SUMMARY

Reproductive biotechnique of the blue bream (*Ballerus ballerus* L.) and the influence of selected biotic and abiotic factors on larval growth and survival under controlled conditions

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Aquaculture is a type of economic activity that has seen rapid growth in production year after year. Its main role is to produce high-quality food. In addition, it supports the active and passive protection of species as well as entire populations. Accordingly, technologies for the production of stocking material are being developed, as well as developed, to maintain the species abundance of open waters, which is in steady decline. Fish species, which, although not economically important, are a valuable component of aquatic ecosystems and affect their biodiversity. Examples include rheophilic cyprinid fish, which do not have economic importance and/or high conservation status, but have a regulatory function in freshwater, such as the asp *Leuciscus aspius*. Other species that are already present only in a limited area include the blue bream *Ballerus ballerus*. It is one of two (along with white-eye bream *Ballerus sapa*) species of fish of the genus *Ballerus* found in Poland. The development of a method of reproduction and subsequent rearing of blue bream larvae under controlled conditions became the main objective of the dissertation.

To achieve the set goal of the dissertation, research tasks published in four original scientific articles were undertaken. **In Article 1** (Piech and Kujawa 2021), the focus was on the development of the breeding technique of the blue bream under controlled conditions. Based on the research conducted, the effect of various hormonal agents and the effects of reproduction under controlled conditions were described. Satisfactory resistance of blue bream spawners to reproductive manipulations under controlled conditions was observed. Ovopel proved to be the best stimulator of blue bream ovulation under controlled conditions. After the application of Ovopel, the survival rate of females to the acquisition of sexual products was also the highest. The lowest survival rate of females was observed after the application of CPH. High fertilization percentages and larval survival rates were obtained in groups of females stimulated with Ovopel or CPH. Material from controlled reproduction (larvae) was used to further study and set further specific goals.

Article **2** (Piech et al. 2023a) analyzed the effects of temperature and stocking density during rearing on larval growth and survival. During 21-day rearing, the breeding parameters obtained during different rearing variants were evaluated. Optimal temperatures and stocking densities were selected, which were characterized by the highest growth rates and larval survival. The study confirmed the high tolerance of blue bream larvae to high temperatures - the optimal temperature for rheophilic fish and high stocking density. The best rearing results and the lowest mortality of blue bream larvae were obtained at the lowest stocking density of 20 indiv.·dm^{-3}. As for the effect of temperature, rearing larvae at the highest temperature tested (30°C) is the best option, with the highest survival rates and growth rates. For mass production of blue bream stocking material, it is recommended to use a temperature of 25°C and a stocking density of 40-80 individuals·dm^{-3}, to obtain optimal rearing results, both biologically and in terms of relatively lower costs associated with heating water in rearing circuits.

Article **3** (Piech and Kujawa 2022) focused on one of the most important issues during intensive rearing, i.e. determining the optimal moment to replace live food, which was the brine shrimp *Artemia* sp.(A), with commercial food (feed-P). It has been shown that rearing blue bream larvae under controlled conditions requires providing them with access to live food during the initial rearing period. The highest growth rate of the blue bream larvae of the tested variants was recorded in the A12P9 group (natural food for 12 days, followed by feed for 9 days). Replacing live food too early with commercial feed decreases growth parameters and increases larval mortality. The assimilation by fish larvae of the ingredients contained in commercial feed can only take place with the help of exogenous enzymes contained in zooplankton since their digestive system is still in the process of development and lacks the appropriate enzymes. Setting a minimum feeding period with natural food without a major decrease in growth rates will help reduce the cost of rearing blue bream stocking material under controlled conditions.

Article **4** (Piech and Kujawa 2023b) investigated how water salinity affects the growth and survival of blue bream larvae. Based on literature data and previous studies, rearing variants with strictly defined water salinity levels were selected. The above experiment obtained the best growth parameters by rearing the blue bream larvae in water with a salinity of 3 ppt. The larvae also accepted higher salinity levels, as evidenced by the calculated rearing parameters. Survival rates of blue bream larvae at all salinity levels tested were very high, ranging from 83.2% to 97.0%. The tolerance of the blue bream larvae to water with a salinity of 3-7 ppt suggests that

they can survive and thrive in natural waters contaminated with brine from post-mining water discharges.

The above results add to the industry literature on blue bream. They may have implications for optimizing the breeding process, thereby reducing the cost of rearing this species.

Keywords: blue bream, larvae, survival rate, growth rate, hormonal stimulation, controlled conditions