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Fish Biology

**THE OCCURRENCE OF SALMON (*Salmo salar L.*) IN THE SZCZECIN FIRTH  
AND LOWER ODRa IN 1973**

**WYSTĘPOWANIE ŁOSOSIA (*Salmo salar L.*) W ZALEWIE SZCZECIŃSKIM  
I DOLNEJ ODRZE W 1973 ROKU**

The present paper deals with numbers and weight of salmon (*Salmo salar L.*) as well as with regions and seasons of fishing for this species in the Polish part of the Szczecin Firth and lower Odra in 1973. An attempt was made to compare the intensities of trout and salmon fisheries during the spawning migration of both species.

**INTRODUCTION**

The studies presented were focused on the determination of numbers and weight of salmon (*Salmo salar L.*) caught from the Polish part of the Szczecin Firth and lower Odra, Warta and Noteć. in 1973. The time of adult salmon entering the Odra system to spawn and that of kelts going to the sea had been planned to be detected. The knowledge of the time of these migrations can play an important role in the conservation of this vanishing species of the great economic value. These problems have not been solved yet. Chełkowski, Chełkowska and Kisielnicka (1976) in their work do not offer any explanation either. They gave an account of the combined catches of salmon and trout from the same regions over the previous 20 years (1952–1972). The present paper is thus a continuation of the latter report, the specific affiliation of fish being considered\*.

\* Dr. Roman Sych is thanked for his valuable suggestions offered during the course of this work.

## MATERIAL AND METHODS

Throughout 1973 Polish fishermen caught a total amount of 2398 kg of salmon and trout from the Szczecin Firth and lower Odra. 2110 kg corresponding to 88% of the total amount were studied taxonomically. The remaining catch was examined only tentatively due to the necessity of its immediate delivery to the market. In 1973 salmon and trout did not occur in catches from the lower Warta and Noteć.

The taxonomic examination of salmon and trout was based on works by Berg (1948), Chełkowski (1964), Schechtel (1926), and Żarnecki (1961). The fish length (*longitudo totalis*) was measured to the nearest cm; the weight of gutted fish was assessed with ± 10 g accuracy (conf. Chełkowski, Chełkowska and Kisielnicka, 1976).

Table 1  
Number of individuals and weight of salmon examined in 1973

| region \ month |                    | ind.<br>kg | March     | April<br>Au-<br>gust | Septem-<br>ber | October    | Novem-<br>ber | De-<br>cem-<br>ber | Total        |
|----------------|--------------------|------------|-----------|----------------------|----------------|------------|---------------|--------------------|--------------|
| Szczecin Firth | Kamień<br>Pomorski | ind.<br>kg | 1<br>1.79 |                      | 1<br>14.70     | 1<br>7.80  |               |                    | 3<br>24.29   |
|                | Świnoujście        | ind.<br>kg |           |                      |                | 1<br>12.10 |               |                    | 1<br>12.10   |
|                | Przytor            | ind.<br>kg |           |                      | 1<br>8.10      |            |               |                    | 1<br>8.10    |
|                | Wolin              | ind.<br>kg |           |                      | 1<br>17.80     |            |               |                    | 1<br>17.80   |
|                | Total:             | ind.<br>kg | 1<br>1.79 |                      | 3<br>40.60     | 2<br>19.90 |               |                    | 6<br>62.29   |
|                | Stołczyn           | ind.<br>kg |           |                      | 2<br>20.89     | 3<br>26.45 |               |                    | 5<br>47.34   |
|                | Dąbie              | ind.<br>kg |           |                      | 1<br>13.40     |            | 1<br>9.90     |                    | 2<br>23.30   |
|                | Widuchowa          | ind.<br>kg |           |                      |                | 1<br>13.10 |               |                    | 1<br>13.10   |
|                | Gryfino            | ind.<br>kg |           |                      |                | 1<br>9.24  |               |                    | 1<br>9.24    |
|                | Total:             | ind.<br>kg |           |                      | 3<br>34.29     | 5<br>48.79 | 1<br>9.90     |                    | 9<br>92.98   |
| Grand total.   |                    | ind.<br>kg | 1<br>1.79 |                      | 6<br>74.89     | 7<br>68.69 | 1<br>9.90     |                    | 15<br>155.27 |

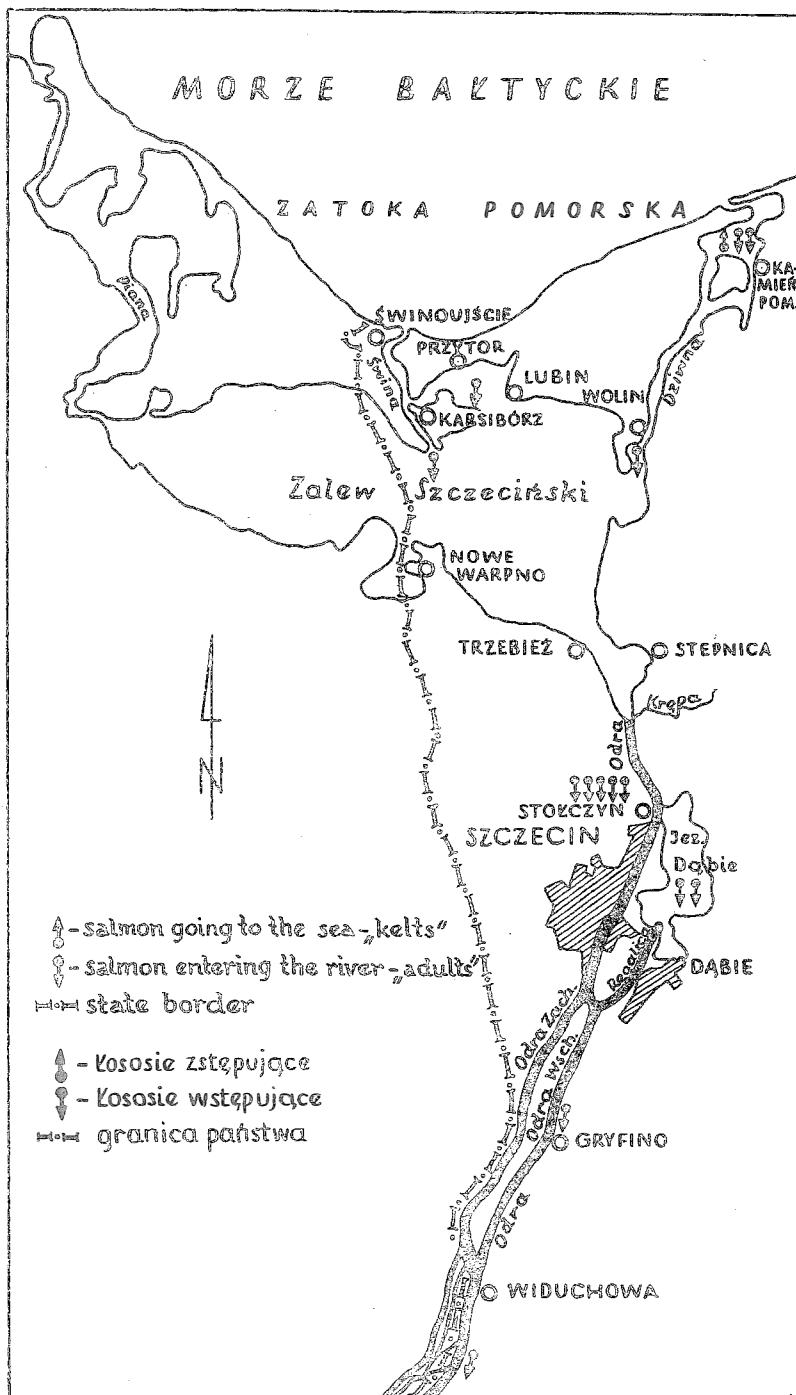


Fig. 1. Sites of salmon capturing

Table 2

Number of individual and weight of trout examined in 1973

| region         | month           | ind.<br>kg | March | April | May    | June   | July   | August | Septem-<br>ber | Octo-<br>ber | Novem-<br>ber | De-<br>cember | Total   |
|----------------|-----------------|------------|-------|-------|--------|--------|--------|--------|----------------|--------------|---------------|---------------|---------|
| Szczecin Firth | Kamień Pomorski | ind.       | 18    | 2     | 11     | 22     | 64     | 34     | 88             | 71           |               |               | 310     |
|                |                 | kg         | 27.42 | 2.48  | 28.65  | 60.58  | 150.13 | 76.03  | 183.85         | 149.61       |               |               | 678.75  |
|                | Świnoujście     | ind.       | 4     | 5     | 5      |        |        |        | 25             | 4            |               | 1             | 44      |
|                |                 | kg         | 13.57 | 8.52  | 7.53   |        |        |        | 67.56          | 14.99        |               | 1.60          | 113.77  |
|                | Przytor         | ind.       |       |       | 3      |        | 3      | 1      | 7              | 6            |               |               | 20      |
|                |                 | kg         |       |       | 8.64   |        | 8.10   | 2.03   | 15.77          | 12.78        |               |               | 47.32   |
|                | Lubin           | ind.       |       |       | 3      | 1      |        | 5      | 12             | 7            |               |               | 28      |
|                |                 | kg         |       |       | 11.82  | 4.24   |        | 11.47  | 29.84          | 21.28        |               |               | 78.65   |
|                | Karsibórz       | ind.       | 2     | 2     | 3      |        |        |        | 3              | 20           | 3             | 1             | 34      |
|                |                 | kg         | 7.20  | 8.41  | 5.96   |        |        |        | 9.05           | 48.55        | 8.26          | 3.75          | 91.18   |
|                | Wolin           | ind.       | 3     | 4     |        |        |        |        | 3              | 36           | 18            |               | 64      |
|                |                 | kg         | 10.53 | 5.63  |        |        |        |        | 5.80           | 82.34        | 31.70         |               | 136.00  |
|                | Nowe Warpno     | ind.       | 1     |       | 2      | 3      | 1      | 10     | 13             | 5            |               |               | 35      |
|                |                 | kg         | 1.55  |       | 9.23   | 13.07  | 1.54   | 23.63  | 24.56          | 8.01         |               |               | 81.59   |
|                | Trzebież        | ind.       | 1     | 6     | 15     | 16     | 9      | 14     | 18             | 16           | 2             |               | 97      |
|                |                 | kg         | 1.27  | 21.39 | 45.02  | 58.24  | 27.27  | 36.17  | 35.12          | 25.94        | 3.60          |               | 254.02  |
|                | Stepnica        | ind.       | 3     | 1     | 4      |        | 1      | 3      | 8              | 20           |               |               | 40      |
|                |                 | kg         | 10.31 | 6.66  | 17.57  |        | 1.40   | 8.18   | 15.87          | 40.48        |               |               | 100.47  |
|                | Total:          | ind.       | 32    | 20    | 46     | 42     | 78     | 73     | 227            | 150          | 2             | 2             | 672     |
|                |                 | kg         | 71.85 | 53.09 | 134.42 | 136.13 | 188.44 | 172.36 | 503.46         | 313.05       | 3.60          | 5.35          | 1581.75 |
| Lowe: Odra     | Stołczyn        | ind.       |       |       | 3      | 6      | 7      | 6      | 23             | 38           | 2             |               | 85      |
|                |                 | kg         |       |       | 9.98   | 14.10  | 16.01  | 13.00  | 48.39          | 73.01        | 4.65          |               | 179.14  |
|                | Dąbie           | ind.       |       | 3     | 8      | 16     | 3      | 4      | 13             | 21           | 2             |               | 70      |
|                |                 | kg         |       | 6.89  | 29.85  | 57.76  | 6.50   | 6.74   | 33.27          | 41.86        | 6.51          |               | 189.38  |
|                | Widuchowa       | ind.       |       |       |        |        |        |        |                | 1            |               |               | 1       |
|                |                 | kg         |       |       |        |        |        |        |                | 1.57         |               |               | 1.57    |
|                | Gryfino         | ind.       |       |       |        |        |        |        |                |              | 1             |               | 1       |
|                |                 | kg         |       |       |        |        |        |        |                |              | 2.91          |               | 2.91    |
|                | Total:          | ind.       |       | 3     | 11     | 22     | 10     | 10     | 36             | 60           | 5             |               | 157     |
|                |                 | kg         |       | 6.89  | 39.83  | 71.86  | 22.51  | 19.74  | 81.66          | 116.44       | 14.07         |               | 373.00  |
|                | Grand total:    | ind.       | 32    | 23    | 57     | 64     | 88     | 83     | 263            | 210          | 7             | 2             | 829     |
|                |                 | kg         | 71.85 | 59.98 | 174.25 | 207.99 | 210.95 | 192.10 | 585.12         | 429.89       | 17.67         | 5.35          | 1954.75 |

## RESULTS

The material examined, presented in Tables 1 and 2, consisted of: 6 salmon individuals of a total weight of 62.29 kg and 672 trout individuals od 1581.75 total weight caught from the Szczecin Firth, and 9 salmons and 157 trouts from the lower Odra, their respective total weights being 92.98 and 373 kg. The material subject to the tentative examination contained no salmon. As a whole, 15 salmon and 829 trout individuals, their respective total weight amounting to 155.27 and 1954.75 kg, were examined. The average weight and length of one salmon individual were 10.35 kg and 100,05 cm, respectively, while the values calculated for one trout individual were 2.36 kg and 60.4 cm, respectively.

The first salmon was obtained from the Szczecin Firth on March 31, the next five specimens being acquired between September 15 and October 16. The salmon specimen caught at the end of March off Kamień Pomorski, i.e., in the river Dziwna connecting the Szczecin Firth with the sea, was in the course of its after-spawning migration, while the fishes caught on other occasions were migrating to spawn. Two such specimens were fished off Kamień Pomorski, while one individual each off Świnoujście, Przytor and Wolin.

The first salmon obtained from the lower Odra was caught on September 4, the last on November 16. All salmon from the lower Odra were migrating to spawn; five were caught off Stolczyn, two off Dąbie and one each off Gryfino and Widuchowa.

Totally, 1 salmon migrating after spawning and 14 migrating to spawn were caught from the Szczecin Firth and lower Odra. Of the latter number, six individuals were caught in September, seven in October, and one in November.

## DISCUSSION AND RESULTS

The amounts of salmon and trout are decreasing with distance from the sea towards the river Odra. Table 3 summarizes this depletion in particular regions. The salmon – trout ratio is in Odra six times higher than that in the Firth ( $9:157 \approx 0.06$  and  $6:672 \approx 0.01$ , respectively).

Using Smirnov test  $\lambda$ (Romanowski, 1951) to compare the distribution of shares from Table 3 we obtain:

$$\lambda = (D) \cdot \sqrt{\frac{n_1 n_2}{n_1 + n_2}} = (0.810 - 0.400) \cdot \sqrt{\frac{15 \cdot 829}{15 + 829}} = 1.57$$

$$P/\lambda = 1.57 / \approx 0.015$$

The low probability value  $P_{\lambda} = 1.571$  obtained indicates to a significantly higher rate of trout depletion compared to that of salmon. In spite of a small amount of material worked out, the result seems justified and can be explained by a numerical predomination

Table 3

Composition of salmon and trout catches with distance from the sea increasing  
in 1973

| Regions        |   | Individuals |       | Shares*       |               | Notes                       |
|----------------|---|-------------|-------|---------------|---------------|-----------------------------|
|                |   | salmon      | trout | salmon        | trout         |                             |
| Szczecin Firth | northern and central part<br><u>the Firth</u> | 6           | 535   | 0.400 (0.400) | 0.645 (0.645) | direction of migration<br>↓ |
|                | Trzebież and Stepnica                         | 0           | 137   | 0.000 (0.400) | 0.165 (0.810) |                             |
|                | Stołczyn and Dąbie                            | 7           | 155   | 0.467 (0.867) | 0.187 (0.997) |                             |
|                | Gryfino and Widuchowa                         | 2           | 2     | 0.133 (1.000) | 0.003 (1.000) |                             |
| Total:         |   | 15          | 829   | 1.000         | 1.000         |                             |

\* cumulated shares in brackets; maximum differences underlined.

of trout and by greater sizes of salmon so that the fishing gear used makes an unequal impact on both species. In practice this means that salmon in Odra should be protected to a greater extent.

The ratios between salmon-and-trout catches of Polish and German (GDR) fishermen over 1960–1972 were 1:1.4 and 1:0.06 in the Szczecin Firth and lower Odra, respectively (Chełkowski, Chełkowska and Kisielnicka, 1976). Moreover, in 1973 6 salmon individuals were caught from Drawa and presumably an equal number spawned naturally (Chełkowska, Chełkowski, 1974). Adopting both these assumptions and our data contained in Table 1 the number of salmon spawners in 1973 in Drawa is estimated at 12, 24 migrating ones being caught from the Firth and Odra (9 individuals caught by the Germans included). Thus 67% of the migrating stock entered the fishery, the mortality less than 1% being assumed.

The Carlin-Larsson model (1975) assumes 50% of A.1+ and 77% of A.2+ and older salmon being caught during their spawning migration. The age structure being considered (also within the model discussed), 60% of the migrating population of Swedish salmon is caught. Thus the intensity of removing the migrating salmon from Drawa is higher.

The catches obtained from the Szczecin Firth and lower Odra consisted of salmon and trout represented by 1.8 and 98.2% of the individuals caught, respectively. As it can be seen, salmon occur in definitely smaller amounts than trout, which – from the economic point of view – is not desirable.

Since an insufficient number of salmon spawners spawns in Drawa, the fishes migrating to spawn should be legally protected or salmon caught from the Szczecin Firth and lower Odra be used for the artificial propagation purposes. A need for immediate attempts of this kind is emphasized by the fact of a thermal barrier being created by the heated waste waters from the Gryfino power station.

In 1973, the total catches of salmon and trout amounted to 1876,65 and 521,42 kg from the Polish part of the Szczecin Firth and lower Odra, respectively. The annual catch from these regions was high, similarly to the annual catches obtained within the last five years (1968–1972) (Chełkowski, Chełkowska and Kisielnicka, 1976).

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#### WYSTĘPOWANIE ŁOSOSIA (*Salmo salar* L.) W ZALEWIE SZCZECIŃSKIM I W DOLNEJ ODRZE W 1973 ROKU

##### Streszczenie

Polscy rybacy wyłowili w 1973 roku z Zalewu Szczecińskiego i dolnej Odry 2398 kg łososi (*Salmo salar* L.) i troci (*Salmo trutta* L.). Z materiału tego poddano badaniom 88% połówów. W połówach z dolnej Warty i Noteći łososie i trocie w wymienionym roku nie wystąpiły.

W badanym materiale z Zalewu Szczecińskiego wystąpiło 6 łososi i 672 trocie oraz w materiale z dolnej Odry 9 łososi i 157 troci. Ogółem przebadano 15 łososi o łącznym ciężarze 155,27 kg i 829 troci o ciężarze 1954,75 kg.

W połówach z Zalewu Szczecińskiego i dolnej Odry 1,8% osobników zaliczono do łosisia i 98,2% do troci. Stąd wynika, że łosoś występuje w wyraźnym regresie liczbowym w stosunku do troci, co z gospodarczego punktu widzenia jest niepożądane.

Z całości przebadanego materiału średni ciężar jednostkowy po wypatroszeniu wyniósł 10,35 kg przy średniej długości (*longitudo caudalis*) 100,05 cm dla łosisia i 2,36 kg przy średniej długości 60,4 cm dla troci.

Z tego 1 łososia złowiono w końcu marca w trakcie wędrówki potarłowej i 14 łososi między 4 września a 16 listopada w trakcie wędrówki tarłowej.

W oparciu o posiadane dane szacuje się, że w 1973 roku do połówów w Zalewie Szczecińskim i dolnej Odrze trafiło 67% wędrującego stada tarłowego łosisia.

W związku z niedostateczną liczbą tarlaków łosisia odbywających tarło w Drawie, wydaje się pożądanym wprowadzenie ochrony ciągnących na tarło ryb lub podjęcie prób wykorzystania

żwionych łososi w Zalewie Szczecińskim i dolnej Odrze w reprodukcji stada. Spieszne podjęcie prób wykorzystania tych łososi uzasadnione jest jeszcze faktem tworzenia się barażu cieplnego przez podgrzane wody elektrowni pod Gryfinem\*.

ЛОСОСЬ (SALMO SALAR L.) В ЩЕЦИНСКОМ ЗАЛИВЕ  
И В НИЖНЕЙ ОДРЕ В 1973 Г.

Р е з ю м е

Польские рыбаки выловили в 1973 г. в Щецинском заливе и в нижней Одре 2398 кг лосося (*Salmo salar L.*) и кумжи (*Salmo trutta L.*). 88% общего улова было подвергнуто исследованиями. В нижнем течении Варты и в Нотеци лосось и кумжа в 1973 г. в уловах не встречались.

В исследуемом материале из Щецинского залива было обнаружено 6 лососей и 672 кумжи, а в материале из нижней Одри - 9 лососей и 157 экз. кумжи. В общем исследовано 5 лососей общим весом 155,27 кг и 829 экз. кумжи общим весом 1954,75 кг.

1,8% особей, выловленных в Щецинском заливе, составляли лососи, а 98,2% - кумжа. Отсюда следует, что в данных водоёмах преобладает кумжа что с хозяйственной точки зрения является нежелательным.

В общей массе исследуемого материала средний удельный вес рыбы после потрошения составлял 10,35 кг при средней длине (*longitudo caudalis*) 100,05 см у лосося и 2,36 кг при средней длине 60,4 см у кумжи.

Один лосось был выловлен в конце марта, во время посленерестовой миграции, а 14 лососей - в период от 4 сентября до 16 ноября во время нерестовой миграции.

На основе имеющихся данных предполагается, что в 1973 г. в Щецинском заливе и в нижней Одре было выловлено 67% мигрирующего стада нерестового лосося.

В связи с недостаточным количеством производителей лосося, совершающих нерест в р. Драве, следует ввести запрет на лов идущих на нерест или же предпринять попытки использования вылавливаемых в Щецинском заливе и нижней Одре лососей для воспроизводства стада.

Срочное проведение мер по использованию этих оправдано фактом образования термической преграды подогретыми водами электростанции под Грифино.

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