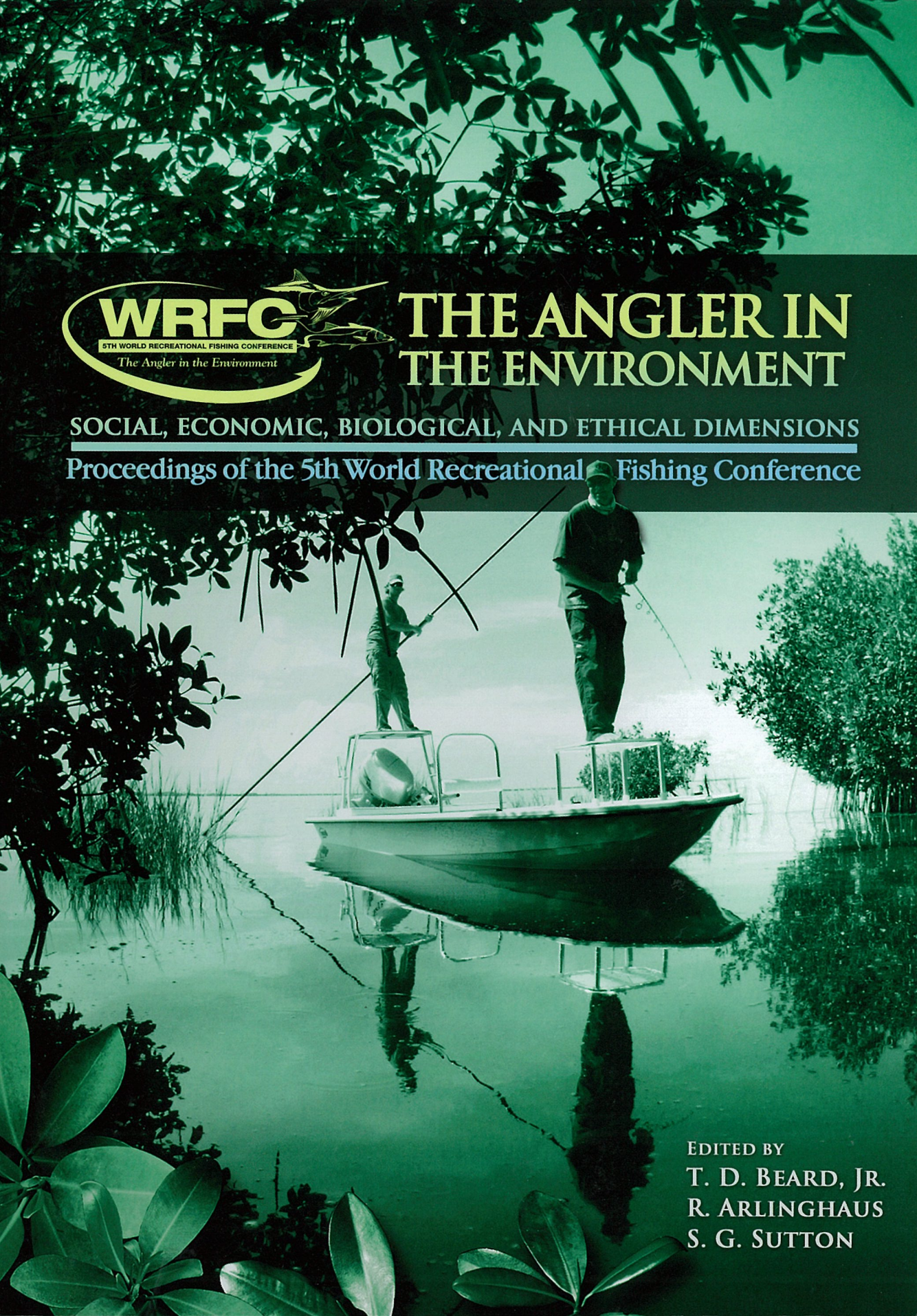

THE ANGLER IN THE ENVIRONMENT

SOCIAL, ECONOMIC, BIOLOGICAL, AND ETHICAL DIMENSIONS

Proceedings of the 5th World Recreational Fishing Conference

EDITED BY
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Social, Economic, Biological, and Ethical Dimensions

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Jason Schratwieser
Chair, Fifth World Recreational Fishing Conference

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Symbols and Abbreviations

The following symbols and abbreviations may be found in this book without definition. Also undefined are standard mathematical and statistical symbols given in most dictionaries.

A	ampere
AC	alternating current
Bq	becquerel
C	coulomb
°C	degrees Celsius
cal	calorie
cd	candela
cm	centimeter
Co.	Company
Corp.	Corporation
cov	covariance
DC	direct current; District of Columbia
D	dextro (as a prefix)
d	day
d	dextrorotatory
df	degrees of freedom
dL	deciliter
E	east
E	expected value
e	base of natural logarithm (2.71828…)
e.g.	(exempli gratia) for example
eq	equivalent
et al.	(et alii) and others
etc.	et cetera
eV	electron volt
F	filial generation; Farad
°F	degrees Fahrenheit
fc	footcandle (0.0929 lx)
ft	foot (30.5 cm)
ft^3/s	cubic feet per second (0.0283 m^3/s)
g	gram
G	giga (109, as a prefix)
gal	gallon (3.79 L)
Gy	gray
h	hour
ha	hectare (2.47 acres)
hp	horsepower (746 W)
Hz	hertz
in	inch (2.54 cm)
Inc.	Incorporated
i.e.	(id est) that is
IU	international unit
J	joule
K	Kelvin (degrees above absolute zero)
k	kilo (103, as a prefix)
kg	kilogram
km	kilometer
l	levorotatory
L	levo (as a prefix)
L	liter (0.264 gal, 1.06 qt)
lb	pound (0.454 kg, 454g)
lm	lumen
log	logarithm
Ltd.	Limited
M	mega (10^6, as a prefix); molar (as a suffix or by itself)
m	meter (as a suffix or by itself); milli (10^{-3}, as a prefix)
mi	mile (1.61 km)
min	minute
mol	mole
N	normal (for chemistry); north (for geography); newton
N	sample size
NS	not significant
n	ploidy; nano (10^{-9}, as a prefix)
o	ortho (as a chemical prefix)
oz	ounce (28.4 g)
P	probability
p	para (as a chemical prefix)
p	pico (10^{-12}, as a prefix)
Pa	pascal
pH	negative log of hydrogen ion activity
ppm	parts per million
qt	quart (0.946 L)
R	multiple correlation or regression coefficient
r	simple correlation or regression coefficient
rad	radian
S	siemens (for electrical conductance); south (for geography)
SD	standard deviation
SE	standard error
s	second

T	tesla	α	probability of type I error (false rejection of null hypothesis)
tris	tris(hydroxymethyl)-aminomethane (a buffer)	β	probability of type II error (false acceptance of null hypothesis)
UK	United Kingdom	Ω	ohm
U.S.	United States (adjective)	μ	micro (10^{-6}, as a prefix)
USA	United States of America (noun)	$'$	minute (angular)
V	volt	$''$	second (angular)
V, Var	variance (population)	$^\circ$	degree (temperature as a prefix, angular as a suffix)
var	variance (sample)	%	per cent (per hundred)
W	watt (for power); west (for geography)	‰	per mille (per thousand)
Wb	weber		
yd	yard (0.914 m, 91.4 cm)		

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Introduction

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Abstract.—The World Recreational Fishing Conference represents the only scientific meeting that is truly global, attracting scientists, managers, industry representatives, policy makers, and other stakeholders to discuss pertinent issues in recreational fisheries. The Fifth World Recreational Fishing Conference was held in Dania Beach, Florida, on November 10–12, 2008. This book represents the peer-reviewed proceedings of the landmark conference. Chapters in this book cover a range of issues such as governance, social and biological management tools and issues, ethics, and novel survey methods to advance the science and management of recreational fisheries.

Introduction

The chapters presented in this book represent the output of the Fifth World Recreational Fishing Conference (WRFC), which was held at the International Game Fish Association's Fishing Hall of Fame & Museum in Dania Beach, Florida, on November 10–12, 2008. With an attendance of more than 200 people from 22 countries and 141 oral and poster presentations, the conference was a resounding success and advanced the growing legacy of the WRFC series.

The theme for the fifth WRFC was *The Angler in the Environment*. This was an effort to expand topics brought forth in previous WRFCs (Table 1). In doing so, we endeavored to assemble discussion topics that provided a holistic view of recreational fishing's global impact, both positive and negative. Topical areas discussed at the fifth WRFC encompassed "traditional topics" such as the economic evaluation of recreational fisheries, while issues like climate change impacts on recreational fisheries were relative newcomers. Increasingly contentious topics such as recreational fishing's impact on the environment, fish welfare, and marine and inland protected areas were also discussed to gain better understanding of these emerging issues.

The International Game Fish Association (IGFA) was extremely pleased to be the host location for the fifth WRFC. Not only did this mark the first time that the conference was held in the United States, but it was also apropos for historical reasons. In 1984, IGFA conducted the First World Angling Conference, which was held in Cap d'Agde, France and culminated in the first book on the science and management of recreational fishing that was truly global (Stroud 1985). The conference was the first of its kind, and it was then IGFA's desire to hold

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such conferences annually to provide a place for people to discuss the important issues related to recreational fishing. While the concept of holding annual conferences did not come to fruition, it was perhaps successful in providing a concept for the first official WRFC that took place 12 years later in Dublin (Ireland) in 1996 (Hickley and Tompkins 1998). This event, now formally recognized as the first WRFC, was convened in association with the 19th session of the European Inland Fisheries Advisory Commission at the Food and Agriculture Organization of the United Nations and attracted 119 participants from 23 countries (Table 1).

The importance of a conference dedicated solely to recreational fishing issues was appar-

TABLE 1. A brief history of the World Recreational Fishing Conference series.

First World Recreational Fishing Conference
(Original title was EIFAC Symposium on Recreational Fisheries; now formally recognized as First World Recreational Fishing Conference.)
Location and date: Dublin, Ireland, June 11–14, 1996
Host: Convened in conjunction with the 19th session of the European Inland Fisheries Advisory Commission (EIFAC)
Theme: Social, Economic, and Management Aspects of Recreational Fisheries
Number of attendees: 119
Number of countries represented: 23
Proceedings: Hickley and Tompkins (1998).

Second World Recreational Fishing Conference
Location and date: Vancouver, Canada, June 1–4, 1999
Host: Fisheries Centre, University of British Columbia
Theme: Evaluating the Benefits of Recreational Fisheries
Number of presentations: 63 (total number of attendees was not noted)
Number of countries represented: 8
Proceedings: Pitcher and Hollingworth (1999, 2002)

Third World Recreational Fishing Conference
Location and date: Darwin, Australia, May 21–24, 2002
Host: Amateur Fishermen's Association of the Northern Territory
Theme: Regional Experiences for Global Solutions
Number of attendees: 196
Number of countries represented: 12
Proceedings: Coleman (2003)

Fourth World Recreational Fishing Conference
Location and date: Trondheim, Norway, June 12–16, 2005
Host: Norwegian Institute for Nature Research
Theme: Fishing Is Life—Building Partnerships across Boundaries
Number of attendees: 250
Number of countries represented: 25
Proceedings: Aas (2008).

Fifth World Recreational Fishing Conference
Location and date: Dania Beach, Florida, USA, November 10–12, 2008
Host: International Game Fishing Association
Theme: The Angler in the Environment
Number of attendees: 220
Number of countries represented: 20
Proceedings: This book

ent early on, to provide a forum to discuss pertinent issues among scientists, managers, policy makers, and the industry, but the commitment to ensuring its longevity took some time. Even after the conclusion of what is now known as the second WRFC in Vancouver (Canada) in 1999 (Pitcher and Hollingworth 1999, 2002), it was still uncertain whether a triannual recreational fisheries conference series would survive, as was noted in the proceeding's closing chapter: "It remains to be seen whether this series will become established as 'The Meeting Place' for recreational fisheries" (Aas 2002). However, with five conferences now completed (2002 Darwin, Australia [Coleman 2003]; 2005 Trondheim, Norway [Aas et al. 2008]; 2008 Dania Beach, Florida [this book]), a sixth planned for 2011 in Berlin, Germany at Humboldt-University, four peer-reviewed proceedings (Hickley and Tompkins 1998; Pitcher and Hollingworth 2002; Aas et al. 2008; and this book) and a dedicated Web site (www.worldrecfish.org) for the advertisement and administration of future conferences, it is clear that the WRFC has both a history, a legacy, and a future (Table 1).

While there is an ever growing number of conferences and symposia, many of which feature topics germane to recreational fisheries or attract delegates presenting work on recreational fisheries, the WRFC series is unique for several reasons. It is the only conference of its kind that relates specifically to recreational fisheries on a global level and across all scientific and managerial/policy disciplines and types of fisheries. Recreational fishing is a growing and constantly evolving entity, and it is vital that this type of fisheries has a forum that facilitates discussing and chronicling the issues affecting it. Throughout the relatively short history of the WRFC, we have witnessed change and adaptation happening rapidly as focal topics have grown from often purely descriptive evaluation of participation and economics in earlier conferences (Hickley and Tompkins 1998; Pitcher and Hollingworth 2002) to investigating the ecological and evolutionary implications of recreational fishing in more recent ones (Aas et al. 2008). Indeed, as time goes on, we will undoubtedly see more and more multidisciplinary and interdisciplinary topics integrating a variety of scientific approaches, and the next conference in Berlin 2011 will be particularly devoted to bridging the gaps between natural science and social science approaches to the understanding and management of recreational fisheries in a changing global climate, which includes not only temperature, but also social and cultural change and exchange.

Perhaps the most unique aspect of the WRFC is the audience to which it caters. Unlike most conferences, workshops, and symposia that relate strictly to scientists and/or managers, the WRFC seeks participation from across the entire spectrum of the recreational fishing sector. This includes the top researchers from both academia and management organizations, but also anglers, industry, representatives from nongovernmental organizations (NGOs), and the fishing media, which all have the ability to attend and participate at various levels. Having a forum that involves various recreational fisheries stakeholder groups from around the world facilitates critical reflection, inspiring discussions and information exchange, and thus helps foster better communication among groups that otherwise may not often interact. This creates creativity and a forum for innovation.

Involving all stakeholders in the WRFC process not only separates it from other conferences, but has also been one of its biggest challenges. This sentiment was echoed in the epilogue of the proceedings of fourth WRFC that was held in 2005 in Trondheim, Norway (Aas and Schramm 2008), which bears repetition here: issues, challenges, and threats to recreational angling are not solved solely by scientists talking to scientists or managers convening with managers, but by giving all concerned parties a seat at the table to deliberate and determine the future direction of recreational fishing. One of the major barriers to effective communication across all stakeholders groups is clearly language. For example, avid anglers or NGO representatives in many countries may feel reluctant to attend a conference held in English. Future organizers should investigate opportunities and funding for helping overcome this obstacle (e.g., by simultaneous translations). Another barrier constitutes travel funds, in particular for countries of the developing world and for many students. It would be prudent to host one of the next conferences in the developing world because we continue to witness low WRFC participation rates from South America, Asia, and Africa, de-

spite knowledge that recreational fisheries are growing in importance on these continents due to rapid economic development.

Overall, it remains imperative that successive WRFC endeavor to increase participation beyond that of science and management and make every effort possible to increase the participation across all stakeholder groups. This needs to be done without compromising the high scientific standards developed over the past six WRFCs. Invariably, most conferences, including the WRFC, culminate in some manner of publication, in which papers are refereed to journal standards by peer reviewers. Such publications are usually suited for technical papers written by scientists or research-oriented fisheries managers, but the need remains to also publish opinions and essays from anglers and other nontechnical stakeholder groups about their reflections on emerging topics (e.g., fish welfare, management paradigms). Clearly, writing essays and opinions may present a challenge to delegates who are less proficient at technical writing, but the mechanism of peer review will not exclude such papers if submitted to forthcoming proceeding volumes. What peer review will maintain is a standard of well-constructed arguments and referencing to pertinent literature, irrespective of the type of paper that is submitted. Such an approach is necessary to maintain credibility and quality of the publication outputs produced by the WRFC conference series. This is pertinent to maintain and increase its role as a leading source of information for all those interested in recreational fisheries science and management issues.

Content of this Book

We consider this book a proceedings of the fifth WRFC and have done our best to ensure that the manuscripts contained within it represent the conference as presented in November 2008. All papers submitted for consideration for inclusion in this book have been refereed to international journal standards, and those meeting such standards have been revised, edited, and presented here. The chapters have been organized into five major themes reflecting important issues facing recreational fisheries in today's world: (1) governance (two chapters), (2) social issues and management tools (five chapters), (3) biological issues and management tools (four chapters), (4) ethical issues in recreational fisheries (three chapters), and (5) survey methods and monitoring (seven chapters). Together with this introductory paper, this amounts to 22 articles covering a range of recreational fisheries topics.

Governance arrangements in place for aquatic systems strongly influence how recreational fishers can access and use fisheries resources and how sustainable the fisheries management system is. Based on a comparative study contrasting the inland fisheries in the United States and "East Germany" and "West Germany," Daedlow et al. (2011) discuss the benefits and constraints of various forms of property rights in recreational fisheries, concluding that each system has strength and weaknesses. Some of the weakness of public fishing rights from the perspective of the recreational fishing community are outlined by Nussman et al. (2011), who question some of the decisions to implement no-fishing areas in state and federal waters of the United States. No-fishing marine protected areas (MPA) are contentious and provide constraints to access to recreational fisheries. However, conflict is likely if MPAs are implemented without full consultation of stakeholders and without evidence for clear conservation benefits created by such management tools.

As the governance chapters in this book suggest, social issues are increasingly at the forefront of recreational fisheries science and management. Chapters 4–8 examine some of the social issues and the associated tools and approaches to address them. Hasler et al. (2011) outline various areas where perceptions about pressing issues differ among anglers, scientists, and managers in North America, although a number of agreements were also noted. To solve pertinent areas where stakeholders disagree, transdisciplinary cooperation between science and practitioners becomes increasingly important, and both Ihde et al. (2011) and Danylchuk et al. (2011) showcase examples of successful partnership projects. While Ihde et al. (2011) were highly successful in cooperatively building computer simulations to address harvest regulations in king mackerel *Scomberomorus cavalla* recreational fisheries, Danylchuk et al. (2011) took a more "hands-on" approach

when interacting with avid anglers in best practice of catch-and-release of bonefish *Albula vulpes* in The Bahamas. These chapters examine issues surrounding the engagement of recreational fishers and their knowledge in fisheries management, and they provide useful advice in support of increasing the effectiveness of angler engagement and education programs. The subsequent chapters address social issues of interaction and conflict between recreational and commercial fishers in New Zealand (Holdsworth and Walshe 2011) and Australia (Tobin and Sutton 2011) and examine ways in which the relationship between the two sectors can be improved. In this context, Holdsworth and Walshe (2011) highlight the key role of a nongovernamental organization—New Zealand Big Game Fishing Council—as a national representative organization to solve management conflicts around striped marlin *Kajikia audax*, and Tobin and Sutton (2011) use human dimensions survey information to show that recreational-only fishing areas in Australia are not providing the expected benefits to the recreational fishing sectors. One issue was simply that despite calls for their implementation, many surveyed anglers were not aware of the location of such areas, suggesting that we often simply need better communication to solve issues.

Social issues and conflicts often arise because of distributional issues among stakeholder groups or because resource states are dwindling. The chapters of this book discussing the biological and ecological issues of recreational fisheries tackle a number of areas that are currently hotly debated. Hühn and Arlinghaus (2011) provide a meta-analysis about determinants of hooking mortality for European freshwater species, identifying that the very same factors impair survival postrelease (e.g., injury) in this species group compared to earlier meta-analyses that focused on marine fishes. However, knowledge gaps pertain to many European species, as many are understudied from a catch-and-release research perspective. Powell et al. (2011) provide an example of such research applied to the Mid-Atlantic Bight summer flounder *Paralichthys dentatus* fishery studying the implications of discard mortality for optimizing size-based harvest regulations and bag limits for this species. The issue of excessive predation by great cormorants *Phalacrocorax carbo* on European fish stocks is reviewed by Steffens (2011), and Sawynok and Platten (2011) investigate the effects of local climate change on an Australian recreational fishery. Both papers emphasize the negative effects of nonfishery related impacts on popular species stemming from predation in the case of cormorants and altered flow regimes in the case of climate change.

Linked to the potential for recreational fishing affecting fish stocks and ecosystems, and facilitated by social value change, recreational fishing is increasingly challenged on moral and ethical grounds in some countries. Arlinghaus and Schwab (2011) present a critical analysis of the five most prevalent moral challenges to recreational fishing and explain their potential implications for recreational fisheries. Two challenges offer a constructive outlook while three challenges threaten recreational fishing with abolition. Solving these threatening issues does not constitute a scientific question and is deeply rooted in social movements, images, values, beliefs, and policy coalitions. The paper by Salmi and Ratamäki (2011) provides evidence for this statement by showing the intimate linkages between culture, policy, and governance in the context of the morally hotly debated practice of voluntary catch-and-release fishing in Finland, whose culture is deeply rooted in a consumptive interaction of humans with fish populations. One way of solving critical ethical issues faced by the recreational fishing community is to develop voluntary codes and standards, and one example is presented by Diggles et al. (2011) in terms of how to address environmental and ethical issues in Australian fishing tournaments.

Policy and management decisions affecting recreational fisheries must be based on sound social, economic, and ecological information. Therefore, finally a series of papers in this book deal with survey methods and monitoring approaches, and many of these advocate complementary survey approaches that build on the strength and weaknesses of particular survey modes (e.g., telephone versus mail). Gentner (2011) describes and evaluates the survey methodologies used by the U.S. National Marine Fisheries Service for collecting recreational fishers' expenditure data and discusses important reasons for the differences in total saltwater expenditures estimated in the National Marine Fisheries Service survey compared to the

estimates derived by the U.S. Fish and Wildlife survey. Given higher response rates to add-on surveys using mail rather than phone contacts of intercepted anglers, Gentner (2011) suggests complementing angler intercepts with mail rather than telephone surveys to collect information on expenditures in the future. Precisely this approach was successfully implemented by Liese and Carter (2011) for collecting economic data from the for-hire charter boat fishery in the southeastern United States. Obviously, the costs of such surveys depends on valid sampling frames, which in the case of charter boats could be improved by an official registration and reporting requirements, as outlined for New Zealand by Massey (2011); yet the charter boat industry has been reluctant to engage in registration and reporting processes due to mistrust of data usage. Complete sampling frames and mandatory participation in data reporting are also useful when attempting to reliably and cost-efficiently survey geographically dispersed recreational anglers. Such systems in place would have been beneficial for Dorow and Arlinghaus (2011) in their complementary telephone-diary-mail survey catch-and-effort study in northern Germany and in the various approaches (complementary telephone-diary, creel surveys with bus route method, etc.) tested by Olyott et al. (2011) in Queensland, Australia to derive catch-and-effort information along with other data. Obviously, there is a large need for longitudinal survey designs to derive trend information (e.g., in terms of catches and underlying fish abundance as shown by Adámek and Jurajda [2011] in their study of Brno Reservoir in the Czech Republic) or to evaluate trends in Florida's saltwater recreational fisheries using multiple indices of fishing pressure and participation as in the study by Hanson and Sauls (2011). The various methodological papers in this volume have collectively emphasized the value of longitudinal as well as complementary survey approaches and have outlined the need for further basic research on optimal survey methods designed to minimize biases and other forms of errors.

Outlook into the Future

Recreational fisheries are globally important to economies, and provide important social, cultural, and ecological services to humans worldwide. The social recognition of recreational fishing is growing, as are the demands placed on the sector for maintaining sustainable fisheries. Achieving this goal depends on networks and collaboration between recreational fisheries scientists, recreational fishing participants, managers, policy makers, and recreational fishing or other advocacy groups. The WRFC series is envisaged as a forum to bring together all these groups to have informed discussions about the issues facing recreational fisheries. We hope that the outcomes of the fifth WRFC, as presented here, serve the needs of recreational fisheries professionals and recreational fishing communities and contribute to ongoing discussions about the issues facing recreational fisheries worldwide. For the future, we predict an increase in studies using interdisciplinary methods that attempt to bridge the gulf between scientific disciplines (e.g., fisheries biology and human dimensions) and between science and practice. In such projects, research and application goes hand in hand, with a view to develop resilient recreational fisheries. This is the theme of the next WRFC to be held in 2011 in Berlin, Germany.

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