

**INTERNATIONAL COUNCIL FOR
THE EXPLORATION OF THE SEA**

C.M. 1989/M:17
Anadromous and Catadromous Fish Committee

**DATA ON DUTCH FISHERIES ON SALMON (1863-1957) AND TROUT (1886-1986)
FISHERIES IN THE RIVER RHINE.**

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Abstract

Plans to reintroduce salmon (*Salmo salar*) in the river Rhine gave rise to the "Ecological Rehabilitation of the River Rhine" programme. This programme is a joint effort of the Ministries of Public Works and Transport of Agriculture and Fisheries and of Housing, Physical Planning and the Environment. As part of this programme a literature survey was carried out on the anadromous fishspecies, present or once inhabiting the river Rhine and Meuse-systems. This contribution deals with the salmon and trout (*Salmo trutta*).

A complete run of catchdata could be established for the salmon (1863-1957), and some indications on the period 1650-1805. A nearly complete run of catch data for the trout (1886-1986).

Still some trout is caught in Rhine and Meuse.

Indicated are the causes for the decline of both species, and the disappearance of the salmon. e.g. canalisation, river-corrections, dams-sluices-weirs, gravel extraction, pollution.

Introduction

In the framework of the International "Ecological Rehabilitation of the Rhine"-programme, an initiative shared by France, German Federal Republic and the Netherlands, a desk study was undertaken to evaluate existing information on the decline and extinction of the salmon (*Salmo salar*) in the river Rhine. Also to study the possibility to reintroduce the salmon in the river system, that once was the largest salmon river of Europe.

The length of the river from Konstanz to Hook of Holland is about 1114 km. The river basin is 185.000 km² (25.000 km² in the Netherlands). The average discharge of the river is 2200 m³/s (575-13.000 m³/s).

History - salmon

The oldest records mentioning the salmon of the Rhine date back to about 1100. Dutch fishermen sold their catches in Koblenz (GFR). This according to toll and tax records. It is at present not possible to indicate the size of the stock of those days.

However, from a study of the historian van der Woude (1988) it is possible to derive some insight. Van der Woude studied the tax system on several products, the "ninth-pence". This tax was levied from 1650-1805

During this period, twice the tax earnings dropped considerably, and after considering all possibilities, van der Woude came to the conclusion, that only a reduction in numbers of the salmon could explain the dip in earnings. The first decline, about 33% occurred, in 1679 and again it dropped during 1680-1699 with another 33% compared with 1650.

From 1700-1805 the earnings were stable. Data on salmon catches for the first half of the 19th century are scarce. Only fragmentary data are available of some fishmarkets, (e.g. Geertruidenberg 1798-1810, 3555 (1810)- 18.415 (1799) salmon per year.

Still in the 19th century, salmon fisheries, contributed largely to the economy and food supply. However, the impression exists that the salmon stocks were already on the decline. This became more evident around 1870, when the Rhine states held the Manneheimer Convention to discuss e.g. the decline of the Rhine salmon. A salmon Treaty ("Zalmtractaat") was formulated to improve the salmon fisheries. The treaty was ratified in 1886 by the Dutch government. However, after an initial rise of the Dutch salmon catches the decline continued. On a national level, the Salmon Commission was installed. Its impressive final report of its findings was published in 1916. It is still a major source of our knowledge on the now extinct species (Anon. 1916)

- Trout

Trout (*Salmo trutta trutta*), still inhabits our inland waters. In the past the migratory trout ("seatrout") contributed only little to the riverine fisheries. Hoek (1893) indicated that a yearly catch of about 1000 trout with an average length of 50 cm and a weight of 1 kg was a good year. It should be noted, that in Hoek's days large trout were seen as a hybrid of salmon and browntrout (the non-migratory form of the trout). The Dutch fisherman referred to "schotzalm", and they could distinguish them from true salmon. The large trout were caught in May and September - November. In certain areas along the river, trout (and salmon) were sold outside the fishmarkets and hence not recorded in the statistics. Hence catch data of trout around the turn of the century (19th/20th) show an underestimation.

At present trout are caught in inland waters and coastal zone, roughly in the same numbers as hundred years ago. If the present-day migratory trout originate from mostly stray fish swimming into our waters or from inland, restocking operations in the upper reaches of Rhine and Meuse is unclear. It may be a combination.

Size of the population - salmon

It was possible to combine data from different sources on the Dutch salmon catches for the years 1863-1957 (table 1, fig. 1) The highest yearly catch was made in 1885 (104422 salmon) Kühn (1976) traced catch data of the German part of the Rhine for the years 1875-1950. Also his data show a peak for 1885 (about 130.000 salmon) Kühn's data combined with those for the Netherlands provide us with a fairly complete picture (fig. 2).

The commercial salmon fisheries came to an end in 1932, those in Germany (GFR) on the Rhine in 1950.

Now and then a salmon is caught in the lower reaches of the Rhine and Meuse (Larsson, 1984).

- Trout

Catch data were collected on trout catches in Dutch inland and coastal waters for 1886 - 1891, 1902 - 1951 (expressed in total numbers) and from 1946 - 1986 (expressed in weight (kg)). (table 2, fig. 3). It is difficult to draw conclusions from these data, only that trout is still present in Dutch waters. Catches in the IJssel lake are increasing, if this is due to releases upstream in Germany is unclear. Also in the coastal zone (Waddensea) trout are caught. They may originate from French or Danish streams. It is a well known fact that trout migrates in coastal waters and penetrates estuaries.

Fluctuations in salmon catches

The grilse (1 seawinter (s.w.), or Jacobszalm, 61-67 cm) entered the Rhine in spring and summer. But most fishes entered the river from June - August. About 85% were males. The 2.s.w. salmon small summersalmon (kleine zomerzalm) entered the Rhine and Meuse from May - July (83-91 cm, 7,5 kg). When they entered they were not mature, but became this during their upward migration in the German part of the river. Large fish, staying for even longer periods in the sea, entered from September - October (Grote zalm (large salmon), winterzalm). They had lengths of 103-115 cm, 5-15 kg. These large fish if caught after the 1st of April were referred to as large summersalmon (grote zomerzalm). The Kelts (hengsten) were mainly caught in April when they returned to the sea. Fig. 4, shows the fluctuations in the various categories for 1903-1919. Fig. 5. the average monthly catches 1911-1918.

Causes for the decline - salmon

From medieval times man has influenced the cause of the Rhine, for either protection of villages, shipping or gravel dredging. The spawning areas in the various tributaries, all in Germany or Switzerland, or France, were affected by man's activities. The multiple activities led to the removal of shallows, banks and islands and confining the main stream into a deepened part of the river. Dredging of gravel in the spawning streams, the closing

of old river loops, destroyed spawningsites and nursery areas. Weirs, dams and barrages built into the river hampered or blocked the up- and downwards migration of fish. Around 1900 most of the side-rivers of the Rhine were affected and became less or unsuited for salmon. Examples are: the Thur, Wutach, Aare, Reuss, Limat - Switzerland; Wiese, Elz, Dreisam, Ill, Rench, Neckar, Main, Nahe, Ruhr - Germany (GFR). Large weirs were built in the Rhine below Basel since 1930. But still some rivers retained their value as salmonrivers, e.g. Kinzig, Sauer, Kill, Salm, Ruhwer, Dhron. However, the once largest salmon-river in Europe, changed into an average salmon-river, comparable with the present-day Tweed. The Mosel became the most important contributor to the Rhine salmon stocks, next to Sieg and Lahn.

Till about the 20-30ties pollution for the main river played an unimportant role, notwithstanding already from medieval times it played an important part in some of the smaller rivers. This fact owed the river by its nature as a gletscher-river. A rainriver is far sooner affected by pollution. However, after 1930 pollution became more and more evident, but it is not the cause of the overall decline of the salmon. It may have speeded up its extinction during the last twenty years.

Also the fisheries should be mentioned as a cause of the decline. For many years (1870-1940) the German fisheries accused the Dutch fisheries for over-exploiting the stocks. This argument was more founded on sentiment than on pure reasoning. But it was even believed by the Dutch government and reason to fund till 80% of the restocking programmes. The benefit of the large scale releases of juvenile salmon (more than 80 years) was never fully demonstrated. Again more believing in it than facts to continue the work.

The true causes, the large construction works, barrages, weirs (Rheinkraft-werke), and indicated as such by Fehlmann (1926), was ignored or overlooked for many years.

- Trout

As trout and salmon inhabit many rivers together, the causes for the decline act similar on both species. But trout has the advantage on salmon, that it exists in a non- and in a migratory form. Trout well adapted to their environment and under optimal conditions do not need to migrate. If conditions deteriorate for a short or long period during the year non-migratory forms will become migratory (Thorpe, n.d.).

For the migratory form it is essential to reach the sea again from their inland waters. This type of trout caught in the river may be held as coming from a migratory stock of trout, which may led to the conclusion that trout still migrates up and down rivers. Juvenile trout in the sea wander in the coastalzones and enter the freshwater in so-called dummyruns. They return after a short stay in the freshwater back to the sea. Again if caught there is no proof that these fish were true migratory trout swimming up the river. Hence it is difficult to establish, as long as landlocked trout also inhabits our waters (browntrout), to what extent the trout stocks declined.

It is unknown how the closing of the Zuiderzee (Afsluitdijk), the Delta-works in the Rhine-Scheldt estuary hampered the migration of trout. That these works will have negative effects on the entry of fish from the sea seems obvious.

Reintroduction of the salmon in the Rhine

An international and national wish is expressed to get back the salmon in the Rhine in the form of a natural population.

Not, perhaps, in the same numbers as in the past, but in enough numbers to demonstrate that the waterquality has sufficiently improved due to the measures taken.

However before reintroduction should be contemplated basic information is needed as:

- 1) Are there still sufficient spawning and nursery areas for salmon in the upper reaches of the river, non-polluted and protected.
- 2) Does the down migrating fish have enough and suitable resting places (the same for upstream migration).

- 3) Is there any sign of a detrimental influence of e.g. detergents and other substances on the sense of smell. This may affect the memory of the outwardbound fish, or wipe out the possibility to recognize olfactory clues for homing to the native stream, by affecting the sense of smell (Bardach, c.s., 1965).
- 4) Most fish passages are built empirically, can they be improved by incorporating the specific behavior of the fish?
- 5) What is the consequence of the large construction-works in the Rhine-Scheldt-estuary, to what extent do they block or hamper migrating salmonids.
- 6) What lessons offers history us to learn what happened in the Rhine to the salmon. Were the fluctuations in numbers the same as in nearby rivers (Elbe, Thames, Tweed etc.)?
Fluctuations may be caused by specific factors in the Rhine proper, but also climatological factors over a far wider area may have played their role. (Shearer, 1988).

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year	number	year	number	year	number
1863	35350	1895	48486	1927	25565
1864	41800	1896	49470	1928	14854
1865	28500	1897	39850	1929	9658
1866	27500	1898	41633	1933	5987
1867	20900	1899	33454	1931	1268
1868	17430	1900	27598	1932	1079
1869	15500	1901	31891	1933	611
1870	21600	1902	37336	1934	2642
1871	23142	1903	34686	1935	2300
1872	32015	1904	27541	1936	2868
1873	58255	1905	3098	1937	2311
1874	79107	1906	31564	1938	1920
1875	56852	1907	40544	1939	2016
1876	42383	1908	23557	1940	982
1877	44300	1909	29657	1941	1169
1878	49649	1910	24447	1942	1200
1879	38807	1911	39376	1943	1913
1880	41736	1912	34580	1944	2315
1881	44376	1913	43594	1945	456
1882	55079	1914	28298	1946	230
1883	78609	1915	27425	1947	233
1884	92116	1916	24161	1948	347
1885	104422	1917	28346	1949	900
1886	84230	1918	21032	1950	327
1887	84509	1919	14559	1951	94
1888	68048	1921	12039	1953	29
1890	34555	1922	13480	1954	27
1891	46091	1923	6520	1955	17
1892	65481	1924	9111	1956	2
1893	75175	1925	14586	1957	2
1894	57458	1926	9670		

Table 1. Total Dutch salmon catches 1863 - 1957

year	number	year	number	year	Kgs
1886	612	1937	300		
1887	912	1938			
1888	765	1939	450		
1889	644	1940	800		
1890	338	1941	1225		
1891	312	1942	975		
1892		1943	950		
1893		1944	175		
1894		1945	1000		
1895		1946	2800	1946	105
1896		1947	750	1947	178
1897		1948	900	1948	716
1898		1949	825	1949	679
1899		1950	600	1950	486
1900		1951	1150	1951	538
1901		1952	542 kg		
1902	233	1953	566 kg		
1903	266	1954	331 kg		
1904	179	1955	657 kg		
1905	176	1956	821 kg		
1906	257	1957	703 kg		
1907	145	1958	467 kg		
1908	129	1959	815 kg		
1909	347	1960	373 kg		
1910	294	1961	221 kg		
1911	168	1962	421 kg		
1912	233	1963	817 kg		
1913	1082	1964	292 kg		
1914	2086	1965	989 kg		
1915	3098	1966	3707 kg		
1916	3845	1967	4484 kg		
1917	1212	1968	1415 kg		
1918	912	1969	1588 kg		
1919	1527	1970	1606 kg		
1920	500	1971	2373 kg		
1921	1050	1972	335 kg		
1922	525	1973	124 kg		
1923	850	1974	153 kg		
1924	900	1975	82 kg		
1925	1525	1976	49 kg		
1926	1275	1977	213 kg		
1927	2350	1978	568 kg		
1928	2275	1979	1123 kg		
1929	1150	1980	755 kg		
1930	925	1981	1442 kg		
1931	1875	1982	664 kg		
1932	1700	1983	1072 kg		
1933	650	1984	1002 kg		
1934	500	1985	1053 kg		
1935	325	1986	976 kg		
1936	250				

Table 2. Total Dutch trout catches 1886 - 1986

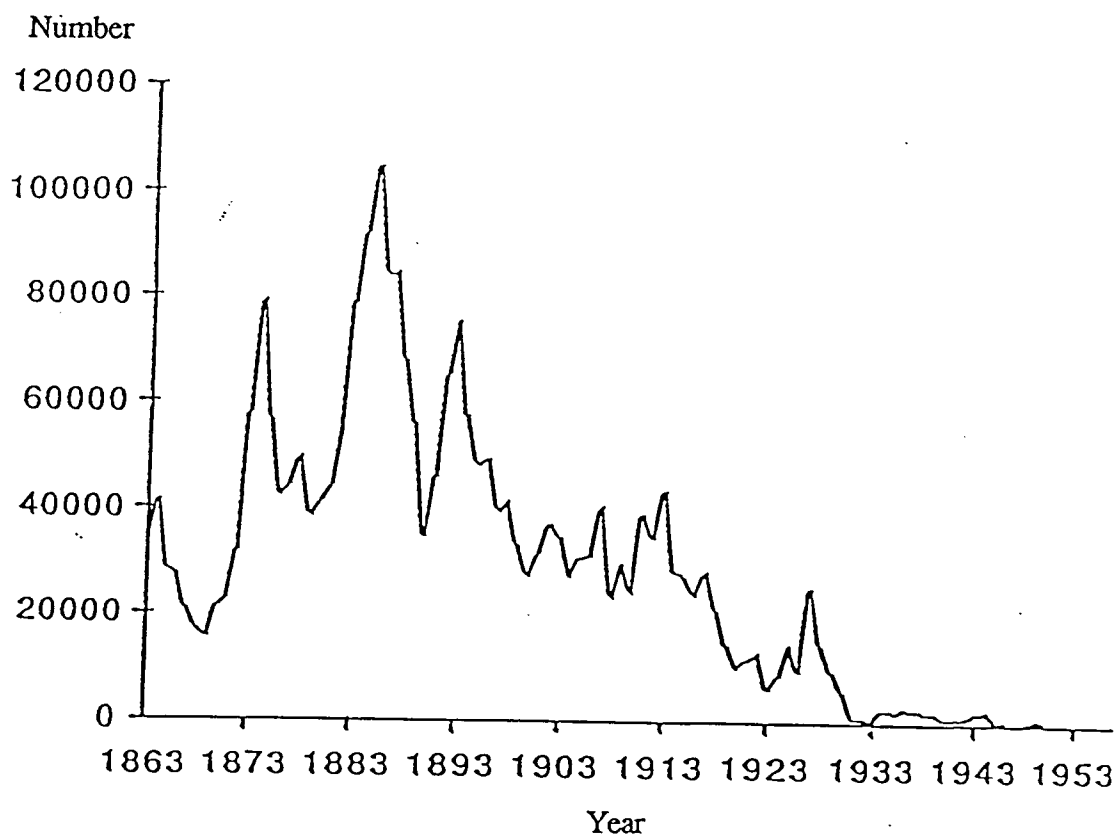


Fig. 1. Dutch salmon catches 1863 - 1957.

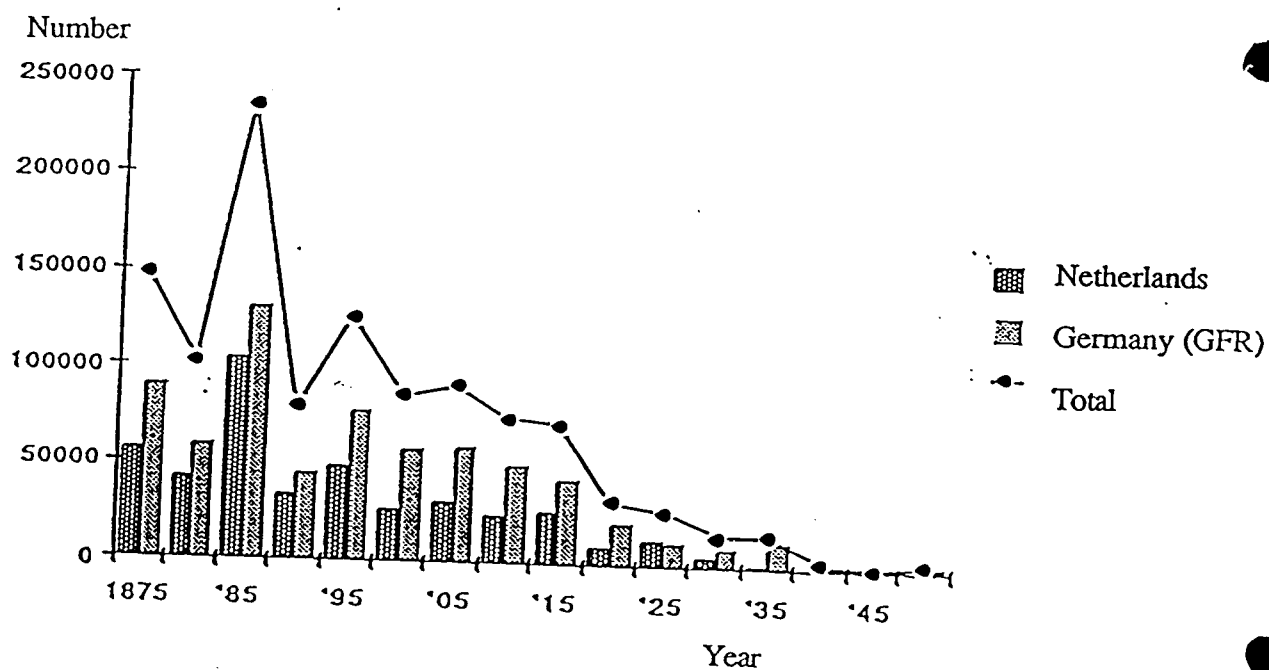


Fig. 2. Total Dutch and German (GFR) salmon catches in the Rhine 1875 - 1950 (Dutch data Fig.1. and Kühn, 1976).

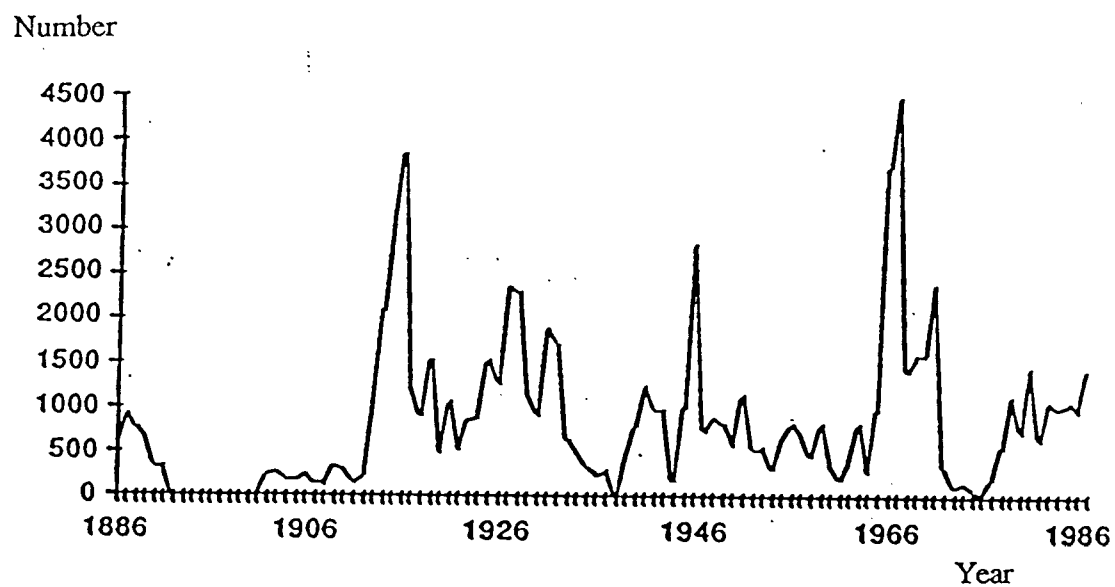


Fig. 3. Dutch trout catches 1886-1986 (1892 - 1901, no data).

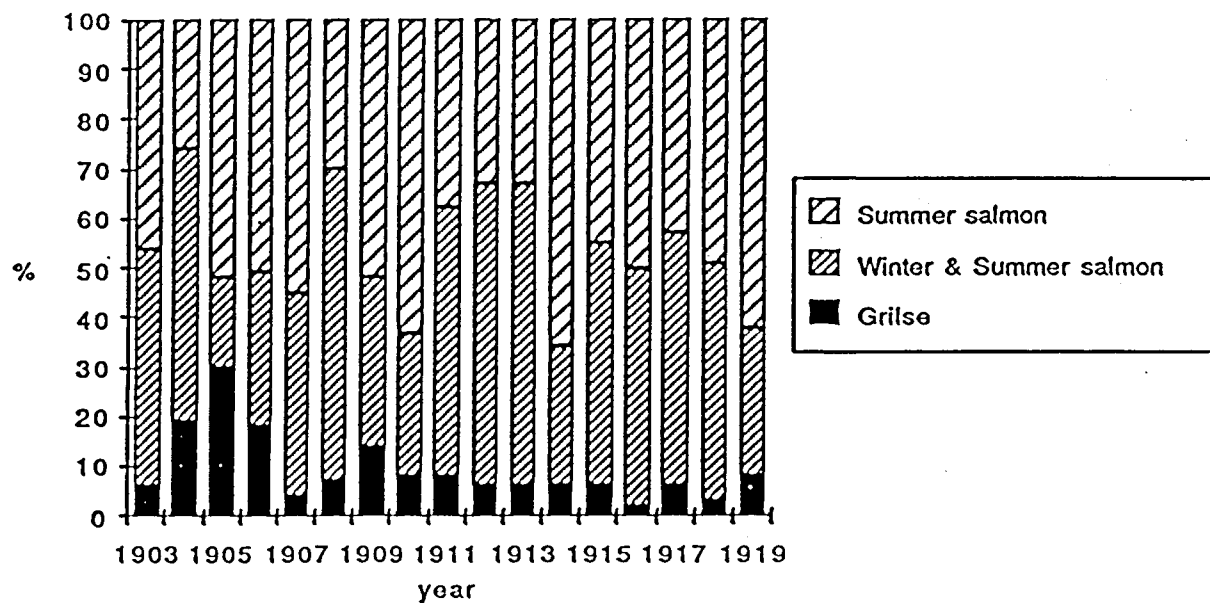


Fig. 4. Dutch salmon catches 1903 - 1919 for the various market categories.

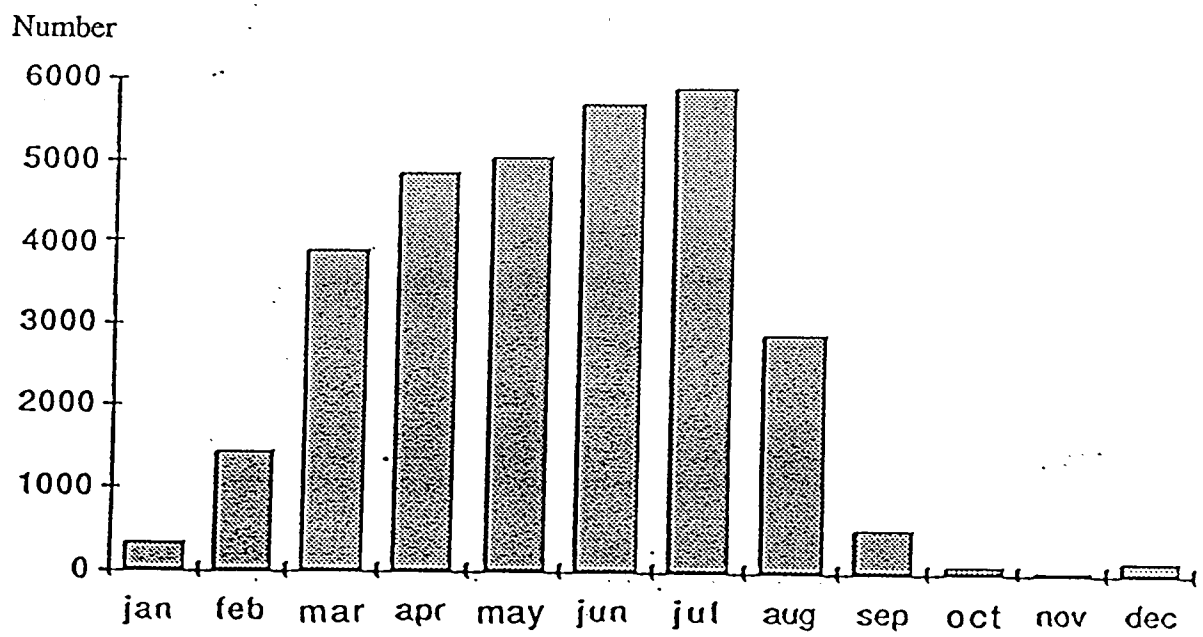


Fig. 5. Average montly landings of salmon 1911 - 1918.

