds, we assume that there are “clusters” of countries with specific perspectives towards recreational fisheries and that we can associate these with wider societal-level deployments that shape cultural and moral values in a given country. The core assumption of our chapter is that society and cultural values exert direct and indirect effects on both fishing participation and the acceptability of fishing practices as well as the acceptability of management interventions by the public at large.

The life-cycle of fisheries – a conceptual model of recreational fisheries development across generations

Although recreational fisheries are of high importance globally (FAO 2012), there is considerable inter-country variance in its relative importance when compared to commercial and subsistence fisheries or other uses of aquatic ecosystems. Broadly speaking, recreational fishing activity increases with economic development of societies, because people can afford to spend time fishing during leisure time rather than engage in fishing as a primary means to secure nutrient input or even survival (Smith 1986). Clearly, there are borderline cases among recreational and other types of capture fisheries, for example, where recreational fishers have strong subsistence motives (Cooke et al. 2018). Recreational and subsistence fisheries differ by the need to secure personal essential nutritional benefits through fishing products. Recreational fisheries start where fishing products are complements and not primary resources for survival (FAO 2012), and this is the case after significant economic development of a given society providing working opportunities beyond the primary fishing sector. Although the use of coastal and sometimes even off-shore marine fish stocks by recreational fisheries also develops with a society’s economic development, the shifts from subsistence to commercial to finally and often exclusively recreational use of wild fish stocks are particularly pervasive in inland fisheries (FAO 2010b).
According to FAO (2010) almost linear increases in recreational fishing interest in a society are expected to occur with its economic development. However, infinite growth of recreational fisheries is unlikely. Specific for inland fisheries, the “life-cycle” of fisheries introduced by Smith (1986) and further developed by Arlinghaus et al. (2002) and Cowx et al. (2010) predicts a stabilization or even decline of recreational fishing growth after an initial rise with economic development of societies (Fig. 1). According to this model, the maximum recreational fishing participation rate is expected to occur during an intermediate phase of economic development (represented by industrialization and urbanization), after which recreational fishing interest is expected to decline. Before this eventual decline, likely caused by now urbanized people losing contact to and interest in fish and wildlife, a rapid rise in freshwater recreational fishing interest coupled with a decline in subsistence or commercial fishing is expected in all countries that experience explosive economic development. Indeed, many countries in transitional economies in Asia, Latin America, South America and Africa are currently experiencing sharply rising development of recreational fisheries (FAO 2010b; Welcomme et al. 2010; Freire et al. in press), and in many regions (e.g. southern Pantanal and Iguape and Cananéia Lagoon Estuarine System in southern São Paulo, both in Brazil) catches by recreational fisheries have surpassed those by commercial fishers, albeit sometimes only for selected species (Catella 2006; Motta et al. 2016). These results suggest that with economic development subsistence fisheries may transform into, or are replaced by more leisure-like forms of fishing, and in some developing nations recreational fishing tourism and/or guiding has become a locally and regionally important activity (Mike and Cowx 1986; Potts et al. 2009; Everard and Kataria 2011). The situation is different in less developed countries, where subsistence and commercial fisheries usually dominate and consequently, subsistence and commercial fisheries strongly influence the management and development of aquatic ecosystems.
FIGURE 1. — A sketch of the life-cycle of inland fisheries (modified from Cowx et al. 2010). The number of “users” involves all stakeholders of aquatic ecosystems, whether they are direct users (e.g., recreationists) and indirect “users” (e.g., people that care about aquatic ecosystems without directly using them).

Because recreational fisheries initially increase with economic development of societies, many recreational fisheries today take place in pervasively anthropogenically-altered habitats and ecosystems that are affected by many impacts unrelated to fishing (e.g., damming, pollution, habitat simplification, non-natives, Arlinghaus et al. 2002). Moreover, many of today’s recreational fishing habitats in more developed nations are characterized by multi-use patterns (e.g., navigation, flood control, energy production, waste disposal, fisheries, boating, tourism). Therefore, recreational fisheries rarely operate in a vacuum, and thus, must take a range of stakeholders, activities and interests into account in their development. The strong effects of non-fishery impacts on aquatic ecosystems, particularly in freshwaters of industrialized countries, not only affects the quality of many recreational fisheries but motivates conservation concern by the wider society, sometimes involving concern for the
welfare of fish and for biodiversity conservation in general (Arlinghaus et al. 2002, 2009) (Fig. 1). One consequence of rising societal demands for conservation of wild living resources, including the need to avoid any further biodiversity impacts (Cowx et al. 2010), is that recreational fisheries must today be managed using integrated (i.e. across various sectors) policies involving a range of tools, including habitat management approaches, besides the more traditionally employed harvest regulations, effort and/or season controls, or fish stocking (FAO 2012).

Global recreational fishing participation and its societal drivers

To understand the drivers of recreational fishing participation, we compiled the best available data on fishing participation rates around the globe and mapped recreational fisher numbers relative to the total population size (Fig. 2). This work updated previous assessments (Arlinghaus and Cooke 2009; Arlinghaus et al. 2015). Data availability on recreational fisher numbers strongly varies around the globe (Fig. 2). Data gaps are particularly widespread in developing countries (Fig. 2), but there is quite good coverage in Oceania, Europe, and North America. Recreational fishing hotspots with more than 20% of the total population participating in recreational fishing involve some Scandinavian countries and Russia. On average across the globe, the recreational fishing participation rate is about 10.6% (Arlinghaus et al. 2015) summing to about 120 million anglers in North America, Oceania and Europe alone. Collectively across the world, the World Bank (2012) estimates a minimum of 220 million recreational fishers globally.
FIGURE 2. — Updated global map of fishing participation.

A range of supply-related factors (e.g., availability of water bodies, Adams et al. 1993) and demand-related factors (e.g., preferences and perceived constraints by individuals, Sutton et al. 2009) interact to affect the likelihood that a person participates in recreational fishing (Edwards 1989). In terms of demand factors, micro-level decision making by individuals is nested in, and affected by, macro-level societal developments (e.g., modernization forces leading to value shifts in society, Manfredo et al. 2009). For example, the macro-level factor “industrialization” is a major driver of cultural and corresponding value change in many countries world-wide (Inglehart 1990; Manfredo 2008). Following the life-cycle of fisheries, many of the industrialization-induced societal changes initially foster public interest in recreational fishing because increasing wealth helps large fractions of society meet their base needs for nutrient intake through other activities than fishing, freeing time and resources for water-based leisure activities (Fig. 1). Consequently, more resources can be invested in leisure activities to meet “higher order” personal needs and psychological goals (see for general sociological perspective, Inglehart 1990; see for a conceptual model in recreational fisheries, Smith 1986; Arlinghaus et al. 2002; FAO 2012). However, there are limits to growth, and indeed in many highly industrialized countries, recreational-fishing interest has either been stable or even declining in recent years (e.g., Canada: Gray et al. 2003; Brownscombe et al. 2014; Germany: Arlinghaus 2006a; United Kingdom: Aprahamian et al. 2010). Several factors
associated with urbanization likely contribute to these trends (Adams et al. 1993; Aas 1996; Arlinghaus 2004; Arlinghaus et al. 2012). However, in several of these countries, after several years of declines, a recent rise in angling participation was documented (Aprahamian et al. 2010; Brownscombe et al. 2014; USFWS 2018).

Macro-level observations, such as a country’s participation rate in fishing, are an emerging property of complex micro-level individual decision-making processes. Recreational fishing is a goal-oriented process that helps the individual person meeting expected psychological outcomes (alternatively termed “needs”, “benefits” or “utilities”) (Driver and Knopf 1976; Driver and Cooksey 1977; Manfredo et al. 1996; Hunt 2005). However, even if a person has the motivation to fish such as finding relaxation from work commitments or achieving other personal goals such as temporary escape or achievement (Driver and Knopf 1976), this can only be accomplished if opportunities are available (e.g., nearby sites, licenses, and areas with abundance of desirable fish species, Edwards 1989; Adams et al. 1993; Hunt et al. 2017), and one has the resources (time, money) to engage in fishing (Walsh et al. 1989; Floyd and Lee 2002). Then, as a next step, any perceived personal constraints have to be overcome and negotiated (Crawford et al. 1991; Stensland et al. 2017). Indeed, the literature on leisure constraints has often identified “lack of time” (e.g., due to family commitments) as an important barrier to initiation of fishing (Fedler and Ditton 2001; Sutton 2007; but see Freudenberg and Arlinghaus 2009 for an alternative finding). Against this background, one might expect that societies in which the average individual has more resources available in terms of time and money will exhibit higher recreational-fishing participation rates. Similarly, higher water availability should be positively associated with fishing-participation rates (Adams et al. 1993).

The country- (and state-) level participation rate in recreational fishing is influenced by demographic (e.g., aging) and other societal-level factors such as proximity to the coastline (Loomis and Ditton 1988; Edwards 1989; Murdock et al. 1992, 1996). Among the many factors affecting fishing likelihood, social-structural variables are better predictors of participation in leisure activities than are self-reported intrapersonal or interpersonal constraints (Shaw et al. 1991; Aas 1996; Sutton et al. 2009). One way to quantitatively understand fishing-participation
rates is to statistically relate individual-level demographic metrics (e.g., age, income or residency in urban areas) to individual-level observations of engagement in recreational fishing and thereby, derive a probabilistic model of fishing interest as a function of underlying demographic variables (e.g., Walsh et al. 1989; Floyd and Lee 2002; Arlinghaus 2006a). Using this approach, a number of correlations between individual-level demographic variables and the likelihood of fishing recreationally have been established. Income, male gender and proximity to, and quality of, fishing sites positively while age (but see Floyd and Lee 2002; Arlinghaus 2006a for other findings), household size (but see Walsh et al. 1989), and urban residency negatively related to the likelihood to fish recreationally in specific studies (e.g., Walsh et al. 1989; Floyd and Lee 2002; Arlinghaus 2006a; Thunberg and Fulcher 2006; Lee et al. 2016). It is unclear whether the age effects reported in these individual-level studies reflect aging or cohort effects, and this open question can only be sorted out through panel designs. The finding that aging had differential impacts in different studies certainly indicates that its influence is not general. At the individual-level, education was found to reduce the likelihood of fishing in freshwater (Arlinghaus 2006a) but positively affected the likelihood for saltwater fishing in the USA (Lee et al. 2016), possibly indicating context specific effects depending on the type of fishery. Despite these uncertainties or partly conflicting findings, studying demographic variation among countries offers a promising way to explain variation in participation rates in consumptive recreational activities such as hunting (Heberlein et al. 2002) and fishing cross-culturally (Arlinghaus et al. 2015).

Developing models that predict participation rates in fishing across countries requires aggregate information that describes demographic and geographic conditions for entire countries or states (e.g., average age of individuals in the nation, available surface water for fishing in a country). In essence, this means moving the sampling unit from the individual member of society to countries or states. By doing so, one can use the observed variance in participation rates in recreational fishing among countries, states, or regions within a country as a sample to develop statistical models at the aggregate country-level. Edwards (1989) and Adams et al. (1993) first applied this approach to model variation in recreational-fishing rates in the U.S.A., followed by Poudyal et al. (2011). Heberlein et al. (2002) used a similar approach to
explain recreational hunting rates across Europe and North America, and Arlinghaus et al. (2015) did the same for recreational fishing globally. Arlinghaus et al. (2015) concluded that five general factors drive variation in fishing participation rates globally, which were broadly supported by results of Poudyal et al. (2011) specifically for the USA.

First, recreational-fishing participation is positively related to the cultural importance of fish and fishing in a given country. Cultural importance was operationalized in the study of Arlinghaus et al. (2015) by the crude indicator of total fishing landings. As expected, a positive relationship between total fish landings and the proportion of a given society that recreationally fishes was found. It is likely that countries with a long tradition in harvesting fish for either subsistence or commercial reasons exhibit a heritage of fishing in society, which might spur interest in recreational fishing as resources and leisure-time become available with industrialization.

Second, there is a negative effect of post-industrialization and urbanization on recreational-fishing rates. Post-industrialization can be assessed by the per capita gross domestic product (GDP) while urbanization can be assessed by population density. Both variables were independently significant in the study of Arlinghaus et al. (2015), indicating that both post-industrialization and urbanization are negatively associated with recreational fishing participation rates. The negative impact of the size of the economy (GDP) on recreational fishing may appear counterintuitive. However, this relationship agrees with the life-cycle of fisheries (Fig. 1). Accordingly, interest in recreational fishing first rises with economic development and hence average prosperity of a country, but then typically it stabilizes or declines after reaching a peak in fishing participation (Fig. 1). Multiple social processes are likely responsible for the combined negative effects of a society’s economic development and urbanization. One important contributor could involve change of social values, value orientations and animal and environment-related norms as a result of post-modernization (see section 4). In fact, economic development of societies tends to de-emphasize utilitarian and favour egalitarian world-views of so-called mutualistic type, which foster an animal-use related ideology of caring as opposed to personal use of wildlife and fish (Manfredo 2008). Reductions in utilitarian values constrain the interest of the public in engaging in consumptive outdoor
recreational activities such as hunting and fishing (Bruskutter and Fulton 2008; Mandredo 2008; Manfredo et al. 2009). Arlinghaus et al. (2012) reported that the fraction of people holding negative moral attitudes to fishing increased with the fraction of society living in urban areas in the USA and Germany. Collectively, economic development could favor values and beliefs within society that reduce the social acceptability of fishing as a leisure activity, but more research on this topic is warranted. For example, the currently rising “green” movements in some of the most economically advanced and urbanized European countries could also lead to increased interest in fishing for meeting nutritional needs based on self-caught local fish.

Another contributor to declining fishing interest with growing prosperity is the growth of alternative leisure activities, many of which may serve similar expected psychological outcomes as fishing. For example, an important motive for recreational fishing is temporary escape (Driver and Knopf 1976; Fedler and Ditton 1994; Ditton 2004) and personal achievement associated with the catch of challenging game fish (Freudenberg and Arlinghaus 2009). Catching and experiencing nature aside, the very same psychological benefits may also be served by alternative leisure activities such as golfing, indoor sports, wildlife viewing, jogging or computer gaming. For example, the motivation of achievement might be better served by computer gaming than through meeting the challenge of catching a trophy fish. Motivations aside, the increasingly supported “videophilia hypothesis” (Pergams and Zaradic 2006) positions that electronic entertainment as well as other leisure activities merely compete with hunting, fishing and other nature-based recreational activities for time and peer support in contemporary western societies. Simply said: if one has limited time and your peers engage in computer games, interest in fishing might decline. There is now considerable evidence that increasing electronic entertainment causes decline in nature-based recreational activities such as recreational hunting (Pergams and Zaradic 2006; Robison and Ridenour 2012).

Another distinct feature of post-industrialization is the tendency for increasing urbanization, which has a range of effects that are not conducive for fishing and hunting participation by the public. This includes, but is not limited to, reducing the exposure of individuals to traditional rural recreational activities such as hunting and fishing (Heberlein et al. 2002), reducing the availability of unmodified land and water for hunting and fishing (Walsh et
al. 1989) and alienation of large segments of society from direct contact with wildlife and nature, contributing to the Nature deficit disorder (Manfredo 2008). Tied to these factors are reductions in the social standing of fishing and hunting as a form of recreation or even life-style (Manfredo 2008), which in turn negatively affects socialization into fishing. The early exposure of fishing and hunting to children by adult family members is probably the most important entry point to develop a fishing interest later in life (Sofranko and Nolan 1972; Arlinghaus 2004). If opportunities to go fishing are no longer available in the now urbanized neighbourhood, it is likely that the younger generations will seek alternative leisure activities to meet their expected psychological outcomes. In fact, these alternative activities may also provide more pleasures if they happen to coincide with the habitual environment experienced as “built urban environment”. In fact, spill over leisure theory (Kraus 2008) argues that people will choose recreational activities that are contextually similar to their work environment. As less physically active indoor activities grow in urbanized countries, people may prefer recreation that is similarly structured (Robison and Ridenour 2012). Not surprisingly, more urbanized states and countries tend to host less recreational fishers (Adams et al. 1993; Aas 1996; Arlinghaus 2004) and hunters (Heberlein et al. 2002), corroborating the findings of Arlinghaus et al. (2015). Other key factors associated with urbanization that diminish participation in angling relate to structural changes in society (e.g., rise of specific minority groups that fish less than Caucasians, Murdock et al. 1996), increases in commute time, urbanization-induced changes in available fishing waters due to land use change, rising education and effects of high opportunity costs of time (see Poudyal et al. 2011 for details).

Third, the availability of individual resources in terms of time and money as well as the perceived leisure needs affect recreational fishing interest. Indicators of resource availability of states or societies are for example average age, average household size, unemployment rate and average weekly working hours (Poudyal et al. 2011; Arlinghaus et al. 2015). The first three variables might be interpreted as measuring the availability of physical (age), time (household size) and monetary (unemployment rate) resources of the average member of society. Some individual-level statistical models of fishing participation have previously documented that age (Walsh et al. 1989; Thunberg and Fulcher 2006, but see Arlinghaus 2006a for alternative
findings), household size (Arlinghaus 2006a) and low availability of monetary resources (Walsh et al. 1989; Floyd and Lee 2002; Arlinghaus 2006a; Lee et al. 2016) negatively affected the probability of fishing for recreation, likely reflecting physical, time and financial constraints. As before, correlation is not causation and to our knowledge there is no convincing study separating aging from cohort effects on recreational fishing participation. Thus, it is unclear whether early demographic studies from the USA reporting that aging at the society-level is expected to reduce angling rates (Murdock et al. 1996), generally hold true across the world (Arlinghaus 2006a). And even in the USA, follow up studies by Thunberg and Fulcher (2006), found that the participation effects of household income, education and age were stable across survey years in a study on marine recreational fishing in the USA. More recently, using US state-level data, Poudyal et al. (2011) revealed positive impacts of income and negative impacts of education, full-time employment status, and commute time. and a generally declining interest among younger cohorts on fishing participation in the USA – a situation that might no longer be present today as recent data show increasing participation rates of young people in the USA (USFWS 2018). Independent of this ongoing discussion particularly related to the age effect, Arlinghaus et al. (2015) adds to this literature by highlighting how resource-related factors exerts effects across countries in relation to recreational fishing participation rates.

In the study by Arlinghaus et al. (2015), average weekly working hours exerted a positive relationship on the participation rate in recreational fishing across the globe (Arlinghaus et al. 2015). While one might be inclined to perceive work time as a constraint and hence barrier to fishing, it is important to realize that the variable rarely (< 5% of all values) exceeded 42 weekly working hours (Arlinghaus et al. 2015). It is contended that this amount of work does not constrain people from engaging in fishing due to “lack of time” (Aas 1995; Fedler and Ditton 2001; Sutton et al. 2009). Instead, the positive effect of weekly working hours, all else being equal, on participation rate is consistent with the idea that development leads to a greater need for leisure thereby, elevating the likelihood that people engage in fishing. Indeed, temporary escape from work-commitments in aquatic nature is often a dominant motive for choosing to fish recreationally (Driver and Knopf 1976; Ditton 2004).
Fifth and finally, availability of fishing opportunities exerted a positive effect on angling participation across the world (Arlinghaus et al. 2015). This result confirms earlier reports that availability of water (Walsh et al. 1989; Adams et al. 1993; Poudyal et al. 2011; Stensland et al. 2017) and that proximity to areas with higher fish abundance (Hunt et al. 2017) indeed positively influence recreational-fishing rates. While this effect is not surprising per se, it is the low relative ranking of the “water factor” in the study of Arlinghaus et al. (2015) that is noteworthy. In fact, macroeconomic, urbanization and demographic factors exerted greater influence in explaining variation in angling rates across countries than did availability of water. This agrees with constraint studies in lapsed recreational fishers who consistently reported that structural aspects such as “lack of time”, too many commitments or poor fishing quality (e.g., low catch rates, see Freudenberg and Arlinghaus 2009) exerted greater inhibitory effect than availability of water per se (Fedler and Ditton 2001; Sutton et al. 2009). Moreover, limited water availability may be compensated by more intensive fisheries management, evidenced by the intensively stocked stillwater fisheries in the U.K. (North 2002). Even when fishing quality was more directly measured as access to areas with abundant fish biomass, Hunt et al. (2017) concluded that urbanization (as measured by population density) had a stronger effect than fish biomass at influencing rates of fishing participation in regions of Ontario, Canada. However, the same study found that a more concrete measure of catch-related fishing quality was a strong driver of license sales, suggesting that better measure of “access to water” can improve the predictive performance of models to explain fishing rates. It is unlikely that recreational fishing interest would be entirely decoupled from the fishing quality in a specific region, although stocking or other amenities can substitute for natural declines of wild fishes.

To conclude, from the available knowledge reviewed above, we propose the general propensity of a society to host recreational fishers is first related to the cultural precondition and fishing legacy of the country (Fig. 3). This suggests that contextual effects that vary among countries and cultures will be relevant and can put a certain national recreational fishery on a given development track. Put differently: although our work suggests that, on average, the life-cycle of fisheries should hold, patch dependencies (e.g., access to marine environments leads to early fishing, in turn leading a country/culture to historically appreciate consumptive resource
use, which then affects how recreational angling is viewed in society) can contribute to country-specific patterns that deviate from the expected impact of urbanization and development. Given the right cultural climate, any member of society is a potential recreational fisher. Whether one becomes a recreational fisher then depends on the interaction of socialization, opportunity, cultural embedding and other contextual conditions and personal goals and needs, particularly the personal choice and motivation to engage in recreational fishing, rather than in other recreational activities, to fulfill one’s expected psychological outcomes consciously or unconsciously (Lee et al. 2016). Assuming that fishing becomes one way to achieve personal aims, the availability of individual resources will then determine whether one actually has the means to go fishing for recreation. Personal resources fall on particularly fruitful grounds if opportunities for fishing exist. Most importantly, however, the participation decision as well as the continuation of angling interest will be strongly driven by key brokers such as relevant others (parent, friend, uncle, aunt, neighbor etc.) that socialize oneself into fishing when young.

Clearly, all aspects mentioned – resources, opportunities and socialization – are affected by demographic, economic and other structural changes in society, many of which correlate with urbanization. Hence, it is concluded that societal-level trends and drivers that are largely outside of immediate control of the fisheries manager will exert a large overall effect on recreational fishing participation (Fig. 3). On this basis, sustained and increased interest in recreational fishing is predicted for economies in transition, while participation rate in recreational fishing, on average, could decay (further) in most highly urbanized societies, simply because urbanization is a major global trend and more and more people will live in cities. That said, proangling cultural conditions in particular societies as well as dedicated marketing and the removal of barriers to participation (e.g., urban fishing, the need to pass examinations in some countries, Heberlein and Tompson 1997) can help to increase fishing participation in countries where the interest has been declining over recent time (e.g., UK, see Aprahamian et al. 2010).
FIGURE 3. — A conceptual model of multi-dimensional and hierarchically organized (from contextual at the level of cultures to individual-level) drivers of recreational fishing participation.

Perspectives from environmental ethics on recreational fisheries and their challenges

Recreational fisheries are embedded in social developments. Changes in social values towards recreational fishing will eventually affect policies and institutions as well as perspectives by politicians, agency staff and managers towards recreational fisheries. In fact, all societies and human communities design laws, regulations and other forms of institutions as a way to suit the contemporary Zeitgeist in society, which is a representation of social and cultural values. The academic discipline that tries to sort the resulting moral issues in navigating human-environment interactions is environmental ethics – a branch of philosophy; it deals with the relationship between humans and nature. Environmental philosophy constitutes
the general framework of the current debate on animal use, also in the context of recreational fisheries (Arlinghaus et al. 2012), and thus, will be briefly reviewed to provide context.

FIGURE 4. — Different domains of interest and key demarcations of moral concern in different schools of environmental ethics.

Broadly speaking four major dimensions of increasing moral concern towards animals and the natural environment, including obviously fishes, can be distinguished (Fig. 4): anthropocentric, suffering-centred (pathocentric), biocentric, and ecocentric worldviews. The anthropocentric (i.e., human-centred) view holds that human beings and their needs are at the centre of moral concern. Anthropocentrism is believed to be at the root of the world-view of the fisheries profession because fisheries management is about actions to achieve human-
defined goals and objectives for fisheries resources and aquatic ecosystems in light of trade-offs (Arlinghaus et al. 2002).

On the opposite level to anthropocentrism, non-anthropocentric views common in debates of environmental philosophy encompass biocentrism and ecocentrism (the latter sometimes also called physiocentrism, Fig. 4). Biocentrism places the entire living world at the centre of considerations. Humans are part of the living world, but morally speaking, the world doesn’t exclusively revolve around humans. Ecocentrism takes the broadest approach and takes the entire ecosphere including abiotic matter into consideration (Leopold 1970; Foltz 2003).

The moral status of animals, including fishes, within anthropocentric and non-anthropocentric views differs widely, but there are three clear perspectives represented in the philosophical literature: animal welfare, animal liberation and animal rights (Arlinghaus et al. 2007a, 2007b, 2012). There are also hybrid views (Sandøe and Christensen 2008), which feature various elements of these and other ethical positions and are more difficult to clearly characterize. All of these perspectives have different implications for the social acceptability of recreational fishing as we will describe below briefly (but also see Arlinghaus and Schwab 2011). We do so acknowledging that in reality the public holds a variety of diverging and potentially contradicting beliefs and attitudes toward the treatment of fishes that might not as neatly be categorized as the attempt below and the field of environmental ethics academically suggests. It is, nevertheless, useful to be reminded about the root moral principles of different ethics schools as these neatly underscore conflict and conflicting perspectives surrounding recreational fishing and its activities.

<B>Anthropocentrism as dominant historical route of fisheries management</B>

The core idea of anthropocentrism is that recreational fishing is good because it provides material and non-material benefits to individual participants, to society at large and possibly also to ecosystems, habitats and populations. When taking this perspective, which is very common among hunters, fishers and the fisheries management professionals, actions maximize the production of the instrumental benefits that fishing creates while maintaining the
extracted resource and the habitats needed to support the resource, which is the core of the traditional sustainability concept related to natural resources. In this context, one can identify the following set of instrumental values associated with recreational fishing in the discourse—all of which follow a utilitarian (use oriented) perspective about recreational fisheries. Accordingly, recreational fisheries are perceived by anthropocentrists as good because it provides the following benefits to individuals, society and ecosystems and populations at large (e.g., Parkkila et al. 2010; Tufts et al. 2015).

*Food benefits.* —

Recreational fisheries is fun, but also about food (Cooke et al. 2018). Although underappreciated, the quasi-subsistence component of recreational fisheries is substantial in many areas of the world (Cooke et al. 2018). Fishing for food is also the most basic justification of fishing in general, which also holds for recreational angling (Arlinghaus et al. 2012) — and success in catching food for dinner also brings about pleasure. The English explorer and adventurer Captain John Smith (1580-1631) observed about indigenous people: “In their hunting and fishing they take extreme paines; yet it being their ordinary exercise from infancy, they esteeme it a pleasure and are very proud to be expert therein.” (as cited in Goodspeed 1939). Such early fishing may not qualify as recreational fishing the way we perceive it today (FAO 2012). If, however, Izaak Walton (1593-1683) enjoyed eating his catch, it was part of recreational fishing where fishing did not provide essential resources for personal survival (FAO 2012). The point we want to make is that the demarcation line among fishing for food for subsistence to recreational fishing where food is a secondary motive might be not as clear cut as thought (Aas and Skurdal 1996; FAO 2012). Nevertheless, be it fresh or saltwater recreational fishing, the pleasures of the table are a widely accepted reason and one popular motive for recreational fishing (Cooke et al. 2018).

*Economic benefits.* —

According to FAO (2012), recreational fishing is distinguished from commercial fishing in that the individual fishing protagonist does not pursue the economic goals of securing
resources to meet his or her own survival. Instead, recreational fishers seek the abstract concept of utility, which is a non-market reward composed of a range of catch and non-catch-related utility components (Hunt 2005). One measure of the degree of utility that a recreational fisher receives is the total amount of monetary resources that the individual would be willing to invest before deciding to do something else in free-time (a concept known as willingness-to-pay, Johnston et al. 2006). The benefits received minus the actual costs incurred are known as economic value or consumer surplus (Weithman 1999; Parkkila et al. 2010) – the net benefits received by angler. These net benefits of a fishing day are usually substantial across the world (see review by Johnston et al. 2006).

The actual costs (expenditure) incurred by anglers reduce the utility of anglers, but at the same time induce a range of economic turnover known as economic impact (Parkkila et al. 2010). These expenditures fuel a large macroeconomic activity in a range of sectors. For example, angler expenditure in the US is responsible for feeding over 828,000 jobs in a 115 billion US$ industry (Southwick Associates 2012). In Germany alone, anglers are responsible for feeding about 52,000 jobs (Arlinghaus 2004), and the total marine recreational fishery in Europe feeds 100,000 jobs (Hyder et al. 2018). The total jobs created by recreational fisheries in countries such as USA and Germany are larger than the jobs dependent on commercial fisheries (Tufts et al. 2015). Recreational fisheries is thus not only a private affair during leisure time, but also a creator of a large industry and of many million jobs world-wide (World Bank 2012). Ironically perhaps, the economic benefits of recreational fisheries are the least well known to the public, according to a public survey in Germany (Riepe and Arlinghaus 2014). Note, however, that from a macroeconomic perspective the job effects are particularly relevant for a given region if they originate from non-resident fishing and thus truly constitute “novel” money that is circulating in the economy only due to the fishing activity (Parkkila et al. 2010).

**Psycho-social benefits.** —

It is tempting to distinguish neatly between individual and social benefits (Parkkila et al. 2010), which in reality is difficult to achieve because all benefits experienced by individual recreational fishers collectively sum to determine social benefits. The problem is where to draw
the line if indeed that is possible. Recreational fishing contributes, for example, to a healthy work-life-balance of individuals and generates a range of desired psychological outcomes related to temporary escape, accomplishment, self-determination and other psycho-social benefits (Manfredo et al. 1996). Individual-level benefits scale to affect the social environment in which each individual is embedded and collectively represent social benefits. Likewise, if an individual is involved in a fishing club in Germany or Switzerland, the benefits are not clearly attributable to an individual. Fishing clubs engage, for example, in all kinds of charity work, providing facilities for disabled anglers, organizing educational events for children and young adults thereby increasing the awareness for environmental issues and socializing the next generation into the sustainable use of fish and wildlife (Daedlow et al. 2011). Introducing young people to fishing helps to direct their energies on constructive activities and leads often to a lifetime interest (Sofranko and Nolen 1972). Fishing clubs are in some places also a vital part of the web of rural life (Arlinghaus 2006b), and they assist in research projects and supervise conservation efforts for threatened species in their area (Daedlow et al. 2011; Harrison et al. 2018). Recreational fishers also fight visible pollution in and out of the water and also support research into causes of invisible pollution (Bate 2001). All such activities benefit both the individual angler (e.g., gain of knowledge, experience, pleasure, satisfaction of achievement) and society at large because it profits from this kind of voluntary work.

Conservation benefits. —

Traditionally recreational fishers have been the guardians of the water. Recreational fishing has vital interest in conservation and angler expenditure contributes to most fish conservation actions across the world (Granek et al. 2008; Tufts et al. 2015). Not surprisingly, angling clubs or more general “the recreational fishing interest” is involved in all sorts of water and habitat improvement schemes and tries to prevent the loss or degrading of the aquafauna and flora. Conservation driven by the recreational angling interests may also create social, economic and individual benefits. Consider the following: on the shores of or in the catchment area of a heavily polluted lake, house and land value is bound to be lower than on a healthy lake (Muller 2009). More than that: all other wildlife will thrive thereby, increasing biodiversity
and that in turn makes entire regions more attractive for tourism in general and not just angling tourism. Like in charity or educational work, conservation benefits all. Conservation creates the most obvious win-win situation all round – including for the fish, of course. What is good for fish, is usually good for humans, and such conservation actions are usually induced, financed or supported by recreational anglers. Clearly, recreational fishers also negatively impact on ecosystems and fish stocks (Post et al. 2002; Lewin et al. 2006), which is why one needs proper management to capitalize on the positive potentials and avoid the damages. The FAO (2012) provides international guidelines on how to develop recreational fisheries responsibly.

**Intrinsic and cultural benefits.** —

A somewhat more abstract final value category related to recreational fisheries relates to the cultural value of recreational angling (Parkkila et al. 2010). This argument is similar to the arguments fashionable in biodiversity science and conservation where people and policy makers assign value to individual species or populations no matter which instrumental value (or ecosystem service in modern terms) they produce to humans. There is intrinsic value to species, and similarly there is intrinsic value to recreational fishing to some people. In the written record, British, European and American traditions emphasize that the „Treatyse of Fyshynge with an Angle“ (published 1496), popularly ascribed to the nun Dame Julia Berners but probably an invention (Pitcher and Hollingworth 2002), was a turning point in the history of fishing (Herd 1999). Herd (1999) observed perspicaciously: ”The prologue of The Treatyse introduces fishing as a sport which is not merely equal, but superior to hunting and hawking, a sentiment that would have raised a few eyebrows in view of the rigid conventions of the time. The places of hunting and hawking were well established, but fishing was, by and large, a pot-filling exercise for the masses rather than a sport for the elite.” In other words, by elevating fishing to a field sport, modern popular recreational fishing was born. That is not to say that in earlier times and other cultures there weren’t individuals practising “recreational fishing”. Indeed there is evidence for all times and all cultures that such was indeed the case (Pitcher and Hollingworth 2002), but The Treatyse is a convenient (albeit western centric) historical marker for the early modern and modern period worldwide. While the focus on the following characterizations of
attitudes towards recreational fishing is on the present day it should not be forgotten that there is a significant historical dimension to recreational fishing and a rich worldwide cultural heritage to which perhaps not all due attention is payed.

The popular side of recreational fishing angling culture as expressed in all sorts of beautiful angling kitsch, in literally hundreds of thousands of how-to-books, in memoirs in and angling magazines is well known. Often overlooked but integral part of recreational fishing are the cultural achievements in literature and fine arts. Recreational angling in this context might be cause and inspiration or both. Perhaps the most striking illustration of angling literature capturing general interest is Izaak Walton’s The Compleat Angler (Walton 1995), which, along with the Bible, the Book of Common Prayer and the complete works of Shakespeare is the most frequently reprinted book in the English language. To famous authors like Nobel Prize winner Ernest Hemingway, fishing was a source of inspiration. However, wherever you look for it you’ll find angling literature and fisherman-authors outside the English speaking world. A case in point is Sergei Timofeevich Aksakov (1791 – 1859). His “Notes on Fishing” (Aksakov 1997) is a landmark in the history of Russian literature. Other Russian authors who fished or wrote about fishing are, for example, Ivan Goncharov, Anton Chekhov, Fjodor Dostoevsky and Konstantin Paustovskii. More examples come from China. From the ancient ShunDi (about 2277 BC - 2277 BC) along the Lazer (now Heze, Liangshan, Shandong Province) patrol, to the Ziya Jiang of Shang Dynasty (about 1156 BC - about 1017 BC), the story of "Jiang taigong fishing, willing to hook up", China's recreational fishery has been around since ancient times. From more than 2000 years ago the Chinese poems in The Book of Songs "monsoon" chapter of "Ti Ti bamboo, to measure Yu Qi" verse, the ancient Chinese literati, keen on fishing, abandoning landscape, edify sentiment, using poetry to express their love for fishing, accumulated the rich contemporary leisure fisheries culture. In the Tang dynasty, the poet Li Bai's "the walking in the tianmu" wrote that "the leisure time to go fishing bixi, and then to the boat dream day side"; and Zongyuan Liu, the Tang Dynasty writer and philosopher, "alone in the ocean, fishing in the snow", is widely circulated in the ancient Canon, for the people to paint a beautiful artistic conception related to fishing. These examples show: from ancient times to the present there have always been representations of fishing. Murals, pottery, mosaics, drawings and pictures testify to the
stellar importance of fishing for human life and culture. The nearer the present day the more obvious the purely recreational character of the fishing scenes depicted. Some of the greatest names in European art like Turner, Renoir, Monet and Klee had a close look at recreational fishing thereby, probably wondering what it is that gets people hooked on fishing. We close by concluding that there is something called cultural and spiritual value to the history of recreational fisheries that may justify intangible assets attached to it without the need to justify instrumental, material aspects.

Pathocentric viewpoints as demarcation of social value shifts

Manfredo (2008) analysed the belief systems of people in the context of different wildlife value orientations. People who use wildlife like in hunting or fishing will “find justification for treatment of wildlife in utilitarian terms.” Examples have been given in the above paragraphs on the instrumental and intrinsic values of fishing. The most basic justification in the case of recreational fishing is usually straightforward: the catch is eaten. The situation may be different if one sees recreational catch-and-release as playing with fish for no good reason (Aas et al. 2002). However, even if the catch is retained for consumption, recreational fishing maybe seen by an increasing number of ethicists and members of society as morally wrong because the fish is said to suffer for an insufficiently important reason – to fuel the fun of the angler (de Leeuw 1996). This anti-fishing view has gained increasing support in the last 30 or so years – at least in influential academic circles among some bioethicists. Some protagonists even demand a complete ban of all fishing (see review in Arlinghaus et al. 2012). Indeed, practicing voluntary catch-and-release fishing is already banned in Germany and Switzerland because recreational angling is only justified there if it is practiced for food (Arlinghaus 2007). Effectively this means, we have a mandatory catch-and-kill regime in place in Germany and Switzerland, with the exception of undersized or otherwise protected fish. Such policies can only succeed in a public climate that has changed from morally putting humans in the centre of concern towards a perspective heavily emphasizing the well-being of individual animals, while down weighing the benefits realized by recreational fishing to individuals or
society. Clearly, this is an extreme example that has not gained global traction, but it is useful to revisit the underlying moral argument. The supporting philosophies centering around the well-being of individual animals can be grouped into animal welfare, animal liberation and animal rights perspectives (Arlinghaus et al. 2012).

*Animal welfare.* —

Generally speaking, animal welfare allows the use of animals including fish for the benefit of people under certain conditions such as minimizing the harm to the individual animal. Animal welfare does not stand for a philosophical theory or doctrine but for a historically evolved concept tight to economic development and cultural values of societies. Animal welfare was not always called animal welfare. In Britain and elsewhere, the beginnings of animal welfare focused on protection against or prevention of cruelty to animals. The famous Martin’s Act of 1822 – the first animal welfare law globally – ran under the heading of “An act to Prevent the Cruel and Improper Treatment of Cattle”. The extended law of 1911 was called Protection of Animals Act and only the contemporary version of 2007 is called the Animal Welfare Act in the UK. The shift in language is of great significance because welfare implies positive promotion and therefore, (scientific) knowledge of what benefits fish. Without science, welfare policies cannot be put in place.

The animal welfare perspective is, perhaps surprisingly, anthropocentric (Evans 2005) because it assumes that the ethical culture of human beings has no meaning for animals and plants. It is therefore, impossible for non-human life to participate in the ethical culture of human beings. This, however, does not mean that humans have no obligations to animals or plants. The sources of these obligations can vary considerably and overlap: tradition is one angle, others include: compassion, religion, utility, aesthetics, preferences and law. In contemporary animal welfare considerations, animal suffering plays an important part but it is not the entire picture. Strictly speaking, it does not matter for animal welfare whether or not an animal is capable of suffering or particularly clever or both; animal welfare concerns all animals and their health and well-being (Arlinghaus et al. 2009). Recreational fishing is seen as a legitimate pursuit provided due account is taken to minimize negative impacts on the welfare
of fish or other aquatic organisms. Measures taken by anglers or managers from a welfare perspective range from the choice of tackle through the proper handling of the catch (Cooke and Sneddon 2007). Ideally, fish welfare measures for recreational fishing are science-based and based on objective measures of impaired well-being (Arlinghaus et al. 2009). Animal welfare is, as defined here, not as an anti-fishing philosophy, and not as promoting any particular form of recreational angling: both catch-and-release and catch-and-kill is accepted provided due concern for the health and well-being of fish is implemented and actions are taken to reduce the potential for pain, suffering or stress during and after capture (Arlinghaus and Schwab 2011). This perspective appeals to common sense, although one is surprised how variable angler behaviour is across the world, for example, in relation to the killing process after capture.

Animal Liberation. —

The concept of animal liberation is different from welfare. Singer (1990) is often hailed as the father of animal rights but he did not believe in rights at all. At the heart of animal liberation philosophy is the individual’s ability to feel pain and suffer. Animal liberation is a utilitarian philosophy in the sense that all ethical thinking is determined by pain and pleasure and the relative presence and absence of it. Animal liberation rests essentially on three pillars:

- If a being is capable of suffering it has interests.

Equal suffering means equal interests and equal consideration. The corollary is if something does not suffer, it has no interests. That in turn means that there is no moral status for the “something”, be it a stone or a fish. If it doesn’t suffer it doesn’t matter morally speaking.

- Speciesism is defined as a “prejudice or attitude of bias in favour of the interests of members of one’s own species and against those of members of other species.”
Like racism and sexism speciesism is seen as a social evil. Animal liberation sees itself as part of social reform and moral progress.

- Utilitarian calculus: actions are right or wrong in proportion to their producing pleasure (happiness) or pain (suffering).

This means only the consequences of an action are morally relevant. This is the reason why utilitarianism is also called consequentialism. Moreover, it means that a *sine quan non* condition for animal liberation is the animal’s ability to feel pain and suffer – both issues that are contentious in the fish literature (pro pain, Braithwaite 2010, Sneddon et al. 2014; critical of fish pain, Rose et al. 2014, Key 2015). Without suffering, animal liberation ideas would not be applicable to fishes. A convenient short-cut in certain circles is then the benefit of the doubt: even if there is doubt if fish are capable of a subjective experience, we provide them with the benefit of the doubt and treat them as if they were sentient and capable of feeling pain (Sneddon 2006). And, in turn, fish fall under animal liberation thinking and ethics.

What does animal liberation mean for recreational fishing? Assuming that fish targeted by anglers are capable of suffering, they have interests. No great deal of utilitarian imagination and calculation is required to construe the sum of pain (suffering) produced by fishing as greater than the sum of pleasure (happiness) because recreational angling is often perceived as not essential for survival of the human being and thus as (largely) unnecessary. Recreational fishing then violates the interests of the fish and the pleasure of the angler is outweighed by the presumed infliction of pain on the side of the targeted fish. However, this anti-angling outcome is not a panacea. Theoretically, utilitarianism opens a door because depending on how you weigh the different elements in the utilitarian calculus, the outcome might favour recreational angling. For example, one could say that recreational fishing provides so many economic benefits to society that the infliction of pain is considered acceptable. In reality, however, the animal liberation perspective is ideologically driven by those that subscribe to it, and the presumed fish pain in practice regularly outweighs the pleasure of the angler and the generation of other socio-cultural and socio-economic benefits produced by recreational
fishing. For example, after examining the evidence for pain and suffering in fish and concluding that fish probably can experience these mental states, the German animal behavior scientist Würbel (2007) stated that whether angling as an activity conducted for pleasure is to be further tolerated must be renegotiated. The Brazilian fish biologist Volpato (2009) expressed the resulting conclusion more explicitly by saying that “the imposition of discomfort in activities solely for human pleasure (e.g., recreational fishing and aquarism) is unacceptable”, and Webster (2005) also judged that a catch-and-release event would traumatize an individual fish to such a degree that for fish welfare reasons it would be better to kill the fish rather than to reserve its life by releasing it. Accordingly, some popular angling practices, such as catch-and-release, or the activity as a whole may well be banned. In a nutshell, that is a common position of animal liberation supporters, particularly a few vocal animal ethicists, and the usual stance taken by its supporters. Thus, animal liberation constitutes anti-angling philosophy that is popular in pro-animal activist groups such as People for the Ethical Treatment of Animals (PETA). Animal liberation philosophy is also deeply embedded in propositions of several Animal Protection/Welfare Acts and has had substantial influence on constraints and bans induced towards once popular angling practices in countries such as Germany or Switzerland (Arlinghaus et al. 2012).

*Animal rights.* —

The other influential animal-rights philosopher and philosophical antipode of Peter Singer is Tom Regan. His seminal “The Case for Animal Rights” was first published in 1983 (Regan 1983). While Peter Singer uses the idea of rights rhetorically, animal rights is the central concept for Tom Regan. How do animals get their rights? Regan distinguishes between “moral agents” and “moral patients”. The paradigmatic moral agent is a normal human adult capable of deliberating his or her actions. The corresponding moral patient is incapable of making deliberations about his or her actions: the paradigmatic moral patients are mammals older than one year and human babies. Moral agents and moral patients seem worlds apart but the common feature that they share is that they are all, in Regan’s term, “subjects-of-a-life”. Subjects-of-a-life are those organisms that fulfil certain criteria such as the capacity to believe
and desire, perception, memory, a sense of the future, ability to experience and an ability to pursue individual welfare. The subject-of-a-life criterion demarcates the border between organisms or objects like plants or stones which are neither moral agents nor moral patients. Having thus, set the scene, Regan postulates that all subjects-of-a-life have equal inherent value (it does not come in degrees). According to Regan, this inherent value confers on moral agents and moral patients alike the right to respectful treatment. Respectful treatment in turn means the right not to be harmed. Rights in Regan’s parlance always refers to individual rights. Like the animal liberation perspective this seems to close the door on all meaningful ecological thinking: a habitat or a shoal of fish can be no right holder, only an individual being can.

Regan was not sure whether fish are “subjects-of-a-life”, and thus, in the category of moral patients. Nevertheless, recreational fishing is out of the question: “Even assuming birds and fish are not subjects-of-a-life, to allow their recreational or economic exploitation is to encourage habits and practices that lead to the violation of the rights of animals who are subjects-of-a-life” (Regan 1983). The full implications of Regan’s view take shape in the following passage: “the goal of wildlife management should be to defend wild animals in possession of their rights, providing them with the opportunity to live their own life, by their own lights, as best as they can, spared by that human predation that goes by the name of ‘sport’. We owe this to wild animals, not out of kindness, nor because we are against cruelty, but out of respect for their rights” (Regan 1983). Thus, in animal rights ideology, recreational fishing is out of the question (Arlinghaus and Schwab 2011).

<B> Biocentrism as moderator among populations/habitats and human impacts

A further and final challenge to recreational fishing emerges from biocentric and ecocentric viewpoints assuming that recreational fishing negatively impacts populations and ecosystems and more general the natural world. We will confine our analysis to biocentrism as it is more prominent. Biocentrism does not put pain or suffering of animals in its core of moral consideration, but instead focusing on natural processes, species, populations, communities and natural habitats. In much of the biocentric and ecocentric philosophical literature, humans
and nature are treated as opposites, and humans are seen as a non-natural disturbance to the ideal, which is wilderness unaffected by humans (Arlinghaus and Schwab 2011). While this perspective is counterproductive to effectively dealing with the pressing environmental problems that the world faces (because it divorces humans and their needs from the place which they intend to preserve), it is nevertheless, a prominent one in certain circles. When humans generally are seen as a largely destructive external force to the ideal (i.e. human-free nature), the recreational fisher in particular will be seen as a destructive force (i.e. a disturbance to nature). De Leeuw (2012) is key reading in this context. In this light, recreational fishing and its practices such as stocking may be perceived as destroying valuable properties of wilderness such as native fish populations and the gene pool of autochthonous species (Lorenzen et al. 2012). Some biocentric stakeholders might even object to the mere presence of anglers at the waterside on the grounds that waterfowl or other wildlife might be disturbed and shorelines trampled on and littered, which clearly is an undesirable component of human presence on earth, and recreational fishers are no exception (Lewin et al. 2006). This is reflected in trends among some conservation biologists and conservation-oriented non-governmental organizations to opt for policies that exclude recreational fishers from habitats and landscapes perceived to be particularly valuable in ecological terms. Note, that here the ethical disapproval of recreational fishing is based not on the presumed impact of angling on an individual fish but rather on the assumption that humans in general, and recreational fishers in particular, can be a threat and an undesirable disturbance to wilderness as indexed by impacts on habitats or endangered species.

To sort this ethical clash, one can break down the largely artificial barrier between humans and nature, or between culture and nature, and look at recreational fisheries as coupled social-ecological systems (Arlinghaus et al. 2017). Then, it becomes clear that recreational fishing can be relatively easily reconciled with the wilderness-centred ethical perspective (Zwirn et al. 2005). Clearly, recreational angling does, and necessarily will to some degree, impact natural processes, from harvesting, littering, and illegal introduction of fish actions (Lewin et al. 2006). However, to deal with these actions requires better management, better compliance and better education of recreational fishers. Therefore, resolving these
issues does not require the abolition of recreational fishing. Moreover, recreational fishers are among the most important social groups working voluntarily and often very effectively to preserve and restore fish and their habitats (Granek et al. 2008). They are also ardent advocates of the hidden fish biodiversity crises in many areas of the world (Granek et al. 2008). Thus, to reconcile wilderness-centred philosophies with contemporary recreational fisheries mainly requires jettisoning the idea of the angler or any recreational fisher as a non-natural disturbance and working towards the development of sustainable fisheries management strategies. Recreational fishing can be constructed as a natural predator-prey interaction between a human and a fish, with potential impacts on the biotic integrity of an exploited fish population or the aquatic ecosystem. Nonetheless, if recreational fishing is believed to impact the biotic integrity of a population, it might be judged as impermissible by Leopold (1970). This would call for improved management to contain or remove negative impacts in such a way that the provision of ecological services provided by fish and aquatic ecosystems to society is sustainable (Carpenter et al. 2017). Thus, in contrast to popular perceptions of some conservation-focused stakeholders, wilderness-centred philosophy can fairly easily come to terms with recreational fishing (Arlinghaus and Schwab 2011).

To conclude this section: recreational fishing and its management will see substantial and continued public support in societies and countries that emphasize anthropocentric and particularly utilitarian world-views. The situation is less clear when cultural value shifts perspectives of a sizable fraction of society towards pathocentric and biocentric worldviews (Inglehardt 1990; Schwartz 2014). Recreational fishing can then be seen as interfering with the welfare of individual fishes of high moral concern (pathocentric viewpoint) or with natural habitats and populations or threatened species (biocentric viewpoints). Often, these perspectives are correlated. However, there is little cross-cultural studies that have carefully elaborated if and how cultural value shifts affect recreational fishing or its practices. What is more certain is that biodiversity conservation concerns are now prevalent in many developed and urbanized societies (Fig. 1), and these concerns have substantially altered the perspectives on fish introductions and fish stocking (Rahel 2016). This is also a consequence of biocentric value shifts affecting and driving conservation regulations as well as those people that today
enter fisheries and other university programs to later become aquatic ecosystem or fisheries managers. Accordingly, in many countries recreational fishing is coming under increasing scrutiny for reasons of biodiversity and natural habitat conservation, and regulations on recreational fishing mortality and other tools are now commonplace across the world. One visible trend, and a preferred policy by conservationists, is an increasing reliance on protected area management where people demand or implement severe bans on access to fishers, including recreational fishers, in an attempt to “save nature” from the human disturbance (Arlinghaus 2006b; Roberts et al. 2017). Despite this clearly visible trend of biocentric values and attitudes affecting recreational fisheries, different societies differ starkly in the degree to which pathocentrism and biocentrism has entered the policy calculus regarding fisheries. We will thus, in the final section review of social standing of recreational fishing in various countries of the world.

Public attitudes towards and trends in recreational fisheries across the world

While most, if not all, industrialized countries now place large importance on maintaining and fostering biodiversity and in this context see activities increasingly critical that harm species diversity or genetic diversity, societies differ more in terms of the rigorous application of animal rights/liberation/welfare ideas towards recreational fishing. A good indication about the status quo is a review about the societal embedding of recreational fishing and the public attitudes towards this practice in various parts of the world.

North America. —

In Canada and the United States, recreational fisheries are very popular, particularly in the USA. Resident fishing dominates both economically and in terms of attention over non-resident fishing. In the latest national survey, it was estimated that 36 million resident Americans over 16 years participated in recreational fishing in the US resulting in about 460 million fishing days and over $46 billion in expenditures (US DOI 2017). In Canada in 2010, the
estimated 3.2 million resident anglers fished for more than 40 million days and contributed to over $2.5 billion spent by anglers on fishing in Canada (Fisheries and Oceans Canada 2012).

Information about recreational fishing for North American countries other than Canada and the United States is scant. In fact, only little information about angling focuses on non-residents. For example, the almost 87,000 tourist anglers in Panama in 2011 were estimated to have spent $97 million on fishing in Panama with an average trip duration of about 8 days (Southwick et al. 2013). Similar attempts to characterize the importance of recreational fishing tourism exist for Costa Rica, Belize, and Mexico. We know that recreational fishing matters to governments and people within these countries because recreational fishing promotes tourism and expenditures that impact local and regional economies.

Non-resident fishing in Canada and the United States is also important, but not to the same level as for other North American countries. Non-resident fishing results in economic benefits accruing to mountain, southeast, northeast, and Laurentian Great Lakes US states (Ditton et al. 2002). Also in Canada, over 400,000 non-residents from primarily the US provide significant contributions to provincial economies (Fisheries and Oceans Canada 2012).

Attitudes towards recreational fishing suggest that the activity represents a highly legitimate form of recreation among most people in North America (Duda et al. 1995; Arlinghaus et al. 2012). The activity remains visible in public and political discourse and is regularly featured in the media. It therefore, comes as no surprise that about 90% of Americans approve of legal fishing and support using fish for food (Driscoll 1995; Duda et al. 1995; Phillips and McCulloch 2005). Some variation in public support exists across states. In a study of wildlife value orientations by the public in 6 western states (Alaska, North Dakota, South Dakota, Idaho, Arizona, and Colorado), Manfredo et al. (2003; summarized in Arlinghaus et al. 2012) found that >96% of the public agreed that recreational fishing for food is acceptable. However, opinions changed when the focus was on recreational fishing for sport. While in the less urbanized states of Alaska, North Dakota, South Dakota and Idaho about 20% of the public agreed that angling for sport is cruel, slightly higher percentages (25-30%) were documented for the more urbanized states of Colorado and Arizona (Arlinghaus et al. 2012). These results suggest that in at least some states in the U.S., there is a sizable segment of the public that holds negative
attitudes towards recreational fishing on moral grounds if the activity is not about food and practiced “just for sport”. However, these perspectives have not gained relevant policy support and have not led to constraining regulations on welfare grounds, although the reported levels of critical sentiment against specific forms of angling are consistent with those reported in other post-industrialized countries such as Germany where stringent regulations on recreational fishing have been enacted (Arlinghaus et al. 2012). One possible reason is that the basal cultural value mindset in the USA is about individualism and mastery and much less about egalitarianism, and it is the latter cultural value that is conducive to enactment of strict pro-environmental and pro-animal welfare policies (Schwartz 2014). Similarly, in Canada, in a survey of the importance of nature to Canadians (Federal, Provincial, and Territorial Governments of Canada 2014), only 3% of Canadian adults identified ethical concerns such as not wanting to harm fish as a reason for their decision not to participate in recreational fishing.

In the USA and Canada, angling has been identified as a contributor to fish population declines (Post et al. 2002; Coleman et al. 2004), and other conservation issues are on the agenda of environmental and fisheries managers such as introduction of non-native fishes (Johnson et al. 2009). Accordingly, there is active management of recreational fisheries impacts and biodiversity conservation is now an important goal (Rahel 2016). Importantly, catch-and-release, both mandatory and voluntary, is permitted and voluntary catch-and-release is actively encouraged to enable conservation-minded anglers to limit harvest of fish stocks (Arlinghaus et al. 2007b). There is thus, no similar impact of animal liberation and rights philosophy on recreational fisheries as for example in central Europe (particularly Germany and Switzerland). In fact, for some fisheries like largemouth bass (*Micropterus salmoides*) in the United States, voluntary catch-and-release fishing has become increasingly common among anglers and is reaching close to 100% participation (Myers et al. 2008), without causing any form of public reaction. The same holds for competitive fishing, which is actively promoted and highly visible in the mass media in the USA, but is prohibited in Germany (Arlinghaus et al. 2012).

*South America.* —
The information base for recreational fisheries in South America is scarce and broad-spanning surveys about how the public views recreational fisheries are largely lacking. One reason for this gap in knowledge is that recreational fisheries have only recently become a relevant activity in South America where subsistence and commercial fishing are more common. Recreational fisheries are now developed in marine and freshwater systems and includes both native and introduced fishes. The most important recreational fishing in marine environments occurs around the tropics in Ecuador, Colombia, Venezuela, Brazil and northern Argentina. Inland recreational fisheries are concentrated around both the large rivers systems (e.g., Amazon, Parana, Orinoco) and the cold-waters surrounding the Andes Mountains Range and the southern part of the continent. Although there is an extensive range and high number of species used for recreational fisheries throughout the continent, there is a lack of statistics with only few regional assessments about the economic importance of recreational fisheries (Valbo-Jørgensen et al. 2008; Freire et al. 2016). For example, in Brazil around 370,000 angling licenses were granted in 2014, but the total number of anglers may be around 10 million (Freire et al. 2012).

In Brazil, it is estimated that revenues from recreational fisheries represent more than USD 400 million (FAO 1998). In inland fisheries, the benefits from recreational fisheries in Brazil are controlled by well-established business that often do not include the participation of local communities (Valbo-Jørgensen et al. 2008). In Paraguay, the importance of recreational fisheries from the Parana River is estimated to be between 5 and 7 million USD per year (Insaurralde and Balbuena 2001). In Argentina, it is estimated that recreational fisheries result in more than USD 100 million per year with the north east region as the most important with dorado (*Salminus spp.*) and surubi (*Pseudoplatystoma spp.*) as the focal species (FAO 2018). Around the tropics, in Brazil and Venezuela, marlins and sailfish have been valuable recreational fisheries resource for a long time (Machado and Jaen 1982; Barroso 2002), and they have been experiencing protection by mandatory and voluntary catch-and-release in the last year. Today, the economic value of recreational fisheries on billfishes is larger than the value in the commercial sector (FAO 2016). Even though recreational fisheries are practiced in Colombia, few studies have been conducted (Alió 2012). The same holds true for Ecuador, where anglers
target mainly marlins, sailfish, wahoo, tunas, and dolphinfish, and total catches from marine recreational fisheries may add to only 0.5-1.0% of all marine catches (Alava et al. 2015).

Introductions of non-native salmonids to South America for recreational fishing purposes began in the early 1850s (MacCrimmon and Campbell 1969). Local governments (Macchi et al. 2008; Arismendi et al. 2014) and illegal stocking efforts continue to support this recreational fishery across the continent. In southern South America, the recreational fishery of salmonids generates revenues for local communities and in some cases international operators (e.g., Vigliano et al. 2000; Macchi et al. 2005; Arismendi and Nahuelhual 2007; Núñez and Niklitschek 2010). In many cases, local people feel connected to introduced salmonids because they have been present in local rivers for over a century, and thus, stories about them have already been passed down for generations (Arismendi et al. 2014; Aigo and Ladio 2016). This makes it difficult to discuss biodiversity issues associated with non-natives, and it is complicated by salmonids providing subsistence fishing opportunities for local communities throughout the continent. In Argentina (Vigliano et al. 2000; Macchi et al. 2005) and Chile (Arismendi and Nahuelhual 2007; Núñez and Niklitschek 2010), recreational fisheries have grown and regulations have been put in place to protect and regularly stock non-native salmonids. During the most recent decades, however, there has been a shift from the promotion of salmonid introductions to a more conscientious view of native ecosystems and their conservation value, supporting a more biocentric view of the public and of legislators and researchers/managers. Currently, managers and policy makers are facing a dilemma of conflicting interests, which implies maintaining self-sustaining trout populations for recreational purposes while minimizing environmental impacts, but also upholding the socio-economic benefit of recreational fisheries for local communities. Similar issues associated with introductions and translocations (originally for recreational fisheries or not) have also been present in Brazil in relation to other species, e.g., *Cichla* spp. (locally known as tucunaré) (Latini and Petreri 2004; Bispo et al. 2016).

While biocentrism is beginning to affect recreational fisheries in South America, pathocentrism and the related animal liberation and rights debates are basically absent from the public discourse across both Brazil and Argentina. Recreational fisheries are growing without significant public opposition, but they are still poorly developed and lack dedicated
research and management attention across much of South America. Fishing competitive events are commonly promoted in Venezuela (Machado and Jaen 1982), Brazil (Freire et al. 2016) and Argentina (see, e.g., Dellacasa and Braccini 2016). Voluntary and mandatory catch-and-release is widely spread in Brazil (Freire et al. 2016). There, even though there is no formal study on the acceptance of recreational fisheries by the general public, some internal conflicts have been observed between catch-and-releasers and harvested-oriented recreational fishers, particularly those practicing spearfishing.

Northern Europe. —

The countries of Northern Europe, the Nordic region, consists of Denmark, Finland, Iceland, Norway and Sweden. The region in characterised by social and economically highly developed countries, scoring high on international welfare and quality of life scales, together with other countries in Western Europe. However, unlike more densely populated European countries, the inhabitants in the Nordic countries also have access to relatively rich aquatic and marine environments given the overall low population density coupled with a high availability of water and coastline. Fishing is very popular and participation rates range among the highest in the world, particularly in Norway and Finland (Fig. 2). Note, that most of the recreational fishing in Nordic countries is conducted with rods and/or lines, but all countries also allow recreational fishing with nets and traps, at least in certain areas, for defined species and depending on local rights to fishing.

Participation in recreational fishing is high in all countries in the region. Between one of five and one of two residents reported that they participated in recreational fishing at least once during the last 12 months (Table 1). The trend in participation is generally slightly decreasing or stable. While significant lower participation is reported for younger adults in several countries, this is partly compensated for by an increase among older people (Odden 2008).

TABLE 1. — Overview about participation in recreational fishing in selected Scandinavian countries.
There exist no general and systematic measurement of public attitudes towards recreational fishing. Due to the high participation level and in light of some sparse data from Finland, Norway and Sweden, the activity is however most likely strongly supported among the public. In all Scandinavian countries the question of fish pain and fish welfare is discussed at academic levels and in selected agencies, and there have been debates on the appropriateness of using catch-and-release as a management tool in fish stock conservation (Olaussen 2016; Ferter et al. in press). There is also generally a high premium placed on biodiversity conservation, which affects discussions surrounding stocking or the escapes of fish from aquaculture.

<table>
<thead>
<tr>
<th>Country</th>
<th>Participation rate (year)</th>
<th>Age groups</th>
<th>Participant numbers</th>
<th>Trend</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>13.6 % (2010)</td>
<td>16-74 years</td>
<td>530 000</td>
<td>Unknown</td>
<td>Sparrevoehn et al. 2011</td>
</tr>
<tr>
<td>Finland</td>
<td>28 % (2016)</td>
<td>Complete population</td>
<td>1 500 000</td>
<td>Negative, primarily for teenagers and young adults</td>
<td>Natural Resources Institute Finland, 2018</td>
</tr>
<tr>
<td>Norway</td>
<td>42 % (2017)</td>
<td>16 – 74 years</td>
<td></td>
<td>Negative, primarily for teenagers and young adults</td>
<td>SSB (Statistics Norway 2017)</td>
</tr>
<tr>
<td>Sweden</td>
<td>1 400 000 (2016)</td>
<td>16 – 80 years</td>
<td>1 400 000</td>
<td>Stable</td>
<td>SCB (Statistics Sweden 2016)</td>
</tr>
</tbody>
</table>

1 https://www.ssb.no/en
2 http://www.scb.se/en/
**Sweden:** Kagervall (2014) reported on the attitudes towards recreational fishing among a random sample (N=1067) of the general population of Swedes aged 16-65. Attitudes towards recreational fishing in general, if the catch is used for consumption, if released and if recreational fishing was with gill-nets was measured. Generally, there was strong support for recreational fishing among Swedes, however, support was highest if the catch was utilised and lowest if fish were caught with gill-nets.

**Norway:** In Norway, a national non-governmental organization engaged in outdoor recreation runs a poll among a representative sample of Norwegians aged 15 years and older every third year (Kantar/TNS 2017). The initial polls included a question about the publics’ general attitudes towards recreational fishing. Because almost all respondents reported a positive attitude towards recreational fishing (the poll also measures attitudes towards hunting, and three of four Norwegians report a positive attitude towards hunting as well), the question was replaced by a question about the attitude towards catch-and-release. The last decade has shown a stable pattern where 50% of Norwegians hold a positive attitude towards the practice, while somewhat fewer are against it (1 of 10 has no opinion). Support for catch-and-release has increased compared to the previous decade. Younger males are those most positive towards catch-and-release. In freshwater, among specialized anglers, the practice of catch-and-release has grown rapidly such as for Atlantic salmon angling during the last decade (Stensland et al. 2017), but there are also studies that show that the utility to some anglers could drop with the implementation of mandatory catch-and-release in some salmon rivers (Olaussen 2016). This typifies the typical tension among specialized anglers and more harvest oriented fishers seen in many areas of the world (Øian et al. 2017).

**Finland:** In Finland, one survey by Sievänen and Neuvonen (2011) showed that as many as 88% of the Finns report that they have fishing skills. The main debate concerning recreational fishing in Finland has dealt with ethical issues, especially voluntary catch-and-release practices, which have become popular among certain fisher groups and, on the other hand, are unacceptable to a substantial number of Finns (Salmi and Ratamäki 2011). Mikkola and Yrjölä (2003) conducted a survey of 2371 Finnish residents, of which 43% were anglers. About 50% of all respondents, as well as half of all non-angling recreational fishers (i.e., those
employing gill nets rather than rod-and-reel) included in the sample, believed that catch-and-release constitutes unnecessary harassment of fish, and 20% of all recreational anglers responding to the survey thought that voluntary catch-and-release of legally harvestable fish should be forbidden (Mikkola and Yrjölä 2003). About half of all non-angling fishers thought that banning of catch-and-release should be pursued. This negative image of voluntary catch-and-release fishing probably reflects the tradition of Finnish people to practice subsistence-type fishing. Indeed, voluntarily release of some fish is only occasionally practiced by 30% of Finnish anglers, and only 4% release all the fish they capture (total catch-and-release).

From the above data and summary, the North European region has a strong, generally positive view of recreational fishing, assessing it as a social activity that should be encouraged. One reason is that all countries have strong historic and cultural ties with fisheries. Compared with many other regions of the world, the region also has a relatively strong resource situation, with access to diverse marine and freshwater fisheries. The clearly dominating perspective is the utilitarian view coupled with conservation concerns, where both food, economic income (most Nordic countries have active strategies for promoting tourism fishing) as well as other psychosocial benefits are recognized. That said voluntary catch-and-release fishing is today ethically debated in Finland and only locally in Norway and Denmark, and biodiversity conservation concerns is generally well developed and guiding management responses in recreational fisheries.

**Central Europe.** —

The central European countries are all highly urbanized and industrialized and as such offer high population densities and comparatively low angling participation rates. Those rates are generally below 8% of the population in countries such as France, Germany, Austria and the UK. Recreational fishing has a very long history particularly in the UK, and its social and economic importance is well documented based on repeated surveys done in all countries (e.g., Arlinghaus 2004).

**Austria:** Kohl (2000) surveyed 722 randomly selected non-anglers by telephone about their attitudes toward various aspects of recreational fishing. A majority (>50%) of respondents
agreed that recreational fishing is a reasonable and healthy leisure activity providing important contributions to the conservation of aquatic ecosystems. However, it is noteworthy that about a fifth (22%) of respondents agreed with the statement that “recreational fishing constitutes cruelty to animals”. Similarly, about 20% of all non-anglers surveyed thought that recreational fishing disturbs the ecological balance and that recreational fishers do not care enough about nature and are only interested in abundant fish harvest.

**Germany:** Germany is a particularly interesting case because, as compared to other nations worldwide, anti-angling regulations are probably most pervasive and restrictive to recreational fishing (Aas et al. 2002). There are two studies from two recent time periods (2002, 2008) looking at how the German public feels about recreational fishing. In 2002, 57% of a random sample of 323 telephone-interviewed people agreed that recreational fishing is a reasonable leisure activity, while 21% disagreed (Arlinghaus 2004). In 2008, the percentage of people agreeing with the idea that recreational fishing is a reasonable activity was much lower (35%) in a study involving face-to-face interviews of over 1000 randomly-selected German residents (Riepe and Arlinghaus 2014). Two different methods were used and hence it is hard to directly compare both figures, but they could suggest a drop in social acceptability of recreational fisheries. However, in 2002, 26% of the public indicated that recreational fishing should be constrained in its scope, and 27% felt that recreational fishing is unnecessary cruelty to animals (Arlinghaus 2004). Figures from 2008 mirrored these findings (Riepe and Arlinghaus 2014). For example, 25% agreed with the statement that “catching fish as a pastime is cruel”, and 35% agreed with the statement that “fish are suffering unnecessarily due to recreational anglers”. Similarly, 35% agreed that “it constitutes unnecessary cruelty to animals when catching and releasing fish during recreational fishing”. Almost one-fifth of the German public (19%) agreed with the statement that “recreational fishing shall be abolished because of the cruelty to animals exerted by anglers”, and a sizable percentage (15%) indicated they would take part in a ballot initiative banning recreational fishing. Also, 39% of those surveyed thought that animal welfare aspects of recreational fishing do not receive sufficient public attention, and 26% felt that there is a pressing need to improve issues of animal welfare in Germany despite recreational fishing being already heavily constrained and regulated for animal welfare.
reasons (Arlinghaus 2007). Put differently, all of these values still indicate that the absolute or relative majority of the German public does not associate recreational fisheries with cruelty to animals and generally consider the activity as reasonable and useful.

The 2008 study by Riepe and Arlinghaus (2014) also showed interesting patterns about the perceived morality of selected recreational fishing practices. Most people (61%) found recreational fishing with the intention to eat fish morally acceptable (the corresponding figures in the US are beyond 95% (Arlinghaus et al. 2012), but 10% found catch-and-eat fishing to be immoral. The majority of the public was surprisingly aware of many of the practices associated with recreational fishing that are critically discussed from a welfare perspective, such as live bait use, tournament fishing and voluntary catch-and-release. When asked about the morality of each of these practices from a fish welfare perspective, perceptions varied depending on what angling practice was under consideration. While only about 20-30% of the public regarded retention of fish in keep-nets, stocking of harvestable fish into a water body to be immediately captured by anglers (put-and-take fishing) and voluntary catch-and-release of harvestable fish as immoral, the respective figures were 57% for use of live baitfish, 65% for non-harvest-oriented competitive fishing events and 87% for a killing process of fish by hypoxia (rather than rapid kill, see Davie and Kopf 2006).

The public was also asked as part of the 2008 survey to evaluate various types of catch-and-release practices. 21% of those surveyed considered selective harvest with voluntary catch-and-release to be immoral, and 40% felt that total catch-and-release was unethical. Alternatively viewed, the majority or relative majority had no issues with voluntary or even with total catch-and-release. Results as a whole showed that recreational fishing, along with some of its practices, is critically viewed by a sizable fraction of German society, but that this fraction is usually far away from a majority vote. Thus, in general the majority of people in Germany positively associate with recreational fishing and approve most of its practices or are indifferent, with some clear exceptions (e.g., competitive fishing, use of live baitfish, death by hypoxia). Importantly, voluntary catch-and-release – a practice implicitly banned in Germany (Arlinghaus 2007) – is not seen negatively by a majority of the German public. This clearly
indicates that other mechanisms must affect the institution of stringent fish welfare policies by decision-makers than the public’s view about an issue.

In terms of the accepted benefits of recreational fishing, the majority of the public perceived fishing to provide social and psychological benefits. However, only one third of the public accepted that angling produced economic benefits (Riepe and Arlinghaus 2014). Similarly, the public was largely split on the question on whether recreational angling positively contributes to conservation. When asking for the morally accepted reasons for fishing, ecological reasons (fishing to re-establish an ecological balance) received greater support than fishing for food. Importantly, when trading off nature conservation with maintaining access to angler, a majority would vote for nature protection and against access to recreational fishing (Riepe and Arlinghaus 2014), clearly identifying a biocentric worldview trading off conservation against human use of aquatic ecosystems for fishing in favour of conservation.

In summary, a relative majority of Germans holds positive views towards recreational fishing. But nature conservation and animal welfare topics feature prominently in the public discourse (in particular, the fish pain issue regularly featured in mass media and TV documentaries), and about a fifth of the public held a decisively negative attitude to recreational angling. This involves many million people that exert considerable influence on national-level policy making through lobby groups, particularly in environmental ministries but also in ministries on consumer protection and animal welfare. Importantly, although in a minority, those that care for animals manage to organize and influence policies, while the majority has no interest in active lobbying pro-fishing. Critical perspectives towards the use of animals are particularly well developed in the Green Party, and whenever the Green Party or the Social Democrats enter into force, one can see important constraints on recreational fisheries being implemented for nature conservation or fish welfare reasons. On top of it, there is no national policy to support recreational fishing, and the angler lobby groups are rather weakly organized in a decentralized fashion (Daedlow et al. 2011). The result is that whenever recreational fishing is mentioned by high level policy makers or in policy documents, it is usually mentioned through their negative impacts on ecological processes or due to fish welfare concerns. This is for example the case in the current negotiation agreement of the big coalition.
where constraining recreational fishing for nature conservation reasons in the Natura 2000 networks is expressed as a relevant policy goal for the next regulatory phase.

England and Wales: In England and Wales, public attitudes toward recreational fishing have been regularly monitored with randomly-administered telephone surveys to several thousand people. Simpson and Mawle (2005) compared surveys from three time periods (2005, 2001, and 1997), and results are presented in brackets from latest to earliest date below. They found that, across all time periods, most people viewed recreational fishing positively. For example, over the time periods between 71% and 75% of respondents agreed with the statement that ‘angling is an acceptable pastime’. Close to a majority (between 46 and 54%) agreed with the statement that ‘anglers care for the environment’. There was less certainty among the public about whether ‘angling is a cruel pastime’. About one quarter of respondents (24% to 27%) agreed with this statement, while nearly half (47% to 52%) of respondents disagreed.

Research on the public perception of angling was repeated in 2010 (Simpson and Mawle 2010). The key results was an improvement of the public perception and overall large public support of angling, may also be caused by the continued release of national policies by the government to support recreational fisheries (https://www.gov.uk/government/publications/2010-to-2015-government-policy-freshwater-fisheries/2010-to-2015-government-policy-freshwater-fisheries). In 2010 most people continued to view angling positively (results in brackets are the 2005 percentages). 74% (71%) agreed with the statement that ‘Angling is an acceptable pastime’, while only 7% (8%) disagreed. In 2010 attitudes toward angling were significantly more positive than in 2005. 51% (53%) agreed with the statement that ‘Anglers care for the environment’; 9% (14%) disagreed. There had been a significant change between 2005 and 2010, in particular a decline in those who disagreed, showing that perceptions became more positive. With regard to the statement ‘Angling is a cruel pastime’, 20% (24%) agreed, while 52% (47%) disagreed and 26% (26%) neither agreed nor disagreed. The change between 2005 and 2010 was statistically significant. Thus, in 2010 angling was less likely to be seen as cruel. Males were more likely to be positive about angling than were females. Young people (12-16 year olds) also had positive views about
angling in general, although they were somewhat less positive than adults. Perceptions of angling as an ‘OK thing to do’ were more positive in 2010 than 2005.

**Switzerland:** A recent nationwide survey in Switzerland provides insights into the public’s perception of angling (Bieri et al. 2018). A large majority of people (about three quarters) of the Swiss public have a positive attitude towards fishing, but 18% showed a negative or very negative perspective. An overwhelming majority of the public perceived recreational anglers as “lovers of nature” and three quarters agreed or strongly agreed that the fishing is conducted in a fish friendly manner. However, 21% of the Swiss public perceived fishing as cruelty to animals.

**Netherlands:** Angling is conducted by about 8% of the Dutch population and is thus lower than the global average. In 2017, a study was conducted that was focused specifically on the public opinion about angling in the Netherlands (R. Verspui, Dutch Angler Association, personal communication). It included 998 participants, a group that was considered to be demographically representative of the Dutch community. People primarily associated angling spontaneously with fish and technical equipment, and consider it as a boring, but harmless, activity. Only 10% of the respondents were very positive about angling, but this percentage was stable over the past 25 years. The percentage of people that are decidedly negative about angling substantially dropped from 72% in 1994 to a relative minority of 42% in 2017. Thus, the amount of people that were indifferent or don’t have a strong opinion about angling increased.

Overall, the public in central Europe views recreational fisheries positively. However, a sizable fraction of the public is concerned with fishing based on fish welfare concerns, particularly in Germany followed by Switzerland, and to a much lesser degree in the England and Wales. Importantly, however, only Germany and to a lesser degree Switzerland has seen strong regulations of recreational fisheries based on welfare arguments. This clearly indicates that specific contextual conditions of a given country, the particularities of rule-making and the influence of lobby groups and particularly the wider policy support received by recreational fisheries will ultimately decide whether anti-fishing perspectives gain stronger public support. It is apparent that Germany lacks public policies at the national level supporting recreational fisheries and uniquely both strong conservation and fish welfare concerns have influenced
actual policies. We do not see similar trends in the other central European countries for which data are available.

*Eastern Europe.* —

Recreational angling has, for the past few decades, been considered one of the leading forms of outdoor recreation in both Poland and the Czech Republic. However, and despite methodological difficulties that arise when attempting to precisely estimate the number of active anglers, the angling participation has substantially declined over the past 35 years in Poland. The Polish Angling Association (PAA), which remains the largest consumptive user group of inland waters in Poland, boasted a count of over 1 million memberships in the early 1980s; yet the number has since then diminished to roughly 0.63 million. Highly precise data on the status of one of the two largest regional departments of the PAA (Katowice) shows that over the last 22 years the member count has diminished from 58,000 to 43,000 (a decline of 26%). The lake commercial fisheries enterprises have also noted a decline in selling of the more expensive long-term permits for angling in favor of affordable short-term licenses in Poland. The reverse of this trend has been observed in sea waters, wherein the number of anglers has, over the years, shown a steady increase. In Poland, the average age of the angling population has sharply increased – in the 1970s, the most populous age demographic consisted of people between 40-49 years of age (30.2%), whereas the most recent statistic presents seniors above the age of 60 (34.7%), with over 30 years of angling experience (56.6%), as the dominant group.

In the Czech Republic, recreational fishing is considered a very important leisure activity. Fishing has a long and rich tradition, and for many anglers, it is considered to be a key social activity. There are 320,000 registered recreational anglers in the Czech Republic (effective at the end of 2016). That makes 3% of Czech population registered anglers. So far, three socio-economic studies have been conducted on trends in fisheries (in 2003, 2009, and 2017). The studies showed that anglers are usually older men above 40 years (60%), and the majority of anglers (58%) have moderate or low economic status (Czech and Moravian Fishing Union 2003, 2009, 2017).
In Eastern Europe, the two most important factors – the perception of angling by the public and the behavior of anglers were greatly affected by the communist regime and the revolution that brought the regime down in 1990s. Before the revolution, angling was a social activity for masses. Fishing was a very popular activity because many other activities (like travelling to Western Europe) were prohibited. The majority of anglers specialized on intensive fish harvesting, and many anglers considered fishing as a quasi-subsistence activity. After the revolution, the number of anglers strongly decreased, and recreational fishing became more of a true recreational activity. Recently, after the sharp drop resulting from the collapse of the communist regime in the Czech Republic recreational fishing has been on the rise again, and anglers are leaning towards releasing caught fish, particularly the younger anglers (Lyach and Čech 2018). Studies showed that 50% of anglers practice catch-and-release, while only 28% of anglers keep caught fish (Czech and Moravian Fishing Union 2003, 2009, 2017). Many anglers believe that the catch-and-release strategy is the future of recreational fishing and suggest elevated enforcement. The same trend is seen in Poland. Here, voluntary catch-and-release is publicly accepted and generally preferred by anglers, especially by younger people. Over 70% of the angling population declares to often or always release the angled fish.

Recreational angling, and being an angler, is generally considered socially acceptable by the Polish society. Similar to Poland, in the Czech Republic, the perception of anglers by the public is generally positive.

*Southern Europe.* —

Information about participation rates in recreational fisheries in southern Europe countries is scarce and formal reporting is largely absent. Based on fishing licenses, participation rates in the marine recreational fisheries in Spain, Italy, Greece and Malta have been reported to be between the 0.6% and 2.7% (Hyder et al. 2018). However, due to the license system, it is difficult to accurately estimate participation rates as usually marine recreational fisheries involve boat licenses, where the number of recreational fishers is not quantified. In fact, local studies suggest that the participation rate in marine recreational fisheries could reach as much as 10% in certain localities (Morales-Nin et al. 2005; Grau 2008).
There is no formal reporting system regarding participation rates in freshwater recreational fisheries, but the number of licences sold is even higher than for marine recreational fisheries, which suggest that the actual participation rate could be somewhere between 5-10% in countries like Spain and Italy. A recent national telephone survey of the general public in Spain suggested that the participation rate in angling is 7 to 11% of the population, a value close to the participation rates for industrialized countries (Arlinghaus et al. 2015).

A proper quantification of the economic impact of recreational fisheries in southern Europe countries is also lacking, but local studies suggest that the impact of marine recreational fisheries may be high. For instance, the annual expenditures of resident recreational fishers was estimated to be 57 million Euro in Mallorca, Balearic Islands, which is threethree to four times larger than the economic value of local commercial fisheries (Morales-Nin et al. 2015). Spear-fishing is also economically and socially relevant in the southern European countries (Sbragaglia et al. 2016), although the participation rate is low, e.g. ~4% of the total marine recreational fisheries in a Mallorca Island (Morales-Nin et al. 2005).

The attitudes toward recreational fishing in southern Europe countries have not been properly quantified. However, a recent randomly-administered telephone survey to several thousand households in Spain generated some new insights into the attitudes of the Spanish general public towards recreational fisheries. 41% of the Spanish general public perceives recreational fishing as a good or very good activity to be practised during leisure time. Regarding possible conflicts between recreational fishing for fish consumption and attitudes towards activities like catch-and-release, half of Spanish population indicated recreational fisheries for harvest as a good or very good activity, while the percentage increased to 60% when the objective of recreational fishing was for catch-and-release purposes. Thus, there are overall very positive attitudes and a global moral acceptance of activities like recreational fisheries, and these positive attitudes becomes stronger when involve catching and releasing the fish.

The economic benefits of angling are only poorly understood by the Spanish public, similar to the case in Germany. Only 20% of the Spanish population agreed or fully agreed with the idea that recreational fisheries produces a relevant number of jobs and job benefits for the
society. By contrast, the Spanish general public has the opinion that commercial fisheries produces more jobs and more benefits although the number of recreational fishers can be orders of magnitude higher than commercial fisheries and their expenditure much greater in some regions (e.g., Morales-Nin et al. 2015).

In terms of ecological impacts, some studies carried in different southern European countries have generated a list of ecological impacts generated by recreational fishing activities (Font and Lloret 2014), especially regarding spear-fishing (Coll et al. 2004). However, when the Spanish general public was asked about their opinion whether recreational fisheries should be banned because its produces over-exploitation of the oceans, only 22% agreed or strongly agreed. This suggests that Spanish public does not generally see recreational fisheries as an ecologically harmful activity.

**Africa.**

There is very limited information available on recreational fishing in Africa (Belhabib et al. 2016). We will focus here on South Africa because this country offers the most valid information. Recreational angling participation is growing in South Africa, although rates are considerably below international averages while being at the same time uncertain due to the lack of valid surveys (Fig. 2). While there have been no specific surveys, or other research on this topic in southern Africa, based on anecdotal information, the attitudes of the public towards recreational angling are diverse in this region. To illustrate this, this section will highlight some of the similarities and differences in the public perceptions of recreational fishing in South Africa, Namibia and Angola.

Due to the favorable climate and aesthetically pleasing surrounds, southern Africans generally spend a large proportion of their time outdoors. Overall, in South Africa, recreational angling is considered to be a socially relevant activity that is encouraged as a cost effective, healthy outdoor activity. It is considered to be “good, clean, fun” for the youth and is preferred and encouraged over most indoor activities. In Namibia, recreational angling is perceived to be one of the nation’s primary pastimes and a relevant social and economic activity (see, e.g., Zeybrandt and Barnes 2001). In particular, recreational angling is viewed favorably as a critical
contributor to the local economy of the coastal towns in this desert region. Public perceptions of recreational fishing in Angola is quite different from South Africa and Namibia. Here, recreational fishing is largely seen as an elitist pastime, predominantly involving foreign tourists, ex-pats and wealthy locals. There is little evidence to suggest that the Angolan public perceive there to be any major benefits of recreational angling.

In terms of conservation, the southern African public is generally not well educated on issues around aquatic environments. Any sentiment around conservation is normally focused on terrestrial conservation issues, with for example, rhinoceros poaching or lion hunting dominating the public concern. Aquatic conservation issues, with the exception of abalone poaching in South Africa, are seldom reported in mainstream media. Despite large conservation issues surrounding recreational fishing, which include the targeting of many iconic and threatened endemic species in marine waters and the relocation of invasive fishes in freshwater environments, it remains low priority in the public discourse around conservation in southern Africa.

Besides aquatic conservation, there is also a lack of public education and awareness on the ethical considerations around recreational angling. This is most relevant in Angola and Namibia, where there is no animal welfare legislation (Cox et al. 2011) and few organisations dedicated to reducing animal cruelty. Unsurprisingly therefore, and in contrast to the situation in some developed countries, there has been little public debate on the ethical considerations of recreational fishing in southern Africa. South Africa, however, does have an “Animals Protection Act” and various enforcement bodies that actively implement the act through investigations and prosecutions (Cox et al. 2011). One example of an animal welfare concern related to recreational fisheries was from the National Society for the Prevention of Cruelty to Animals (SPCA), who issued a press release in 2010 advocating that “Fishermen should avoid using live bait such as frogs because it is cruel and contravenes the Animals Protection Act” (https://www.news24.com/SouthAfrica/News/Stop-using-live-bait-SPCA-20101223, accessed 7 March 2018). They essentially drew attention to the cruelty of forcing frogs into 500 ml plastic bottles before being sold as bait at popular recreational fishing venues. This press article was not only met with resistance from recreational anglers, but from the general public who felt
that there were far more concerning issues (such as the high murder rate) to report in South Africa. This example essentially sums the public perceptions in South Africa at present. It is speculated that the general opinion is that there are far greater challenges to be concerned with than the ethics of recreational angling.

*China.*

China’s recreational fisheries are mainly organized as events in small multi-purpose pond fisheries based on fee fishing (Shen 2008; Yang et al. 2017). These are much more abundant in China than in western countries where put-and-take type fisheries using commercial operators are probably the form of fisheries which most closely resembles China’s recreational fisheries (Shen 2008). China’s recreational fishery is an industrial form of recreational fisheries creating a leisure entertainment experience, linking tourism, cultural heritage, science popularization and restaurants. It realizes the integration and development of the first, second and third industries to provide products and services to satisfy people leisure needs. In particular, China’s recreational fishery is divided into recreational fishing based on released fishes from aquaculture, recreational fishing and sightseeing, aquarium watching and education, and the historical culture and fishing experience related to fisheries.

In recent years, the recreational fishery in China has developed rapidly, and the proportion of recreational fishing among the total value of fishery economy is rising (Table 2). Shen (2008) noted that there is an estimated 90 million anglers in China, representing 7% of the population. In 2011, the output value of the national recreational fee fishery was 25.6 billion yuan, and reached 66.5 billion yuan in 2016, which increased by nearly three times. The proportion of recreational fisheries among the total output value of fishery economy increased from 3.2% in 2011 to 5.5% in 2016, and thus nearly doubled. In 2016, there were 200 million people employed in recreational fishery in China, among which, the fishing population was nearly 100 million.

TABLE 2. — China's recreational fee fishery economic output value in 2003-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Unit: hundred million yuan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>25.6</td>
</tr>
<tr>
<td>2011</td>
<td>66.5</td>
</tr>
<tr>
<td>2016</td>
<td>100.0</td>
</tr>
<tr>
<td>Year</td>
<td>Total fishery output value (A)</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>2003</td>
<td>3323</td>
</tr>
<tr>
<td>2004</td>
<td>3796</td>
</tr>
<tr>
<td>2005</td>
<td>4180</td>
</tr>
<tr>
<td>2006</td>
<td>4569</td>
</tr>
<tr>
<td>2007</td>
<td>4956</td>
</tr>
<tr>
<td>2008</td>
<td>5521</td>
</tr>
<tr>
<td>2009</td>
<td>5937</td>
</tr>
<tr>
<td>2010</td>
<td>6752</td>
</tr>
<tr>
<td>2011</td>
<td>7884</td>
</tr>
<tr>
<td>2012</td>
<td>9049</td>
</tr>
<tr>
<td>2013</td>
<td>10105</td>
</tr>
<tr>
<td>2014</td>
<td>10861</td>
</tr>
<tr>
<td>2015</td>
<td>11329</td>
</tr>
<tr>
<td>2016</td>
<td>12003</td>
</tr>
</tbody>
</table>

Note: data source "China fishery statistics yearbook" (2003-2016); Output value: according to the current price statistics.

The acceleration of industrialization has led to an increase in demand for recreational fishing experience in China. China's development will continue to grow rapidly in the next decade. Experts predict that over the next 20 years, China's tourism and leisure market will reach more than 8 billion people, with explosive growth, which will provide large space for the development of recreational fishing. There is no information available on how the public views recreational fishing in China.

South Asia. —

Data availability for recreational fisheries activities in South Asia (Afghanistan, Bangladesh, Bhutan, India, Maldives, Pakistan, Nepal, Sri Lanka) is low overall and formal reporting is largely absent for these countries (as is common, see Welcomme 2011). However, participation in recreational fishing is increasing in the region (e.g., the Maldives, FAO 2009; Bangladesh, FAO 2010a; India, Gupta et al. 2016) and interest in developing tourism-based
recreational fisheries is also growing (e.g., in the Maldives, FAO 2009; Nepal, Gurung and Sah 2017). Indeed, Welcomme et al. (2010) referred to growth of recreational fisheries in the inland waters of emerging economies as ‘explosive’ due to its high economic potential. Yet, quantifying and comparing recreational fishing activity is difficult in South Asia. Recreational fisheries activities in this region, like elsewhere, are diverse in terms of habitats, gears, and target species groups, but in this region recreational fishing activities also commonly blend into other endeavors such as subsistence and small-scale fishing activities, and traditional community harvests. For the purposes of this chapter, we limit discussion of recreational fishing activities in South Asia to those using rod and reel.

The earliest known reference to recreational fishing activity in South Asia is found in the Mānasāllosā treaty of India, written in 1127 AD (Hora 1951, cited by Gupta et al. 2015a). Despite this long history, the degree to which recreational fishing activity is embedded in South Asian culture is low. Recreational fishing does not constitute a reported portion of national income in any South Asian countries, and national rates of participation, while unknown, would not be expected to be high relative to other regions. For example, in Pakistan an estimated 900 participants landed approximately 130 t of fish across all recreational fishing activities in 2002, and participation is estimated to have increased to 1000 participants operating 120 – 150 licensed boats by 2009 (Khan 2006). Thus, where recreational fishing activity is known to occur, it is described as being of limited but increasing importance (Bangladesh, FAO 2010a).

Due to the low visibility of recreational fishing as a distinct sector in South Asia, public recognition of the activity on a large scale is minimal. In some areas, recreational fishing is viewed as an activity for the wealthy (e.g., in Bangladesh, FAO 2010a). This perception is changing rapidly in India as more local businesses are established (e.g., tourism operations, gear vendors, Gupta et al. 2015a) and tackle costs, which were previously prohibitively high, decrease (e.g., in Bhutan, Rajbanshi and Csavas 1982). Anglers active in 25 Indian states perceive recreational fishing as being of high conservation importance and exhibit high willingness to contribute to conservation activities (Gupta et al 2015b).

Overfishing, pollution, and hydropower development are commonly described as threats to inland biodiversity across the region (Petr 2003; Everard and Kataria 2011; see Malik
et al. 2014 for reference to heavy metal accumulation in reservoir fishes). Additional sources of conflict may be unique to South Asia, or unique to developing countries. In particular, conflicts are generated by sand mining activities (Bower et al. 2017), by the prevalence of destructive fishing gears such as poison or dynamite (Rajbanshi and Csavas 1982; Bower et al. 2017), and profuse stocking of native and non-native hatchery fish is common across the region (in Bhutan, Rajbanshi and Csavas 1982; in Afghanistan, Petr 1999; in Pakistan, Khan et al. 2011; in India, Bower et al. 2017). Whether via introductions or culture of native species, many South Asian recreational fisheries are culture-based. There may be opportunities to promote conservation of native freshwater fishes by stocking, fostering angler interest in fishing for native species and harvesting invasive species. Finally, conflict among socio-economic classes of fishers can be expected to increase in South Asia as recreational fishing activity continues to increase. Decreasing access for subsistence fishers is possible as recreational fishing activity increases, particularly if subsistence activities continue to be viewed as poaching by recreational fishers (Bower et al. 2017).

Japan. —

Recreational fishing is very popular outdoor activity in Japan. Based on the White Paper on Leisure in Japan (2017), the rank of recreational fishing in sport was 10th of all outdoor activities. 6.9 million people (6.9 % of Japanese aged between 15 and 79 years) participate in recreational fishing. The participation rates were 10.9 % and 3.0 % for men and women, respectively. In addition, recreational angling ranks first for men in the potential demand (would like to do) among all of sports, although it is outside of the top ten for women. Therefore, recreational fishing is very popular and preferable activity, especially for men.

Japanese people love to eat fresh whole fish, shellfish and lobster. Thus, harvest-oriented fishing is very highly accepted by almost all Japanese people. According to a recent internet survey, 33.6 % anglers enjoy recreational fishing in freshwater region. There are no public survey data, but the general public seems to view recreational fishing positively.

Oceania. —
Australia, New Zealand and the Pacific Island countries and territories represent a culturally and biophysically diverse region. In terms of recreational fishing, its importance is more significant in westernised countries of Australia and New Zealand (Fig. 2). In most Pacific Island countries and territories fishing is focused on subsistence or small scale commercial fishing. There are some important exceptions though where dedicated recreational fishing tourism is an important economic contributor. Examples of this include charter fishing operations that target Bonefish *Albula vulpes* and pelagic species in the Cook Islands and New Caledonia, and those that target Papuan Black Bass *Lutjanus goldiei* and Barramundi *Lates calcarifer* in Papua New Guinea.

The majority of the discussion in this section focuses on Australia. Recreational fishing is a key way that many members of the public experience the aquatic environment. It is considered a socially relevant activity in Australia. This is evidenced by the large number of participants and inclusion in state fisheries legislation of objectives specific related to recreational fishing. There are also national level policies devoted to recreational fisheries, which exemplifies the high standing of angling in society. The last national recreational fishing survey undertaken in 2000/01 identified that 3.36 million people (19.5% of the population at the time) went recreational fishing annually for an estimated 23.2 million fishing events (Henry and Lyle 2003).

In terms of legislative recognition, there is an objective to enhance the recreational fishing experience and to promote quality recreational fishing opportunities in the Australian state of New South Wales (Mcphee 2008). It is further evidenced by government investment in recreational fisheries management, marketing recreational fishing as part of tourism experiences, infrastructure (e.g. boat ramps and fish cleaning facilities), and fisheries research. Much of this government investment originates from consolidated revenue, although some is recovered from recreational fishing licence fees and other specific levies.

Despite the recognition of recreational fishing as a socially relevant activity, participation rates in recreational fishing have fallen, particularly in urban areas (McPhee 2017). However, increasing population in Australia have resulted in the total number of recreational fishing participants remaining similar or increasing through periods surveyed. In the Australian
state of Victoria $AU46 million is being invested over five years in a program called “Target One Million” which aims through various initiatives to increase the number of recreational fishing participants to one million in 2020 from the estimated 719,000 in 2009 (Ernst and Young 2009).

While there is no quantitative information on the moral acceptability of recreational fishing in Australia, it is reasonable to suggest that those that partake in the activity consider it morally acceptable, and the proportion that do not undertake the activity consider it either acceptable, unacceptable or are ambivalent.

Catch and release fishing is proving to be an increasing dilemma in fisheries management. It is potentially an example of where goals, activities and attitudes related to sustainability and animal welfare are not aligned. Provided the fish survive release, the sustainability benefits of releasing rather than killing a fish to consume are self-evident, however the debate as to whether this is ethically appropriate is a much more “values based” proposition. The scientific focus on animal welfare continues to grow in Australia (Walker et al. 2014). Although not yet formally studied, there are emerging conflicts between groups of recreational anglers that practice catch and release and those that retain fish to consume.

An emerging conservation concern in Australia that potentially involves and also impacts recreational fishers is associated with biosecurity. Recently an outbreak of white spot syndrome virus (WSSV) in farmed prawns occurred. The WSSV was present in imported uncooked prawns that were sold for human consumption and introduced into the wild by the use of infected uncooked prawns for bait by recreational anglers (Diggles 2017). The detection of the WSSV in the wild necessitated fishing closures to recreational fishing for crustaceans and marine worms to help prevent the further spread of the disease. The introduction and spread of the WSSV has focused attention on recreational fishing activities as a potential vector for aquatic diseases which affect aquatic animal health – an example of biocentric values gaining importance.

TABLE 3. — Summary of the case studies in relation to various metrics emphasizing participation rates (Fig. 2), trends, ethical perspectives and a global assessment of support for the life-cycle of fisheries (Fig. 1)
<table>
<thead>
<tr>
<th>Region</th>
<th>Trend</th>
<th>and trend</th>
<th>Develop and support recreational fisheries or fishing tourism</th>
<th>Conservation concerns about fishing impacts on populations, habitats etc. and associated regulations</th>
<th>and active regulation (e.g., of voluntary catch-and-release, C&amp;R)</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>Highly developed in USA and Canada, developing in central areas</td>
<td>High, stable and recently increasing in the US</td>
<td>High, stable and recently increasing in the US</td>
<td>Yes</td>
<td>The use of ecosystem is actively encouraged, but conservation concerns are strongly addressed, trend towards biocentrism</td>
<td>Little evidence, voluntary C&amp;R encouraged, despite about 20% of the public viewing angling for sport angling</td>
</tr>
<tr>
<td>South America</td>
<td>Developing</td>
<td>Average, rising</td>
<td>Not a major topic, no information on trends</td>
<td>Not widespread, early development in some countries such as Brazil</td>
<td>Focus on instrumental benefits (anthropocentrism), some local conservation concerns</td>
<td>No, debate on voluntary catch-and-release more a conflict among consumptive and non-consumptive motives</td>
</tr>
<tr>
<td>Northern Europe</td>
<td>Highly developed</td>
<td>Very high, stable in most countries</td>
<td>High, stable in most countries</td>
<td>High, but varied among countries, relatively low in Germany, stable or increasing in most, except possibly Germany</td>
<td>Strong conservation concerns and biocentrism, although the human benefits of using aquatic ecosystem are widely accepted (e.g., Norway)</td>
<td>Strong influence of biocentrism on environmental policies that affect fisheries</td>
</tr>
<tr>
<td>Central Europe</td>
<td>Highly developed</td>
<td>Low, stable</td>
<td>High, but varied among countries, relatively low in Germany, stable or increasing in most, except possibly Germany</td>
<td>No, with few exceptions (Netherlands)</td>
<td>Varied, yes in Germany and Switzerland, less so or not at all in other countries such as UK, despite strong animal rights movement in society, voluntary catch-and-release banned in Germany</td>
<td>Encouraged and</td>
</tr>
<tr>
<td>Region</td>
<td>Development Status</td>
<td>Fishing Pressure</td>
<td>Conservation</td>
<td>Cultural and Ethical Considerations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------</td>
<td>------------------</td>
<td>--------------</td>
<td>-------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>Developed</td>
<td>Low, declining in some, modest recent increases in other countries</td>
<td>High, stable</td>
<td>No Anthropocentric attitudes dominate, some influence of biocentrism on conservation issues</td>
<td>No, voluntary catch-and-release discussed from a cultural conflict with subsistence motives</td>
<td></td>
</tr>
<tr>
<td>Southern Europe</td>
<td>Developed</td>
<td>Average, stable</td>
<td>High, stable</td>
<td>No Anthropocentric attitudes emphasizing use of strong, conservation concerns increasing</td>
<td>No, voluntary catch-and-release seen positively by public</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>Developing</td>
<td>Low, rising</td>
<td>Largely irrelevant to society, stable</td>
<td>No Anthropocentric attitudes dominate, locally conservation concerns</td>
<td>No, voluntary catch-and-release not discussed</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>Developed, in some areas developing</td>
<td>Low, rising</td>
<td>?</td>
<td>No Anthropocentric attitudes</td>
<td>No, voluntary catch-and-release not discussed</td>
<td></td>
</tr>
<tr>
<td>South Asia</td>
<td>Developing</td>
<td>Low, rising</td>
<td>?</td>
<td>No Anthropocentric attitudes</td>
<td>No, voluntary catch-and-release not discussed</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>Developed</td>
<td>Average, stable</td>
<td>High, stable</td>
<td>No Conservation relevant concern</td>
<td>No, voluntary catch-and-release not discussed</td>
<td></td>
</tr>
<tr>
<td>Oceania</td>
<td>Developed</td>
<td>High, declining</td>
<td>High, stable</td>
<td>Yes Biocentrism on the rise</td>
<td>Public discourse ongoing, also on voluntary catch-and-release in some circles, so far without regulatory impact</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusions**
The work reviewed here provides general support for the life-cycle of fisheries (Fig. 1, Tab. 3) that positions that interest in recreational fishing rising rapidly with economic development before eventually declining or staying stable. In particular urbanization was found consistently to negatively impact recreational fishing rates. Our review shows, in agreement with the life-cycle metaphor, that in poor countries recreational fishing is currently not a relevant issue at the societal level and is often considered sport for a few elite members of society or for rich tourists (several countries of south Asia, Africa, and Central America). By contrast, in economies in transition (e.g., many countries in South America, China) interest in recreational fishing rises, but data quality to support this assertion is poor. Finally, in highly developed and economically wealthy countries of the western world, data quality on recreational fisheries is mostly good, yet participation rates in fishing either have levelled or are declining, with a few exceptions such as the USA or the Czech Republic where participation rates in recreational fishing appear to be increasing after a period of decline. Overall, our review support the proposition that participation in recreational angling across the globe is directly related to societal-level developments affecting resources, time and socialization into fishing. Moreover, culture and the way fish is historically situated within society appears to be a major driver affecting interest in fishing as well as the public’s perception of critical fishing practices (see below). The latter statement is less well supported by data and clearly is an area for more cross-cultural research.

The life-cycle of fisheries also suggests that the view of the public and correspondingly the institutions (rule systems) developed by organizations predictably changes from a focus on anthropocentric moral perspectives to biocentric ones (that broadly focus on maintaining or restoring wildness and conservation or restoring natural biodiversity). This change can be complemented by pathocentric ethical viewpoints emphasizing the well-being of individual fish and other animal and disregarding recreational fishing on moral grounds (Fig. 1). Our review supports a shift from anthropocentrism to more biocentric viewpoints as societies develop economically in relation to recreational fisheries (Tab. 3). This is for example exemplified by the reliance of recreational fisheries on introduced fishes, which is prevalent in less developed nations, but increasingly considered an ecological issue in more developed nations. As another marker, a shift from anthropocentrism to biocentrism with economic development is indicated.
by a more rigorous implementation of management and regulatory schemes designed to reduce unwanted ecological impacts of recreational fishing activities in more developed nations (FAO 2012; Rahel 2016).

In contrast to what the life-cycle of fisheries proposes, our global review revealed that pathocentric worldviews have not strongly materialized and have not led to regulations of recreational fisheries or some of its practices on fish welfare grounds, with two notable exceptions (Germany, Switzerland) (Tab. 4). It is clear that fish welfare is rarely issue in poor countries or developing nations. By contrast, the fish welfare discourse can be traced to almost all developed countries, but this does not mean the recreational activity is threatened or welfare-oriented regulations similar to Germany and Switzerland (who are strong exceptions) are widely implemented. We speculate that specific contextual conditions in a given country (e.g., how are recreational fisheries organized and represented in the policy arena), the social embedding and social-political support of recreational fisheries (indexed for example by the presence of national-level policies for the development of recreational fisheries) and the presence of pro fish welfare activism in a given country put different countries on different paths, either encouraging or discouraging fish welfare regulation. The final outcomes also seem largely independent of the actual public perception whether recreational fishing just “for fun” is cruel or not (Riepe and Arlinghaus 2014). For example, while public surveys in central European countries and even in the US have revealed that in the more urbanized states about a quarter of the public sees angling for sport to be cruel, strong constraints on critical angling practices have only materialized in Germany and recently Switzerland (Tab. 4). Better understanding the social, political and legal conditions that either favor or prevent fish welfare-related regulations from becoming established is a key area for future research. Moreover, it is important to study whether discourses surrounding practices such as catch-and-release are fundamentally about animal liberation or rights or simply a reflection of a conflict between harvest-oriented fishing styles and those that emphasize the conservation contribution or non-consumptive aspects of catch-and-release (Øian et al. 2017).

Finally, our review has revealed that recreational fisheries generally are seen as an acceptable pastime activity, in all countries where survey data are available. This statement
must be qualified. It is not the case that in each survey a majority of respondents felt positive about recreational fisheries. Rather, it is that in all cases, a minority felt negatively, with many simply being indifferent. It is also important to make a distinction between acceptance and support. Here, there is ample variation among countries. For example, in the USA over 90% consider fishing for food morally acceptable, while the corresponding figures is only 60% in Germany. Our review also showed, however, that in many countries where trend data are available, support for recreational fisheries is either stable or increasing. We are thus not seeing developments that strongly threaten the public’s favorable view of recreational fisheries. Nevertheless, the tension among biocentric conservation and more anthropocentric fisheries management is likely to stay or become stronger, as agencies increasingly regulate recreational fisheries for ecological reasons in many areas of the world.

Our review also revealed a number of research needs. First, national level surveys of both recreational fishing participation and the public’s view about the activity are scattered and not standardized. This standardization begins with definitions of what is a recreational fisher and continues with the lack of thorough trend data (exceptions include UK, Norway and USA) demanding repeated sampling to be able to infer time trends. Standard approaches to sample anglers and general publics and measure support for recreational fishing and specific practices such as voluntary catch-and-release need to be developed. Second, although we saw general support for the life-cycle of fisheries, ample variation persisted pointing to a more complicated model where broader economic and urbanization trends interact with a range of cultural conditions in affecting how many people fish, how the public views recreational fisheries and which type of regulations are implemented with regards to recreational fisheries. Sorting this question out using cross-country studies is a major research need. Finally, we are seeing major structural changes in many societies related to immigration and alteration of ethnic grouping, and we know little on how this plays out to drive recreational fishing participation and behavior, and the view of the general public towards fishing.

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