CHAPTER 2

Global Participation and Attitudes toward Recreational Fishing

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2.1 INTRODUCTION

To understand angling participation in a given society, it is worthwhile to ask general questions about societal-level developments that shape the values and interests of citizens to engage in fishing relative to other leisure activities. Similarly, fisheries managers must be alert not only to the expectations of local resource users, but to all citizens whose values and interests will be affected by management actions. In many western countries, for example, 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. Recreational science is well advised to capture these systematic effects of the social embedding of recreational fisheries.

This chapter examines societal-level influences on recreational fisheries by reviewing research on fishing participation rates and philosophical and ethical perspectives on recreational fisheries. Based on a range of case studies in several areas of the world, the social embedding of recreational fisheries is described. Given shared historic backgrounds, it is assumed that there are clusters of countries with specific perspectives towards recreational fisheries and that it is possible to associate these with wider societal-level deployments that shape cultural and moral values in a given country. The core assumption here is that society and cultural values exert direct and indirect effects on fishing participation as well as the public's perception of the acceptability of fishing practices and management interventions.

2.2 THE LIFE CYCLE OF RECREATIONAL FISHERIES

Although recreational fisheries are of high importance globally (FAO 2012; Arlinghaus et al. 2019), considerable interregional and intercountry variance in its relative importance exists 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, particularly when recreational fishers have strong subsistence motives (Cooke et al. 2018). Recreational and subsistence fisheries, however, 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 typically the case after significant economic development of a given society provides employment opportunities beyond the primary fishing sector. Although the use of coastal and sometimes even offshore marine fish stocks by recreational fisheries also develops with economic development of a society, the shifts from subsistence to commercial and finally and often exclusively to recreational use of wild fish stocks are particularly pervasive in inland fisheries (FAO 2010b).

According to FAO (2010b), almost linear increases in recreational fishing interest in a society are expected to occur with its economic development. Specific for inland fisheries, the "life cycle" of fisheries introduced by Smith (1986) and extended 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 (Figure 2.1). According to this conceptual 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 (Arlinghaus et al. 2015), a rapid rise in freshwater recreational fishing interest coupled with a decline in subsistence or commercial fishing is expected in all countries that experience strong growth in economic development. Indeed, many countries in

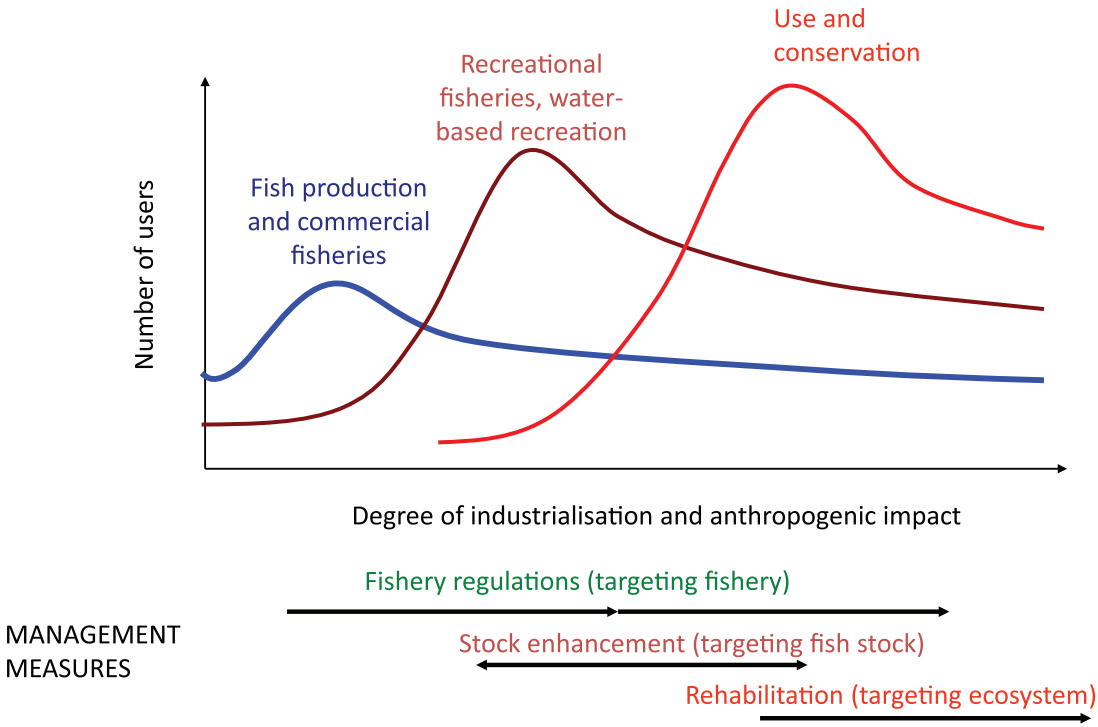

Figure 2.1 The life cycle of inland fisheries (modified from Cowx et al. 2010). The number of users involves all stakeholders of aquatic ecosystems, whether they are direct users (e.g., recreationists) or indirect users (e.g., people that care about aquatic ecosystems without directly using them).

transitional economies in Asia, Latin America, South America, and Africa are currently experiencing sharply rising development of recreational fisheries (Potts et al. 2009; FAO 2010b; Welcomme et al. 2010; Freire et al. 2018, Bower et al. 2020), 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 for select species have surpassed those by commercial fishers (Catella 2006; Motta et al. 2016). These results suggest that with economic development, subsistence fisheries may transform into or be 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 1996; 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.

Because recreational fisheries initially increase with economic development, many contemporary recreational fisheries take place in pervasively altered habitats and ecosystems that are affected by many impacts unrelated to fishing, such as damming, pollution, habitat simplification, and nonindigenous species establishment (Arlinghaus et al. 2002; Carpenter et al. 2017). Moreover, many recreational fishing habitats in more developed countries are characterized by multi-use patterns (e.g., navigation, flood control, energy production, waste disposal, fisheries, boating, and tourism). Recreational fisheries, therefore, rarely operate in a vacuum and a range of stakeholders, activities, and interests must be considered. Nonfishery impacts on aquatic ecosystems, particularly in freshwaters of industrialized countries, not only influence the quality of many recreational fisheries but also motivate 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). 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 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 controls, season controls, or fish stocking (FAO 2012).

2.3 GLOBAL RECREATIONAL FISHING PARTICIPATION AND ITS DRIVERS

To understand the drivers of recreational fishing participation, the best available data and studies on fishing participation rates around the globe were compiled and recreational fisher numbers relative to the total population size were mapped (Figure 2.2). This work updated previous assessments (Arlinghaus et al. 2015, 2019). Data availability on recreational fisher numbers strongly varies around the globe. Data gaps are particularly widespread in developing countries, but there is good coverage in Oceania, Europe, and much of North America. Recreational fishing hotspots with more than 20% of the total population participating in recreational fishing include 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, the World Bank (2012) estimates a minimum of 220 million recreational fishers globally, but this estimate should be considered a vast underestimate given that in China alone, 220 million recreational fishers have been reported (China Society of Fisheries 2018).

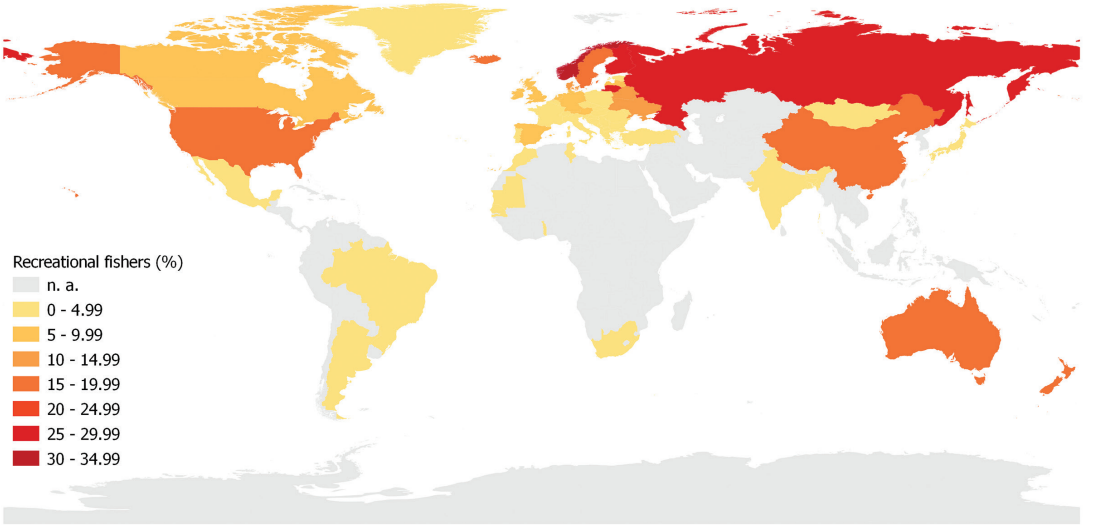

Figure 2.2 Revised map of fishing participation rates as a fraction of the entire population of a country (updated from Arlinghaus et al. 2019). NA = no estimate available.

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 (Manfredo et al. 2009). For example, the macro-level factor "industrialization" is a major driver of cultural and corresponding value change in many countries worldwide (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 activities other than fishing, freeing time and resources for outdoor recreational activities such as fishing. 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). Yet, there are limits to growth, and indeed, in many highly industrialized countries, recreational-fishing interest has either stabilized or even declined in recent years (e.g., Canada: Gray et al. 2003; Brownscombe et al. 2014; Germany: Arlinghaus 2006b; United Kingdom: Aprahamian et al. 2010; the Netherlands: van der Hammen and Chen 2020). Several factors associated with urbanization likely contribute to these trends (Adams et al. 1993; Aas 1996; Arlinghaus 2004; Arlinghaus et al. 2012). In several of these countries and after several years of declines, however, a recent rise in angling participation has been documented (Aprahamian et al. 2010; Brownscombe et al. 2014; U.S. Fish and Wildlife Service and U.S. Census Bureau 2018).

Macro-level observations, such as the participation rate for fishing in a country, 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 and social outcomes, alternatively termed "needs," "benefits," or "utilities" (Driver

and Knopf 1976; Driver and Cooksey 1977; Manfredo et al. 1996; Hunt 2005). Yet, even if a person is motivated to fish, this motivation can only be achieved 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 time and financial resources to engage in fishing (Walsh et al. 1989; Floyd and Lee 2002). As a next step, perceived personal constraints must be overcome and negotiated (Crawford et al. 1991; Stensland et al. 2017). Indeed, the literature on leisure constraints has often identified lack of time, such as 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 where the average individual has more resources available, greater recreational-fishing participation rates will occur. Similarly, greater water availability should be positively associated with fishing-participation rates (Adams et al. 1993).

The macro-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 associate individual-level demographic metrics, such as age, income, or residency in urban areas, with individual-level observations of engagement in recreational fishing and thereby estimate a probabilistic model of fishing interest (Walsh et al. 1989; Floyd and Lee 2002; Arlinghaus 2006b). Using this approach, many associations between individual-level demographic variables and the likelihood of fishing recreationally have been established. Income, male gender, proximity to, and the quality of fishing sites related positively to recreational fishing participation, while age (but see Floyd and Lee 2002; Arlinghaus 2006b for other findings), household size (but see Walsh et al. 1989 for exception), and urban residency affected the likelihood to fish recreationally in different studies (Walsh et al. 1989; Floyd and Lee 2002; Arlinghaus 2006b; Thunberg and Fulcher 2006; Lee et al. 2016; van der Hammen and Chen 2020). While it is unclear whether the age effects reported in these individual-level studies reflect period, aging, or cohort effects, a recent study from the Great Lakes area in the United States found support for both aging and cohort (i.e., a generally decreasing interest in fishing across younger generations) effects that negatively affect fishing participation interest (Burkett and Winkler 2019). The conclusion of the aging effect, however, is not universal among different studies. At the individual level, formal education is associated with a reduced likelihood of fishing in freshwater (Arlinghaus 2006b; van der Hammen and Chen 2020) but an increased likelihood for saltwater fishing in the United States (Lee et al. 2016), possibly indicating context specific effects depending on the type of fishery and the financial resources needed to acquire access. Despite these uncertainties and 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 (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). This requirement 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. This approach has been adopted to study participation rates in the United States (Edwards 1989; Adams et al. 1993; Poudyal et al. 2011), in specific Canadian provinces (Dabrowska et al. 2014; Hunt et al. 2017), and globally (Arlinghaus et al. 2015). Arlinghaus et al. (2015) concluded that four general factors drive variation in fishing participation rates, which were broadly supported by Poudyal et al. (2011) for the United States.

First, recreational-fishing participation is positively related to the cultural importance of fish and fishing in a given country. Cultural importance was operationalized by Arlinghaus et al. (2015) through the crude indicator of total commercial fishing landings. As expected, a positive relationship existed between total fish landings and the proportion of a given society that recreationally fishes. It is likely that countries with a long tradition of 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 postindustrialization and urbanization on recreational-fishing rates. Postindustrialization 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 postindustrialization and urbanization are negatively associated with recreational fishing participation rates. The negative impact of the size of the economy (GDP) on recreational fishing may at first appear counterintuitive. This relationship, however, agrees with the life cycle of fisheries (Figure 2.1). 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.

Multiple social processes are likely responsible for the combined negative effects of 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 postmodernization (see section 2.4). In fact, economic development of societies tends to deemphasize utilitarian and favor egalitarian worldviews 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 (Bruskotter and Fulton 2008; Manfredo 2008; Manfredo et al. 2009). Arlinghaus et al. (2012) reported that the proportion of people holding negative moral attitudes towards fishing increased with the proportion of society living in urban areas in the United States 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. Conversely, the currently rising "green" or "slow food" 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 provide similar expected psychological outcomes as fishing. For example, important motives for recreational fishing are temporary es-

cape (Driver and Knopf 1976; Fedler and Ditton 1994; Ditton 2004) and the 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 watching, jogging, or computer gaming. For some people, the motivation of achievement might be better served by computer gaming than through meeting the challenge of catching a trophy fish, in turn decreasing the likelihood to engage in fishing if the alternative leisure activity becomes available through technological development. Motivations aside, the increasingly supported "videophilia hypothesis" (Pergams and Zaradic 2006) positions that electronic entertainment and other leisure activities compete with hunting, fishing, and other traditional 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 or other indoor activities, interest in fishing might decline through social copying. Considerable evidence now exists that increasing electronic entertainment causes or is at least strongly correlated to a decline in nature-based recreational activities, such as recreational hunting (Pergams and Zaradic 2006; Robison and Ridenour 2012).

Another distinct feature of postindustrialization is increasing urbanization, which has a range of effects that are not conducive to fishing and hunting participation. These effects include, but are not limited to, reducing the exposure of individuals to traditional rural recreational activities such as hunting and fishing (Heberlein et al. 2002; Manfredo 2008), 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" (Louv 2009). Tied to these factors are reductions in the social standing of fishing and hunting as a form of recreation or even lifestyle (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 not available in the now urbanized neighborhood, it is likely that the younger generations will seek alternative leisure activities to meet their expected psychological outcomes. These alternative activities may also provide more pleasure 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 professions 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 (Poudyal et al. 2011).

Third, the availability of individual time and financial resources and the perceived leisure needs affect recreational fishing interest. Indicators of resource availability of states or societies include 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 2006b for alternative findings), household size (Arlinghaus 2006b), and low availability of monetary resources (Walsh et al. 1989; Floyd and Lee 2002; Arlinghaus 2006b; 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 there is only one study that separates aging from cohort effects on recreational fishing participation (Burkett and Winkler 2019). Given that there is only one cohort study, it is unclear whether early demographic studies from the United States reporting that aging at the society level is expected to reduce angling rates (Murdock et al. 1996) generally hold true across the world (Arlinghaus 2006b). Even in the United States, follow-up studies by Thunberg and Fulcher (2006) revealed that the participation effects of household income, education, and age were stable across survey years in a study on marine recreational fishing. More recently, using U.S. 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. The same was reported from the Great Lakes states more specifically, but only for males, while fishing by females was recently showing increasing trends (Burkett and Winkler 2019). Also, recent data show increasing participation rates of young people in the United States (U.S. Fish and Wildlife Service and U.S. Census Bureau 2018). Independent of this ongoing discussion, particularly related to the aging versus cohort effects, 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.

Average weekly working hours was positively associated with the participation rate in recreational fishing (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. It is contended that this amount of work time commitment does not constrain people from engaging in fishing due to lack of time (Aas 1995; Fedler and Ditton 2001; Sutton et al. 2009). The positive effect of weekly working hours, all else being equal, on participation rate, instead, 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 quality fishing opportunities, or rough surrogates such as access to waters, exerted a positive effect on angling participation across the world (Arlinghaus et al. 2015). This result is confirmed by Hunt et al. (2017), who found a positive relationship between fishing participation in Ontario, Canada and proximity to areas with higher fish abundance (Hunt et al. 2017). While this effect is not surprising, per se, the measurement of quality fishing opportunities is often proxied by availability of, or access to, water (Walsh et al. 1989; Adams et al. 1993; Poudyal et al. 2011; Stensland et al. 2017). The use of this proxy makes it difficult to assess the relative importance of quality fishing opportunities versus other factors in influencing fishing participation rates. In the one instance with a more direct measure of quality fishing opportunities, Hunt et al. (2017) concluded that urbanization (as measured by population den-

sity) had a stronger effect than fish biomass at influencing rates of fishing participation in regions of Ontario, Canada. Relatedly, in the multi-country study by Arlinghaus et al. (2015), access to the coastline and extent of freshwater areas available to fishing had much lower importance to affect recreational fishing than urbanization or the size of the economy. This result agrees with constraint studies in lapsed recreational fishers who consistently reported that structural aspects such as lack of time or too many commitments exerted greater inhibitory effect than availability of water, per se (Fedler and Ditton 2001; Sutton et al. 2009). Of course, it is unlikely that recreational fishing interest can be entirely decoupled from fishing quality in a specific region.

To conclude, it is proposed that the general propensity of a society to host recreational fishers is first related to the cultural precondition and fishing legacy of the country (Figure 2.3). This conclusion 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 the life cycle of fisheries should hold, patch dependencies (e.g., access to marine environments leads to early fishing, which in turn lead to societal appreciation for consumptive resource use) 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 the expected psychological outcomes consciously or subconsciously (Lee et al. 2016).

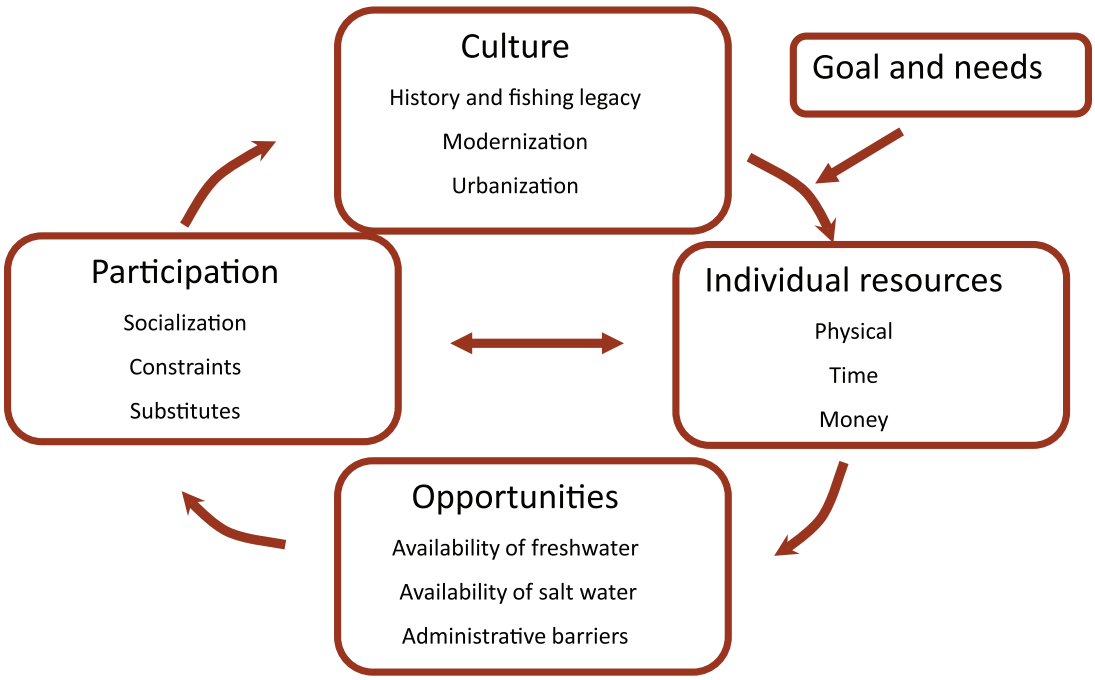

Figure 2.3 A conceptual model of multi-dimensional and hierarchically organized (from contextual at the level of cultures to individual level) drivers of recreational fishing participation.

If fishing becomes one way to achieve personal aims, the availability of individual resources will then determine whether one has the means to recreational fish. Personal resources fall on particularly fruitful grounds if opportunities for fishing exist. Most importantly, however, the participation decision and the continuation of angling interest will be strongly driven by key brokers such as relevant others (e.g., parent, friend, uncle, aunt, or neighbor) that socialize oneself into fishing when young. All aspects mentioned (i.e., resources, opportunities, and socialization) clearly are affected by demographic, economic, and other structural societal changes, many of which correlate with urbanization. Thus, 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 (Figure 2.3). 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 increasing urbanization is a major global trend (see projections by the World Bank, www.worldbank.org). Pro-angling cultural conditions in particular societies, as well as dedicated marketing and the removal of barriers to participation (e.g., the need to pass examinations in some countries, Heberlein and Thomson 1997; urban fishing, Eades et al. 2008), can, however, help to increase fishing participation in countries where the interest has declined recently (e.g., UK; see Aprahamian et al. 2010).

2.4 ENVIRONMENTAL ETHICS ON RECREATIONAL FISHERIES AND THEIR CHALLENGES

Recreational fisheries are embedded in sociocultural processes. Changes in social values towards recreational fishing will eventually affect norms, policies, institutions, and 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 to suit the contemporary societal context, which is a representation of social and cultural norms and values. The academic discipline that tries to sort the resulting moral issues in navigating human–environment interactions is environmental ethics, which is a branch of philosophy that deals with the relationship between humans and nature. Environmental philosophy constitutes the general framework of the current debate on animal use, including use for recreational fisheries (Arlinghaus et al. 2012), and thus, it will be briefly reviewed to provide context.

Broadly speaking, four major dimensions of increasing moral concern towards animals and the natural environment, including obviously fishes, can be identified (Figure 2.4): anthropocentric, pathocentric (suffering centered), biocentric, and ecocentric worldviews (Arlinghaus and Schwab 2011). The anthropocentric (i.e., human centered) view holds that human beings and their needs are at the center of moral concern. Anthropocentrism is believed to be at the root of the worldview of the fisheries profession because fisheries management is about actions to achieve human-defined goals and objectives for fisheries resources and aquatic ecosystems, considering trade-offs (Arlinghaus et al. 2002).

On the opposite level to anthropocentrism, nonanthropocentric views common in debates of environmental philosophy encompass biocentrism and holism (the latter sometimes also called ecocentrism or physiocentrism; Figure 2.4). Biocentrism places the entire living world at the center of considerations. While humans are part of the living world, morally speaking, the world does not exclusively revolve around humans. Holism takes the broadest approach and considers the entire ecosphere including abiotic matter (Leopold 1970; Foltz 2003).

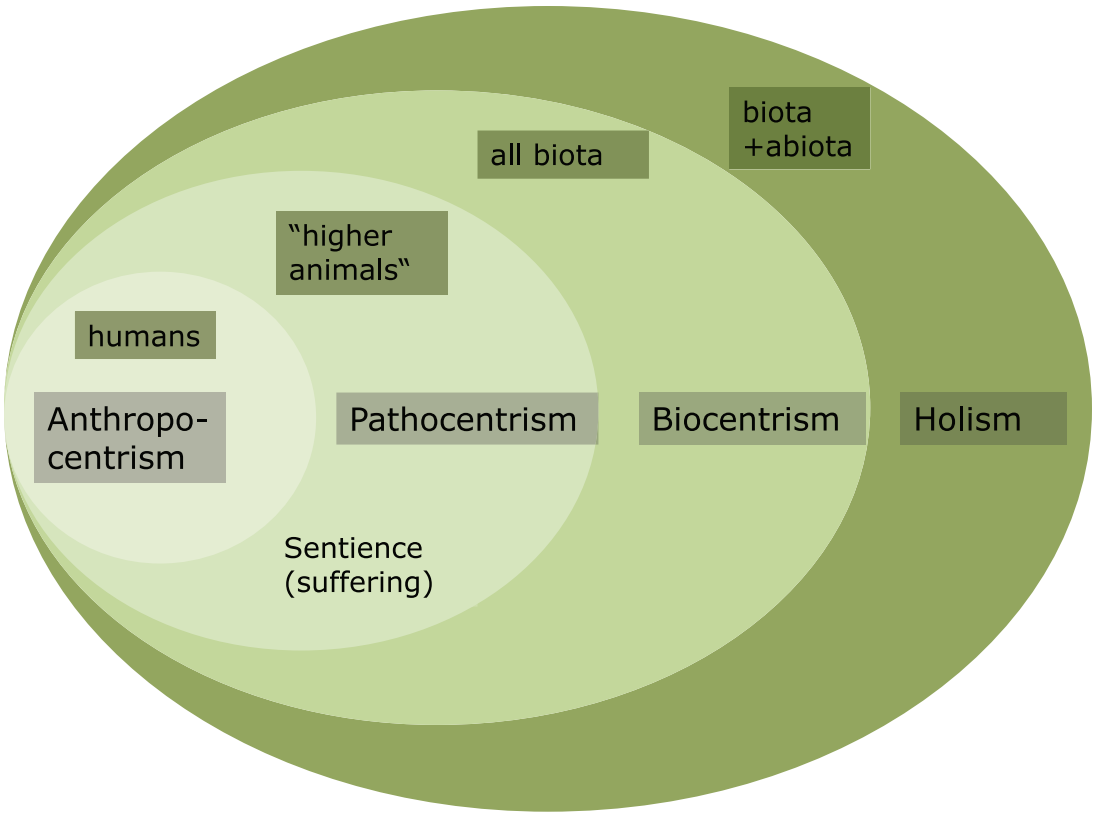

Figure 2.4 Different domains of interest and key demarcations of moral concern in different schools of environmental ethics.

The moral status of animals, including fishes, within anthropocentric and nonanthropocentric 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 characterize clearly. Each perspective has different implications for the social acceptability of recreational fishing, as is briefly described below. This description is done acknowledging that the public actually 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 field of environmental ethics suggests (Arlinghaus and Schwab 2011). 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.

2.4.1 Anthropocentrism as Dominant Historical Route of Fisheries Management

The core idea of anthropocentrism is that recreational fishing is good because it provides material and nonmaterial benefits to individual participants, to society at large, and possibly to ecosystems, habitats, and fish populations. When taking this perspective, which is very common among hunters, fishers, and 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 they provide 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 fishing is fun but is often also about food (Cooke et al. 2018). Although underappreciated, the quasi-subsistence component of recreational fisheries is substantial in many areas of the world (Aas and Skurdal 1996; 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 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 esteem it a pleasure and are very proud to be expert therein." (Goodspeed 1939). Such early fishing may not qualify as recreational fishing as it is defined 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). Whether for fresh or saltwater recreational fishing, the pleasures of the table are a widely accepted reason and a 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. Recreational fishers; instead, seek the abstract concept of utility, which is a nonmarket reward composed of a range of catch- and noncatch-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 (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) and represent the net benefits received by an 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 value of fishing to anglers but, at the same time, induce a range of economic impacts in the economy (Parkkila et al. 2010). These expenditures fuel a large macroeconomic activity in a range of sectors. For example, angler expenditures in the United States create more than 828,000 jobs in a US$115 × 109 industry (Southwick Associates 2012). In Germany, angling supports about 52,000 jobs (Arlinghaus 2004), and the total marine recreational fishery in Europe generates roughly 100,000 jobs (Hyder et al. 2018). The total jobs created by recreational fisheries in countries such as United States and Germany are larger than the jobs dependent on commercial fisheries (Tufts et al. 2015). Recreational fishing is thus not only a private affair during leisure time, but also a producer of a large industry and of millions of jobs worldwide (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 that from a mac-

roeconomic perspective, however, the job effects are particularly relevant for a given region if they originate from nonresident fishing and thus truly constitute novel money that is circulating in the economy only due to the fishing activity (Parkkila et al. 2010; Butler et al. 2020).

Psychosocial benefits.—It is tempting to distinguish neatly between individual and social benefits (Parkkila et al. 2010), which is difficult 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 for individuals and generates a range of desired psychological outcomes related to temporary escape, accomplishment, self-determination, and other psychosocial benefits (Manfredo et al. 1996). Individual-level benefits scale to affect the social environment in which everyone is embedded and collectively represent social benefits. Likewise, if an individual is involved in a fishing club, the benefits are not clearly attributable to an individual. Fishing clubs can engage, for example, in all kinds of charity work, providing facilities for disabled anglers and 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 2006a), and they can 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 support research into causes of invisible pollution (Bate 2001). All such activities benefit both the individual angler (e.g., gain of knowledge, experience, pleasure, and satisfaction of achievement) and society at large because it profits from this kind of voluntary work.

Conservation benefits.—Recreational fishing obviously impacts fish populations and ecosystems, but the overall outcomes are not necessarily negative. Traditionally, recreational fishers have also been key guardians of aquatic ecosystems. Recreational fishing has a vital interest in conservation, and angler expenditure contributes to fish conservation actions across the world (Granek et al. 2008; Tufts et al. 2015). Not surprisingly, angling nongovernmental organizations or, more generally, "recreational fishing interests" are involved in all sorts of water and habitat improvement efforts to help prevent the loss or degrading of the aquatic fauna and flora. Conservation driven by the recreational angling interests may also create social, economic, and individual benefits. For example, on the shores of, or in the catchment area of, a heavily polluted lake, house and land value are typically lower than on a healthy lake (Muller 2009). All other wildlife, furthermore, will thrive, thereby increasing biodiversity and, in turn, potentially making entire regions more attractive for tourism in general, and not just angling tourism. Like in charity or educational work, conservation benefits many. Clearly, recreational fishers also negatively impact 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 Food and Agriculture Organization of the United Nations (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 like the arguments fashionable in biodiversity science and conservation

where people and policymakers assign value to individual species or populations, no matter which instrumental value (or ecosystem service in modern terms) they produce to humans (Ghilarov 2000). There is intrinsic value to species, and similarly, there is intrinsic value, for some people, to recreational fishing. In the written record, British, European, and American traditions emphasize that *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) 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 were not individuals that practiced recreational fishing. Indeed, there is evidence for all times and all cultures that such a practice was indeed the case (Pitcher and Hollingworth 2002), but The Treatyse of Fyshynge with an Angle 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 paid from the scientific community.

The popular side of recreational fishing culture, as expressed in all sorts of beautiful angling kitsch, in literally hundreds of thousands of how-to-books, in memoirs, and in angling magazines is well known. An often overlooked but integral part of recreational fishing are the cultural achievements in literature and fine arts. Recreational fishing 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 1653), 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. Yet, wherever you look for it, you will 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 Russian literature. Other Russian authors who fished or wrote about fishing include Ivan Goncharov, Anton Chekhov, Fjodor Dostoevsky, and Konstantin Paustovskii. More examples come from China. The recreational fishery in China has been around since ancient times, at least dating back to the ancient ShunDi (about 2277 BC–2277 BC) and ZIya Jiang of Shang dynasty (about 1156 BC to about 1017 BC). Chinese poems and the ancient Chinese literati, keen on fishing, used poetry to express their love for fishing, culminating in the rich contemporary leisure fisheries culture in China. In the Tang Dynasty, the poet Li Bai and the writer and philosopher Zongyuan Liu promoted the ancient canon, painting an artistic conception related to fishing. These examples show that 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 to the present day, the more obvious the purely recreational character of the fishing scenes is depicted. Some of the greatest names in European art, like Turner, Renoir, Monet, and Klee, had a close look at recreational fishing, perhaps wondering what it is that gets people hooked on fishing.

We conclude 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.

2.4.2 Pathocentric Viewpoints as Demarcation of Social Value Shifts

Manfredo (2008) analyzed 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 already been provided 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; fishing is for food. The situation may be different if one sees recreational catch and release as playing with food for no good reason (Aas et al. 2002). Even if the catch is retained for consumption, recreational fishing may be seen by some as morally wrong because the fish is said to suffer for an insufficiently important reason, that is to fuel the fun of the angler (de Leeuw 1996). This view has gained increasing support in the past 30 years, at least in influential academic circles among selected bioethicists. Some protagonists even demand a complete ban on or all parts of recreational fishing (see review in Arlinghaus et al. 2012). Indeed, practicing voluntary catch-and-release fishing of legally harvestable fish 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 that a mandatory catch-and-kill regime exists in Germany and Switzerland, except for undersized or otherwise protected fish. Such policies develop in a public climate that has changed from morally putting humans at the center of concern towards a perspective that heavily emphasizes the well-being of individual animals while downplaying the benefits realized by recreational fishing to individuals or society. This is clearly an extreme example that has not gained global traction, but it is useful to revisit the underlying moral argument. The supporting philosophies focused on the well-being of individual animals can be grouped into animal welfare, animal liberation, and animal rights perspectives (Arlinghaus et al. 2012).

Animal welfare.—Animal welfare allows the use of animals 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 tied to economic development and cultural values of societies. Animal welfare originally began in the UK and elsewhere focused on protection against or prevention of cruelty to animals. The famous Martin's Act of 1822 (i.e., 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 the 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 greatly significant because welfare implies positive promotion and therefore (scientific) knowledge of what benefits the animal. Without science-based information, welfare policies cannot be put in place.

The animal welfare perspective is 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 nonhuman life to participate in the ethical culture of human beings. This, however, does not mean that humans lack obligations to animals or plants. The sources of these obligations can vary considerably and overlap: tradition is one angle; others include compassion, religion, utility, esthetics, preferences, and law. In contemporary animal welfare considerations, animal suffering plays an important part; but it does not represent the entire

consideration. Strictly speaking, it does not matter for animal welfare whether an animal is capable of suffering, is 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 if it is conducted in a manner 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; Brownscombe et al. 2017; Danlychuk et al. 2018). 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 an anti-fishing philosophy and is not promoting any particular form of recreational angling as both catch and release and catch and kill are acceptable, given that 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 behaviors, such as the killing process following capture, are across the world.

Animal liberation.—The concept of animal liberation (Singer 1990) differs from welfare as it depends on the ability of an individual to feel pain and suffer; it is pathocentric. 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: (1) suffering—if a being can suffer, it has interests; (2) speciesism—a "prejudice or attitude of bias in favor of the interests of members of one's own species and against those of members of other species," and (3) utilitarian calculus—actions are right or wrong in proportion to their producing pleasure (happiness) or pain (suffering) (reviewed in Arlinghaus and Schwab 2011).

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 does not suffer, it does not matter, morally speaking.

Like racism and sexism, speciesism is seen as a social evil. Animal liberation sees itself as part of social reform and moral progress.

The utilitarian calculus means only the consequences of an action are morally relevant. A sine qua non condition for animal liberation is the ability of an animal to feel pain and suffer, which both 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 shortcut in certain circles is then to lobby for the precautionary approach and provide fish with the benefit of the doubt: even if there is doubt that fish are capable of a subjective experience, one should treat them as if they were sentient and capable of feeling pain (Sneddon 2006). In turn, all fish fall under animal liberation thinking and ethics.

What does animal liberation mean for recreational fishing? If 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 therefore angling is (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 to fish. This anti-angling outcome is not a panacea. Theoretically,

utilitarianism opens a door because depending on how one weighs the different elements in the utilitarian calculus, the outcome might favor 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. The animal liberation perspective, however, is ideologically driven by those who subscribe to it, and the presumed fish pain, in practice, regularly outweighs the pleasure of the angler and the generation of other sociocultural and socioeconomic 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 preserve its life by releasing it. Accordingly, some popular angling practices, such as catch and release, or the entire activity of fishing may well be banned. Thus, animal liberation constitutes an anti-angling philosophy that is popular in pro-animal activist groups such as PETA (People for the Ethical Treatment of Animals). 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 most visible in Germany or Switzerland (Arlinghaus et al. 2012).

Animal rights.—The Case for Animal Rights was first published in 1983 (Regan 1983). While Singer (1990, first published in 1975) uses the idea of rights rhetorically, the concept of animal rights is central for 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 1 year and human babies. Moral agents and moral patients seem worlds apart, but the common feature that they share is that they are all what Regan describes as "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. 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, according to Regan, 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 is not a rights holder as only an individual being can be a right holder.

Regan was unsure whether fish are subjects-of-a-life and thus in the category of moral patients. Nevertheless, recreational fishing is considered an unacceptable practice: "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 the view of Regan 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).

2.4.3 Biocentrism as Moderator among Populations/Habitats and Human Impacts

Further and final challenges to recreational fishing emerge from biocentric and ecocentric viewpoints, which assume that recreational fishing may negatively impact populations and ecosystems and more general the natural world. Although biocentrism does not put pain or suffering of animals in its core of moral consideration, it instead focuses 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 unnatural 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 some 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 (e.g., 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 advocates for the biocentric perspective 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 (Lewin et al. 2006). This objection is reflected in trends among some conservation biologists and conservation-oriented nongovernmental 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/animal, but rather on the assumption that humans in general, and more specifically, recreational fishers, can be a threat and an undesirable disturbance to wilderness as indexed by impacts on habitats or endangered species.

One can help to sort out this ethical clash by breaking 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). It then becomes clear that recreational fishing can be relatively easily reconciled with the wilderness-centered 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). Effectively dealing 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-centered philosophies with contemporary recreational fisheries mainly requires

jettisoning the idea of the angler or any recreational fisher as an unnatural 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 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-centered philosophy can come to terms with recreational fishing (Arlinghaus and Schwab 2011).

Recreational fishing and its management will see substantial and continued public support in societies and countries that emphasize anthropocentric worldviews. The situation is less clear when cultural value shifts perspectives of a sizable proportion of society towards pathocentric and biocentric worldviews (Inglehart 1990; Schwartz 2014). Recreational fishing might 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. Few cross-cultural studies have carefully elaborated if and how cultural value shifts actually affect recreational fishing or its practices. It is more certain that biodiversity conservation concerns are now prevalent in many developed and urbanized societies, and these concerns have 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. In some countries, accordingly, 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 regulations or even bans on access to fishers, including recreational fishers, to conserve nature from human disturbance (Arlinghaus 2006a; Roberts et al. 2017). Despite this clearly visible trend of biocentric values and attitudes affecting recreational fisheries, different societies vary starkly in the degree to which pathocentrism and biocentrism has entered the policy calculus regarding fisheries. The final section will review the social standing of recreational fishing in various countries of the world.

2.5 RECREATIONAL FISHERIES AROUND THE WORLD

Most, if not all, industrialized countries now place great importance on maintaining and fostering biodiversity and, in this context, critically view activities that harm species or genetic diversity. Societies, however, differ more in their rigorous application of animal rights/liberation/welfare ideas towards recreational fishing. The sections below are developed from a review of available information at regional and country-specific levels. This review focuses on information related to participation in and the economic importance of recreational fishing, efforts to develop or expand recreational fishing, and attitudes and perspectives of recreational fishers and others towards this activity. The level of information available for each region and country varies, and consequently, no information is provided for some large regions and countries, such as Southeast Asia, the Middle East, much of Africa, and Russia.

The summarized information from the detailed reviews is provided in Table 2.1. The summary illustrates that fishing participation rates vary widely and, in many cases, are not known with certainty. In most developing countries, recreational fishing is being encouraged to nonresidents to develop fishing tourism markets, and little information is known about recreational fishing among residents. Public acceptance of recreational fishing is strong but varies depending on specific regions, people (e.g., anglers and nonanglers), and context (e.g., catch-and-release fishing and fishing for food and recreation). Anthropocentrism still dominates perspectives and discourse in most areas, though biocentrism is increasingly part of highly developed countries. To date, pathocentrism views are in a minority or nonexistent in relation to recreational fishing. The summary here is consistent with the life cycle of fisheries (Figure 2.1), though some exceptions occur.

2.5.1 Northern America

Northern America includes the highly developed countries of the United States and Canada. Both countries have extensive recreational fisheries that are very popular among residents. From the 2016 national survey, 35.8 million resident Americans over 16 years old participated in recreational fishing in the United States (14% participation rate), resulting in 459 million fishing days and more than $\$46 \times 10^9$ in expenditures (U.S. Fish and Wildlife and U.S. Census Bureau 2018). In Canada, in 2010, the estimated 3.2 million resident anglers (9.4% participation rate) fished for more than 40 million days and contributed to at least $\$2.5 \times 10^9$ spent by anglers on fishing in Canada (Fisheries and Oceans Canada 2012).

Recreational fishing by nonresidents of Canada and the United States is important as it results in economic benefits accruing to mountain, southeastern, northeastern, and Laurentian Great Lakes U.S. states (Ditton et al. 2002). In Canada, more than 400,000 nonresidents from primarily the United States significantly contribute 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 this area (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 public wildlife value orientations in six 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. Opinions, however, changed when the focus was on recreational fishing for sport, which includes competitive fishing and fishing solely for fun. 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 greater 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 U.S. states, a sizable portion of the public holds negative attitudes towards recreational fishing on moral grounds if the activity is practiced just for sport. These perspectives have not led to constraining regulations on animal welfare grounds, although the reported levels of critical sentiment against specific forms of angling are consistent with those reported in other postindustrialized countries, including Germany, where stringent regulations on recreational fishing have been enacted

Table 2.1 Summary of the case studies in relation to various metrics emphasizing participation rates, trends, ethical perspectives, and a global assessment of support for the life cycle of fisheries.

Country/region	Economic development state	Participation rate and trend	Public acceptance and trend	Policies supporting recreational fisheries	Anthropocentrism or biocentrism evidence	Pathocentrism evidence
Northern America	Highly developed	High, stable/ increasing	Very high, stable	Yes Yes	Anthropocentric, increasing biocentrism	Some but no large impact on constraining fishing
Central America and Caribbean	Developing	Unknown	Unknown	Yes (some countries)	Unknown	Unknown
South America	Developing	Average, increasing	Unknown	Not widespread	Anthropocentric, some local biocentrism	None
Northern Europe	Highly developed	Very high, stable or decreasing	Very high, stable	Yes (some countries)	Mixed	Some, increasing regulations/debate in selected countries
Central Europe	Highly developed	Low, stable	High, but varied exceptions	No, with few	Biocentrism	Varied, strong in selected countries
Eastern Europe	Largely developed	Low, mixed	Likely high, stable	No, with one exception	Anthropocentric, emerging biocentrism	None
Southern Europe	Largely developed	Average and likely stable	High, stable	No	Anthropocentric, some biocentrism	None
Southern Africa	Developing	Unknown	Ambivalent, stable	No	Anthropocentric	None
East Asia	Developed or developing	Low, increasing to stable	Likely high	No	Anthropocentric, some biocentrism	None
South Asia	Developing	Likely low, increasing	Public acceptance is variable, trend is increasing	No	Anthropocentric	None
Oceania	Mainly highly developed	High, declining	High, stable	Yes	Anthropocentric, increasing biocentrism	Some, mainly public discussion, but limited regulatory actions
South East, central, and western Asia	Developing to developed	Unknown	Unknown	Unknown	Unknown	Unknown

(Arlinghaus et al. 2012). One possible reason is that the basal cultural value mindset in the United States 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, 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 (Federal, Provincial, and Territorial Governments of Canada 2014).

Researchers note that angling contributes to fish population declines (Post et al. 2002; Coleman et al. 2004), and fisheries management considers these impacts along with other conservation issues such as introduction of nonindigenous fish species when managing aquatic ecosystems (Johnson et al. 2009). Accordingly, there is active management of recreational fisheries impacts, and biodiversity conservation is now an important goal (Rahel 2016). Catch and release, both mandatory and voluntary, is permitted, and voluntary catch and release is actively encouraged to limit harvest of fish (Arlinghaus et al. 2007b). For some fisheries like Largemouth Bass *Micropterus salmoides* in the United States, voluntary catch-and-release fishing has resulted in virtually all caught fish being released (Myers et al. 2008) without evidence of negative public reaction to this practice. The same holds for competitive fishing, which is actively promoted and highly visible in the mass media in the United States (Schramm et al. 1991).

2.5.2 Central America and Caribbean

The countries of Central America and the Caribbean largely consist of developing countries. Information about recreational fishing for these countries is scant, with the only information being available for nonresidents (Bower et al. 2020). 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 d (Southwick et al. 2013). Similar attempts to characterize the importance of recreational fishing tourism exist for Costa Rica, Belize, and Mexico. It is believed that recreational fishing matters to governments and people within these countries because recreational fishing promotes tourism and expenditures that impact local and regional economies.

2.5.3 South America

The information base for recreational fisheries in South America is scarce (Bower et al. 2020), 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 this continent where subsistence and commercial fishing are more common. Recreational fisheries are now developed in marine and freshwater systems and include 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, and Orinoco) and the cold waters surrounding the Andes Mountains Range and the southern part of the continent. Although there is an extensive range and large 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 South America, it has been estimated that recreational fisheries activities could have generated revenues between $\$1.19 \times 10^9$ and U.S.$\$1.69 \times 10^9$ in 2015 (Funge-Smith 2018). For example, in Brazil, it is estimated that in 19 municipalities of São Paulo, revenues from recreational fisheries represent between $305.00 million and $57.06 million in 2014 (Freire et al. 2016). In inland fisheries of Brazil, the benefits from recreational fisheries are controlled by well-established businesses that often do not include the participation of local communities (Valbo-Jørgensen et al. 2008). In Argentina, there are least 3 million fishers (Baigún and Delfino 2001). In some cases, revenues between $15 million and $20 million per year were estimated in some areas of the Patagonia during the 1990s (Vigliano and Alonso 2000). In northeastern Argentina, dorado *Salminus* spp. and surubi *Pseudoplatystoma* spp. are the focal species of recreational fisheries (FAO 2018). Around the tropics, in Brazil and Venezuela, marlins (*Tetrapturus* spp. and *Makaira* spp.) and sailfish *Istiophorus* spp. have been valuable recreational fishing resources for a long time (Machado and Jaen 1982; Barroso 2002), and they have recently experienced protection by mandatory and voluntary catch-and-release regulations and practices. The economic value of recreational fisheries on billfishes is larger than the value in the commercial sector (Gentner 2016). Even though recreational fisheries are practiced in Colombia, few studies have been conducted (Alió 2012). The same holds true for Ecuador, where fishers target mainly marlins (*Kajikia* spp., *Tetrapturus* spp., and *Makaira* spp.), sailfish, Wahoo *Acanthocybium solandri*, tuna *Thunnus* spp., and dolphinfish *Coryphaena* spp., 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 nonnative salmonids to South America for recreational fishing purposes began in the early 1850s (MacCrimmon and Campbell 1969; Pascual et al. 2007). Local governments (Macchi et al. 2008; Arismendi et al. 2014) and illegal stocking efforts continue to support this recreational fishery across the continent (Arismendi et al. 2019). 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; Arismendi and Nahuelhual 2007; Macchi et al. 2008; Núñez and Niklitschek 2010). In many cases, local people feel connected to introduced salmonids because they have been present in local rivers for more than a century, and thus, stories about them have already been passed down for generations (Arismendi et al. 2014; Aigo and Ladio 2016). This connection makes it difficult to discuss biodiversity issues associated with nonnatives, and it is complicated by salmonids providing subsistence fishing opportunities for local communities. In Argentina (Vigliano et al. 2000; Macchi et al. 2008) 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 nonnative salmonids (Shepard et al. 2019). During the most recent decades, however, there has been a shift from promoting salmonid introductions to a more conscientious view of native ecosystems and their conservation value, supporting a more biocentric view of the public, legislators, and researchers/managers. Currently, managers and policymakers 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 socioeconomic benefit of recreational fisheries for local communities. Similar issues associated with introductions and translocations are present in Brazil (Latini and Petrere 2004; Bispo et al. 2016) for other species, such as Peacock Bass *Cichla ocellaris*.

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. Competitive fishing events are commonly promoted in Venezuela (Machado and Jaen 1982), Brazil (Freire et al. 2016) and Argentina (e.g., Dellacasa and Braccini 2016). Voluntary and mandatory catch and release is widespread in Brazil (Freire et al. 2016). Even though there is no formal study on the acceptance of recreational fisheries by the general public, some internal conflicts have been observed between fishers who practice catch and release and those that are harvested-oriented, such as with spearfishing.

2.5.4 Northern Europe

The countries of northern Europe consist of Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, and Sweden. The region in characterized by social and economically highly developed countries, scoring high on international welfare and quality of life scales. Unlike in more densely populated European countries, the inhabitants of these countries 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. Between 14% and 50% of residents reported that they participated in recreational fishing at least once during the past 12 months (Table 2.2). While most recreational fishing in these countries is conducted with rods and/or lines, 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. The trend in participation is generally slightly decreasing or stable. While significant lower participation rates are reported for younger adults in several countries, this is partly compensated for by an increase among older people fishing (Odden 2008).

There exists no general and systematic measurement of public attitudes towards recreational fishing for the region. Due to the high participation level and based on some data from Finland, Norway, and Sweden, the public is most likely strongly in support of the activity. 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. 2020). There is also a high premium placed on biodiversity conservation, which affects discussions surrounding stocking or the escapes of fish from aquaculture (Aas et al. 2018).

Sweden.—Kagervall (2014) reported on the attitudes towards recreational fishing among a random sample (N = 1,067) of the general population of Swedes between 16 and 65 years of age. Attitudes were measured toward (1) recreational fishing in general, (2) if the catch is used for consumption or if released, and (3) if recreational fishing was conducted with gill nets. While strong support existed for recreational fishing, the support was greatest if the catch was utilized and lowest if fish were caught with gill nets.

Norway.—A national nongovernmental organization engaged in outdoor recreation conducts 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 general attitudes of the public towards recreational fishing (Espen Farstad, Norwegian Hunting and Fishing Association,

Table 2.2 Participation and trends in recreational fishing in selected Scandinavian countries.

Country	Participation rate (year)	Age-groups	Participant numbers	Trend	References
Denmark	14% (2010)	16–74 years	530,000	Unknown	Sparrevohn et al. 2011
Finland	28% (2016)	Complete population	1,500,000	Negative, primarily for teenagers and young adults	Natural Resources Institute Finland 2018
Norway	42 % (2017)	16–74 years		Negative, primarily for teenagers and young adults	SSB 20171
Sweden	19% (2016)	16–80 years	1 400 000	Stable	SCB 20162

[1] www.ssb.no/en.
[2] www.scb.se/en/.

personal communication). Because almost all respondents reported a positive attitude toward recreational fishing, this question was replaced by a question about the attitude toward catch and release. Over the past decade, a stable pattern exists where 50% of Norwegians held a positive attitude towards the practice while somewhat fewer were against it and 10% of respondents had no opinion. Support for catch-and-release fishing has increased compared to the previous decade, with younger males having the most positive attitudes toward catch and release. In freshwater and among specialized anglers, the practice of catch and release has grown rapidly, such as for Atlantic Salmon Salmo salar angling during the past decade (Stensland et al. 2017). There is evidence that the utility of some anglers could drop if a mandatory catch and release was implemented for specific salmon rivers (Olaussen 2016). This result typifies the usual tension among specialized anglers and more harvest-oriented fishers seen in many areas of the world (Øian et al. 2017).

Finland.—In Finland, Sievänen and Neuvonen (2011) estimated that as many as 88% of the Finns have fishing skills. The main debate concerning recreational fishing in Finland has dealt with ethical issues, especially voluntary catch-and-release practices, which are acceptable to some recreational fishers and unacceptable to many Finns (Salmi and Ratamäki 2011). Mikkola and Yrjölä (2003) conducted a survey of 2,371 Finnish residents, of which 43% were anglers. About 50% of all respondents and 50% of all nonangling 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 nonangling fishers thought that banning 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-based fishing. For example, voluntarily release of some fish is only occasionally practiced by 30% of anglers, and only 4% of anglers release all the fish they capture (i.e., they practice total catch and release; Mikkola and Yrjölä 2003).

From the above data and summary, the citizens of northern Europe have a strong, generally positive and encouraging view of recreational fishing. This view likely arises from the strong historic and cultural ties that people have with fisheries and the 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 that promote tourism fishing), and other psychosocial benefits are recognized. The ethics of voluntary catch-and-release fishing, however, has been debated in Finland and only locally in Norway and Denmark. In parallel, biodiversity conservation concerns are generally well-developed and guiding management responses in recreational fisheries.

2.5.5 Central Europe

The central European countries, which include Austria, France, Germany, the Netherlands, Switzerland, and the United Kingdom, are all highly developed, urbanized, and industrialized and, as such, offer high population densities and, in comparison with northern Europe, low angling participation rates (Arlinghaus et al. 2015). 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 in these areas, particularly in the UK, and its social and economic importance is well documented based on repeated surveys conducted in all countries.

Austria.—Kohl (2000) surveyed 722 randomly selected nonanglers 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 that provides important contributions to the conservation of aquatic ecosystems. About one-fifth (22%) of respondents, however, agreed with the statement "Recreational fishing constitutes cruelty to animals." Similarly, about 20% of all nonanglers 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 all other nations, anti-angling regulations are probably most pervasive and restrictive to recreational fishing (Aas et al. 2002). There are two studies from two recent periods (2002 and 2008) that examined how the German public felt about recreational fishing. In 2002, 57% of respondents from a random sample of 323 telephone-interviewed people agreed that recreational fishing is a reasonable leisure activity while 21% of respondents disagreed (Arlinghaus 2004). In 2008, the percentage of people agreeing that recreational fishing is a reasonable activity was much lower (35%; Riepe and Arlinghaus 2014). Although the use of different survey methods might explain the change in attitude, the change could also signal a decline in the social acceptability of recreational fisheries. In 2002, however, 26% of the responding public indicated that recreational fishing should be constrained in its scope, and 27% felt that recreational fishing is unnecessarily cruel to animals (Arlinghaus 2004). Figures from 2008 mirrored these findings (Riepe and Arlinghaus 2014). For example, 25% of respondents agreed with the statement "Vatching fish as a pastime is cruel," and 35% agreed with the statement "Fish are suffering unnecessarily due to recreational anglers." Similarly, 35% of respondents 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 "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, 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 considered 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 United States are beyond 95%, Arlinghaus et al. 2012), but 10% found catch-and-harvest fishing to be immoral. Most of the public was surprisingly aware of many 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, public perceptions varied depending on the angling practice being considered. 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 (i.e., 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 nonharvest-oriented competitive fishing events, and 87% for a killing process of fish by hypoxia rather than rapid kill (Davie and Kopf 2006).

The public was also asked as part of the 2008 survey to evaluate various types of catch-and-release practices. Twenty-one percent of those surveyed considered selective harvest with voluntary catch and release to be immoral, and 40% felt that total catch and release was unethical. These results suggest that recreational fishing, along with some of its practices, is critically viewed by a sizable fraction of German society but that this fraction is typically much less than a majority. In general, most 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, and death by hypoxia). Voluntary catch and release, which is a practice implicitly banned in Germany (Arlinghaus 2007), is not viewed negatively by most of the German public. This clearly indicates that mechanisms other than public perspectives must have led to the adoption of stringent fish welfare policies.

In terms of the accepted benefits of recreational fishing, most Germans perceived fishing as providing social and psychological benefits. Only one-third of Germans, however, accepted that angling produced economic benefits (Riepe and Arlinghaus 2014). Similarly, the views of the public were largely split on the question of whether recreational angling positively contributes to conservation. When asking for the morally accepted reasons for fishing, ecological reasons (e.g., fishing to re-establish an ecological balance) received greater support than fishing for food. When trading off nature conservation with maintaining access to anglers, a majority would vote for nature protection (Riepe and Arlinghaus 2014). This result clearly identifies a biocentric worldview, trading off conservation against human use of aquatic ecosystems for fishing in favor of conservation.

England and Wales.—In England and Wales, public attitudes toward recreational fishing have been regularly monitored using randomly administered telephone surveys. Simpson and

Mawle (2005) compared surveys from three time periods (1997, 2001, and 2005). They found that across all time periods, a majority of people viewed recreational fishing positively. For example, between 71% and 75% of respondents agreed with the statement "Angling is an acceptable pastime." About a majority (between 46% and 54%) agreed with the statement "Anglers care for the environment." There was less support for the view that "angling is a cruel pastime" as about one-quarter (24% to 27%) agreed while nearly half (47% to 52%) of the respondents disagreed with this statement.

Research on the public perception of angling was repeated in 2010 (Simpson and Mawle 2010). The key results were overall large and growing public support of angling, which may result from the continued release of national policies by the government to support recreational fisheries (Department for Environment Food and Rural Affairs 2915). In 2010, most people continued to view angling positively (results in parentheses are from 2005, which are provided for comparison). Seventy-four percent (71%) agreed with the statement "Angling is an acceptable pastime" while only 7% (8%) disagreed. Fifty-one percent (53%) agreed with the statement "Anglers care for the environment" while 9% (14%) disagreed. A significant change existed between 2005 and 2010 regarding the statement "Angling is a cruel pastime." In 2010, fewer supported this statement: 20% (24%) agreed while 52% (47%) disagreed, and 26% (26%) neither agreed nor disagreed. This change in attitude between 2005 and 2010 was statistically significant, with angling being viewed as less cruel in 2010 than in 2005. Males were more likely to hold positive views about angling than did females. Young people (12–16 years old) also held positive views about angling in general, although they were somewhat less positive than adults were. Perceptions of angling as an "okay thing to do" were more positive in 2010 than 2005.

Switzerland.—A recent nationwide survey in Switzerland provided insights into the public perception of angling (Bieri et al. 2018). A large majority of people (about 75%) held a positive attitude towards fishing, but 18% held a negative or very negative attitude. An overwhelming majority of the public perceived recreational anglers as "lovers of nature" and 75% agreed or strongly agreed that the fishing is conducted in a fish-friendly manner. Yet, 21% of the public perceived fishing as cruelty toward animals.

The Netherlands.—Angling is conducted by about 8% of the Dutch population and is thus lower than the global average and declining in recent years (van der Hammen and Chen 2020). In 2017, a study was conducted that focused specifically on public opinion about angling in the Netherlands (R. Verspui, Dutch Angler Association, personal communication). The public primarily associated angling with fish and technical equipment but consider it as a boring but harmless, activity. Only 10% of the public were very positive about angling, but this percentage was stable over the past 25 years (Verspui, personal communication). The percentage of people that were decidedly negative about angling substantially dropped from 72% in 1994 to 42% in 2017, implying that there was an increase in the percentage of people stating that they were indifferent to or unsure about the activity.

The public in central Europe view recreational fisheries positively. A sizable proportion 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 England and Wales. Only Germany and, to a lesser degree, Switzerland, however, have adopted strong regulations of recreational fisheries based on welfare arguments. This indicates the importance of contextual conditions

of a given country, including the particularities of rulemaking, the influence of lobby groups, and the wider policy support received by recreational fisheries, which 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. There are no similar trends in the other central European countries for which data are available.

2.5.6 Eastern Europe

Eastern Europe consist of a variety of countries with different degrees of economic development, including Belarus, Bulgaria, Czech Republic, Hungary, Moldova, Poland, Romania, parts of Russia, Slovakia, and Ukraine. Information about recreational fishing for most countries is lacking and the focus here is on Czech Republic and Poland where some information exists. Recreational angling has, for some time, been considered one of the dominating forms of outdoor recreation in both Poland and the Czech Republic (Czarkowski et al. 2018; Lyach and Čech 2018; Remr 2020). Despite methodological difficulties that arise when attempting to estimate the precise number of active anglers, angling participation has substantially declined over the years 1979–2016 in Poland (Leopold and Bnińska 1980; Czarkowski et al. 2018). The Polish Angling Association, which remains the largest angling user group of inland waters in Poland, boasted a count of more than 1 million memberships in the early 1980s, yet that number has since diminished to roughly 0.63 million in 2016 (Czarkowski et al. 2018). Precise data on the status of one of the two largest regional departments of the Polish Angling Association (Katowice) shows that in the period 1996–2018, the member count has diminished from 58,000 to 43,000 (a decline of 26%; Czarkowski et al. 2018). 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 (Trella 2012). The reverse of this trend has been observed for marine fisheries, where the number of anglers has steadily increased over the years 2000–2014 (Trella and Mickiewicz 2016). In Poland, the average age of the angling population has sharply increased. In the late 1970s, people between 40 and 49 years of age represented 30.2% of anglers, while in 2016 individuals 60 years and older were the most populous group of anglers (34.7%).

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 a key social activity. In 2016, there were 320,000 registered recreational anglers, representing 3% of the Czech population. To date, three socioeconomic studies were conducted on trends in fisheries (in 2003, 2009, and 2017). Results from these studies revealed that anglers are usually men older than 40 years of age (60%), and most anglers (58%) have moderate or low economic status (The Czech and Moravian Fishing Union 2003, 2009, 2017).

In eastern Europe, 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 1989–1990 (Lyach and Remr 2020). During the communist regime, angling was a social activity for masses. Fishing was a very popular activity due to the permanent shortage of fresh food on the market and poverty of society and because many other activities (like traveling to many countries, including Western Europe) were not available to the vast part of population (Lyach and Remr 2020). Most anglers specialized on intensive fish harvesting, and many anglers considered fishing to be a quasi-subsistence activity (Leopold and Bnińska 1980; Ly-

ach and Čech 2018; Lyach and Remr 2020). After the political change in 1989, the number of anglers strongly decreased but the activity shifted from subsistence towards recreation. After this decrease, participation in recreational fishing has been increasing, and anglers, especially younger anglers, are increasingly practicing release of caught fish (Lyach and Čech, 2018). One-half of anglers practice catch and release while only 28% of anglers kept the fish that they caught (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 (Lyach and Čech 2018; Lyach and Remr 2019). The same trend is seen in Poland where voluntary catch and release is publicly accepted and generally preferred by anglers, especially by younger people, with more than 70% of the angling population reporting that they often or always release fish caught by angling (Wolos et al. 2008; Czarkowski et al. 2018). Following this trend, the first papers on catch and release of selected fish species and fishing efficiency using different hook types, including barbless hooks, appeared in Polish literature (Czarkowski and Kapusta 2019a, 2019b).

2.5.7 Southern Europe

Information about participation rates in recreational fishing in Southern European countries (i.e., Albania, Bosnia and Herzegovina, Croatia, Cyprus, Greece, Italy, Malta, Portugal, and Spain) is scarce and formal reporting is largely absent. Based on fishing licenses, participation rates in the marine recreational fisheries in the developed nations Spain, Italy, Greece, and Malta are between 0.6% and 2.7% (Hyder et al. 2018). These rates are likely overly conservative given the license systems (e.g., usually marine recreational fisheries involve boat licenses, where the number of recreational fishers is not quantified). Local studies suggest that the participation rate in marine recreational fisheries might be as high as 10% (Morales-Nin et al. 2005; Grau 2008). While there is no formal reporting system regarding participation rates in freshwater recreational fisheries, the number of licenses sold is even greater than for marine recreational fisheries, which suggests that the actual participation rate could be somewhere between 5% and 10% in countries such as Spain and Italy. A recent national telephone survey of the general public in Spain suggested that the participation rate in marine and freshwater angling is 9.7% based on people that fished at least once in the past 12 months (J. Alós and B. Morales-Nin, paper presented at I Simposio Internacional sobre Pesca Marítima Recreativa Vigo, 2018), a value similar to the average participation rates in industrialized countries (Arlinghaus et al. 2015).

A proper quantification of the economic impact of recreational fisheries in these countries is lacking. Local studies, however, suggest that the economic impact of marine recreational fisheries may be strong. For example, annual expenditures by resident recreational fishers were estimated to be €57 million in 2010 in Mallorca, Balearic Islands, amounting to about 1% of the gross domestic product of the island and being three to four times larger than the economic impact of local commercial fisheries (Morales-Nin et al. 2015). Spearfishing is also economically and socially relevant in the southern European countries (Sbragaglia et al. 2016), although the participation rate is low at about 4% of the total marine recreational fisheries in places such as Mallorca (Morales-Nin et al. 2005).

The attitudes toward recreational fishing in southern European countries have not been properly quantified. A randomly administered telephone survey to several thousand households in Spain in 2017 generated some new insights into these attitudes towards recreational

fisheries (Alós and Morales-Nin, unpublished). Accordingly, 41% of the Spanish public perceived recreational fishing as a good or very good activity to be practiced during leisure time. Regarding possible conflicts between recreational fishing for fish consumption and attitudes towards activities like catch and release, half of the Spanish population indicated that recreational fisheries for harvest was a good or very good activity while this percentage increased to 60% when the objective of recreational fishing was for catch-and-release purposes (Alós and Morales-Nin, unpublished). Thus, there are very positive attitudes and a moral acceptance of activities like recreational fisheries, and these positive attitudes increase when focusing on catch-and-release fishing.

The economic benefits of angling are poorly understood by the Spanish public. Only 20% of the population agreed or fully agreed with the idea that recreational fisheries produce a relevant number of jobs and job benefits for society (Alós and Morales-Nin, unpublished). By contrast, the general public has the opinion that commercial fisheries produce more jobs and 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).

Research in different southern European countries has resulted in a list of ecological impacts from recreational fishing (Font and Lloret 2014), especially spearfishing (Coll et al. 2004). When the Spanish public was asked whether recreational fisheries should be banned because they can overexploit marine fish stocks, only 22% agreed or strongly agreed, suggesting that most of the Spanish public does not view recreational fisheries as an ecologically harmful activity.

2.5.8 Africa

There is very limited information available on recreational fishing in Africa (Belhabib et al. 2016), except for South Africa. Recreational angling participation appears to be stable in South Africa, although participation rates are considerably below international averages and the trends are uncertain given the lack of valid surveys. While there have been no specific surveys or other research on this topic in southern Africa, the attitudes of the public towards recreational angling appear to be diverse in this region (Barnes and Novelli 2008; Britz et al. 2015). To illustrate this point, this section highlights some similarities and differences in the public perceptions of recreational fishing in South Africa, Namibia, and Angola.

In South Africa, recreational angling is considered to be a socially relevant activity that is encouraged as a cost-effective, healthy outdoor activity. In Namibia, recreational angling is perceived to be one of the primary pastimes and a relevant social and economic activity (e.g., Zeybrandt and Barnes 2001). Angling is viewed favorably as a critical contributor to the local economy of the coastal towns in this desert region (Kirchner and Stage 2005; Barnes and Novelli 2008).

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, except for 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 of 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 organizations are dedicated to reduce animal cruelty. Little public debate has occurred 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" (SPCA 2010). 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 met with resistance from recreational anglers and the general public.

2.5.9 East Asia

East Asia consists of a mix of developed and developing countries, including China and its administrative regions (Hong Kong, Macao), Mongolia, North Korea, South Korea, Japan, and Taiwan. Information on recreational fisheries in this region is highly variable and the focus below is on China and Japan.

China.—Recreational fisheries are mainly organized as events in small multi-purpose pond fisheries based on fee fishing (Shen 2008; Yang et al. 2017). Chinese recreational fisheries are 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 primary, secondary, and tertiary industries to provide products and services to satisfy the leisure needs of people. In particular, the recreational fisheries here are 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 (Yang et al. 2017).

In recent years, the recreational fishery in China has developed rapidly, as evidenced by the increasing total value of recreational fishing (Table 2.3). Early estimates suggested 90 million anglers, which represents 7% of the population (Shen 2008), but more recent estimates indicate that about 220 million Chinese people fish for leisure (China Society for Fisheries 2018). In 2011, the output value of the national recreational fee fishery was $\$3.61 \times 10^9$, and reached $\$9.38 \times 109$ in 2016. The percentage of total output value of the recreational fishery economy increased from 3.2% in 2011 to 5.5% in 2016. In 2016, there were 200 million people employed in the recreational fishery (Yang et al. 2017).

The acceleration of industrialization has led to an increase in demand for recreational fishing. Development will continue to grow rapidly as experts predict that over the next 20 years, the tourism and leisure markets in China will reach more than 8×10^9 people. No information exists on how the public views recreational fishing in China.

Japan.—Recreational fishing is a very popular outdoor activity. Based on the "White Paper on Leisure" (Japan Productivity Center 2017) in Japan, recreational fishing was ranked as the 10th most popular outdoor activity, with 6.9 million people (6.9% of Japanese aged between 15 and 79 years) participating in recreational fishing. The participation rates were 10.9% and

Table 2.3 Economic output value of the recreational fishery in China, 2003–2016 (unit: hundred million yuan). Data source: National Bureau of Statistics of China (2016); output value: according to the current price statistics.

Year	Total fishery output value (A)	Recreational fishery output value (B)	Recreational fishery growth rate (%)
2003	3,323	54	
2004	3,796	76	40.74%
2005	4,180	82	7.89%
2006	4,569	102	24.39%
2007	4,956	154	50.98%
2008	5,521	174	12.99%
2009	5,937	216	24.14%
2010	6,752	211	–2.31%
2011	7,884	256	21.33%
2012	9,049	298	16.41%
2013	10,105	366	22.82%
2014	10,861	432	18.03%
2015	11,329	489	13.19%
2016	12,003	665	35.99%

3.0% for men and women, respectively. In addition, recreational angling ranked first for men in the potential demand (i.e., would prefer to conduct) among all of sports, although the rank was outside of the top 10 sports for women. Recreational fishing, therefore, is very popular and preferable activity, especially for men.

Japanese people love to eat fresh whole fish, shellfish, and lobster (Altintzoglou et al. 2016). Thus, harvest-oriented fishing is a very highly accepted practice by almost all Japanese people. According to a recent Internet survey, 35.2% of anglers enjoy recreational fishing in freshwaters (Nakamura 2020). Also, the general public seems to view recreational fishing and inland fishery cooperatives positively (Nakamura 2019).

2.5.10 South Asia

The countries in South Asia (Afghanistan, Bangladesh, Bhutan, India, Maldives, Pakistan, Nepal, and Sri Lanka) are characterized as developing economies. Data availability for recreational fisheries activities for these countries is poor and formal reporting is largely absent (Welcomme 2011). Participation in recreational fishing, however, is increasing in the region (e.g., the Maldives, FAO 2009; Bangladesh, FAO 2010a; and 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.

Quantifying and comparing recreational fishing activity are difficult in South Asia. Recreational fisheries activities in this region, like elsewhere, are diverse in terms of habitats, gears, and target species groups, but recreational fishing activities also commonly blend into other endeavors such as subsistence and small-scale fishing activities and traditional community harvests. The discussion of recreational fishing activities here is limited to those using rod and reel.

The earliest known reference to recreational fishing activity in South Asia is found in the Mānasōllosā 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 poor. Recreational fishing does not constitute a reported portion of national income in any South Asian countries, and national rates of participation, while unknown, are not expected to be high relative to other regions. For example, in Pakistan an estimated 900 participants landed approximately 130 metric tons of fish across all recreational fishing activities in 2002, and participation is estimated to have increased to 1,000 participants operating 120–150 licensed boats by 2009 (Khan 2006). This example illustrates that where recreational fishing activity occurs, it is 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 (this is also the case in Bhutan: Rajbanshi and Csavas 1982). Anglers active in 25 Indian states perceive recreational fishing as being of high conservation importance and exhibit a strong 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), the prevalence of destructive fishing gears such as poison or dynamite (Rajbanshi and Csavas 1982; Bower et al. 2017), and the profuse stocking of native and nonnative hatchery fish across the region (in Bhutan: Rajbanshi and Csavas 1982; in Afghanistan: Petr 1999; in India; Sehgal 1999; in Pakistan; Khan et al. 2011). 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. Indeed, angler interest in mahseer Tor spp. in India led to the formal identification of the Humpback Mahseer as Tor remadevii and its subsequent listing by the International Union for the Conservation of Nature as critically endangered (Pinder et al. 2018a, 2018b). Finally, conflict among socioeconomic classes of fishers is expected to increase in South Asia as recreational fishing activity increases. 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).

2.5.11 Oceania

Australia, New Zealand, and the Pacific Island countries and territories represent an economically, culturally, and biophysically diverse region. In terms of recreational fishing, its importance is more significant in highly developed countries of Australia and New Zealand (Figure 2.2). In most Pacific Island countries and territories, fishing is largely focused on subsistence fishing, small-scale coastal commercial fishing, or offshore commercial fishing for tuna (Ansell et al. 1996; Gillett and Tauati 2018). There are some important exceptions though where dedicated recreational fishing tourism is an important or potentially important economic con-

tributor (Whitelaw 2003; Wood et al. 2013; Allen 2014). Examples of this include charter fishing operations that target Bonefish *Albula vulpes* in countries such as the Cook Islands and New Caledonia (Allen 2014), gamefishing for billfishes in many central and western Pacific countries and territories (Whitelaw 2003), and those that target Papuan Black Bass *Lutjanus goldiei* and Barramundi *Lates calcarifer* in Papua New Guinea (Sheaves et al. 2016).

Most discussion in this section focuses on Australia where recreational fishing is a key way that many people experience the aquatic environment. It is considered a socially relevant activity in Australia, as evidenced by the large number of participants and inclusion in state fisheries legislation of objectives specific related to recreational fishing (McPhee 2008). There are also national level policies devoted to recreational fisheries that exemplify the high standing of angling in society. This includes a national recreational fishing industry development strategy supported by the Australian government (RFAC 2011). The last national recreational fishing survey undertaken in 2000–2001 identified that 3.36 million people (19.5% of the population at the time) participated in recreational fishing annually for an estimated 23.2 million fishing trips (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 (NSW DPI 2016). Much of this government investment originates from consolidated revenue, although some is recovered from recreational fishing license fees and other specific levies.

Despite being recognized as a socially relevant activity, recreational fishing participation rates in Australia have fallen, particularly in urban areas (McPhee 2017). Increasing population in Australia has, however, stabilized the total number of recreational fishing participants through periods surveyed. In the Australian state of Victoria, $31.57 million is being invested over 5 years in a program called "Target One Million," which aims through various initiatives to increase the number of recreational fishing participants to 1 million in 2020 from the estimated 719,000 in 2009 (Ernst and Young 2009).

No quantitative information exists on the moral acceptability of recreational fishing in Australia. Catch-and-release fishing is becoming an increasing dilemma in recreational 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 of whether this practice is ethically appropriate is a values-based proposition. The scientific focus on animal welfare and recreational continues to grow in Australia (Walker et al. 2014; Wadiwel 2019). There is a national animal welfare strategy for recreational competition and charter fishing in Australia, which, in collaboration with the recreational fishing sector, has developed practical approaches for addressing relevant animal welfare issues (Hardy-Smith 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 impacts recreational fishers is associated with biosecurity. A recent 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 anglers introduced them into the wild by using

infected, uncooked prawns for bait (Diggles 2017). The detection of the WSSV in the wild necessitated 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 and provides an example of the increasing importance of biocentric values.

2.6 CONCLUSIONS

This review provides general support for the life cycle of fisheries that hypothesizes that interest in recreational fishing rises rapidly with economic development before eventually stabilizing or declining. Urbanization was consistently observed to have a negative impact on recreational fishing rates. The review showed, in agreement with the life cycle metaphor, that in poorer 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, South Africa, Central America, and the Caribbean). By contrast, in economies in transition (e.g., China, India, Angola, and many countries in South America), interest in recreational fishing is increasing, 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 better, yet relative participation rates in fishing have tended to stabilize or decline with notable exceptions, such as the United States or the Czech Republic, where relative participation rates appear to be increasing after a period of decline. Overall, the present review supports 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 that fish is historically situated within society appear to be major drivers affecting interest in fishing as well as the public 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 (e.g., rule systems) developed by organizations predictably changes from a focus on anthropocentric moral perspectives to biocentric ones that broadly focus on maintaining or restoring wilderness 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. The review is consistent with a shift from anthropocentrism to more biocentric viewpoints as societies develop economically in relation to recreational fisheries. This is 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; Aas et al. 2018).

In contrast to what the life cycle of fisheries proposes, the 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 the notable exceptions of Germany and Switzerland. Fish welfare is rarely a concern in poorer countries or developing

nations. By contrast, although fish welfare discourse occurs in almost all developed countries, this does not mean that the recreational activity is threatened or that welfare-oriented regulations similar to Germany and Switzerland will be widely implemented. Research is needed to understand how country-specific (1) fisheries management organization and representation in the policy arena, (2) social embeddedness and social-political support of recreational fisheries, and (3) presence of pro-fish welfare activism put countries on different paths that either encourage or discourage fish welfare regulation. The outcomes also seem largely independent of the actual public perception of 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 United States have revealed that in the more urbanized states about a quarter of the public views angling for sport as cruel, strong constraints on critical angling practices have only materialized in Germany and Switzerland. Better understanding of 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. It is also 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 nonconsumptive aspects of catch and release (Øian et al. 2017).

Recreational fisheries are generally seen as an acceptable pastime activity, at least for countries where survey data are available. This statement needs further evidence. It is not the case that in each survey that most respondents felt positive about recreational fisheries. Rather, only a minority felt negatively about recreational fisheries, with many individuals simply being indifferent. It is also important to make a distinction between acceptance and support. Moreover, there is ample variation among countries. For example, in the United States, more than 90% consider fishing for food morally acceptable while the corresponding figure is only 60% in Germany. Nevertheless, in both cases, the majority express a favorable view about recreational fishing. Thus, overall, there are no identifiable developments that strongly threaten the favorable view of the global publics towards recreational fisheries. The tension among biocentric conservation and more anthropocentric fisheries management, nevertheless, is likely to stay or become stronger as agencies increasingly regulate recreational fisheries for ecological reasons in many areas of the world.

Based on this global review of recreational fishing trends, several research needs and limitations are clear. First, national level surveys of both recreational fishing participation and the public 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, with exceptions of the UK, Norway, the United States, and Canada. 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 the analysis supports the life cycle of fisheries, ample variation persisted that supports 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-national comparative studies is a major research need. Finally, major structural changes are occurring in many societies related to immigration and alteration of ethnic and cultural grouping, and little is known how these might affect future

recreational fishing participation and behavior and the view of the public towards fishing. Clearly, major events such as global pandemics that eliminate time constraints might affect recreational fishing, which constitutes an emerging research area.

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