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Intensive fish farming in Italy

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Nuova Azzurro farm raises sea bass, sea bream in raceways

The commercial culture of various marine fishes is well developed in several countries along the Mediterranean coast, including Italy. A number of facilities like the intensive Nuova Azzurro Fish Farm – which produces European sea bass (*Dicentrarchus labrax*) and to a lesser extent, gilthead sea bream (*Sparus aurata*) – utilize intensive fish production technology.

Located near Civitavecchia about 1.5 hours north of Rome, Nuova Azzurro operates its own broodstock and hatchery tanks to produce fingerlings and 20 nursery tanks and 19 concrete raceways for grow-out. High fish densities are continuously maintained throughout the entire production cycle using liquid oxygen.



Each raceway has a computerized control panel that monitors temperature and dissolved-oxygen levels to maintain optimum conditions for the cultured fish.

Water management

Water for the Nuova Azzurro farm comes from two sources: the sea and the discharge from a nearby electrical plant. During the month of July, the farm was pumping 19 degrees-C water from the ocean and 27 degrees water from the plant. By mixing both sources, an average incoming water temperature of approximately 22 degrees-C is maintained.

Water enters the farm by a main canal at 3,000 liter per sec. The incoming water is injected with about 60 kg pure oxygen per hour, or 1 kg oxygen per minute. Oxygen levels in the distribution canal are raised from 6-7 ppm to a supersaturated 12 to 14 ppm by using two big venturi pumps. Water can lose 1 to 2 ppm oxygen in this canal between the first and last raceways.

Raceway effluent drains into a common, lined sump, where it is filtered through fine-mesh pipe filters. This prevents accidental release of fish into the Mediterranean Sea.

Broodstock and hatchery

About 50 adult sea bass are kept in a broodstock tank of 20 meters diameter and 2.5 meters depth that holds 1,500 cubic meters of water. Interestingly, these animals have been in captivity and reproducing for the past 15 years and are in very good health. No growth or genetic issues have been reported from the fry produced by the broodstock. Water exchange in the tank is 100 percent per day, and no supplemental aeration is used.

The hatchery produces 3 to 4 million fry per year, mostly for internal consumption, although some seedstock are sold to third parties by special order. The hatchery produces its own live feeds, mainly algae and rotifers for the early stages. Dry artificial feeds are used in the later stages. Average annual survival in the hatchery is 20 percent. Currently, some *Solea solea* flatfish are also produced for experimental purposes.

Nursery tanks

The nursery section includes twenty 600-cubic-meter tanks with 1.5-meter depth and four to six aerators that maintain dissolved oxygen at 100-110 percent saturation. Water is exchanged daily at 500 to 600 percent. Tanks are usually stocked at 200 to 250 fry per cubic meter and harvested after about four months at a density of 160 to 200 juveniles per cubic meter. The juveniles, which average 100 to 150 grams each, reflect a survival rate of 80 percent.

Grow-out raceways

The farm has 19 cement grow-out raceways that each hold 1,000 cubic meter of water at a 1.5 meters depth. Stocking density is 100-120 fish per cubic meter, and average survival after 12 months is 85 to 90 percent. The maximum average biomass is 50 kg fish per cubic meter. Each raceway produces up to 50 metric tons (MT) of 500- to 600-gram fish in a 12-month grow-out cycle.

Oxygen management

Each raceway has an average daily water exchange of 500-600 percent and four Force 7 1.5-hp aerators installed on each side. In operation, each unit uses approximately 2 kg pure oxygen per hour, or 30 to 35 l injected oxygen per minute. All aerator units are individually controlled by a computer that automatically turns them on and off according to oxygen levels in the raceways.

Usually, four units are in operation at any time, while the remaining four units are used during feeding hours. Liquid oxygen is stored in two large cryogenic tanks, where it is converted into a gaseous form before leaving the tanks.

Centralized monitoring

Each raceway has a computerized control panel that monitors temperature and dissolved-oxygen levels, and sends the information to the main computer indoors. Based on the data it receives, the main computer runs the aeration equipment.

The computer constantly checks parameters and adjusts oxygen levels to keep them at 100-110 percent saturation. Each raceway consumes about 19.2 kg oxygen per hour. This automated system significantly reduces the labor force of the farm.



Force 7 aerators inject oxygen into raceways (above). Both source water and culture water receive oxygen injection to raise oxygen levels.

Feeding, harvesting

Feed pellets are distributed using a small, motorized vehicle fitted with an air blower. Feeding is usually done twice a day, every day. Different feed sizes and formulations are stored in silos. Reported feed-conversion rates during grow-out are 1.8-1.9:1.

As with feeding, harvesting is mechanized. A truck fitted with a suction harvesting pump and separating tank efficiently harvests the mature fish.

Technology transfer

The intensive fish production technology applied at Nuova Azzurro Fish Farm could be easily transferred to tropical developing countries, where higher water temperatures would increase fish growth rates. The most significant limiting factor would be a reliable method for management of dissolved oxygen. At prevailing higher water temperatures, other commercial fish species could be better candidates for implementation of this intensive technology in tropical areas.

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