

**Economic value of Icelandic salmon (*Salmo salar* L.)
in angling and net fisheries**

by

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Introduction

The Standing Committee on the Precautionary Approach (SCPA) of NASCO recognised at its meeting in Ottawa in February 2001 that there were gaps in the knowledge about the true social and economic values of wild Atlantic salmon. It was also stressed that such values were important in relation to management decisions taken under a precautionary approach.

NASCO Council subsequently decided to hold a Technical Workshop on Social and Economic Values of Atlantic Salmon and encouraged its Contracting Parties to provide relevant information for their respective areas.

Although commercial netting of salmon in the sea has been prohibited within Iceland's territorial waters for over 80 years, salmon were traditionally caught in set nets in large glacial mainstem rivers. Although most of the netting has been eliminated through rental agreements there is still some in-river netting for salmon on Iceland's south coast.

Angling for Atlantic salmon in Iceland has been growing steadily for the last 50 years and is now a highly valuable fishery. It has been roughly estimated that direct and indirect revenues from the Icelandic angling catch of approximately 30.000 salmon amount to US \$ 30 million, which corresponds to \$ 1000 per angled salmon.

The purpose of this paper is to provide best estimates regarding the value of salmon in sports fisheries based on angling information for the last 5 years. The value of commercially netted salmon is also compared to that of angled salmon. No attempt was made to estimate the aesthetic or socioeconomic value of salmon to environmental groups or laymen, which would have been difficult to estimate in monetary terms.

Methods

The value of salmon differs depending on the user group. The value is thus different to a river owner, who gets a direct income from the resource, than to an angler, which appreciates the recreational value but wants to keep price of licences low. The value of salmon was thus calculated in two ways. Firstly as a direct revenue to river owners and secondly as a gross value to the Icelandic economy.

The Federation of Icelandic River Associations has for a number of years estimated the value of the salmon resource to its members using revenue and catch data for 16 Icelandic rivers, 8 rivers with an average catch ranging from 700 to 1900 salmon and 8 with a catch ranging from 100 to 500 salmon. This method gives fairly exact information as outfitters and angling clubs frequently rent the angling rights on a river for a number of years at a fixed annual price. This data adjusted to 2002 price levels is shown and summarized in table 1 for the years 1995 to 2000. Also shown are income per rod permitted as well as the value of each salmon caught.

When calculating the value of salmon to the Icelandic economy the variable pricing of rods through the season and the income of outfitters and angling associations from renting of lodging and other accommodations has to be taken into account. The number of permitted rods on each river is fixed as decided by the Directorate of Freshwater Fisheries and the gross income per rod can thus also be calculated.

The information on pricing of rods, rod utilization as well as board and lodging was obtained from various sources. The Reykjavík Angling Club as well as the Lax-á and Strengir angling clubs issue price lists for the upcoming season and also provide information on their homepages (svfr.is, lax-a.is, strengir.is). The Federation of River Owners also provides valuable information on angling prices on their homepage (angling.is). According to those sources the prices vary greatly through the season, being highest during the peak of the salmon run in July. Foreign anglers make up a large component of the clientele during that period in many rivers. They usually pay for a great deal of accessories linked to fishing such as guidance on the river and transport to and from airports, which is commonly included in the price of the licence.

These calculations for the 2001 salmon season are shown in table 2. It shows data for the 95 Icelandic salmon rivers, whereof 18 (20 %) have a catch of more than 500 salmon and 77 (80 %) have less than 500 salmon caught. It is assumed that the 100 day fishing season is divided into 3 equal periods with the highest price for licences during the center period when approximately 50 % of all the salmon are angled. This distribution is based on Icelandic salmon catch statistics for a number of years. The data for the 3 periods are then summaries, providing the total income for each river group as well as for all the Icelandic salmon rivers. The value of salmon for each river group as well as for all the salmon rivers can then be calculated. For the purpose of calculating the values it has furthermore been assumed that 85 % of permitted rods are utilized each day.

It should be pointed out that no distinction is made between salmon harvested and those that are hooked and released and they are collectively referred to as harvested. Catch and release has, however, been gradually increasing in Iceland and is recorded separately in the catch records (Guðbergsson 2002).

Results

a) Income to River Associations

Table 1. summarizes the income to river associations for 8 rivers with relatively high catches and 8 rivers with lower catches for the last 6 years.

As shown in the summary column the 8 rivers with the high catches have a total of 75 rods operating each day, which harvest about 9700 salmon annually, which is close to 30 % of the total annual catch. The total value of those rivers to their owners is close to 2,5 million \$ US, which corresponds to \$ 34.000 per rod. The value of each salmon harvested to the river associations is thus \$ 261.

Similarly the 8 rivers with lower catches have 24 rods operating per day, which harvest roughly 2000 salmon annually. The total value of those 8 rivers to their owners is close to US \$ 380.000, which corresponds to \$ 16.000 per rod. The value of each salmon to the river associations in this class of river is thus \$ 190.

Since over 80 % of Icelandic salmon rivers would fall into the latter category it seems safe to assume that the net value of each angled salmon to the river associations is just over 200 \$ US.

b) Value of salmon to the economy

Table 2 summarizes the value of salmon angling to the Icelandic economy for the 2001 salmon season adjusted to 2002 prices.

The 18 rivers with the highest catches utilize 153 rods per day, harvesting about 21.000 salmon, which is close to 70 % of the total annual angling catch. The total revenue for the sale of licences, lodging as well as guiding on the rivers is close to US \$ 9,4 million, which corresponds to \$ 61.178 per rod allowed on all the rivers through the season (153). Based on the above catch the value of each salmon to the economy is about \$ 446 for this class of rivers.

The 77 rivers with mediocre and low catches utilize about 196 rods per day, which harvest about 9.000 salmon annually. The total revenue for the sale of licenses and other commodities for these rivers is close to US \$ 5,3 million, which corresponds to \$ 26.990 per rod permitted (196). The value of each salmon to the economy, however, is close to \$ 588 for this river class.

It is interesting to note that the value of each salmon to the economy is higher for the rivers with lower catches whereas the opposite was true for the value of each salmon to the river owners. This indicates that the profit margin for outfitters and angling associations is higher in less expensive rivers. It should also be noted that increased catches in a year will lead to lower value of each salmon as these are inversely related.

The bottom section of table 2 summarizes these data for all Icelandic salmon rivers (95). All these rivers utilize a total of 350 rods per day, which harvest an average annual catch of 30.000 salmon. The total revenue for the sale of licences and other commodities on the rivers is about US \$ 14.6 million, which corresponds to \$ 41.978 per permitted rod (349). The value of each salmon to the economy for all the rivers is about US \$ 488. This value is irrespective of the size of the salmon, which seems to be of lesser importance to anglers than the number of salmon available for catching.

Value of net caught salmon

During the 2001 season about 3000 salmon were caught in set-nets in rivers, which is less than 10 % of the total catch (Guðbergsson 2002). All of these salmon are marketed within Iceland and since wild salmon are a rare seasonal commodity, they fetch a reasonably high price on the market compared to reared salmon. According to gill-netters on the Ölfusa river the 2002 price was close to 6,5 US \$ per kilogram, which is close to \$ 16 for an average size grilse. Similar average value for 2-SW salmon would be \$ 32. Assuming that roughly half of the salmon caught would be grilse the adjusted value for net caught salmon would be \$ 24. From this figure we need to subtract the cost of netting and marketing, which is likely to be at least \$10 per salmon. The net value of netted salmon would thus be \$ 14, which is 1/35th of the value of such a salmon in an angling fishery.

Conclusions

From the above discussion it can be concluded that each salmon in the Icelandic sport fisheries is worth about US \$ 500 to the Icelandic economy, when only river related factors are considered such as fishing licences, food and lodging as well as guiding on the rivers. To this can be added the revenues from the sale of bait, tackle and angling gear as well as airline fares and marginal costs associated with a luxury fishing trip. No information is available to estimate these costs but it is probably safe to assume that the most expensive factors have been considered. If we assume that these factors add 20 % to the above value of each salmon the estimated value rises to \$ 600 per salmon. The value in Euros would be approximately equivalent.

This figure is somewhat lower than the value of \$1000 per salmon quoted earlier but it should be noted that reduced catches in a season lead to higher value per salmon, since these are inversely related. Although this seems somewhat paradoxical one can probably assume that high quality fishing in the long run keeps up demand and thus price of licences.

The calculations in the paper are clearly sensitive to changes in exchange rates. The dollar values used correspond to 92 Icelandic crowns per dollar, which was valid in June 2002. The current exchange rate is I. Kr. 82 per dollar, which increases the value of the angling components sold in an Icelandic currency. The above figures are thus a minimum estimate.

With respect to net caught salmon we can draw the conclusion that angled salmon are at least 35 times more valuable

Literature

Diverse Icelandic homepages regarding angling
(angling.is; svfr.is; lax-a.is; strengir.is)

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**Table 1. Value of salmon to Icelandic River Associations with revenue adjusted to 2002 prices.
Partly based on information from the Federation of Icelandic River Associations.**

		1995	1996	1997	1998	1999	2000	Summaries (averages)
Group 1 8 representative rivers 5 year mean catch: 700-1900 salmon per river	Number of allowed rods per day	74	74	75,8	74,2	75	74,7	74,6
	Mean total catch for the previous 5 years	9957	10048	9250	9545	9995	9547	9723,7
	Revenue	\$1.748.092	\$1.840.785	\$1.962.923	\$2.065.431	\$2.328.244	\$2.634.678	
	Adjusted revenue*	\$2.255.038	\$2.319.389	\$2.434.024	\$2.519.826	\$2.747.328	\$2.950.840	\$2.537.741
	Income per rod	\$30.473	\$31.343	\$32.111	\$33.960	\$36.631	\$39.503	\$34.004
	Value per salmon	\$226	\$231	\$263	\$264	\$275	\$309	\$261
Group 2 8 representative rivers 5 year mean catch: 100-500 salmon per river	Number of allowed rods per day	24	24	24,3	24,3	24	24	24,1
	Mean total catch for the previous 5 years	2266	2237	2046	1941	1941	1851	2047,0
	Revenue	\$293.348	\$298.800	\$295.529	\$317.339	\$329.335	\$355.507	
	Adjusted revenue*	\$378.419	\$376.489	\$366.456	\$387.154	\$388.615	\$398.168	\$382.550
	Income per rod*	\$15.767	\$15.687	\$15.080	\$15.932	\$16.192	\$16.590	\$15.875
	Value per salmon*	\$167	\$168	\$179	\$199	\$200	\$215	\$188

* Price adjusted to June 2002 values

1\$ June 2002: 91,7 kr.

Table 2. Estimation of value of angled salmon for the year 2001. All prices are adjusted to 2002 price index.

1\$ june 2002 = 91,7 kr. Total catch of salmon (s) = 30000 Number of days for each catching period (t): Percent salmon caught for each period (p):				Angling periods			Summaries	Formulas for calculations
				Beginning of period	Middle part of period	Later part of period		
				33	33	33	99	
				25%	50%	25%	100%	
Group 1	Rivers (n1) = 18	Percent of total angling catch (k1)	70%					
	Catch more than 500 salmon	Number of salmon for each angling period (a1)		5250	10500	5250	21000	$a1=s*k1*p$
		Mean number of allowed rods per river per day (r1)	10					
		Percent of used rods for each day (m1)	85%					
		Total number of rods used each day (b1)		153	153	153	153	$b1=n1*r1*m1$
		Total number of used rods (c1)		5049	5049	5049	15147	$c1=b1*t$
		Price per rod per day (d1)		\$273	\$1.200 *	\$273	\$582	d1
	(20 % of all rivers)	Board and lodging per rod per day (e1)		\$55	Lodging included**	\$55		e1
		Gross income (f1)		\$1.651.799	\$6.056.598	\$1.651.799	\$9.360.196	$f1=(d1+e1)*c1$
	Gross income per rod (g1)		\$10.796	\$39.586	\$10.796	\$61.178	$g1=f1/b1$	
	Value of each salmon (h1)		\$315	\$577	\$315	\$446	$h1=f1/a1$	
Group 2	Rivers (n2) = 77	Percent of total angling catch (k2)	30%					
	Catch less than 500 salmon	Number of salmon for each angling period (a2)		2250	4500	2250	9000	$a2=s*k2*p$
		Mean number of allowed rods per river per day (r2)	3					
		Percent of used rods for each day (m2)	85%					
		Total number of rods used each day (b2)		196	196	196	196	$b2=N2*r2*m2$
		Total number of used rods (c2)		6468	6468	6468	19404	$c2=b2*t$
		Price per rod per day (d2)		\$164	\$273	\$218	\$218	d2
	(80 % of all rivers)	Board and lodging per rod per day (e2)		\$55	\$55	\$55	\$55	e2
		Gross income (f2)		\$1.410.687	\$2.116.031	\$1.763.359	\$5.290.076	$f2=(d2+e2)*c2$
	Gross income per rod (g2)		\$7.197	\$10.796	\$8.997	\$26.990	$g2=f2/b2$	
	Value of each salmon (h2)		\$627	\$470	\$784	\$588	$h2=f2/a2$	
Group 1 and 2 combined	Rivers (n1+n2) = 95	Total salmon caught in 2001 (a3)		7500	15000	7500	30000	$a3=a1+a2$
	All rivers	Total number of rods used each day (b3)		349	349	349	349	$b3=b1+b2$
		Total number of used rods (c3)		11517	11517	11517	34551	$c3=c1+c2$
		Proporsional price per rod (d3)		\$184	\$448	\$228	\$287	$d3=(N1*d1+N2*d2)/(N1+N2)$
		Board and lodging per rod per day		\$55		\$55		
		Gross income (f3)		\$3.062.486	\$8.172.628	\$3.415.158	\$14.650.273	$f3=f1+f2$
		Gross income per rod (g3)		\$8.775	\$23.417	\$9.786	\$41.978	$g3=g1+g2$
		Value of each salmon (h3)		\$408	\$545	\$455	\$488	$h3=g3/a3$

* Minimal spending

** Lodging, food, guide and transportation