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AN ATTEMPT TO ESTIMATE CHANGES IN THE FISH STOCK OF LAKE JEZIORAK ON THE BASIS OF THE FISHING YIELD OF SEINES

PRÓBA OSZACOWANIA ZMIAN W POGŁOWIU RYB W JEZIORZE JEZIORAK NA PODSTAWIE WYDAJNOŚCI POŁOWOWEJ PRZYWŁOK

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Analyses were performed of changes in the fishing yield and fish composition of catches obtained with seine nets in Lake Jeziorak in 1967–1985. The results were compared with similar data for 33 lakes of pikeperch type.

It was found that average fishing yield of seines in Lake Jeziorak amounted to 362.87 kg, being 115.98 kg higher than the average calculated for 33 lakes of pikeperch type. Fishing yield showed an increasing trend at decreasing fishing effort and increasing fish catches. These differences and trends were caused by: change of the protective size for bream, so that specimens smaller than 0.5 kg were caught, and increased predation which reduced prey fish stocks, mainly that of roach.

INTRODUCTION

Seines are very popular in inland fishery due to the possibility of performing a catch in a relatively short time, gigh effectiveness, and low risk of being damaged (by poachers or touristes). Share of seine nets in total intensity of the exploitation in pikeperch lakes amounted to 40% (Bonar 1974, Bonar 1987b). Also Dąbrowski, Leopold and Nowak (1964a,b) stated that seines were very popular in Polish inland fisheries.

Fishing yield of the fishing gear, in this also of seines, was frequently used to assess changes in fish biomass and densities of the fish stocks and fish populations (Dąbrowski, Leopold, Nowak 1964a, b, Kozłowska-Filar 1971, Forney 1977, Johnson 1977, Johnson and Hale 1977, Bonar 1987a,b, 1989, Bonar and Kempa 1987a,b).

The objective of the study was to assess changes in the exploited fish stock in Lake Jeziorak on the basis of the fishing yield of seines.

MATERIALS AND METHODS

Materials consisted of records kept by the State Fish Farm Iława (Poland). They embraced intensity and effectiveness of exploitation with seine nets of the fish stock in Lake Jeziorak (3245,4 ha, average depth 4.1 m) in 1967-1985. The materials collected contained the following information: number of seine-days, weight of fish caught with these gears classified to species, and in case of bream – also to size groups.

Wing length of seines used in Lake Jeziorak was up to 180 m. Mesh size in the bag varied from 28 mm to 40 mm.

Fishing effort was expressed as number of seine-days in a year Fishing yields were obtained dividing the catch by the fishing effort and expressed as kg caught per one seine-day. Seine catchability was calculated in the same way. According to Dąbrowski (1964) gear catchability is understood as weight of the given species (in kg) caught by the given gear in a time unit. Analysis of the fishing yield were based on the following assumptions, depending on the needs:

– relatively constant weight of the exploited fish stock,
– similar construction of the gear and similar fishing methods.

Fulfillment of he first condition allows for analysing the dependence between fishing yield and gear construction and methods of fishing. Fulfillment of the second condition allows for an assessment of changes which take place in the exploited stock (Bonar 1990).

Methods of calculating average fishing yield also depend on the objective of studies. In the available literature long-term, annual and monthly averages are used.

1. Long-term (multi-year) fishing yields are usually calculated for a definite group of lakes and used to characterized gear catchability and exploitation pressure, as well as to assess average fishery resources.

2. Average annual fishing yields of the fishing gear are analysed in multi-year periods and may supply information on the biomas and species composition of the fish stocks, assuming that gear construction and fishing methods have not chaged.

3. Average monthly fishing yields are used to study changes in gear catchability in an annual cycle. These may be due to changing fish behaviour connected with fish biology. Seasonal grouping and seasonal migrations increase gear catchability, this being taken advantage of by the fishermen.

In this study, average annual and long-term fishing yields of seines were analysed. Studies embraced Lake Jeziorek and a period 1967–1985. Changes of the gear catchability with respect to particular fish species were analysed, and in case of bream also with respect to its size groups. The results were compared with similar calculations made for 33 lakes belonging to pikeperch type, similary as Lake Jeziorak.

RESULTS

Catches obtained with seines in Lake Jeziorak amounted on the average to 17.7 kg/ha in 1967–1985, this being 62% of total fish catch in this lakes (Tab. 1). It was also found that they tended to increase by 0.57 kg/ha annually on the average (Fig. 1). In other pikeperch lakes, average share of seines in total fish catch was 67% (Bonar 1987b).

Average annual fishing effort, expressed in the number of seine-days in Lake Jeziorak amounted to 158 (Tab. 1) and showed a decreasing trend notwithstanding increasing trend of catches (Fig. 1). Popular use of seine nets was observed in Mazurian lakes by Dąbrowski, Leopold and Nowak (1964a,b) as well as by Bonar (1987b) in lakes of pikeperch type.

Table 1

Significance of summer seine in total catch in Jeziorak Lake
(average in year 1967–1985)

Specification	Unit	Summer seine with bag	Another gears	Total
Yield	kg kg/ha %	57.444 17.70 62.04	35.148 10.83 37.96	92.591 28.53 100.00
Fishing effort	Number of gear-days	158.30	–	–
Fishing efficiency	kg/gear-day	362.87	–	–

Effectiveness of seining, measured with the fishing yield of these gear, was 362.87 kg per one seine-day, being higher than the average for 33 pikeperch lakes by 115.98 kg (Tab. 2). Fishing yields showed an increasing trend similarly as the catches (Fig. 1). In Lake Jeziorak as well as in the group of pikeperch lakes, bream predominated in

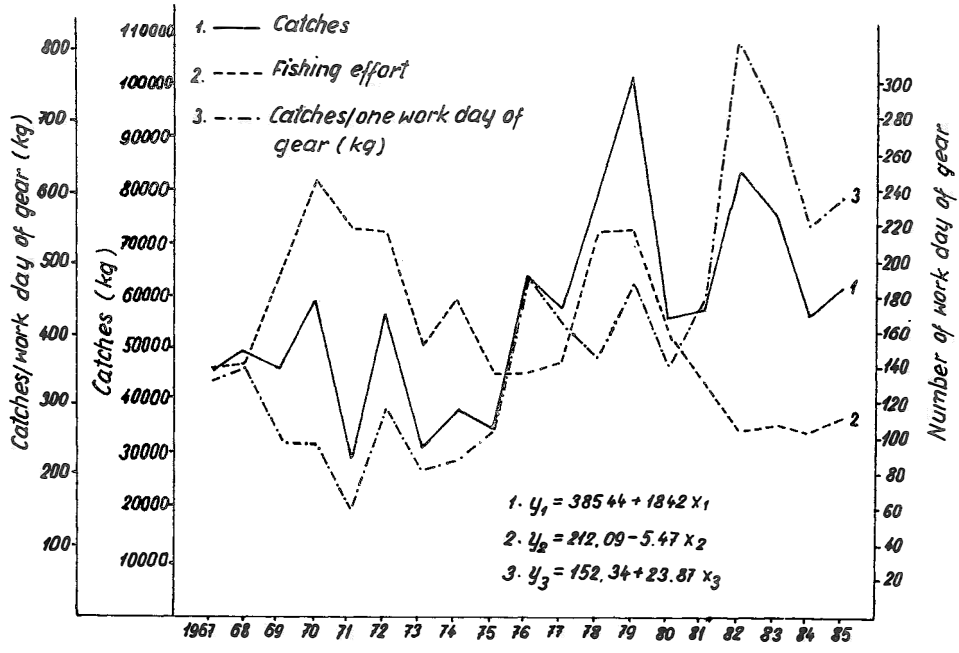


Fig. 1. Intensity and effectivity of summer seine with bag catches in Jeziorak Lake

seine catches, mostly small specimens, below 0.5 kg in weight (Tab. 2). Lowering of the protective size for bream is quite common especially in strongly eutrophic lakes. In view of poor resources of the bottom fauna (Giziński 1974) growth rate of bream tends to decrease at simultaneous increase of its reproductive potential and higher survival of juvenile fish (Laskar 1949, Brylińska 1971). Also Cazemier (1984) found that bream transferred to lakes with higher biomas of *Chironomidae* larvae was characterized by better condition and more rapid growth than in native lakes.

These observations, confirmed also by the fishermen, resulted in the fact that protective size for bream has been lowered and fish smaller than 0.5 kg are being caught. These decision usually result in increased catches and increased fishing yield (Bonar 1974, 1987a, Bonar and Kempa 1987a).

Table 2

Species composition of catches of summer seine

Species	Jeziorak Lake		33 pike perch lakes (Bonar, 1989)	
	kg/one seine-day	%	kg/one seine-day	%
Bream > 0.5 kg	27.92	7.69	33.24	13.46
Bream < 0.5 kg	253.88	69.96	109.16	44.21
Pike-perch	43.78	12.07	17.11	6.93
Pike	5.43	1.50	5.62	2.28
Eel	14.46	3.98	6.27	2.54
Roach	8.26	2.28	63.02	25.53
Another species	9.14	2.52	12.47	5.05
Total	362.87	100.00	246.89	100.00

Table 3

Theoretical yield of summer seine catches

Specification	Jeziorak Lake	33 pike-perch lakes (Bonar, 1989)
1. Yield of summer seine catches	362.87	246.89
2. Yield of summer seine catches minus bream smaller than 0.5 kg	108.99	137.73
3. Catches of predatory fishes (pike-perch, perch, pilke, eel)	63.67	29.00
4. The share of predatory fishes in yield of summer seine catches	17.55	11.75
5. Theoretical mass of fishes being the food of predatory fishes (coefficient = 5)	318.35	145.00
6. Theoretical yield of summer seine catches *	363.67	253.73

* Yield of summer seine catches minus bream smaller than 0.5 kg and predatory fishes and plus theoretical mass of fish being the food of predatory fishes.

Share of bream smaller than 0.5 kg in the fishing yield of seines used in Lake Jeziorak as welll as in the compared group of pikeperch lakes was high, amounting

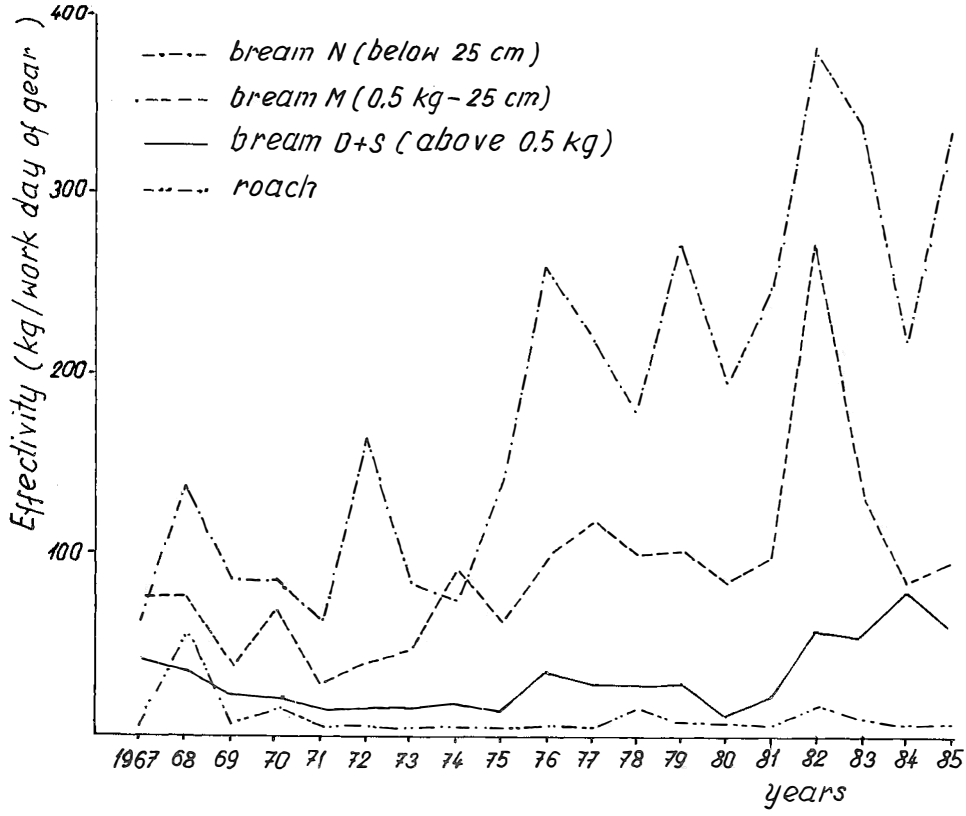
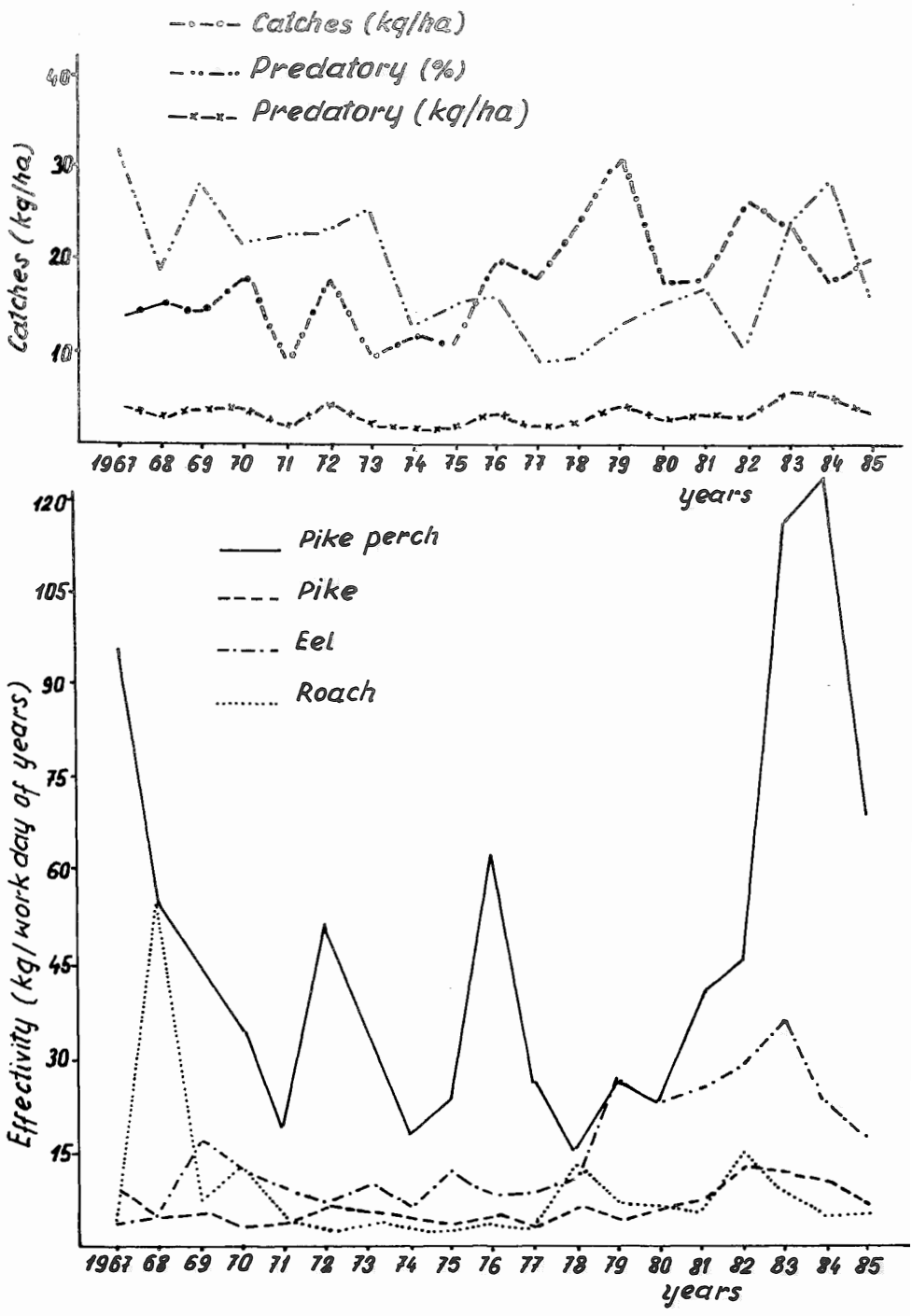


Fig. 2. Yield of bream in kg per one work-day of summer seine with bag in Jeziorak Lake

respectively to 70% and 44%(Tab. 2). When this fraction was excluded, average fishing yield reached 109 kg and 138 kg per seine-day (Tab. 3) and was lower than the fishing yield of seines found by Dąbrowski, Leopold and Nowak (1864a,b) for lakes belonging to various fishery types (vendance, bream, pikeperch, pike-tench).

Consecutive positions in the fishing yield of seine were occupied by: pikeperch (44 kg) and eel (14 kg), while in the comparative group of lakes: roach (64 kg) and pikeperch (17 kg). Also share of predator differed. It amounted respectively to 17.55% and 11.75% (Tab. 3).

Studies devoted to the effect of exploitation and predation in fish communities on the exploited stock revealed that the highest effectiveness of exploitation was obtained when predators represented 25% of the catch. Increase of this percentage by 1% on the average resulted in a decrease of catches by 0.5 kg/ha (Bonar 1977). In order to confirm this relations, theoretical fishing yield of seine nets was calculated. Method of calculation is given in Tab. 3. Theoretical weight of prey fish consumed by predators, recalculated per one seine-day, amounted to 318 kg in Lake Jeziorak, and to 145 kg in pikeperch lakes (Tab. 3).



Species composition of fish caught with summer seine with bag in Jeziorak Lake

These comparisons suggest that the impact of predators on prey populations was higher in Lake Jeziorak than in the group of pikeperch lakes. This suggestion is indirectly confirmed by roach catches, and especially by share of this species in the fishing yield. In Lake Jeziorak it amounted to 2% (8 kg per gear-day) and in pikeperch lakes to 26% (63 kg per gear-day) (Tab. 2).

Also changes in seine catchability in 1967–1985 confirm the relationships between lowering of protective size for bream and increased impact of exploitation upon this species on the one hand, and the stock of roach and predators on the other hand. Increased effectiveness of pikepech (years 1967, 1979, 1983 and 1984) and pike (years 1972, 1978, 1982 and 1983) fishing was usually noted after high effectiveness of roach fishing (Fig. 3). No effect was noted of decreased protective size for bream upon the effectiveness of roach exploitation, but such a relationship is quite possible. Similar results were obtained during and analysis of catches from Lake Wielimie, which is also a pikeperch lake.

Lammens (1986) noted prey similarity as regards juvenile stages of bream and roach. Similar observations were reported by Brylińska and Bryliński (1968) after Vogatowa, Zeltenkowa and Cavkina. Relationships between bream and roach stock and that of predators were well illustrated by the analysis of catches from 79 lakes of pikeperch type. Domination of roach was accompanied by lower share of bream and predators, while domination of bream was coupled with higher catch of predatory fish and lower catch of roach (Bonar 1990).

Having in mind potential effect of predators and increased exploitation of the bream stock in Lake Jeziorak (removal of individuals smaller than 0.5 kg) it may be concluded that fish densities in this lake were similar to those observed in the 33 lakes of pikeperch type.

DISCUSSION

Fishing yield of the gear depends on gear construction, and methods and season of fishing on the one hand, and species composition of the ichthyofauna, biomass of particular fish populations and protective fish sizes on the other (Dementieva 1960, Dąbrowski 1964, Dąbrowski et al. 1964b, Bonar 1987a, b, 1989, 1990). Protective size divides fish population into two parts: protected and catchable one. Any change of protective sizes will thus be reflected in the fishing yield (Bonar 1974, 1987a, b).

This results in the following facts: when the fishing gear, techniques of fishing and fishing seasons are not much differentiated, fishing yield of the gear will reflect changes in fish densites quite well. On the other hand, when the gear used, methods of fishing, and fishing seasons are highly differentiated, fishing yields may not be connected with fish densities (Bonar 1990).

Classical seines used in Polish lakes differ as regards wing length (from 60 to 180 m) and meash size of the bag (from 28 to 44 mm). However, in case of single lakes, usually these differences are negligible. The same seines are used for many years, and catches are performed on the same fishing grounds and in the same months.

Average fishing yield of seines used in Lake Jeziorak in 1967–1985 was 362.87 kg, being by 115.98 kg higher than a similar average calculated for 33 pikeperch lakes (tab. 2). The difference was caused by:

1. Changed protective size for bream and increased exploitation of juvenile specimens which did not attain 0.5 kg (Fig. 2), at simultaneously decreasing intensity of exploitation. As a result, fishing yield of seines gradually increased (Fig. 1).

2. Increased impact of predators on prey populations, especially on roach. Share of predatory fish in the fishing yield of seines used in Lake Jeziorak was 17.55%, while share of roach was only 2.2%. In the comparative group of pikeperch lakes the respective values were 11.75% and 25.53%.

Domination of roach in the food of pikeperch, pike and eel was observed by Dziekońska (1854), Antosiak (1863a,b), Draganik (1962), Szypuła (1964), Martyniak (1975), Bahnsavy (1989).

Fishes represent the highest level of changes in lakes. As such they may determine by feed-back mechanism the distribution of the food resources (Dąbrowski 1964, Anderson et al. 1978, Kerr 1977, Bonar 1977, McQueen et al. 1986). Thus, commercial exploitation affects rate and direction of changes and may be a destabilizing factor. The effects of exploitation depend on the strategy, this being implemented by the selection of gear, method and season of fishing (Bonar 1990).

Predation is a regulatory mechanism in the fish communties. It maintains a dynamic balance both within the populations of predators as well as of prey fish (Bonar 1977, Kerr 1977, Bonar 1990). It was found that domination of roach in the fish catch is usually accompanied by relatively lower share of bream and of predators, while predomination of bream was usually accompanied by higher catch of predators and lower of roach (Bonar 1990).

Thus, there is strict relation between effects of catches and species composition of the fish communities, and if the effects of fishery management, or more strictly of the exploitation, are not recognized, fish production may collapse (Bonar, 1977).

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PRÓBA OSZACOWANIA ZMIAN W POGŁOWIU RYB W JEZIORZE JEZIORAK NA PODSTAWIE WYDAJNOŚCI POŁOWOWEJ PRZYWŁOK

STRESZCZENIE

Badano zmiany wydajności połowowej przywłok stosowanych do połowu ryb w jeziorze Jeziorak w latach 1967–1985. Określono zmiany łowności tych narzędzi, skład gatunkowy oraz strukturę gatunkowo-asortymentową odłowów. Uzyskane wyniki porównano z przeciętną łownością przywłok stosowanych w 33 jeziorach podobnie jak Jeziorak klasyfikowanych jako sandaczowe.

Tendencja wydajności połowowej była wzrastająca przy malejącym nakładzie połowowym i zwiększających się odłowach.

Stwierdzono, że zmiany wydajności połowowej przywłok miały związek z jakością odłowów. Udział procentowy leszcza, płoci i ryb drapieżnych (węgorz , sandacz, szczupak) wpływały na ogólną wydajność połowową tych narzędzi i ich łowność w stosunku do wymienionych gatunków. Stwierdzono także związek pomiędzy zmianą wymiaru ochronnego dla leszcza i wyławianiem osobników poniżej 0,5 kg, a nieznacznym wzrostem łowności płoci i zwiększającą się łownością przywłok w stosunku do sandacza, węgorza i szczupaka.

Powyższe obserwacje potwierdzają sugestię, że zmiana zasady eksploatacji zasobów rybackich znajduje odzwierciedlenie w jakości odłowów, a reakcje zespołów ryb na wyławianie mają charakter kompleksowy.

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