



Providing context to the global code of practice for recreational fisheries

R. ARLINGHAUS

Department of Biology and Ecology of Fishes, Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany
Inland Fisheries Management Laboratory, Faculty of Agriculture and Horticulture, Humboldt-University of Berlin, Berlin, Germany

S. J. COOKE

Fish Ecology and Conservation Physiology Laboratory, Department of Biology, Carleton University, Ottawa, Canada

I. G. COWX

University of Hull, International Fisheries Institute, Hull, UK

Abstract An in-depth explanation of selected content of the European Inland Fisheries Advisory Commission's 'Code of Practice for Recreational Fisheries' (CoP) is presented. The focus is on core areas that were intensely debated in the drafting the CoP. These include definition of recreational fishing, recreational fishing practices, fish welfare, recreational fisheries management and research. It is anticipated that the CoP for recreational fisheries promotes best practice and management principles for sustainable recreational fisheries, within the recreational fisheries sector and ancillary industries/sectors regionally, nationally, and ultimately globally. To be viable, the CoP for recreational fisheries must be adopted by the international community complementing the Code of Conduct for Responsible Fisheries of the Food and Agriculture Organization of the United Nations.

KEYWORDS: angler, angling, code of conduct, fish welfare, sustainable fisheries management.

Introduction

Fisheries throughout the world, in all environments, are in crisis from exploitation pressures to meet societal needs (Pauly *et al.* 2002; Allan, Abell, Hogan, Revenga, Taylor, Welcomme & Winemiller 2005). Sustainable use of the fisheries resources requires concerted actions that are adopted by individuals, stakeholder groups, non-governmental organizations (NGOs), regions, states and nations (Arlinghaus *et al.* 2002). One global initiative to promote sustainable fisheries has been the Code of Conduct for Responsible Fisheries (CCRF) by the Food and Agriculture Organization of the United Nations (FAO 1995). This document was endorsed by multiple national and international bodies and countries (Cochrane & Doul-

man 2005). It provides guidelines for the sustainable use of the world's fisheries (Garcia *et al.* 1999). Notwithstanding some constraints in its application (Cochrane & Doulman 2005), the CCRF has successfully influenced fisheries management world-wide, not least by raising the issue of non-sustainable fisheries among policy makers and the broader public (Hosch 2009).

The CCRF focuses mainly on marine commercial fisheries, but some articles are relevant to the commercial and recreational inland fisheries (Pitcher 2003) and the aquaculture sector, and these have been developed into technical guidelines to promote the CCRF relative to these activities (e.g. FAO 1997). The CCRF, however, does not address issues that are particular to recreational fisheries, despite their

Correspondence: Prof. Dr Robert Arlinghaus, Department of Biology and Ecology of Fishes, Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany (e-mail: arlinghaus@igb-berlin.de)

increasingly recognised socio-economic and ecological importance in industrialised countries (Arlinghaus *et al.* 2002; Cooke & Cowx 2004) and transitional economies (Mike & Cowx 1996; Cowx 2002; Arismendi & Nahuelhual 2007). It has also become apparent that high recreational fishing mortality (either harvest or incidental post-release mortality) and certain fisheries management actions, such as introduction of non-native fish, can negatively impact fish stocks (reviewed in Cooke & Cowx 2006; Lewin *et al.* 2006), something that has been largely overlooked by the public (McPfee *et al.* 2002; Post *et al.* 2002). Moreover, despite considerable environmental and cultural differences, recreational fisheries worldwide (Arlinghaus & Cooke 2009) are threatened by pollution, anthropogenic change of aquatic ecosystems, cultural change and changing societal perceptions that conflict with the practice (Arlinghaus *et al.* 2002; Arlinghaus 2006), and thus have similar rights and plights. Hence, the need for a global code of practice (CoP) for the recreational fishery sector has increased (Cowx & Arlinghaus 2008).

Several international conferences (Hickley 1998; Pitcher & Hollingworth 2002; Cowx & Arlinghaus 2008), and international organizations, agencies and angling bodies [e.g. FAO-European Inland Fisheries Advisory Commission (EIFAC), European Anglers Alliance (EAA)] have highlighted the need for an international CoP for recreational fisheries. Such a CoP would reduce the need for national, provincial and local authorities to develop their own code as they could use and adapt an international document that sets a minimum standard of ethically permissible, environmentally friendly and, depending on local situations, socially acceptable recreational fishing (Cowx & Arlinghaus 2008). After some delay in development, primarily because of lack of funding, the EIFAC instigated the development of a CoP for recreational fisheries. The final document (EIFAC 2008) built on an early version produced by staff of EAA and various other nationally or locally available codes of practice for recreational fisheries. Various stakeholder groups, ranging from individual anglers and conservationists to representatives of angling bodies, fisheries agencies and academia, were invited to provide input into a draft CoP. The final CoP was endorsed by the 25th session of EIFAC in May 2008 in Antalya, Turkey. It provides a generic collection of best practice guidelines for the sustainable development of recreational fisheries. Its provisions are not narrowly focused on the recreational fishing sector, but include broader issues, experiences and impacts of relevance for aquatic ecosystems, fish stocks and

recreational fisheries in general. All principles of the CoP for recreational fisheries are scientifically defensible and based on fact to avoid conflict.

The aim of this paper was to provide explanation for the structuring and selected content of the CoP for recreational fisheries developed under the auspices of EIFAC. The discussion is restricted to the most relevant articles. The structure of the present paper follows the extensive comments received in the preparation of the CoP that highlighted areas needing in-depth explanation to avoid misunderstanding. First, the structure of the CoP is introduced. Afterwards recreational fisheries are defined so as to mark a clear separation between this practice and commercial fisheries or pure subsistence fisheries. Finally, in-depth context for selected core areas and articles (see Fig. 1) in the original CoP is provided, followed by an outlook into the future.



Figure 1. Articles of the code of practice (CoP) for recreational fisheries in hierarchical order. Core areas (with its respective articles) are influenced by each level in a top-down manner. For example, values influence policy which influences technical substance etc. Most core areas of the CoP are comprised by various individual articles. Only selected articles are discussed in the text.

Structure of the CoP for recreational fisheries

The CoP (EIFAC 2008) has 13 articles and one annex that lists definitions of major terms used in the document (Fig. 1). In addition, a brief introduction highlights the purpose of the CoP.

Similar to the structure of the CCRF (FAO 1995), the first three articles of the CoP for recreational fisheries are introductory: (1) Nature and Scope; (2) Objectives; and (3) Implementation and Updating. Some General Principles are contained in article (4), which is followed by the article (5) on Environmental Stewardship and Ethics. These two articles prescribe a set of basic values that people involved with recreational fisheries should embrace when promoting sustainability. However, pro-environmental values are not good enough to develop sustainable recreational fisheries. What is also needed is a functioning Policy and Institutional Framework (article 6) as well as appropriate Compliance and Enforcement (article 7). What follows these articles on basic policy and governance are four articles that deal with the various technical areas of importance for developing responsible and sustainable recreational fisheries, viz. Recreational Fishing Practices (article 8); Fish Welfare (article 9); Stakeholder Interactions (article 10); and Management (article 11). Successful recreational fisheries management is impossible without some level of understanding about the dynamics of recreational fisheries. This necessitates recreational fisheries research, which is dealt with in article (12). Article (13) on Awareness, Education and Training closes the CoP by detailing necessary steps to popularise the code and educate fisheries and other stakeholders impacting on recreational fisheries resources.

As is typical for documents developed by international bodies with no executive power, the CoP for recreational fisheries is voluntary and is designed to be interpreted and applied in conformity with the relevant rules of various international, national and regional agreements and legislation relating to the aquatic environment and fisheries. It complements the CCRF. The CoP for recreational fisheries is specifically directed towards recreational fishing but also addresses, to some extent, anthropogenic influences that impact on aquatic ecosystems and fish stocks external to what is commonly perceived as the recreational fisheries sector (e.g. water resources management, nature conservation). This is particularly relevant in freshwater recreational fisheries where non-fishing influences have had, and continue to have, the most dramatic impact on the quality of the recreational fishing experience and fish stocks (FAO 1997; Collares-Pereira & Cowx 2004;

Cowx & Arlinghaus 2008). Therefore, while overfishing seems to be the most important impact on many commercially exploited fish stocks in the marine environment (Pauly *et al.* 2002), overfishing is of lesser importance in recreational fisheries, but this does not mean that recreational fisheries exploitation is without an impact (see Post *et al.* 2002; Lewin *et al.* 2006). Although the EIFAC Code was developed with respect to Europe, its provisions have been drafted in a way that the document is applicable worldwide. It covers all recreational fisheries in both fresh and marine waters.

Defining recreational fishing

Defining recreational fisheries by distinguishing this activity from commercial and pure subsistence fishing has proved elusive. Various definitions of recreational fisheries have been proposed in the primary literature or in policy documents, but all have weaknesses or are not sufficiently generic for a CoP that covers all forms of recreational fisheries globally. For example, the discipline of leisure sciences defined recreational fishing as 'any form of fishing done during free time (as opposed to working time) that is subjectively defined by the individual as being leisure' (Aas 2002). However, the term 'free time' used by leisure researchers to define recreational fishing excludes indigenous people, children younger than school age and jobless people (including retirees) that do not experience the dichotomy of working time vs leisure time (Aas 2002). Other earlier definitions of recreational fishing focus on the type of benefits accruing to the individual actor in the process of fishing. For example, Policansky (2002) defined recreational fishing as 'fishing primarily for recreation or enjoyment as opposed to fishing whose main purpose is the production of food or other products'. Similarly, FAO (1997) defined recreational fishing as 'fisheries conducted by individuals primarily for sport but with a possible secondary objective of capturing fish for domestic consumption but not for onward sale'. These definitions address the motivations of recreational fishers such as fishing for enjoyment (Policansky 2002) or sport (FAO 1997). However, motivations of recreational fishers are diverse and differ from individual to individual and probably from fishing trip to fishing trip (Fedler & Ditton 1994), rendering the use of specific motives unsuitable for defining recreational fishing. Moreover, according to modern perceptions of the term sport in the sport sciences, defining recreational fishing as sport is only valid for particular forms of recreational fishing, such as those that involve competition (Heister 2005).

It is useful to approach a generic definition of recreational fishing and distinguish it from commercial and pure subsistence fishing by focusing on primary human needs and analyse which type of fishing is fulfilling these needs (Arlinghaus & Cooke 2009). Maslow (1971) described human needs as a hierarchy in terms of their potency. Although all needs are instinctoid, i.e. innate, some are more powerful, i.e. more important for human survival than others. The base of the hierarchy is formed by the physiological needs, including the biological requirements for food, water, air and sleep. Once the physiological needs are met, an individual can concentrate on the second level, the need for safety and security, the third level (love and belonging), the fourth level (self-esteem) and so on. In the process of drafting the CoP, it was agreed that recreational fisheries is different from commercial and pure subsistence fisheries because recreational fishing does not contribute substantially to meeting essential physiological (i.e. nutritional) needs. By contrast, commercial and pure subsistence fisheries are primarily directed towards livelihood and therefore contribute substantially to meeting physiological needs. Moreover, recreational fishing products are generally not sold on markets, but there are rare exceptions to this rule where recreational fishers sell surplus harvest to offset costs (Cowx 2002). To account for these facets and to distinguish recreational fishing unequivocally from commercial fishing and pure subsistence fishing, the following generic definition of recreational fishing was adopted for the CoP: *'Recreational fishing is fishing of aquatic animals that do not constitute the individual's primary resource to meet nutritional needs and are not generally sold or otherwise traded on export, domestic or black markets'*.

This definition is sufficiently broad to include other animals beyond fish (e.g. invertebrates such as lobster and crabs), it avoids pointing to individual motivations (fun, sport, enjoyment, thrill of the catch, social bonding), does not discriminate against particular methods of fish capture (e.g. recreational rod and line angling vs recreational gill netting, which is an important recreational fishing activity in some countries [Salmi *et al.* 2008]), does not preclude the catch being taken for personal consumption (as long as the catch does not become the primary resource to meet essential physiological needs), does not discriminate against non-Western cultures, but does discriminate commercial and purely subsistence fishing from recreational fishing. It is acknowledged that the unambiguous demarcation between pure

recreational fisheries and pure subsistence fisheries is impossible because many recreational fishers have strong subsistence-like incentives to harvest fish (Macinko & Schumann 2007). However, using fishing activity to generate resources for livelihoods marks a clear differentiation between recreational fisheries and pure subsistence fisheries, and, as a rule, recreational fishers have the capacity to substitute the products of their fishing experience by other products to meet nutritional needs. Globally, angling is by far the most common recreational fishing technique, which is why recreational fishing is often used synonymously with (recreational) angling (Arlinghaus *et al.* 2007b).

Guiding norms and values

The CoP provides a balance between principles that promote and strengthen recreational fisheries, for example, by explicitly acknowledging its role and importance in many of the world's freshwater and marine fisheries, while at the same time forwarding the general principle of environmental stewardship as the main moral principle against which to judge the activities of those involved in or dealing with recreational fisheries (articles 4 and 5). This duality is, for example, stressed by emphasising the importance of providing access to recreational fisheries, but doing so only to the extent that sustainability is assured.

Environmental stewardship as the guiding moral value system is defined in the CoP as 'the moral obligation to care for aquatic environments and the actions undertaken to provide that care.' Thus, the CoP requires the recreational fisheries sector to support and implement measures that address undesirable impacts of recreational fishing practices and management actions on individual fish, fish populations and the aquatic ecosystems as a whole. Particularly, the sector should aim to avoid irreversible, costly or slowly reversible changes to aquatic biodiversity, fish populations and aquatic ecosystems, and there is increasing scientific evidence that recreational fishing can indeed exert such impacts (Post *et al.* 2002; Cooke & Cowx 2006; Lewin *et al.* 2006). The CoP highlights these potential impacts that recreational fishing might have on fish stocks and the ecological services provided by fish to society (Holmlund & Hammer 1999). The CoP is therefore not a one-sided document that only promotes recreational fishing. Instead, it is proactive; emphasising actions to address contentious issues, while improving and conserving high quality fishing experiences.

Technical substance

The core of the CoP encompasses articles that provide the technical substance of what constitutes good practice in recreational fisheries. Some of the more heavily debated articles are briefly discussed below.

Recreational fishing practices

For the CoP to be accepted by society at large, it must provide guidelines on how to conduct environmentally friendly, socially acceptable and conflict-free fishing practices. The code, *inter alia*, provides this by calling upon recreational fishers to:

- not take more fish or other aquatic organisms than are needed for consumption in the close network of family and friends.
- avoid littering and damage to the environment (Cryer *et al.* 1987a; Radomski *et al.* 2006).
- not stock, introduce or transfer fish or other aquatic organisms within or between catchments without permission from the appropriate authorities; this is particularly relevant if live baitfish are used in water bodies from which they were not captured (Hickley & Chare 2004).
- avoid disturbance of wildlife and waterfowl, particularly not fishing near nesting birds and avoid using bait that might be ingested by waterfowl (Cryer *et al.* 1987b).
- minimise the use of lead weights on the fishing line and use alternatives to lead where possible and when appropriate (Jacks *et al.* 2001; Radomski *et al.* 2006).
- minimise other environmental impacts resulting from access to fishing sites (Cooke & Cowx 2006), boat travel (Wolter & Arlinghaus 2003), groundbaiting/chumming (Niesar *et al.* 2004) and other fishing activities such as collection of bait (e.g. backfill holes on the foreshore that are dug when collecting bait) (McPfee *et al.* 2002).

It is acknowledged that not all of the issues mentioned above are of relevance to the same degree in every recreational fishery. Moreover, these factors are probably present a lesser threat to aquatic biodiversity globally than other factors impacting on fisheries resources (Lewin *et al.* 2006). Locally, however, some of the factors can be of importance for conservation, hence their inclusion in the CoP.

Fish welfare

A contentious issue within recreational fisheries is fish welfare and how this welfare might be compromised in the process of recreational fishing (Huntingford *et al.* 2006; Arlinghaus *et al.* 2007a, 2009b; Arlinghaus

et al. 2009b). Fish welfare perspectives always deal with the individual fish, not with impacts resulting from recreational fishing at the population level (Arlinghaus 2008). By the very nature of the activity, hooking or otherwise catching a fish with recreational fishing gears causes stress and induces some injury to an individual fish (Cooke & Sneddon 2007). This can impair the welfare of the individual fish, but this judgement is contingent on how fish welfare is defined. Irrespective of the definition of impaired fish welfare, appropriate (i.e. fish-friendly) treatment and handling of fish is critical for all recreational fisheries because it reflects a high moral attitude of recreational fishers towards their quarry.

Defining fish welfare has proved elusive even among scientists (Arlinghaus *et al.* 2007a). However, a feelings-based approach to define fish welfare that focuses on difficult to measure 'unpleasant mental states' of fish (Huntingford *et al.* 2006) was found to be unsuitable for the CoP on recreational fishing based on arguments presented in detail in Arlinghaus *et al.* (2007a, 2009b). Stakeholders involved in the development of the CoP preferred a function-based definition of fish welfare based on objectively measurable indicators of impaired fish welfare (*sensu* Arlinghaus *et al.* 2007a, 2009b). Indeed, compared with feelings-based definitions of fish welfare, most function-based definitions allow a greater variety of such objective indicators to be measured (Huntingford & Kadri 2008). Thus, a function-based definition of fish welfare was found more appropriate than a feelings-based approach. Consequently, the definition adopted in the CoP was 'good welfare means that an individual fish is in good health, with its biological systems functioning properly and with no impairment of fitness'. This is, for example, relevant when a fish is caught and released by recreational anglers with an injury to the mouth region. If full recovery from the catch-and-release event is quick, leading to no measurable impacts on fitness (as indicated by unaltered reproductive output, high quality of the gametes or lack of a growth depression), the fish welfare impact of the catch-and-release event is negligible.

A number of techniques and handling practices promote this scenario (Arlinghaus *et al.* 2007a), while other practices potentially aggravate fish welfare impairment. To address these issues and provide guidance, some detailed recommendations for appropriate behaviour and techniques for minimising fish welfare impairments are provided in the CoP. For example, to maintain the welfare condition of angled fish, tackle and gear should be used in a way that minimises landing duration (e.g. Meka & McCormick

2005), minimises air exposure (e.g. Ferguson & Tufts 1992) and minimises injury (e.g. Arlinghaus, Klefoth, Kobler & Cooke 2008). In recreational angling, fish that are to be harvested should be immediately anaesthetised and killed, preferably before dehooking. For most fish species, anaesthetization before death can most easily be achieved by a sharp blow to the cranium (e.g. cerebral percussion) and the kill can most quickly be achieved by exsanguinations (bleeding-out) (see Davie & Kopf 2006 for details). If fish are to be held alive after capture, devices should be used that provide sufficient space and maintain high water quality (Arlinghaus *et al.* 2007a). Suitable devices include keepnets (Raat *et al.* 1997) and live-wells (Suski *et al.* 2006); stringers or very small metal cages should not be used (Cooke & Hogle 2000). To take due regard of fish welfare, recreational fishing should also adopt the use of alternatives to live baitfish. Further, if fish are to be assessed (e.g. weighed) and released after capture, e.g. in fishing competitions, weigh-in stress should be reduced by minimising air exposure and crowding/compromised water quality at the weigh-in facility (Suski *et al.* 2004). Afterwards, the fish should be released as quickly as possible and as close as possible to the original capture site. Finally, detailed criteria for good fish welfare in the context of catch-and-release angling are provided in the CoP. This entails, in agreement with the current body of literature (see Muoneke & Childress 1994; Bartholomew & Bohnsack 2005; Cooke & Suski 2005; Arlinghaus *et al.* 2007b for reviews) that fish are released in the best condition possible.

Management of recreational fisheries

One of the most important aspects of a CoP for recreational fisheries is to encourage development of sustainable management systems. Moving from the goal of sustainability (reviewed by Arlinghaus *et al.* 2002), the underlying management philosophy promoted by the CoP rests on the ecosystem approach (Arlinghaus & Cowx 2008) and the precautionary approach (Richards & Maguire 1998) to avoid potentially irreversible changes to biodiversity and aquatic ecosystems induced by recreational fishing and its supporting activities such as stocking. This necessity is borne out of the increasing realisation that excessive harvest mortality as well as deleterious management actions, such as some forms of fish stocking, (Lewin *et al.* 2006; Lewin *et al.* 2008) might pose threats to the structure and functioning of recreationally exploited fish stocks. This in turn damages the quality of recreational fisheries necessitating the development of

sustainable recreational fisheries practices. Sustainability of recreational fisheries resources includes conserving biodiversity at all levels, including genetic diversity, as well as supporting terrestrial and aquatic ecosystems, while maximising the social and economic benefits that recreational fishing generates within society (Arlinghaus *et al.* 2002). Such management is holistic and integrated in orientation, and differs from the more traditional narrow focus on one component of interest, such as a targeted fish stock, and thus is in line with the objectives of the CCRF (FAO 1995).

The CoP for recreational fisheries emphasises and acknowledges that the management of recreational fisheries is multi-dimensional, requiring recognition of the complexities of the resource system, the interactions between social and ecological subsystems of recreational fisheries, and effective communication and cooperation among stakeholders. To manage this complexity in a meaningful manner, an adaptive management framework (Walters 1986) is needed that embraces uncertainty and responds to environmental and social change rather than imposing strict regulatory frameworks. This can only be successful if management decisions are based on best available science (see below) while recognising traditional ecological, socio-economic and cultural knowledge and the need to balance competing demands. The CoP, however, also stresses that lack of scientific information common in many small-scale, spatially diffuse, recreational fisheries (Post *et al.* 2002) should not preclude decision making. In this scenario, experiences from other regions should guide the adaptive management process. Irrespective, successful recreational fisheries management requires clear identification of generic goals and operational (i.e. measurable) objectives (Barber & Taylor 1990). Such goals and objectives are highly dependent on societal values and should be developed in consultation with all stakeholders.

There was some disagreement among the stakeholders providing feedback on drafts of the CoP regarding the focal point of recreational fisheries management. Some more conservation-oriented stakeholders heavily promoted a focus on avoiding change to aquatic biodiversity, while more fishing-oriented people emphasised the socio-economic domain of sustainable recreational fisheries management. The final CoP was drafted reaching a compromise among these partly opposing viewpoints. It was stressed that all management decisions in recreational fisheries must promote high quality fishing opportunities while balancing the needs of other parties, respecting the ecological limitations of the supporting ecosystem, and acknowledg-

ing the socio-economic needs of society. If possible and technically feasible, a management plan should be established for each fishery consisting of (Cowx 1998; Arlinghaus 2004):

- well-defined, measurable objectives.
- analysis of the current state and the problems requiring attention.
- suggested actions to overcome the identified problems.
- required human and financial resources for implementation of the proposed management actions.
- proposed time scale and monitoring approach.

The need for improved monitoring was considered crucial by most stakeholders involved in drafting the CoP, as these data are essential to inform management decisions in the future by 'learning-from-doing' (Arlinghaus 2006). Indeed, evaluation of the effectiveness and appropriateness of management actions, as well as the collection and verification of information and its dissemination to all interested stakeholders, is critical for the sustainable use of recreational fisheries resources and to allow capacity-building. Such activities should be conducted whenever possible to comply with the good practice principles of the CoP.

Because monitoring demands might be daunting for those regions that lack experience with recreational fisheries management, appropriate expert assistance should be provided and promoted to establish a more coherent approach to recreational fisheries management. All recreational fisheries managers should seek alternative qualified advice when uncertain about likely outcomes of a planned management intervention. This is particularly important in privately managed European recreational fisheries, where some local managers do not accept the need for qualified advice (Arlinghaus 2006).

New knowledge

Recreational fisheries research

A structured approach to sustainable management of recreational fisheries requires understanding of the features and the dynamics of targeted fish stocks and the associated social-ecological system, i.e. focussed, cutting-edge research. Unfortunately, such information is sparse in the recreational fisheries sector compared with other dimensions of fisheries science and management (Arlinghaus *et al.* 2002). The CoP highlights the importance of high quality recreational fisheries research that is application-oriented. These activities should support policy decision making with respect to the aquatic environment to reduce the risk of

negative effects on recreational fisheries and to support and improve recreational fishing for those that enjoy the practice. Such science supporting recreational fisheries must, depending on the problem to be solved, adopt a multidisciplinary, interdisciplinary and trans-disciplinary approach. Research programmes should promote study designs that will cross research disciplines because modern recreational fisheries research extends the traditional fisheries biology research domain and explicitly integrates social and economic sciences (Ditton 2004; Arlinghaus 2005, 2006; Arlinghaus *et al.* 2009a).

Some more specific advice on how to conduct research is also provided in the CoP. In particular, it is stressed in the CoP with respect to research and in line with article (11) on management that recreational fisheries organizations and agencies should monitor and assess the stocks under their jurisdiction, including the impact resulting from land use change, climate change, habitat alteration and other anthropogenic sources. Basic data needs include catch, harvest, catch structure (e.g. age and length structure, species, if possible age and size at maturation), harvest, recreational fishing effort and fisher/angler preferences, attitudes and behaviour. Such data should be updated regularly and verified through an appropriate peer-review system. There is a need to provide the resources and human capital to allow local recreational fishing communities to gather these data in joint collaboration with trained researchers to be functional (Lester, Marshall, Armstrong, Dunlop & Ritchie 2003). Data should be collected in a standardised way to ensure progress towards management goals and objectives is documented and comparable across regions. Equally important is to monitor social, economic, marketing and institutional factors affecting recreational fishers and fisheries. Fishers are required to contribute to the monitoring of fish populations by reporting relevant data and other observations to the appropriate agencies.

To facilitate successful research in recreational fisheries, a number of prerequisites must be met; the CoP provides detailed insights into what this entails. First, research programmes should work across multi-level governance systems at local, regional, national and international levels, as well as involving various bodies with management and research responsibilities, such as universities, consultancy and private sector organizations, local agencies, national institutes and international fisheries organizations. Second, adequate resources, including research facilities and trained staff, should be provided for recreational fishery research programmes. These programmes

should be provided with financial support from public sources and from a variety of self-sustaining funding mechanisms, such as user-pay initiatives and cost-recovery mechanisms. Third, states and relevant international organizations with the ability to support capacity-building should work with developing countries to promote appropriate institutional strengthening and research programmes.

Recreational fisheries research is, by definition, applied research, and therefore must not be conducted in isolation from the real world. Development of joint initiatives to identify meaningful recreational fishery research questions is important for successful fisheries management. These frameworks should incorporate traditional ecological knowledge of recreational fishers and other stakeholders to ensure that their research needs are met. Recreational fisheries research results should be shared with stakeholders using clear language and concise communication approaches that match the needs of the stakeholders.

Final remarks

This paper expounds on a number of issues raised during the endorsement of the CoP for recreational fisheries. It is not an exhaustive account of the intense discussions underpinning the development of the Code or the content of the Code; but focuses on those articles where some level of disagreement was noted or where additional detail was thought to be important.

The CoP on recreational fisheries is intended to provide general advice in support of the implementation of CCRF and its follow-up technical guidelines (e.g. for inland fisheries, FAO 1997) pertinent to the development and management of recreational fisheries in all environments (fresh, brackish and marine waters). The document is meant to serve as general guidance, and should be taken as suggestions or observations for consideration when addressing issues related to the implementation of the provisions of CCRF. Furthermore, any eventual differences in the terminology employed should not be understood as intending reinterpretation of the CCRF. It should also be remembered that since the guidelines are intended to be flexible and capable of evolving as circumstances change, or as new information becomes available, they may be further revised and complemented by other guidelines and notes on specific issues, some of which are already under elaboration.

The CoP for recreational fisheries is mainly targeted at policy makers, representatives of angler associations, unions and clubs, recreational fishers,

the recreational fishing industry at large, local and regional fisheries managers and fisheries scientists to serve as a communication tool for best practices for individual recreational fishers/anglers and fishing groups and local/regional recreational fisheries management. It is anticipated that the CoP for recreational fisheries promote these best practice and management principles for responsible recreational fisheries, among nations, regions, organisations or individual recreational fishing communities in the Europe, and ultimately worldwide. Its most important impact may not be on the individual recreational fisher, but by raising the profile of recreational fisheries as an important actor in the exploitation of the world's fisheries, and promoting the socio-economic importance of recreational fishing among public bodies, NGOs and individual stakeholders involved in conservation, management and development of aquatic ecosystems (Cowx & Arlinghaus 2008).

Adherence to, and promotion of, the CoP for recreational fisheries offers many advantages to the recreational fisheries sector including (Cowx & Arlinghaus 2008):

- increased awareness in the policy arena and an entry point for viable dialogue, at global, regional, national and local level;
- increased acceptance of the sector as a major player in the world's fisheries;
- improved understanding and management of impacts of recreational fisheries to move towards sustainability;
- improved assessment of, and potential resolution of conflicts between sectors and user groups;
- better identification of issues of conservation concern;
- promotion of a platform for exchange of experiences;
- enhanced awareness among relevant actors and stakeholders within the recreational fishing community;
- promotion of traditional management measures;
- promotion of low risk and sustainable enhancement measures;
- promotion of a positive image of recreational fisheries within society;
- promotion of integrated aquatic resource management and an ecosystem approach to recreational fisheries management;
- promotion of environmentally and socially responsible behaviour of recreational fishers/anglers.

Ultimately the CoP can have a dual role in influencing international fisheries management and

policy through its incorporation into international agreements and conventions, and national and local fisheries management through its influence on regional recreational fisheries and fisher/angler behaviour. This creates spin-over effects for conservation in general. Recreational fishers/anglers are excellent ambassadors to promote the fish cause (Arlinghaus *et al.* 2002). More opportunity needs to be made of the recreational fishers' willingness to support environmental and conservation campaigns because the general public often has poor awareness of the issues and problems facing exploitation and conservation of fish, particularly in freshwater fisheries. Similarly, fishing clubs and organisations are encouraged to promote protection of fisheries and front environmental lobbying of potentially damaging development projects.

However, to be viable, a CoP for recreational fisheries must be adopted by the international community and be further developed as the new issues and conflicts arise. Consequently, it is recommended that the CoP for Recreational Fisheries is institutionalised as an annex to the CCRF (FAO 1995) and is adopted by member states of FAO and by international angler and industry alliances such as the European Anglers' Association, RecFish Australia or the American Sportfishing Association. This will give the CoP for recreational fishing the recognition it deserves and a focal point for governments, agencies and international policy makers. It will also provide the necessary infrastructure for development and updating of the CoP for recreational fisheries on a timely basis.

Acknowledgments

The authors wish to thank the numerous persons whom commented on various stages of a draft CoP. Particular credit goes to A. Rothuis of the Dutch Ministry of Agriculture, Nature and Food Quality and to F. Bloot of the Dutch Recreational Fishing Association for their financial and logistic support in hosting the workshop, as well as to the Irish Fisheries Board – particularly J. Caffrey – for partial funding of this project. Additional funding was also provided through the Adaptfish-project (<http://www.adaptfish.igb-berlin.de>) funded by the Gottfried-Wilhelm-Leibniz-Community (Germany) through a grant to RA.

References

- Aas Ø. (2002) The next chapter: multicultural and cross-disciplinary progress in evaluating recreational fisheries. In: T.J. Pitcher & C.E. Hollingworth (eds) *Recreational Fisheries: Ecological, Economic and Social Evaluation*. Oxford: Blackwell Science, pp. 252–263.
- Allan J.D., Abell R., Hogan Z., Revenga C., Taylor B.W., Welcomme R.L. & Winemiller K. (2005) Overfishing of inland waters. *BioScience* **55**, 1041–1051.
- Arismendi L. & Nahuelhual L. (2007) Non-native salmon and trout recreational fishing in Lake Llanquihue, Southern Chile: economic benefits and management implications. *Reviews in Fisheries Science* **15**, 311–325.
- Arlinghaus R. (2004) *A Human Dimensions Approach Towards Sustainable Recreational Fisheries Management*. London: Turnshare, 158 pp.
- Arlinghaus R. (2005) A conceptual framework to identify and understand conflicts in recreational fisheries systems, with implications for sustainable management. *Aquatic Resources, Culture and Development* **1**, 145–174.
- Arlinghaus R. (2006) Overcoming human obstacles to conservation of recreational fishery resources, with emphasis on central Europe. *Environmental Conservation* **33**, 46–59.
- Arlinghaus R. (2008) The challenge of ethical angling: the case of C&R and its relation to fish welfare. In: Ø. Aas, R. Arlinghaus, R.B. Ditton, D. Policansky & H.L. Schramm Jr (eds) *Global Challenges in Recreational Fisheries*. Oxford: Blackwell Publishing, pp. 223–236.
- Arlinghaus R. & Cooke S.J. (2009) Recreational fishing: socio-economic importance, conservation and management. In: W.M. Adams, B. Dickson & J.M. Hutton (eds) *Recreational Hunting, Conservation and Rural Livelihoods: Science and Practice*. Oxford: Blackwell Publishing, pp. 39–58.
- Arlinghaus R. & Cowx I.G. (2008) Meaning and relevance of the ecosystem approach to recreational fisheries management: emphasis on the human dimension. In: Ø. Aas, R. Arlinghaus, R.B. Ditton, D. Policansky & H.L. Schramm Jr (eds) *Global Challenges in Recreational Fisheries*. Oxford: Blackwell Publishing, pp. 56–74.
- Arlinghaus R., Mehner T. & Cowx I.G. (2002) Reconciling traditional inland fisheries management and sustainability in industrialized countries, with emphasis on Europe. *Fish and Fisheries* **3**, 261–316.
- Arlinghaus R., Cooke S.J., Schwab A. & Cowx I.G. (2007a) Fish welfare: a challenge to the feelings-based approach, with implications for recreational fishing. *Fish and Fisheries* **8**, 57–71.
- Arlinghaus R., Cooke S.J., Lyman J., Policansky D., Schwab A., Suski C., Sutton S.G. & Thorstad E.B. (2007b) Understanding the complexity of catch-and-release in recreational fishing: an integrative synthesis of global knowledge from historical, ethical, social, and biological perspectives. *Reviews in Fisheries Science* **15**, 75–167.
- Arlinghaus R., Klefoth T., Kobler A. & Cooke S.J. (2008) Size-selectivity, injury, handling time and determinants of initial hooking mortality in recreational angling for northern pike

- Esox lucius*: the influence of type and size of bait. *North American Journal of Fisheries Management* **28**, 123–134.
- Arlinghaus R., Johnson B.M. & Wolter C. (2009a) The past, present and future role of limnology within freshwater fisheries science. *International Review of Hydrobiology* **93**, 541–549.
- Arlinghaus R., Cooke S.J., Schwab A. & Cowx I.G. (2009b) Contrasting pragmatic and suffering-centred approaches to fish welfare in recreational angling. *Journal of Fish Biology* (in press).
- Barber W.E. & Taylor J.N. (1990) The importance of goals, objectives, and values in the fisheries management process and organization: a review. *North American Journal of Fisheries Management* **10**, 365–373.
- Bartholomew A. & Bohnsack J.A. (2005) A review of catch-and-release angling mortality with implications for no-take reserves. *Reviews in Fish Biology and Fisheries* **15**, 129–154.
- Cochrane K.L. & Doullman D.J. (2005) The rising tide of fisheries instruments and the struggle to keep afloat. *Philosophical Transactions of the Royal Society B* **360**, 77–94.
- Collares-Pereira M.J. & Cowx I.G. (2004) The role of catchment scale environmental management in freshwater fish conservation. *Fisheries Management and Ecology* **11**, 303–312.
- Cooke S.J. & Cowx I.G. (2004) The role of recreational fishing in global fish crises. *BioScience* **54**, 857–859.
- Cooke S.J. & Cowx I.G. (2006) Contrasting recreational and commercial fishing: searching for common issues to promote unified conservation of fisheries resources and aquatic environments. *Biological Conservation* **128**, 93–108.
- Cooke S.J. & Hogle W.J. (2000) The effects of retention gear on the injury and short-term mortality of smallmouth bass. *North American Journal of Fisheries Management* **20**, 1033–1039.
- Cooke S.J. & Sneddon L.U. (2007) Animal welfare perspectives on catch-and-release recreational angling. *Applied Animal Behaviour Science* **104**, 176–198.
- Cooke S.J. & Suski C.D. (2005) Do we need species-specific guidelines for catch-and-release recreational angling to conserve diverse fishery resources? *Biodiversity and Conservation* **14**, 1195–1209.
- Cowx I.G. (1998) Aquatic resource planning for resolution of fisheries management issues. In: P. Hickley & H. Tompkins (eds) *Social, Economic and Management Aspects of Recreational Fisheries*. Oxford: Blackwell Science, pp. 97–105.
- Cowx I.G. (2002) Recreational fisheries. In: P. Hart & J. Reynolds (ed.) *The Fisheries Handbook*, Vol. II. Oxford: Blackwell Science, pp. 367–390.
- Cowx I.G. & Arlinghaus R. (2008) Recreational fishing in the 21st century: towards a code of conduct. In: Ø. Aas, R. Arlinghaus, R.B. Ditton, D. Policansky & H.L. Schramm Jr (eds) *Global Challenges in Recreational Fisheries*. Oxford: Blackwell Publishing, pp. 338–352.
- Cryer M., Corbett J.J. & Winterbotham M.D. (1987a) The deposition of hazardous litter by anglers at coastal and inland fisheries in South Wales. *Journal of Environmental Management* **25**, 125–135.
- Cryer M., Linley N.W., Ward R.M., Stratford J.O. & Randerson P.F. (1987b) Disturbance of overwintering wildfowl by anglers at two reservoir sites in South Wales. *Bird Study* **34**, 191–199.
- Davie P.S. & Kopf R.K. (2006) Physiology, behaviour and welfare of fish during recreational fishing and after release. *New Zealand Veterinary Journal* **54**, 161–172.
- Ditton R.B. (2004) Human dimensions of fisheries. In: M.J. Manfredo, J.J. Vaske, B.L. Bruyere, D.R. Field & P.J. Brown (eds) *Society and Natural Resources: a Summary of Knowledge Prepared for the 10th International Symposium on Society and Resource Management*. Jefferson, MO: Modern Litho, pp. 199–208.
- EIFAC [European Inland Fisheries Advisory Commission] (2008) *EIFAC Code of Practice for Recreational Fisheries*. Rome: EIFAC. Occasional Paper No. 42, 45 pp.
- FAO (1995) *FAO Code of Conduct for Responsible Fisheries*. Rome: FAO, 41 pp.
- FAO (1997) Inland fisheries. *FAO Technical Guidelines for Responsible Fisheries 6*, Rome: FAO, 36 pp.
- Fedler A.J. & Ditton R.B. (1994) Understanding angler motivations in fisheries management. *Fisheries* **19**(4), 6–13.
- Ferguson R.A. & Tufts B.L. (1992) Physiological effects of brief air exposure in exhaustively exercised rainbow trout *Oncorhynchus mykiss*: implications for “catch-and-release” fisheries. *Canadian Journal of Fisheries and Aquatic Sciences* **49**, 1157–1162.
- Garcia S.M., Cochrane K., van Santen G. & Christy F. (1999) Towards sustainable fisheries: a strategy for FAO and the World Bank. *Ocean and Coastal Management* **42**, 369–398.
- Heister M.A. (2005) *Ist Angeln Sport? Geschichtliche und systematische Betrachtung*, Unpublished Magister Thesis, Münster: Westfälische-Wilhelms-Universität, Philosophische Fakultät, 120 pp. (In German).
- Hickley P. (1998) Comments concerning a code of good practice for recreational fishing. In: P. Hickley & H. Tompkins (eds) *Recreational Fisheries: Social, Economic and Management Aspects*. Oxford: Blackwell Science, pp. 299–304.
- Hickley P. & Chare S. (2004) Fisheries for non-native species in England and Wales: angling or the environment? *Fisheries Management and Ecology* **11**, 203–212.
- Holmlund C.M. & Hammer M. (1999) Ecosystem services generated by fish populations. *Ecological Economics* **29**, 253–268.
- Hosch G. (2009) *Analysis of the Implementation and Impact of the FAO Code of Conduct for Responsible Fisheries Since 1995*. Rome: FAO. Fisheries and Aquaculture Circular No. 1038, 112 pp.

- Huntingford F.A. & Kadri S. (2008) Welfare and fish. In: E.J. Branson (ed.) *Fish Welfare*. Oxford: Blackwell Publishing, pp. 19–31.
- Huntingford F.A., Adams C., Braithwaite V.A., Kadri S., Pottinger T.G., Sandøe P. & Turnbull J.F. (2006) Current issues in fish welfare. *Journal of Fish Biology* **68**, 332–372.
- Jacks G., Byström M. & Johansson L. (2001) Lead emissions from lost fishing sinkers. *Boreal Environmental Research* **6**, 231–236.
- Lester N.P., Marshall T.R., Armstrong K., Dunlop W.I. & Ritchie B. (2003) A broad-scale approach to management of Ontario's recreational fisheries. *North American Journal of Fisheries Management* **23**, 1312–1328.
- Lewin W.-C., Arlinghaus R. & Mehner T. (2006) Documented and potential biological impacts of recreational angling: insights for conservation and management. *Reviews in Fisheries Science* **14**, 305–367.
- Lewin W.-C., McPhee D. & Arlinghaus R. (2008) Biological impacts of recreational fishing resulting from exploitation, stocking and introduction. In: Ø. Aas, R. Arlinghaus, R.B. Ditton, D. Policansky & H.L. Schramm Jr (eds) *Global Challenges in Recreational Fisheries*. Oxford: Blackwell Publishing, pp. 75–92.
- Macinko S. & Schumann S. (2007) Searching for subsistence: in the field in pursuit of an elusive concept in small-scale fisheries. *Fisheries* **32**, 592–600.
- Maslow A. (1971) *The Farther Reaches of Human Nature*. New York: The Viking Press, 423 pp.
- McPhee D.P., Leadbitter D. & Skilleter G.A. (2002) Swallowing the bait: is recreational fishing in Australia ecologically sustainable? *Pacific Conservation Biology* **8**, 40–51.
- Meka J.M. & McCormick S.D. (2005) Physiological response of wild rainbow trout to angling: impact of angling duration, fish size, body condition, and temperature. *Fisheries Research* **72**, 311–322.
- Mike A. & Cowx I.G. (1996) A preliminary appraisal of the contribution of recreational fishing to the fisheries sector in north-west Trinidad. *Fisheries Management and Ecology* **3**, 219–228.
- Muoneke M.I. & Childress W.M. (1994) Hooking mortality: a review for recreational fisheries. *Reviews in Fisheries Sciences* **2**, 123–156.
- Niesar M., Arlinghaus R., Rennert B. & Mehner T. (2004) Coupling insights from a carp *Cyprinus carpio* L. angler survey with feeding experiments to evaluate composition, quality, and phosphorus input of groundbaits in coarse fishing. *Fisheries Management and Ecology* **11**, 225–235.
- Pauly D., Christensen V., Guénette S., Pitcher T.J., Rashid Sumaila U., Walters C.J., Watson R. & Zeller D. (2002) Towards sustainability in world fisheries. *Nature* **418**, 689–695.
- Pitcher T.J. (2003) The compleat angler and the management of aquatic ecosystems. In: A.P.M. Coleman (ed.) *Regional Experiences for Global Solutions*. The Proceedings of the 3rd World Recreational Fishing Conference 21–24 May 2002, Northern Territory, Australia. Fisheries Report 67. Darwin, Australia: Fisheries Group, Department of Business, Industry and Resource Development, pp. 3–7.
- Pitcher T.J. & Hollingworth C.E. (eds) (2002) *Recreational Fisheries: Ecological, Economic and Social Evaluation*. Oxford: Blackwell Science, 271 pp.
- Policansky D. (2002) Catch-and-Release recreational fishing: a historical perspective. In: T.J. Pitcher & C.E. Hollingworth (eds) *Recreational Fisheries: Ecological, Economic and Social Evaluation*. Oxford: Blackwell Science, pp. 74–94.
- Post J.R., Sullivan M., Cox S., Lester N.P., Walters C.J., Parkinson E.A., Paul A.J., Jackson L. & Shuter B.J. (2002) Canada's recreational fisheries: the invisible collapse? *Fisheries* **27**(1), 6–15.
- Raat A.J.P., Klein Breteler J.G.P. & Jansen A.W. (1997) Effects on growth and survival of retention of rod-caught cyprinids in large keepnets. *Fisheries Management and Ecology* **4**, 355–368.
- Radomski P., Heinrich T., Jones T.S., Rivers P. & Talmage P. (2006) Estimates of tackle loss for five Minnesota walleye fisheries. *North American Journal of Fisheries Management* **26**, 206–212.
- Richards L.J. & Maguire J.J. (1998) Recent international agreements and the precautionary approach: new directions for fisheries management science. *Canadian Journal of Fisheries and Aquatic Sciences* **55**, 1545–1552.
- Salmi P., Neuman E. & Hakaste T. (2008) Scale and participation in recreational fisheries management: Nordic examples. In: Ø. Aas, R. Arlinghaus, R.B. Ditton, D. Policansky & H.L. Schramm Jr (eds) *Global Challenges in Recreational Fisheries*. Oxford: Blackwell Publishing, pp. 130–149.
- Suski C.D., Killen S.S., Cooke S.J., Kieffer J.D. & Tufts B.L. (2004) Physiological significance of the weigh-in during live-release angling tournaments for largemouth bass. *Transactions of the American Fisheries Society* **133**, 1291–1303.
- Suski C.D., Killen S.S., Kieffer J.D. & Tufts B.L. (2006) The influence of environmental temperature and oxygen concentration on the recovery of largemouth bass from exercise: implications for live-release angling tournaments. *Journal of Fish Biology* **68**, 120–136.
- Walters C.J. (1986) *Adaptive Management of Renewable Resources*. New York: MacMillan, 374 pp.
- Wolter C. & Arlinghaus R. (2003) Navigation impacts on freshwater fish assemblages: the ecological relevance of swimming performance. *Reviews in Fish Biology and Fisheries* **13**, 63–89.