

Maturation diets for shrimp

– Is there alternative to natural food?

In recent years, shrimp culture has become one of the most important aquaculture industries in the world. Current production levels reach over three million tonnes per year, corresponding to a market volume of over US\$10 billion (FAO 2008).

However, even with this expansion in the production there are some unknowns.

One of the problems with shrimp (and other crustacean) culture is broodstock diets and nutrition.

Currently, most, if not all, hatcheries around the world are using fresh or frozen, unprocessed marine organisms as food items. These include squid, various mollusks (mussels, oysters or clams), marine polychaetes, crustaceans such as shrimp (Peixoto et al., 2004; Preston et al., 2004, Coman et al., 2006) and *Artemia* biomass (Anh et al., 2008, Gandy et al., 2007). These feeds are usually topped up with nutritional additives such as vitamins, minerals and fatty acids (Hoa et al., 2009).

Maturation diets based on combination of fresh and frozen marine organisms usually results in high reproductive performances for both domesticated and wild caught broodstock shrimp.

However, this practice is far from ideal, exposing the cultured animals to several major issues -

Biosecurity: Fresh and frozen food organisms can, potentially, become transferring vector for different pathogens and diseases. This is more so when crustaceans are been used (Coman et al., 2006). Although, recognized for their contribution to the maturation process through supplementing maturation hormones and other nutrients, the importation of crustaceans such as *Artemia* was banned in several countries in an attempt to reduce the risk of disease

transfer. Similarly, in many countries the use of shrimp heads or shrimp meal in maturation diets was banned. It is not known if none-crustacean organisms can transmit shrimp viruses such as white spot syndrome virus (WSSV) and yellow head virus (YHV) or others but due to their origin, post harvest methods and storage, they are all prone to become a vector for other pathogens.

Nutritional profile: Due to the fact that fresh/frozen food organisms are been caught in the wild, their nutritional profile varied. Season, location, life cycle, pre and post harvesting methods can and will affect their nutritional profile. This inconsistency in the quality and nutritional profile makes it hard to standardize protocols even within the same company. Different countries and even regions within a country will have different access to fresh/frozen food organisms and will used them differently resulting in high fluctuation in FCR's and performances between farmers, regions and countries culturing the same species.

Water quality: In many cases high water flow is needed following feeding of fresh / frozen food organisms. In many cases daily (or even few times during the day) siphoning is essential to keep good water quality and tank hygiene. This is obviously labor-intensive task that might also affect the brood animals.

Domestication: It is commonly accepted that wild broodstock shrimp needs fresh / frozen food organisms. For example, Conan et al., 2006 raised the hypotheis wether the removal of crustacean component from the maturations diet for domesticated *P. monodon* broodstock has contributed to the broodstock low performances.

Considering the cost of broodstock (especially 'SPF'), these are serious risks and in many cases resulting in high mortality and/or reduced productivity, leading to significant financial loss.

Until now, shrimp broodstock fed maturation-formulated diet, pelleted or extruded did not match the performances of animals fed on fresh/frozen food (Wouters et al., 2002. Braga et al., 2010). Formulated diets tend to break down due to the unique feeding behavior of the animals, resulting in polluted water and very high FCR. Moreover, palatability and ingestion rates are usually low. Even using the same food organisms as dry meals in formulated diets didn't result in similar performances as when fresh/frozen organisms were given.

Recently, new maturation diet (NutraFeed®) for crustacean that can completely replace the use of fresh/frozen feed was developed. The diet is semi-moist (around 30-35% moist) and manufactured as short pellets at any length and diameter needed. The diet is stable in the water for 24 hours and will not break down when the shrimp is holding and chewing it.

NutraFeed® diets are based solely on dry meals without any fresh or frozen products. They are certified as pathogen free (all ingredients pass Gamma radiation) with a shelf life of six months (refrigerated) or 12 months (frozen). To boost the hormonal cycle, herbal extracts (NutraGreen® products) are incorporated into the diets. These are 100% natural additives aimed at improving broodstock performances including; enhancing egg and larvae quality, sperm mortality, vitellogenesis, as well as immune system and digestive system support.

Initially these natural herbal additives were developed as natural hormonal replacements for woman during IVF treatments and during menopause period.

Large experiment

To compare the performances of the maturation diet against traditional fresh/frozen food organism, a large experiment was conducted independently by one of

Table 1: Comparison between traditional (control) fresh/frozen food and formulated semi-moist diet

Treatment	Days	%Mort/day	Avg. SR/day	Total spawns	Egg/Female	Nauplii/Female	% Hatch	Total Nauplii
Control	124	0.09	3.34%	602	179,364	154,364	86	92,860,000
NutraFeed	124	0.05	4.74	849	186,266	160,188	86	136,000,000
Difference		44.4%	29.5%	29.1%	3.7%	3.7%	0%	46.5%

the biggest shrimp producers in the world. The results (see Table 1) showed significant performance improvements when the broodstock fed on NutraFeed® semi-moist diet.

Moreover, using the semi-moist diet also proved to be cost effective compared to traditional diets. 200 white shrimp *L. vannamei* were fed control diet (squid, polychaetes and nutritional booster) or NutraFeed® SM diet. The broodstock were kept in identical tanks and under the same environmental conditions. Growth, mortalities, spawning events, fecundity, hatching rates and number of nauplii were determined over 124 days.

The diet was also used with domesticated *P. monodon* broodstock in Australia with remarkable results. This is a significant achievement since it is known that *P. monodon* are particularly picky with their diet and feeding them solely on formulated diet used to be challenging, not to mention, achieving similar or better performances.

Currently the diet is been used in several commercial hatcheries in Thailand, India and Malaysia and the company is up-scaling the production.

References

Anh, N.T.N., Hoa, N.V., Van Stappen, G., and Sorgeloos, P. 2008. Effect of different supplemental feeds on proximate composition and Artemia biomass production in salt ponds. *Aquaculture*, 286, 217-225.

Braga, A.L., Nakayama, C.L., Martins, J.G., Colares, E.P., and Wasielesky, W. Jr. 2010. Spermatophore quality of the pink shrimp *Farfantepenaeus paulensis* (Decapoda, Dendrobranchiata) broodstock fed with different maturation diets. *Aquaculture*, 307, 44-48.

Coman, G.J., Arnold, S.J., Callaghan, T.R., and Preston, N.P. 2006. Effect of two maturation diet combinations on reproductive performance of domesticated *Penaeus monodon*. *Aquaculture*, 263, 75-83.

Coman, G.J., Arnold, S.J., Peixoto, S., Coman, F.E., Crocos, P.J., Preston, N.P., 2006. Reproductive

performance of reciprocally crossed wild-caught and tank reared *Penaeus monodon* broodstock. *Aquaculture* 252, 372-384.

Gandy, R.L., Samocha, T.M., Masser, M.P., Fox, J.M., Ali, S.A.M., Gatlin III, D.M., and Speed, M. 2007. The effect of unilateral eyestalk ablation and diet on the reproductive performance of wild-caught *Farfantepenaeus aztecus* (Ives, 1891) using a closed recirculating maturation system. *Aquac. Res.* 38, 580-587.

Hoa, N.D., Wouters, R., Wille, R., Thanh, V., Dong, T.K., Hao, N.V., and Sorgeloos, P. 2009. A fresh-food maturation diet with an adequate HUFA composition for broodstock nutrition studies in black tiger shrimp *Penaeus monodon* (Fabricius, 1798). *Aquaculture*, 297, 116-121.

Peixoto, S., Coman, G.J., Arnold, S.J., Crocos, P.J., Preston, N.P., 2005. Histological examination of final oocyte maturation and atresia in wild and domesticated *Penaeus monodon* broodstock. *Aquac. Res.* 36, 666-673.

Preston, N.P., Crocos, P.J., Keys, S.J., Coman, G.J., Koenig, R., 2004. Comparative growth of selected and non-selected Kuruma shrimp *Penaeus (Marsupenaeus) japonicus* in commercial farm ponds. *Aquaculture* 231, 73-82.

Authors & Company

Dr Sagiv Kolkovski is the Principal scientist, marine aquaculture, at the Department of Fisheries, western Australia. He is also the R&D director at Nutrakol Pty Ltd. **Judith Kolkovski**, ND is a nutritionist and herbalist and the general manager of Nutrakol Pty Ltd. Nutrakol Pty Ltd is specialized in developing and manufacturing nutritional and natural health solutions for aquaculture.

Company products

Nutrakol specialized in nutritional and health solutions for aquaculture. 'Tailor-made' diets and additives for broodstock and enrichments for larvae. These products can be manufacture to specific requirements or species. Crustacean broodstock semi-moist diets for complete replacement of fresh/frozen food. NutraGreen natural health solutions solely based on herbal extracts and specifically design to support gonadal development, immune system and digestive system.

Semi-moist maturation diet for Shrimp
Completely replace the need for fresh/frozen feed with even better results

Avoid potential pathogens and diseases
Ideal for SPF (specific pathogen free) broodstock

Better performance
Nutrafeed - Improved bio-security, better performances, great palatability and no contamination of the water

Meet us at World Aquaculture, Natal Brazil, Booth 66

Nutra-Kol Pty Ltd
Western Australia, Australia
Tel: +61 8 9403 2287
Fax: +61 8 9403 2287
Email: info@nutrakol.com

'Tailor--made' Nutrition and natural health solutions for aquaculture

www.nutrakol.com