

8. RESEARCH IN PROGRESS AT THE LIVE PREY RESEARCH UNIT, QDPI NORTHERN FISHERIES CENTRE, CAIRNS

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The Northern Fisheries Centre (NFC) undertakes research, development and extension activities in the field of live prey to support the aquaculture industry in Queensland. Our Live Prey Unit comprises three main areas:

- microalgae
- rotifers
- copepods.

These are integrated to deliver a continuous supply of live prey organisms to support larviculture research at NFC.

MICROALGAE

We maintain a small collection of microalgae that are acclimatised to tropical conditions (Table 8.1). These are grown primarily to feed rotifers and copepods.

Recently we ran experiments to evaluate the potential for boosting productivity of mass (500-L) algal cultures through the addition of CO₂ via feedback of the culture pH. Typically, algal productivity declines with increasing volume, largely due to poor nutrient dynamics, gas exchange and light attenuation. The addition of CO₂ increased the growth rate and productivity of several species. For *Rhodomonas*, culture density could be doubled by the addition of CO₂ (Figure 8.1A). However, no benefit was demonstrated for *Nannochloropsis oculata* (Figure 8.1B)

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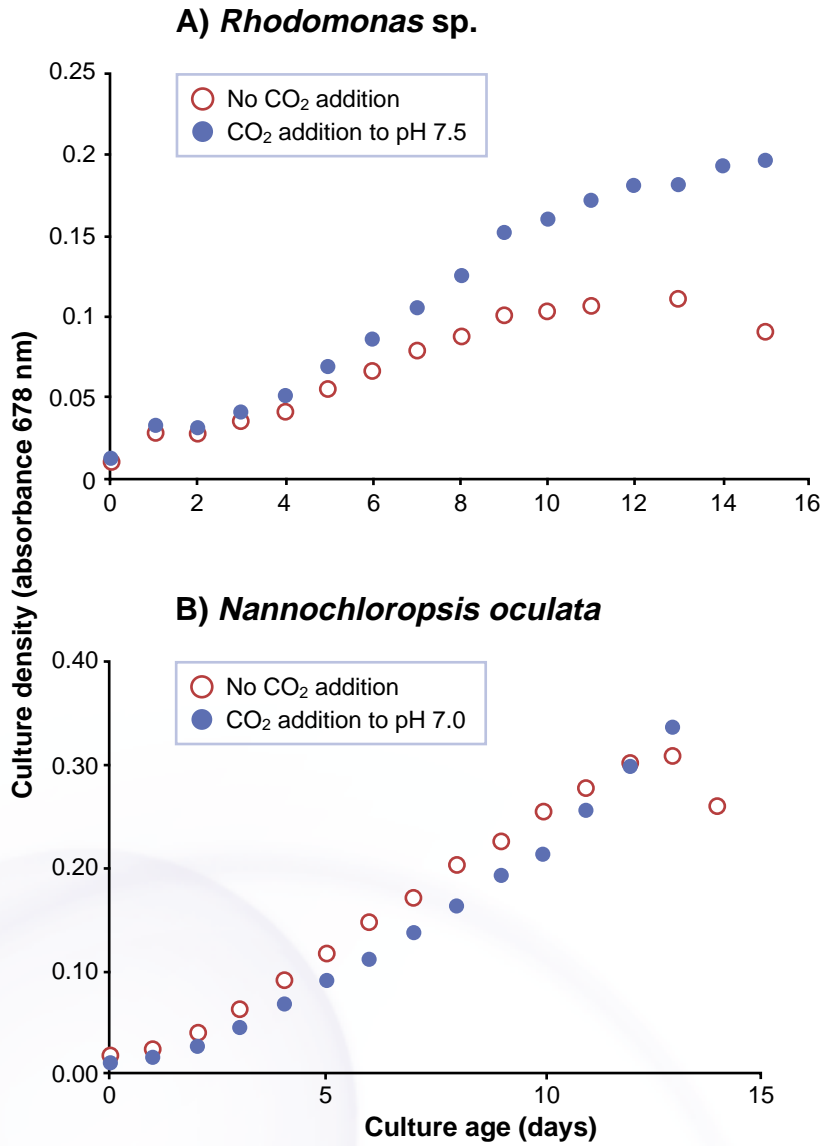


Figure 8.1. Growth curves (absorbance versus time) for aerated cultures of (a) *Rhodomonas* sp. and (b) *Nannochloropsis oculata* with and without CO₂ addition. CO₂ dosed to control pH to 7.5 for *Rhodomonas* sp. and pH 7.0 for *N. oculata*. Average values, n = 2.

Table 8.1. Microalgae maintained and supplied to industry by NFC.

Class	Species	Primary use
Eustigmatophyceae	<i>Nannochloropsis oculata</i>	Rotifer production
Chlorophyceae	<i>Dunaliella tertiolecta</i>	Stimulate mixis in rotifers
Cryptophyceae	<i>Rhodomonas</i> sp.	Major component of copepod diet
Dinophyceae	<i>Heterocapsa niei</i>	Boosts copepod productivity
Prasinophyceae	<i>Tetraselmis chuii, suecica</i> , NT sp.	Minor component of copepod diet
Prymnesiophyceae	<i>Isochrysis</i> sp. (T.ISO), NT sp.	Minor component of copepod diet

ROTIFERS

Previously, *Brachionus plicatilis* (L-type) rotifer was cultured at NFC for barramundi larviculture research. However, this species is too large (about 240 µm lorica length) for many marine finfish larvae. For our current research on grouper species we have isolated a strain of *B. rotundiformis* from a local lake. This isolate is within the size range classified as SS-type (Table 8.2).

Table 8.2. Lorica size (mean ± 1 SD; range in square brackets; $n = 50$) of L-, S- and SS-type *Brachionus* (Su *et al.*, 1994) compared to the NFC SS-type isolate ($n = 97$).

Rotifer type	Length (µm)	Width (µm)
L	219 ± 13 [193-243]	186 ± 13 [161-208]
S	176 ± 16 [158-205]	133 ± 10 [124-151]
SS	147 ± 11 [111-163]	123 ± 8 [93-134]
SS-NFC	151 ± 15 [96-173]	113 ± 8 [64-137]

The size distribution of the isolate showed it to have an average lorica length of 151 µm with the distribution skewed toward the smaller sized rotifers (Figure 8.2).

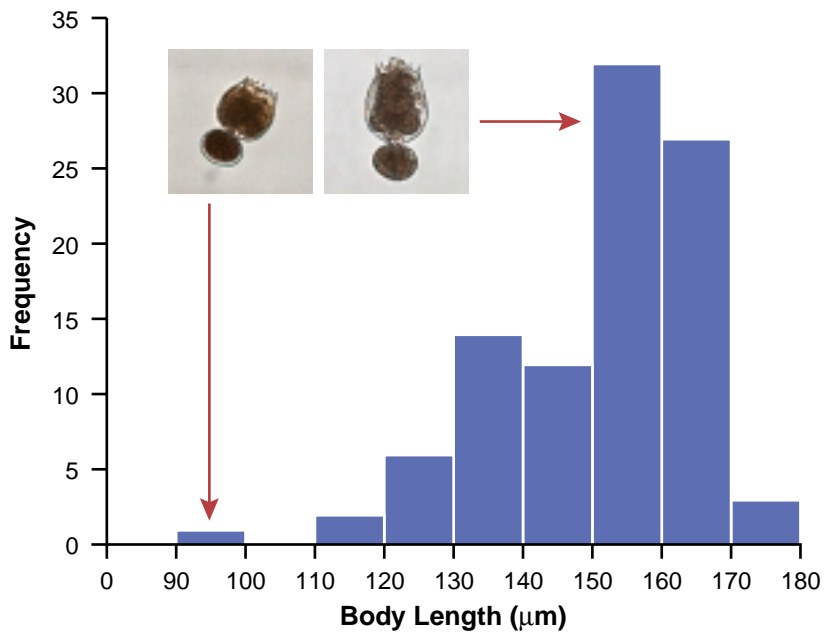


Figure 8.2. Histogram of the size distribution of lorica length of egg bearing female NFC rotifers (n=97).

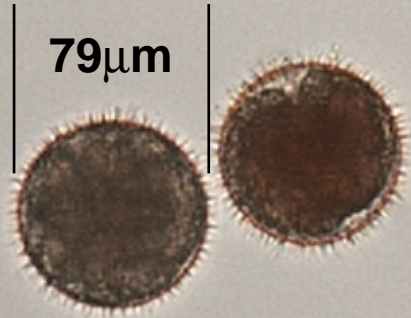
For early-stage grouper larvae, even SS-type rotifers need to be screened (under 90 µm) before feeding. To achieve a stable population of such small rotifers, we need to select for the smallest rotifers in the population. Initially, we will select for the largest and smallest 0.01% of the population and assess size in relation to heritability, rate of reversion and reduction in productivity associated with a decrease in size.

COPEPODS

Copepod nauplii have been shown to be essential prey items during the first 4 days of feeding for snapper larvae (Lutjanidae) and to improve survival of grouper larvae. They are beneficial because of their small size, digestibility, fatty acid profile and their swimming motion.

Copepods

Acartia eggs



(88 µm with spines)



Nauplius (n1)

Figure 8.3. Eggs and nauplius of Acartia sp.

At NFC we have focused on developing production technology for the calanoid copepod *Acartia* (*Acanthacartia*) sp. These are cultured in 400-L conical bottom tanks with a central airlift that screens out adult copepods but not eggs and nauplii (Figure 8.3), which are collected in a fine screen tray at the top of the airlift. Collected eggs and nauplii are taken and counted each morning to measure productivity. Initially, tanks were operated as a batch system, operating for 7–10 days until productivity fell because of loss (death) of most of the adult population (Figure 8.4A). More recently, the algal feed rate was increased by 25% and the adult population was supplemented daily with copepodids that had been grown on from some of the harvested eggs (Figure 8.4B). This improved the stability of the adult population, extended the production cycle and doubled the number of eggs and/or nauplii harvested from a tank over a batch cycle.

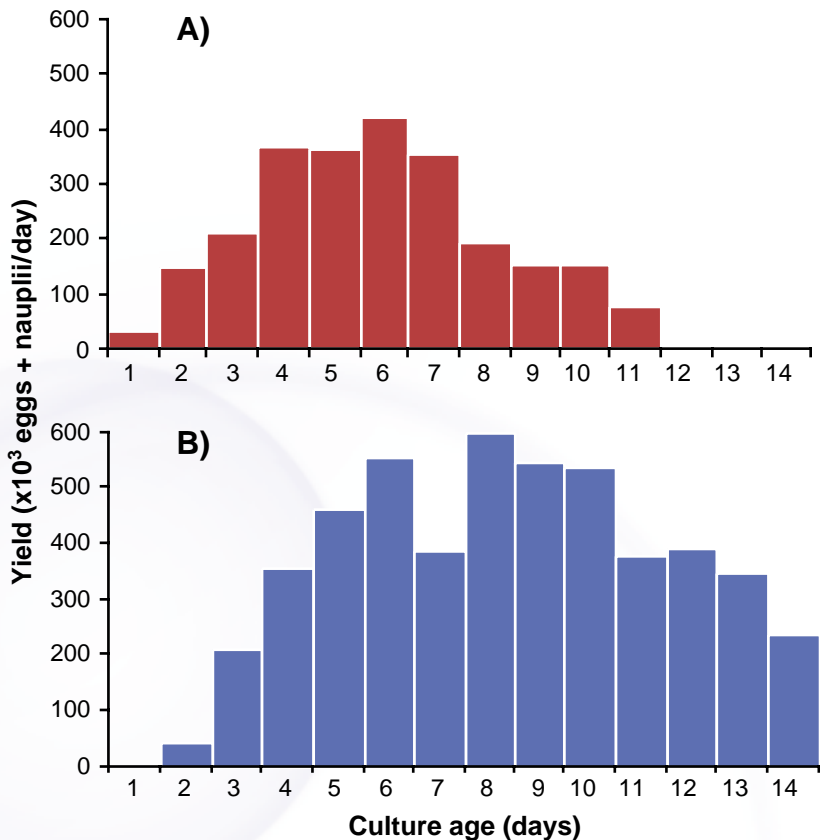


Figure 8.4. Average daily production of *Acartia* eggs and/or nauplii from 400-L culture tanks operated with a single addition of adults (A) and with the initial adult population supplemented with daily addition of copepodids (B).

Copepod production per tank cycle increased from 2.5 million to 5 million and the production period was extended from 4 days to 10 days. With four 400-L tanks operating, about 2 million nauplii per day could be supplied as larval feed. In the future we shall continue to refine the culture methods for *Acartia* and also for the second copepod species that we maintain, *Bestiolina similis*. We are currently assessing the potential of cold storage of eggs and nauplii to boost numbers available to fish larvae during the critical early days of development.

FUTURE RESEARCH

In the future, we shall investigate interactions of live prey on fish larval development. This work will include investigating the effect of diet on the nutritional value of live prey and the effect of prey type on larval gut development in relation to gut morphology and digestive enzyme activity.

REFERENCES

- Su, H-M., Su, M-S. and Liao, I-C. (1994). Selection of super small-sized strain of the rotifer (*Brachionus plicatilis*) and its rearing conditions *J. Taiwan Fish. Res.*, 2(1), 19–29.