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EUROPEAN INLAND FISHERIES ADVISORY COMMISSION

METHODOLOGIES FOR ASSESSING SOCIO-ECONOMIC BENEFITS OF EUROPEAN INLAND RECREATIONAL FISHERIES

Cover picture: Sunset at Lake Päijänne.
Courtesy of Mr. Veli-Matti Paananen (2004)

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREPARATION OF THIS DOCUMENT

Upon request by the European Inland Fisheries Advisory Commission (EIFAC), the present "Methodologies for assessing socio-economic benefits of European inland recreational fisheries" has been prepared by the EIFAC Working Party on Socio-Economic Aspects of Inland Fisheries. An expert workshop was held on 12-15 January 2009 in Helsinki, Finland, to discuss the methodologies available and the structure of this document. Selected stakeholders from academia, national and international fisheries bodies, fisheries governmental and non-governmental organizations were invited to this workshop and 21 experts attended. Financial and logistic support to host this workshop were provided by the Centre for Economic Development**,** Transport and the Environment for Central Finland (former Employment and Economic Development Centre for Central Finland), the Finnish Game and Fisheries Research Institute, and the Ministry of Agriculture and Forestry.

The Technical Secretary of EIFAC Sub-Commission IV on "Social and economic aspects of inland fisheries", Mr. Raymon van Anrooy (FAO) coordinated, jointly with the convener of the EIFAC Ad Hoc Working Party on Socio-Economic Aspects of Inland Fisheries, Mr. Matti Sipponen, the preparation and participatory discussion of this document. The document passed several rounds of comments from the Working Party experts and was shared with EIFAC national correspondents for comments in April 2010. The document was technically edited by Mr. Brad Gentner.

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ABSTRACT

The EIFAC Methodologies for assessing socio-economic benefits of European inland recreational fisheries were prepared in 2009 by the European Inland Fisheries Advisory Commission (EIFAC) Ad Hoc Working Party on Socio-Economic Aspects of Inland Fisheries. EIFAC considered that the implementation of fisheries policy and management would benefit from a more compatible, comparable and scientifically rigorous application of benefit evaluation methods. To reach this goal, the Working Party prepared guidelines to conduct surveys focusing on social and economic benefits of inland recreational fishing in EIFAC member countries. Due to institutional aspects and management traditions, these guidelines are confined to Europe. By means of this Occasional Paper, the Working Party tries to highlight both the methodological and practical viewpoints when assessing the monetary value of social net benefits or other societal benefits from recreational fishing. The purpose is to make societal and economic valuation more accessible and to give insight to best current practices and black spots related to these tools.

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FOREWORD

The fisheries sector comprises commercial, subsistence and recreational fisheries. In the past, commercial activity has predominated marine and inland capture fisheries in Europe. However, in response to societal change, the importance of commercial capture fishing is decreasing and recreation is becoming the more important beneficiary of fish stocks. In many developed countries, recreational fishing is now the primary fishing activity in most inland and many coastal waters. For the competent and sustainable management of recreational fisheries it is essential that the sector recognizes its responsibilities and considers all environmental, economic and social aspects in its management measures and decision making.

The European Inland Fisheries Advisory Commission (EIFAC) provides an inter-governmental forum for collaboration and information exchange on inland fisheries and aquaculture across European countries. Scientific work is undertaken in Working Parties by specialists from member countries. The Food and Agriculture Organization of the United Nations (FAO) Code of Conduct for Responsible Fisheries states that users of living and aquatic resources should conserve aquatic ecosystems and that the right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources. Accordingly, EIFAC Working Party activity has included the recent publication of the Code of Practice for Recreational Fisheries and the production of these Methodologies as a sequel.

It is now generally recognized that recreational fishing is an important and highly valued leisure activity that provides a myriad of economic, social and ecological benefits to society. Nonetheless, the exact dimensions and value are often poorly known or difficult to quantify. Benefit evaluation is more complex than just counting the number of anglers and working out how much they spend. Indeed, the assessment of recreational fishing quality can depend as much upon subjective evaluation by the angler of the perceived fulfillment that the fishing experience provides, as it does upon rigorous objective appraisal. These new Methodologies will assist fisheries authorities and managers to understand how to properly value their recreational resource and thus will aid policy creation and decision making.

Policy guidance documents produced by EIFAC traditionally tended to focus upon the more conventional aspects of fishery management but times are changing and the challenges of the present day need to be embraced. There is increasing pressure on stakeholder authorities to pay due regard to the economic, social and human dimensions aspects of the sustainable management of the recreational fisheries resource; hence, this guidance could not be issued at a better time.

Phil Hickley
EIFAC Chairperson

1. Introduction

This document is a sequel to the EIFAC code of practice for recreational fisheries (EIFAC Occasional Paper No 42, Rome 2008), which suggests that the comprehensive value of inland fishing, including social and economic values, be taken into account when analyzing and managing these fisheries. The EIFAC Methodologies for assessing social and economic benefits of European inland recreational fisheries were prepared in 2009 by the EIFAC Working Party on Socio-Economic Aspects of Inland Fisheries, upon request of the Commission.

It is essential that state-of-the-art knowledge and tools are applied in economic and social analysis of recreational fishing. This document reviews and demonstrates the state-of-the-art.

For the best and most efficient, long term management of recreational fisheries, it is essential that the sector recognizes its responsibilities. The sector should:

- promote high quality recreational fishing experiences within the limits set by ecology, economics and society;
- adopt measures for the long term conservation and sustainable use of recreational fisheries resources, and base such on the best available knowledge;
- adopt the ecosystem approach as the guiding philosophy and exercise the precautionary principle/approach;
- identify all relevant parties having a legitimate interest in the use, conservation, management and development of recreational fisheries resources and engage them in the management process;
- base recreational fisheries management action on pre-defined management objectives, formulated as a recreational fisheries management plan; and
- consider all environmental, economic and social values and impacts in the appraisal of management measures.

Fisheries management and recreational fisheries management of inland waters should follow the ecosystem approach, which "strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems, and their interactions, and applying an integrated approach to fisheries within ecologically meaningful boundaries".[1] This includes the evaluation of the biological impacts and benefits of recreational fishing across all fisheries subsystems.

European inland fish stocks are exploited by about 30 million recreational anglers in 36 countries (Tillner, 2007). Consequently there is a need for comprehensive understanding of the benefits that recreational fisheries provide to societies and individual anglers in order to improve societal resource allocation. Knowledge is needed and can be produced on national, regional and local scale depending on the issue in question. Fishery authorities and managers, when exercising their powers, need to consider the wider socio-economic consequences of their actions on a local, regional, national and sometimes transboundary scale. They should also be aware of the preferences and values of the current and, importantly, the potential recreational anglers in order to better manage existing and planned fisheries.

The purpose of this document is to suggest methods and tools for assessing social and economic benefits of fishing, and to facilitate decision-making about issues fisheries authorities and managers

[1] http://www.fao.org/DOCREP/005/Y4470E/Y4470E00.HTM

are faced with in their daily routines. The baseline is the anglers and their fishing activity, which may be analysed from different social and economic perspectives. The costs incurred by anglers for transport, food, tackle, equipment, and other goods and services tied to their hobby generates economic activity in other sectors. How these expenditures generate economic activities directly and indirectly can be estimated. However, sometimes the value of the fishery itself cannot be captured using market transactions. Sometimes recreational activities are not traded directly in a market where a market price would determine the access to the fishery. Sometimes recreational activities are sold at nominal prices that are less than what the market would bear as in particular lake fisheries. Different types of valuation methods have been developed to equalise the valuation of these non-market goods and services with commercial activities where values are established through market forces.

Often, it is beneficial to know in more detail what anglers demand when they want to go fishing, including the manner in which they make choices and the trade-offs between different attributes in the fishery. Distance to the fishing site, species available, company of other anglers, or type of gear may determine demand patterns. Such information may aide decisions on most efficient investment in development of new fishing sites, and it may be used to inform the tourism industry about which fishing products tourist anglers value the highest so marketing efforts can be targeted toward these anglers. Additionally, more specific studies may reveal specific effects of recreational fishing, such as health related benefits of the fishing activities.

Questions posed by managers are often tied to policy changes which have a wide range of implications. The overarching question is often related to allocation of scarce resources. This is both allocation between sectors (transport, infrastructure, recreational or commercial fishery, aquaculture, tourism, etc.) and between stakeholder groups and individuals. Changes in management may be aimed at reducing harmful effects from overutilization of the resource, conservation of vulnerable habitats, environmental investments aimed at improving the quality of the environment or re-establishing former lost habitats. All management decisions require informed knowledge, for example assessments of costs and benefits of planned changes.

The human dimension of management encompasses the study of human behaviour. The empowerment of people through stakeholder involvement in the management process is established as a key factor for compliance and social control mechanisms in the management system. Participatory approaches where relevant stakeholders, such as recreational anglers and owners of fishing rights, are involved in goal setting are often essential for achieving widely accepted managerial solutions. Adaptive management, in turn, involves experimental trials of management approaches that have been jointly designed by managers and researchers, using stakeholder input.

Introduction of the ecosystem approach as the new paradigm within management of natural resources poses a specific challenge to present and future managers. The implementation of the ecosystem approach to management has not found a commonly accepted methodology, but aims to include both goods and services made available for humans (as part of the ecosystem), but also the intermediate ecosystem goods and services preserving ecosystem integrity and reproduction. The questions tied to regulatory ecosystem services (i.e., carbon cycle, food webs, decomposition of nutrients) are relevant also when managing recreational fishing.

This EIFAC Occasional Paper provides guidance on how social and economic benefits of inland recreational fishing can be described, assessed and measured. It reviews and provides the descriptions of the most commonly used concepts and methods to assess social and economic benefits and costs associated with recreational fisheries. Economic benefits focus on (market and non-market) valuation and (local) economic impact. Social benefits are described using a Human Dimensions approach. Due to the role of EIFAC, emphasis in this Occasional Paper will be on inland fisheries.

This document is mainly targeted to policy managers and fisheries authorities. It is also targeted to people who commission or manage valuation studies and need to understand more about valuation or human dimension methods and underlying principles. It does not aspire to, and cannot function as, a manual for those who undertake valuation studies.

2. Social and economic approaches to benefits

A critique of European inland fishery management has been the limited amount of economic and social research (Aas & Ditton, 1998; Arlinghaus, Bork & Fladung, 2008). Inland fisheries management is about making choices using many types of information to meet established goals and objectives for fisheries resources (Krueger & Decker, 1999). From this definition, it follows that inland fisheries management is as much about people management as it is fish stock management because management goals and objectives are socially constructed. The general aim of fisheries management is to maintain, and if possible increase, the total sum of benefits fisheries provide to fishing communities and society at large, including conservation of biodiversity. To manage sustainably, it is thus paramount to understand the nature and diversity of benefits generated by inland fishing to anglers, communities and society at large as a basis for decision making and to defend the sector against other social priorities. It appears, however, that there is some confusion among fisheries professionals as to how to develop a complete picture of the benefits of fishing. This stems, in part, from the fact that there are varying approaches used to determine what constitutes fishing benefits and how to best measure and assess those benefits. There is currently no comprehensive framework which captures all types of social and economic benefits generated by fisheries. Thus, a major aim of this section is to explain benefits that arise from fisheries and to incorporate them into a common framework.

2.1. A joint framework for the human dimensions and economic research paradigms

Social and economic approaches to research in recreational fishing have a long tradition in both economics and other social sciences. In order to bring some clarity into the complexity of these research fields, Figure 1 presents a rough framework which elabourates on the fundamental stages of human behaviour (top row), and positions the major research activities by economics and the human dimensions (HD) paradigms in terms of their assumptions, theories and research questions by these stages. Referring to Figure 1, row two captures the economic approach to benefits measurement and row three captures the HD paradigm while row four lists the appropriate data collection methods. It is hoped that this integrated framework adds to the clarity of the fundamental objectives of each discipline as well as the relationships between them.

Human behaviour is the foundation of both economics and the other social sciences. One can observe human behaviour in association with all areas of life, and, in effect, each behaviour is associated with an act of choice. In other words, any behaviour must be predated by a decision or choice. Countless behavioural theories have posited various concepts and mental processes that guide or precede behaviour. For example, before one makes an actual decision, a person might typically go through a state of behavioural intention; depending on the choice this state might only last a split second (e.g. choosing a candy), or it might rely on months of investigative or search behaviour (e.g. choosing a car or house).

While economic research puts its main emphasis on these two stages of the behavioural process, other social sciences have focused their research on explaining the various cognitive phenomena that influence or lead up to behaviour. Much of this research revolves around the concepts of preferences and attitudes. Psychology defines attitudes as long-lasting predispositions to behaviour. The term preference(s) cannot be located as precisely in this framework, and psychology does not provide a clear definition. Depending on the application of a specific study, preferences may be positioned anywhere between attitudes and a location falling just short of the actual choice. The concept of stated and revealed preference research makes it clear that preferences may be inferred from overt (actual) behaviour, or may be elicited by means of various survey methods. In economics and other social sciences, preference refers to the set of assumptions relating to a real or imagined "choice" between alternatives and the possibility of rank ordering of these alternatives, based on the degree of happiness, satisfaction, gratification, enjoyment, or utility they provide. The reference to real or hypothetical behaviour leads to the distinction between revealed and stated preference research, which is fundamental for large sections of this EIFAC Occasional Paper.

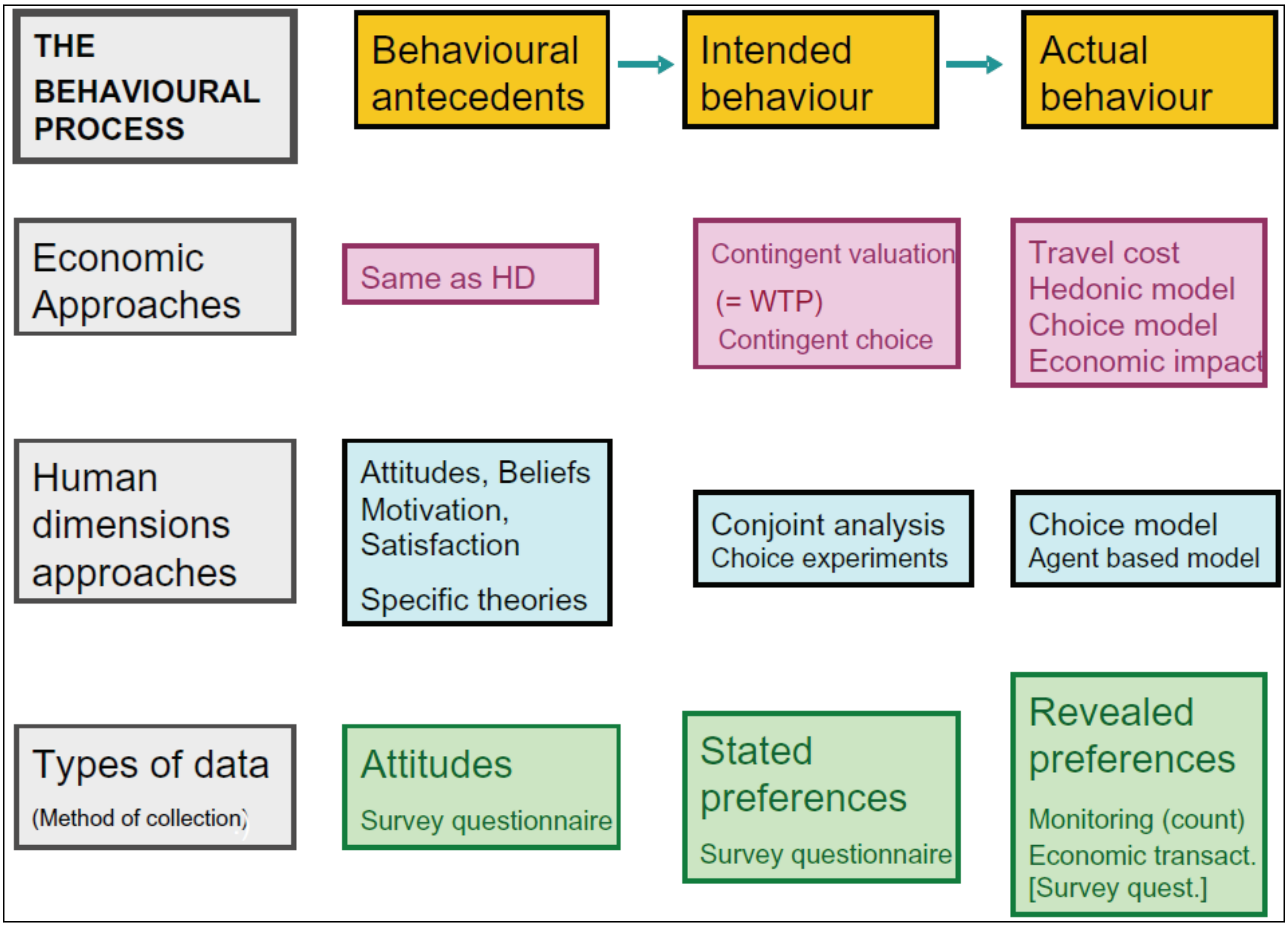

Figure 1. Relationship of HD and economics as they relate to examining human behaviour.

Around these fundamental principles of human behaviour, many different theories have been developed. The discussion of economics and the more general human dimensions paradigm below will make it apparent quickly that each approach places its major emphasis on different stages of the behavioural model.

Utility is a concept developed in the field of economics to describe the enjoyment received from consuming goods and services. Economics assumes that humans are utility maximizers and this objective is reflected in every choice made. For example, if a recreational angler selects one lake over other lakes, it is assumed that this one lake possesses some characteristics that make it preferable over other lakes. Thus, the act of actual (overt) choice provides the best insights about human behaviour and much of economic modeling focuses on choice. Most goods and services are exchanged in a market, and the interplay between supply and demand determines its price and consequently its value. For many European inland fisheries, access to fishing is traded in a typical market transaction. However, in the context of recreational fishing and other activities that rely on public goods or services, such markets do not exist. Therefore economists have developed a suite of methods to infer the value of such goods or services, which will be presented later in this Occasional Paper. At the moment we only want to mention that economics focuses largely on data representing the actual behaviour (travel cost analysis, hedonic modeling) or, in some cases, collects information about intended behaviour (contingent valuation). Much of this Paper will elaborate further on these economic approaches.

The various disciplines in the social sciences regard human behaviour as a more complex phenomenon. Led by psychology and social psychology, the emphasis of these research directions is on explaining a suite of behavioural antecedents, i.e. which cognitive aspects contribute to the eventual behaviour, and how do they contribute to the choice process. Other research questions focus on the relationship of these components to actual behaviour, and whether any of these components can be influenced for the purpose of eventually influencing behaviour. The HD approach was introduced in the early 1970s by Hendee & Potter (1971) and has continued to follow a social-psychological research tradition (Manfredo, 2008). In this tradition, the social benefits generated by fisheries are measured by both quantitative and qualitative methods. Human dimensions research focuses predominantly on the behavioural antecedents in the behavioural model. Although the term human dimensions originated in recreational fisheries research, it is now used much wider, and may very well span the entire phenomenon of social sciences in resource management.

While this HD research does not rely on one single convenient unit of measurement, like money as economics does, an important component of human dimensions research are the many theories and concepts that have been developed using social psychology and structural sociology, which provide more in-depth explanations of the benefits of fishing, and have enriched many managerial discussions in that way. General concepts and theories of social psychology have found their applications in recreation research in general and recreational fisheries research in particular by focusing on satisfaction, motivation, perceived crowding, norms and standards, and many more.

Over time, recreation and fisheries specific theories and concepts have emerged, which now guide much of the work. Undoubtedly the most prominent of all theories is the specialization theory (Bryan, 1977; Bryan, 2000), which has since been applied across many outdoor recreation activities (Hvenegaard, 2002; Kuentzel & Heberlein, 2006; Kuentzel, 2001), and has been used as a lens to explain the diversity of preferences associated with the level of experience in an activity (Kuentzel & Heberlein, 2006).

Another branch of HD research has focused on the reasons anglers give for going fishing (Fedler & Ditton, 1994). Motives are the underlying forces that act on a tendency to engage in an activity with an expected outcome (Atkinson, 1969), while satisfaction refers to the difference between the expected outcome and its perceived fulfillment (Holland and Ditton, 1992). While most empirical studies on the motivation for fishing show that catch motivations may not be the primary motivations for anglers to fish, these catch aspects may also constrain angler satisfaction (Arlinghaus, 2006).

Other topics regularly investigated with the guidance of various theories are recruitment to a recreation activity, spatial displacement from one location, or product shift, explaining how users might need to adjust their personal perception of a product when some characteristics of the product change, but they prefer to remain in the same location for whatever reason; these arguments are based on cognitive dissonance theory (Festinger, 1957).

An approach that guides much of the HD research is the Theory of Planned Behavior (also referred to as Theory of Reasoned Action) (Ajzen and Fishbein, 1980), which postulates a relationship between the various behaviour stages similar to the sequence in Figure 1: Attitudes are thought to influence intended behaviour and therefore in turn also behaviour. In many applications of this theory the concepts of attitudes themselves has been refined into various more specific components, such as a cognitive component, an affective component, personal importance attitudes, an attitude towards the target of behaviour (e.g. Bright and Manfredo, 1996). While the theory of planned behaviour has been applied frequently in the HD of wildlife management, no complete application is known in recreational fishing although many recreational fisheries studies use its components.[2]

[2] For example, the detailed conceptualization of attitudes, which may be used for designing education campaigns, or other public outreach programs, and, occasionally, models are developed to predict from attitudes to actual behaviour.

Placing the main research activities of economics and the other social sciences into this framework shows that despite these many shared commonalities, to a large extent the respective disciplines focus on different stages of the behavioural process: economic research focuses predominantly on behaviour, while the various social science approaches focus more on behavioural antecedents. Given this divergent emphasis, combined with the very different paradigmatic backgrounds and somewhat different research methods, economics and the other social sciences are usually perceived as more different than they actually should be. It is one of the goals of this Paper to explain each approach in its own right, as well as to explain overlaps and possible synergies, which are recently emerging. While some researchers and other experts would argue that economics is or should be part of the 'human dimensions paradigm' and while we might agree with the concept, we will keep the two concepts separate for this Occasional Paper as it facilitates the required explanations. Nevertheless, potential overlaps and synergies will be identified in the appropriate locations of the Paper.

What kind of data collection is suitable and feasible depends to a large extent on the respective stage of the behavioural model that the research question is positioned. Data about actual behaviour are collected by simple observation (e.g. creel surveys, or more general counting by observers, by automatic counters, etc.). Data about behaviour may also be collected by simple on-site surveys, or by surveys mailed later (e.g. at the end of a trip respondents explain what they did, or they are asked to recall their angling behaviour over the past season, or the past year). Clearly, recall problems and biases may become an issue when the recall covers a longer period of time.

If the management goal requires quantitative analysis, data collections for the other stages of the behavioural process preceding the actual choice depend primarily on questionnaire surveys. The types of questions in the survey instruments range enormously across the stages of choice being examined, specific research approach, research questions, and theories applied. These details will become apparent throughout the remainder of this document.

Broadly defined, the economic tradition uses two different concepts to examine the implications of policy decisions on society: economic value and economic impacts. The first, economic value, also known as economic benefit or welfare, monetizes the value society places on resources or activities. Welfare analysis first came into use in the early 20th century and gained mathematical rigor and wider use mid-century (Samuelson, 1947). Economic value should be the metric used to decide between one course of action and another (e.g., Edwards, 1990; Freeman, 1993; Samuelson, 1947).

Economic value however is not the only criterion that should be examined when analyzing resource policies. Equity, fairness, distributional concerns, and other social impacts are important (Edwards, 1990). Economic impact analysis, also know as input-output analysis, is useful in addressing distributional concerns. However, equity, fairness and other social impact questions are best addressed in the HD tradition (Miller & Blair, 1985). Economic impact analysis, while often confused with societal welfare measures, is a method that addresses distributional concerns within an economy. The economy in question can be defined as a city, region, or an entire nation. Economic impact analysis traces the flow of economic transactions through the researcher defined economy and answers the research question on what specific economic sectors win or lose as the result of a policy change.

Economic metrics are often intuitive to decision makers, which is why the economic approach to fisheries policy analysis appeals to decision makers. When properly measured, economic value measures capture all individually held values for resource use or preservation including psychological, health, and cultural benefits. However many detractors doubt that some of these more intangible concepts can be captured monetarily. On the other hand, economic impact tools only trace the flow of economic activity in a community and cannot capture the full set of cultural and social benefits of fishing.

For example, while development of a tourism fishery at a large inland water body might be valued in terms of how a sample of local residents prefer this development over alternatives (economic value) or in terms of the additional income and jobs generated by the development over alternatives (economic impact), the social impacts of tourism development or the cultural value of traditional fisheries is likely to be only partly captured in such assessments unless surveys are designed that specifically assess cultural values in economic terms. It is also doubtful to what degree monetary values can be assessed in every situation in a complete way, which is why there is a role for alternatives ways of assessing the benefits and costs of fish resources and fisheries management policies.

The economic valuation of environmental and other non-market goods and services such as fishing experiences is useful because all decision making involves choices and tradeoffs in allocating scarce resources. Hence, valuation provides explicit and comparable information for policy-makers and insight to social effects (benefits and costs) of different management policies or projects and their subsequent economic or social impacts. In this context, assessment of economic value is the correct measurement in many cases (Edwards, 1991), e.g. when valuing the impact of water quality changes for recreational fisheries.

The context in which fisheries authorities and managers are faced with economic valuation or economic impact analysis is usually related to fisheries damage assessment, defining various management options (e.g., stocking versus doing something else) and ultimately defining the total benefits that recreational fisheries provide to society to safeguard satisfactory allocation of societal resources for the sector. Economic valuation of fisheries is also needed because cost-benefit analysis (CBA) is generally used for assessment of societal profitability of certain projects or policies. This approach applies efficiency criteria and assesses whether the value of benefits overrun that of costs regarding the policy. Therefore, application of CBA presumes that commensurate measures, i.e. monetary units for values of benefits and costs related to environmental change, are available.

In the following, the different components of benefits of fishing will be described from both the HD and the economic research perspectives. This section will conclude by suggesting a combined framework that highlights the overlap of these two different traditions. In later parts of this Occasional Paper, the particular methods to assess the various benefit components will be presented in detail.

2.2 Benefits of fishing from the human dimensions (HD) perspective

Benefits of fishing from a HD perspective focus on direct and indirect benefits. The direct perspective revolves around the individual angler emphasizing how fishing generates benefits that satisfy the wishes, needs and expectations of anglers (psychological benefits) and how fishing generates ancillary benefits, e.g. improved health (physiological benefits). Indirectly, fishing is a cultural asset and makes important contributions to the social structure of societies in many parts of the world. HD researchers ask questions about the benefits of fishing for social communities and as an expression of culture in fishing-dependent areas (social and cultural benefits). Finally, anglers often have an incentive to conserve fishable stocks, and fishing provides a means for enhancing traditional ecological knowledge that is of value for meeting overarching societal goals for sustainable exploitation (ecological benefits). Figure 2 characterizes the grouping of this diverse set of benefits. The value of assessing the full range of benefits from a non-economic HD approach perspective is the ability to examine the disaggregated benefits that fishing generates for society and to assess the individual components of total benefit that the economic approach to benefit measurement typically aggregates into one measure.

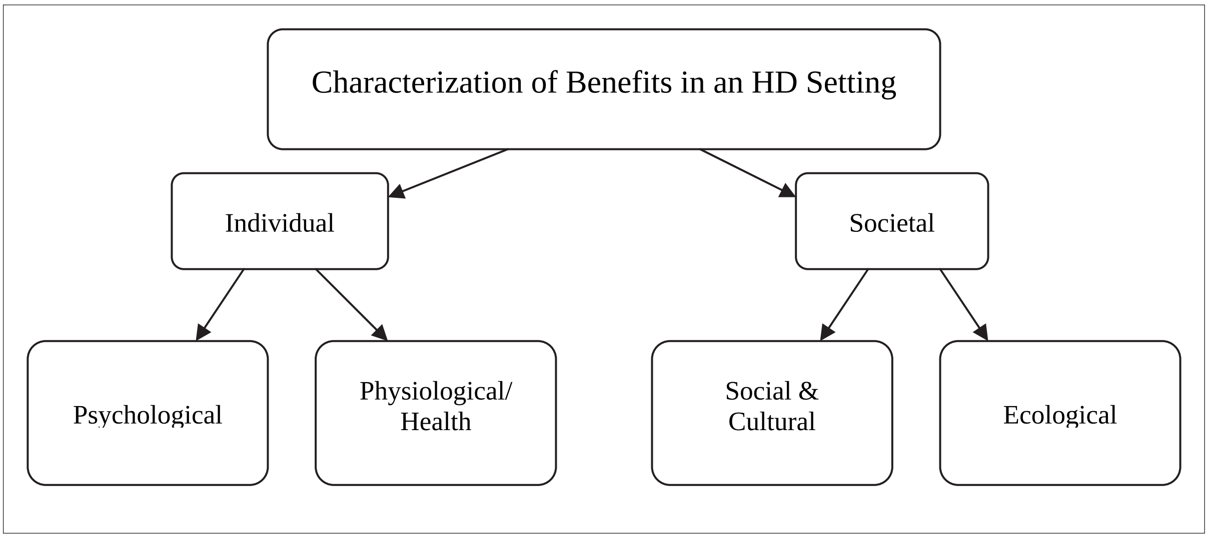

Figure 2. Categorization of benefits of fishing from a non-economic human dimensions perspective.

2.2.1 Psychological benefits

Research studying the psychological benefits of inland fishing, particularly recreational fishing, has progressed from an activity approach to a behavioural approach. The activity approach defines fishing as an individual recreational activity. The behavioural approach focuses on why people are motivated to participate in recreation activities and the benefits sought by participation in a particular outdoor recreation activity (Manning, 1999; termed "experiential approach" by Manfredo, Driver & Tarrant, 1996). Based on psychological expectancy and motivational theory, it is assumed that human behaviour in outdoor recreation is generally goal-oriented and aimed at meeting particular psychological needs (Hendee, 1974; Manfredo et al., 1996). More specifically, Driver and colleagues have applied social psychological expectancy theory to suggest that people engage in activities in specific settings to realize a group of psychological outcomes that are known, expected and valued (Driver & Cooksey, 1977; Driver & Knopf, 1976; Fedler & Ditton, 1994; Manfredo et al., 1996; Manning, 1999). Thus, people select and participate in recreation activities, such as recreational fishing, to meet personal goals or satisfy certain needs. Leisure theory holds that participation in recreational activities is self-rewarding when it occurs during free-time and engaged in by free choice (Manfredo et al., 1996). Personal benefits, which range from values associated with the catch to personal experiences of the catch, ultimately result in social benefits of improved relations with significant others and physiological benefits related to stress relaxation and improved health.

Generally, psychological outcomes related to fish are categorized as activity-general (e.g., nature experiences) and activity-specific (e.g., fish catch and consumption) outcomes, both of which result in or contribute to a satisfying fishing experience. Satisfaction is assumed to be the ultimate product of the fishing experience, at least for recreational anglers (Hendee, 1974). Manning (1999) distinguishes four levels in the behavioural approach to outdoor recreation. Level 1 represents the general demand for a given activity such as fishing. Level 2 represents the setting in which the activities take place (e.g., remote or urban). Level 3 emphasizes the underlying reasons (motivations) for people to participate in a given activity (Level 1) in a given setting (Level 2). Level 4 refers to the ultimate higher-order benefits (alternatively referred to by various researchers from different research traditions as utilities, welfare, satisfactions, benefits or value) that the participant experiences as the end-result of the outdoor experience (e.g., enhanced self-esteem, enhanced personal health) (Manning, 1999). In the context of psychological benefits of fishing, spiritual benefits may be the benefits of recreational fishing which is most difficult to define. This aspect of the fishing experience enriches humans' relations with fish, water and nature. In the seminal work of Driver et al. (1996), spiritual experiences in outdoor recreation are defined as reflection on deep personal values, respect, wonder, awe, mystery and sense of humility and connectedness to nature.

2.2.2 Physiological benefits

In addition to meeting psychologically defined expectations, fishing can consciously or unconsciously create physiological benefits and benefits for human health. For example, Pretty, Hine & Peacock (2006) found that negative feelings and depression were relaxed after fishing experiences. Moreover, objective indicators of improved physiological state (e.g., heart rate, skin conductivity) and general health can be expected to be related to fishing (Pretty et al., 2007). It will be argued through this document that fishing is a vehicle for improved health although further research is needed to justify this assertion. Despite the obvious physiological benefits that participating in an active outdoor recreational activity such as fishing can have, the research on this area is rudimentary. However, if physiological benefits are not conscious to the respondents, it is unlikely that these benefits can be measured by economic analyses based on surveys of individuals. Instead, other techniques can be used to develop the economic value of physiological and health benefits.

2.2.3 Social and cultural benefits

Describing and documenting social and cultural benefits of fishing is challenging but needed for inland fisheries, and for recreational fishing more generally. The idea is that fishing is valued in social terms as a cultural asset because fishing is important for social systems, for generating wealth, for social identity and for improving the quality of life. Cultural benefits are a separate aspect of social benefits, but focus more on how an activity, such as recreational fishing, provides meaning, is represented in the community, and gradually materialize in established discourses, social groups and events of a society. This, then, creates references in terms of space and time (geographical names, specific dates for instance related to the opening of the fishing season, ceremonies etc.). Little research has been done on these benefits of recreational fishing compared to subsistence fishing, and there is a need to apply approaches from fields such as history and anthropology to reveal and clarify such benefits. In the context of social impacts, the Social Impact Assessment research tradition aims to assess broad community benefits from fishing activities in their widest sense (Schirmer & Casey, 2005). This assessment tradition is explicitly linked to landscape planning and decision making processes, and is highly applied and flexible in terms of methods, measures and degree of complexity and rigidity.

2.2.4 Ecological benefits

Inland fishing creates a wide range of ecological benefits for society. The benefits range from the engagement of anglers in management and governance of natural resources, funding of fisheries management programs, an increase of traditional ecological knowledge, environmental legislation for preservation, and the socialization of young people in the sustainable use of renewable social resources. In some instances, compensation claims for pollution events, which could effectively reduce the likelihood of undesirable ecological changes, are possible because of the structure of property right systems in specific fisheries. In other cases, anglers are ambassadors and lobbyists for the health of the resource, fighting for better protection and conservation of habitat and fish stocks. There are large, undervalued ecological benefits for society associated with this social movement. Moreover, under private fishing right regimes, angler organizations or landowners are generally required by law to manage fisheries. Thus, fisheries management obligations are transferred to the local level, and anglers or other rights holders generally invest private funds or engage voluntarily during free time to engage in such activities as stock fisheries, clean shorelines, or even undertake habitat conservation projects. Also, angler organizations have sometimes been instrumental in partnering with nature conservationists, resource management agencies and land owners to create fish passage facilities and other habitat improvements (Granek et al., 2008). All these ecological impacts of recreational fishing are directly or indirectly amenable to objective assessment and quantification using a range of methods from comparative case studies, history or economics, but limited research has been conducted.

2.2.5 Summary of HD benefits research

The variety of benefits from recreational fishing are obviously measured in different units providing a challenge for comparing benefit categories or summing them to provide an overall measure of total benefits. HD separates benefits accrued by an individual person in the process of engaging in fishing (e.g., physiological and physiological/health benefits) and benefits accruing to larger units of the system (e.g., social and cultural benefits) (Weithman, 1999). In addition, ecological benefits are conceivable both at the individual level (e.g., increased awareness and knowledge of ecological issues among practitioners) or at the societal scale (e.g., increased level of engagement in conservation through incentives and property rights by fishing communities) (Arlinghaus, Mehner & Cowx, 2002; Granek et al., 2008). However, ecological benefits have not been emphasized in the traditional HD literature to date.

2.3 Benefits of fishing from an economic perspective

A complimentary, yet often separately considered approach to benefit assessment of fisheries originates from the economic sciences. Economic studies and HD research have considerable, if not complete, overlap in estimate of benefits, but each uses different jargon and definitions which hamper a common approach. Economists take two general approaches to estimating value. One, economists estimate a single value that incorporates the value of the good in use, including ancillary benefits (psychological, physiological, etc.) and non-use values such as the value of access to or the existence of a resource (Gentner & Lowther, 2002). Two, economists will focus directly on a single attribute of an experience, such as the value of one additional fish in an angler’s catch (Gentner, 2007). Recently there has been additional interest in using techniques such as hedonic valuation or stated preference choice experiments (also known as conjoint analysis) to decompose the value of a good or service into all, or the relevant portion, of its constituent parts (Gentner, 2004; Louviere, Hensher & Swait, 2000).

2.3.1 Economic value versus economic impact

Economists distinguish two types of outcomes created by fisheries, economic value and economic impact. Economic value refers to the net benefits received by society, while economic impacts trace the flow of economic activity through a local economy (Miller & Blair, 1985). While policy makers often confuse the two, the concepts of value and impact refer to fundamentally different economic frameworks (Edwards, 1991). The use of each of these approaches in decision-making depends on the objectives of the decision makers. If overall economic efficiency is the objective, value metrics are the clear choice. With value, a positive increase in value strictly means society is better off and conversely a loss in value as the result of a policy, a cost, is strictly negative.

In contrast, the concept of economic impacts examines the flow of expenditures on fishery resource activities and products, and how this spending filters through a community. While economic impact measures should not be used to choose a specific course of action, they can be used to examine what particular sectors in the economy are affected positively or negatively by a particular policy and to what degree. Economic impact analysis examines the distribution of value changes identified when comparing benefits, making both types of analysis complementary. Economic impacts cannot be used to select the most efficient use of resource. Economic impact analysis is driven by consumer or producer spending on the goods. As a result, economic impacts are maximized when spending is maximized. Maximizing impacts violates basic economic principles of maximizing profits for a given level of output for firms, or minimizing expenditures for a given level of utility for consumers or anglers (Edwards, 1991). That is, the most efficient level of fishery production involves keeping costs down in order to keep profits up. If the goal were maximizing economic impacts, the suggestion would be to maximize costs. Often advocacy groups will use economic impact metrics to bolster their arguments in the policy process and this is incorrect. Additionally, it is impossible to add value estimates to economic impact estimates as both concepts are fundamentally different.

2.3.2 Total economic value

A central concept of environmental and welfare economics is total economic value (TEV), which has proven useful as a conceptual framework for analysis of policy choices and their impact on social welfare. It is measured by the preferences of individuals (recreational anglers, fishery owners, commercial fishermen and the public) for aspects of fishing and reflects the benefits humans gain from the direct or indirect use and non-use of the natural environment. Figure 3 illustrates the various types of values included within TEV, which can be broadly categorized into use and non-use values. The discussion is here focused on recreational fishing for simplicity and draws from Edwards (1990), Freeman (1979), Haab & McConnell (2002), and Mitchell & Carson (1989).

Use value is the current use value derived by recreational fishing, which may be direct or indirect.

Direct use value: Individuals make use of a resource in either a consumptive or extractive way, such as harvest by recreational anglers, or in a non-consumptive way. For example, sight-seeing, enjoyment of nature and other ecosystem services generated by a fishery that do not deplete the fishery resources are non-consumptive direct uses of a fishery (e.g., viewing fishing activity by others, and enjoyment of wild salmon jumping in their native river).

Indirect use value: Individuals benefit from ecosystem services supported by a fishery resource without actually using it. Indirect use value may include activities away from the site, including reading about the fishery or special activities at the fishery location. All of this indirect use of a fishery may provide value to people that are enjoyed and thus can be valued formally in monetary terms.

In addition to current use values, individuals may hold value for preserving the option to use the resource in the future. If this option refers to own use, it is called *option value*.

Non-use value (also called passive use value): Non-use value derived from a fishery without directly or indirectly using it. It involves the benefits from simply knowing that the environmental resource or service is maintained without any actual, planned or possible use. Non-use value can be partitioned into three basic components: *existence value, altruistic value and bequest value*. *Altruistic value* is derived from knowing that the environmental resource or service is available to the current generation, while *bequest value* arises from knowing that, for instance, certain fish stock will be passed on to next and future generations. *Existence value* is purely associated to the personal satisfaction of knowing that, for example, fish stock or an ecosystem with all its organisms will be maintained and continues to exist.

Various methods have been developed to quantify the use and non-use value of a recreational fishery. These can be broadly categorized into stated and revealed preference methods (see section 3.2.).

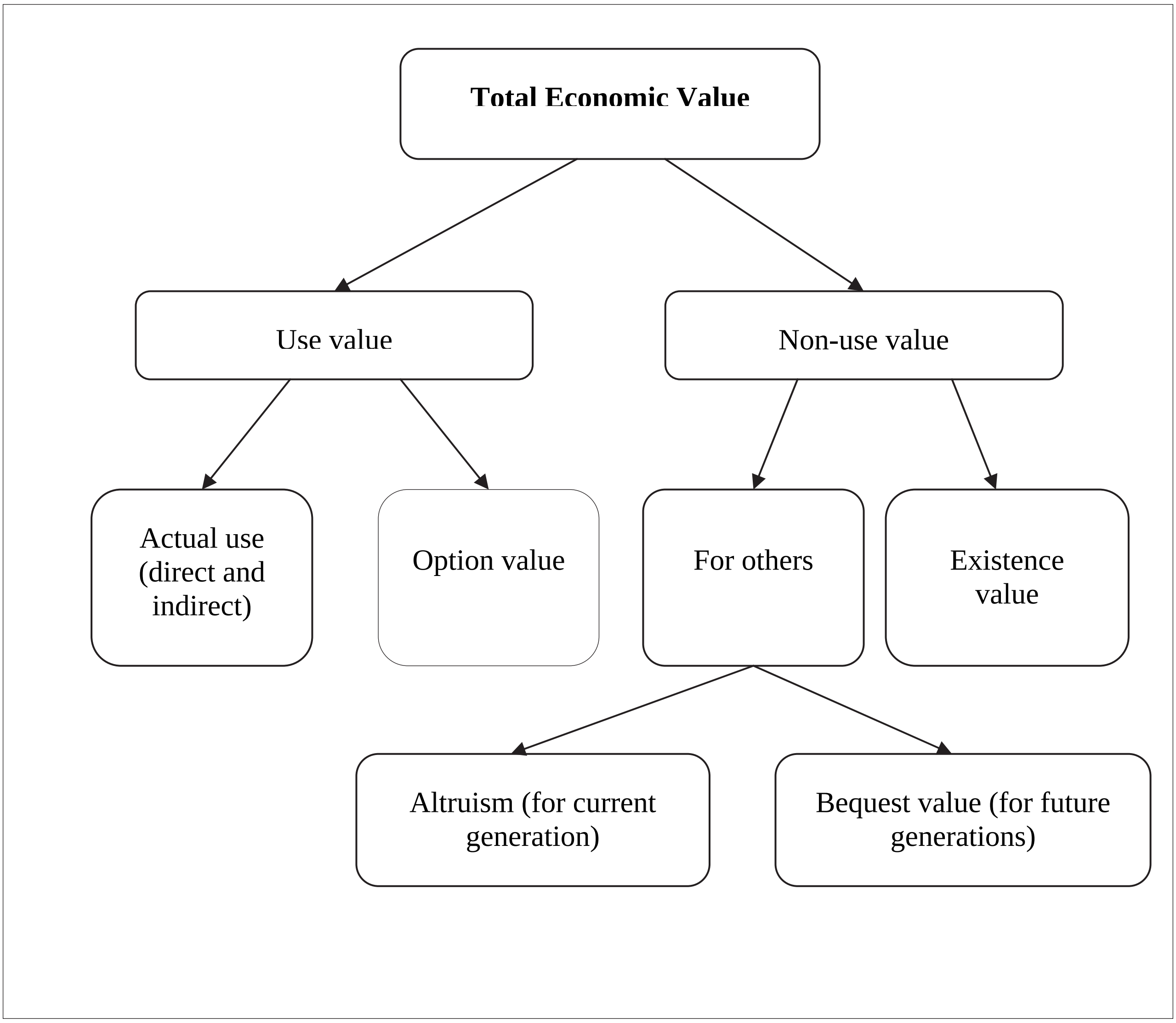

Figure 3. Categorization of total economic values (modified from Bateman et al., 2002).

2.3.2.1 Economics of resource allocation

Economics, particularly the study of economic value, provides an excellent tool for allocating scarce resources among competing user groups. In essence, every fisheries policy change is an allocation question: allocating fish between commercial fishermen and recreational fishermen, allocating stocks between consumption and conservation, allocating water behind a damn for power generation or for coldwater fisheries, etc. From an economic perspective, allocations between uses should be set at the level that maximizes total benefit from the resources.

For both the recreational and commercial sectors, total value is the sum of consumer and producer surplus. Producer surplus is measured by examining the supply curves for commercial producers of seafood, including harvesters, processors, wholesalers, and distributors, as well as the supply curves for for-hire recreational service providers. Essentially, producer surplus is the difference between the cost of producing the good and the euro value generated by the sale of the good and is similar to the concept of business profit. While the concept of producer surplus as profit is intuitive and easily understood, consumer surplus is less intuitive. Sometimes it helps to think of consumer surplus as a consumer’s profit. Consumer surplus is measured by examining the demand for goods at the consumer level including the demand for fish at markets and restaurants and the demand for recreational fishing trips. Consumer surplus is the difference between the amount actually paid and the amount consumer would have been willing to pay for the good in question. In the case of recreational fishing, or any other environmental good that is not traded in a market, special techniques are needed to estimate consumer surplus or willingness to pay.

In the case of allocating fish between commercial and recreational sectors, total value or net benefits for the recreational sector is the sum of the consumer surplus from recreational fishing participants and producer surplus from fishing guides and resource owners. For the commercial sector, total value is the sum of consumer surplus from the purchase of seafood products in markets and restaurants and the producer surplus from harvesters, processors, wholesalers, and distributors of those fishery products.

Value is not static across all allocations, and, as any consumer obtains more of a good, the marginal value of obtaining the next unit of that good falls. That is, there are diminishing returns to additional consumption of any good and this is a fundamental tenet of consumer demand, which has important implications for allocation decisions. A similar tenet exists for producers, but does not always hold depending on the character of the industry. As a result, it is important to examine the schedule of these marginal values in each sector. Societal benefits are maximized at the allocation where marginal value from one use is equal to the marginal value from a competing use. This is known in economics as the equimarginal principle. Using the equimarginal principle is widely recognized as the best way to maximize societal value in an allocation analysis (Edwards, 1990; Freeman, 1993). The equimarginal principle is particularly useful when there are multiple competing user groups. Often, it is difficult to develop a complete schedule of marginal values across all possible allocations. In this case, it is appropriate to examine total value, recognizing, however, that total value may not take diminishing marginal returns into account.

2.3.2.2 Economic value of recreational fishing: consumer side

Utility is a general term used by economists to capture all benefits derived from a good or service by an individual. Utility can be thought of as the pleasure or satisfaction an individual experiences from being in a particular situation or from consuming goods and services. The most basic tenet of consumer theory is that consumers seek to maximize their utility in every choice and across all choices, given their budget constraint. In general, consumers reveal their utility preferences for goods through the choices they make in the marketplace for the goods they prefer. Consumers always choose to purchase a good or a service because they perceive it to be a good deal or worth the investment. That is, they hold a valuation for that good that is as least as high as the price the good is offered for sale in the marketplace. As a result, there is always some amount more the consumer would have been willing to pay to acquire that good, but did not have to pay. That excess willingness to pay is value or consumer surplus.

Through an examination of demand and supply, consumer surplus (CS) or willingness to pay (WTP) can be estimated. By examining the choices consumers make, demand curves for the individual can be developed for each good. Because of the principle of diminishing marginal utility discussed above, demand curves are generally downward sloping. Figure 4 displays a typical downward sloping demand for recreational fishing trips. The demand curve for an individual is the locus of all utility maximizing units of consumption at each price level and therefore contains all of an individual’s preferences for the good in question. This is an important point that bears further explanation. An individual’s choice to participate in an activity contains their valuation for all the attributes that make participation an attractive option. That is if an angler believes fishing is worth participating in because of physiological, psychological, social, harvest or a myriad of other reasons, their valuation of that choice to take a fishing trip contains the value for those attributes. Typically, however, economists do not disaggregate those attributes.

Similar to the consumer side, producers seek to maximize profits for a given cost structure. In many ways, it is much easier to conceptualize profit than it is utility. In Figure 4, it is assumed that supply is horizontal for fishing trips, as is often the case. The horizontal slope is due to the constant marginal cost of providing recreational experiences in many cases. That is the cost to produce one or one million fishing trips to a given location is assumed the same to the producer of those trips. In this case the producer of fishing experiences is the government or the landowner. Producer surplus will be discussed in greater detail below.

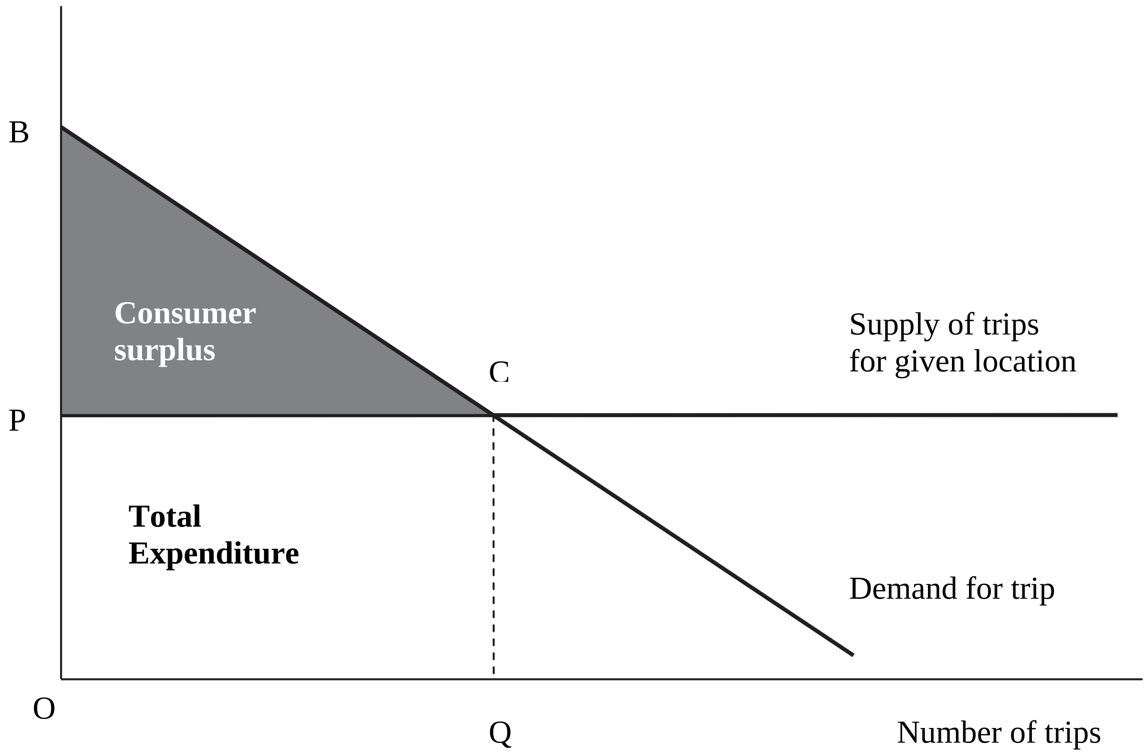

Figure 4: Demand for recreational fishing trips for a given location.

Where demand and supply intersect is the equilibrium market price (P) and quantity demanded (Q) for fishing trips. Consumer surplus, or WTP, is the area PCB in Figure 4. It is the amount above and beyond what the consumer is currently paying (area PCQO) that the consumer would be willing to pay for the good. Many things can change the size of triangle PCB. Shifts in supply can increase or decrease CS. If the marginal costs of the supplier of fishing trips increase, supply shifts upwards, fewer trips will be taken, and CS shrinks. If the marginal costs of the supplier shrink, the supply curve shifts downward, more trips will be taken and CS increases.

Demand shifts can also change CS. Figure 5 displays both an increase in demand (D’) and a decrease in demand (D”). Demand shifts can be driven by any number of factors, other than changing price, including changing preferences or tastes, changes in income impacting the budget constraint, or changes in the prices of related goods. For an increase in the stock size at this site through increased water quality or stock enhancement, the demand curve would shift outward to D’. At D’, the CS increases from PCB to PAD. The amount of the increase in CS is BCAD. CS might also shrink as a result of a fishery policy change. For example, if a new planned harvesting policy reduces the potential for harvest by anglers (e.g., reduced daily bag limit) at this site, this change reduces the relative attractiveness of fishing at this site compared to other fishing sites or other sources of recreation. This regulatory policy shifts the demand curve inward, moving demand from D to D”. Consequently the size of CS shrinks to PGH corresponding to a welfare loss of HGCB (Figure 5). This change in welfare measures the social impacts of different policy alternatives and allows the comparison of the effects of different policies to identify the policy that provides the best benefit-cost ratio or to analyse the degree of compensation for the loss of utility.

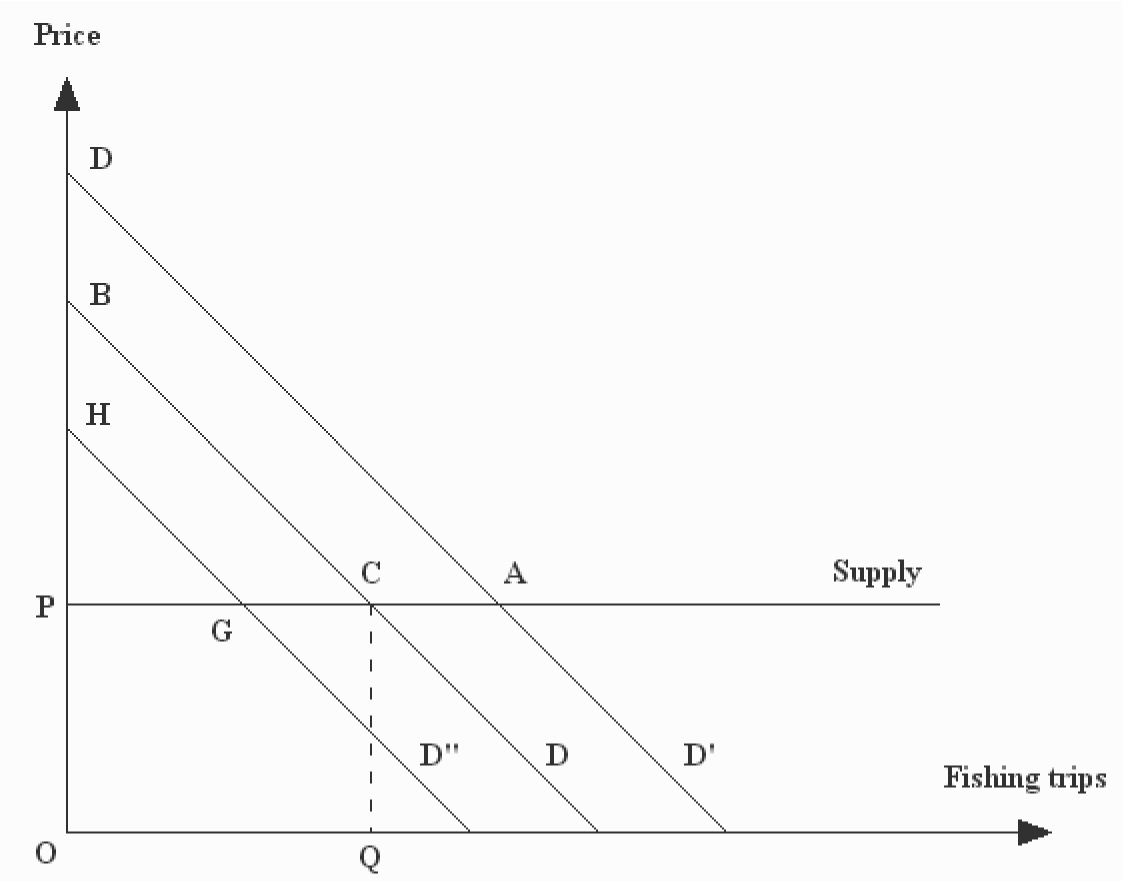

Figure 5. Illustration of the effects of altered demands curves on consumer surplus.

In Figures 4 and 5, demand for recreational fishing is expressed on a two-dimensional graph as a function of price of fishing. While many goods are traded in a market, many recreational activities and most environmental goods are not. In some cases, like trips on private property, price can be characterized using the price of access, in many cases there is no defined good traded in the marketplace when one takes a fishing trip. Goods like fish flesh are traded in the market and it is relatively straightforward to use market purchase data to construct demand curves and estimate CS/WTP. Recreation and environmental goods are considered non-market goods as there is no defined market for water quality or fishing trips. These goods are not traded in the market as a whole unit, but instead, in the case of fishing, are composed of expenditures on travel, tackle and other trip expenditures. Special survey based techniques are necessary to value non-market goods in most cases and those methods will be discussed in greater depth in section 3.2.

There are many factors that determine the cost of taking a fishing trip and many attributes of the trip including regulations, size of the fish, harvest size, scenic beauty, access, facilities etc. (Hunt, 2005). Economists interested in valuing recreational fishing experiences would therefore estimate demand functions as a function of a bundle of attributes (e.g., fish size, aesthetic quality, regulation in place, catch rate, water quality). Functions based on multiple attributes can then be used to estimate change in CS stemming from changes in the attributes affected by the policy. This approach values what happens to the individual angler and these individual values can be aggregated to the population of all recreational anglers impacted by the policy, provided that estimates of total number of anglers in a region are available. These value or benefit estimates would then be used to identify optimal policies in a cost/benefit analysis framework.

2.3.2.3 Economic value of recreational fishing: producer side

On the production side, the supply curve traces the locus of all profit maximizing production points for a given set of production costs. Unlike on the consumer side, the industry supply curve can be upward, horizontally or vertically sloped depending on the structure of the industry. An industry characterized by constant marginal costs will have a horizontal supply curve, an industry with infinite marginal costs will have a vertical supply curve (the rare case of a good with a completely fixed supply), and an industry with increasing marginal costs will have an upwards sloping supply curve (most typical case). For the purpose of this EIFAC Occasional Paper, producers include recreational opportunity providers such as landowners and for-hire recreational providers and commercial fishermen.

While a production decision is always the result of a market transaction, calculating producer surplus requires detailed data on the costs and earnings structure of individual firms in the fishery. Figure 6 contains a representation of a producer surplus under the typical upward sloping supply function. Under perfect competition, the output supply function is equal to the marginal cost function of the firm. In most cases, perfectly competitive firms face increasing marginal industry costs and therefore have upward sloping supply functions.

To illustrate producer surplus in a competitive market, in Figure 6, the price of a good such as fish flesh is a function of its supply and demand in the market where producers supply their products. In Figure 6, the quantity of good demanded is shown to decrease as price increases, as is typical under diminishing marginal utility as described above. The supply of the good relates to the costs of its production (e.g., fuel to catch fish). At low prices only the most efficient producers are able to operate, but as the price increases, less efficient producers enter the industry, resulting in increased supply. As a result, the supply of the good increases with increasing price and marginal cost is an increasing function of quantity supplied. In perfectly competitive markets, market price is set at the intersection of supply and demand at price P and quantity demanded Q. As above, consumer surplus is the darker shaded triangle PCB.

Total revenue in Figure 6 is the rectangle OPCQ. The total cost of producing the good by all producers is given by the area under the supply curve, OACQ. The difference between the total revenue generated from sales and the total costs of production, given by the area APC, is a surplus accruing to the production industry. This producer surplus (PS) represents benefits accruing to the producers from being able to sell the good at market price P. In essence, it is the return earned by the firm selling fish products, providing recreational access, for-hire recreational services or hatchery fish for stocking.

Landowners that provide access to fishing on private property are considered producers of recreational fishing trips and estimation of their producer surplus deserves particular attention. This is only relevant in privately governed recreational fisheries or inland fisheries (which is common in Central and Northern Europe). For an owner of a fishery, this return may be economically important, depending on the quality of the fishing site and resource costs necessary to maintain the fishery. Marginal cost for the production of fishing access, in cases where the landowner does not invest in stock enhancement, access provision nor other maintenance costs, is simply the cost of the resource. If the land in question is not mortgaged, the resource cost is simply the opportunity cost of using that property for another income generating purpose like timber production, agriculture, or development. Often, in the case of inland fisheries in central and northern Europe, the opportunity costs are assumed to zero (see chapter 3.4). That is, the landowner could not generate income from his land in any other fashion than the provision of fishing access.

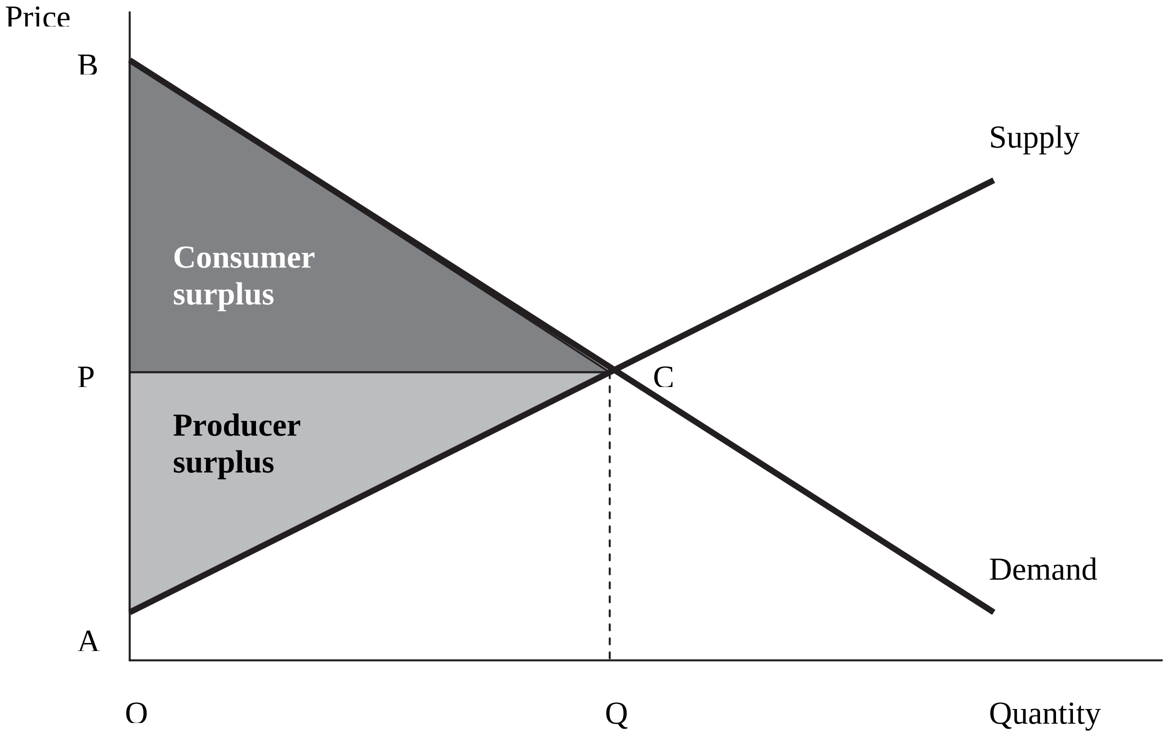

Figure 6: Consumer surplus (CS) and producer surplus (PS) as a measure of economic benefit for individual (CS) and for producer (PS).

In economic theory, the portion of producer surplus that accrues to the resource is called resource rent. Under perfectly competitive markets, resource rents are typically driven to zero unless the producer can exercise non-competitive market power. In the case of providing access to a lake or other water body entirely owned by a single owner or producer, that owner can act as a monopolistic producer if his holdings are unique from any other resources. It is not hard to imagine that owners of fishing resources could easily position themselves with this type of market power. Resource rent (also called economic rent) will exist when the owner can set price above marginal costs, as in monopolistic pricing. For this to occur, the landowner has to act as a monopolist in the provision of access to the property. Under perfect competition, supply equals marginal cost.

Under a monopoly, the producer sets his price higher than the competitive price using the intersection of the firm's marginal revenue and marginal cost curves. Figure 7 highlights these concepts visually assuming the owner of the fishing right has a fixed marginal cost (Po) regardless of the number of permits issued. This generates the horizontal supply curve. Additionally, because demand is downward sloping, the landowner's marginal revenue function is also downward sloping. Following monopolistic pricing rules, the landowner would charge price P for a permit, where his marginal revenue and marginal cost curves intersect (marginal cost is horizontal). At price P, demand for fishing trip is Q.

Because of the landowner's monopolistic power, resource rent is indicated by the area ABCD in Figure 7 as the difference between the actual price charged (P) in the market and the cost of providing a fishing permit (Po). At price level P, the total economic surplus of the fishery is the sum of CS (DCE) and resource rent (ABCD), with CS being a measure of value for the anglers and resource rent being a measure of value accruing to the owner of a fishery. If the permit price equals the marginal cost of providing permits (Po), as would be the case under perfect competition, the resource rent accruing to fishing rights owner is zero. In this case the total surplus coincides with CS (AFE), and the number of sold permits is Q1.

Economic rent can, in principle, be estimated from market data using fishing permit prices and landowner expenditure data. Owners of fishing rights receive at least a net income flow (payments from anglers in excess of fishery operating and maintenance costs) and they can sell the right to this flow. In theory, the market value of fishing rights will be such that the annual net income flow from fishing right ownership is broadly equivalent to the return expected from other forms of wealth holding. Briefly, the market value of fishing rights represents a capitalisation of the net income flow, and this net flow is a good approximation to economic rent in private inland recreational fisheries. This also implies that changes in market value are measures of change in economic rent (Radford et al., 2001). Basically, the resource rent relates to the richness (i.e., attractiveness) of the resource to the consumer (the angler), and can be assumed to differ, for example, between a salmon river and a typical lake coarse fishery, depending on the preferences of the consumer.

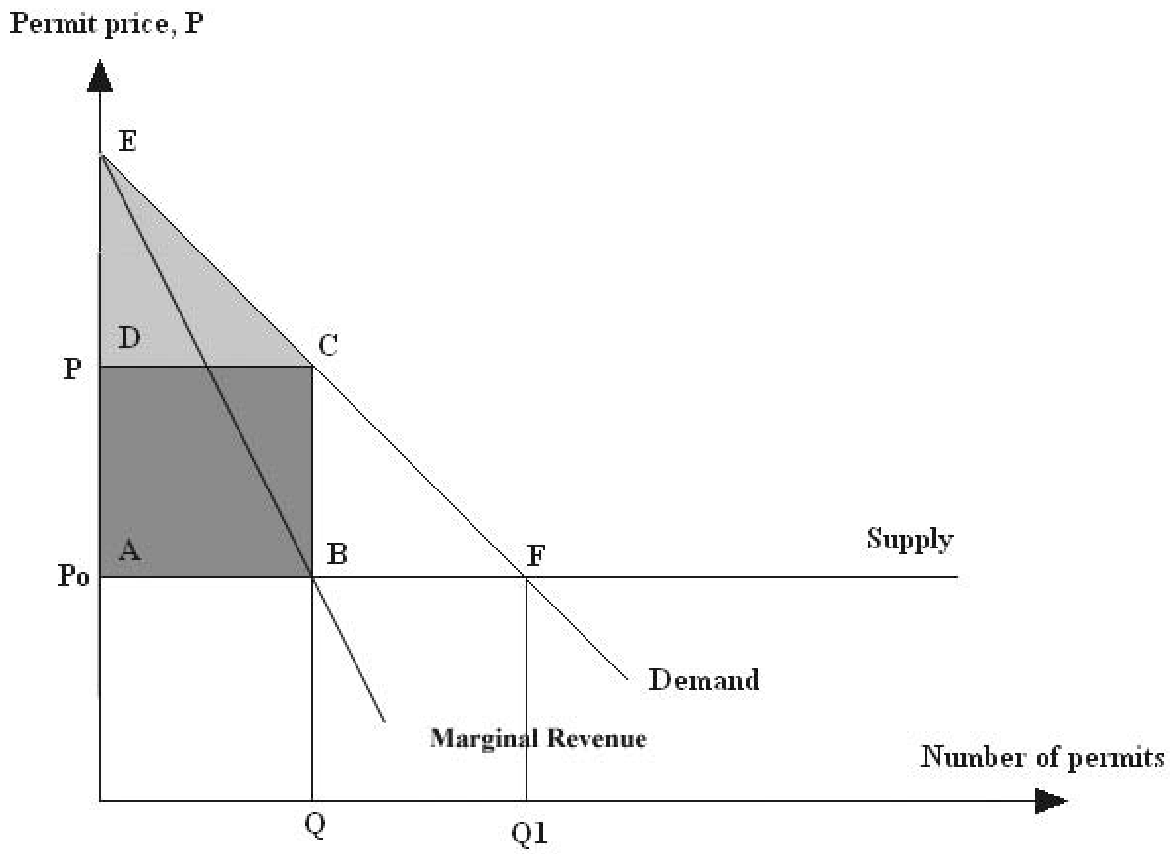

Figure 7. Economic rent for owner of fishing rights and total surplus.

The owner or manager would normally work to increase demand for recreational fishing in his fishery, thereby increasing economic returns up to the point where negative attributes affecting demand (e.g., crowding, overfishing, decrease in fish size, etc.) begin to impact demand negatively. At a given price, this can be done by increasing the quality of the fishing experience to a level that would support higher prices for access.

In summary, producer surplus is the business corollary to consumer surplus and it is a firm's willingness to pay to produce goods (e.g., access) or services (e.g., guided fishing). As a reminder, TEV is the sum of consumer surplus and the producer surplus of all industries providing goods or services from a resource. If Figure 6 was the market for guided fishing trips, the TEV of guided fishing trips would be the sum of the two shaded triangles. In an examination of the allocation of a fish stock between commercial harvest and recreational uses, when the use of the stock included guided fishing opportunities, recreational TEV would include:

- Private recreational angler consumer surplus
- Landowner producer surplus or rent
- Guided recreational angler consumer surplus
- Fishing guide producer surplus

In the same example, the TEV of the commercial harvesting industry would include:

- Commercial harvester producer surplus
- Fish purchaser consumer surplus

Generation of PS will ensure that production resources are used in the way that maximizes value to all of society, not just one particular sector.

2.3.3 Total economic impact

In contrast to economic value, economic impact analysis traces the flow of goods and services through an economy and can be used to assess changes in the economy as the result of a change in final demand such as fishing trip expenditures. Economic impact models are representations of all the transactions in an economy and allow analysts to outline the relationships between the production of goods and their final consumers. Economic impact models, also call input/output models, are built by tracing the flow of purchases from the consumer to the final producer using economic accounts by industrial sector. Economic impact models require large amounts of data and input/output tables are usually produced for general use by the government and/or private businesses specializing in the construction of such models. It is rarely cost effective to build an input/output model for a single policy analysis task if a readymade model does not already exist.

Economic impacts begin with a consumer purchase or final demand. These initial expenditures constitute the direct impact. For recreational fisheries, these include purchases of fishing access, fishing equipment, bait, food and other goods necessary to the enjoyment of the fishing trip. For commercial fisheries, this includes a consumer purchase of seafood. From this initial purchase, the store purchases its inventory and labour, as do the suppliers of those goods and services required by the store. When business and suppliers import goods from outside the economy (the boundaries defined in the analysis model used), that money, called a leakage, leaves the economy and is not considered in further calculations. Tracking purchases of supplies and labour by business continues until all the original purchase amount is exhausted by leakages. The sum of all this activity is called the indirect impact. The portion of labourer’s income and business owner’s profits from the indirect phase that is then re-spent on goods and services in the normal course of that consumer’s life is considered the induced impact. The sum of direct, indirect and induced impacts describes the total impact of consumer expenditures in an economy. These impacts can be denominated by the number of jobs supported, value added, or contribution to Gross Domestic Product, income or the total output in an economy.

In addition to changes in individual and producer benefits (values) resulting from changes in recreational environment, economic impacts can also be estimated. To clearly illustrate the difference between economic value and economic impact, assume that Figure 4 represents typical demand and supply curves for fishing trips. The intersection of the demand and supply curves indicate the current price of fishing licences and the corresponding demand for angling trips. While CS would be the triangle (PCB) over and above the price anglers would be willing to pay, the rectangle OPCQ indicates the total expenditure by anglers; its area is equal to price times the total number of trips taken. This total expenditure represents the final demand expenditure that generates a cascading chain of economic transactions in the economy. These expenditures generate the direct, indirect and induced impacts described above. Economic impacts are ways to estimate the effects of expenditures in regional and national economies and detail how those expenditures are distributed to the industrial sectors in the economy.

In terms of economic impacts of commercial fishing, the arguments would be identical to those mentioned for recreational fisheries. The interesting metric in this context is the effect of this economic activity on local and regional economies. For example, commercial fishing in the production of a good sold on markets demands goods and services from other enterprises (direct expenditure), which again demand good and services form other industries (indirect expenditures). Moreover, salaries of employees in commercial fishing enterprises and in those branches that depend on commercial fishing enterprises, engage in economic activities. The total impact of such activities can be measured in money circulating in an economy and generating jobs and income.

2.4 An integrative framework joining the HD and economic approaches to fisheries benefits

The structure of Figure 1 documents clearly that each one of two paradigms focuses on one of the stages of the behavioural process. Economics focuses on the realm of revealed preferences, and to a lesser extent on stated preferences, while the HD approaches focus on the behavioural antecedents, but always have the larger picture of the behavioural stages of human behaviour in mind. A large body of research undertaken in all the various research traditions has in the past informed fisheries management.

The economic branch of the social sciences estimates benefits accruing to the individual person, but unlike the HD tradition, those benefits can be readily aggregated to total societal benefits because monetization provides a common platform across individuals. This is the major advantage of the economic approach to measuring fisheries benefits. It represents a cohesive framework measuring individual and societal benefits in a common currency, i.e. monetary values. This allows its relatively straightforward integration into cost/benefit analysis of different options for allocating resources and developing policies that maximize social welfare (economic value).

Economic value is the paramount measure for quantitative policy analysis when efficiency and maximization of societal value is the primary goal. From this brief examination, economic value is the only technique cohesive enough to provide consistent advice across multiple users and multiple projects because value is always denominated by a unified measure: currency. That is not to say that other criteria should not be used to assess policies. However, the concepts of economic value, economic impact and HD techniques are all important elements of a complete policy analysis package. Additionally, HD concepts of value contain significant overlap with economic concepts of value, and, in many cases, HD analysts use the same theory and models as economists to explore their conceptualization of value.

In many countries and for many resource uses, maximizing economic value or minimizing societal costs is legally mandated as the primary management concern. However, economic value cannot address fairness, equity, societal well being, social identity, social capital or distributional concerns. When making policy decisions, the examination of HD concepts of value and economic impacts provides the human context in contrast to the sharpness of the efficiency only criteria found in economic value. In many nations that use cost/benefit analysis as primary criteria, secondary criteria involve economic impacts to small businesses, community impacts and other measures that fall under the HD rubric. For instance, if a policy maker is considering several fishery management policy options with similar policy outcomes and economic value profiles, it is the economic impact and HD information that can be used as secondary criteria to determine which policy has a lesser social impact, is more equitable and has the least distributional impacts. Additionally, there may be situations where efficiency or value is not the primary goal of policy makers. Instead, the focus may be on maximizing health benefits, maximizing employment or other rural/community development goals. In those cases, HD or economic impact approaches will be suited equally for its examination.

Overall, the economic approach to benefits seems to be more coherent and conceptually grounded in one theory compared to a HD approach. This makes the economic approach initially appear easier to integrate into policy choice assessments. Economic value is always denominated in currency, whereas the HD approach to benefits does not allow derivation of a consistent monetary measure to be included in cost benefit analysis. The HD perspective, on the other hand, can add decisional context which the various economic approaches to benefits capture only minimally. The HD approach emphasizes multi-disciplinary concepts of benefit, while the economic concept of value is rigid and narrowly focused on efficiency and cost/benefit analysis. The latter point is both a positive and a negative aspect for economic value measures.

On one hand, economic valuation produces a consistent measure that is comparable across very diverse policy contexts, but on the other hand, it does not incorporate the complete policy impact on society. Consequently, the question emerges whether cost benefit analysis is warranted in every case, and considerably divergent opinions exist in this respect because of the obvious limitations of monetizing all benefits of fishing in the same currency. Therefore, it is prudent and responsible to choose the particular benefit approach based on the particular problem at hand. In some instances, an economic approach may be the best tool. In other instances, a combination of methods and metrics may provide a better and more complete picture about the pros and cons of fisheries resource allocations. In the next sections, the various methods will be presented in more detail.

3. Methods for assessment

3.1. Human dimensions methods for assessing benefits of inland fisheries

Human dimensions (HD) research has increased our understanding of the diversity in angler behaviour, preferences and attitudes (Aas & Ditton, 1998; Arlinghaus, 2004b; Ditton, 2004: Ditton, 1996). HD research documenting psychological, physiological, social, cultural and ecological benefits of recreational fishing is still in its infancy and will benefit from further studies, utilizing standardized methods and measurement techniques, both quantitative and qualitative. Currently, the research on benefits of related outdoor recreation activities (Driver, 2009) and low-intensity outdoor sports provides platform for informed studies of the benefits of recreational fishing.

3.1.1. Study designs: quantitative versus qualitative methods and cross sectional versus longitudinal designs

Within HD, data gathering techniques are commonly divided into quantitative and qualitative techniques (Graziano & Raulin, 1989; Smith, 1983). Surveys are the quantitative technique most often used in HD (Guthrie et al., 1991; Pollock, Jones & Brown, 1994), and participant observations and in-depth face-to-face interviews are the most common qualitative approaches (Marshall & Rossman, 2006). Similar to economic research, the main body of research within the HD tradition in recreational fisheries is quantitative, using mail, phone, on-site and internet based surveys (Dillman, 2000; Guthrie et al., 1991; Pollock et al., 1994; Smith, 1983). Consequently, the quantitative approach will be emphasized here. However, both quantitative and qualitative approaches have their strengths, and the choice of an approach depends on such thing as the nature of the project, hypotheses and research questions, population studied, budget opportunities and time frame for the project (see Brown, 1991; Dillman 2000; Guthrie et al. 1991; Pollock et al., 1994; Smith 1983 for reviews).

For an HD study of inland fishing benefits, it is important to design the study appropriately. Frequently, time and budget constraints make cross-sectional case studies the only feasible course of action. However, there are many potential benefits for using experimental designs[3] when comparing benefits across sub-samples, such as participating in different activities (which experimentally would be referred to as different treatments). Longitudinal designs, using population or panel studies, although more costly and complex, often provide data that better answers HD questions. With this method, groups are followed over time to gain a better understanding of recreational benefits (Graziano & Raulin, 1989). For instance to examine how recreational fishing can reduce depreciative and criminal behaviour among youth, a longitudinal panel study could be undertaken in which participants taking part in a fishing program would be compared with a similar group not taking part in such a program (Wightman et al., 2008). A further example includes assessing how recreational fishing could contribute to self esteem and better social relations among elderly or disabled using a longitudinal panel study or a cross sectional case study based on self reported changes (See the Box 1 below).

3.1.2. Measurement approaches

A difference between the economic and HD approaches to the study of benefits of recreational fishing is that the HD approach relies on a wide range of measurements and indicators of benefits. Quantitative studies generally identify three main measurement approaches: psychometric scale measures, physiological and health measures, and demographic/behavioural measures.

3.1.2.1. Psychometric approaches to assess the benefits of fishing

Much of the quantitative research within the HD tradition is based on self reporting and self-evaluation through questionnaires. In particular, psychometric scales are developed to measure different, yet related aspects of leisure experiences, such as experience preferences, motivations, satisfaction, outcomes and benefits. These scales are built on general advancements in psychology and social psychology, and may then be applied to leisure situations. For example, Knopf, Driver and Bassett (1973) developed a fundamental scale for motivation research in outdoor recreation that found repeated adaptation in recreational fishing studies, culminating in a meta-analysis of motivation for recreational fishing, presenting a scale with 16 items (Fedler and Ditton, 1994).

It is important to rely on already developed scales for at least two reasons. First, it increases the opportunities for comparing studies across time and space, including a possible future meta-analysis; Second, the inventories or scales that have already been tested by other researchers (in HD research and in social psychology in general) have proven to be reliable and to measure what they intend to measure. Additionally, several conceptual scales offer a choice between a longer and detailed or a shorter and more general item list, depending on the purpose of the study and available budget. Such psychometric scales can be used to assess all types of benefits of fishing, including psychological, physiological, social, cultural and ecological benefits. For many concepts of interest, such as motivation, satisfaction, and specialization, methodological research in HD has been done and the appropriate tools, such as scales, have been published in social science journals (see Box 1 and Box 2).

To produce rigorous HD research results, it is important to distinguish the specific aspects of benefits that can be objectively assessed. For example, when examining how recreational fishing generally contributes to an individual's well-being the researcher should take advantage of research into quality of life (QOL) scales, and how leisure time and the activities pursued during leisure (e.g., recreational fishing) contributes to QOL (Iwasaki, 2006; Lloyd & Auld, 2002). Several measurement scales are developed that measure general QOL and how leisure contribute to this. By

[3] The definition of a "true" experimental design differs somewhat between different texts on methods. Some textbooks prefer to call experiments that take place in the "real" world as "quasi" experiments as there might be confounding and uncontrollable factors inferring the field experiment (Graziano & Raulin, 1989).

making some adjustments to these scales, they can be used to assess the contribution of inland fishing to overall QOL, or to more specific areas of QOL.

The most often used approach to measure the psychological benefits of recreational fishing is based on expectancy theory (Manfredo et al., 1996). This theory says that people pursue activities to meet specific psychological goals. One way to indirectly measure the underlying goals of an angler is to measure motivations to participate in the activity. Motivations or experience preferences (alternatively termed preferred psychological outcomes (Driver, Brown & Peterson, 1991)) are considered to be a measure of potential or preferred outcomes and benefits of fishing, that is, a simple surrogate of benefits. However, some limitations apply because benefits experienced per se are not measured by motivations (Manning, 1999). In other words, by measuring how important a specific motive (e.g., experiencing nature) is for engaging in an activity, it is not clear whether a respective benefit is actually experienced (i.e., the degree or quality of the nature experience). Experience preferences or motivations are thus not equivalent to the actual benefits experienced by the recreationist. There are fundamental differences in the concepts of expected outcomes (i.e. motivations) and the satisfaction with these outcomes (Arlinghaus, 2006) and more generally the benefits experienced.

Box 1. The REP inventory applied to measuring general social psychological recreational fishing benefits.

The Recreation Experience Preference (REP) Scales (Driver et al., 1991; Manfredo et al., 1996) is a psychometric inventory that has been widely used in HD studies of outdoor recreation, including angling (Fedler & Ditton, 1994). The inventory and the rationale behind it make it flexible and usable for a variety of purposes, situations and samples. First, variants of the scales can be used to investigate experiences (perceived or actual) both at a general (all social and psychological aspects) as well as at a specific level (for instance learning). To what extent the inventory is useful to measure (perceived) benefits as it is often referred to as measuring motivations or preferred outcomes depend on design (after or during the activity rather than before) and wording of the question and items.

A short and generic variant of the REP scale used in angling surveys is this one (Fedler & Ditton, 1994). By asking anglers if they agree or disagree about the following potential benefits of fishing, and having them respond on a 5-point Likert scale ranging from (1) strongly disagree to (5) strongly agree can elicit what benefits they experience from fishing.

Domain	**Items**
Psychological – physiological	To get away from daily routine
	For relaxation
	To experience new and different things
	For physical exercise
Natural environment	To be outdoors
	To experience natural surroundings
	To be close to sea/water
Social	To get away from other people
	For family recreation
	To be with friends
Fishery resource	For the challenge or sport of fishing
	For the experience of the catch
	To obtain fish for eating
	To obtain a trophy fish
Skill and equipment	To develop skills
	To test my equipment

Most HD research has focused on studying the general structure of the motivation of anglers to infer the variety of benefits sought in principle. When studying larger samples and broad questions about the general motivations to fish, usually catch-related aspects of the fishing experience tend to be of lower importance compared to some non-catch related motives by most angler populations (Fedler & Ditton, 1994). In fact, the non-catch aspects of the fishing experience (e.g., relaxation, to be outdoors, to get away from the regular routine, to be with friends and family) appear to be almost universal motivations desired by most recreational anglers to some degree (Ditton, 2004), while investigations of the heterogeneity of angler (i.e., by segments) shows significant variability in the importance attached to the various catch-related aspects of the fishing experience (Aas & Kaltenborn, 1995; Bryan, 1977; Fedler & Ditton, 1986; Fisher, 1997; Wilde et al., 1996).

Interestingly, despite the salient importance for a good fishing experience (Arlinghaus, 2006), catch motives are comparatively less studied in recreational fishing compared to non-catch motives (Finn & Loomis, 2001). However, because non-catch related motivations seem to be more easily satisfied than catch-related expected outcomes, catch aspects were found to constrain overall angler satisfaction to a greater degree than non-catch related aspects (Arlinghaus, 2006; Arlinghaus et al., 2008; Arlinghaus & Mehner, 2005), although this is not always the case (Holland & Ditton, 1992). With satisfaction constituting the ultimate product of the fishing experience for the individual angler, these recent findings emphasize the importance of quality catch opportunities for enhancing the total benefits realized by angler. Other research has also revealed that the importance of catch motivations increases strongly if motivations for a particular setting or experience (e.g., fishing for species A at locality B) rather than when general motivations are assessed (Beardmore et al., under review). Thus, even in the area of angler motivations much more research is needed to better study the specific motivations and expectations anglers have for particular fishing experiences and localities.

Box 2. A study documenting differences in benefits from angling among anglers with and without disabilities (Freudenberg & Arlinghaus, 2010).

A recently published study from Germany documents similarities and differences in benefits of fishing among anglers with and without disabilities. A paired sample of anglers with and without a disability of the German Anglers Association were given a questionnaire with a 27-item Likert scale of experienced benefits from fishing (see above box on REP scale). The study provided valuable insight into differences and similarities between the two groups. The 27 items on perceived benefits were developed in close contact with anglers with a disability to ensure their perspectives were taken into account. These items were used:

Sharing nice experiences with others
Having contact with other people
Colleagueship, supporting each other
Being together with friends
Making new friends
Development of tight social bonding
Training of mental abilities
Enhancement of self-esteem/self confidence
Training of physical abilities
Self-determination
Self-conquest
Relaxation and recreation
Understanding nature
Experiencing silence
Nature experience
Feeling of success
Thrill
Feeling of acceptance
Experience the catch of fish
Getting away from everyday life
Experiencing new and different things
Enjoying solitude

Family experiences
Self-supply with fresh fish
Tolerance by others
Positive outcome for my daily work

Fishing seemed to provide more and different benefits to anglers with a disability than to those without a disability. Social benefits and self-improvement benefits were reported as more important to anglers with a disability. Many anglers with a disability relied on fishing as their sole recreational activity. In comparison, anglers without a disability participated in more varied types of activities.

To document such differences in benefits might be irrelevant or insignificant in an economic valuation perspective, but, due to general societal goals concerning equal opportunities, it provides highly relevant information on benefits for people with disability and is an important contribution to understanding diversity of values achieved among different groups.

3.1.2.2. Quantitative methods from sports and health sciences to assess physiological benefits

While most of the HD research tradition is based on self-report and self-evaluations, health effects such as reduced illness, stress release and improved fitness can be measured for effectively using objective physiological indicators (e.g., blood pressure, skin conductivity) routinely applied in health and sports sciences. Some of these are physical measures such as fitness and lung capacity (e.g., Lacy & Hastad, 2006), and general health issues are often investigated applying methods of epidemiology, where large populations are analysed and effects of lifestyle and exercise on overall health, life length and QOL can be investigated.

It is important to not overemphasize or simplify the potential physical and physiological health benefits from fishing, as it is a complex area involving issues such as heredity, lifestyle, living environment as well as physiology, diseases and ageing. Given the sensitivity of the measures and the large number of confounding factors it is essential to apply methods and study designs that are capable of documenting such effects (e.g., choosing appropriate control groups, and applying longitudinal designs where groups are followed over time). That said, it would be interesting to study, for instance, if fishing offers physical activity to groups who are not able to participate in more active physical exercise, similar to those benefits achieved from mild exercise such as moderate walking.

Typical fitness measures include lung capacity (O_2) measured on a tread mill and a range of cardiovascular measures including hearth capacity, size, and functions (Froelicher & Froelicher, 1991). Such measures can be used to study whether a population of anglers differs from other groups with similar sociodemographic characteristics, or by comparing fitness measures of a group before and after they have taken part in a fishing trip.

In addition, physiological measures can be used to assess human response to emotional, stressful and arousal-increasing stimulation (Ulrich et al., 1991). Such measures are based on four major bodily response systems: electrocardial, autonomic, sceleto-muscular and endocrine. Measurements of the first three systems are commonly performed with skin surface electrodes, while measures in the endocrine system are biochemical (e.g., measures of stress hormones). While it is anecdotally well known that fishing can be relaxing and induce arousal, to date, there are no known studies which have investigated the benefits of fishing from such a methodological perspective.

As said above, few studies have explicitly researched the health benefits from inland fishing using biological measures. On the other hand, there have been studies using questionnaires on which anglers self-report on such things as exercise effects, stress release and increased well-being (Pretty et al., 2007). However, studies applying methods from medicine and sport sciences are needed, and should be conducted by applying general methods from the sports and health sciences. A challenge with, for instance, studying lasting health improvements is that costly, long time panel studies may be needed.

Box 3. An exploratory study on exercise effects of small game hunting in Eastern Norway (Kleiven & Bekkevold, 1994).

Small game hunting, primarily for willow ptarmigan, is the most popular form of hunting in Norway. In a pilot study, Kleiven & Bekkevold (1994) explored how five or six days of active hunting affected the hunter's oxygen uptake capacity. Hunting for ptarmigan includes long walks in mountainous terrain at relatively low intensity, not unlike that of fishing in the mountains where you will have to walk to the lake.

The study applied a standardized method for measuring maximum oxygen capacity (VO_2max) on study participants jogging on a treadmill. An automatized procedure for measuring capacity that has been validated against other methods was applied. The tests showed that the hunters had average physical capacity, with variations among the test persons. The performance tests showed that VO_2max on average changed from 46,81 before the hunting (ml/kg pr. min) to 48,21 after.

The improvement was in accordance with the hunters own assessments of their fitness improvement. About half assessed their improvement as modest, and somewhat fewer assessed their fitness as better than before the hunting trip.

Interestingly, the study showed that exercise was not an important motivation for hunting. Instead, aspects related to psychological, social and natural environment domains of the REP scale were rated high. The low rank of exercise as a motivation for hunting are in accordance with the rather modest effect measured, but might also be an indication that recreationists are not always motivated by all relevant benefits.

3.1.2.3. Demographic/behavioural measures

A range of concrete measures can be applied to study potential benefits of angling. More objective measures could preferably supplement the self-evaluation character of survey data. Demographic, economic and performance indicators from different sources can assist in assessing potential benefits from recreational fishing on targeted segments or sub-populations across a range of benefits.

Box 4. A study on social inclusion benefits of angling in England (Wightman et al., 2008).

In a project in England, angling has been used as a means to help return disadvantaged and troubled young people to society (Wightman et al., 2008). Angling was used to enhance self-esteem and self-confidence. Evaluation reports document that if only 1 in 300 participants is saved from prison, the benefits equals the costs. Using measures of offensive behaviour, school attendance and educational achievements, an evaluation report showed that anti-social behaviour fell by 70 %, school attendance rose by 70 % and that educational achievements rose "dramatically" (Macgill & Bradley-Nicholson, 2001 as cited in Wightman et al., 2008). Evaluation reports also used qualitative techniques, interviewing social workers, and as such used a variety of methodological approaches, including economic, behavioural and qualitative.

"I don't know what it is about fishing, but this lad supposedly had ADHD. A nightmare most of the time. Goes fishing, he sits there for four hours without catching anything and doesn't move. He has to be practically dragged away and can't wait to go again." Social worker cited in Wightman et al., 2008.

3.1.2.4. Measures to assess ecological benefits

Straightforward approaches to map and describe the ecological benefits of recreational fishing in social terms are largely lacking. Most available research has been narrative and qualitative (Rolston III, 1991) or used methods from environmental or legal history to exemplify how recreational fishing has contributed to development of water legislation, e.g. in Switzerland (Kirchhofer, 2002) and how recreational fishing organizations have been instrumental in fighting formally (i.e., legally) and informally against pollution of aquatic habits (Rolston III, 1991; Bate, 2001). A case study approach has also been used to show how recreational anglers have contributed globally to fish conservation projects (Granek et al., 2008). In some jurisdictions, such as in North America and Norway, licence sales and taxes on fishing tackle are instrumental in financing public fisheries agencies and fisheries management and conservation programs. Political scientists and economists could use a replacement approach to quantify the costs that would accrue to society for fish management and fish habitat conservation if the contribution of anglers would suddenly stop.

Another aspect around ecological benefits that lacks research is the value of learning about nature through fishing experiences. One could compare ecological knowledge and awareness between subpopulations that fish versus those that do not, ideally in a quantitative study. There exist several psychometric scales to measure the extent of learning benefits among users (see Box 1), for example, the REP scale has learning as a domain. Ecological benefits could also be measured by comparing fish population structure, management costs or the educational performance of environmental programs designed specifically for anglers compared to other types of environmental programs not involving anglers.

3.1.3. Qualitative methods to assess benefits of recreational fishing

Qualitative studies often focus on how an activity, such as recreational fishing, provides meaning for the informant and his or her network, is represented in the community and gradually materializes into established discourses, social groups and events in a society, as well as how the resource use create references in terms of space and time (geographical names, specific dates for instance related to the opening of the fishing season, ceremonies etc). In recreational fishing, hardly any research has been conducted with these methods. These approaches have found wide application to document the values and attitudes of subsistence fisheries, especially of indigenous people (e.g., Holthaus, 2008).

Qualitative methods and qualitative researchers aim to produce a more contextual understanding of human behaviour and the benefits and impacts associated with recreational fishing compared to quantitative approaches (Marshall & Rossman, 2006). Qualitative techniques allow a richer insight into what drives humans within the complex web of the institutions, norms and structures of social systems, and their relationship to the attitudes and behaviours of the agents within these social systems. The disadvantage associated with qualitative techniques is the reduced ability to generalize because sample sizes are usually small, and interpretation of qualitative data often entails a greater subjectivity on the side of the researcher. However, techniques to circumvent these challenges exist. Rooted in the standard participatory observation methods in anthropology and ethnography, qualitative methods have, in recent decades, gained growing reputation within basic disciplines, such as sociology and psychology, but even more so in applied multidisciplinary research fields such as gender studies, leisure research, natural resource management research and evaluation studies.

Qualitative methods often rely on purposive rather than random sampling. The researcher is not seen as objective and does influence the interviewee. Instead, qualitative research acknowledges the influence and role of the researcher. The focus of the research is on content validity, rather than reliability (Denzin & Lincoln, 2005). The primary methods are participant observation, in-depth face-to-face interviewing, document review and content analyses, with a range of supplementary data collection techniques, such as narratives, historical analysis, films, videos and photographs (Marshall & Rossman, 2006). It is well established that methodological pluralism across the quantitative – qualitative spectrum is needed to enhance and gain further insight (Aas, 2002; Smith 1983) and is referred to as ‘triangulation’. Especially when theory is lacking, qualitative research can help to develop an insight into proposed relationships between variables and quantitative approaches can provide a conclusive test of the assumed relationships.

When the concern is about social impacts of fishing policies, the Social Impact Assessment approach (Burdge, 2004; Schirmer & Casey, 2005) provides a framework to evaluate broad community benefits from fishing activities in their widest sense. This assessment tradition is explicitly linked to landscape planning and decision making processes, is highly applied and flexible in terms of methods, measures and degree of complexity/rigidity of the study/assessment. This approach ensures that social aspects are incorporated into planning processes or management decisions. It also exemplifies how social impact assessments can be undertaken with few resources, often combining existing statistics and databases (i.e., secondary data) with novel quantitative and qualitative primary data gathering procedures. For instance, the meaning and importance of fishing can be assessed by comparing its role with substitutes or alternatives (both in a commercial and recreational perspective).

Appropriate guidelines are now widely available on the Internet (e.g., Schirmer & Casey, 2005) which explain how general social and economic indicators and measures can be applied to assess social impacts and social benefits connected to fisheries, such as social profiles, quality of life and work/leisure satisfaction indicators, indexes of dependency of different activities, educational level etc., and of course a range of economic measures. Schirmer and Casey (2005) show that social assessments can be performed without the costs of primary research. A challenge for many social impact assessments is the often very descriptive and case-specific nature of available data, and the associated challenges of combining data and findings of very different origin and characteristics. The use of matrix analyses, maps and construction of indexes is advisable and insightful.

3. 2. Economic value: non-market and market valuation methods

Economic valuation refers to the assignment of monetary values to non-market goods and services, where the monetary values may be either marginal or total in nature. Marginal values are the most often used, since the value for an incremental, often only minor, change in quality or quantity of a particular good or service (e.g., when number of daily catch increases from 2 to 4 fish) is easier to attain than the total value (e.g., the value of all 4 fish). More importantly, for many policy decisions, the marginal value is the only essential information. Research offers three main approaches towards economic valuation, depending on the type of data used (Freeman, 1993; Haab and McConnell, 2002):

- stated preference methods (contingent valuation and choice experiment methods),
- revealed preference methods (actual market data, hedonic property pricing and travel cost method), and
- market price proxies.

In this section, information is presented on how to carry out economic valuation with stated and revealed preference techniques. The following is based on Bateman et al. (2002) and Champ, Boyle and Brown (2003), as well as the authors' personal experiences.

Market analysis in this context refers to the analysis of economic value derived by businesses that provide recreation opportunities for hire or that supply the inputs to the recreational experience. Market analysis can also be used to assess consumer values, but in the majority of cases a recreational fishing trip is not traded in a market and is considered a non-market good. The various quantitative methods and fundamental technical aspects associated with the implementation of each approach are explained below. Examples for each of the methods, as well as for benefit transfer, will illustrate potential uses in the fisheries policy context. These examples detail the application methods and resources required to accomplish each of the economic valuation methods.

3.2.1. Stated preference methods

The two main stated preference (SP) approaches are the contingent valuation method (CVM) and the choice experiment method[4] (CE), which may be applied to estimate use and non-use values associated with environmental goods and services (see Figure 3 section 2.3.2). The CVM and the CE methods share many similarities. For example, they are consistent with the underlying theory of welfare economics and both employ carefully designed survey questions. The WTP measure derived from SP methods is formed by the anglers' capacity to make trade-offs between the attributes of the good and changes in income as the result of a change in activity cost. The main difference between the CVM and the CE method is that in a CVM study the respondent is asked to reveal his/her WTP for a single policy change as a whole good, while the CE method elicits the WTP for several attributes of the good, including policy attributes, simultaneously by simply choosing one good over the other in a series of choices. Both methods are accepted as the workhorses for valuation research in resources economics, but have not seen widespread application in recreational fishing in Europe. Appendix 1 includes examples of SP and RP methodology (see section 3.2.2) associated with fishery and preservation of fish stocks in Nordic countries and Central Europe.

Stated preference (SP) methods are widely used for valuation of non-market goods and services where other methods fail. SP methods elicit values directly via constructed (hypothetical/simulated) markets in which survey respondents state their willingness to pay (WTP) for attaining a certain good(s) or service(s), or changes in the amount or quality of a good or a service, induced through a change in policy, the outcome of a public program, or other exogenous shock. Ecosystem services can also be valued with these methods. While surveys are costly to implement, surveys designed for valuation can also collect expenditure and HD data providing a wealth of complementary information.

SP methods are extremely versatile. Their results can be applied to cost-benefit analysis, used in legal damage assessment, investigate public policy by quantifying trade-offs between competing resource uses where the comparative metric is now the 'part-worth utility' or preference, or be used to segment clienteles and determine their respective market shares under different management regimes. Obviously, choice experiments are also excellent HD tools, even though they are discussed within this economics section. See Aas et al. (2000) for one such non-economic application in Scandinavia.

3.2.1.1. Contingent valuation method

In contingent valuation method (CVM) survey respondents are asked to choose between the current situation and a future policy situation, for instance, with an improved quality of fishing, which will incur an additional cost to the respondent. Based on the responses, willingness to pay (WTP) for an entirety of policy change (one policy scenario) is estimated and the determinants of the WTP are explained. This method can be used to estimate both use and non-use value components.

The CVM is the most frequently used technique for estimating the total economic value for project or policies changing the supply of environmental good or services, such as qualitative or quantitative changes in quality of recreational fishing. CVM defines the environmental goods and services as a bundle of different characteristics (quality, quantity, different services etc.) and seeks to elicit the WTP for the entirety of the bundle. A CVM study can be used, for instance, to estimate values that people place on improved recreational fishing experience currently (actual use) and in future (potential use) or on avoiding the extinction of endangered species (existence values), in relation to the current situation without new policy. Moreover, this method is widely used for

[4] It should be noted that in various niches of research, choice experiments are also referred to as stated choice models or discrete choice experiments.

various policy analyses and damage claims (Bateman et al., 2002; EVRI inventory). Typically CVM studies are local or regional in scale, but can be done on a national scale, as well.

According to Champ et al. (2003) there are 10 major steps in the CVM design and implementation process including:

1. Identify the change(s) in quantity or quality to be valued.
2. Identify whose values are to be valued.
3. Select data collection mode.
4. Choose a sample size.
5. Design the information component of the survey instrument.
6. Design the contingent valuation question.
7. Design the auxiliary questions.
8. Pre-testing and implementation of the survey.
9. Data and statistical analysis
10. Interpretation of results.

These steps are examined more closely in Appendix 2.

Each of these steps poses its own challenges. For instance, knowledge of the theory of non-market valuation is required in the first step. In the scenarios presented in the Appendix, the environmental conditions with and without the recreational policy are described with details based on the current decision problem. Income taxes, admission fees and donations can be used as a payment vehicle to pay for the new policy. The sampling protocol must be selected carefully because improper sampling protocols can lead to various biases including aggregation biases when the total value lost (gained) from a particular policy. Selection of the WTP format among discrete choices, open-ended and payment card formats, for the CVM question are a fundamental step and affect to the sampling issues and approach to be used for welfare estimation. Less frequently, people are asked the amount of compensation they would be willing to accept (WTA) to give up a specified good or service (see Appendix 2 and 5).

A detailed knowledge of survey design, survey administration and econometric skills for data analysis are needed. Once the policy change of interest has been identified, the survey instrument must be developed and pre-tested. The data must be collected, coded and entered into a database, unless data is entered by participants in the case of internet surveys. Finally, the survey responses must be analysed. Every step in the research process is crucial to produce credible welfare (valuation) estimates.

The CVM method has a long history of providing reliable value estimates. Detailed recommendations for designing a CVM study are available (e.g., Champ et al., 2003). The problems associated with this method are well known and documented, allowing the researcher to address criticisms. The main criticism of CVM is its hypothetical nature, and this needs to be taken into account during the survey design phase particularly when respondents are unfamiliar with the valued item (e.g. ecosystem services). In the case of fisheries, however, anglers and others are typically informed and aware of the valued good: improved fishing quality, water quality or other attributes of the recreational fishing experience. Therefore, the CVM method is suitable for estimating both user and non-use benefit and potential damages associated to fishing. The extensive literature, including scientific articles and unpublished studies, provides various examples of CVM applications. Previous applications can be utilized for designing a new CVM study.

Box 5. presents a study of improving wild salmon passages which utilizes the CVM method.

Box 5. Costs and Benefits of Improving Wild Salmon Passage in a Regulated River
(Håkansson, 2007; Håkansson, 2006).

Policy question
Does it make economic sense to adopt measures that would increase the number of wild salmon in the Vindel River in northern Sweden, while at the same time reducing electricity production by a major hydropower plant that uses water from the river? This is an in-stream water allocation problem.

Method(s)
Cost Benefit Analysis (CBA); Contingent Valuation (CVM); bioeconomic models

Background
On their way to their spawning grounds the wild salmon from the Vindel River, northern Sweden, enter an area in which the water from the turbines from Stornorrfors hydropower plant and the bypass channel merge. The amount of water in each pathway depends on the amount of electricity being generated. Since the water flow in the channel is relatively minor, the salmon have difficulties finding the pathway and only about 30 per cent succeed.

The Economic Problem
A diversion of water from electricity production has two effects. First, it has an immediate, negative impact on electricity production. Second, it indirectly results in an increase in salmon numbers in the future. The CBA considers these benefits and costs.

River-specific data were used to generate estimates of changes in the resource conditions that would accompany the measures considered. A model that predicts the effects of changes in water flow on the number of salmon that can pass the hydropower plant was used to obtain estimates of the cost of increasing the numbers of salmon in the Vindel River (in terms of lost electricity production). Concerning the benefits, a salmon population model for the river, was used to develop the valuation question scenario and a willingness to pay (WTP) question.

Valuation question
Respondents were asked about their WTP for an increased number of wild salmon that reach the spawning grounds in the Vindel River each year. The average number of salmon per year that reached the spawning grounds between 1995-2004, which was approximately 3000, was used as a baseline.

The respondents could choose between expressing their WTP for increasing the number of wild salmon from 3000/year to 4000/year as an amount or as an interval, where it is assumed that if a respondent has valuation uncertainty he/she will express an interval.

For example:
Try to state what you are willing to pay, either as an interval between two amounts or as an exact amount.

Option 1:
I am willing to pay between .... and ………. this year as a lump sum.

Option 2:
I am willing to pay ....SEK this year as a lump sum.

Survey
Following two pilot surveys, the full-scale survey was carried out in 2004 to obtain more information about Swedes' sentiments towards the wild salmon in the Vindel River. The survey was tailored to fit the theoretical framework as well as existing biological knowledge concerning the wild salmon in the river. The survey initially provided general information about the current situation for wild salmon globally and specific information concerning the wild salmon in the Vindel River. The respondents were also made aware that increasing the number of wild salmon typically comes at a cost. In addition, the background part of the questionnaire included information about the present and future fishing situation in the river. In addition to the WTP question, the questionnaire included questions in three main categories;: general questions about angling and sentiments towards wild salmon, questions designed to acquire information regarding explanatory variables about why (or why not) the respondent would be WTP, and some general socioeconomic questions about respondents' age, gender, etc.

Sampling
A total of 1 192 Swedes received a questionnaire and the response rate was 59 percent. The individuals in the survey were sampled from a general population register of the Swedish population (SPAR). All individuals less than 18 years of age were excluded.

Results
The findings suggest that non use values are the major benefits (96-517 million Swedish kronor) accruing from increasing the stock of wild salmon in the Vindel River to 4000/year. The estimated value per person is 6-7 € as a lump sum. The sensitivity analysis suggests that the opportunity costs in terms of lost electricity are typically higher than the estimated benefits.

Policy implication and concluding remarks
Even if allocating more water to facilitate passage of the salmon would be socially beneficial, which the results indicate that it is not, this might not be the most cost-efficient approach for carrying out the project. Only if one or more management options could be identified that would be able to increase the number of salmon to 4000/year without exceeding the total benefit, 96-517 million Swedish kronor, it could be argued that the project would be beneficial for the Swedish society.

Note that the results from the valuation study show that the respondents' revealed WTP is mainly due to non-use values. The net present benefits for increasing the number of wild salmon to 4000/year would have been considerably lower if only use values were considered. Furthermore, if only people that fish in the river were included in the analysis, as in many valuation studies of fish management/recovery, the estimated total net present benefits would have been even lower.

Costs
About 10 000 Euros (only for the questionnaire, not for working time)

Time
6 month for the work with questionnaire and the data
5 month reporting the results

3.2.1.2. Choice experiment method

In a choice experiment (CE) survey the respondent is asked to choose their preferred alternative from a choice situation with several alternatives, which are described by various attributes and attribute levels. Several choice situations are included in the CE survey and respondents make repeated choices. The alternatives are designed in such a way that based on the respondents' answers the marginal rate of substitution between each attribute and payment (cost is always one of the attributes for a valuation CE) is revealed. CEs can be used to estimate all value components of total economic value. Thus, one definite advantage of CEs is their ability to forecast changes in fishing effort or participation as well as changes in welfare.

In the 1980's choice experiments[5] emerged out of the conjoint approach in transportation economics and market research, and it was not until the mid 1990's that resource economists started to adopt this method for valuation purposes (e.g., Adamowicz, Louviere & Williams, 1994; Hensher, Rose & Greene, 2005). The good or service under valuation is now constructed as a multivariate profile of several attributes, including a payment vehicle, and the levels of each attribute are varied systematically. For example, a lake may be described in terms of its ecological quality, chemical water quality, number and type of species it provides habitat for, and so on.

The CE method can be used to estimate the monetary values of benefits and damages associated with all kinds of policy changes affecting fisheries. For instance, regulatory changes may improve fishing quality or prevent environmental degradation (e.g. eutrophication) and thus benefit anglers and potentially the wider public. Or the method can be used to value damages to natural environment (certain species etc.), heritage and other attributes affected by the oil spills in certain water area. Typical examples of the CE method include valuation of characteristics of angling site, valuation of changes in angling quality, changes in water ecology and changes in

[5] The reader should be aware of that terminology of choice experiment is dispersed and vary depending on disciplinary (environmental economics, transportation, and marketing) (e.g., Hensher et al., 2005).

management/regulation program. Given its multi-attribute nature several of these changes can be valued concomitantly, and respondents make trade-offs while providing their answers.

The design of a CE survey follows essentially the same procedures as suggested for the CVM study (Appendix 3 contains step-by-step design details for CEs and for additional information see Hensher et al., 2005). The main difference between CE and CVM is in the way the hypothetical market is provided. CE design steps include:

1. Identify relevant attributes, attribute levels and alternatives
2. Develop and generate experimental design
3. Develop survey instrument
4. Pre-test and ground truth attributes
5. Administer survey and complete data entry
6. Estimate model and interpret the results for policy analysis and decision support

First, identify all relevant attributes affecting angler's choices and have relevance to the policy question at hand. While CEs are very flexible, there is an upper limit on the number of attributes that can be included with the limit dictated by respondent burden. Therefore it is essential to use focus groups, cognitive interviews or other pre-test techniques to identify the relevant attributes and insure the total number selected does not overburden respondents. In the case of recreational fishing, size of expected catch, status of certain fish species and number of anglers (possible congestion problem) could represent the quality of angling site. Finally, ambiguity and inter-attribute (associated to cognitive perceptions) correlations must be considered when selecting attributes to be used in study.

The levels that attributes could take are described qualitatively (e.g. large, medium, small) or quantitatively (e.g. abundance of salmon could be 0.5, 1 and 1.5 million). Usually a quantitative specification will provide more precise results, but the choice depends on the nature of the problem and the nature of the attributes to be included. A range of attribute levels should encompass the whole range of value expected to enter into an angler’s decision process (minimum and maximum value). Alternatives with different combinations of attribute levels can be unlabeled or labelled. In the first case alternatives are defined with generic titles (e.g. alternative 1, alternative 2.), and in later case titles are labelled with the names, which describe the alternative (e.g. bus, car, train in a travel mode study; or possible several fish species in a fisheries study). A no-choice (status quo or so called opt-out option) alternative is typically presented as one of the alternatives. Success with any SP method, but particularly CEs, lies in the design phase of the project including correctly identifying the relevant attributes and correctly specifying their levels.

The next phase is to make decisions concerning the experimental design to be used (see further e.g. Hensher et al. 2005). Statistical design theory is used to combine attribute levels into an appropriate number of different choice sets. Specialised computer software and statistical packages can be used to generate actual designs. Because each alternative combination contains price or cost as one attribute in an economic application (e.g. increase in cost of angling day or additional conservation/management fee), the subsequent analysis of respondents’ choices reveals their WTP (or WTA) for each of the attributes presented to them. Through the use of econometric models, the parameters in the utility function are estimated and different values are produced. Finally, study results can be interpreted and may be used in policy analysis and to support the decision making.

As with contingent valuation, the CE method offers certain advantages over the other valuation methods. The CE method is flexible. Several potential combinations of environmental or policy changes, including those that currently don’t occur, can be presented within one questionnaire (multi-dimensional response surface). One of the major strengths of the CE method is the ability to decompose values associated to policy change or environmental programs into implicit values related to particular attributes. In addition, estimation of several policy changes described by the attributes is possible. In this way CE provides a fuller description of preferences than obtained with single scenarios used in CVM implementation. Additionally, since CEs are based on statistical experimental designs, they yield great statistical efficiency (Champ et al., 2003).

Some disadvantages associated with the CE method should also be listed. The preparation of such a study likely requires more time and more expertise for the survey design due to the statistical experimental design (e.g., Bateman et al., 2002; Bennet & Blamey, 2001; Hensher et al., 2005). Also, the CE is a relatively new method in environmental economics, and the consensus, for instance, on the process used to generate the experimental design is lacking. Finally, the use of CEs in litigation is limited compared to the long history of the use of CVM in environmental damage assessment.

The CE application is illustrated with the study of Dorow et al. (2010), and serves as an example how CE can combine research questions on valuation with more general policy concerns within the same response task.

Box 6. Winner and losers of conservation policies for European eel: an economic welfare analysis for differently specialised eel anglers (Dorow et al., 2010).

Policy question
Effective management action is needed to conserve declining eel populations. Eel stocks can be enhanced in many ways, e.g. by controlling fishing mortality, reducing mortality at hydropower facilities, and improving connectivity of the river ecosystems. However, differently specialised anglers exhibit distinct preferences for catch variables and eel angling regulations. What measures should the European inland fisheries management apply to achieve the given policy objective? Understanding which future strategies are likely to receive support from various eel angler groups can assist decision makers to match regulatory changes with angler preferences to avoid conflicts and improve rule compliance.

Background
The European eel population is considered to be outside of safe biological limits because of over-fishing, habitat loss, destruction of migrating routes, pollution and disease etc. Several political actions to support the eel population have been undertaken. Specifically each member state of the EU must develop eel management plans to achieve a target escapement rate of the 40 % adult silver eels from all river basins relative to the “undisturbed” situation.

The Economic problem
The loss of the eel resource may have considerable effect on the socio-economic state of many fishing communities in Europe. Stricter regulations are expected to reduce the quality of the angling experience and therefore may affect anglers’ behaviour and welfare (benefits from angling experience). Changes in regulation are expected to be more acceptable to specialised rather than general anglers. Also benefits may be allocated differently. Recreational fisheries constitute the most important use of the inland fish stocks in all industrialized countries, and thus must be explicitly considered in the development of eel management plans.

Objectives of study
The CE method is used to analyse trade-offs between utility-determining attributes of an eel angling experience of an angler, i.e. catch variables vs. regulations (see example of choice set). The method also allows calculation of the economic welfare changes associated to different hypothetical management policy scenarios in general or for the specialised eel angler segments.

Choice situations and experimental design
Hypothetical eel angling experiences are composed from seven attributes (see example of choice situation below), each having 3-4 levels. To combine all attributes and their levels in choice sets, a full factorial design require 84 934 656 (4^{10}x 3^4) combinations. Using an orthogonal fractional factorial design the number of combination (i.e. choice set) decreased to 64. Additional orthogonal variable grouped choice sets into 16 blocks consisting of 4 choice sets, leading to 16 different versions of the questionnaire, each with four choice situations. In this study respondents choose between 2 hypothetical scenarios, without any base alternative such as ‘neither’. No base was used in order to operationalise further follow-up questions, which are not shown here.

Example of choice situation:

	Option A	Option B
Expected Catch		
Catch number	1 eel	2 eel
Average length	60 cm	65 cm
Regulations for eel angling		
Minimum-size limit	60 cm	55 cm
Daily bag limit	3 eel/day	1 eel/day
Temporal closure	7 days/month	No closure
Rod limit	1 rod	2 rods
Increase of cost for an angling day	5 € increase	No increase
(1) Which eel angling option do you prefer? *Please choose only one!*	☐ Angling Day A	☐ Angling Day B

Survey and sampling
In April 2007 the 14 pages questionnaire was mailed to 381 eel anglers in the state of Mecklenburg-Vorpommern (MV) located in the north east of Germany. Anglers participating in the study were recruited via telephone by random digit dialing, as well as random selection from a recreational fishing licence frame of MV. The total population of anglers targeting eel within MV is about 72,000. The usable number of questionnaires was 193 resulting in a response rate of 53 %.

Results
Results include part-worth-utilities for every attributes and level, representing their proportions of the utility. Relative change in net WTP for an eel angling day was estimated based on regulation changes in relation to the current situation. Three angler segments, defined along specialization, differed significantly on all management and experience attributes, documenting how important it is to account for heterogeneity. For example, contrary to the prediction of specialization theory, the casual anglers (=least experienced) preferred the largest fish, while intermediate anglers were indifferent to size, and the advanced eel anglers preferred the second largest size. Similar patterns emerged on all other attributes. All segments disliked increasing cost per trip. One additional advantage of CE results is that they can be used to build a decision support tool, in which the preferences for all possible (management) scenarios can be evaluated.

Policy implications
Alternative policy scenarios comparing the current state with possible future scenarios were developed, showing that casual eel anglers would be winners under slightly or moderately stricter eel angling regulations, advanced anglers would become losers when eel angling regulations would become overly strict compared to the status quo. When calculating total economic welfare changes associated with these respective scenarios, revealed a total welfare gain of about Eu 2.5 million with the implementation if moderately strict scenarios, while the strictest scenarios were associated with annual welfare losses of Eu 12 million and 15 million respectively.

Costs
1 fulltime researcher (or one ¼ to ½ time senior researcher and one research assistant full time)

Time
Plan / Survey preparation: at least 2, possibly 4 months or more (with knowledgeable person), depending on the complexity of the research question.
Data collection : depends on survey method (3 weeks with web-survey; 3 months for mail with follow ups and data coding.
Modelling and reporting: 4-6 months.

3.2.1.3. Stated preference methods - pros and cons

SP methods are the only techniques available to estimate both the use value and non-use value components (values held by both users and non-users) of an environmental good or service. Because these methods estimate values related to goods and attributes of interest directly, the lack of existing market data does not limit the valuation as is the case in RP methods. In addition, in situations with only few or no substitutes for the good being valued, non-use values are relatively high and SP methods should be used for value estimation. The most challenging phase with all SP methods is the design phase. Choices in either method must be correctly framed so they: use the correct valuation method; reflect the actual decision problem; include the appropriate attributes; and, in the case of CVM, correctly define the good being valued. Designing the relevant valuation scenario/choice situation typically requires collabouration between researchers representing different fields, interaction with managers and opinions and input from the anglers themselves.

Valuation with SP methods still faces challenges. The field of SP valuation is currently evolving rapidly, particularly the CE literature, in several distinct areas of applications, such as valuation of existence value for endangered species, valuation of use value in the case of recreation, or the comparison of policy alternatives, frequently without valuation. Therefore we recommend following the ever evolving literature. It has often been argued that hypothetical questions give hypothetical answers. Despite such criticism, both CVM and CE studies can provide valuable knowledge as long as the survey instruments are designed properly, are intensively pre-tested and use focus groups, one-to-one interviews, verbal protocols and pilot surveys (post/web pilot or debriefing), before they are implemented.

The contingent valuation method is very useful for single amenity valuation, and if one clearly defined alternative exists to the current situation:

- CVM is commonly used for valuation (WTP) of a single or specific scenario;
- The mean/median WTP measures can be obtained relatively easily;
- It requires the use of rather large sample sizes. In general, samples below 1 000 are not recommended, especially when using closed-ended valuation formats;
- Designing a reliable scenario might be demanding and time consuming, if the effects of policy change are not known (e.g. improvement in water quality or status of fish stock) and only a well-designed study can provide insights to guide public (fisheries) policy. However this data requirement about the effects of change applies also to the other valuation methods.

The choice experiment (CE) method is recommended for situations, where estimation of marginal values (WTP) for all attributes of scenario is needed.

- CE is favourable for valuing environmental goods or services with multiple policy alternatives that are described with different characteristics and their varying levels, as long as respondents can differentiate these characteristics;
- Can also be used for forecasting and prediction of aggregate demand or policy support. This is particularly important for fisheries where gauging the anglers' effort response is very important;
- Is particularly suitable for policy decisions, when attributes might be conflicting, target levels are not fixed or when policy creates new goods or services that are not yet on the market;
- The separation of total economic value into its constituent parts is possible by selecting attributes in an appropriate way;
- When the study becomes larger in terms of attributes and/or levels, or the research question requires a more complex presentation than a simple generic choice of A vs B, care should be taken when selecting an experimental design, and a specialist should be consulted in order to avoid biased value estimates;
- Adequate, quantitative information is typically needed regarding the impacts of management policies affecting welfare of respondents, although the attributes and their levels can also be qualitatively described;

- The results obtained with the CE method are sensitive to the original study design and choice of attributes and levels. Hence elabourate pre-testing as described above is essential.

3.2.2. Revealed preference methods

Revealed preference (RP) methods, as the name suggests, are methods that elicit value of goods through actual consumer behaviour in markets. Indirect valuation of the environmental good is possible using the methods on market valued goods used in concert with the environmental amenity of interest. The environmental amenity constitutes a part of the marketed goods price, which is extracted using RP methods. Because of the observatory nature of RP methods, they are unable to estimate non-use values (unless a joint SP study is conducted). Additionally, they are not well-adapted to evaluate large changes in environmental services unless real-world data of such phenomena exist. Additionally, since the methods depend on observed behaviour, they do not work well on valuating sites with minor human activity (as was the case in the Exxon Valdez oil spill). Despite these shortcomings the insight RP methods give on the value of environmental amenities is important. These methods extract actual market transactions and thus give realistic picture on the least amount of money consumers are willing to pay for environmental services, and therefore the lower bound of the value or benefits. Additionally they provide information on the market structures and may present also other than value insights to policy making.

Revealed preference methods have not been extensively applied in Europe to value fishery resources, although the Travel Cost method (TC) has excellent properties to evaluate fishing benefits. Another often used revealed preference method in environmental valuation is the Hedonic Pricing method (HP). These RP methods provide different angles to environmental value estimation.

3.2.2.1. Travel cost method

The travel cost method (TC) measures benefits from recreational use of natural resources at a specific site through analysing the factors that affect demand for the recreational activity (Champ et al., 2003). To monetize the demand, costs from transportation, accommodation, lost working time, permits and equipment rentals are included in the estimation. The economic hypothesis is that, in general, the frequency of visits is lower for people with high travel costs, meaning that demand for recreational visits decreases with higher prices.

The TC method can be used to value both single and multiple sites, each having their own modelling approaches. Single site valuations are fairly simple to conduct, but they are not without caveats. Single site valuation provides an estimate of the total use value of the site, which can be used in estimating damages from drastic changes in environment, such as closing off a river from fisheries use. Since TC models estimate the recreation demand of a site, a simple demand analysis may be conducted for cases like introducing a purchasable fishing permit, which would be analogous to an increase in travel costs. Since single site models don't include substitute sites, they tend to over value a single site. An important aspect in these studies is to identify possible substitutes to the fishery. If a fishery is closed down but the recreational anglers have another site nearby, the loss in benefits is drastically less than in the case of a single viable option.

A problem that arises with single-site models is with subtler changes in site characteristics than a complete closure the fishery such as increased fish catch in rivers due to decreased pollution. Analyzing smaller quality changes in single site analysis requires time-series data on site visits and quality changes. Multiple site models handle these types of problems much more readily, and are also able to take into account many substitute sites, which would draw new visitors with the closure of one site. The strength in multiple site models is that they use the variation between sites to estimate how changes in one site affects total benefits. Thus when choosing multiple sites for estimating the benefits from, for example, better water quality, a number of sites with good and poor quality are needed in the sample. Thus far, the most widely used multiple-site model is the random utility maximisation (RUM) model. The RUM model estimates which site an individual chooses from a bundle of different choices, including non-participation, for a given choice situation in the study period.

A sub-type of the single site model is the zonal TC model. These models are very simplistic but can use available secondary data on site visitation to generate values. These models require data on user visitation by user zone where the researcher defines the zones under consideration. All that is needed is an estimate of visitors to the site from each zone. This type of data can be taken from national recreation inventories and can therefore utilize data drawn from larger populations that can be afforded with primary data collections targeted at specific sites.

The TC method has many good properties for estimating user benefits from inland fishing. First, it is based on actual behaviour, and thus has appeal even to people with doubts on stated preference methods. Second, inland fishery sites are easy to define in most cases. Data is also quite straightforward to collect, and travel data may already be available, or possible to gather jointly through other sources, saving resources and time. The method, however, cannot estimate all benefits perceived from fishing, namely the non-use values thereby generating lower bound benefit estimate. For example, people who truly value some fishing site may purchase a property near the site, and thus the TC method would underestimate their benefits. Furthermore, since hobbies like recreational fishing, may have periods of higher and lower popularity, TC studies should be conducted frequently enough in the same area to be able to form a more trustworthy estimate of recreational fishing benefits than single studies. See Appendix 3 to discover major steps for conducting study applying the TC method. The study of Vesterinen & Pouta (2009) in Box 7 illustrates the use of a zonal TC method.

Box 7. Water clarity effects on near-home water recreation value (Vesterinen & Pouta, 2009).

Policy question
What are the effects of improved water quality imposed by the Water Framework Directive on everyday near-home water recreation value? Are the benefits comparable to the costs faced by agricultural producers for reducing eutrophicating agents in surface waters.

Method(s)
Travel Cost Method (TC); Cost-Benefit Analysis (CBA)

Background
The Water Framework Directive demands good ecological status for surface waters by the year 2015. Finnish agricultural producers are thus under pressure to reduce nutrient runoff to surface waters, which incurs costs. On the other hand, water recreation presents important use-values to the society and is the most obvious sufferer from increased eutrophication in both sea and inland waters.

The Economic Problem
What are the determinants that affect water recreation activity and how does water quality affect water recreation behaviour in quantifiable measures? What is the value of a single water recreation trip?

Data
The study was conducted using an existing national recreation inventory dataset, from which water recreation related parts were extracted for research. The recreation inventory contained a representative sample of 5 500 Finns. The data provided information on water recreation behaviour in general, travel cost data for the last visited water recreation site, and respondent background information. Since the recreation inventory was not specifically designed for travel cost method, some details were unattainable, making the analysis slightly more challenging. After choosing water clarity as a proxy for water quality, each respondent was connected spatially to local water clarity measure using a national surface water quality database.

Results

The results show that local water clarity, as a proxy for water quality, had a significant effect on the frequency of local, one-day swimming and fishing trips. The number of anglers was also estimated to increase with improved water clarity. The average value per one-day, near-home water recreation trip was estimated to be at a range between 6 and 19 Euros. For a one-meter increase in aggregate water clarity in Finland the estimated benefits would then increase between 31 to 92 million euros annually for swimmers, and 43 to 129 million Euros for anglers. Boaters were not found to be statistically significantly sensitive to near-home water clarity.

Policy implications
The benefits from improved near-home water quality are not very high in comparison with the current cost estimates of agricultural runoff cuts. On the other hand, making cost and benefit studies commensurable was found difficult due to the complexity of ecological functions, i.e. quantifiable cause and effect of nutrient runoff cut to water clarity is not available. The benefits from improved water clarity were, however, found significant and represent only a part of the use-values of surface waters, since out-of-home and multiple-day use-values are omitted in the study. The study shows that valuation studies can be conducted using existing datasets, if such exist, with less costs in time and money compared to designing and implementing completely new surveys.

Costs
Wages of 1 full-time researcher
Data available for free

Time
Data collection: approximately 3 months
Data preparation approximately 2 months
Modeling and reporting the results 12 months

3.2.2.2. Hedonic pricing method

Hedonic pricing method estimates economic values for environmental goods and services by examining the indirect effect those goods and services have the prices for other goods traded in the marketplace. The method decomposes the price of a marketed good between its attributes, including the valued environmental good. The most common application is associated to housing prices where price variation is expected to reflect the quality (value) of local environmental characteristics.

The Hedonic Pricing method (HP) considers marketed goods as bundles of services rather than a physical object or a simple service. When the services provided by goods, such as housing, can be quantified with enough precision, it is possible to decompose the price of the good for each service type, given that there is enough variation in the market prices and characteristics of goods sold in markets. Typically, the HP method is used in housing markets because houses have multiple characteristics that give value to and take value from the property. For example, if two summer houses would be sold at a price difference of 5 000 Euros, and the more expensive summer house would be located on the shore of a better fishing lake than the cheaper one, other things equal, the HP method would give an “implicit price” of 5 000 Euros to good fishing location (Champ et al., 2003).

If we had a market as simple as in the previous example, it would be easy to estimate benefits with the HP method. However, since it is impossible to find property sales that are identical except for their access to fishing, the HP method is heavily dependent on large amounts of property sales data. Property sales data tends to be available from governmental archives, but may be lacking details on the house attributes. To be accurate, the method requires great detail on all property attributes, from the number of rooms to types of flooring used to the primary heating system. Using less attribute rich property sales, like unbuilt lots, may provide a workaround of the problem. The more detailed data is available, the better the model should be in predicting the willingness to pay for an environmental amenity, like the vicinity of good fishing grounds.

Like any valuation method, results obtained from the HP method are largely affected by the area chosen for analysis. The researchers must decide on where to stop counting possible benefits for property owners. Many studies have only considered waterfront properties, but these estimations ignore the benefits for properties located even slightly further away from the lake or river. Enlarging the study area quickly increases the need for data. Spatial modelling procedures have become more accessible to accommodate for missing regional data.

The HP method will, as a first-stage analysis, estimate implicit prices for property attributes, which work as point estimates, but are unsuitable to estimate large changes in environmental characteristics. In the second stage of analysis, demands for the individual housing attributes are estimated. Most environmental valuation studies using HP settle with first stage estimates due to methodological challenges in producing accurate demand curves.

The HP method, given a large and accurate database, is a good valuation method. It can be used to evaluate the benefits of inland fishing in the vicinity of a permanent or holiday residence. However, the large amount of data needed may be costly to acquire if pre-existing databases do not exist with sufficient levels of accuracy. On the other hand, HP methods do not require costly primary data collections, in most cases.

The case study for the HP method, presented in Box 8 below, is based on a study by Vesterinen (2009). Work is still in progress and results are expected to be available in 2010/2011.

Box 8. Value of Water Quality in Summer House Markets (Vesterinen, 2009).

Policy question
Will the demands for good ecological status of surface waters by the Water Framework Directive (WFD) have an effect on summer house markets? What are the most important factors of water quality to the consumer in contrast to the natural scientist's view?

Method(s)
Hedonic Pricing Method (HP)

Background
There are slightly less than 500 thousand summer houses in Finland, which typically reside near a water body. Valuation studies tend to focus current use values or willingness to pay figures for future changes in water quality. There is little information even in the European context concerning water quality effects on residential prices, which reflects the value of water invested in capital assets, something not captured in travel cost studies.

The Economic Problem
What are the significant price determinants of summer house markets in Finland? What aspects of water quality are actually valued when purchasing a summer house?

Data
The data for summer house sales were obtained from an official property sales database. Since the official database on sales was found to lack detailed information on the sold properties, the database was supplemented with a detailed survey sent to all summer house purchasers in the study year via internet and mail. The survey elicited data on the respondents' socioeconomic background, water recreation behaviour and quality opinions, details of the summer house and the lot, and carried additional questions relating to travel cost, contingent valuation and choice experiment methods to provide a chance for future joint-method analysis. Despite the survey was burdensome with 20 pages, the response rate climbed to near 45 %. Additionally a national surface water quality database was added to the two databases using computerized geographical processing (GIS).

(Anticipated) Results
The data shows summer house sales to be sensitive to water quality levels. Implicit prices for changes in water quality levels are significant. Summer house owners are interested mostly in the water quality indicators that have direct implications in water use, be it recreational fishing or for physical consumption.

Possible policy implications
Since the WFD puts weight on the ecological status of surface waters, it could overlook the use-values that summer house owners enjoy. For example, if it is deemed that a lake should be restored to its original condition, it may, in some cases where the original condition was very humid etc., decrease the use-values, and thus the property-values for the

current summer house owners. However, if the restoration of water quality improves water recreation possibilities, which is the likely case, summer house owners' property values will increase. This may lead to a positive willingness to pay for local water quality improvement schemes.

Costs
Property sales data of 4 years from official records and conversion by a third party to usable form.
Supplemental survey to the property sales data via internet and two reminder mailings:
4 to 5 Euros per person.
Wages: 24 months for one person, minimum

Time estimates
Data collection and survey implementation: 12 months
Coding and joining databases: 3 months
Analysis :12 months

3.2.2.3. Revealed preference methods - pros and cons

RP methods can be used to estimate the use-values of non-market goods through the consumption of related market goods. Due to the observational nature of RP methods, they provide conservative estimates of benefits. The travel cost method is the oldest environmental valuation method and has gained a foothold in the science of valuation. The hedonic pricing method is also applicable and has been thoroughly tested.

To evaluate the value of inland recreational fishing, revealed preference methods offer a way to study the use-values retained by anglers. The travel cost method is especially well suited for single site studies, as well as larger regional studies provided there is adequate time and financial resources to send surveys to a large study population. If, on the other hand, fishing rights are under private ownership, access to fishing grounds is restricted, or the anglers constitute a large market share of property owners or renters, hedonic pricing studies could be used to extract the value of good fishing sites with directed surveys and residential sales or rental data.

The travel cost method is a very suitable valuation method, given that the evaluated sites enjoy frequent visitors and the method:

- works for single, multiple sites and regions
- only estimates use-values, but based on observed data
- surveys are comparably easy to make

The hedonic pricing method is less suitable, since fishing tends to be a mobile activity:

- If liberal "every-man's rights" prevail, HP might not be a relevant method. On the other hand, if fishing grounds are privately owned and access is limited, prices of properties could reflect fishing values.
- The HP method may provide additional insight in assessing total economic value that the TC or SP methods may not capture.

3.2.3. Benefit transfer

Benefit transfer takes existing non-market valuation estimates obtained at a "study site" and applies them to a new "policy site" where a new study is too expensive or time consuming to carry out. Benefit transfer is cheaper, but also less accurate than on-site studies. Accuracy of benefits transfer can still be acceptable compared to accuracy of cost estimates in a number of decision settings.

Benefit transfer (BT) is the process of using information about benefit estimates from one context (the study site) and adapting these to another context, called the policy site. The information from existing valuation studies is used in the method, transferring the unit values (mean estimates of

WTP) or by altering model variables so that they coincide with the evaluated area. Thus, BT is not a valuation method in itself, but, as the name suggests, it is used to "transfer" prior benefit estimates to a new area or policy context. For example, values for recreational fishing associated with certain policy change in a particular site can be estimated by applying measures of recreational fishing values from a previously conducted study in another site. The method is applicable particularly in situations, where budget, time or lower significance of policy impacts do not require undertaking a primary valuation study for evaluating management or policy impacts. For these reasons and because conducting an original valuation study is relatively expensive and time-consuming, benefit transfer is one of the rapidly growing areas in the valuation literature.

Box 9. Environmental Valuation Reference Inventory™ (EVRI™) – An example of a general benefits transfer database.

The EVRI is a web-based database intended primarily as a tool to assist policy analysts using the benefits transfer approach to estimate economic values for changes in environmental goods and services or human health. It contains non-market valuation studies described according to a standard set of study design criteria across a wide range of environmental goods and services and health impacts.

1. **Study Reference –** basic bibliographic information
2. **Study Area and Population Characteristics –** information about the location of the study along with population and site data
3. **Environmental Focus of the Study** – fields that describe the environmental asset being valued, the stressors on the environment, and the specific purpose of the study
4. **Study Methods** – technical information on the actual study, along with the specific techniques that were used to arrive at the results
5. **Estimated Values** – the monetary values that are presented in the study as well as the specific units of measure
6. **Alternative Language Summary –** an abstract of the study available in English and French

Because of its wide coverage of topics and standardised description of studies EVRI is useful for managers in a first cut assessment of available studies in their environmental field of interest, and in devising terms of reference for benefits transfers or primary valuation studies. Despite the large number of non-market studies contained in EVRI, for any particular BT application in a particular country there might be few available studies entered in the database. The EVRI is regularly updated, but not at the pace at which non-market valuation studies are published.

Source: http://www.evri.ca/

Applying benefit transfer, however presumes availability of valuation studies from study sites with similar characteristics to the current policy site study (the subject of valuation). BT value estimation is always highly conditional on quality of the initial studies. Because recreational use values are relatively easy to transfer, there are a number of benefit transfer applications associated to recreational activities including recreational fishing, which are however mainly conducted in the USA (e.g., Rosenberger & Loomis, 2001).

The current Occasional Paper is focused on undertaking original primary valuation studies, so the benefit transfer method is discussed only in broad terms (for additional information see Rolfe & Bennett, 2006; Rosenberger & Loomis, 2001; Wilson & Hoehn, 2006). Further guidelines on benefit transfer can be found in several web-sites including the Environmental Value Reference Inventory (EVRI, see Box 9.) and the Wildlife Habitat Benefits Estimation Toolkit (Box 10.)

3.2.3.1. Benefit transfer - different approaches

Benefit transfer may be performed in several ways, with value unit transfer and more sophisticated value function transfer regarded as two main approaches. According to Spash & Vatn (2006) value unit transfer is further divided to three different types of estimation methods. The simple single point “value transfer” basically records of a unit value of welfare, typically average values (consumer surplus and mean WTP and WTA estimates), from one site or sites to another directly without adjustment. In addition, value transfer involves administratively approved value estimation in which case the explicit adjustment process occurs.

Next, function transfer uses statistical models to transfer data (entire function) from an original study to another context. Functions may be based on single ‘best’ studies or meta-analysis of a number of similar studies. Using the functions one is able to explain welfare estimates with set of explanatory variables and fit the measurable characteristics among studies, original and new, which systemically differ from each others. This advantage is considerable since benefit estimates vary in the literature according to several factors (quality of site, differences among the user population characteristics, extent of the market, temporal/spatial differences, and methodologically induced differences). What is considered a “similar site”? Recent research on water quality valuation (Bateman et al. 2009) suggests that theoretically specified benefit functions have lower transfer errors than studies that estimate ad hoc statistical “best fit” functions for a site. Site characteristics justified by economic theory include the magnitude of change of provision of the environmental good (scope), the distance from the respondents household to site in question, the distance to substitute sites and income. Basic differences in these transfer methods are summarised in Figure 8 (Rosenberger & Loomis, 2001).

Basically performing the benefit transfer includes the same phases involved in other types of transfer techniques. Rosenberger and Loomis (2001) and Rolfe & Bennet (2006) provide step by step guidance for each transfer estimation technique and also represent applications for recreational use.

Box 10. Wildlife Habitat Benefits Estimation Toolkit – An example of a specialised benefits transfer database.

The Wildlife Habitat Benefits Estimation Toolkit is a set of easy-to-use spreadsheet-based valuation models, tables and databases directed at land use and wildlife planners and others interested in estimating the economic benefits associated with wildlife and habitat conservation in specific geographic regions. The toolkit comprises different models estimating

- ***Open Space Property Value Premium***
- ***Activity Day Value*** models for hunting, fishing and wildlife viewing
- ***Habitat Value*** or ***Habitat Improvement Value*** for terrestrial and aquatic habitats and wetlands
- ***Threatened, Endangered and Rare Species*** **Value** and ***Salmon Value***

The data is based on US non-market valuation studies. The authors estimated meta-analysis wildlife recreation use models for National Wildlife Refuges that are applicable to state Wildlife Management Areas, and state-level wildlife recreation use estimation models for the lower 48 states that can be applied to privately owned and public lands that represent potential habitat for game and non-game species (Kroeger T., J.Loomis and F. Casey (2008). For valuation of sport fishing specifically, all the database studies were disaggregated into three types of fishing (cold, warm, anadromous - i.e., steelhead and salmon); the meta-analysis presents average values for these types with the exception of salmon. Due to the limited number present the individual study values rather than an average so as to facilitate individuals performing point value transfers by matching their policy site to a particular study site.

Source: toolkit can be downloaded from Defenders of Wildlife website:
http://www.defenders.org/programs_and_policy/science_and_economics/conservation_economics/valuation/benefits_toolkit.php

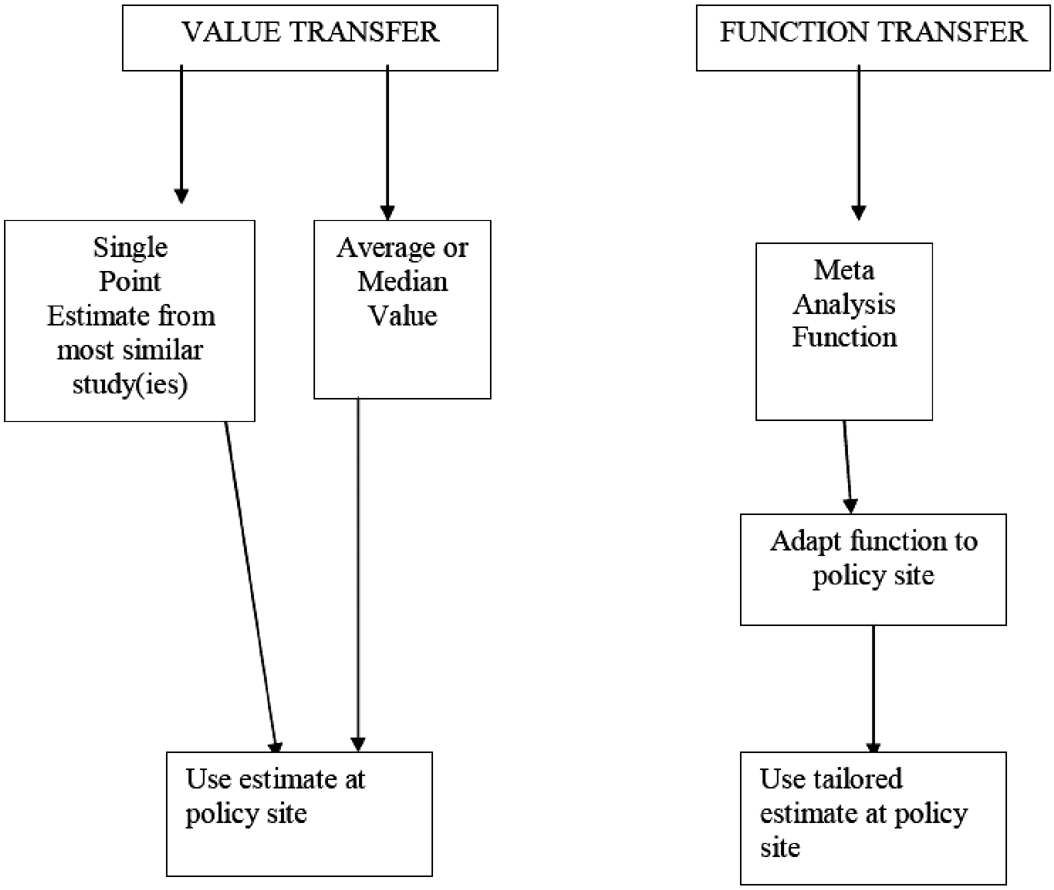

Figure 8. Benefit transfer approaches (Rosenberger & Loomis, 2001).

Benefit transfer always starts by identifying the policy change, data needed and the accuracy of the original data. First, the site characteristics and expected impacts (on fishing site / fish stocks) of the proposed policy or program are identified and quantified. Then these impacts have to be translated to changes in recreational fishing and how fishing will be changed is measured. After that the extent and number in the affected population are identified. Next data needs are identified, including the type of benefit measure (unit, average, marginal value) to be used and the value components (use, non-use, or total value) to be estimated. Accuracy of the data needed depends on the importance of the policy change or if the impact of the policy change is large. In the next phase, source studies are identified with the help of the databases (e.g. EVRI™[6]or Envalue[7]) or directly from non-market valuation literature, and applicable benefit transfer type is selected. Provided that similar studies can be found, their reliability[8] and correspondence[9] with current study is evaluated. Then an applicable benefit measure estimates from study/studies is selected, and the transferability and relevancy of the data is assessed. Finally, the statistical modelling used in original study is assessed and benefit transfer is performed.

The choice of the appropriate value transfer approach depends on the information available. A conceptual example is given in Figure 9.

[6] EVRI™ — The Environmental Valuation Reference Inventory. (available at: http://www.evri.ca/english/about.htm)
[7] Envalue Study database (available at:http://www.environment.nsw.gov.au/envalue/StudyCnt.asp)
[8] Correctness of used valuation method and empirical techniques
[9] Similarities and differences in population, scale of policy change(s) between sites

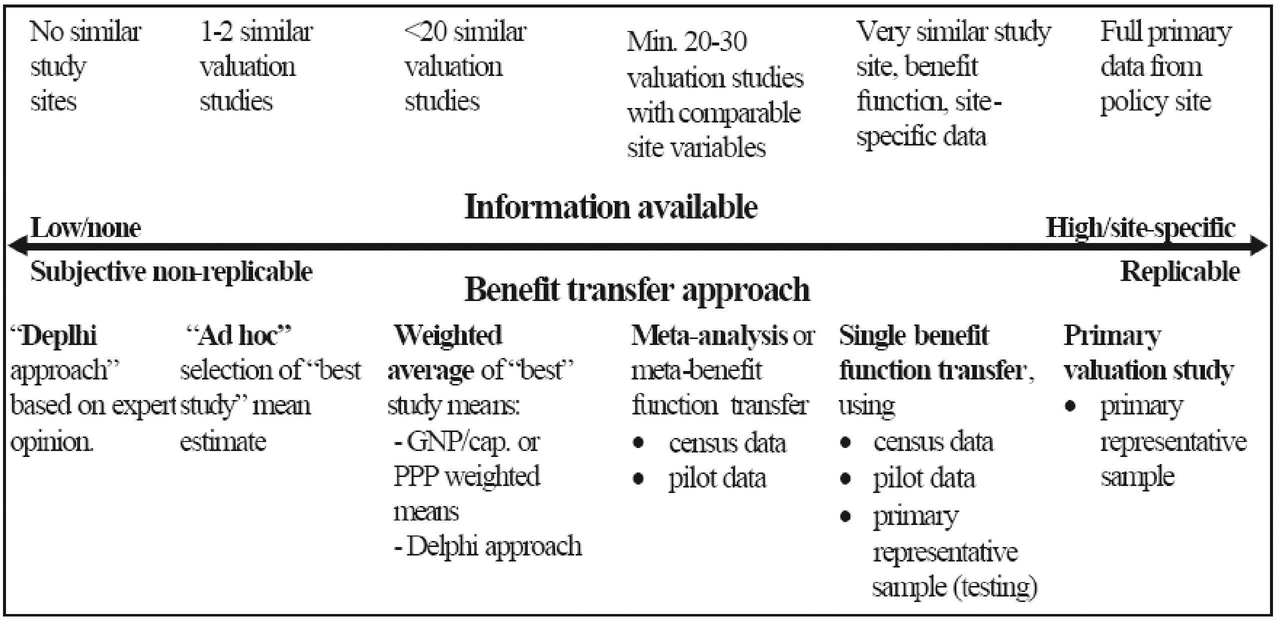

Figure 9. A continuum of benefits transfer approaches (Barton, 1999).

With no similar studies available to the study site expert based judgement Delphi-type methods are often used, perhaps borrowing estimates from a similar field of recreation. With the large number of non-market valuation studies available, such pure expert 'guesstimation' is perhaps a thing of the past. Unit value transfers are now often conducted with 1-2 similar studies or when a particular study site is very similar to a policy site. When a handful of studies are available, sometimes weighted averages have been used for scoping policy benefits. Different weighting methods may be used, for example, in adjusting values between countries using purchasing power parity (PPP) factors. One study may include several independent estimates so fewer than about 20 studies are also seen in meta-analysis of willingness to pay for a particular environmental good. Once meta-analyses have a sufficient number of studies to draw from to find significant site characteristics that explain WTP, meta-analysis becomes a benefit transfer approach as well. Meta-value functions may be applied to a policy site using site specific data from a census and/or pilot studies. Often, a meta-analysis will be a precursor to identifying the 'best' single study for a single benefit function transfer. Function transfers are carried out using census or pilot data from the policy site. Single function transfers are also used in the literature to 'test' the magnitude transfer errors between two study sites. A primary valuation study is the end of the continuum regarding how much policy site specific information is collected. Generally information is increasing from left to right in Figure 9, as are valuation study costs.

Hanley et al. (2006) tested benefit transfer for the EU Water Framework Directive comparing the results from two identical choice experiments. Choice experiments initially lend themselves better to BT than contingent valuation because more site specific attributes of the environmental good can be corrected for. The authors found significant differences between the results of original studies and using benefit transfer method. They recommended future research on finding acceptable methods of benefit transfer, with emphasis on using choice experiment studies as original studies. The problem with benefit transfer is whether it can be reliable.

Meta-analysis is more data demanding than conventional benefit transfer, although it also uses already conducted benefit studies for estimation. In meta-analysis the researchers collect many similar studies together and attempt to find, using statistical methods, trends and aggregate benefit estimates for the studied environmental amenities. Thus, meta-analysis is the statistical summarization of research outcomes, while its results can be also applied to benefits transfer in order to provide value information. As one study on benefits may offer multiple estimations to be used in meta-analysis, it may be possible to conduct a meta-analysis with relatively few studies.

Meta-analysis provides aggregated results that may be used best to form a regional or national scale synthesis on, for example fishing benefits. While BT is used to transfer value estimates, the original purpose of meta-analysis was to widen the basic information (e.g. associated to the set of explanatory variables of the WTP/value estimates) and to utilize that information in new studies. Moreover, it is used to explain the differences in mean WTP estimates in different studies. More recently meta-analysis is being increasingly used particularly in the US to produce valuation estimates for regulatory assessment at national or state level (see Box 11).

Meta-analysis studies regarding economic valuation of recreational fishing have been published. For instance, Johnston et al. (2006) analysed if variation in marginal WTP per one additional salmon fish among recreational anglers could be explained by variation in resource, context and angler attributes, or whether the methodological factors would dominate. Ahtiainen (2009) have applied meta-analysis to value marine resources in the Baltic Sea, which is presented as a case study for the BT method (Box 11, see also Box 10).

Box 11. Valuing international marine resources – a meta-analysis on the Baltic Sea (Ahtiainen, 2009).

Policy question
What is the current knowledge on the monetary benefits of protecting the Baltic Sea? Are the benefits the same order of magnitude as the costs of protection measures?

Method(s)
Meta-analysis (MA), Benefit transfer (BT), Cost-benefit analysis (CBA)

Background
The state of the Baltic Sea has been adversely affected by human activities for several decades, and its protection has been called for on many occasions. There are still no binding agreements on the protection of the Baltic. Net benefits of different policies are crucial for reaching agreements on protection measures. It is likely that the costs and benefits are asymmetrically distributed between the countries involved. The available information on the benefits of protecting the Baltic Sea is fragmented. The purpose of the study was to assess the magnitude of the benefits of improving the state of the Baltic Sea using meta-analysis. The results from the meta-analysis were applied to benefit transfer to assess the distribution of benefits between countries.

The Economic Problem
Which factors affect WTP for marine water quality? How are the benefits distributed between the littoral countries? What are the total net benefits of protecting the Baltic Sea?

Data
The starting point of the data search for the primary studies was a review, which compiled information about valuation studies on the Baltic Sea from the littoral countries. In addition to the studies found in the review, the data encompassed also comparable research from the United States. The limited amount of European studies motivated the inclusion of studies from the U.S. In general, the lack of suitable data is a common problem in benefit transfers and meta-analyses in the field of environmental valuation.

The selection criteria for the studies were the following. First, the focus of the study needed to be water quality. Water quality was defined broadly to include effects from eutrophication, the state of fisheries and also other physical factors. Second, the water quality change valued had to affect recreational activities and/or biodiversity in water ecosystems. Third, the valuation methods were limited to SP methods (contingent valuation and choice experiment) and the TC method. Fourth, it was essential that the study report provide sufficient data for purposes of the analysis. Both peer-reviewed publications and “gray literature” (such as working papers, reports, master’s thesis and PhD dissertations) were included. The final data consisted of 32 studies and 54 observations.

Results
Based on the results of the meta-regression, the WTP for water quality varied systematically according to expectations. Importantly, the results indicated that the variables describing the change in water quality were statistically significant in explaining the willingness to pay estimates. The income level of the focal country, represented by its gross domestic product, had a significant effect on WTP, allowing the assessment of benefit distribution among the Baltic Sea countries. In addition, the water body type, the study methodology and the year of the study affected the value of water quality changes. The mean annual WTP for water quality based on the data was 64 Euros per person.

The distribution of the benefits of protecting the Baltic Sea was found to be asymmetric, and the magnitude of the total benefits was in line with previous research. The total benefits were around MEUR 5 000 per year for all Baltic Sea countries. The aggregate net benefits of protecting the Baltic were estimated to be positive.

Policy implications
The fact that the net benefits are distributed asymmetrically between the Baltic Sea countries is interesting from the viewpoint of international negotiations, as net benefits are decisive in determining countries' incentives to adhere to international agreements on protecting shared marine areas. Although total net benefits from the protection measures will be positive, some countries will have to bear costs that are higher than their anticipated gain, and these countries may thus be reluctant to participate in common actions. In this situation, binding agreements are difficult to reach. However, the positive aggregate net benefits noted would allow for compensation to be paid between countries, which might facilitate the conclusion of international agreements on the protection of the Baltic Sea.

Costs
Wages of at least one full-time researcher

Time estimates
Data collection: 2 months
Coding the meta-data: 3 months
Analysis and reporting: 6 months

3.2.3.2. Benefit transfer method - pros and cons

Benefit transfer is considered a rather controversial valuation method in academic circles. Comparative studies which transferred benefit estimates to actual study results have found large discrepancies between the transferred and locally estimated values, and until now the method has not been very successful (Hanley, Wright & Alvarez-Farizo, 2006). However, in project assessment it is regularly practiced due to lack of time and resources to conduct original on-site studies. The method seems to work in certain contexts better than in others, such as when transferring recreational (fishing) use values, but the reasons for this are not known at the moment (Bateman et al., 2002).

Standards for the BT, however, may vary depending on the context, i.e. lower standards may be accepted when values are used to give only preliminary information for decision making, when costs are likely to far exceed or not attain benefits (but requires documentation), or when uncertainty regarding costs of environmental measures is expected to be as high/higher than that of benefit transfer.

3.3. Economic impact analysis

Economic impact analysis examines the flow of expenditures through a community in terms of jobs, incomes, total sales, and contribution to gross domestic product (GDP). Economic impact analysis relies on a model on the local economy that translates data on the production of goods and services into multipliers that can be applied recreational angler expenditures or changes in expenditures. This type of analysis is useful for demonstrating the economic importance of the current level of an activity in the economy. It is also useful for analyzing the distributional impacts of a change in recreational fishing policies or any other external shock to recreational fishing activities. These effects can be positive or negative. Impact analysis is normally considered in terms of the actual or hypothetical introduction of new activity or the ending of existing activity, for example of a salmon fishery. These changes are peculiar to a particular region and its economic structure, and to the pattern of expenditure associated with the activity.

Recreational fishing generates economic impacts to local and regional economies, where recreational expenditure generates business revenues, jobs and personal income. Three types of economic impacts are discernible: direct impacts, which are the purchases made by anglers, including travel, accommodation and food costs; indirect impacts, which are the purchases made by businesses to produce goods or services demanded by anglers; and induced impacts, which are the purchases of goods and services by households receiving wages from businesses producing direct or indirect goods. Households then use some of their higher income for consumption, thus increasing the income of companies. Indirect and induced impacts are sometimes referred to as secondary impacts. The summation of these three levels of impact is the total economic impact (TEI). The most common tool to analyze these impacts are the input-output models (I-O model). Its popularity has been engendered by the growth of ready-made I-O modelling systems.

The flows of commodities between the various branches of production within a given time are presented in the input-output table, those of goods and services usually being expressed in monetary terms. The description of commodity flows by means of an input-output table is characterised by their simultaneous examination from the point of view of commodity production and commodity use. Input-output analysis combines the correlations between the various forms of production even if they do not seem very close. Ease of application of an I-O model depends to a large extent on availability of existing input-output tables, either national or regional, which are usually produced by national statistical authorities.

I-O-models are based on the idea that a demand stimulus has a multiplier effect because an initial purchase circulates several times through the local economy. Multiplier impacts are reflected in practice in the form of increased demand, production and income. A multiplier is the ratio of direct, indirect and induced changes within a regional economy to the direct change itself. The output multiplier measures the effect of an extra unit of recreational anglers spending in economic activity levels in the economy. The employment multiplier measures the relationship of the direct and indirect employment generated by additional recreational anglers spending to direct employment alone. The income multiplier expresses the amount of income generated in the economy directly or indirectly as a result of increased expenditures (e.g., Martin, 1987).

It is important to recognize that economic impacts are confined to the region described in the model, such as a county or other regional unit. Leakages occur when goods and services are purchased from outside the region. This money is no longer available in the region for further spending. The magnitude of leakages from the local economy depends upon the size of the study area and the extent of internal business linkages. Other things being equal, larger regions and regions with more diversified businesses activities will experience smaller leakages in a given time period (Martin, 1987). For example, if a fishery ceases and anglers move to another county, theoretically all angler expenditure could be lost to the region. On the other hand, anglers may have substitutes for fishing: either some other type of fishing or activity in their place of residence, in which case only part of regional income and employment would be lost.

Economic impact provides a direct link between the use of the resource and the associated level of economic activity in the region. It enables managers to relate a change in the level of the activity of recreational fishing to the resulting change in the benefit to businesses and wage earnings. Thus, fisheries management decisions can be translated into sales, income and jobs (Martin, 1987).

It should be noted that economic values and economic impacts are fundamentally different measures. Economic value indicates the value of recreational fisheries to individual and further to society, while economic impact indicates the changes in income, employment and revenues a demand stimulus generates. In brief, the recreational anglers' expenditure is a measure of size only and does not answer by itself the question whether resources are appropriately allocated.

Regional impacts of recreational fishing can be remarkable, as the example from England and Wales shows (Box 12).

Box 12. Economic impact of inland fisheries (Mawle & Peirson, 2009; Radford, Riddington & Gibson, 2007)**.**

Policy question

The study, *Economic evaluation of inland fisheries. The economic impact of freshwater angling*, had the following objectives:

- to estimate annual expenditure on different types of freshwater angling in each region of England and Wales, and
- to estimate the impact on regional economies of potential increases and decreases in different types of freshwater angling, identifying the contribution made by tourism.

Methods

Expenditure estimates were then processed in DREAM® models tailored to each regional economy. The DREAM® model is based on the incorporation and reconciliation of all current statistics on production and consumption in the UK (Detailed Regional Accounting Model developed by CogentSI Ltd).

Data

Thirty-three separate assessments were produced of the dependency of regions on the spending of anglers fishing for coarse fish, trout, salmon and sea trout. Estimates were also categorised by types of surface water, that is, rivers, stillwaters and canals.

Assessments were made for the nine Government Office Regions of England; Wales; and for England and Wales as a whole. For each of the 33 region/fish species combinations, the study estimated the economic activity supported by each species as well as the potential economic impact of their loss. Among the parameters estimated were:

- total annual income in the form of wages, profits and income from self-employment accruing to households − this is called gross value added (GVA);
- total employment (measured in full-time job equivalents (FTEs);
- GVA generated per pound of angler expenditure;
- angler expenditure necessary to generate one FTE;
- GVA generated per angler day;
- FTEs per thousand angler days.

An online internet questionnaire was used to collect information across the combinations of regions and fish species. Given that in England and Wales a licence is required to fish in freshwater, the Environment Agency holds the names and addresses of licenced anglers. A controlled sample of 3,000 anglers was drawn from these records. ADAS Ltd then managed a telephone survey of the anglers and collected observations on the average number of angling days per angler across the region/fish species combinations. Using the known total number of anglers from licence sales, these observations were scaled to population totals (angler days per region per fish species). Having established population totals, the survey generated data on average angler expenditure per day across the 33 combinations.

Results

For England and Wales as a whole, the total effort on freshwater angling by licenced anglers in England and Wales in 2005 was 30 million angler days. Coarse angling was the most popular activity, while salmon and sea trout angling was a relatively minor activity.

Angler gross expenditure across the whole of England and Wales was £1.18 billion, with coarse angling responsible for £971 million of this. Household income of £980 million and 37,386 jobs were generated across England and Wales. In the unlikely event of all forms of angling ceasing, expenditure would be diverted to other activities creating income and jobs elsewhere in England and Wales. Thus, although income and jobs would be lost in angling services, there would be increases elsewhere.

The study could not estimate the economic impact of the loss of all species; however, a substitution analysis was carried out for each species, to estimate the net expenditure loss and associated income and job effects. Taking coarse fish as an example, the gross expenditure of coarse anglers in England and Wales supported household incomes of £804 million and 30,580 FTEs. If coarse angling were to cease across England and Wales, from interviews with anglers we estimate that £161 million would be lost, resulting in a net loss of £133 million in household income and 5,060 jobs. The same interpretation can be applied to trout and salmon and sea trout.

Policy implications

In the public domain, the total expenditure of anglers and the employment generated is often used for advocacy purposes. In some instances, the findings of an impact study are used inappropriately. This inappropriate use may be deliberate but may also simply be misguided. Both culpable and innocent misuse is best tackled by ensuring that all sides are familiar with the scope and limitations of impact studies.

Costs
Total budget for the study was £ 120 000.

Time
Timescale for the research itself and production of supporting documentation was circa three years.

The application of an input-output methodolgy is rather straightforward provided that basic data and models exist. However, the interpretation of the results of input-output analysis presupposes that following items are considered:

- Values and impacts are incomparable: economic valuation and economic impact assessment measure different things and results of one cannot be compared with another or used as respective surrogates (Hanna et al., 2006).
- Impact analyses provide a measure of the impact of economic activity associated with fishing. Unless (regional) input-output tables have been constructed and are accessible, the application of the method may turn inappropriate for fisheries analysis only.
- Key assumptions that should be documented to ensure the accuracy of impact analysis are: size of the region modelled, existence of substitution possibilities, expenditure location, price effects and resource constraints. Often studies are conducted with the implicit assumption that no substitutes exist for the activity being analysed. However, if they do exist, loss of a given opportunity may not result in a total loss of benefits or expenditure as it would in the absence of substitute opportunities. It is also important to know whether the location of the substitute activity is within or outside the study region (Hanna et al., 2006). One should also notice that impact studies can be used to exaggerate the benefits of policies or proposals in some cases and their costs in others.

3.4. Market studies and resource rent

Market analysis, in this context, includes the analysis of the economic value derived by businesses that provide recreation opportunities for hire or that supply the inputs to the recreational experience. The value generated is measured by producer surplus (PS), which can be generalized as the profit a business generates. For hire businesses include but aren't limited to fishing guides or resource owners that provide access to fishing for a fee. Businesses that supply inputs to the recreational fishing experience include but aren't limited to tackle stores, bait providers, and hatcheries.

In a cost/benefit framework, every business that supports the provision of recreational fishing generates producer surplus (PS) that should be included along with consumer surplus (CS) in the calculation of total benefit or total economic value. To estimate a producer surplus, i.e. the total revenue generated from sales less the costs of production, regression based techniques are used to estimate production functions. Production functions can be constructed based on revenue, cost, or profit functions which are then used to derive input or output supply functions. Detailed cost and return data is needed from the businesses being examined in order to estimate these functions.

Beyond simply calculating value accruing to producers, it is important to also focus on producer behaviour in the face of changing policies or environmental conditions just as understanding consumer behaviour is important. Development of supply curves allow the examination of producer behaviour, which in turn allow the examination of business efficiency, profitability, response to environmental or policy change, and industry capacity, which has become an increasingly important concern in fisheries.

Collecting data on producers and consumers allow the development of market studies. Market studies provide vital information regarding the impact of changes in fisheries policies, changes in environmental conditions, or the viability of increasing recreational fishing services in a particular area. Fisheries are differentiated from each other by their characteristics (average catches, length, number of pegs, access), and these characteristics influence their market price. With a sufficient number of owners' estimates of market value and details of the accompanying combinations of characteristics, an 'implicit price function' can be estimated. Given an estimated implicit price function, the market value of any fishery can theoretically be predicted from knowledge of its characteristics. More importantly, this relationship can be used to predict how the market value of fisheries would vary with overall changes in individual characteristics. The same data set can be used to estimate the total market value for each fishery type, provided that an appropriate scaling factor is available (Radford et al., 2001). Caution is warranted when transferring an implicit price function from one site to another for many of the same reason identified in the benefits transfer section (3.2.3).

For priced fisheries, as many European inland fisheries are, anglers have an additional item of expenditure because the owners of fishing rights extract permit charges from anglers. Because there is usually no opportunity costs associated with access charges, they are transfers of income from anglers to owners. Resource rent exists when payments to owners of the resources used in production exceed opportunity costs of maintaining these resources. If the opportunity costs of the resources fishery owners control are negligible, then the owner’s revenue is resource rent. Net economic value could thus be estimated by summing economic rents and the remaining consumers’ surplus. However, the crucial assumption is that that all payments to owners are resource rent (i.e. that the opportunity costs are zero of the resources fishing right owners control) (Radford et al., 2001). In spite of the riparian ownership of fishing grounds commonly found in Europe, research focusing on the capital value or market functions of such rights is scarce. The Finnish case has been studied by Sipponen (1999).

Examining producer behaviour requires data on individual firms that supply recreational services including landowners, hatcheries, and for-hire recreational service providers. Data collected should include detailed cost information, both variable and fixed costs, detailed revenue information, and detailed business characteristics data. The same data is also needed to construct economic impact models presented in the previous section.

4. Sampling issues and survey implementation

Both the economics and the HD paradigms rely to a large extent on the sampling of anglers at all stages of the behavioural process. While some of the measurement techniques listed above rely on secondary sources of data, the majority require a primary data collection. Primary data collection is expensive, time consuming and requires rigorous methods to produce data that both suit the analysis task at hand and is unbiased. In analogy to the stages of the behavioural process (Figure 1), primary data collection may occur at any one of the three stages. Data on actual behaviour may be obtained from simple observation, from survey questionnaires or a combination of simple observation and a follow up survey. Data collection about behavioural intention, or about other stages representing the behavioural antecedents requires some kind of questionnaire survey.

This chapter will briefly describe the main observational methods, followed by a discussion of survey questionnaires, and will conclude with a brief discussion of sampling methods and sampling biases. This chapter will not cover creel surveys, which are specific to fishing, and also represent a survey method, albeit with the primary purpose of collecting biological information about catches. Often, creel surveys have been used to collect select socio-demographic or even attitudinal information (Hicks et al., 2000). The purpose here is not to provide an authoritative treatment of survey methods. Plenty of textbooks have been written to that effect (e.g. Dillman, 2000). Instead we simply want to emphasize the main aspects of sound survey research.

4.1 Observational methods

With the emergence of sophisticated new surveying techniques, many new observational techniques have been introduced to social science research and have also found application for monitoring recreation behaviour. Cessford and Muhar (2003) described these methods (list below is modified):

- human observers
- automatic counters (magnetic, infra-red, etc.)
- triggered cameras
- video or time-lapse video
- overflight counting from aircraft

A detailed evaluation of the advantages and disadvantages of these methods goes beyond the limits of this EIFAC Occasional Paper. However, biases are associated with each method, and their implementation requires constant testing and calibration. For example, Arnberger et al. (2005) systematically compared the results of video-monitoring with observer-based counting, and report biases in that video-monitoring, which depends on human extraction of information under-counts actual user numbers in low-use situations, while at high-use situations human observers become less reliable.

The applicability of methods depends on purpose and the physical setting of the angling situation. For sizeable waterbodies, or a region with many waterbodies, periodic overflights might be appropriate and efficient. The efficient use of automatic counters typically requires settings with a limited number of access points.

4.2 Questionnaire surveys

Questionnaires are undoubtedly the single most important means of primary data collection covering the antecedent stages of the behavioural process. The focus of this Occasional Paper will be on formal questionnaires that rely on probabilistic sampling approaches, as opposed to qualitative forms of data collection which also involve other types of interactions between researcher and research subject. Qualitative interviews are excellent sources of information for obtaining some initial understanding about specific issues or to delve into depth about certain behaviour or motivations by select individuals. However, if the goal is to determine the opinion, preference, or even past behaviour of a predefined population, then well designed questionnaires are the method of choice (Vaske, 2008).

Table 1 compares the four main survey methods (on-site in-person interviews, mail, telephone, and internet surveys) on the most relevant criteria. The information in this table speaks for itself and will not be repeated here in all its detail. Survey applications to recreational fishing have traditionally relied mostly on mail surveys, as the cheapest method, prone to relatively few biases. The main advantages of telephone surveys are usually outweighed by its high administration cost. Over the past few years, internet surveys have become another excellent survey method in many areas of social science research, and nowadays internet penetration might be high enough among anglers to reduce biases.

4.2.1 Sampling

Sampling is the process of selecting an unbiased subset of observations for the purpose of describing a larger population based on only a selected portion of that population. A sample is representative when all individuals in the population have a known chance of being selected (Vaske, 2008). Quantitative surveys typically rely on some form of probability sampling, as compared to a non-probability or purposive sample. The latter are applied to recruit focus group participants or for other qualitative methods.

In simple **random sampling** each member of the population has an equal chance of being selected. When a list of eligible population members (e.g. fishing licences) is available, a random sample can be selected based on a random number table. As an alternative, if work with a random numbers table becomes too cumbersome, systematic sampling involves randomly selecting the first individual, and thereafter choosing subsequent individuals based on a pre-determined interval. Many modern spreadsheets, database packages and statistical software offer random sampling tools.

Table 1. Some Broad Criteria for Choosing a Survey Type for Economics and Human Dimensions Research in Inland Fisheries (Source: Vaske 2008).

	On-site	Mail	Telephone	Internet
Questionnaire construction and design				
Allowable length of survey (minutes to complete)	5–15	30–45	10–20	15–30
Type of questions				
Allowable complexity	Medium	High	Low	High
Success with open-ended (fill-in-the-blank) questions	Low	Medium	High	Medium
Success with screening questions	Medium	Low	High	High
Success with controlling sequence of question completion	Medium	Low	High	High
Success with avoiding item nonresponse	Medium	Low	High	High
Sensitivity to design layout	High	High	Low	Medium
Accuracy of answers				
Likelihood of interviewer distortion / bias	Medium	Low	Medium	Low
Likelihood of social desirability bias	Medium	Low	Medium	Low
Administration considerations				
Cost per completed survey [1]	High	Low	Medium	Low
Anticipated response rates				
General population	Medium	Medium	Low	Medium
Specific user group or stakeholder / interest group	High	Medium	Medium	Medium
Data collection completion time after survey is developed [2]	Medium	Slow	Fast	Fast
Control of survey once developed and administered	High	Low	High	Medium
Need for sample contact list from population	Low	High	High	Medium

[1] Cost is variable depending on circumstances. On-site surveys, for example, can be expensive if they require substantial out-of-state or international travel (e.g., air, vehicle) and accommodation, but can be conducted for a lower cost if these costs are not incurred. Costs for mail surveys can be variable depending on type of postage selected (e.g., bulk, business reply, first class, international).

[2] Completion time is variable depending on number of personnel working on survey administration.

Cluster sampling is used when "natural" groupings are evident in the population, and some groups may be very small, and would be too small for proper statistical analysis based on a regular random sample (e.g. a certain age group, or purchasers of a special fishing licence). In this case a minimum sample size is drawn for each group. Cluster sampling and stratified sampling are very similar. The main difference between the two methods involves the level of sampling. Stratified samples draw sample from each strata whereas with cluster sampling only selected clusters are sampled. Additionally, stratified sampling is typically performed to increase precision whereas cluster sampling is often performed to increase efficiency and reduce costs.

In the case of recreational fishing, **multistage sampling** is often an appropriate technique, especially for collecting observational data, or when undertaking intercept surveys. In that case, the sampling strategy considers a number of fishing locations, distinguishes between weekdays and weekend, and sampling effort may also be weighted by the proportion of effort allocated to the various locations or fishing modes (shore, private boat, for-hire).

Useful variations within random sampling are **stratified random sampling**, and cluster sampling. In stratified random sampling, the population is divided into several, mutually exclusive groups (i.e. strata), and a random sample is drawn from each stratum so that the final overall sample reflects the proportions in the overall population. If the population you are sampling is considered heterogeneous based on characteristics that can be determined from the sample frame, stratification improves representation. For instance, if possible, it is desirable to stratify between shore anglers, private boat anglers and for-hire anglers as it is expected that each of these strata would hold very different preferences, expenditures and value for the recreational experience.

4.2.2 Potential sources of error

One crucial aspect associated with any survey research is the avoidance of various errors. The textbooks typically list four types of errors that might occur when implementing survey research (Salant and Dillman, 1994; Vaske, 2008).

Coverage error occurs when the list, or sample frame, from which the sample is drawn does not include all elements of the population that researchers wish to study (Salant and Dillman, 1994). In other words, not all elements of the target population have an equal or known chance of being included in the sample. Coverage error is reduced by using up-to-date user lists, and consideration of the appropriateness of the list for the sampling purpose at hand.

Measurement error occurs when a respondent's answer to a given question is inaccurate, imprecise, or cannot be compared in any useful way to other respondent's answers (Salant and Dillman, 1994). A measurement error is associated with the actual process of data collection, and may be caused by the survey method, the question itself, the interviewer or the respondent. Any one of these reasons may lead to imprecise, inaccurate answers that cannot be compared to other respondents. For example, vague response categories to a question about frequency of fishing (never, rarely, occasionally, regularly), might be too imprecise, and eventually lead to less insightful analysis. Interviewer bias is a very important source of error for contingent valuation and other stated preference surveys (Mitchell and Carson, 1989; Arrow et al, 1993). This type of bias can arise because of improper interviewer training or improper question design.

An interviewer bias might be introduced easily during in-person or telephone interviews, and can be reduced with careful training of interviewers. Most important of all is a careful multi-stage pilot testing of a survey instrument.

Non-response error occurs when a significant number of people in the survey sample do not respond to the questionnaire and are different from those who do respond in a way that impacts the results of the study (Salant and Dillman, 1994). This bias may occur for many reasons, such as some respondents protesting the introduction of a user fee or certain regulations, and attempting to void a survey with their non-participation. Frequently, reasons for such biases may not be as obvious. Aiming for a high response rate is fundamental for reducing non-response error.

Sampling error occurs when researchers survey only a subset or sample of all the people in the population instead of conducting a census (Salant and Dillman, 1994). Obviously a certain sampling error is a fact of life with survey research, and can be controlled with increasing the sample size.

Table 2 indicates the required sample size as a function of the population size, and characteristics at the three levels of precision. In this case precision refers to: the confidence level (typically set to 95% for regular survey research); the acceptable sampling error (which depends on many factors including whether the study is exploratory or confirmatory); and the expected heterogeneity in the population. The table uses only the 95% confidence level, displays a column for three levels of sampling error (± 3%, ± 5% and ± 10%) and levels of heterogeneity. The heterogeneity levels describe the proportion of the sample expected to select one response from a question allowing two responses.

The main features of this table are that 1) the acceptable sampling error influences the required sample size enormously, and 2) required sample size does not increase by large amounts as the population size increases, especially once a population is above 10,000 members.

Table 2. Completed Sample Sizes Needed for Population Sizes and Characteristics at Three Levels of Precision (Dillman 2000; Table 5.1 p. 207).

	Sample size for the 95% confidence level					
	± 3% sampling error		± 5% sampling error		± 10% sampling error	
	50/50 split	80/20 split	50/50 split	80/20 split	50/50 split	80/20 split
100	92	87	80	71	49	38
200	169	155	132	111	65	47
400	291	253	196	153	78	53
600	384	320	234	175	83	56
800	458	369	260	188	86	57
1,000	517	406	278	198	88	58
2,000	696	509	322	219	92	60
4,000	843	584	351	232	94	61
6,000	906	613	361	236	95	61
8,000	942	629	367	239	95	61
10,000	965	640	370	240	95	61
20,000	1,013	661	377	243	96	61
40,000	1,040	672	381	244	96	61
100,000	1,056	679	383	245	96	61
1,000,000	1,066	683	384	246	96	61
1,000,000,000	1,067	683	384	246	96	61

4.3. Survey implementation

Depending on the purpose of a study, the research question, and possible sampling strategies, several survey methods are frequently combined in the context of recreational fishing. For the longest time in recreation research in general and HD research specifically, Dillman's "Tailored Design Method" (Dillman, 2000) was cited as the standard for the implementation of a mail survey. He suggested a multi-stage process, to ensure adequate information and building trust with respondents, including the following phases:

- pre-notification letter
- first questionnaire packet
- thank you / reminder postcard
- replacement questionnaire packet

As long as licence information is available, and the licences contain complete addresses, a mail survey can be administered by following the Tailored Design Method. Nowadays, many agencies have placed licence sales on the internet managing their client data base electronically. This has improved the quality of licence frames and many now contain e-mail addresses. While anglers often come across as a conservative group skeptical of the internet, they often rely on the internet for up to the minute fishing reports, weather forecasts and other important fishing information. As a result, web-based surveys may now be the most cost effective survey method of licence holders. A well designed internet survey is appealing, allows better control of the sequence of survey questions (i.e. nesting) than a mail survey, does not require extra effort for data coding thereafter, and data collection can be completed very fast. For stated preference surveys, web based surveys allow each choice occasion to be tailored to the individual respondents characteristics and preferences.

However, some research questions need to rely at a sampling population that is not completely (or not at all) represented by licence holders. Often there are no easy solutions and a multi-stage sampling and surveying technique might be essential. Two examples highlight such situations.

Imagine an agency that is interested in surveying lapsed anglers, i.e. anglers who have not purchased a licence in a few years. One might be able to identify a sample from old records, but in many cases addresses might no longer be correct, and the fact that some of these anglers might have perished might lead to unnecessary strain on their family. The ideal approach to such a situation would be to start the research with a random digit dialing phone interview of the general population: in a few questions regular anglers, non-anglers and lapsed anglers can be identified, and recruited for full-length surveys. Unfortunately, such an approach will be very expensive, but will deliver good estimates of the relevant proportions, and the few questions asked over the telephone allow later testing for non-response bias with a later full survey by mail or internet.

Another frequently used multi-stage approach is the recruitment of anglers at specific waterbodies or regions via an intercept survey. These intercept surveys may be undertaken by researchers at access points, or while roving on the water. A cheaper version is to simply leave short intercept surveys at windshields in the parking lots, however this method will most likely produce a lower response rate and other potential biases. Such intercept surveys provide excellent information about their origin, gear carried, length of fishing on that day, or satisfaction with the angling on that day, which again can be used for later testing of non-response biases, or actually complement the full survey.

In the box below, the study of Toivonen et al. (2000) is presented as a best practise example for conducting a survey (see also Roth et al., 2000; Roth et al. 2001) on recreational fishery. See also Annex 6 for the questionnaire.

Box 13. The economic value of recreational fishery in the Nordic countries. Case study of a multinational survey (Toivonen et al., 2000).

Background
Recreational fishing is a very popular free time activity in the Nordic countries. Compared to the central European countries, there are plenty of lakes, long coast lines and many rivers. They provide natural opportunities for recreation. Additionally, there is a culture of second homes and summer cottages, and they are most often located by water bodies providing accommodation.

Method
Contingent valuation method (CVM)

Valuation question
The economic value of a non-market commodity like recreational fishing comprises of use value and non-use value. To avoid overestimating the economic value of recreational fishing, it was assumed that anglers represent the use value and non-anglers represent the non-use value. In cases where CVM results are applied to cost-benefit analyses, the WTP over and above what has actually been paid is the correct measure for the benefit, consumer surplus. We first asked the anglers to count their annual fishing expenses, and next we asked how much more they would have been willing to pay for the same fishing experience until it would have been too expensive and they would have stopped fishing. A scenario

was depicted on present and future threats to fish stocks and fishing possibilities. Both anglers and non-anglers were asked their WTP for conserving the current state of fish stocks and current quality of recreational fishing.

The Survey

The economic value of recreational fishing was measured using an identical mail survey in all five Nordic countries through October 1999 – January 2000. Since also those people who do not fish themselves can hold a value towards fishing, they were asked as well. Population registers were used as sampling frames, and systematic samples were drawn from geographically sorted registers. Every individual, man or woman, from 18 to 69 years of age had an equal chance to be chosen in the sample. The research unit was the individual person. According to national statistics the participation in recreational fishery in each country at the time was in Denmark 12.5 %, Finland 40 %, Iceland 31.5 %, Norway 50 %, and in Sweden 35 % of the population (Toivonen et al. 2000). The samples accordingly included both anglers and non-anglers.

The survey was executed centralized from Finland. In practice, however, serious difficulties were encountered due to legislation on person registers in Denmark and Norway, where export of population register samples is denied. The problem was settled by conducting the mailings nationally in Denmark and by using telephone catalogue as the sampling frame in Norway. It was checked afterwards (Roth et al. 2000) how well the response represented the populations in each country. In Norway it was found that there were less young persons, men in particular, in the response than in the population. This resulted in large weights among those groups, and that can be destructive to confidence limits in unfavourable cases.

The subcontracting print house printed the translated questionnaires and cover letters, sent out the mailings and received the return mail. The names and addresses of the receivers were printed on the questionnaires from the address files, and windowed envelopes were used. The address files were updated after the first and second wave. The second and the third contact were sent to those who had not replied by the deadline. The data were stored optically by the print house. The functions were coordinated between Finland Post Ltd and Post Denmark Ltd as the Danish return mail was routed unopened to Finland for return mail control and data storage.

The original sample size was 25 200 Nordic citizens, 5 200 from Denmark, 5 000 from Finland and Norway, 2 500 from Iceland and 7 500 from Sweden. After deletion of the unreachable, the sample size was 24 900. Since the number of replies was 11 400, the overall response rate was 45.8 %. The lowest rate was 34.2 % in Iceland, and the highest was 51.3 % in Finland. The mean of the sampling interval across the countries was 630, and the mean of the true interval, the mean of the weights at the same time, was 1 400 in regard to the response rate. The price of the survey, including only variable costs like materials, addresses, printing, mailing services, data storage and some incidental items, was 135 000 € (in 2008 value).

Results

The results (see Appendix 5) of the survey were computed by multiplying each value with a weight that was specific to the respondent. Each respondent represented several persons depending on the country, sex and age group. Additionally, the weights were calibrated to return the true participation percentage in recreational fisheries in each country. This was necessary because fishermen are more likely to respond than non-fishermen due to the interest in the topic (Dalecki, Whitehead & Blomquist, 1993).

To obtain the 95 % confidence limits of the means, standard errors of the mean were multiplied by 1.96. For confidence limits of aggregate estimates, dedicated software is needed. An experiment was conducted to see if it would have been possible to retrieve reliable results with a smaller sample size and thereby obtain savings in the survey costs. Random samples of the data set of 11 400 replies were drawn using the jacknife technique, 50 replications by country and variable. New weights, means and confidence limits were calculated for each replication. For the key variables, the pain barriers of ± 30 % in the confidence limit was exceeded in Iceland already with the full sample and in Denmark with the random sample size of 75 % of the response. In Finland, Norway and Sweden, 50 % of the response would still have ensured a decent confidence limit of under ± 30 %. These results are due to the low participation percentage in Denmark and low response rate in Iceland, moderate response rate and participation percentage in Finland, large sample in Sweden and even share of recreational anglers and non-anglers in Norway.