Fisheries Management and Ecology, 2004, **11**, 1–14

The economic value of recreational fisheries in Nordic countries

A.-L. TOIVONEN

Finnish Game and Fisheries Research Institute, Helsinki, Finland

E. ROTH

Department of Environmental and Business Economics, University of Southern Denmark, Esbjerg, Denmark

S. NAVRUD

Department of Economics and Social Sciences, Agricultural University of Norway, Ås, Norway

G. GUDBERGSSON

Institute of Freshwater Fisheries, Reykjavik, Iceland

H. APPELBLAD

Department of Social and Economic Geography, University of Umeå, Umeå, Sweden

B. BENGTSSON

National Board of Fisheries, Gothenburg, Sweden

P. TUUNAINEN

Finnish Game and Fisheries Research Institute, Helsinki, Finland

Abstract Recreational fishing, whether free or at cost, has an economic value. This value was measured in five Nordic countries based on a contingent valuation mail survey. Regression models were used to identify demographic characteristics, types of fishing patterns and differences in the countries' management regimes that can explain both actual fishing expenditure and willingness to pay for the non-market benefits by persons participating in fishing or enjoying the benefits derived by it. Net benefit, i.e. willingness to pay over and above actual expenditure was highest amongst those fishing. In Denmark, the small number of generalist fishermen get the highest benefit. In Finland results are mixed but sports fishermen benefit on average even more than generalists. Urban sports fishing raises the highest benefit in Iceland while in Norway the benefit is more equally spread, with occasional anglers and women reaping the least. In Sweden the mean benefit is the lowest in the Nordic countries but evenly distributed among categories of fishermen. In the Nordic countries combined, nationality explains willingness to pay as being Norwegian or Finnish increases benefit and being Icelandic reduces it. The non-use value of recreational fisheries was elicited through posing questions on willingness to pay for the preservation of the existence of current fish stocks and current quality of recreational fishing to persons participating in fishing or

Correspondence and requests on access to original data: Anna-Liisa Toivonen, Finnish Game and Fisheries Research Institute, POB 6, FIN-00721 Helsinki, Finland (e-mail: anna-liisa.toivonen@rktl.fi).

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enjoying the benefits derived from it. For those not fishing or people in general, the power of the models to explain willingness to pay for the existence of recreational fisheries was very weak. The benefit, i.e. willingness to pay, is higher if somebody in the household fishes. Educated, young, urban, well-off citizens also put value on the non-use of the resource.

KEYWORDS: contingent valuation, economic value, general linear models, Nordic countries, recreational fishing.

Introduction

The economic importance of recreational fisheries has often been expressed through expenditure made by those who fish. When details of expenditure are known it is possible to calculate the economic impact of the activity on the local, regional or national economy (Riechers & Fedler 1996). This expenditure, however, does not measure the benefit of the activity. This expenditure is a cost to those fishing. The difference between what a commodity like recreational fisheries actually costs and what those fishing would be willing to pay for it, is theoretically defined as the consumer surplus and represents the net benefit, i.e. the net economic value, to those fishing The gross benefit includes both the commodities that are purchased and the consumer surplus.

To society, the economic value of a commodity is the net social benefit that comprises both consumer surplus and producer surplus. Where producer surplus is a part of the real market economy, the consumer surplus is the additional willingness to pay over and above the market expenditures. This hypothetical and potential market value has a number of implications to society. The market for recreational fisheries goods and services may potentially be able to capture part of the consumer surplus by selling more goods and services through the market. Furthermore, these benefits may serve as reference points for potential public spending on conservation, and restoration and management of the natural resources supporting the recreational fishery or infrastructure investments in this sector (e.g. access roads and service facilities).

One fundamental question when dealing with either private or publicly-owned resources, such as a recreational fishery, which is almost entirely publicly managed in the Nordic countries, is who pays the costs and who reaps the benefits of these resources. Economically, the costs and benefits of recreational activities are traceable in so far as they are born by or beneficial to participants in the market, and are represented by licence fees or other contributions to private or public coffers. The non-market costs and benefits are real to people experiencing and valuing the services of nature, although they are not directly accounted for.

The development of economic theory has provided a framework and some basic tools for the valuation of natural resources and their exploitation. These tools may be used for valuation of non-market goods where very different benefits are derived from specific activities, as with recreational fisheries. Conceptually, the total economic value of a resource comprises its use value and non-use value (Munasinghe 1992). Use values may be further broken down into the direct use value, the indirect use value and the option value. The categories of non-use value are existence value and bequest value. The total economic value of a fish stock in particular is explained by Navrud (2001). The total economic value of the environmental resource can be established by the contingent valuation method (CVM) that is widely used for valuing non-market goods and resources. The contingent valuation technique uses surveys to determine consumers' willingness to pay for protecting or improving environmental quality or services by creating hypothetical markets (Mitchell & Carson 1989).

To acquire comparable information, the economic value of recreational fisheries was measured in all five Nordic countries simultaneously with an identical mail survey (Toivonen, Tuunainen, Navrud, Roth, Bengtsson & Gudbergsson 1999). The main objective of this paper is to examine the factors affecting the willingness to pay for both the use and the non-use of recreational fisheries and answer the following questions: which demographic and fisheries-specific components determine the expenditure level and the willingness to pay for the non-market benefits? Who commands these benefits? What contributes to the differences between the Nordic countries?

Materials and methods

The benefits of recreational fisheries to participants and non-participants were assessed using a mail survey carried out between October 1999 and January 2000, as an updated application of the Dillman (1978) Total Design Method. The sample size was 25 000 Nordic citizens randomly selected from the respective national

population registers. The overall response rate of the survey was 45.8%. The details of the survey and the representativeness of the data are described by Roth, Toivonen, Navrud, Bengtsson, Gudbergsson, Tuunainen, Appelblad & Weissglas (2001). The mean and aggregate fishing expenses and willingness to pay are presented in national currencies by Toivonen, Appelblad, Bengtsson, Geertz-Hansen, Gudbergsson, Kristofersson, Kyrkjebø, Navrud, Roth, Tuunainen & Weissglas (2000). For the present study the Organisation for Economic Co-operation and Development (OECD) purchasing power parities of 1999 were used to convert the five national currencies to US dollars.

In the survey, annual fishing expenditure was requested. Participants were also asked how much more, over and above actual expenditure, they would be willing to pay until it would become too expensive and they would stop fishing. Both fishermen and non-fishermen were asked how much they would be willing to pay for preserving the current fish stocks and current quality of recreational fishing. The sampling unit and the statistical unit of the survey was the person who received the questionnaire. In explaining personal fishing expenditure and willingness to pay, however, characteristics of the household, like number of fishing household members (FHHMEMB) and household income (HHINC), were relevant.

To avoid overlap, two approaches were used to determine the total economic value, knowing that both may result in underestimates. The use value was measured as the aggregate amount of how much more over and above fishing expenses fishermen would be willing to pay for their 12 months fishing experience (Table 1). This was added to the aggregate amount non-fishermen are willing to pay annually for the existence of freshwater fish stocks and recreational fishing possibilities. The sum of the two aggregate estimates includes use value of fishermen and non-use value to the non-fishermen, but partly excludes the non-use value to fishermen. Therefore it was compared with the aggregated estimate of what people in general (both fishermen and non-fishermen) are willing to pay for the existence of freshwater fish stocks and recreational fishing possibilities. This again may be an underestimate because it, at least partly, excludes the use-value to fishery users.

The mean expenditure (FEXPENS), and willingness to pay over and above what the fishermen already spent on fishing (use-value) (WTP-F) as well as non-use value for both non-fishermen and 'all' (WTP-NF and WTP-ALL) for individual respondents vary between countries (Table 2). General linear models (GLMs) were applied to the data for multiple regres-

Table 1. Fishermen's annual fishing expenses and components of the total economic value, aggregate willingness to pay (WTP) in million US dollars, two estimates

		Use value	Non-use value	Total economic value	
	Fishermen's annual fishing expenses (million US$)	Fishermen's extra WTP for their fishing experience (million US$)	Non-fishermen's WTP for current state of fish stocks and current quality of recreational fisheries (million US$)	Use value + non-use value (million US$)	Fishermen's and non-fishermen's WTP for current state of fish stocks and current quality of recreational fisheries (million US$)
Denmark	60	29	254	283	322
Finland	201	82	93	176	178
Iceland	23	7	15	22	25
Norway	193	106	87	193	196
Sweden	281	106	173	279	306

Table 2. Means and confidence limits of the dependent variables in the models

	FEXPENS			WTP-F			WTP-NF			WTP-ALL		
	Mean (US$)	95% CL (%)	*n*	Mean (US$)	95% CL (%)	*n*	Mean (US$)	95% CL (%)	*n*	Mean (US$)	95% CL (%)	*n*
Denmark	135.32	26	534	71.27	27	484	86.85	11	1697	96.06	10	2214
Finland	153.44	11	1183	73.16	11	1013	48.17	14	1193	54.50	8	2399
Iceland	418.49	18	262	139.78	23	237	134.41	36	537	148.56	23	794
Norway	139.78	9	1108	82.40	13	1026	63.78	14	958	71.76	9	2059
Sweden	151.90	13	1179	56.46	21	1192	49.49	10	2028	56.38	8	3256

FEXPENS, annual fishing expenses, US$ (1999 prices); WTP-F, use-value for fishermen, US$ (1999 prices); WTP-NF, non-use value of non-fishermen, US$ (1999 prices); WTP-ALL, use and non-use value of fishermen and non-use value of non-fishermen, US$ (1999 prices).

sion to determine which factors, if any, explain people's fishing expenditure and willingness to pay for recreational fisheries. In the models, the value of one dependent variable was described in terms of one or more independent variables. The GLM handles classification variables, which have discrete levels, as well as continuous variables. Categorical and linear independent variables were reductively chosen so that their *P*-values were significant ($P < 0.05$). Coefficient estimates were run with SAS statistical software and Systat statistical software was used for double-checking the models and for graphical display of the data.

The issue of multicollinearity often arises in multiple regression studies (Walsh 1986). In explaining the dependent variable, mutually highly correlated independent variables may lose their explanatory power. For example, HHINC comprises personal income (PINC) and other income (OINC) and therefore the components easily correlate with the total. The Johnston test suggests that all independent variables with an absolute value of correlation coefficient between 0.8 and 1 are suspect of multicollinearity. When two independent variables in a model were found to correlate strongly, the less significant was removed from the model.

To overcome the limitations of linear regression analysis, some apparently non-linear relationships were fitted to the models using logarithmic transformations (Dougherty 1992). The logarithmic transformation of both the independent and dependent variables simplifies the interpretation of the results. The coefficients b_j may then be interpreted directly as the elasticity.

For all models, histograms of residuals were plotted, and residuals were also plotted against predicted values (Fig. 1). The distribution of the residuals appeared to be reasonably normal in the case of fishermen's expenditure. Residuals against predicted values gave striped plots which illustrates the tendency of respondents to state their expenses and, even more so, to state their willingness to pay in round figures.

Results

Private costs to fishermen (annual expenses) and the estimated benefit of total use and non-use values to fishermen and non-fishermen respectively (Table 1) show that a very large part of the benefit is reaped by non-fishermen, although this figure reflects differences in how many people actively participate in recreational fishery between countries. Denmark, with the lowest participation rate, has the largest benefits from the existence value elicited by non-fishermen's willingness to pay for conserving the resource. The economic values measured in the contingent valuation survey revealed which components determine the level of expenditure, the willingness to pay by both fishermen and non-fishermen, and also about an overall model relevant to all Nordic countries (Tables 3–7).

All national models for fishing expenditure were fitted to double-log GLMs (Table 3). The explanatory power of the models varied between 35.6 and 46.1%. In explaining the fishing expenditure, the type of recreational fishermen is a powerful categorical variable in all countries except Norway. Gender is significant in all countries except Iceland. Men spend significantly more money on recreational fishing than women. Residential environment, however, is only included in the models for Iceland and Sweden. In Iceland rural households spend significantly lower amounts on recreational fishing than semi-urban or urban households. The logarithm of fishing days (FD) is included in every model. The hypothesis that expenditure level rises with number of FD is supported by data from Denmark, Finland, Norway and Sweden. The interaction of log (FD) and type of recreational fishing participant proved to be the only significant interaction term and it is included in the Swedish model. None of the three logarithmic income variables is significant for Iceland, whereas in all other countries at least one income variable is significant in the model. This is probably because recreational fishing is very

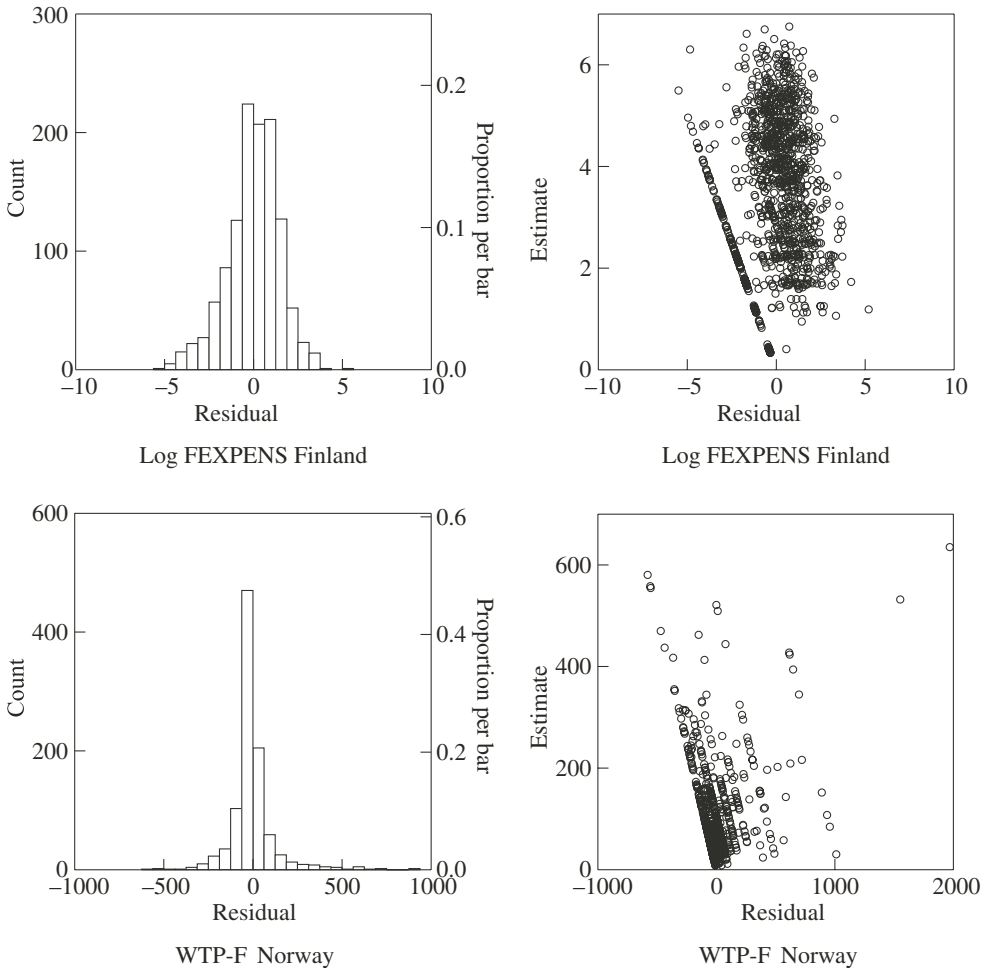

Figure 1. Examples of histograms of residuals distribution and scatter plots of residuals against predicted. Upper graphs from Finnish data presenting residuals of logarithmic total fishing expenditures, lower graphs form Norwegian data presenting residuals of fishermen's additional willingness to pay for the same fishing experience.

expensive in Iceland and cheap alternatives are few. Age is significant only in Sweden where the data show that the older the person the higher the spending. The number of fishing family members was significant in Denmark and Norway: the more persons fishing in the family, the higher the personal fishing expenditure.

The model for net benefit (additional willingness to pay) (Table 4) elicits the use-value fishermen establish when faced with a hypothetical market situation. The explanatory and significant parameters are few but show a very uniform valuation across the active recreational fishing population. Except for Denmark, the explanatory power is fairly low, which is common in contingent valuation surveys. Cummings, Brookshire & Schulze (1986) discussed the accuracy of CVM-measures, and suggested a confidence interval of ± 50–100% on CVM-measures, because of the inherent inaccuracy of the method. With this in mind, the models show much lower r^2 – explanatory power – than similar expenditures with higher expected accuracy of the underlying data.

All national models for fishermen's net benefit (additional willingness to pay) were fitted to a full linear GLM and all contained a constant (Table 4). The only significant categorical variables were type of participant in recreational fishing in Finland and residential environment in Iceland. Generalists and sports fishermen expressed a significantly higher willingness to pay than occasional anglers and household fishermen in Finland. In Iceland, urban dwellers expressed a significantly higher willingness to pay than semi-urban or rural households. Fishing expenditure is the best predictor for additional willingness to pay and it is included in every model. The more they spend, the

Table 3. Models for fishing expenditure and coefficients b_i

Log FEXPENS	Denmark	Finland	Iceland	Norway	Sweden
RF					
Occasional	0.384 (1.57)	−0.834 (−4.94)***	0.675 (1.78)		0.637 (1.76)
Household	−0.910 (−2.44)*	−0.669 (−3.61)***	−0.104 (−0.17)		−0.797 (−1.28)
Sports	0.673 (2.42)*	0.119 (0.72)	1.337 (3.80)***		3.088 (5.77)***
Generalist	0.000	0.000	0.000		0.000
Gender					
Female	−0.385 (−2.49)*	−0.538 (−5.39)***		−0.610 (−6.02)***	−0.464 (−4.68)***
Male	0.000	0.000		0.000	0.000
RENV					
Rural			−1.175 (−3.37)***		−0.265 (−2.25)*
Urban			0.070 (0.30)		−0.265 (−2.47)*
Semi-urban			0.000		0.000
RF×Log FD					
Occasional					−0.519 (−3.47)***
Household					0.151 (0.57)
Sports					−0.692 (−3.90)***
Generalist					0.000
Log FD	1.163 (18.45)***	0.883 (16.82)***	1.240 (7.82)***	1.107 (20.52)***	0.992 (8.42)***
Log PINC		0.060 (2.71)**		0.308 (4.06)***	
Log OINC				0.210 (2.67)**	
Log HHINC	0.559 (5.71)***				0.179 (2.74)**
AGE					0.009 (2.76)**
FHHMEMB	0.136 (2.25)*			0.108 (2.61)**	
Constant	−5.094 (−4.66)***	1.698 (5.58)***	1.825 (3.44)***	−1.908 (−2.38)*	−0.567 (−0.75)
r^2 Adjusted	0.461	0.426	0.356	0.383	0.441
n	501	1163	261	1062	1120

t-Statistics appear in parentheses below the parameter estimates and the significance is denoted as * $P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$. FEXPENS, annual fishing expenses; RF, recreational fishermen; RENV, residental environment; FD, fishing days; PINC, personal income; OINC, other income; HHINC, household income; FHHMEMB, fishing household members.

more they are willing to pay over and above what they have already spent. In all countries but Denmark one of the three income variables is significant. All have positive indications of higher willingness to pay for higher income levels. The number of FD has predictive power for additional willingness to pay in Iceland and Norway. This follows normal expectations that the marginal value of an extra FD is positive in the hypothetical market. Age has a negative impact on additional willingness to pay in Sweden: older fishermen are less willing to pay. The interaction of type of recreational fisher and number of FD in Finland is the only significant interaction term.

Models for non-fishermen willingness to pay to maintain the current state of fish stocks and current quality of recreational fisheries (Table 5) still include a relation to fishing in Iceland, Norway and Sweden: the existence of somebody else in the household fishing gives a higher willingness to pay by non-participants. Years of education is significant in every country, as higher education gives higher willingness to pay, and gender is also significant in Denmark where women's willingness to pay is higher than that of men which is counter to the expenditure pattern. Only in Iceland is no income variable significant. The correlation coefficients are as equally low as the ones for the whole population and show an explanatory level of only 4–8%.

The whole population's willingness to pay to maintain the current state of fish stocks and current quality of recreational fisheries (Table 6) was measured by using a scenario in the survey. The model was a double logarithmic GLM. Whether the respondent was a participant or had a family member who fished turned out to be a significant categorical variable in every country, as was duration of education. Fishermen show a higher willingness to pay for the state of the fish stocks than respondents who do not fish and have nobody else in the family fishing. It is possible that more than the non-use value is included in this figure, as the fishermen might have included some use-value in their answer to this question. Likewise, respondents with higher levels of education give higher willingness to pay. Gender was only significant in Denmark

Table 4. Models for net benefit (additional willingness to pay) and coefficients b_i

WTP-F	Denmark	Finland	Iceland	Norway	Sweden
RF					
Occasional		−84.758 (−4.43)***			
Household		−82.542 (−3.37)***			
Sports		−24.714 (−1.15)			
Generalist		0.000			
RENV					
Rural			3.280 (0.06)		
Urban			96.376 (2.87)**		
Semi-urban			0.000		
RF×FD					
Occasional		1.562 (2.44)*			
Household		0.867 (1.81)			
Sports		1.218 (2.74)**			
Generalist		0.000			
FEXPENS	0.393 (27.48)***	0.075 (4.69)***	0.114 (4.53)***	0.327 (13.45)***	0.258 (13.59)***
FD		−0.435 (−1.35)	3.575 (2.28)*	0.969 (2.73)**	
HHINC					0.001 (3.57)***
PINC		0.002 (6.56)***	0.002 (2.76)**	0.001 (2.24)*	
Age					−1.149 (−2.51)*
Constant	17.740 (2.75)**	79.679 (4.31)***	−55.789 (−1.58)	6.611 (0.63)	36.250 (1.72)
r^2 Adjusted	0.611	0.169	0.220	0.222	0.160
n	481	972	226	993	1065

t-Statistics appear in parentheses below the parameter estimates and the significance is denoted as *$P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$. RF, recreational fishermen; RENV, residental environment; FD, fishing days; FEXPENS, annual fishing expenses; HHINC, household income; PINC, personal income.

Table 5. Models for non-fishermen's willingness to pay for current state of fish stocks and current quality of recreational fisheries and coefficients b_i

Log WTP-NF non-fishermen	Denmark	Finland	Iceland	Norway	Sweden
RFHH					
No but somebody in household (HH) fishes		0.409 (1.97)*	0.290 (2.48)*	0.247 (3.01)**	
No nobody in HH fishes		0.000	0.000	0.000	
RENV					
Rural	−0.199 (−1.81)	0.026 (0.19)			
Urban	0.273 (2.42)*	0.270 (2.70)*			
Semi-urban	0.000	0.000			
Gender					
Female	0.223 (2.44)*				
Male	0.000				
YOE					
< 11	−0.381 (−3.44)***	−0.481 (−3.57)***	−0.048 (−3.98)***	−1.011 (−7.42)***	−0.498 (−4.97)***
11–13	−0.201 (−1.72)	−0.012 (−0.12)	−0.622 (−3.03)**	−0.482 (−3.72)***	−0.232 (−2.73)**
> 13	0.000	0.000	0.000	0.000	0.000
Log PINC				0.072 (2.97)**	0.062 (3.54)***
Log HHINC	0.333 (4.57)***	0.196 (2.98)**			0.224 (3.81)***
Age	−0.007 (−2.01)*	−0.009 (−2.32)*		−0.009 (−2.27)*	
Constant	0.114 (0.14)	1.314 (1.93)	3.480 (26.08)***	3.208 (11.07)***	0.170 (0.29)
r^2 Adjusted	0.038	0.046	0.037	0.082	0.041
n	1529	1103	531	929	1875

t-Statistics appear in parentheses below the parameter estimates and the significance is denoted as * $P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$.

RENV, residental environment; PINC, personal income; HHINC, household income.

Table 6. Models for whole population's willingness to pay for current state of fish stocks and current quality of recreational fisheries and coefficients b_i

Log WTP-ALL	Denmark	Finland	Iceland	Norway	Sweden
RFHH					
Fisherman	0.595 (4.93)***	0.501 (7.24)***	0.877 (5.24)***	0.325 (3.94)***	0.424 (6.55)***
No but somebody in household (HH) fishes	−0.060 (−0.53)	0.101 (1.12)	0.368 (1.81)	0.267 (2.34)*	0.232 (2.90)**
No nobody in HH fishes	0.000	0.000	0.000	0.000	0.000
RENV					
Rural	−0.138 (−1.44)	0.021 (0.25)			
Urban	0.278 (2.82)**	0.175 (2.35)*			
Semi-urban	0.000	0.000			
Gender					
Female	0.207 (2.50)*				
Male	0.000				
YOE					
< 11	−0.367 (−3.82)***	−0.336 (−3.72)***	−0.759 (−3.63)***	−0.695 (−7.35)***	−0.310 (−3.62)***
11–13	−0.228 (−2.24)*	−0.054 (−0.74)	−0.477 (−2.87)**	−0.259 (−2.96)**	−0.185 (−2.77)**
> 13	0.000	0.000	0.000	0.000	0.000
Log HHINC	0.334 (5.21)***	0.235 (5.23)***			0.196 (4.26)***
Log PINC				0.059 (3.29)**	0.058 (4.05)***
Age	−0.010 (−3.38)***	−0.011 (−4.42)***		−0.010 (−3.50)***	−0.010 (−4.04)***
Constant	0.247 (0.35)	1.011 (2.18)*	3.405 (27.67)***	3.210 (14.84)***	0.848 (1.86)
r^2 Adjusted	0.049	0.065	0.049	0.051	0.045
n	2018	2256	784	2011	3044

t-Statistics appear in parentheses below the parameter estimates and the significance is denoted as * $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$. RENV, residental environment; HHINC, household income; PINC, personal income.

(women have higher willingness to pay than men), and income and age were significant elsewhere but in Iceland. No interactions were significant. The explanatory power of the models is low, ($r^2 < 0.1$).

When the data from all five Nordic countries are integrated (Table 7), nationality can be used as a categorical variable and it also proves to be significantly explanatory. When Sweden is considered as 'the standard', the Icelanders and Danes spend significantly more on fishing expenses. This expenditure by the Icelanders and Danes is not strictly by choice. Market pricing of riparian owners' fishing rights captures a higher share of consumer surplus – which makes it more expensive to fish in private waters. Additional willingness to pay differs from that of the Swedes in both Norway and Finland. This is consistent with the results for fishing expenditure, as consumer surplus, i.e. willingness to pay over and above what is already paid, is significantly higher in Norway and Finland where market forces have not captured as much of the consumer surplus, as free access to recreational fishing is still prevalent in most waters. The willingness to pay to maintain the current state of fish stocks and current quality of recreational fisheries by non-participants was higher in Denmark and Norway than Sweden, and all inhabitants' willingness to pay was higher in Denmark, Norway and Iceland than Sweden. No other categorical or linear variable is present in all models.

Gender is significant in explaining fishing expenses in that females have significantly lower costs and significantly higher willingness to pay. Those who fish, or who live in households where there are fishermen, are more likely to express a willingness to pay to maintain the current state of fish stocks and current quality of recreational fisheries. When generalists are considered 'the standard', both household fishermen and occasional anglers are less willing to pay with respect to both fishing expenses and additional willingness to pay for the same fishing experience. Sports fishermen differ from generalists because they show a greater willingness to pay. Neither residential environment nor years of education play a part in fishermen's expenses or additional willingness to pay. Urban and more educated people are more willing to pay to maintain the current state of fish stocks and current quality of recreational fisheries. The number of FD, PINC and number of FHHMEMB explain fishing expenses. Additional willingness to pay for the same experiences is best explained by fishing expenses and PINC. Household income and number of FHHMEMB have a positive

Table 7. Models and coefficients b_i for fishing expenses and the components of total economic value of recreational fisheries in the Nordic countries combined

Log WTP-Nordic	Log FEXPENS	WTP-F	Log WTP-NF	Log WTP-ALL
CC				
Denmark	0.335 (3.71)***	11.937 (1.13)	0.452 (7.76)***	0.454 (9.41)***
Finland	−0.021 (−0.34)	18.022 (2.48)*	0.031 (0.47)	0.089 (1.91)
Iceland	1.448 (6.20)***	−1.391 (−0.05)	0.228 (1.11)	0.353 (2.23)*
Norway	0.099 (1.66)	19.039 (2.70)**	0.209 (3.03)**	0.140 (2.94)**
Sweden	0.000	0.000	0.000	0.000
Gender				
Female	−0.559 (−10.33)***		0.175 (3.79)***	
Male	0.000		0.000	
RFHH				
Fisherman				0.360 (7.01)***
No but somebody in household (HH) fishes				0.149 (2.83)*
No nobody in HH fishes				0.000
RF				
Occasional	−0.427 (−5.31)***	−23.971 (−2.72)**		
Household	−0.380 (−3.35)***	−23.127 (−1.67)		
Sports	0.445 (5.40)***	0.039 (0.00)		
Generalist	0.000	0.000		
RENV				
Rural			−0.110 (−1.80)	−0.068 (−1.51)
Urban			0.107 (2.02)*	0.080 (2.01)*
Semi-urban			0.000	0.000
YOE				
< 11 years			−0.494 (−8.19)***	−0.395 (−8.64)***
11–13 years			−0.227 (−4.27)***	−0.186 (−4.68)***
> 13 years			0.000	0.000
log FD				
(fishing days, logarithmic)	0.904 (30.57)***			
FEXPENS				
(fishing expenses, US$)		0.250 (25.93)***		
PINC				
(personal income, US$)		0.001 (5.19)***		
Log PINC				
(personal income, logarithmic)	0.063 (5.22)***			
Log HHINC				
(household income, logarithmic)			0.226 (6.52)***	0.196 (7.52)***
Log OINC				
(other income, logarithmic)			−0.593 (−5.71)***	−0.052 (−6.36)***
FHHMEMB				
(fishing household members)	0.090 (4.26)***		0.127 (4.51)***	0.049 (2.48)*
Age				
(years)		−0.546 (−2.53)*	−0.007 (−4.04)***	−0.009 (−7.28)***
Constant	1.162 (7.08)***	37.899 (2.97)**	0.952 (2.59)**	1.429 (5.23)***
r^2 Adjusted	0.393	0.200	0.057	0.053
n	4080	3746	5552	9595

t-Statistics appear in parentheses below the parameter estimates and the significance is denoted as * $P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$. RF, recreational fishermen; RENV, residental environment.

effect on willingness to pay. Young people are in general willing to pay more than old people. The explanatory power of the models is better, 39 and 20%, for the fishermen only and weak, about 5%, for non-participants and the total Nordic population.

Discussion

The models show the determinants of expenditure and willingness to pay for the actual use of the resource as well as conservation issues. Both demographic and

fisheries-related components determine the level of benefits. The inherent result illustrated in these models is that the people who value recreational fisheries the highest also derive the highest benefit from the resource.

The explanatory power of the models is higher in Denmark than elsewhere. The Danish model for fishing expenditure has both gender and type of recreational fisherman as categorical variables. The model for additional willingness to pay has only one explanatory variable, fishing expenses, with highest explanatory power among all models. This may arise because there are not very many recreational fishermen in Denmark. The vast majority of them are occasional anglers and the true keen hobbyists are very few. Males have a higher profile in general than females. Additionally, female anglers are usually not the only one in the family who fishes. Generalists and sports fishermen have the highest fishing expenditure (Table 8). These groups of fishermen account for 42% of the aggregate additional willingness to pay. Occasional anglers form the biggest group and make up 57% of the aggregate additional willingness to pay. For marketing, however, the sports fishermen and generalists are an easier target. An earlier survey conducted on recreational fisheries in Denmark (Bohn & Roth 1997) showed that 13% of all recreational fishermen are members of an angling association and that recreational fishermen in general are not keen newspaper readers. This increases the importance of angling associations as key information channels in focusing marketing attempts to the most promising groups of fishermen.

Official statistics on recreational fisheries are published semi-annually in Finland and 82% of fishermen class fishing as just a hobby among others, as opposed to 18% of fishermen stating that fishing is their most important hobby (Recreational Fishing 2000 2002). Occasional anglers do not spend much money on fishing but they fish so seldom that the price of a FD is relatively high (Table 9). Their additional willingness to pay is low, which is in accordance to the fishing expenditure. In relation to their fishing expenditure, however, their additional willingness to pay is highest of all categories. The cost of occasionally participating in the hobby is very marginal. This is a positive signal to administrative authorities and to the business community. The economic barriers to participation are negligible. Household fishery participants are more catch oriented and clearly aware of the costs. They can be characterized as cost effective. Their price for a day's fishing is only half that of a sports angler. The additional willingness to pay is also not very high. It is absolutely higher than that of occasional anglers but relatively low compared with fishing expenditure. Generalists and sports fishermen spend most money on their activity. In regard to the price of a FD, generalists are more price effective than sports fishermen but on the whole, their mean expenditure is the highest.

Men and women act very consistently over expenditure and additional willingness to pay. The 80/20 rule applies to both amounts, 20% of fishermen account for 80% of the aggregate figures. A fundamental difference lies in the number of annual FD between the categories. If it was not for the household users who are conscientious and frequently fish, the correlation between number of FD and fishing expenses would be even higher, and the explanatory power of the model would probably be better.

Iceland differs substantially from the other Nordic countries. First, the actual cost of recreational fishing is rather high and demand is primarily for sports fishing

Table 8. Characteristics of relevant variables in the models for Denmark

	Gender		Type			
	Male	Female	Sports	Household	Generalist	Occasional
Percentage	79	21	13	4	7	76
Mean annual fishing expenditure, US$	158	69	292	229	408	86
Percentage of aggregate actual fishing expenditure	90	10	29	5	16	51
Mean net benefit (additional willingness to pay), US$	78	47	143	27	185	53
Percentage of aggregate additional willingness to pay	88	12	28	1	14	57
WTP/expenditure, %	49	68	49	12	45	62
Mean price of fishing day, US$	13.7	12.8	16.1	7.1	9.9	13.8
Mean number of fishing days	13.7	6.9	20.3	31.7	29.2	8.4
Percentage of males			85	96	89	78
Mean number of fishing household members	1.52	2.10	1.48	1.22	1.47	1.69
Mean annual household income, US$	51 900	46 100	49 800	51 600	49 500	51 100

Table 9. Characteristics of relevant variables in the models for Finland

	Gender		Type			
	Male	Female	Sports	Household	Generalist	Occasional
Percentage	65	35	20	13	11	56
Mean annual fishing expenditure, US$	187	86	283	147	342	68
Percentage of aggregate actual fishing expenditure	81	19	38	11	24	27
Mean net benefit (additional willingness to pay), US$	89	41	133	58	125	43
Percentage of aggregate additional willingness to pay	81	19	38	9	20	33
WTP/expenditure, %	48	48	48	40	36	64
Mean price of fishing day, US$	11.2	9.1	14.1	6.7	10.4	10.1
Mean number of fishing days	21.7	14.2	27.7	33.7	41.2	8.1
Percentage of males			84	68	84	53
Mean annual personal income, US$	18 600	14 100	17 800	17 100	17 700	16 600

targeting high value species in rivers. The general population has access to commercially caught fish at a higher level than that in the other Nordic countries as the activity level in this sector is higher. Relatively more people are dependent on fishing for their living than in other Nordic countries. Although sports fishing is expensive, the income variables are not significant in the models for Iceland. This is because only fairly well-off people can afford to fish, and there is no variation in the data to explain how income influences the actual spending and the willingness to pay.

In Iceland type of recreational fisherman and residential environment are significant explanatory categories. Sport fishing dominates the economic scene with a major share of aggregate fishing expenses, and aggregate additional willingness to pay (Table 10). Even more clear is the dominance of urban participants. Generalists are cost effective in having the most FD on average for a considerably low price. Semi-urban fishermen have the highest expenses but a low number of FD.

Sport fishing is a common way for firms in Iceland to entertain customers. The firms can deduct the costs from their tax liabilities. Therefore, the estimate of annual expenses of sports fishermen is probably an underestimate. Sport fishing also has special status among youngsters. This may be why age does not explain the level of expenditure on fishing. Both household and PINC are significantly lower in rural areas than in semi-urban or urban areas for all citizens in Iceland. This is also true for those fishing, but the difference is not significant.

In Norway gender appears to be the only relevant categorical variable that explains fishing expenditures. Male and female categories have different economic profiles (Table 11). The type of recreational fisherman is not a significant variable, but is very close to being one. Sport fishermen, household fishermen and generalists all have very similar profiles, the only difference is for occasional anglers. Occasional anglers and females have many common characteristics.

One of the characteristic features of recreational fishing in Norway is that sea fishing is far more common than freshwater fishing. The majority of FD, 65%, is spent at sea or in the coastal waters while fishing in lakes only constitutes 26% and rivers 18% of the total. All categories fish mostly at sea, but sport fishermen favour fresh waters, i.e. rivers and lakes.

Table 10. Characteristics of relevant variables in the models for Iceland

	Type				Residential environment		
	Sports	Household	Generalist	Occasional	Rural	Urban	Semi
Percentage	38	4	11	47	12	61	27
Mean annual fishing expenditure, US$	754	183	273	209	255	444	462
Percentage of aggregate fishing expenditure	65	2	9	25	7	64	29
Mean net benefit (additional willingness to pay), US$	190	111	169	96	78	179	79
Percentage of aggregate additional willingness to pay	52	3	13	33	6	87	15
WTP/expenditure %	25	60	62	46	31	40	17
Mean price of fishing day, US$	79	25	26	56	32	67	59
Mean number of fishing days	10.8	5.6	14.5	3.9	10.3	7.3	7.3

Table 11. Characteristics of relevant variables in the models for Norway

	Gender		Type			
	Male	Female	Sports	Household	Generalist	Occasional
Percentage	64	36	25	5	14	56
Mean annual fishing expenditure, US$	173	83	223	191	208	79
Mean net benefit (additional willingness to pay), US$	102	53	126	120	120	53
WTP/expenditure, %	59	64	57	63	58	67
Percentage of aggregate additional willingness to pay	80	20	40	7	21	32
Mean price of fishing day, US$	12.8	10.7	11.8	21.7	12.3	11.0
Mean number of fishing days	16.3	8.6	21.6	17.9	20.0	7.6
Percentage of males			81	80	75	55
Number of fishing household members	1.76	1.86	1.77	1.79	2.05	1.74
Mean annual personal income, US$	30 100	20 000	27 200	23 900	30 300	25 800
Mean annual other income, US$	17 000	25 300	17 600	21 900	21 200	20 100

Aas (1996) cited several surveys from 1970 to 1993 in Norway. The overall fishing participation in 1993 was 56%, and 66% of non-participants are females. Less than half (43%) are occasional anglers, the remaining 57% are categorized as frequent anglers because they go fishing more than five times annually. Half the occasional anglers and a quarter of the frequent anglers are women. Sea fishing is more common than freshwater fishing in all surveys cited.

There are three relevant categorical variables that help explain fishing expenditure in Sweden (Table 12). Females hold a low profile economically in recreational fisheries in Sweden. Occasional anglers spend very little money on the hobby but their additional willingness to pay is relatively high. Household fishermen are older in general than in any other category and their HHINC is the highest. Sport fishermen spend most and fish longer (prerequisite of the post-stratified category). The difference to occasional anglers is nearly tenfold. Unlike in Iceland, urban fishermen spend the least money on fishing in Sweden. The price of one FD is highest for the urban fishermen because of the low number of FD.

The additional willingness to pay, and the net benefit of recreational fisheries are relatively low in Sweden. This can be partly explained by the so-called historical common right (everyman's right) to fish. In the former Danish counties on the west and south coasts of Sweden the right to fish for subsistence was 'given' to the citizens. When fishing no longer was linked to livelihood, the free fishing right was further developed and modernised. This common right is applied in all Nordic countries to a greater extent than in most other countries and means public access to private land and waters with rules of what one may and may not do. In Sweden people are well aware of their right and strongly associate it to freedom from payment along the coasts and in the five largest lakes. Except for this case, fishing is not included in the common right in Sweden.

According to the latest official statistics for the Recreational Fishing in Sweden (2000), the number of

Table 12. Characteristics of relevant variables in the models for Sweden

	Gender		Type				Residential environment		
	Male	Female	Sports	Household	Generalist	Occasional	Rural	Urban	Semi
Percentage	71	29	24	5	14	57	29	44	27
Mean annual fishing expenditure, US$	183	89	367	175	199	39	152	144	176
Mean net benefit (additional willingness to pay), US$	61	39	108	20	78	28	45	57	61
WTP/expenditure, %	33	44	29	11	39	72	30	40	35
Percentage of aggregate additional WTP	78	22	48	2	21	29	24	45	31
Percentage of males			79	57	78	64	72	68	71
Mean price of fishing day, US$	14.1	8.8	17.7	12.3	11.6	10.5	9.3	14.0	13.6
Mean number of fishing days	14.7	9.7	27.1	10.6	20.7	5.5	16.8	10.8	13.1
Mean age	43.9	41.5	43	50.3	45.4	42.0	43.4	42.0	44.7
Mean household income, US$	39 100	35 300	35 500	48 100	41 600	37 100	36 700	39 000	37 500

people that declare they are interested in fishing has increased from the previous surveys from 48 to 55%. However, the actual participation is 34%. Half of the population considers fishing unimportant and fishing is a very important hobby for 29% of those who claim some importance.

Conclusions

Icelandic fishermen have by far the largest expenses compared with those in the other Nordic countries. If Sweden is considered the 'standard', expenses are significantly higher in Denmark. In all Nordic countries combined, sports fishermen spend the most on recreational fisheries. Expenditure elasticity is positive in relation to number of FD, PINC and number of FHHMEMB. Money used on recreational fishing, including all commodities and services, is part of the market. The producer surplus, or business profit, is one part of the total economic value of recreational fisheries. The other part makes up consumer surplus, net benefit, i.e. consumers' willingness to pay more than the market price.

In the Nordic countries, recreational fishermen derive most consumer surplus in Norway and Finland and least in Iceland. High profiles can be found among sports fishermen and generalists in Finland; in Norway it is more even between categories. The net benefit is increased by involving other family members in fishing. The vast majority of occasional anglers is not willing to pay any extra, not to mention the household fishermen. Consumer surplus goes to the young, urban, educated and well-off. These are the characteristics of fishermen who are most willing to pay extra for their hobby.

Even non-participants are willing to pay for conservation of the present fish stocks and present quality of recreational fisheries, even if it represents non-use value. Highest consumer surplus emerges in Denmark and Norway, whereas it is very scarce in Sweden. In Denmark it is the non-fishing, young, urban women who generate consumer surplus. In Norway, young, rich and educated persons with somebody else in the household fishing, generate the highest net benefit.

When all Nordic citizens are considered, regardless of relationship to fishing, the highest consumer surplus occurs in Denmark and Norway, and significantly higher also in Iceland compared with Sweden and Finland. Country by country the highest consumer surplus originates, not surprisingly, from those who fish.

This result, as a stated preference by the informants of the survey, can be explained by making minor generalisation of the structure of national economy and environmental conditions. In Denmark the condition of fresh waters that are suitable for recreational fishing is threatened by eutrophication. Finland enjoys rich freshwater fishing opportunities, although these are not always very challenging. Waterways are not under any direct environmental threat. In Iceland fishing is a very important part of the national economy and therefore – even in connection with recreation – people in general are seriously responsible about the resource. This may be a sign of some hidden use or option value in their valuation. Also in Norway, fishing is historically an important part of the national economy – and not free from environmental threats. In these respects, Sweden is similar to Finland compared with other countries. In conclusion, the results support the use of CVM survey results in cost-benefit analyses on the economic viability of conservation projects and other public nature restoration projects where benefit of recreational fisheries occur.

Acknowledgments

The authors are grateful to the Nordic Council of Ministers, Ministry of Agriculture and Forestry (Finland), The Agricultural Productivity Fund (Iceland) and to the participating institutions, University of Southern Denmark, Danish Institute for Fisheries Research, Finnish Game and Fisheries Research Institute, Institute of Freshwater Fisheries (Iceland), Agricultural University of Norway, Directorate for Nature Management (Norway), National Board of Fisheries (Sweden) and Umeå University (Sweden). We also thank the rest of the project team – Peter Geertz-Hansen, Dadi Kristofersson, Hilde Kyrkjebø and Gösta Weissglas and Professor Peter Burbridge for valuable comments.

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Appendix 1. List of variables used in the models

Dependent variables	
Log FEXPENS	Total annual fishing expenditure, $, logarithmic
WTP-F	Fishermen's extra WTP for the same fishing experience, $
Log WTP-NF	Non-fishermen's WTP for current state of fish stocks and current quality of recreational fisheries, $, logarithmic
Log WTP-ALL	Fishermen and non-fishermen's WTP for current state of fish stocks and current quality of recreational fisheries, $, logarithmic
Independent variables	
Categorical	
RF	Type of recreational fishermen: occasional, household, sports, generalist
RFHH	Fishermanship: fishermen, no but somebody in household fishes, no nobody in household fishes
RENV	Residental environment: rural, urban, semi-urban
GENDER	Gender: male, female
YOE	Years of education: <11, 11–13, >13
Linear	
FEXPENS	Annual fishing expenses, $
FD	Number of fishing days
Log FD	Number of fishing days, logarithmic
AGE	Age, years
FHHMEMB	Fishing household members
PINC	Personal income, $
Log PINC	Personal income, $, logarithmic
OINC	Other income, $
Log OINC	Other income, $, logarithmic
HHINC	Household income, $
Log HHINC	Household income, $, logarithmic