Implication of success in Pacific bluefin spawning in land tanks under artificial control

It was already reported that scientists of the Seikai National Fisheries Research Institute (SNFRI) located in Nagasaki had succeeded in ar tificially controlling spawning of Pacific bluefin tuna (PBFT) and obtaining almost all eggs spawned last summer, using newly-constructed rearing tanks located on part of the grounds of the SNFRI . As I had a chance to participate in a briefing session on this outcome held in Tokyo a couple of months ago, I would like to express my views on the implication of this success for future PBFT farming and fisheries.

Currently, the major process for PBFT farming starts with capturing wild juveniles of approximately 30cm in length and three months old, by small jig boats. PBFT juveniles are called yokowa in Japanese. Then, after a short period for feeding, yokowa are transferred to large pens where they are reared for about three years up to 50kg and then harvested for markets.

However, there are three weak points in this mode of farming.

Firstly, it relies on wild juvenile fish to start the farming process and their catch levels fluctuate greatly year by year. Secondly, even though the Kinki University succeeded in achieving the full life-cycle aquaculture of PBFT, spawning timing cannot be forecasted accurately and collecting fertilized eggs remains difficult in the sea. Therefore, work plans cannot be established in a foreseeable and stable manner. Thirdly, due to the deterioration of the PBFT stock, the harvest of juvenile fish has become subject to severe regulations including decreased catch levels of juveniles for farming.

For the purpose of resolving these problems, it was attempted for the very first time to control artificially the whole process of spawning of the PBFT in the newly constructed land tanks. This attempt resulted in significant success, by obtaining approximately 10 million fertilized eggs during the period from mid-May to late-August in 2014. At the beginning of this experiment, approximately 130 two-year-old fish (ca. 15kg in weight) were transferred in May 2013 from the Amami region (another SNFRI tuna feeding station where PBFT are fed in pens, located in the Amami region of Kagoshima Prefecture) to Nagasaki, and were fed for a year in two large water tanks (each 20m in diameter and 6m in depth) within which both water temperature and daylight hours are artificially controlled. The collected fertilized eggs were sent back to the Amami station by aircraft before hatching, and now they are growing healthily at normal survival rates.

Such environmental factors as daily sea water temperatures and daylight hours in the tanks can be controlled, taking into account the data obtained from several examples of successful spawning taking place in pens. Environmental conditions within the tanks are controlled and recorded, and the behavior of fish is monitored around the clock with video cameras. Video monitoring is intensified when spawning events are considered to start in a short time. After confirming the commencement of spawning, fertilized eggs are collected in an effective manner.

In addition to the above-mentioned core procedures, a number of other relevant challenges, e.g., the transfer of fish from the farming pens to the land tanks via tender boats, had to be overcome. It is obvious that this success would not have been attained without expending tremendous efforts.

Through the process leading to this success, many interesting pieces of information relating to their spawning behavior have been obtained including the following: i) spawning in the tanks started at the water temperature of 21℃ that is lower compared to the 24℃ observed in the major spawning areas for PBFT in the Nansei Islands (near Okinawa) and ii) spawner mortality, which is considered to be incurred by fatigue due to continuous spawning activities, took place at a higher rate for males compared to that for females. It is anticipated that more important information will be provided as detailed analyses of the results of the experiments proceed.

The experiment is continued with the view to verifying the success attained last year and if proved successful, farming production of the PBFT will become more stable and able to secure planned production, leading to further improvement the full life-cycle aquaculture. The PBFT farming brings higher profits than that of yellowtail and red sea bream but the catch of wild PBFT juveniles for aquaculture is currently subject to restrictions under management regulations. Under these circumstances, this significant breakthrough leading to the provision of juvenile PBFT for aquaculture without being affected by fluctuating stock status of the PBFT, has enormous potential to give a new perspective to PBFT farming. Although there still remains the need for increasing survival rates from the egg to harvesting stages, this success brings Japan a step ahead in leading bluefin tuna and southern bluefin tuna farming technologies in the world. I hope Japan will be a good example for well-balanced aquaculture which is sustainable and environmentally friendly, in the new stage of tuna farming to be brought about by artificially controlled spawning technology.