Proof of major advances in rotifer substitution for marine fish species

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Larval rearing is a crucial phase in marine finfish aquaculture, marked by significant developmental changes in fish larvae. Initially, larvae rely on yolk sac reserves for nutrition as they lack functional eyes and have a rudimentary digestive system. As the yolk sac is absorbed, their vision develops, and the digestive system matures, allowing the larvae to start exogenous feeding with live prey.

Current challenges and innovations

Marine fish hatcheries typically depend on live prey like rotifers (Brachionus sp.) and Artemia nauplii. Despite advancements in live food culture protocols and enrichment products, maintaining the required quantity and quality of rotifers remains a challenge. These challenges often lead to inconsistencies in larval nutrition, impacting growth and survival rates.

In 2022, INVE Aquaculture revolutionized the industry with the introduction of Natura pRo, a premium feed line designed to reduce reliance on rotifers. This innovation results from decades of dedicated research and collaboration with the scientific community to understand marine larvae's physiology and nutritional needs. The Natura pRo features an unique formulation available in two different sizes, optimized for early larval development.

Natura feed line: A game changer

"The introduction of the Natura feed line is a significant step forward in aquaculture. By reducing dependency on live prey, we improve the efficiency of larval rearing and create more sustainable practices. This innovation helps hatcheries maintain high standards of fish health and growth while ensuring consistent feed quality," said Jessica Teske, R&D engineer at INVE Aquaculture.

The development of the Natura feed line involved extensive research and testing. The feeds are designed to:

- Be attractive to larvae and encourage capture and ingestion with the proper particle size and behavior in water

- Be easily digestible and assimilable by the larvae's undeveloped digestive system.
- Efficiently convert into energy to support proper growth and survival.

Trials conducted at INVE's research center demonstrated that these feeds could significantly reduce the need for rotifers. For instance, rotifer use was reduced by up to 80% for seabream and completely for seabass when using the "Green Water Technique." These reductions were achieved without compromising the growth or survival rates of the larvae.

Expanding horizons

Following the success in European hatcheries, the Natura feed strategy was tested on tropical species such as Barramundi, yellowtail amberjack, snapper, and totoaba. The results were impressive, showing not only good growth and survival rates but also reduced cannibalism and better stress resistance compared to traditional feeding protocols.

"The new Natura pRo feed is a game-changer for marine fish hatcheries. It offers a practical solution to the perennial problem of rotifer supply, allowing farmers to achieve consistent, high-quality results. This advancement shows our commitment to providing innovative solutions that support the growth and sustainability of the aquaculture industry," said Thomas Raynaud, product manager at INVE Aquaculture.



Over the past two years, INVE's Technical Support Team has conducted commercial validation trials, tailoring feeding protocols to specific hatchery needs. This approach has confirmed the versatility

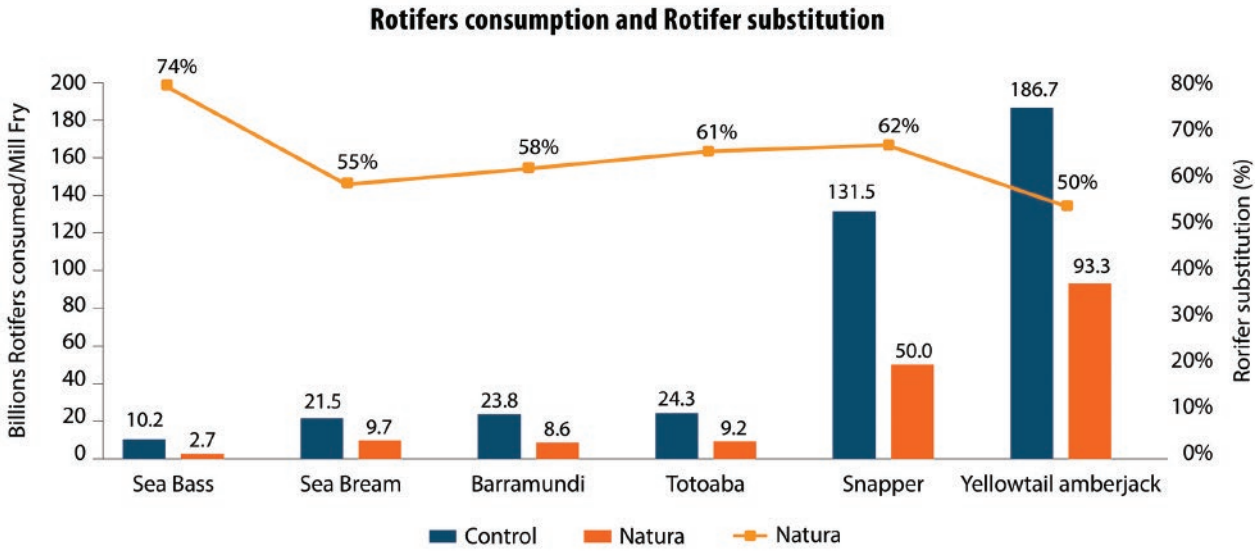


Figure 1. Rotifer consumption and reduction levels

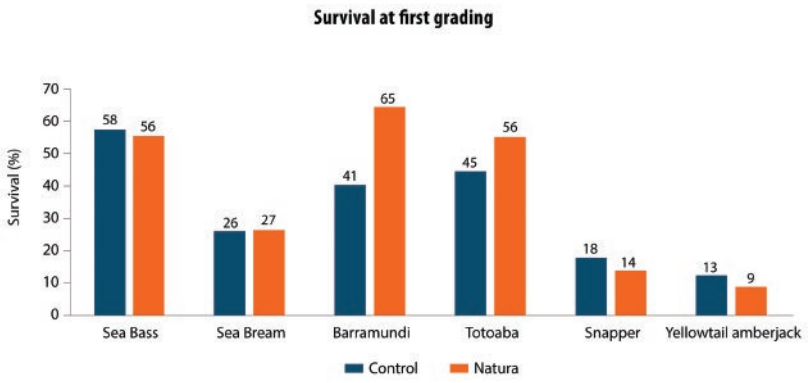


Figure 2. Survival at first grading

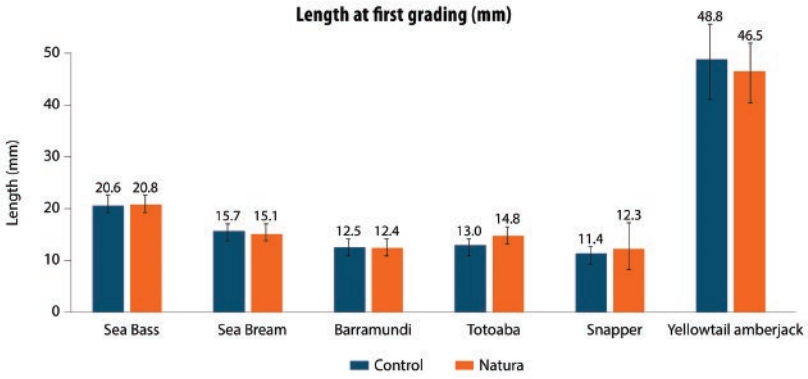


Figure 3. Length at first grading

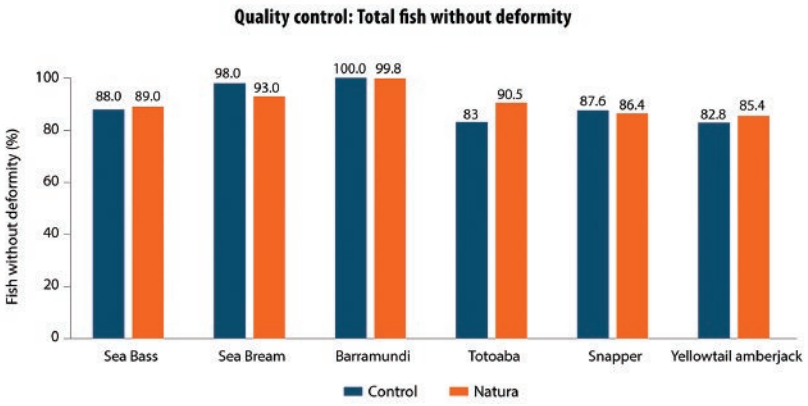


Figure 4. Quality control: Total fish without deformity

and effectiveness of the Natura feed line across different species and hatchery conditions.

Performance and benefits

The trials revealed that the weaning protocols with Natura reduced rotifer consumption by 50% or more, depending on the species (Fig. 1). This significant reduction did not compromise other growth parameters. In some cases, survival rates were even higher with the Natura protocol, such as with Barramundi and Totoaba.

Natura feeds ensured proper growth across all species tested, with good diet acceptance from the beginning of exogenous feeding. Although survival rates for seriola and snapper were slightly lower than the control, the growth rates were similar, and the population was more homogeneous, reducing cannibalism (Fig. 2, 3).

"Using Natura feeds in hatcheries worldwide has shown remarkable results. We have seen improved survival rates and growth in various species, and we've also reduced the environmental impact of live prey cultivation. This progress is crucial for securing sustainable food sources for our growing global population and ensuring the long-term success of aquaculture operations," said Valentina Carbone, global technical support fish at INVE Aquaculture.

Fish robustness is crucial for the sustainability of marine fish hatcheries. The trials showed that fish fed with Natura had similar or better quality, with lower deformity rates in species like totoaba and yellowtail amberjack (Fig. 4). This indicates that Natura provides all the essential nutrients for healthy development.

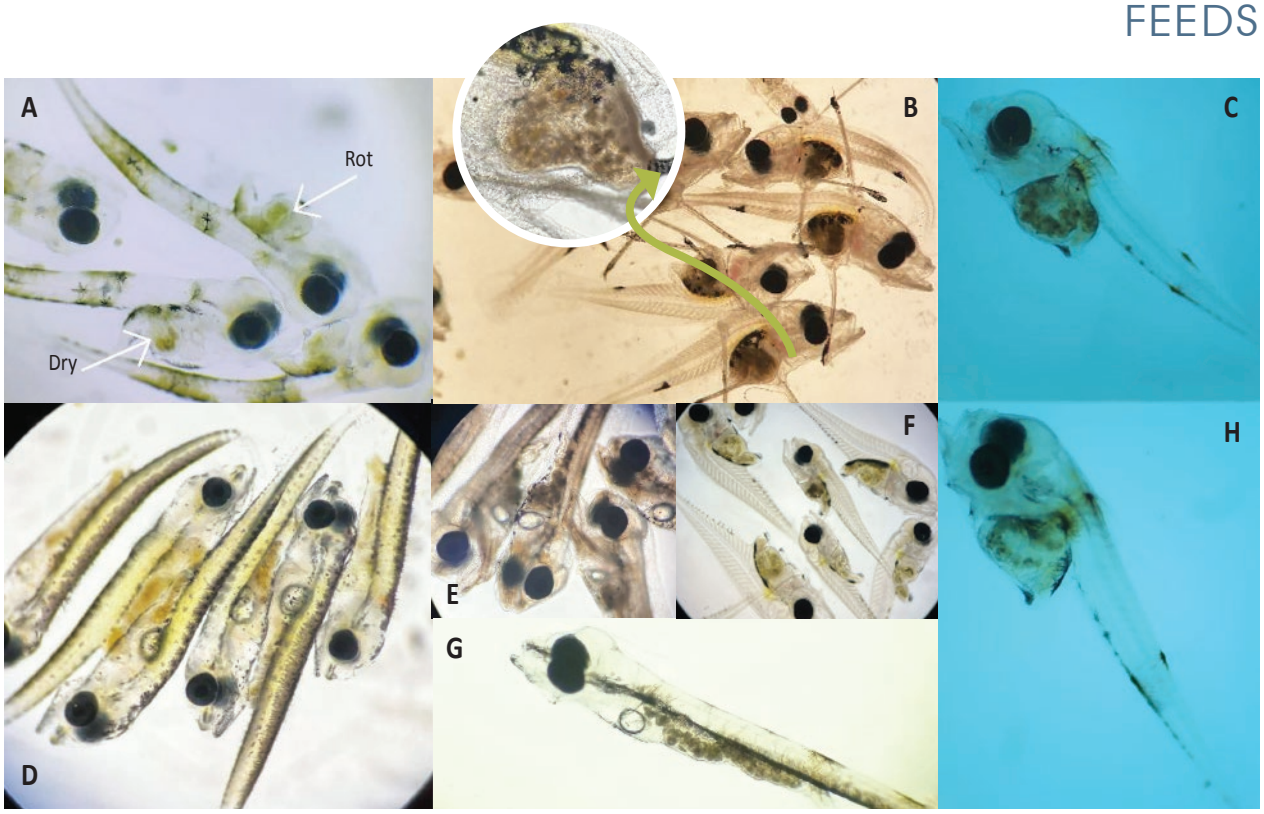


Figure 5. How NATURA pRo appears in the gut: A) 7-day-old seabream larvae; B) 8-day-old grouper larvae; C) 7-day-old *Totoaba macdonaldi* larvae; D) 5-day-old yellowtail amberjack larvae; E) 3-day-old barramundi larvae; F) 10-day-old snapper larvae; G) 5-day-old European seabass larvae; H) 7-day-old *Totoaba macdonaldi* larvae.

Future directions

To keep making progress in reducing live food dependency and simplifying the larval rearing process, we need to combine new scientific knowledge with industry insights and hatchery expertise. Recent studies highlight the importance of feed production technology in controlling particle behavior in water and ensuring feed nutritional integrity. Ongoing refinement of dietary formulations will improve digestibility, and understanding metabolic and biological processes will be crucial. This incremental approach aims to fully substitute live food, emphasizing the need for sustained research and innovative thinking to meet the demands of improved aquaculture practices.

The way forward for aquaculture requires a commitment to innovation and collaboration. By leveraging advanced research and industry experience, we can develop sustainable and efficient feeding strategies that secure the health and growth of marine fish larvae. INVE Aquaculture's dedication to these key advancements aligns with our vision for an aquaculture industry with less environmental impact and improved productivity, contributing to a more sustainable and secure global food supply.

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