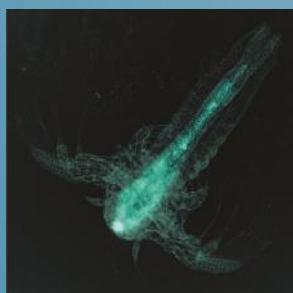
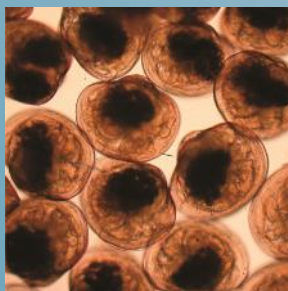
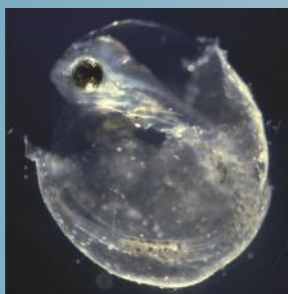


larvi 2013

6th fish & shellfish larviculture symposium

Euryhaline rotifer *Proales similis*
as initial live food
for rearing fish larvae with small mouth

Atsushi Hagiwara



ghent university, belgium, 2-5 september 2013



Larvi 2013 Ghent, Belgium

Nagasaki Univ.

Euryhaline rotifer *Proales similis* as initial live food for rearing fish larvae with small mouth

A. Hagiwara, S. Wullur

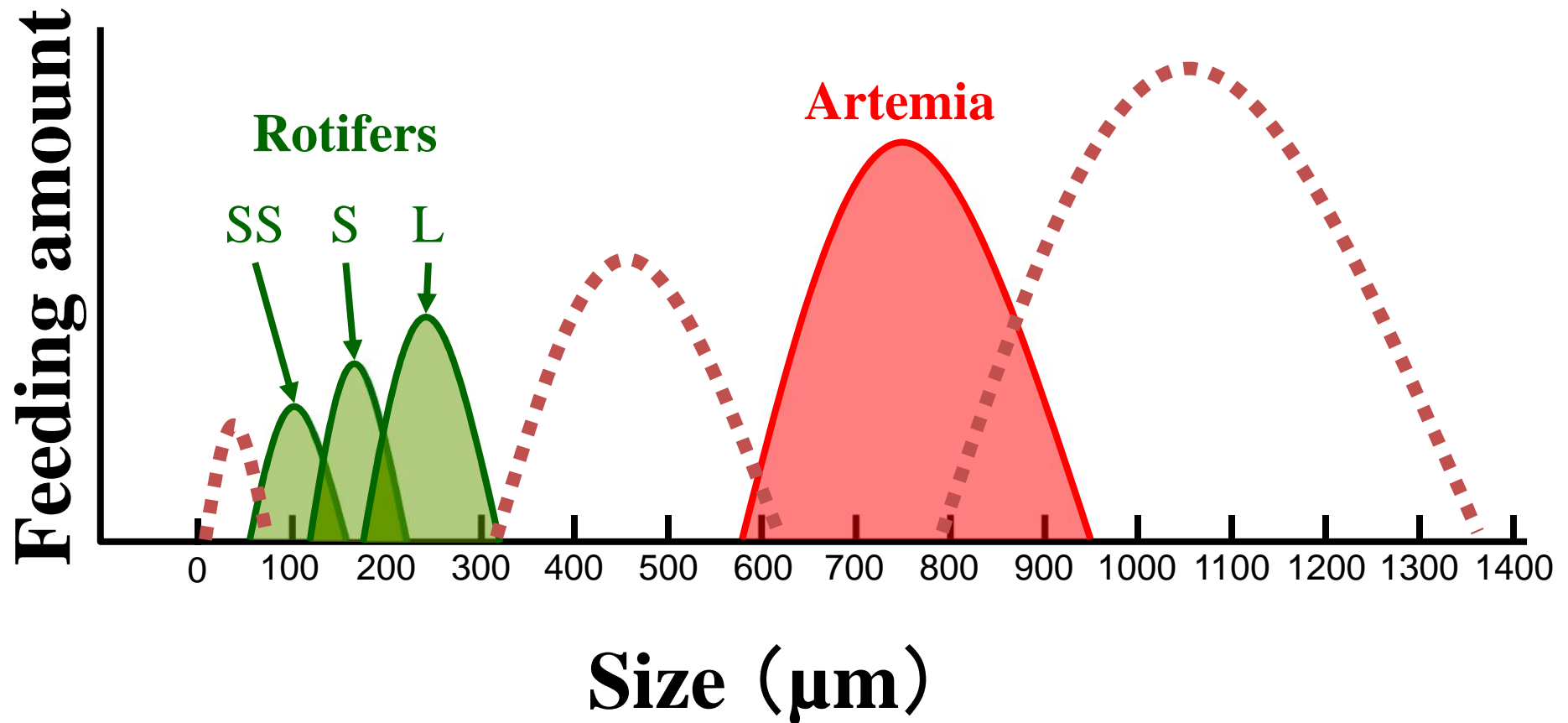
N. Hirai & Y. Sakakura



Proales similis de
Beauchamp, 1908

Size of Live food species

Natural zooplankton, Artificial microdiet



Proales similis (left)

B. rotundiformis (SS type, right)



References of *Proales similis*

Culture

Wullur et al. (2009)

Larval rearing

Wullur et al. (2011) Seven-band grouper

Wullur et al. (2013) Japanese eel

Hirai et al. (2011, 2013) Hump head wrasse

Introduction



Proales similis de
Beauchamp, 1908

50 μ m

Taxonomy;

Phylum : Rotifera

Class : Monogononta

Family : Proalidae

Genus : *Proales*

Culture;

No information in literature

(Except for *P. sordida* and *P. decepiens*)

Collection;

Ishigaki island, Okinawa-Japan.
(189th field trip-July 2004)



Morphometry

Rotifer	Body dimension (μm)	
	length	width
P. similis	82.7 \pm 10.9	40.5 \pm 6.4
SS-type	133.6 \pm 13.5	102 \pm 11.9
Body ratio of P. similis	38.1% smaller	60.3% narrower

Values are indicated as mean \pm standard deviation

- Body size smaller than SS-type
- Soft body without lorica

Can be used as initial food for feeding fish larvae with small mouth (or pharynx) size or less digestive ability?

Individual culture

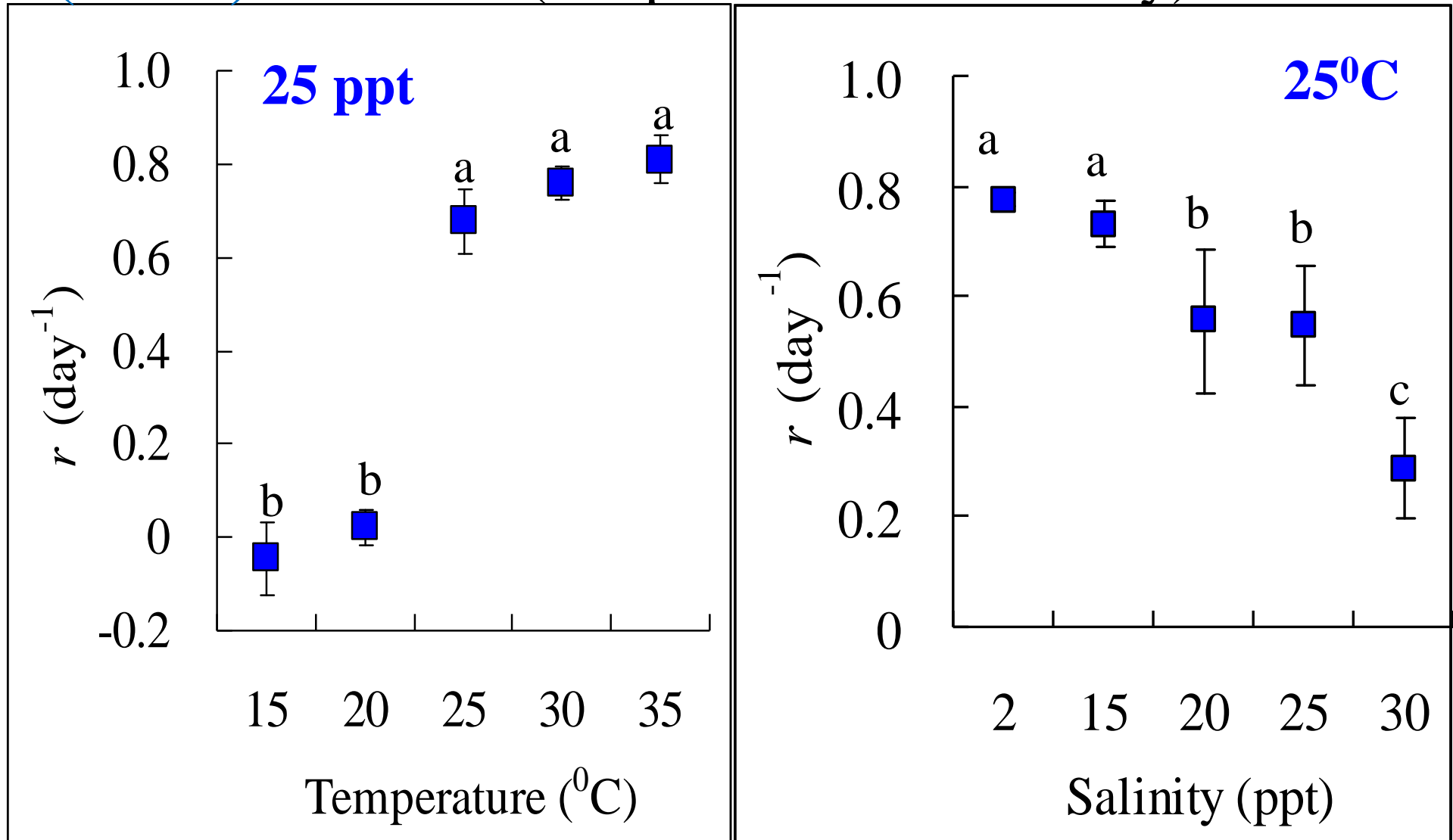
Life history parameters (at 25⁰C)

Parameters (<i>B. plicatilis</i>)	Salinity (ppt)		
	2	15	25
Life span (days) 7-10	4.6 ± 1.7	4.0 ± 1.4	4.7 ± 2.0
Generation time (days) 2	2.5	2.4	2.8
Reprod. period (days) 5-7	2.9 ± 1.2	3.4 ± 1.1	3.2 ± 1.1
Fecundity (female ⁻¹) 20-30	7.8 ± 3.9 ^a	4.3 ± 1.4 ^b	4.3 ± 2.6 ^b
<i>r</i> (day ⁻¹) 0.4-0.8	0.93	0.70	0.63

Fisher PLSD test, $p < 0.05$. $a > b$. Values are indicated as mean ± standard deviation

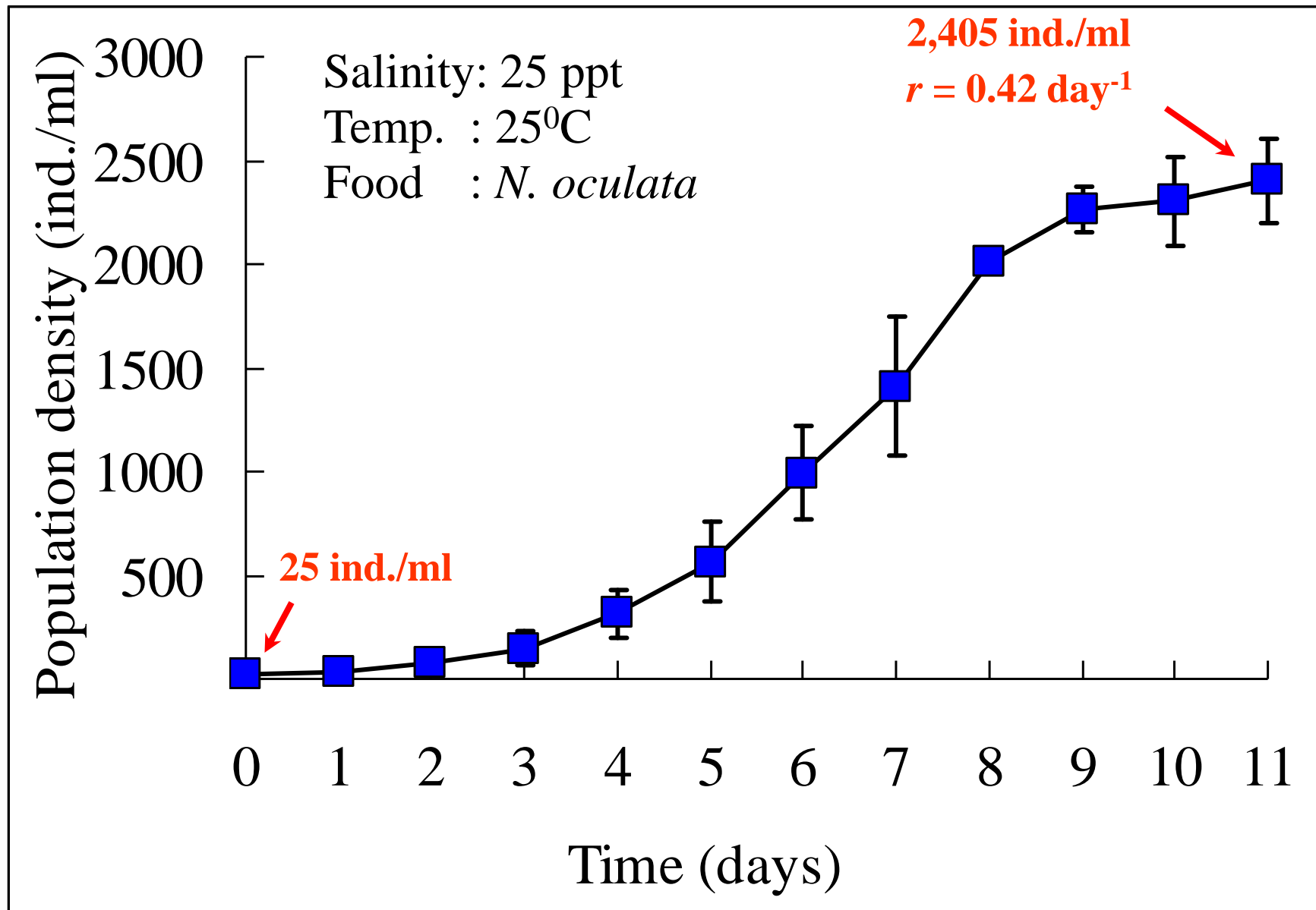
Batch culture (3 mL)

Population growth (temperature and salinity)



Tukey-Kramer test, $p < 0.05$, $a > b > c$. Bars are indicated as standard deviation

Mass culture (2 L)



HUFA composition

Methods

- Mass cultured in 50 L polycarbonate tanks
- Food source;
 - Nannochloropsis oculata
 - Super fresh Chlorella vulgaris V-12
- HUFA analysis (Chlorella company, Fukuoka-Japan)

Results

	N. oculata	Super fresh C. vulgaris®	SS-type
Total lipid (% per wet weight)	2.4	2.6	1.5
HUFA (% total lipid)			
C20:4n-6 (AA)	5.3	0.5	0.8
C20:5n-3 (EPA)	23.2	11.0	6.1
C22:6n-3 (DHA)	0.0	17.5	6.6
DHA/EPA	0	1.59	1.08

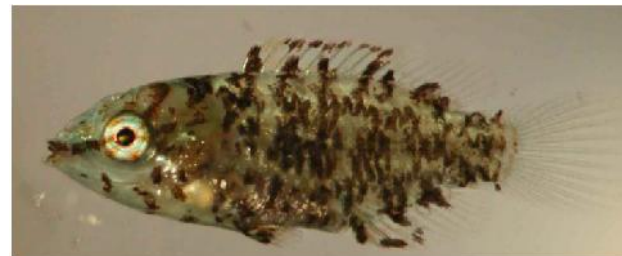
Feeding trials to fish larvae



Seven-band grouper
(*Epinephelus septemfasciatus*)



Humphead wrasse
Cheilinus undulatus



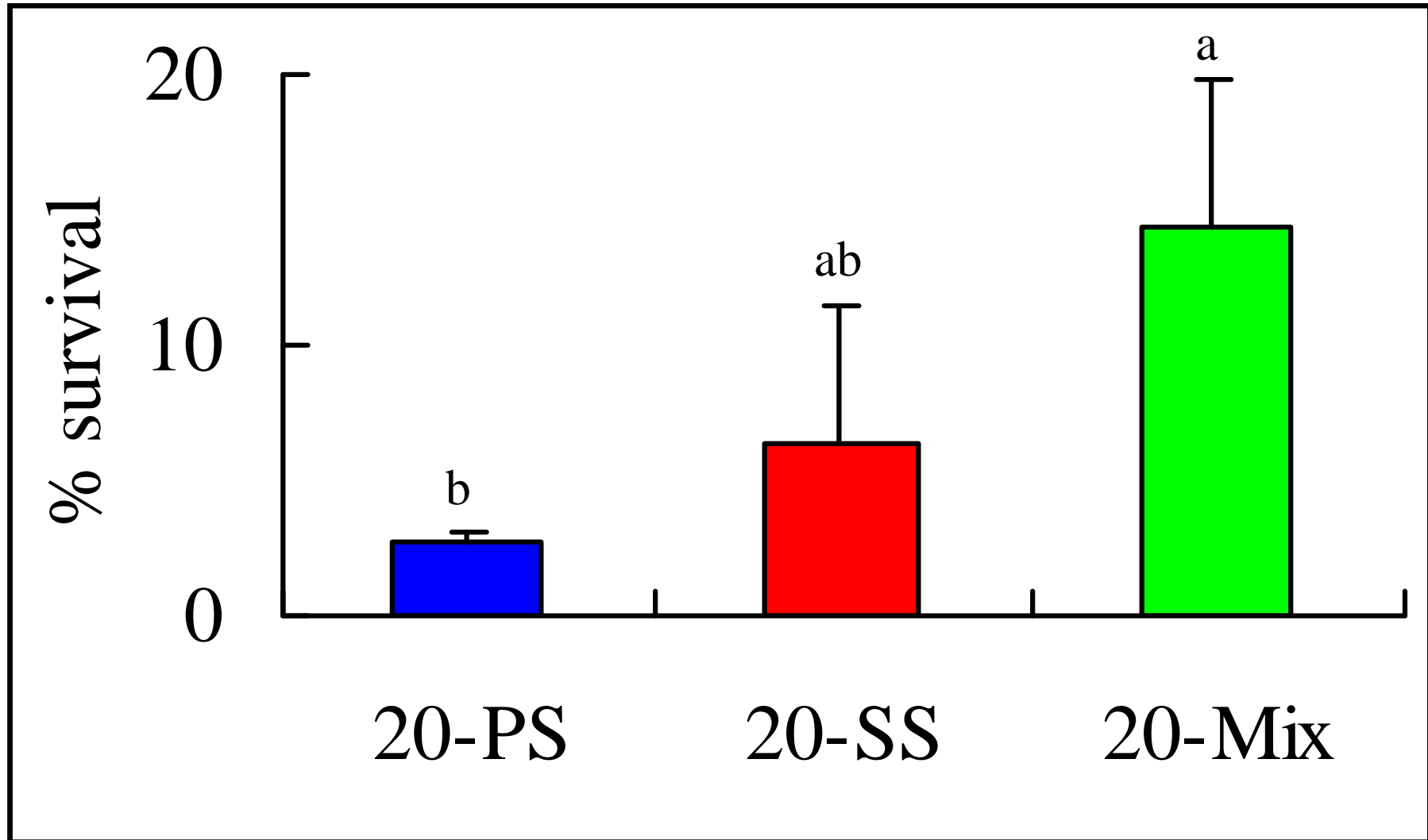
Feeding trials on seven-band grouper larvae

Methods

- 100 L polycarbonate tanks
- *P. similis* (20 ind./ml),
SS-type (20 ind./ml)
and mix (20 ind./ml)

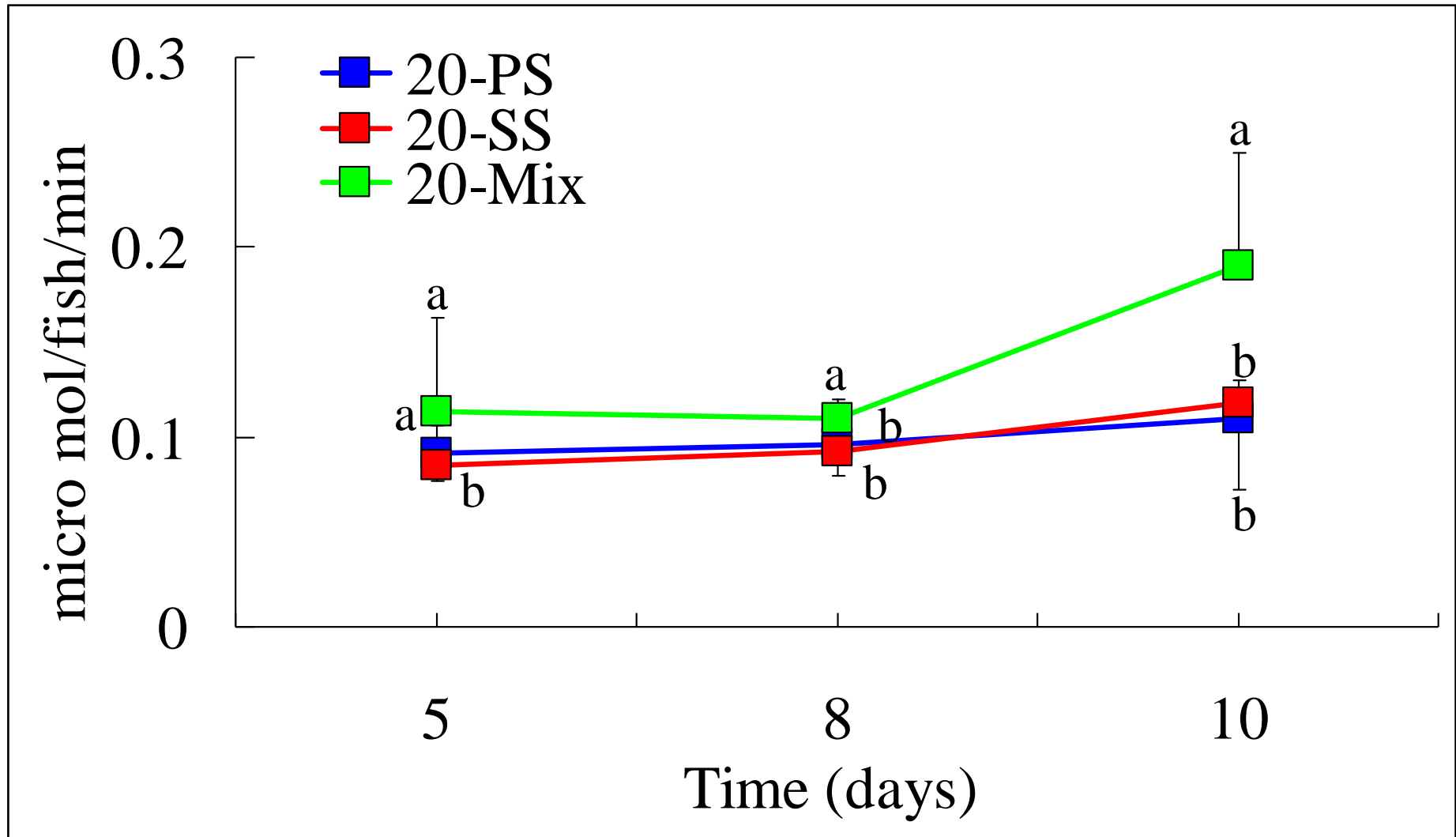
Results

Survival on 10 DAH

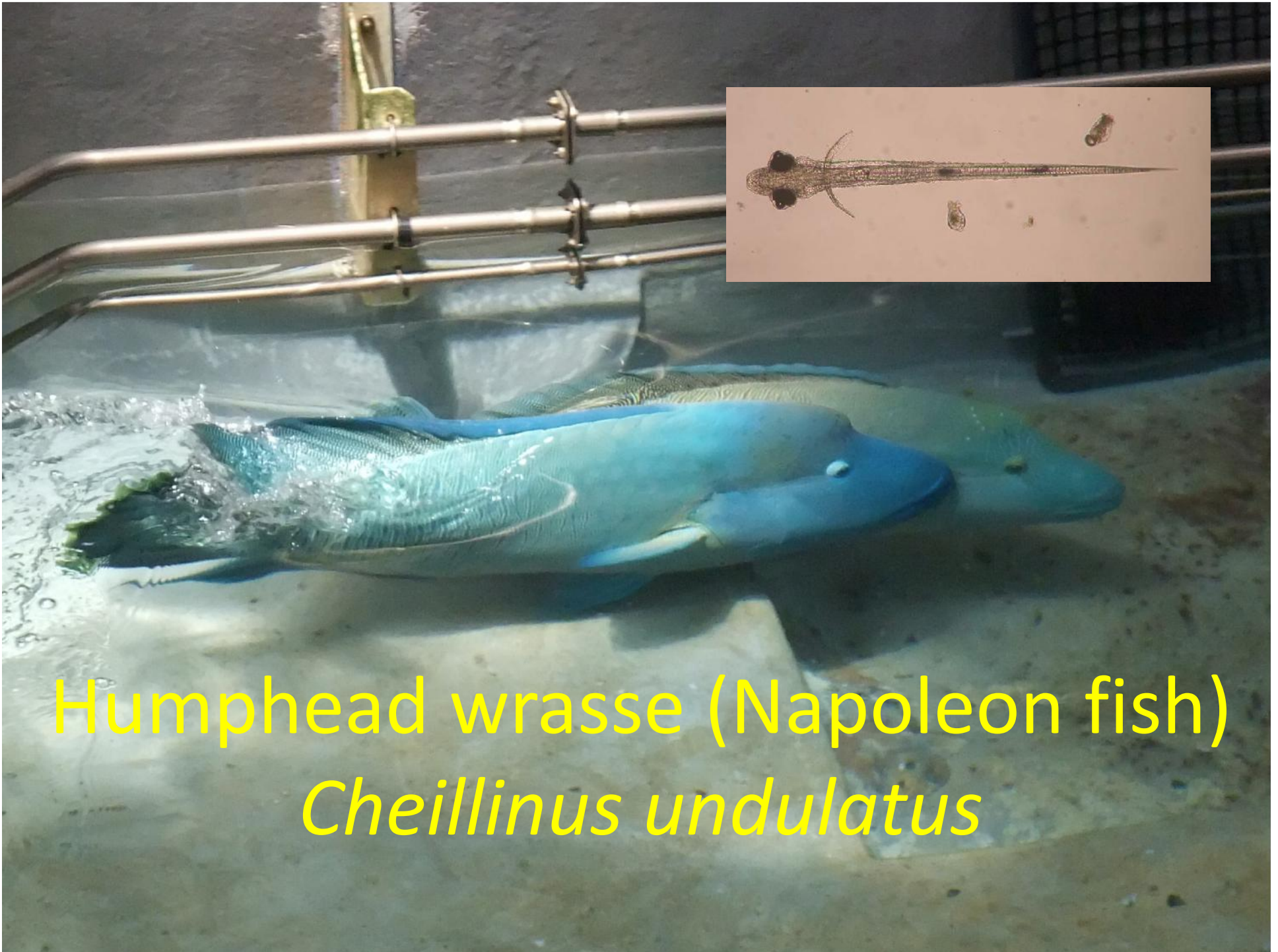


Fisher PLSD test, $p < 0.05$. $a > b$

Tryptic activity



Fisher PLSD test, $p < 0.05$. $a > b$



Humphead wrasse (Napoleon fish)
Cheilinus undulatus

† Study for larval rearing

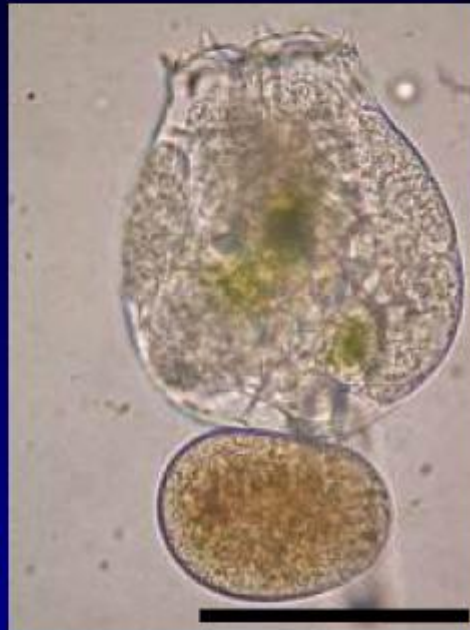
Food for initial feeding



50µm

Proales similis

(Collected from
Ishigaki island)



100µm

SS type rotifer
Brachionus rotundiformis
(Thai strain)

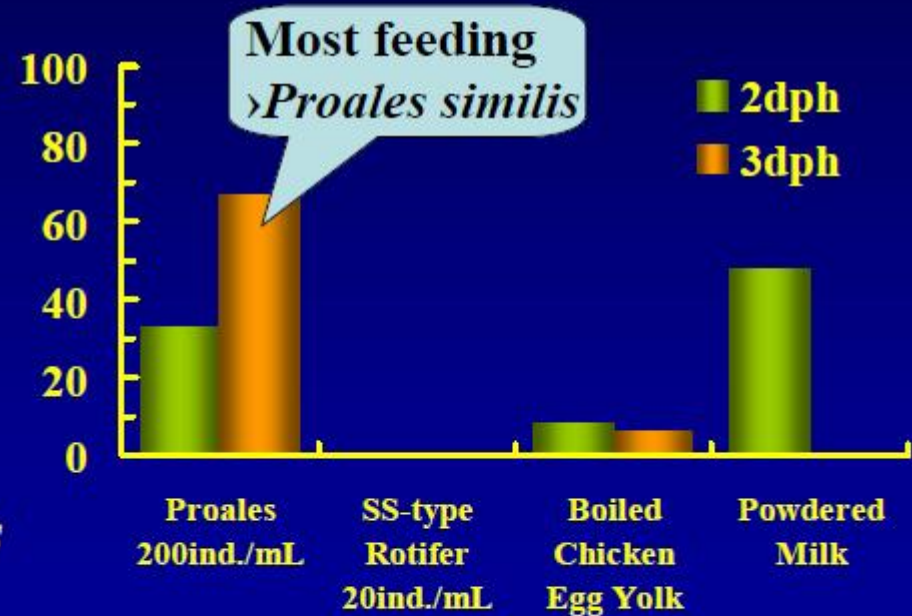


Boiled chicken egg yolk



Used in Indonesia

Preliminary feeding test in 100L tank



Larva of humphhead wrasse fed *Proales similis* (2dph)

Characteristics of larva and juvenile of humphead wrasse



14dph (TL 3.3mm) Preflexion larva
Proales → Start feeding of SS-type rotifer



21dph (TL 4mm) Flexion larva
Increase body height, Form of hypural.



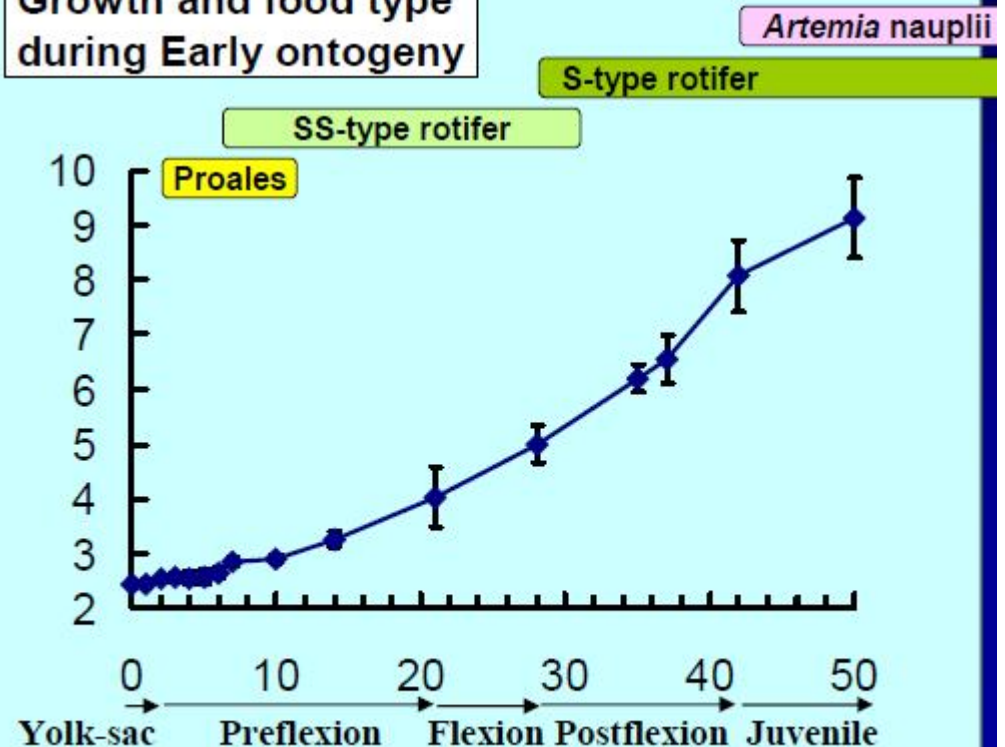
55dph (TL 12mm) juvenile

40dph ~ Pigmentation

Change of behavior

(Pelagic → Settlement?)

Growth and food type
during Early ontogeny



Conclusion

- ✓ *P. similis* can be mass cultured
- ✓ HUFA composition of *P. similis* can be manipulated to suit with the HUFA requirement of fish larvae
- ✓ Fish larvae could ingest *P. similis* effectively and grow.

P. similis can be used as initial food for feeding fish larvae with small mouth size