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PECULIARITIES OF SEXUALIZATION OF MALE AND FEMALE RAINBOW FLOWERFISH IN THE CONDITIONS OF UZBEKISTAN

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ABSTRACT

Despite the fact that the water temperature in the fish nursery of Uzbekistan's cold water farm is very cold throughout the year, female fish reach sexual maturity for the first time in the 2nd or 3rd year of life. (GSI) is a clear indicator of the maturity of salmonids. The mean GSI was observed to vary from June to the time of impact (January).

KEYWORD. *Fertility, Gametogenesis, Reproduction of oogonia, Previtellogenesis, Cytoplasmic growth, Vitellogenin, Oocyte in trophoplasmic growth, Karyosphere formation, gonadogenesis, gametogenesis, Polycyclic, oogenesis, Gonads, Oocyte maturation ratio, Vitellogenesis.*

INTRODUCTION

Activities in the field of high production based on modern scientific achievements and innovative technologies are widely used in the intensive development of fisheries in cold water basins. Accordingly, it is important to identify adaptation mechanisms in the body of fish in cold water fisheries, to develop measures to increase reproductive performance, increase the life span of fish, and forecast productivity indicators.

Scientific research is being conducted on the embryological development of cold-loving fish species with high productivity in different geological conditions, the formation of molt, sexual maturity, biological variability of growth processes, indicators of resistance to stress factors, and the wide application of new technologies and innovations in the cultivation of these fish. In this regard, special attention is paid to the acclimatization of promising fish species that quickly adapt to water bodies in mountain areas, the formation of reproductive biology in water bodies, fertility, reproductive mother fish and fish fry, and the development of intensive methods of industrial scale breeding and reproduction of fish in hatcheries [1].

PART OF THE EXPERIMENT

The goal is to determine the reproductive characteristics and fertility indicators of the rainbow flowerfish in the cold water basins of Uzbekistan in conditions that are new to the species.

Compared to the countries where the scientific innovation was imported, the indicators of growth, sexual maturity and fertility of rainbow trout in the cold water reservoir of Uzbekistan increased by 40-72%.

The characteristics of moderate gonadogenesis and gametogenesis processes of rainbow flounder in the cold water reservoirs of our country were revealed, and the technology for industrial scale development of absolute fertility of sexually mature female fish under new conditions for the species was developed.

Practical results The mechanism of gonadogenesis and gametogenesis processes of both sexes of rainbow flounder in the water basin of the cold water reservoir of Uzbekistan was observed to develop earlier than in the natural distribution area in the northern regions of the world.

Both sexes of rainbow trout have one pair of gonads and are located along the dorsal wall of the abdomen. When we dissected the fish, it was observed that the length of the left and right gonads of female fish differed, and the left one was often longer [3].

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Figure 1. Different stages of Sexualization of The Gonads of The Rainbow Flower Fish Adapted to The Conditions of Uzbekistan

Rainbow trout ovaries are of the open type, and the plates that produce caviar are covered with a single layer of epithelium and do not have their own shell. According to our calculations, the number of spawning plates in the ovary of female fish at the beginning of the III stage of sexualization can be 33-55 (n = 6 pieces). The cranial part of the gonads is enlarged and round. The caudal part of the ovary is sharpened. Rainbow trout do not have oviducts. In the wall of the coelom, there is a funnel-shaped genital opening, which opens behind the anus and in front of the urethra. Oocytes develop in spawning plates in egg follicles. The follicular epithelium is important for the supply of nutrients and other substances to the developing germ cells[2]. Mature gametes are released from spawning plates into the body cavity, and the ovulatory fluid flows out of the genital opening.

Gametogenesis of female rainbow fliers. Based on the analysis of the histological preparations prepared from the samples taken from the rainbow trout and the results of generally accepted ichthyological research on the oogenesis of fishes in inland water bodies, we determined the stage of development of the female reproductive cells of this species. The obtained data well describe the process of sexual maturation of rainbow flounder in the conditions of Uzbekistan. Reproduction of oogonia. Primary germ cells begin to divide by mitosis and then divide many times to develop oogonia. Morphologically, oogonia have cytoplasm with few organelles and are located between follicular cells. The nucleus has one or more nucleoli. (In our studies, we did not dissect representatives of rainbow trout, in which primary germ cells are best developed from germ cells). Primary meiotic remodeling. It is known that with the development of oogonia, their mitotic division stops, the early stages of meiosis are reorganized in the nucleus (leptotene, zygotene, pachytene, diplotene). At the end of this period, the oocyte enters the diplotene stage of prophase, which continues until sexual maturation is completed [4]. In the histological sections we prepared, we observed that the oocytes separated into less stratified groups. Previtellogenesis. The term "small growth period" is also used here. In many studies of fish biology, this term is considered sufficient even now. A number of authors use the term "cytoplasmic growth" and "protoplasmic growth". As the oocyte develops, they increase in size, but the oocyte material is used for growth (this is reflected in the names used). The onset of periods is determined when each oocyte is clearly surrounded by follicular epithelium on histological sections (ie, the follicle has formed). The researcher, armed with a powerful microscopic technique, sees that the follicular epithelial cells are dense, the surface of the cytoplasmic membrane is smooth at the beginning of the period, and after time it folds, then microvilli develop towards the membrane of the follicular epithelial cells. Despiralized active chromosomes appear in the nucleus. A large number of wall-side nuclei are formed. We found out that the oocytes of rainbow trout at the beginning of this period are 31-48 μm, rarely - 55 μm, and have 1-4 nuclei. Oocytes develop during the phase - reach 59 - 172 μm, and in them it is possible to see crescent-shaped areas of cytoplasm (circumnuclear zone) that differ in color. The number of nuclei increased and the volume of the cytoplasm increased (cytoplasmic growth of the oocyte occurs). At the end of the cytoplasmic growth phase, oocytes can be identified by their increased size. The size of rainbow trout oocytes reaches 210-320 μm (when measured with an ocular-micrometer). It is well seen that the circumnuclear zone is closed and located around the nucleus in small oocytes, and in the peripheral zone in relatively large oocytes. The size of the largest (that is, the best developed) oocytes in the small growth zone reaches 370-420 μm, and thus this phase ends. We could not detect a circumnuclear zone in such oocytes. After that, oocytes pass to the phase of development of cortical alveolus (in English-language literature) or cortical vacuole (in Russian-language literature). The size of oocytes continues to increase, we found that it reached 445-580 μm in the cross-section of the samples taken from the rainbow trout. Vacuoles are initially few and small and are located around the outer membrane [5]. As they develop, their number increases and their size increases. At the end of the period, the size of oocytes reaches 650-1100 μm (according to our data). Vacuoles called fat vacuoles appear in them. In cross-sections, fat vacuoles appear initially as a thin zone near the center of the oocyte compared to cortical vacuoles. In relatively large oocytes (that is, late), fat vacuoles begin to completely fill the nuclear periphery. Later, with the development of oocytes, they grow significantly (they become very large in cross-sections). This growth takes place due to the complex combination of protein, lipoprotein, carbohydrates accumulated in oocytes. Vitellogenin- yolk protein precursor is produced in the liver and transported to

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the gonads with the help of blood, vitellogenin is reformed in oocytes and saturated with lipoproteins turns into vitelline, as well as polysaccharides, enzymes are formed and they are activated only after fertilization. It seems that the main source of growth is not the substances in the oocytes themselves, but perhaps the substances coming from the organism of the parent fish. It is for this reason that another widespread term "oocyte in trophoplasmic growth" is relevant. The beginning of vitellogenesis can be determined by the appearance of small granules of yolk in the sections. We found that the size of such oocytes is 980-1280 µm. Later, the number and size of granules increase significantly and reach - 1400-1480 µm. At the end of the period, the size of the oocytes of the rainbow trout becomes very large and practically reaches the definitive size. In our researches, in different years, this indicator was found to be -3800-4600 µm and -4600-5200 µm. It should be noted that the fishery may have used different breeds or groups of fish to breed rainbow trout in different years. Puberty (end of puberty). Oocytes have reached definitive sizes. Cytologically, meiosis is restored and completed during this period. Karyosphere formation ends. Yolk fragments become larger and eventually merge into a whole. The oocyte is sexualized and then ready for the ovulation process for fertilization.

Gonadogenesis in female rainbow trout. The development of the gonad of fish is an important sign of adaptation to external environmental conditions. Obviously, there are many similarities in the gonadogenesis of different fishes. The development of gonads occurs only in one direction, the changes taking place can be classified, divided into a number of periods and stages. At the same time, there is great diversity in the passage of these periods in fish of different systematic and ecological groups, including a very strong difference in the course of the gonadogenesis process in different populations of the same species, and variability is also observed within populations. Knowledge of the formation of reproductive biology (in this case - sexual maturation, gonad development) is important and is considered one of the foundations of aquaculture in a certain area for obtaining a new generation from cultivated fish. Because species with high adaptability are selected in aquaculture, it is necessary to study in detail the process of gonadogenesis in new conditions of new objects of aquaculture. The course of the gonadogenesis process of objects can change strongly in a new environment (first of all, the rate of sexual maturation). This requires a change in breeding technology. The above also applies to rainbow butterflies.

The level of development of gonads is inextricably linked with gametogenesis, more precisely with relatively advanced periods and phases in the development of germ cells. This applies to both monocyclic and polycyclic as well as to fish with simultaneous maturation and division and asynchronous oogenesis. In fisheries research, the development of gonads is characterized by scales of sexual maturity, and the stages of this scale are determined by visual analysis of both the development of gametes and the development of somatic elements of gonads. Researchers have already abandoned the idea of using a universal scale of sexual maturation stages for all fish. More precisely, there may be the most general approaches, but solving the scientific and practical tasks in fisheries research requires the use of a relatively flexible and more sensitive approach in determining the sex of fish. Therefore, separate scales have been developed to determine the sexuality of each species [6]. Different researchers divide the gonads of different species into different number of scales when determining sex. However, there is a difference in the views of researchers from different countries and different schools when determining the stage of sexual maturity of the same objects. Much research has been done on this issue for species as important to catch as salmonids. A 6-point scale of gonad maturation is usually used for salmonids, with stages III and IV of ovarian development and stages I, III and VI of sperm development being divided into sections. Based on the analysis of data from literature sources and the results of our own research, we offer the following scale of sexual maturation to determine the stages of sexual maturation of the gonads of rainbow marigolds grown in the conditions of Uzbekistan. We observed a high degree of diversity during previtellogenesis in rainbow trout oocyte growth. The results of the analysis of three female fish used in the breeding company showed that the gonads of the rainbow flounder had changed from stage VI to stage III 2.5 months after the spawning season. An overview of the visual identification of gonads at different stages of puberty, which we recommend for further research in the country.

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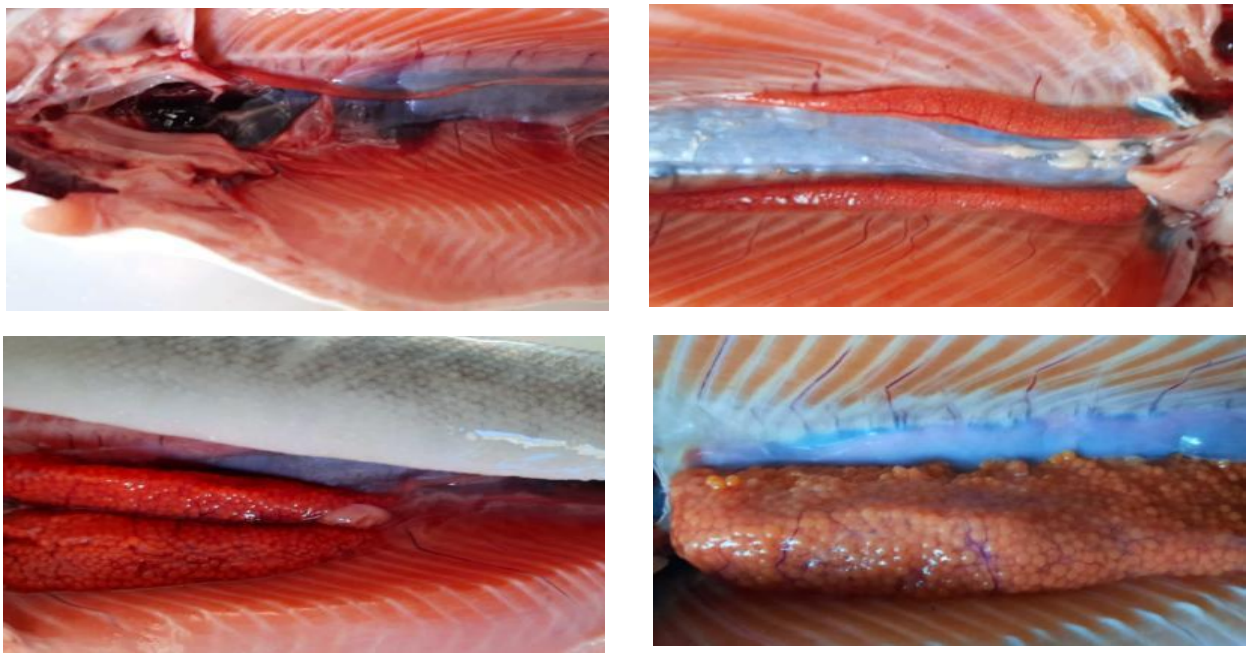
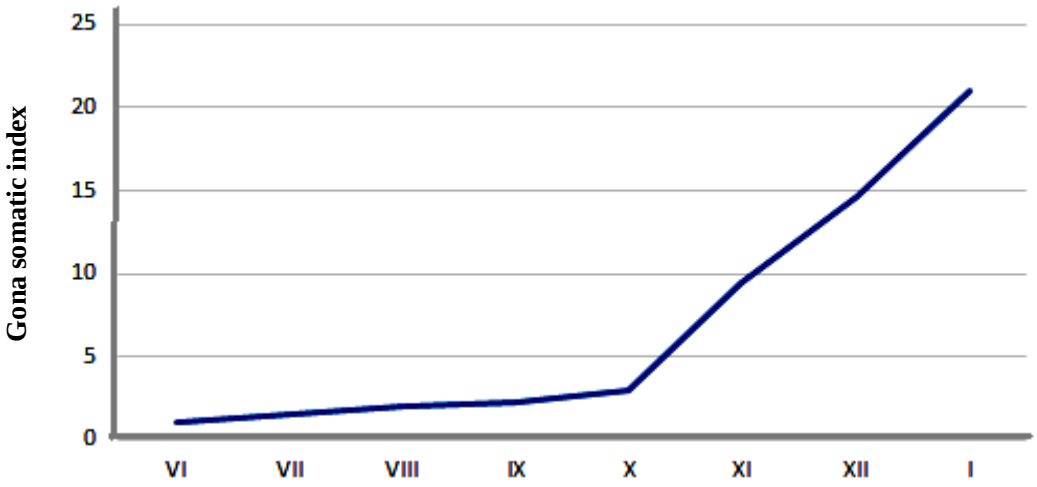


Figure 2. General view of gonads at different stages of puberty: top left – stage II, top right – beginning of stage III, bottom left – close to the end of stage III, bottom right – stage IV.



Thus, based on what has been shown, it can be said that despite the fact that the water temperature in Uzbekistan's cold water fish nursery is very cold throughout the year, female fish reach sexual maturity for the first time in the 2nd or 3rd year of their life. Maturation coefficient (also gonado-somatic index, GSI) is a clear indicator of the sexual maturity of salmonids. The mean GSI was observed to vary from June to the time of impact (January). GSI increased from 0.4% (in June) to 20% as vitellogenesis progressed.

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