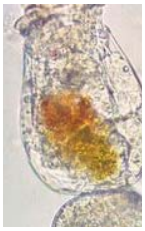
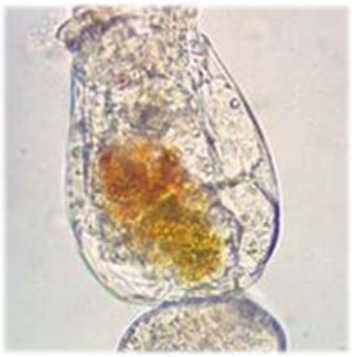


New all-in-one rotifer feed from Reed Mariculture

Timothy Allen Reed, president, CEO and head of research and development, and Eric C. Henry, Ph.D., research scientist at Reed Mariculture Inc. discuss how feed and enrichment of rotifers in one step with their new product, RotiGrow *OneStep*™, results in better nutrition, stronger rotifers, less stress and healthier larvae, with less work and mess.



Rotifer feasting on RotiGrow *OneStep*.

Rotifers remain the most widely-used live feeds for early stages of larval fish culture, and success depends on having a stable supply of healthy rotifers that deliver the nutrition larvae need for rapid growth and normal development.

The nutritional value of rotifers depends entirely on the feeds used to produce them. Typically, a batch culture is grown to harvest density using a low-cost, yeast-based feed of low nutritional value and then it is switched to a high lipid content "enrichment" feed a few hours before feeding to larvae. This "gut loading" strategy fills the digestive tracts of the rotifers with the lipid-rich feed, to be delivered to the larvae when the rotifers are consumed. But this conventional approach to enrichment is best described as "Too much, too late."

Active, clean, healthy rotifers are essential for healthy larvae. Unfortunately, the extreme lipid content of conventional enrichment feeds is stressful to rotifers, weakening them and reducing their motility. Lipid emulsions foul the enrichment tank as well as the rotifers, so much of the enrichment feed is not consumed by the rotifers and is, therefore, wasted. The emulsion-fouled rotifers must then undergo stressful harvesting and washing procedures before being fed to larvae.

Rotifers that have been stressed by intensive enrichment and washing are invariably compromised. This stress is more evident when the popular "cold bank" technique is used (storing rotifers in a cooler and feeding over 18-24 hours). Temperature shock when enriched rotifers are cold banked often causes the rotifers to eject their gut contents (and enrichment), fouling the cold storage and further weakening or killing many of the rotifers before they are fed to larvae.

A New Paradigm

Continuous enrichment using whole algae growth feeds during grow-out so that the entire body of the rotifer is enriched is by far the most effective enrichment strategy. The benefits are multiple:

(1) Rotifers are not stressed, so they retain good health and motility in the larval tank.

(2) The enrichment is in rotifer tissue and more bio-available (as phospholipids, organically bound minerals and vitamins, etc.).

(3) Rotifers require no washing and in some applications can be fed directly to the larval tank, eliminating the labor of harvesting and washing, and avoiding shocks that cause ejection of the gut contents.

(4) Rotifers do not expel their enrichment in "cold-bank" applications.

(5) Rotifers enriched during grow-out retain their enrichment in the larval tank longer and deliver more enrichment to the larvae.

About RotiGrow *OneStep*

RotiGrow *OneStep* is a concentrated microalgae-based liquid rotifer feed that is specifically formulated for the larvae of high-need, high-HUFA tropical species such as seriola, grouper and snapper. Because the microalgal cells are kept hydrated, they retain their full functionality and nutritional value.

The feed provides all the following advantages:

- Full-spectrum enrichment from seven species of microalgae— In addition to optimal highly-unsaturated fatty acid (HUFA) enrichment, RotiGrow *OneStep* provides comprehensive tissue-bound vitamin, mineral, and carotenoid enrichment of rotifers without sacrificing other nutritional factors or stressing the rotifer.
- Optimal HUFA enrichment with high protein content — Eliminates any separate enrichment steps —Typical analysis (ash free) of rotifers grown on RotiGrow *OneStep*: 69% Protein; 12% lipid; 26% DHA; 7.5% EPA; 5.5% ARA.
- Healthy rotifer cultures — Rapid growth, fouling minimized, reduced bacteria loads.
- Higher yields at high densities — Rotifers can double daily at

Clean continuous rotifer production on RotiGrow *OneStep*. 1 billion rotifers per day - 35% daily harvest at 3000 rotifers/ml. 22 hours since the last cleaning and the tanks are still clean.

NEW ALL-IN-ONE ROTIFER FEED FROM REED MARICULTURE

densities over 5 million L-Type rotifers per litre. RotiGrow *OneStep* grows rotifers as well as Nannochloropsis or RotiGrow Plus.

- Concentrated, clean, liquid form — Exceptionally easy to use, produces cultures with minimal foaming or clumping, requiring less maintenance.

The Best Way is the Low-Cost Way

Healthy larvae with vigorous growth and high survival is the goal. Assuring larvae are fed rotifers with a rich, diverse and abundant nutritional profile that meet your larvae's complex needs is the best way to hatchery success. For high-need, high-HUFA species, RotiGrow *OneStep* is your solution.

It eliminates stress-inducing and costly additional enrichment and washing stages and even allows enriched rotifers to be pumped continuously from the rotifer culture tank into the larval tank. This saves both the labor costs and added complexity of setting up enrichment feeding schedules, rotifer washing, and other handling procedures, and their opportunities for mistakes.

Additional savings can be realized by optimizing rotifer culture practices with either batch or continuous culture—RotiGrow *OneStep* is ideal for either process.

Benefits of Batch Production

1. Batch production has been and continues to be the standard rotifer production protocol.
2. Eliminates contamination with regular water changes.
3. Built-in redundancy.

Benefits of Continuous Culturing

1. Rotifers are most productive under stable conditions. The consistent feeding and harvest regimes that prevail in continuous culture promote rotifer health, supporting high productivity and nutritional quality. Once the culture reaches the target density, only a fraction is harvested (typically 20–

50%) and this harvest can be repeated every day, indefinitely.

2. The rotifers have a younger age distribution than in batch cultures, due to the high daily harvest rate. Younger rotifers feed more actively, are more fecund, and are more vigorous swimmers in the larval tank.

3. Simplified management of culture operations by using the same feeding and harvest levels every day, thus minimizing the opportunities for costly mistakes.

4. No interruption of rotifer production while a new culture grows to harvest density.

5. No need for tanks to be frequently emptied, cleaned, refilled and re-inoculated, further minimizing the opportunities for mistakes, and saving unnecessary labor.

Grow-out enrichment with RotiGrow *OneStep* and adoption of optimal rotifer culture practices enables hatcheries to reduce costs, improve the reliability of rotifer production and produce more nutritious and more vigorous rotifers, for improved growth and survival of larvae. Step up to *OneStep*!

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ABOUT THE AUTHORS

Left: Dr. Eric Henry. Right: Timothy A. Reed

Dr. Eric Henry earned his Ph.D. in phycology (algae studies) at the University of British Columbia and continued academic research on algae for the next 16 years, authoring or co-authoring 25 research papers in scientific journals. In 1996 he joined the private sector to develop algal mass culture and associated aquaculture technologies, and he has been part of the Reed Mariculture team since 2003. Eric works on algal and zooplankton culture, development of new products, and provides customer technical support relating to uses of Instant Algae®, rotifer culture and larviculture of shellfish and finfish.

For more information, contact Eric at techsupport@reedmariculture.com.

Timothy A. Reed is the originator of the ideas and foundational research of Reed Mariculture Inc.'s core competencies and biosecure processes. As CEO, he sets the direction for the company, assuring that Reed Mariculture continues to stretch the boundaries of what is possible in the development of marine aquaculture feeds. Tim's pioneering drive has led Reed Mariculture to become the world's largest producer of marine microalgae concentrates for larval fish, bivalves, crustaceans, and other filter feeders. Tim received his BA from University of CA, Riverside with a double major in Sociology and Economics, and a Masters in Statistical Economics from UC Santa Cruz.

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More information about Rotigrow *OneStep*.