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Fish culture

PRELIMINARY RESULTS OF RESEARCH ON THE EUROPEAN EEL
(*ANGUILLA ANGUILLA* L.) CULTURE IN WARM WATER FROM
THE „POMORZANY II” POWER STATION

WSTĘPNE WYNIKI BADAŃ NAD TUCZEM WĘGORZA
(*ANGUILLA ANGUILLA* L.) W WODZIE POCHŁODNICZEJ
Z ELEKTROWNI „POMORZANY II”

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During the period of 145 days, in 1974, an experiment with the European eel (*Anguilla anguilla* L.) culture into the net cages was carried into effect. The cages, 6 in number, were kept in warm water canal running out from the „Pomorzany II” power station in Szczecin. The water temperature in this canal evermore was above 20°C (21–32°C), and the oxygen content never fall down below 6.5 mg/litre throughout all 4 months of research. The eels were fed with minced freshwater fish at the first period of experiment, and hereafter with the mackerel flesh only. Growth of the fishes was unequal and very discriminating. Fish mortality amounts to 6.15 per cent.

Steadily rising demand as well as an attractive prices of freshwater eels on the world seller's marked have a bearing on an additional interest of Poland to intensify the European eel (*Anguilla anguilla* L.) husbandry. A significant decrease of this fish catches in our estuaries and inshore waters, as soon as necessity to base its inland-water farming on a permanent stocking with the elvers, coerce into searching for an additional opportunities to height the eel production. One of the way for it may be considered the eel culture in water of labile salinity and higher temperature, and different technical installations.

The Japanese eel (*Anguilla japonica*) culture was started in Japan on commercial scale since 1894. According to Ussui (1974) record, about 24,000 tons of consumptive eels per year have been landed from the eel culture industry, and its production is still growing.

In recent years the experiments with the European eel culture have been undertaken too. As Koops (1965), Lauterbach (1968) and Bohl (1970) have already pointed out, the appropriate feed selection and a favorable environmental conditions make sufficient facilities for successful eel culture on commercial scale. In addition to earthen and concrete ponds (Koops, 1965, 1971; Bohl, 1970) a net cages (Lauterbach, 1968) are in use for eel culture soon. This fish species culture in freshwater is recorded, by Koops (1965, 1971), Meske (1969) and Bohl (1970), in brackish water by Lauterbach (1968), and in warm water by Meske (1968).

Since 1974, an experiment with the European eel culture into net cages placed in warm water from the power station was undertaken by the present authors soon.

MATERIAL AND METHODS

Experiment with the European eel culture was placed in a warm water canal running off from the "Pomorzany II" power station in Szczecin. This warm water canal was 1,200 meters in length, 17–20 m. in width, and 2.5–3.5 m. in depth; and the water flow was 0.4–0.6 m/sec. in it. For this eel culture 6 net cages, each of 2.5x1.3x1.5 m. in dimension, were used. These were collocated in about 40 meters distance from place, where warm postcooling water from the power station was dropped down. All 6 cages were swung on a self-bearing floating construction (Fig. 1) because of relatively high lability of the water level (upto 0.8 meter) in the canal. The frames of the cages were made of the "Vinidur" plastic tubes (40 mm in diameter) and of the plastic net (6x6 mm in mesh size) which was of red colour. All the 764 eels were caught on June 16th 1974 in the Szczecin

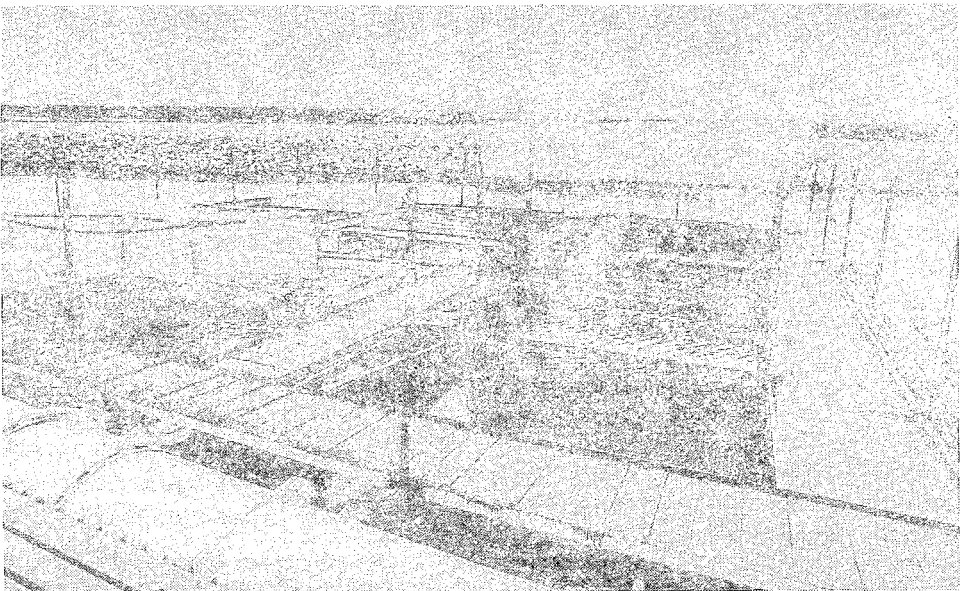


Fig. 1. Platform surrounding the net cages for eel culture

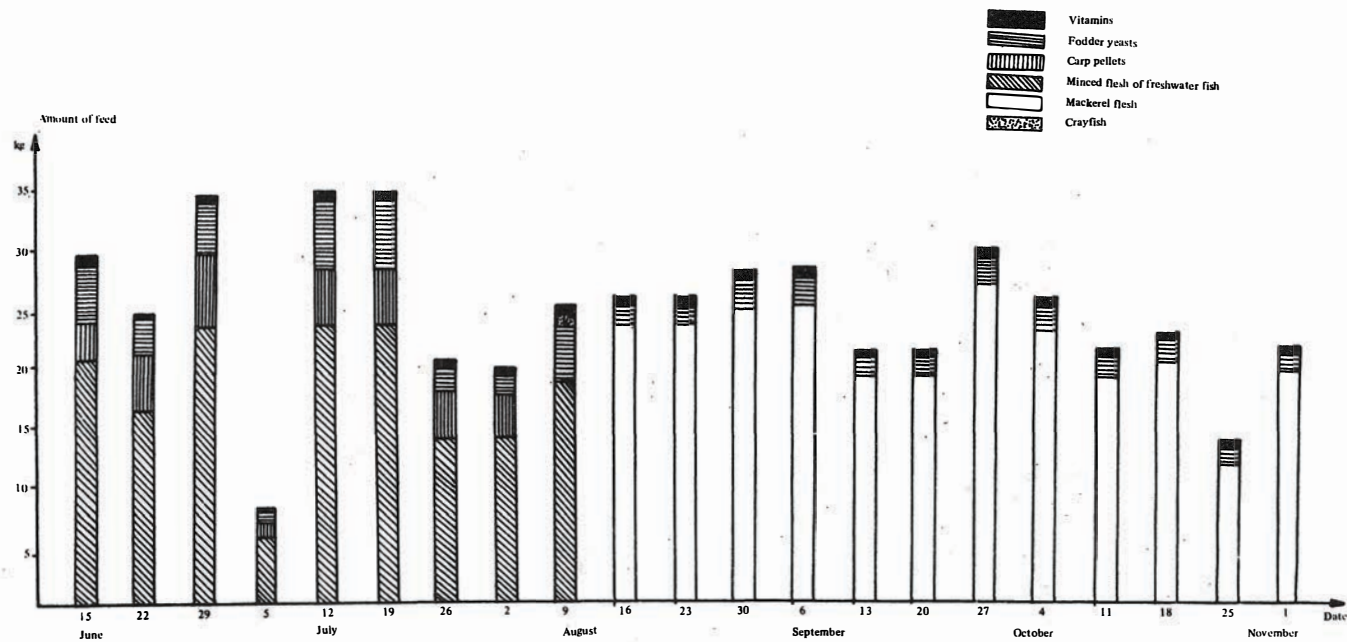


Fig. 2. Composition of feed in different periods of eel feeding

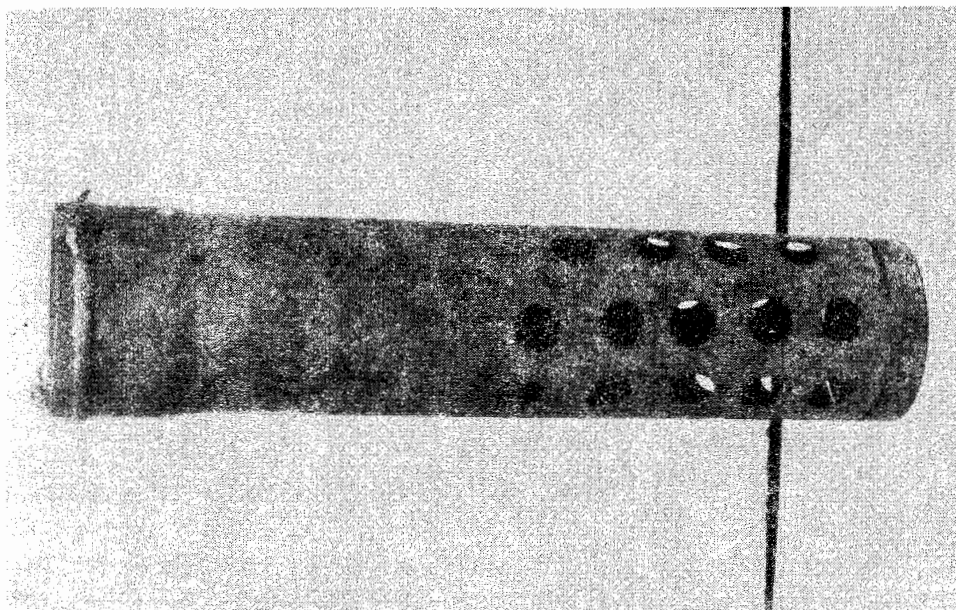


Fig. 3. "Admitting pipe feeder" for eels

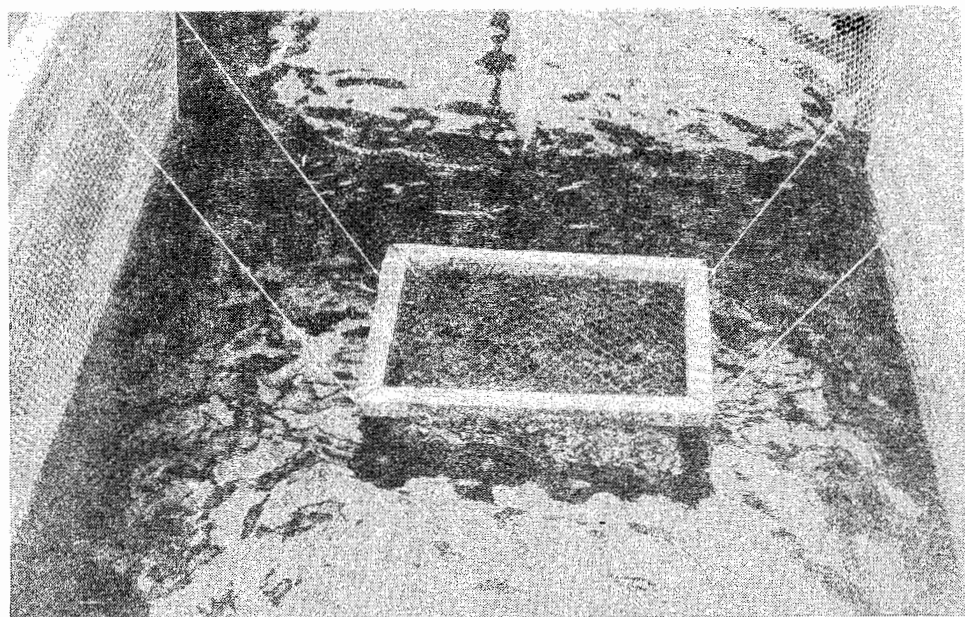


Fig. 4. "Frame-net feeder" for eels

Firth (that constitutes a large estuary of the River Oder), and all these cultured fishes were below 100 gms. in weight. Within each of the 6 net cages the same fish number was kept. All the eels cultured looked healthy and were in a very good condition. They were fed with fresh feed only. The components being used for feed preparation at the beginning of experiment were as follow: freshwater minced fishes (roach, bream, bream flat, perch, pope), carp pellets, fodder yeasts, and vitamins added in a different proportions (Fig. 2), and, starting from mid of August, the mackerel flesh only. The mackerel was purveyed to us in a minced form formed into a frozen block, so the fodder yeasts and vitamins were added after the blocks were efrized (Fig. 2). After these components were mixed together the feed of a thick paste consistence was obtained. This paste was put in the "admitting pipe feeders" (Fig. 3) as soon as onto the "frame-net feeders" (a big mesh trays) which were just above the water surface hung (Fig. 4). The eels were fed once a day only, just between 5 p.m. and 8 p.m. A diurnal feed dose amounts to about 10 per cent by fish body weight. Temperature, oxygen and pH were measured every day in the warm water canal as soon as in water inlet canal running in to power station.

RESULTS

By the period of 145 days, between June 15th and November 6th 1974, an experiment with the eel culture in warm water from the "Pomorzany II" power station in Szczecin was carried out. The water temperature never overrun 33°C in summer months, and it was evermore about 8–10°C higher in warm postcooling canal running out from the power station than in inlet water canal. (Fig. 5). Oxygen content in this warm water ranges between 6.6 and 9.4 mg/litre and the pH varies from 6.8–7.8 (Fig. 6, 7). As the oxygen and pH averages and weakly limits (presented on diagrams) proved, the Odra River water in warm postcooling canal running out from the "Pomorzany II" power station may be put to a good use for fish culture, including eel.

Please note that scatterely (about twice a month) superficial water pollution with oily matters was observed, but it seems to has no special influence on the eel growth and the rate of its mortality.

The first weight control, achieved on 16th day of culture, shows that in three of six net cages all the eels increased their weight from 3.6–11.3 gms., but in remaining cages inconsiderable weight loss occurred. In this period of time the first eels mortality have been observed, 20 fish died. Such slight growth rate as soon as its weight loss are probably due to objectionable feed quality, inappropriate consistence of paste that was used for feeding, and wrong feeding method soon.

During the second weight control (on July 6th) the weight loss was ascertained in all cages (Fig. 8). In addition to efficient cause being just mentioned the eels weight loss was probably set off by significant oxygen content decrease in water (Fig. 6). The average weight of eels decreased in this time from ca. 105 gms. to 95.7 gms. Please note that the next mortality took place in this time, and 14 eels more died. Differences in food composition as soon as variation in oxygen content and water temperature are considered

to by the factors causing continuous weight loss of eels, coming off to 94.7 gms. The water temperature in this time was high, scatterely getting at 32°C (Fig. 5). This time mortality was noted again, and 13 eels died.

Unfortunately, two net cages were destroyed on September 5th, so all the eel cultured escaped from there. The feed composition and feeding method were changed after the mid of August: minced freshwater fish replaced with the mackerel flesh, and "the admiting pipe feeders" were withdrawn from circulation, so "frame-net feeders" were used only (Fig. 4).

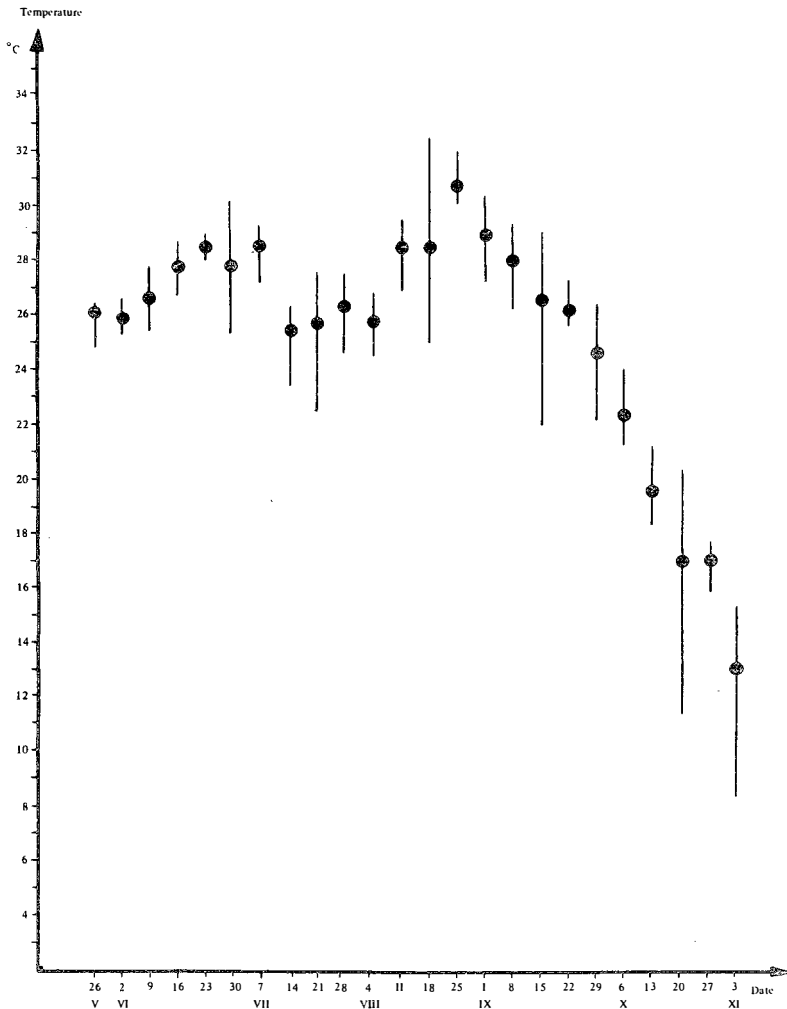


Fig. 5. Weekly varations of water temperature in warm postcooling water canal

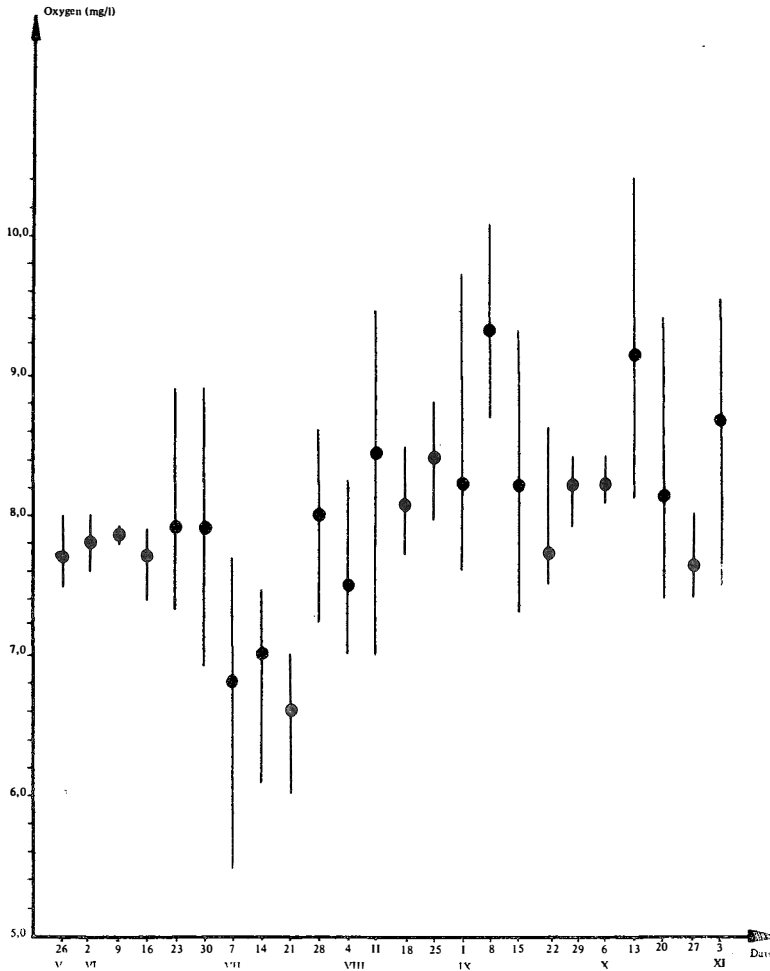


Fig. 6. Weekly changes in oxygen content in warm water canal

Next weight control of fishes (on October 6th) reveals positive influence of these changes on the eel growth; their average weight increased upto 112.2 gms.. No fish mortality have been observed at this time.

Last weight control (on November 6th) indicates, indeed, the continuous increase the average weight of fishes upto 123 gms., but it shows the growth rate decrease soon. It seems to be caused by a significant lapse of water temperature to 13.1°C in this period of time.

During last weighing all the eels were divided into two groups: "green" and "silver", due to significant size variations these fish. The average weight of the "silver" and "green" eels was 104.4 gms. and 154.9 gms., approximately. The presumption is that the "green"

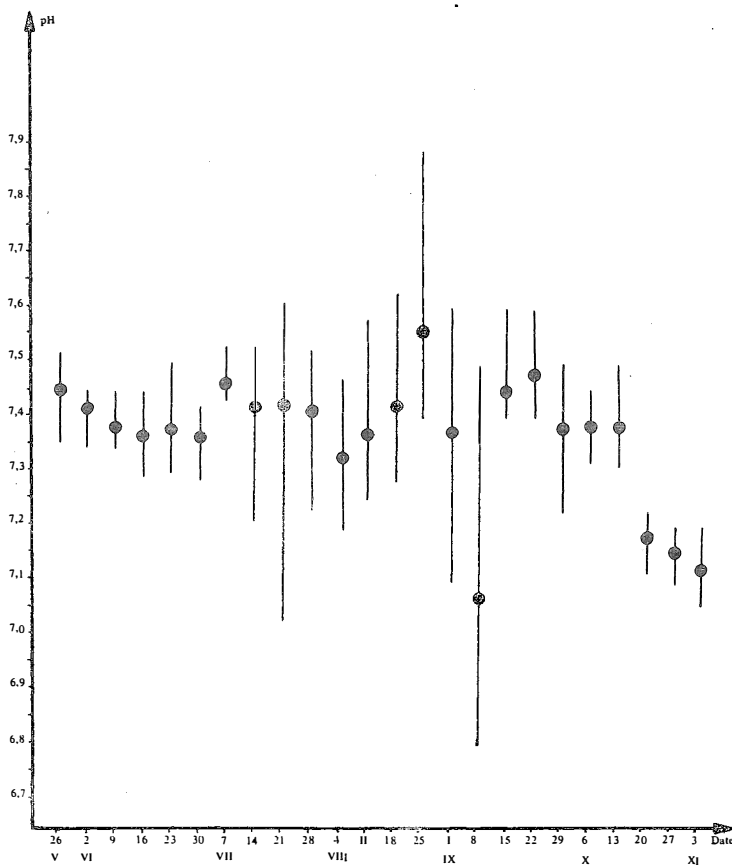


Fig. 7. The ph weekly changes in warm water canal

eels grow much faster than "silver" eels. The weight of a biggest "green" individuals reached upto 320 gms. Out of 717 fishes being under investigation there were 360 "green" and 357 "silver" eels at the end of experiment.

CONCLUSIONS

The results of experiments with the European eel (*Anguilla anguilla* L.) culture in warm postcooling water canal from the "Pomorzany II" power station may be assumed as follows:

1. The observations we have get through so far proved that the warm water canal from the "Pomorzany II" power station in Szczecin is usefull for the eel culture.
2. The increase of eel weight is determined by the cultured material quality, the feed composition and by the feeding method.
3. The best results in eels feeding weere obtained in "frame-net feeders" using minced mackerel flesh as the feed.

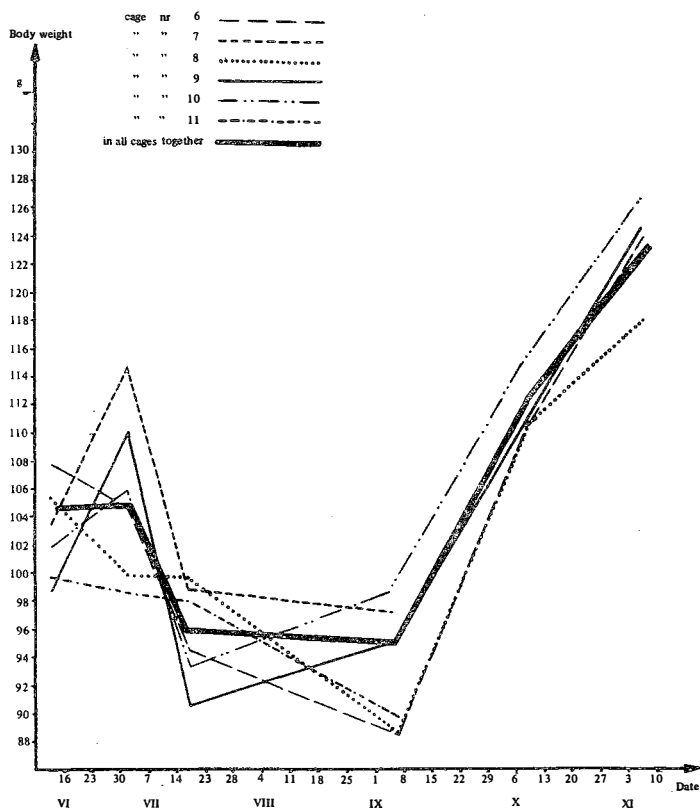


Fig. 8. Changes in the average body weight of eels in particular net cages and together

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WSTĘPNE WYNIKI BADAŃ NAD TUCZEM WĘGORZA (*ANGUILLA ANGUILLA* L.) W WODZIE POCHŁODNICZEJ Z ELEKTROWNI „POMORZANY II”

Streszczenie

W ramach prowadzonych badań testowych nad przydatnością wody odrzańskiej do hodowli ryb podjęto w 1974 r. próbę tuczu węgorza w sadzach sieciowych zawieszonych na pływającym pomoście hodowlanym ustawionym w kanale zrzutowym Elektrowni „Pomorzany II” w Szczecinie.

Doświadczenie prowadzone było przez okres 145 dni. W czasie doświadczenia węgorza żywiono początkowo świeżą rybą słodkowodną (płoc, krap, jazgarz), później zaś mięsem makreli. Ta ostatnia pasza była najlepiej pobierana przez ryby. W trakcie doświadczenia straty w obsadzie wyniosły 6,15%. Pomimo nieregularnego wzrostu węgorzy w czasie doświadczenia, zwiększyły one średni ciężar z 104,4 do 123,0 g. Po rozdzieleniu węgorzy na „srebrzyste” – słabo rosnące i „zielone” – dobrze rosnące okazało się, że pierwsza grupa – w porównaniu z ciężarem wyjściowym – nie zwiększyła swojego ciężaru, natomiast średni ciężar ryb z drugiej wyniósł 154,9 g, przy czym największe osobniki z tej grupy osiągnęły nawet 320,0 g.

Temperatura wody zrzutowej przez znaczny okres doświadczenia utrzymywała się w granicach 20,0–32,0°C, zaś zawartość tlenu w wodzie nie spadała poniżej 6 mg O₂/l.

ПРЕДВАРИТЕЛЬНЫЕ РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЙ В ОБЛАСТИ ОТКОРМА РЕЧНОГО УГРЯ (*Anguilla anguilla* L.) В СБРОСНОЙ ВОДЕ ПОСЛЕ ОХЛАЖДЕНИЯ РЕКИ ОДРЫ

Р е з ю м е

В пределах проводимых тест-исследований касавшихся пригодности воды реки Одры для рыбоводства, в 1974 г. сделано попытку произвести откорм речного угря в сетевых садках завешенных на плавучей рыбоводческой платформе, установленной на канале для сбрасывания Электростанции „Поможаны II” в г. Щецин.

Опыты проводились на протяжении 145 дней. Во время опыта угрей кормили сначала свежей пресноводной рыбой (плотва, густера, ёрш), а потом мясом скумбрии. Самым лучшим являлся этот последний корм. Во время опыта потери состава рыб равнялись 6,15%. Несмотря на нерегулярный рост угрей во время опыта, наблюдалось увеличение их среднего веса с 104,4 до 123,0 г. После разделения угрей на „серебристых” – отличающихся слабым ростом и „зелёных” – хорошо увеличивающихся оказалось, что в первой группе вес угрей не увеличивался по сравнению с исходным. Средний вес угрей во второй группе равнялся 154,9 г., а самые большие особи этой группы достигли даже 320,0 г.

Во время опыта, в течение значительного периода температура сбросной воды удерживалась в пределах 20,0–32,0°C, а содержание кислорода в воде равнялось не ниже 6 мг O₂/л.

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