

**Impact of recreational fishery
on the formal Danish economy**

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Abstract

This paper presents estimates of the economic impact of recreational fisheries on the formal economy of Denmark. It utilises primary data from a CVM (contingent valuation method)-mail survey conducted in 1999 in Denmark, Norway, Finland, Sweden and Iceland. The sample used in this paper covers 546 Danish respondents (recreational fishermen only). The questions on expenditure were asked in order to jog the memory of the respondents prior to the CVM questions in the form of willingness to pay questions. The annual mean amount spent on recreational fishery was estimated to be 1.170 DKK in national currency and the aggregate Danish expenditure was estimated to be 517 million DKK. The expenditure estimates from the original survey distributed on expenditure categories were used as the starting point of this study.

The estimation of the economic impact was done from the demand side using the Danish input-output tables. In the model each known expenditure category from the survey was allocated to a similar commodity group posting in the input output model nomenclature. As a result, the impact of expenditure on recreational fisheries activities on employment, import, indirect taxes and income was calculated.

Table of contents

1. Introduction	7
2. Methods and data.....	8
2.1. Survey	8
2.2. Data on total expenditure on recreational fishery.....	9
2.3. Description of the model	11
2.4. Distribution of the expenditure on expenditure groups	12
2.5. Estimation method using the input-output tables	14
3. Results and discussion.....	16
4. Discussion of the input-output method.....	20
5. Conclusions	21
6. References	23

1. Introduction¹

A large number of commercial activities in the service sector cannot easily be described and quantified in economic terms, and often these activities are not seen as a formal sector of the economy. Goods and services demanded in lieu of sports and hobby activities, however, do create employment and income to society. Recreational fishing is one of the activities, where the fulfilment of consumers' demand draws on a variety of different goods and services from numerous economic sectors. Hence recreational fishery as a product is a composite product and not a homogeneous one. Consequently the different parts of the product like transportation, lodging and licenses are not produced within a single production line – a condition that normally defines an industry (Smith, 1998; Tremblay, 1998). Therefore the traditional supply side approach cannot be used, and in order to estimate the economic impact of recreational fishery a demand side approach in the form of the input-output model has to be applied.

In Denmark our legal framework clearly differentiates between commercial and recreational fishery. In recent years commercial fishery in Denmark has had a decreasing trend both in value and on employment, but as a political factor the influence is still quite high. In contrast to commercial fishery recreational fishery is not given much attention, which in part may be explained by the difficulties in defining the concept and in the problems with estimating the impact of it. This paper aims at changing this disparity.

Looking at the definition of recreational fishery it is normal in Denmark to include three groups, namely angling, leisure fishing (household fishing) and fishing in “put and take” lakes. Angling means in this context fishing with light hand tools (rod and line), while leisure fishing means fishery with a restricted number of passive gears (nets or fish traps) in marine waters. Only riparian owners are allowed to use nets and traps in own fresh water like lakes and streams.

¹ We sincerely thank Anna-Liisa Toivonen and Ina Drejer for valuable comments on this paper.

The study is limited to recreational fishery by residents in Denmark. The economic impact of Danish residents fishing abroad is not included² nor are the foreign tourist anglers visiting Denmark. Actually the latter segment is given a higher and higher priority in Danish tourism development plans.

2. Methods and data

2.1. Survey

The data utilised in this study originate from a CVM-survey (Roth *et al*, 2001, Toivonen *et al*, 2000), which aimed at establishing the non-market value of recreational fishery in the Nordic Countries. The survey was a mail survey with a sample size of 25.192 of which 5.192 were Danish. The sample was drawn as a random sample from the Danish national population register (CPR). The response rate of the Danish sample was 46%, 2376 persons, of which 23% were recreational fishermen. Naturally only the fishermen, 546 respondents, answered the following question³ about fishing expenses:

“Approximately how much did you spend during the last 12 months on recreational fishing? Please fill in the form below. If you had no expense on an item, please write “0” Kr. DO NOT count the cost of items that last for many years, e.g. gear (rods, nets), fishing clothes and boats”.

The question specified 8 different expenditure categories, which are presented in the table 2.1 below.

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- 2 The questionnaire does not explicitly exclude costs of recreational fishery abroad, but the majority of recreational fishermen described themselves as occasional anglers indicating very local and sporadic fishing activity. Further the leisure/household fishermen cannot bring their hobby abroad. Left is the group of sports fishermen, which might have part of their costs associated with fishing abroad. This last marginal potential error is not taken into account.
 - 3 The questionnaire was translated in 5 different Nordic languages, the English version served as the reference.

The design of the question on expenses was chosen to jog the memory of the respondents before the contingent valuation question was posed.⁴ Utilising these results for the purpose of estimating the economic impact of recreational fishery on the formal economy was therefore not the focal point of the survey but may be seen as a by-product of a traditional CVM-design.

Socio-economic background data and statistical population data were used to calculate the weighting coefficients in the survey. The participation rate of the population to recreational fisheries was established from national sources (Bohn and Roth, 1997).

The results of the survey showed an annual mean expenditure of 1.170 DKK (about 156 Euro) per recreational fisher. According to the survey recreational fishermen in Denmark used an aggregate amount of 517 million DKK (about 68,9 mill. Euro) on recreational fishery in 1999.

2.2. Data on total expenditure on recreational fishery

The starting point of the estimation was the information on total expenditure on recreational fishery in Denmark in 1999 (Table 2.1).

Principally the collected data contained information on final demand of goods and services of the recreational fishermen as consumers. Only variable costs were involved. Long lasting items and investments like boats and fishing rods purchased before or after the recreational fishery were not part of the analysis. For two of the expenditure categories, fishing journals etc and licenses and annual membership fees, it could be argued that they also relate to demand before and after the activities in question. However, it may also be argued that licenses and membership fees are a prerequisite for actually engaging in an activity like recreational fishery. So even though the licenses etc were paid before the fish-

4 The contingent valuation question was: "What is the most you would almost certainly pay over and above of what you now spend before you would stop going to the fishing sites you now use?"

ery started the licenses were capitalised during the fishery. For fishing journals, books, videos, CD-ROM's the argument for including the expenditure is that it is difficult to know whether the commodities are purchased before, during or after the fishery and the purchase may be necessary in order to participate in the activity or it simply increases the experience of recreational fishing. A similar discussion of whether final and capital expenditure should be included in the estimations has taken place in relation to tourism (Boskin, 1996; Hansen & Jensen, 1996; Smith & Wilton, 1997). Further Toivonen *et al* (2000) argued that including the investments and allocating these as annual costs for recreational fisheries is difficult and the inconsistency, which may emerge, would weaken the results.

Table 2.1. The distribution of fishing expenditure in different categories

Expenditure category	%	DKK million
Automobile transportation to fishing site (fuel, rental cars, road tolls)	27	139,59
Boating (fuel, other operating expenses, rental costs etc.)	17	87,89
Other transportation to fishing site (ferry, air plane, train etc.)	13	67,21
Lodging	8	41,36
Licenses and annual membership fees	20	103,40
Fishing journals, books, videos, CD-ROMS....	4	20,68
Extraordinary food and drink expenses (above what you would have spent anyway)	8	41,36
Other expenses	3	15,51
Total	100	517,00

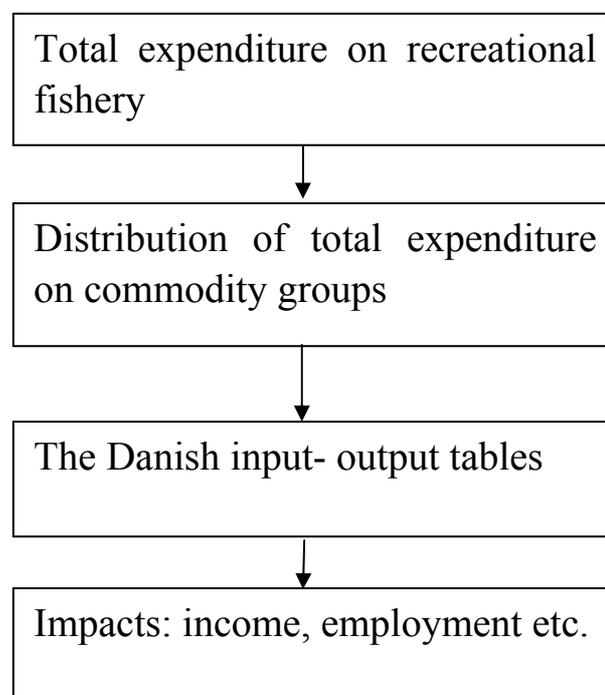
Source: L. Toivonen *et al*. Economic value of recreational fisheries in the Nordic countries. TemaNord 2000:604, Nordic Council of Ministers, Copenhagen, 2000.

2.3. Description of the model

An input-output model was used for estimating the impact of recreational fishery on the formal Danish economy. In the model it is possible to estimate the impact on employment, income, import, and indirect taxes. The basic principle of the model is shown in figure 2.1 and the four steps of the model are presented in more detail further on.

The demand driven model is used because recreational fishery has impacts not only on one sector of the economy, but on several. Like in the related research field, tourism, you may argue that the recreational fishery product is a composite product and not a homogeneous product. Input-output analysis is a well known approach in tourism (Hansen & Jensen, 1996; Fletcher, 1989), and it has also been used for analysing the impact of angling tourism in Southern Jutland, Denmark (Roth & Jensen, 1997). But before describing the input-output method in detail the next sub-section will describe how the data on expenditure are made in shape for estimation of the impacts.

Figure 2.1. The flow cart of the model



2.4. Distribution of the expenditure on expenditure groups

When the total expenditure and the distribution on expenditure categories are known it is possible to use this information in the input-output calculation. But first the expenditure categories have to be adjusted to correspond to the private consumption commodity groups in the Danish input-output tables. There are 72 commodity groups in the Danish input-output tables (Danmarks Statistik, 2000). Because the questionnaire only specified 8 expenditure categories, the private consumption commodity groups were aggregated specifically to fit the recreational fishery data (see table 2.2).

Table 2.2. Expenditure categories of recreational fishery and the respective commodity groups in the Danish input-output tables

Expenditure category in questionnaire	Commodity group in input-output table ^a	Recreational fishery consumption (DKK million)
1. Automobile transportation to fishing site (fuel, rental cars, road tolls)	Fuels and lubricants (7220)	227,48
	Other services in respect of personal transport equipment (7240)	
2. Boating (fuel, other operating expenses, rental costs etc.)	Fuels and lubricants (7220)	67.21
	Other services in respect of personal transport equipment (7240)	
3. Other transportation to fishing site (ferry, air plane, train etc.)	Transport services (7300)	
4. Lodging	Accommodation services (9820)	41.36
	Actual rentals for housing (4100)	
5. Licenses and annual membership fees	Recreational and cultural services (9400)	103.40
6. Fishing journals, books, videos, CD-ROMS.....	Recording media for pictures and sound (9140)	20.68
	Books, newspapers and periodicals (9510)	
7. Extra food and drink expenses (above what one would have spent anyway)	Meat (1120)	41.36
	Ice cream, chocolate & confectionery (1182)	
	Mineral waters, soft drinks & juice (1220)	
	Beer (2130)	
8. Other expenses	Other recreational items and equipment (9300)	15.51
Total recreational fishery demand		517,00

a. The Danish input-output tables classify private consumption expenditures into 72 commodity groups. Numbers in parentheses refer to the list of commodity groups (Danmarks Statistik, 1998).

2.5. Estimation method using the input-output tables

When the distribution of the recreational fishermen's expenditure on commodity groups is known, it is possible to estimate the employment and other economic key variables by using the input-output tables. The input-output model takes both direct and indirect impacts into account. The direct impacts are the result of firms selling directly to recreational fishermen while the indirect impacts result from firms selling directly to recreational fishermen are getting supplies from other firms. Induced impacts are not a part of the model. Induced impacts are a result of when generated income in firms is used for an increased private consumption of the owners and thereby resulting in additional employment.

The input-output tables are an account for the economic production system in a well-defined geographical area – in this case Denmark. In the model with exogenous consumption the impact on production of the recreational expenditure may be found by comparing final consumption with the size of production. The employment from recreational fishing may then be found by using the following equation:

$$E_f = q \text{diag} (\mathbf{I} - \mathbf{A})^{-1} \mathbf{F} C_f \quad (1)$$

E_f is employment from recreational fishery while C_f is the part of private consumption that is used for recreational fishery in Denmark. Equation 1 is deduced from the more general equation:

$$E = q \text{diag} (\mathbf{I} - \mathbf{A})^{-1} \mathbf{F} (C + G + I + X) \quad (2)$$

The equation summarizes that total employment in Denmark depends on the private consumption (C), public consumption (G), investments (I) and exports (X). In this article a destination approach to recreational fishery is used, so only private consumption is interesting.

Looking at equation 1, employment from recreational fishery is in addition to private consumption from recreational fishery determined by three other factors namely the labour productivity q , the production multiplier $(\mathbf{I} - \mathbf{A})^{-1}$, and the market structure F . The measure for labour productivity q relates the use of labour and the production output for every industry in the input-output table. The labour productivity is determined as the number of employees per one million DKK of output. The production multiplier is the inverted matrix $(\mathbf{I} - \mathbf{A})^{-1}$. The diagonal in the matrix shows the direct and indirect impacts while the number off the diagonal shows the indirect impacts. \mathbf{A} relates to input structure of the industries. In fact, \mathbf{A} shows what is needed to produce one unit of output. The inputs are for example raw materials and semi-manufactured goods. Finally F relates to the market structure. F shows how final consumption distributed on commodity groups is satisfied by domestic output from different industries, import, etc.

The structure of the input-output tables implies that the requirement to input from recreational fishery in the form of raw materials, semi-manufactured goods, and the primary input import, indirect taxes and income may be estimated. The domestically produced raw materials and semi-manufactured goods may, when looking at the direct and indirect impacts, be converted into their content of primary input. Thereby one unit of consumption directly and indirectly demand one unit of primary input. This means that it is possible in the model to estimate how much import, indirect taxes and gross domestic income a certain demand requires.

The input-output table is the registration of the production structure in the Danish society for a certain period of time, normally one year. The production structure changes from year to year. As the tables are published with a time delay, it is often necessary to make estimations on an older table than the information on expenditure set the scene for. Deflating total consumption with the retail price index solves the problem. Employment figures may then be recalculated to the initial year by using information on the development in labour productivity in the industries in question. In this paper the information on recreational

fishery consumption was from 1999 while the latest published input-output tables date back to 1998. The figures were deflated by the retail price index before estimation. Reported numbers for employment are in 1998-prices, as it is chosen not to adjust them with the development in labour productivity. This limitation only cause minor errors in the final results as the increase in labour productivity in the period in question only amounts to about 2 percent per year and in the service sector even less.

The definition of employment in the input-output tables is the average number of employed during a year. There is no distinction between full-time and part-time employees. The employment concept covers both wage earners and self-employed. The concept is defined so that a person working for 4 months in a year counts as been employed for one third while another person having been part-time employed for a whole year counts as one employee.

In the study the national Danish input-output tables were used for estimation. Actually the data on recreational fishing consumption was collected on a regional basis. It would have been possible to estimate the impacts on a regional dimension as well but as this estimation causes more complexity than valuable results due to the small employment figures this possibility was rejected.

3. Results and discussion

Table 3.1 shows that recreational fishery results in a direct employment of 500 persons. If the indirect effects also are included recreational fishery results in an employment of further 258 persons, so that the total impact on employment is 758 persons.⁵ Total employment in Denmark amounts to 2,65 million persons. A share of 0,03 percent of total employment seems very marginal but it must be remembered that this study only estimates the impact on employment resulting from the variable costs of recreational fishermen. A significant part of the em-

5 The number covers both full-time and part-time employees. The distribution between the two groups of employees may not be estimated in the model.

ployment impact from recreational fishermen most likely is the result of the fixed costs like fishing equipment and other investments that are excluded from this study.

Table 3.1. Employment¹

Consumption category	Total expenditure DKK million	Direct employment	Direct + indirect employment	% direct + indirect employ	Employees per million DKK
1. Automobile transportation to fishing site	139,59	94	129	17,0	0,96
2. Boating	87,89	59	81	10,7	0,96
3. Other transportation to fishing site	67,21	132	217	28,6	3,32
4. Lodging	41,36	13	25	3,3	0,63
5. Licenses and annual membership fees	103,40	113	175	23,1	1,82
6. Fishing journals, books, videos, CD-roms	20,68	27	42	5,5	2,09
7. Extra food and drink expenses	41,36	41	62	8,1	1,50
8. Other expenses	15,51	21	27	3,6	1,67
In total	517,00	500	758	100,0	1,52

1. The consumption figures are in 1999-prices, while the employment figures are at the 1998 level.

The different expenditure categories cause different employment effects not only because of the different amounts of money spent but also because they generate different employment per million DKK consumption (as shown in the last column of table 3.1).⁶ Every million DKK of expenditure on recreational fishing generates employment for 1,52 persons, which is slightly more than the employment generation by private consumption in the Danish society as a whole counting 1,36 person per million DKK in 1998.

⁶ The so-called employment multiplier.

Within recreational fishery the employment generation range from 0,63 for lodging to 3,32 for other transportation. For lodging the generation is low because some of the possible places of accommodation like rented holiday homes and camping have a high degree of self-services. Other transportation includes for instance flights, ferries, buses and trains – an area where it may be necessary to maintain a certain employment to keep the business going. Different import contents across commodity groups in the input-output tables may also explain some of the differences in employment generation. A commodity group where relatively much of the consumption is covered by import has a lower employment generation than an expenditure group where the import ratio is lower.

Table 3.2. Economic key variables¹

	Total (million DKK)	%
Import	67,7	13,6
Indirect taxes	126,7	25,5
Income	302,7	60,9
Total	497,2	100,0

1. Figures are in 1998-prices.

The impact of recreational fishery on different economic variables (table 3.2) include:

- Import, which is the share of final demand that is used to buy goods and services abroad
- Indirect taxes, which is primarily VAT
- Income, which is recreational fishery's contribution to gross domestic income i.e rent to labour and capital in the form of wages and profits

The estimation shows that nearly 14 percent of the consumption made by recreational fishermen is met by imports. One fourth of total consumption goes to indirect taxes - an amount almost identical to the Danish VAT level of 25 per-

cent. Finally consumption generates an income of 303 million DKK or 61 per cent of total expenditure.

Table 3.3. Economic activities caused by different categories of final demand

	Demand	Indirect tax	Import	Income	Employment	Indirect tax	Import	Empl. pr. mio DK
	Billion DKK				(1.000)	Percent		
Private consumption ¹	580,77	119,44	120,78	340,55	789,8	20,6	20,8	1,36
Recreational fishery	0,50	0,13	0,07	0,30	0,8	25,5	13,6	1,52
Export	413,40	4,75	169,62	239,03	582,9	1,2	41,0	1,41
Public consumption	300,45	18,61	21,14	260,71	854,3	6,2	7,0	2,84
Investments	240,31	29,65	73,72	136,94	365,2	12,3	30,7	1,52
Other final demand	42,63	2,69	6,98	32,96	57,7	6,3	16,4	1,35
Total	1.578,07	175,27	392,30	1.010,49	2.650,7	11,1	24,9	1,68

1. Except recreational fishery.

The economic impact of recreational fishery compared to the economic impact of other types of final demand (table 3.3) show that the share of demand destined for indirect taxes is higher for recreational fishery than both private consumption in general and for the other types of final demand like investments, export and public consumption. The findings may be explained by the fact that public consumption and export to a large extent have VAT exemption. Another explanation may be that in some industries, like for instance farming, subsidies play a major role. Looking at import, which is the share of final demand used to buy goods and services abroad, recreational fishery has an import quotient in the lower end with only public consumption being lower. Public consumption is to a large extent focused on delivering services to people, so the product content is small and localised geographically closer to the consumer than goods.

4. Discussion of the input-output method

The advantages of applying input-output method are apparent but the limitations of the method must be in the mind of the researcher both in general and with specific relation to the topic of this study.

The advantages of using the input-output tables to estimate the economic impacts of recreational fishery are:

- the method is applicable for the purpose
- the possibility to compare the impacts of recreational fishery with the impacts of other activities in the economy

Even though recreational fishery is not an industry in the traditional sense of the word, this study proves that it is still possible to make estimations using the expenses of the fishermen to get an insight of the impact on the formal economy. It is also possible to compare the impacts of recreational fishery with the impacts of other activities in the economy within the same framework, i.e. within the same model.

The disadvantages of using the input-output tables to estimate the economic impacts of recreational fishery are:

- All inputs are assumed to be found in sufficient amounts even when increasing fishery
- Data on expenditure groups is often not collected with a use in the input-output tables in mind
- It may be difficult to find comparable expenditure groups in the input-output tables

There is a close connection between the National Accounts and the input-output tables. The tables only take production conditions into account. In principle it

means that all inputs continue to be found in a sufficient amount. A shortage in supply does not impede an increasing demand. As the precondition for the development of recreational fishery is delimited by the nature's capability to resist depletion and the natural growth in the fish stock, the input-output method is not very useful to assess the economic sustainability of a major increase in the demand for recreational fishery in a longer perspective.

It may be difficult to find comparable expenditure groups in the input-output tables. This is especially the case when there is only specified a few commodity groups in the input-output tables used. With 72 commodity groups in the Danish input-output tables the range of possibilities is quite good. Another problem is that the data on expenditure groups is often not collected with a use in the input-output tables in mind. If this was the case one may include expenditure groups that were more easily translated to commodity groups. In this particular study for instance the expenditure on licenses and fees caused problems.

5. Conclusions

This study used primary data from a CVM (contingent valuation method)-mail survey conducted in 1999 in Denmark, Norway, Finland, Sweden and Iceland. The result from the Danish part of the survey was used in this paper to estimate the economic impact of Danish recreational fishermen on the formal Danish economy. The estimate of the aggregate expenditure of recreational fishermen in Denmark was 517 million DKK in 1999. The estimation of the economic impact was done from the demand side using the Danish input-output tables.

The impact of expenditure on recreational fishery activities on direct and indirect employment was estimated to 758 persons. The employment figures only include jobs induced by the variable costs of recreational fishermen. These must be counted on the top of the jobs induced by producing and selling fishing equipment and other related investments, which was not the subject of this study. The employment multiplier is higher in recreational fishing than in pri-

vate consumption in general in Denmark. The impact on import was 68 million DKK, on indirect taxes 127 million DKK and on income 303 million DKK.

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