Shrimp larval quality as a function of broodstock condition

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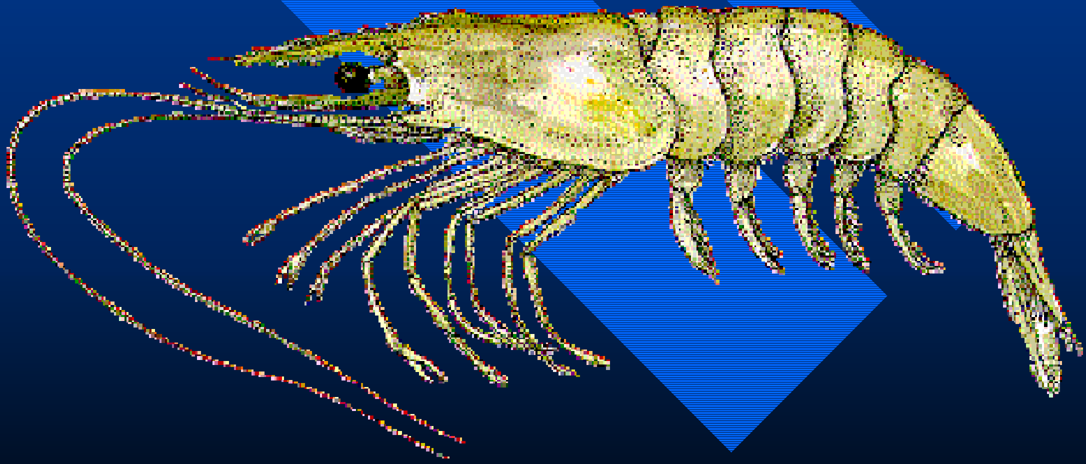
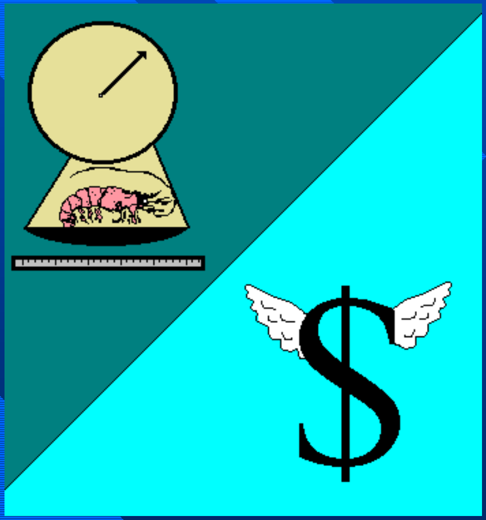


Larval quality

- Performance during culture (growth, survival, physiological condition)
- Spawn quality (eggs and nauplii) and larval quality (zoea to PL)
- A priori (predictive), or a posteriori criteria (final)



Higher yields and profits

Criteria of spawn and larval quality

- Biochemical composition
- Morphological (weight, size, deformities)
- Behavioral (positive phototropism, swimming activity)
- Production (fecundity, fertilization, hatching, larvae survival)
- Stress tests (low salinity, formalin, low oxygen, high ammonia)

Spawn quality: biochemical composition of eggs and nauplii

- Lecitotrophic stages: their development depends on nutrients transferred from ovaries.
- Initial levels and subsequent use will determine hatching and survival to further stages
- A final criterion for broodstock condition
- A possible predictive criterion of larval quality

Biochemical composition of eggs or larvae related to a performance characteristic.

Biochemical component	*Related performance*	*Reference*
Triglycerides	Egg development rate	Wickins et al., 1995
Triglycerides, carotenoids	Spawner condition and larval survival	Palacios et al., 1999 (this presentation)
EPA and DHA	Fecundity, Hatching	Xu et al., 1994
Lipids and carbohydrates	Successful development to PL	Hernández-Herrera et al., 2001 (poster)
Carotenoids in diet	Survival to zoea	Wyban et al., 1997
RNA/DNA ratio	Feeding condition of postlarvae	Moss, 1995

Spawn and larval quality: Production variables

- Fecundity, fertilization and hatching rates (a result of broodstock condition)

↓

Number of nauplii.

- Larval survival through zoea, mysis and postlarval stages

(a result of both larval culture and broodstock condition)

↓

Postlarvae yield

Production variables

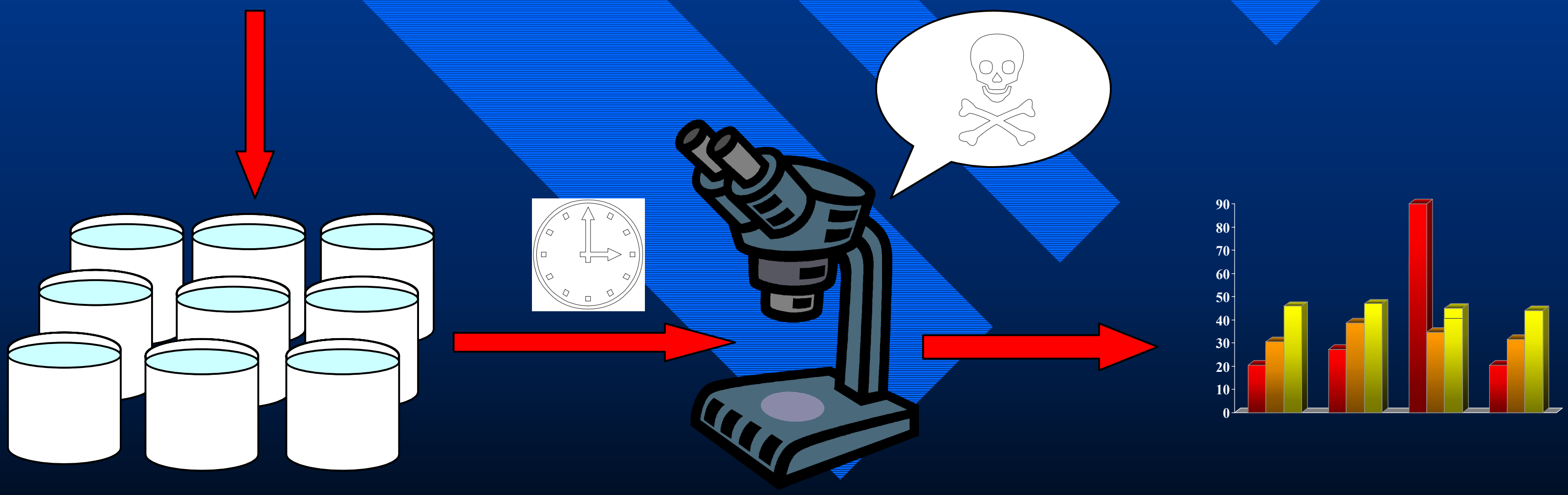
- Final criteria in studies of broodstock management or larval culture (e.g. nutrition).
- Could be used as a predictive criteria: e.g. survival to PL based on early characteristics

Although intuitive, few studies have addressed the suitability of such relation

Larval quality: Stress tests

Based on an abrupt transfer to adverse environmental conditions (e.g. low salinity, low temperature, low oxygen, high ammonia) and survival assessment:

Larvae or Postlarvae



Salinity stress test: age and condition

Survival to low salinity depends on PL age (Charmantier et al., 1988; Aquacop, 1991; Samocha et al., 1998).

Age	*Salinity*	*Survival*	*Condition*	*Reference*
PL2	18ppt	60-90%	Spawner	Hernandez-Herrera, et al., 2001 (poster)
PL5	14-20 ppt	0-90%*	Diet*	Tackaert et al., 1989, Gallardo, 1995
PL10	0-14 ppt	18-98%*	Diet*	Tackaert et al., 1989; Rees et al., 1994; Wouters et al., 1997
> PL15	0 ppt	39-89%	Spawner	Palacios et al., 1999 (this presentation); Hernandez-Herrera, et al., 2001 (poster)
> PL15	0 ppt	0-95%*	Diet*	Tackaert et al., 1989; 1991; Coutteau et al., 1996

* also depends on exposure duration

Use of salinity stress test

- Widely used as a final criterion for experimental studies (e.g. nutrition) on larval and postlarval culture.
- Assumed as a predictive criterion for stocking in ponds and further growout, although this has not been experimentally tested.
- In early PL stages salinity stress test could be used as a predictive criterion of further PL performance

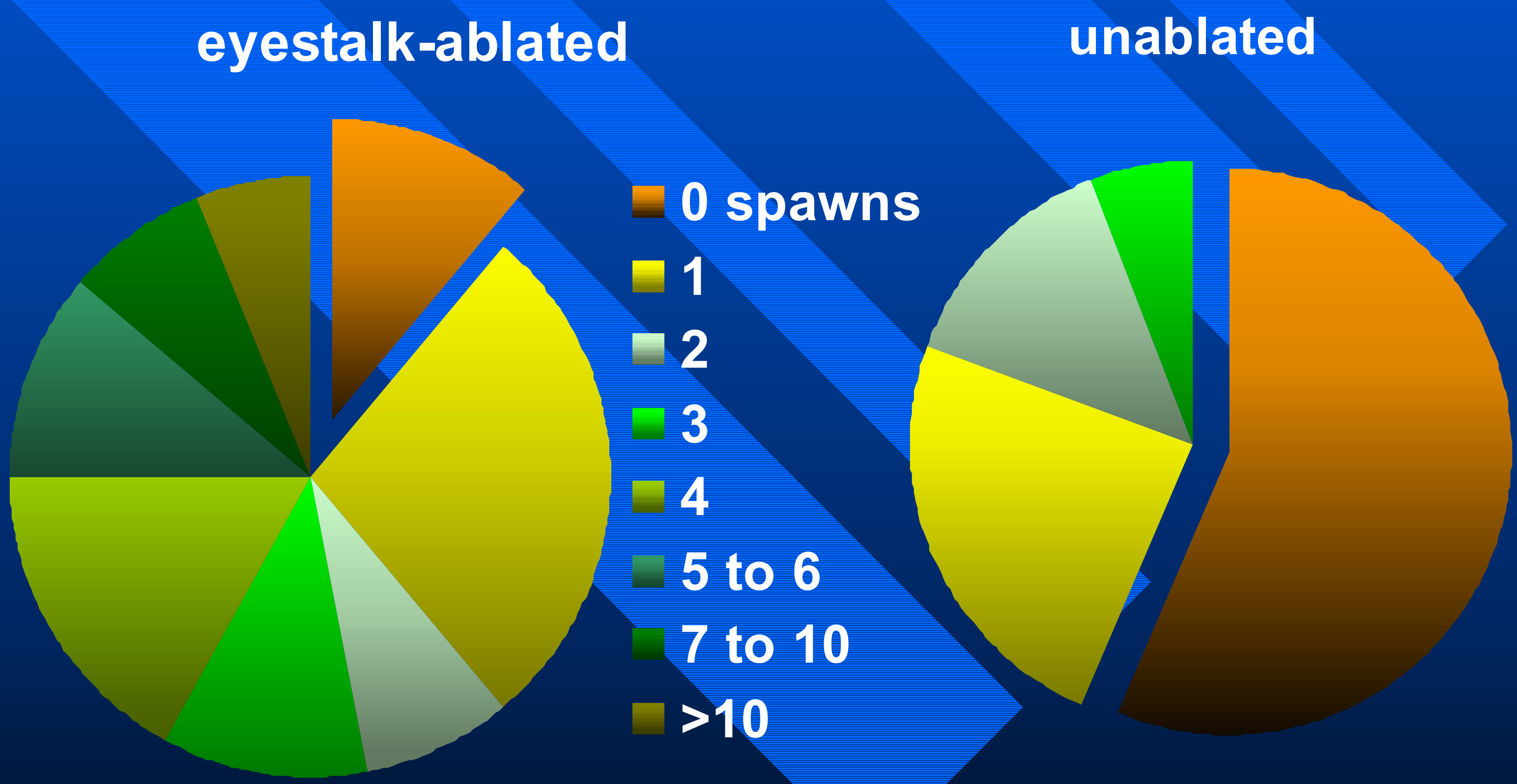
Influence of broodstock management on larval quality

- Nutrition
- Environmental conditions
- Shrimp size, age and season of the year
- Origin of shrimp
- Endocrine manipulations
- Reproductive exhaustion
- Genetic variability

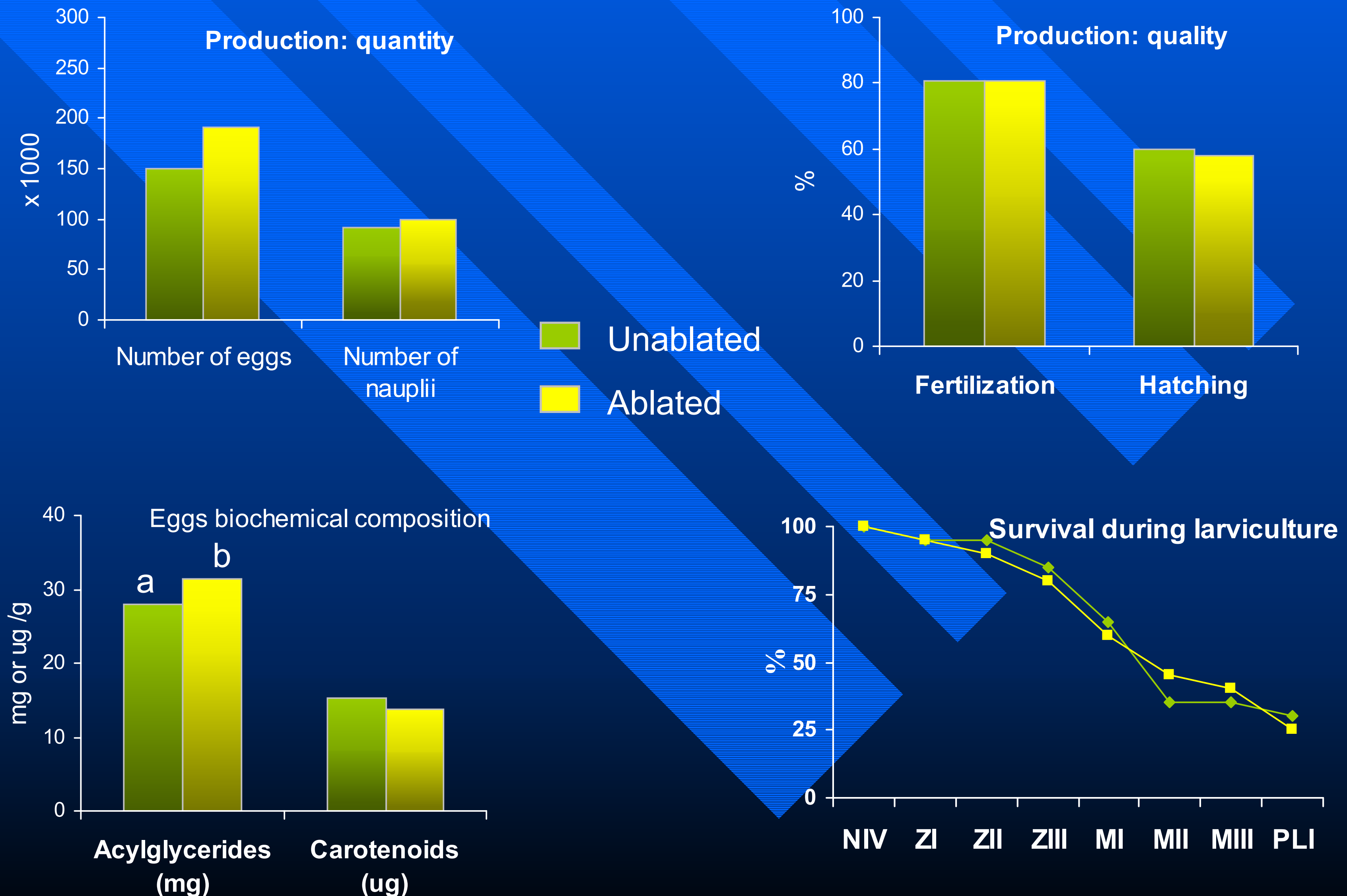
Broodstock endocrine manipulations

- Eyestalk ablation (which produce a decrease in gonad inhibiting hormone) represents by far the most commonly used procedure for most species. Controversies exists about the consequences on spawn and larval quality.
- Some alternatives such as methylfarnoseate supplement in the diet, or serotonin injection have been tested on larvae production.
- Other alternatives (peptides, steroids) have been tested only on ovary development and sperm production.

Eyestalk ablation and spawning frequency



Spawn and larval quality



Reproductive exhaustion

- Decline in reproductive capacity under intensive maturation conditions.
- Occurs both in males and females as a consequence either of time or consecutive rematurations.

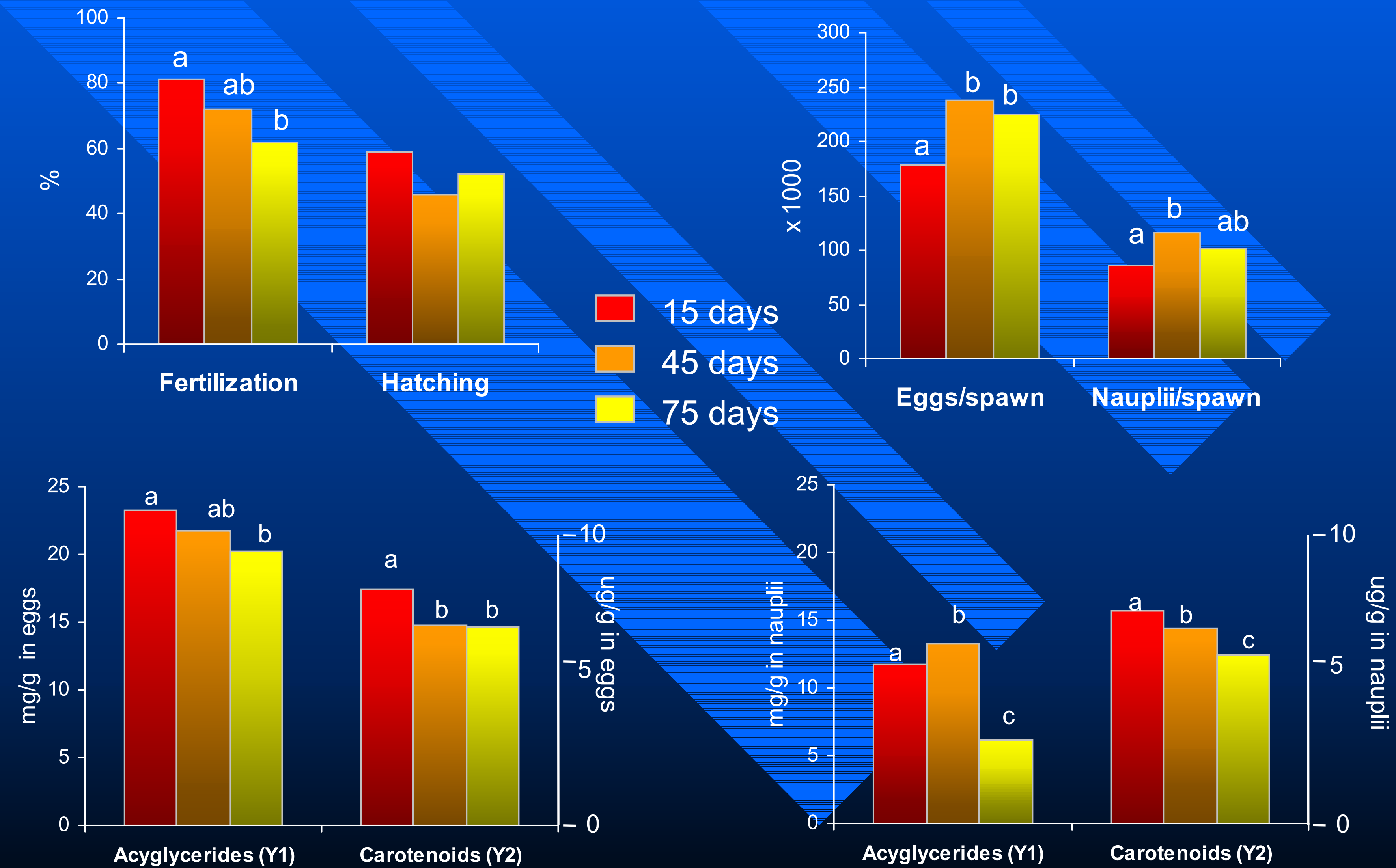
↓

Broodstock replacement (2 to 6 months)

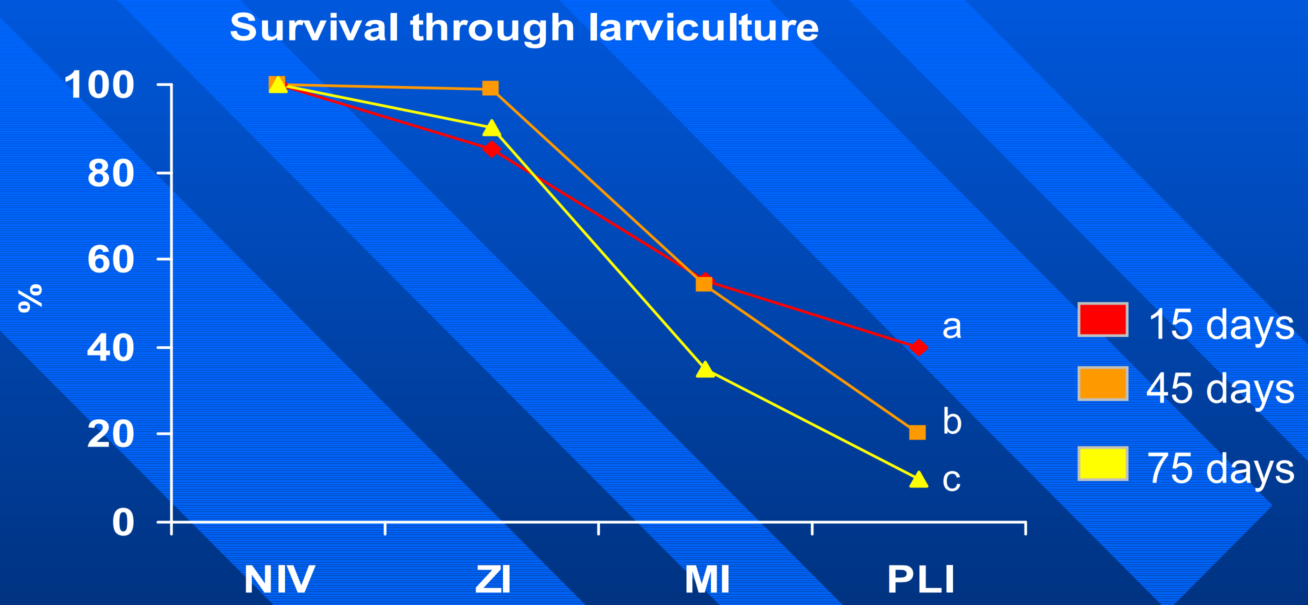
Time spent in maturation conditions

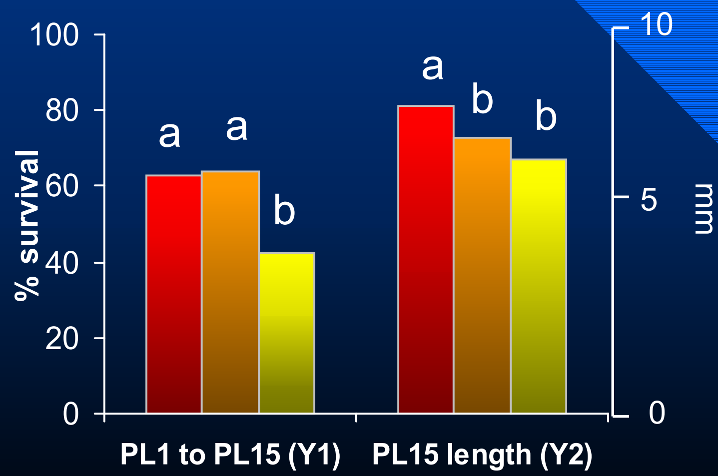
Time in tanks	*Consequence*	*Reference*
at 6-8 weeks	↓ fertilization, ↓ hatching, ↓ metamorphosis to zoea	Simon, 1982
1 to 7 weeks	↓ sperm count, ↓ live sperm ↑ abnormal sperm	Leung-Trujillo and Lawrence, 1987
1 to 6 weeks	↓ hatching	Bray et al., 1990
5 to 40 days	↓ fertilization	Menasveta et al., 1993
1 to 14 weeks	↓ survival to zoea	Wyban et al., 1997
18 to 96 days	↑ fecundity, ↓ fertilization ↓ biochemical components	Palacios et al, 1998
15 to 75 days	several traits	Palacios et al, 1999

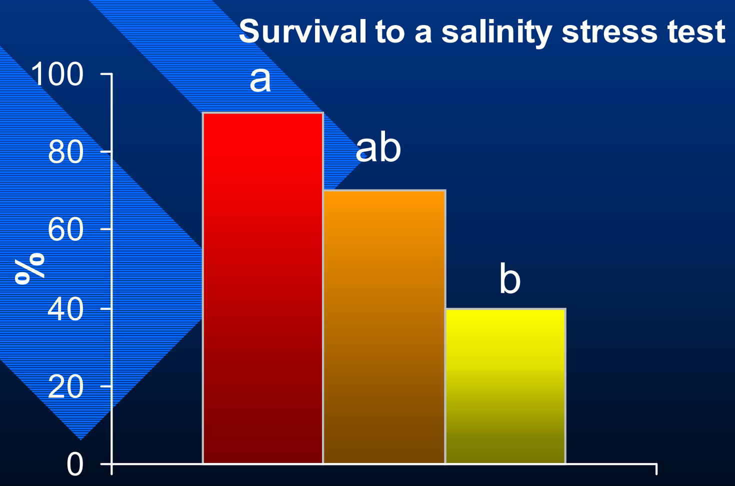
Time spent in tanks and spawn quality



Time spent in tanks and larval quality



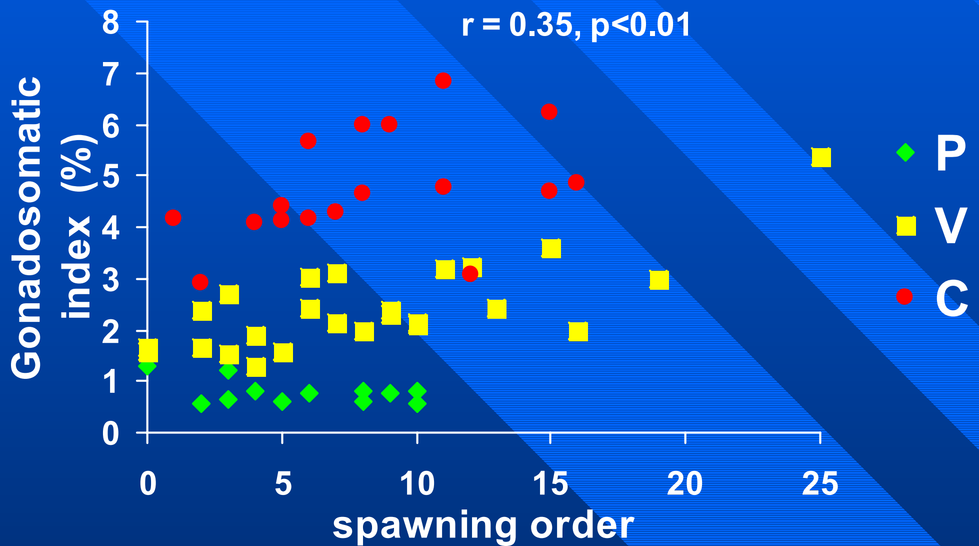


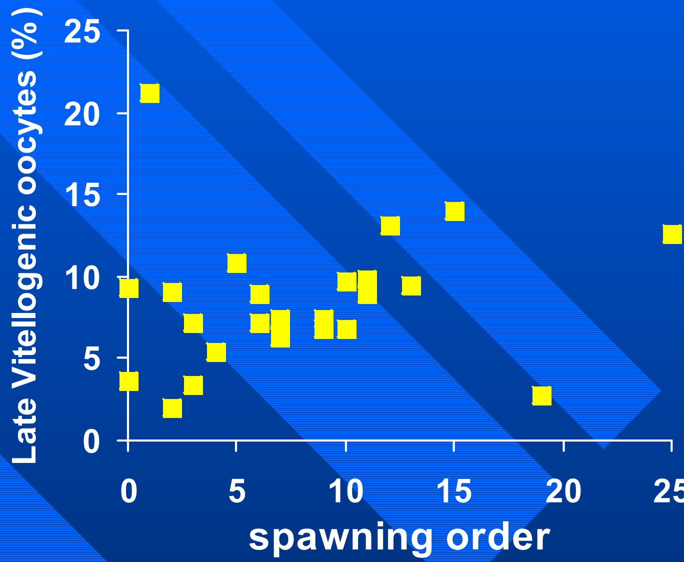


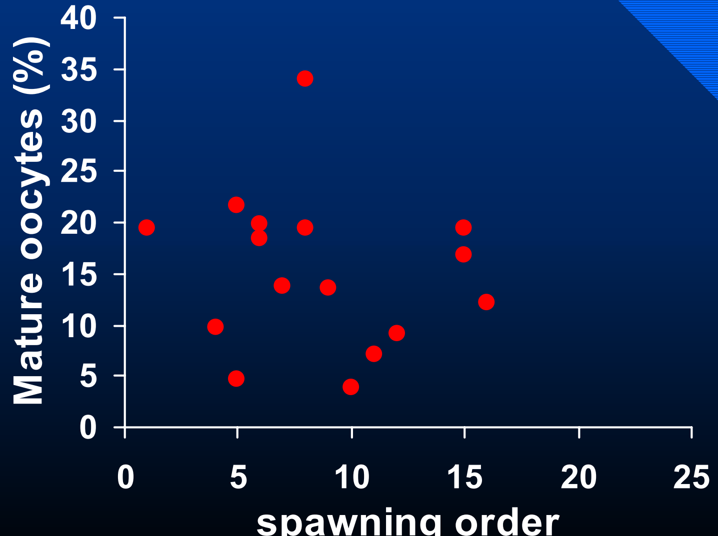
Consecutive spawns

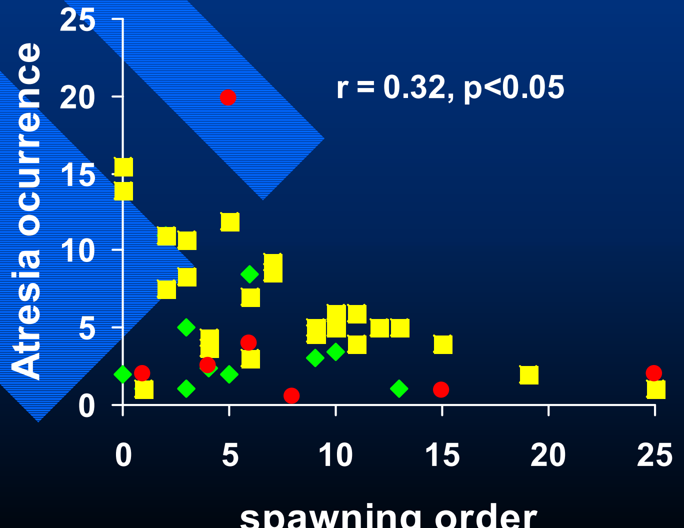
Spawn order	*Consequence*	*Reference*
1 to 8	↓ gonadosomatic index = fecundity and hatching	Lumare, 1979
1 to 9	↓ hatching, = fecundity and =nauplii/spawn	Emmerson, 1980
1 to 5	= fecundity and hatching	Chamberlain and Lawrence, 1981
1 to 9	= fertilization and hatching = metamorphosis to zoea	Browdy and Samocha, 1985
1 to 3	↓ lipids in hepatopancreas	Vázquez-Boucard, 1990
1 to 6	= fecundity, ↓ hatching ↓ survival to zoea	Marsden et al., 1997
1 to 5	↓ metamorphosis to zoea	Wouters et al., 1999

Maturation capacity: ovary development

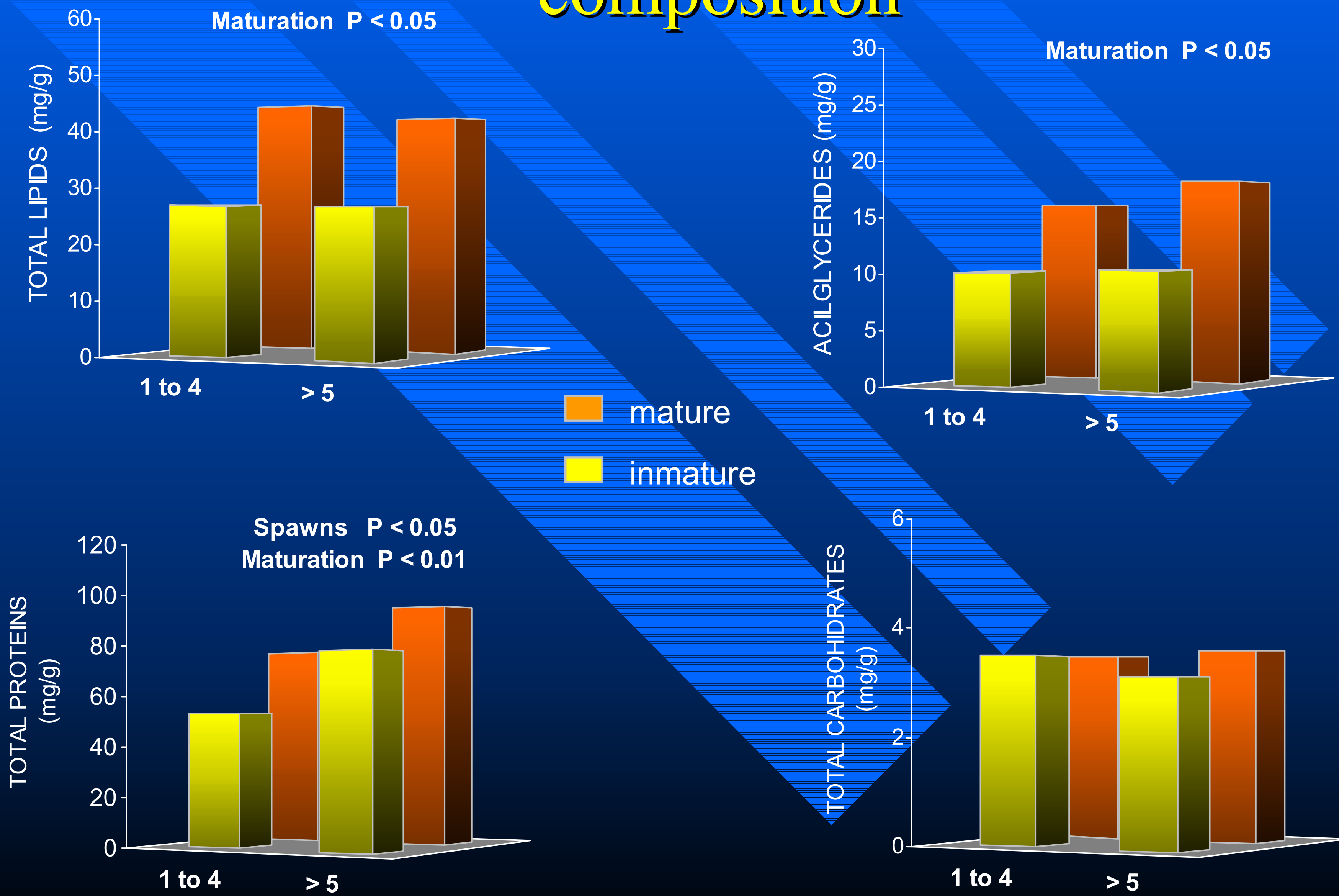




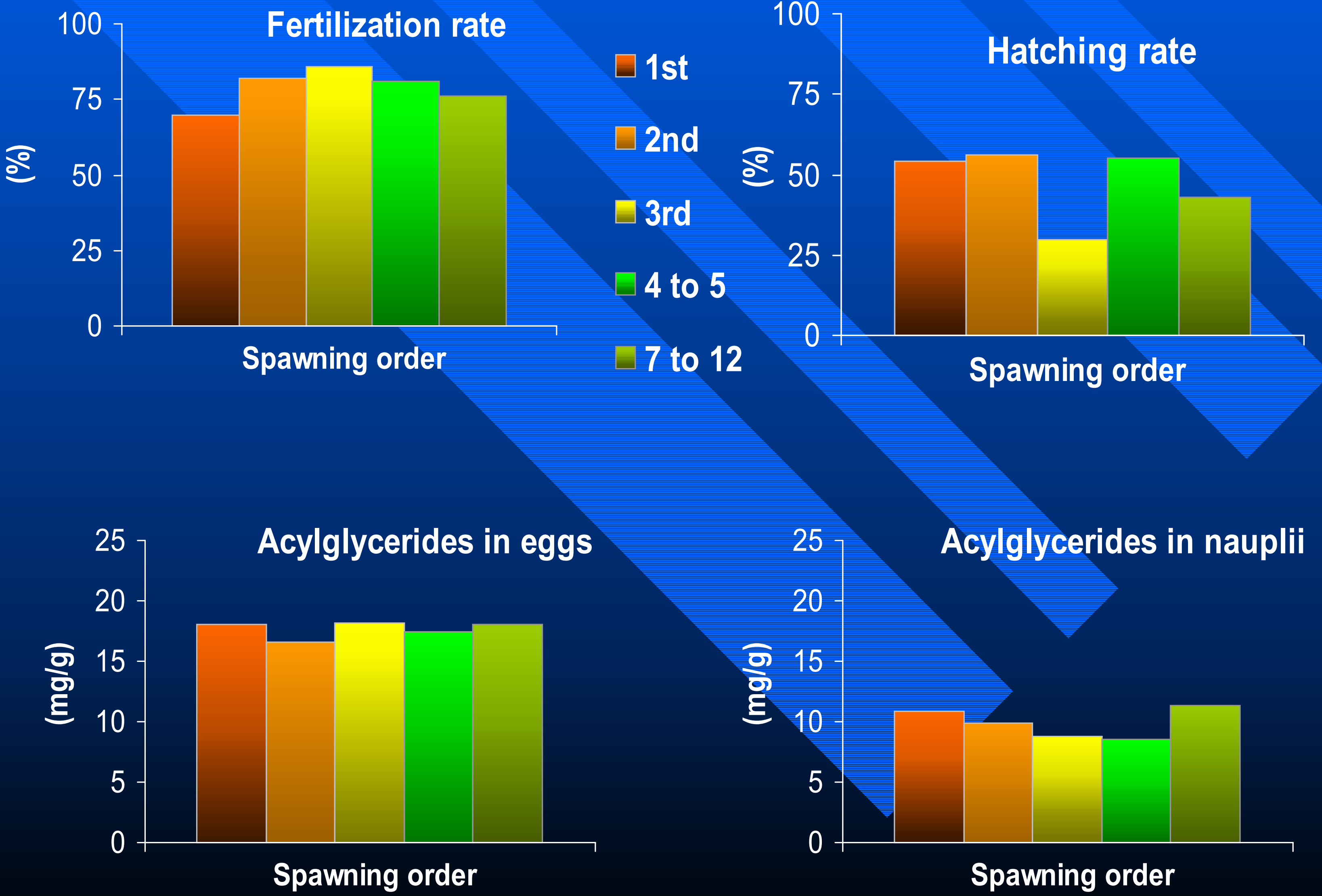




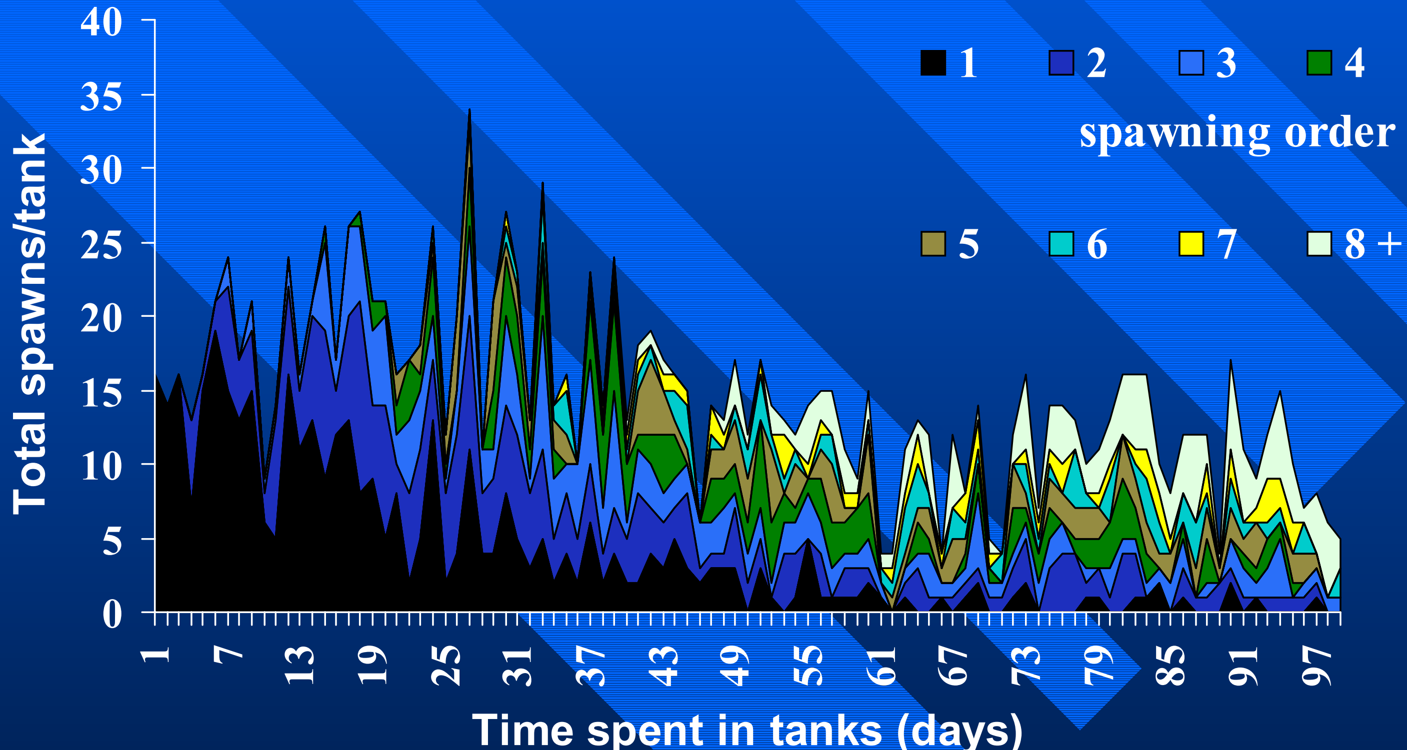
Maturation capacity: ovary biochemical composition



Spawn quality



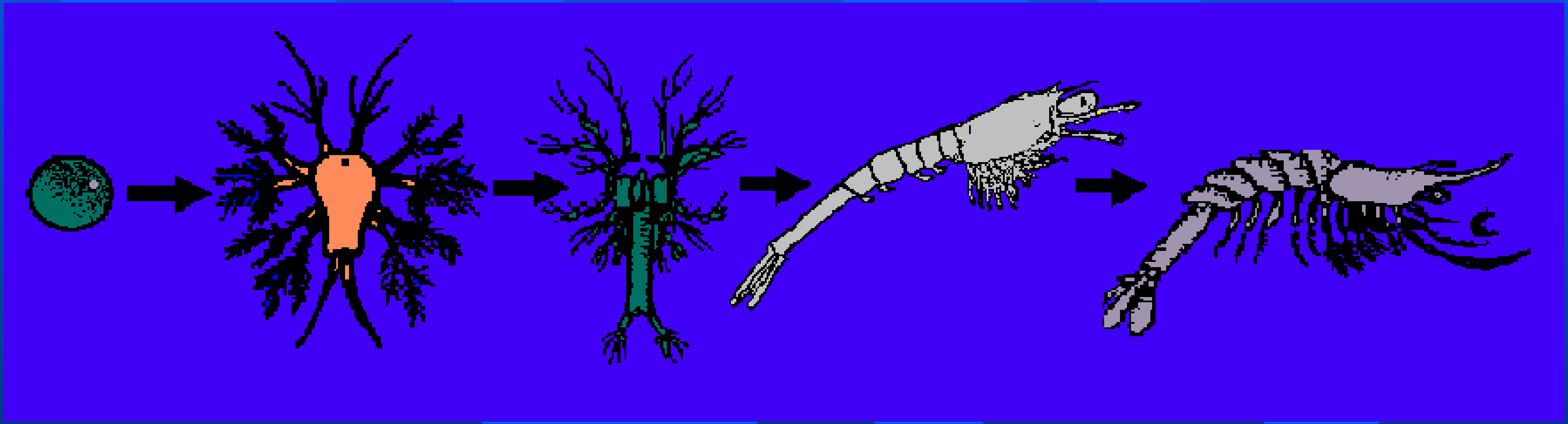
Time in maturation tanks vs. consecutive spawns



- Time spent in tanks is only partially related to consecutive spawns
- Evaluation must consider separately both factors

Conclusions

- Eyestalk ablation does not affect spawn and larval quality under our conditions
- Reproductive exhaustion consist of at least two factors: time spent in tanks and consecutive spawnings
- Time spent in tanks decreases spawn and larval quality
- Female maturation capacity and spawn quality was not significantly decreased by consecutive spawns



Thank you