COLDWATER FISH: WHITEFISH AND SMELT

Anthony J. Novotny
Fisheries Research Biologist, Marinka International, 1919 E. Calhoun, Seattle, WA 98112-2644,USA

Keywords: aquaculture, brackish waters, cages, capture fisheries, coregonids, floating net pens, fresh water, gill-netting, hatchery, lakes, net value, non-inland waters, osmerids, ponds, pond culture, pumped water, rivers, seining, smelts, traps, whitefish.

Contents

Summary

The production of fresh and brackish water whitefish and smelts by either capture or culture between 1984 and 1997, represents an average of less than 0.5% of all world wide freshwater fish production. While the total world freshwater fish production has increased each year during this period, the production of whitefish and smelt has declined.Whitefish and smelt are products of northern hemisphere cold and temperate climate countries. Production of smelt is by capture fisheries, and the production of whitefish is by capture fisheries and aquaculture. Capture fisheries may be limited for both the smelts and the whitefish by the productive capacity of the habitat, while the aquaculture production of the whitefish may be limited by competitive supplies, regional demands and price structures.

1. Introduction

Fresh water rivers, lakes and ponds comprise less than 131,000 km^3, which is less than 0.35% of the total world fresh water volume (ice, ground water, rivers, lakes, ponds and

World freshwater fish (aquaculture production)		World freshwater fish (wild harvest)	World freshwater fish	Percent of freshwater fish		Smelt and whitefish as a percent of all
Year			Totals	Cultured	Total smelt and whitefish	freshwater fish production
1984	3,875,665	6,224,039	10,099,704	38%	86,697	0.86%
1985	4,657,399	6,286,331	10,943,730	43%	75,909	0.69%
1986	5,362,821	6,446,463	11,809,284	45%	83,604	0.71%
1987	6,120,324	6,506,155	12,626,479	48%	94,224	0.75%
1988	6,684,024	6,551,816	13,235,840	50%	93,567	0.71%
1989	7,143,954	6,802,118	13,946,072	51%	76,185	0.55%
1990	7,594,213	6,895,298	14,489,511	52%	64,350	0.44%
1991	7,797,129	6,834,283	14,631,412	53%	77,256	0.53%
1992	8,824,645	6,495,092	15,319,737	58%	66,312	0.43%
1993	10,015,847	6,978,615	16,994,462	59%	63,270	0.37%
1994	11,542,404	7,038,089	18,580,493	62%	47,124	0.25%
1995	13,388,652	7,637,758	21,026,410	64%	57,888	0.28%
1996	15,110,332	7,672,275	22,782,607	66%	41,772	0.18%
1997	16,714,718	7,775,573	24,490,291	68%	56,967	0.23%
Totals	124,832,127	96,143,905	220,976,032	56%	985,125	0.45%

Table 1. Total world production of cultured and captured freshwater fishes as compared to smelts and whitefishes- 1984-1997 (metric tons).

air), and 0.01% of the total world water volume of all types, including marine. This limits production capacity of edible fish by any means. The world production of both wild harvested and farmed fresh water fish reached a peak of 24.5 million mt by 1997, but from 1988 onward, the world farmed fresh water fish production exceeded that of the wild harvest (Table 1.). The whitefish and the smelt, both fresh and brackish cold water families, represent less than 1% of the total world fresh water fish production during the FAO 1984-1997 data collection period (Table 1.). The whitefish are represented by both wild fish harvest and aquaculture production. The smelt are limited to wildfish harvest, and are only cultured for research purposes at this time.

2. World Production of the Smelt in Fresh and Brackish Waters by Capture

The current species of captured smelt reported to FAO are the European smelt, the pond, and the rainbow smelt. Where smelt species have not been identified, the FAO data is combined as smelt nei. The methods of capture include seining, traps, and some gill-netting.

2.1. World Smelt Production by Capture in Inland Fresh Waters - 1984-1997

Smelt production by capture comes from the cold waters of the northern hemisphere, including all of the former USSR, the lowland and Baltic countries, Scandinavia, Canada, and the USA. Pond smelt are the only species reported by Canada. The harvest reached a peak of 11,580 mt in 1987, and has been declining ever since (Figure 1.). Rainbow smelt are the only captured species reported by the USA, where the harvests have been declining since 1984 (Table 2.). The same is true of the Russian Federation (Table 3.).

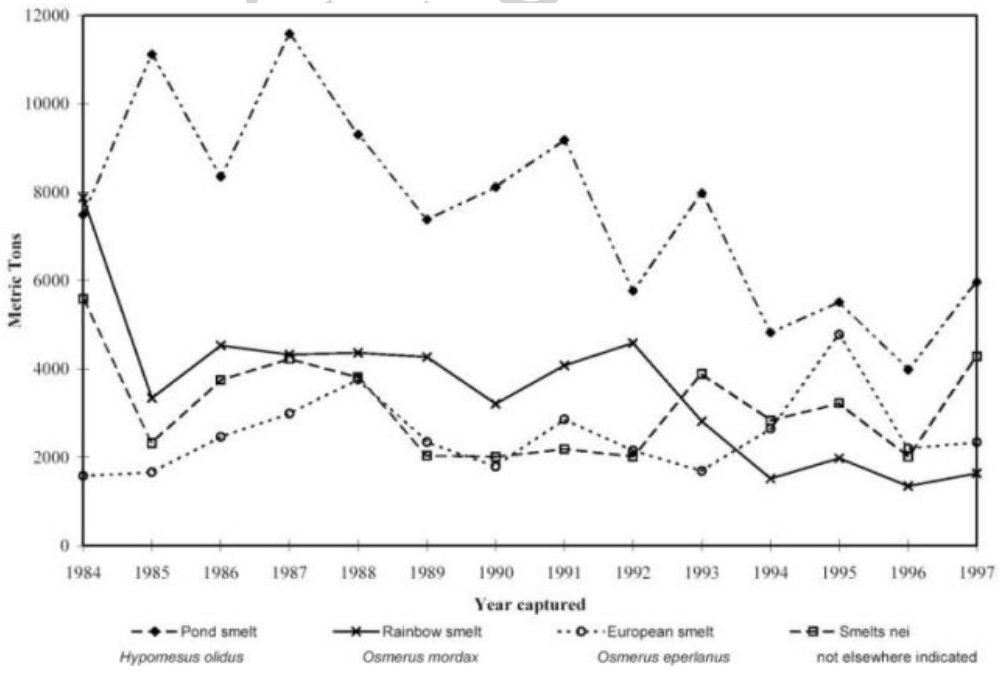

Figure 1. World capture data: 1984-1997. Production of inland fresh water smelt by species.

Country	Area	Species	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Canada	America, North Inland waters	Pond smelt	7490	11119	8353	11580	9304	7384	8116	9184	5769	7975	4826	5517	3981	5964
Denmark	Europe - Inland waters	European smelt	0	0	0	0	0	0	0	0	0	0	0	0	7	--
Estonia	Former USSR area - Inland waters	European smelt								0	0	502	224	710	478	401
Estonia	Former USSR area - Inland waters	Rainbow smelt				468	468	422	--	0	0	0	0	0	0	
Estonia	Former USSR area - Inland waters	Smelts nei					123	123	115	--	0	0	0	0	0	0
Estonia	**total metric tonnage**	**all smelt species**					**591**	**591**	**537**	**0**	**0**	**502**	**224**	**710**	**478**	**401**
Finland	Europe - Inland waters	European smelt	**223**	**250**	**498**	**576**	**269**	**349**	**301**	**351**	**628**	**603**	**864**	**1100**	**854**	**854**
Latvia	Former USSR area Inland waters	European smelt					0	0	0	0	0	0	3	3	2	4
Latvia	Former USSR area Inland waters	Rainbow smelt					6	1	0	0	0	0	0	0	0	0
Latvia	Former USSR area Inland waters	Smelts nei					211	0	0	0	0	0	0	0	0	0
Latvia	**total metric tonnage**	**all smelt species**					**217**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**2**	**4**
Lithuania	Former USSR area Inland waters	Rainbow smelt					0	38	0	19	0	0	0	0	0	0
Lithuania	Former USSR area Inland waters	Smelts nei					232	300	140	238	301	136	131	105	81	190
Lithuania	**total metric tonnage**	**all smelt species**					**232**	**338**	**140**	**257**	**301**	**136**	**131**	**105**	**81**	**190**
Netherlands	Europe - Inland watersaters	European smelt	**1357**	**1411**	**1956**	**2409**	**3484**	**1982**	**1481**	**2504**	**1517**	**580**	**1537**	**2952**	**856**	**1033**
Poland	Europe - Inland watersaters	European smelt												**40**		
Russian Federation	Former USSR - Inland waters	Rainbow smelt					2500	2371	1302	2615	2990	1143	338	1006	640	1113

Russian Federation	Former USSR - Inland waters	Smelts nei					3246	1618	1755	1948	1719	3750	2701	3118	1927	4095
Russian Federation	**total metric tonnage**	**all smelt species**					**5746**	**3989**	**3057**	**4563**	**4709**	**4893**	**3039**	**4124**	**2567**	**5208**
Sweden	Europe Inland watersaters	European smelt			**7**	**6**	**9**	**15**	**8**	**8**	**7**	**7**	**18**	**11**	**9**	**10**
Un. Sov. Soc. Rep.	Former USSR Inland waters	Rainbow smelt	4163	1842	2372	2267	0	0	0	0	0	0	0	0	0	0
Un. Sov. Soc. Rep.	Former USSR Inland waters	Smelts nei	5584	2318	3749	4230	0	0	0	0	0	0	0	0	0	0
Un. Sov. Soc. Rep.	**total metric tonnage**	**all smelt species**	**9747**	**4160**	**6121**	**6497**	0	0	0	0	0	0	0	0	0	0
United States of America,	North Inland waters	Rainbow smelt	**3712**	**1496**	**2158**	**2057**	**1389**	**1388**	**1486**	**1446**	**1597**	**1666**	**1183**	**968**	**711**	**522**
TOTAL			**22529**	**18436**	**19093**	**23125**	**21241**	**16037**	**15126**	**18313**	**14528**	**16362**	**11825**	**15490**	**9546**	**14226**

Note: Country totals and grand totals are in bold type
European smelt - *Osmerus eperlanus*
Pond smelt - *Hypomesus olidus*
Rainbow smelt - *Osmerus mordax*
Smelts nei - not elsewhere indicated

Table 2. FAO Country capture data for the inland fresh water smelts: 1984-1997 (metric tons).

Area	Species	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Totals
Europe - Inland waters	European smelt	0	0	0	0	0	0	0	0	0	0	0	0	7		7
Europe - Inland waters	European smelt	223	250	498	576	269	349	301	351	628	603	864	1100	854	854	7720
Europe - Inland waters	European smelt	1357	1411	1956	2409	3484	1982	1481	2504	1517	580	1537	2952	856	1033	25059
Europe - Inland waters	European smelt														40	40
Europe - Inland waters	European smelt			7	6	9	15	8	8	7	7	18	11	9	10	115
Former USSR area - Inland waters	European smelt								0	0	502	224	710	478	401	2315
Former USSR area - Inland waters	European smelt					0	0	0	0	0	0	3	3	2	4	12
	European smelt	1580	1661	2461	2991	3762	2346	1790	2863	2152	1692	2646	4776	2206	2342	35268

America, North - Inland waters	Pond smelt	7490	11119	8353	11580	9304	7384	8116	9184	5769	7975	4826	5517	3981	5964	106562
America, North - Inland waters	Rainbow smelt	3712	1496	2158	2057	1389	1388	1486	1446	1597	1666	1183	968	711	522	21779
Former USSR area - Inland waters	Rainbow smelt					468	468	422		0	0	0	0	0	0	1358
Former USSR area - Inland waters	Rainbow smelt					6	1	0	0	0	0	0	0	0	0	7
Former USSR area - Inland waters	Rainbow smelt					0	38	0	19	0	0	0	0	0	0	57
Former USSR area - Inland waters	Rainbow smelt					2500	2371	1302	2615	2990	1143	338	1006	640	1113	16018
Former USSR area - Inland waters	Rainbow smelt	4163	1842	2372	2267	0	0	0	0	0	0	0	0	0	0	10644
	Rainbow smelt	7875	3338	4530	4324	4363	4266	3210	4080	4587	2809	1521	1974	1351	1635	49863
Former USSR area - Inland waters	Smelts nei					123	123	115		0	0	0	0	0	0	361
Former USSR area - Inland waters	Smelts nei					211	0	0	0	0	0	0	0	0	0	211
Former USSR area - Inland waters	Smelts nei					232	300	140	238	301	136	131	105	81	190	1854
Former USSR area - Inland waters	Smelts nei					3246	1618	1755	1948	1719	3750	2701	3118	1927	4095	25877
Former USSR area - Inland waters	Smelts nei	5584	2318	3749	4230	0	0	0	0	0	0	0	0	0	0	15881
	Smelts nei	5584	2318	3749	4230	3812	2041	2010	2186	2020	3886	2832	3223	2008	4285	44184
	TOTAL	22529	18436	19093	23125	21241	16037	15126	18313	14528	16362	11825	15490	9546	14226	235877
Canada	Pond smelt	7490	11119	8353	11580	9304	7384	8116	9184	5769	7975	4826	5517	3981	5964	106562
Percent of totals		33%	60%	44%	50%	44%	46%	54%	50%	40%	49%	41%	36%	42%	42%	45%
TOTAL METRIC TONNAGE	Rainbow smelt	7875	3338	4530	4324	4363	4266	3210	4080	4587	2809	1521	1974	1351	1635	49863
Percent of totals		35%	18%	24%	19%	21%	27%	21%	22%	32%	17%	13%	13%	14%	11%	21%
TOTAL METRIC TONNAGE	European smelt	1580	1661	2461	2991	3762	2346	1790	2863	2152	1692	2646	4776	2206	2342	35268
Percent of totals		7%	9%	13%	13%	18%	15%	12%	16%	15%	10%	22%	31%	23%	16%	15%
TOTAL METRIC TONNAGE	Smelts nei	5584	2318	3749	4230	3812	2041	2010	2186	2020	3886	2832	3223	2008	4285	44184
Percent of totals		25%	13%	20%	18%	18%	13%	13%	12%	14%	24%	24%	21%	21%	30%	19%
	TOTALS	22529	18436	19093	23125	21241	16037	15126	18313	14528	16362	11825	15490	9546	14226	235877

Note: Species totals and grand totals are in bold type
European smelt - *Osmerus eperlanus*
Pond smelt - *Hypomesus olidus*
Rainbow smelt - *Osmerus mordax*
Smelts nei - not elsewhere indicated

Table 3. FAO world species capture data for the inland fresh water smelts: 1984-1997 (metric tons).

The primary production by capture of the European smelt is from the Netherlands and Finland (Table 2.). The catches of European smelt in inland waters have not declined since 1984 (Figure 1.). Virtually all of the smelt catches not identified by species come from the former USSR federations (Tables 2 and 3), and in general, production by capture has been fairly steady since 1985 (Figure 1.). This data is most probably a combination of rainbow smelt and European smelt.

The Canadian pond smelt has averaged 45% of the world total smelt production by capture from inland waters between 1984 and 1997, followed by the rainbow smelt, which averaged 21% (Table 3.). The world production by capture of all smelt species in inland waters was over 23,000 mt in 1987, and has been generally declining ever since (Table 2.).

-
-
-

Bibliography

Brown, E. Evan (1983). World Fish Farming: Cultivation and Economics. The AVI Publishing Co., Westport, Connecticut, 2nd Edition. 516 pp. [This book is a compilation and condensation of fish farming data, organized by country.]

FAO (1998). Fishstat Plus. V2.1. Global Production-1950-1997. Kay Schatz. [This is a database software program in tabular format that is capable of organizing fisheries data by country, region, species, etc. for capture fisheries or aquaculture.]

Remes, Mika (1999). Finland invests in new species research. Fish Farmer. March/April, 1999. pp32-33. [a review of the successful culture of the European whitefish in Finland.]

Wheaton, Frederick W. (1977). Aquacultural Engineering. John Wiley & Sons, New York, N.Y. 708 pp. [This book presents a summary of world availability of water and complete chapters on all aspects of water and culture systems related to aquaculture.]

Biographical Sketch

Anthony Novotny graduated from the University of Washington College of Fisheries, and was a Fisheries Research Biologist with the National Marine Fisheries Service for over 30 years. His entire career has been spent in the enhancement and propagation of salmonids of all species, both in this country and abroad. His early research work ranged from parasitology to behavior; passage of salmon in the Columbia and Snake Rivers, and salmon enhancement through new technologies. He pioneered the use of net-pens for culturing salmon in the sea in the Pacific Northwest, both for the commercial marketplace and for enhancing regional sport and commercial fisheries, and the development and use of injectable vaccines and vaccination technology for the prevention of microbial diseases in fish. An accomplished writer, he has published over 60 technical papers, books and articles, in addition to organizing, editing and publishing symposia and conferences, more recently in the field of fish health and immunology. He is a member of a number of professional societies, is certified by the American Fisheries Society Board of Professional Certification as a Fisheries Scientist, and has been an instructor at the University of Washington. He is currently the owner of Marinka International, an aquaculture consulting firm.