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MARINE WORMS: THE SECRET BEHIND HEALTHY SHRIMP BROODSTOCK

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Successful shrimp farming begins with healthy broodstock capable of producing large numbers of high-quality eggs and larvae. Broodstock shrimp require nutrient-rich diets to mature, spawn regularly and produce robust offspring. Although formulated broodstock feeds are available, most shrimp hatcheries continue to use natural feeds such as squid, mussels, clams and polychaete worms.

Among these feeds, polychaetes are particularly important because they contain high-quality protein, essential fatty acids, phospholipids, cholesterol, vitamins and minerals. Consequently, they are widely regarded as one of the most effective natural maturation feeds for penaeid shrimp (Chimsung, 2014).

What Are Polychaetes?

Polychaetes are segmented marine worms belonging to the phylum Annelida. The name “polychaete” means “many bristles,” referring to the numerous hair-like chaetae present on their body segments. These bristles help the worms crawl, swim, burrow or anchor themselves in marine sediments. Polychaetes occur in almost every marine environment, including estuaries, mangroves, sandy beaches, mudflats, seagrass beds and the deep sea. Depending on the species, they feed on algae, microorganisms, detritus, organic matter or small animals. Several polychaete genera are used as shrimp broodstock feed, including *Perinereis*, *Nereis*, *Marphysa*, *Hediste*, *Alitta* and *Glycera*. In India, species belonging to *Marphysa* and *Perinereis* are commonly collected from coastal areas and supplied to shrimp hatcheries.

Why Do Shrimp Breeders Feed Polychaetes?

Reproduction is an energy-intensive process. Female shrimp require substantial quantities of nutrients to develop their ovaries and produce eggs, while males need balanced

nutrition for the formation of sperm and spermatophores. Nutritional deficiencies can delay gonadal maturation, reduce spawning frequency and adversely affect egg and larval quality.

Polychaetes provide reproductive nutrients in a natural and readily digestible form. Their soft body tissues are easily consumed by shrimp, while their natural smell and movement stimulate feeding. Live worms may encourage broodstock to feed even when they show a poor response to formulated diets. In hatcheries, polychaetes are normally offered as part of a mixed maturation diet containing squid, mussel, clam and formulated feed. Such a combination provides a broader range of nutrients than any single feed ingredient (Chimsung, 2014).

Nutritional Value of Polychaetes

High-quality protein

Polychaetes are rich in protein and essential amino acids required for maintaining broodstock tissues and developing reproductive organs. In female shrimp, amino acids support the synthesis of vitellogenin, an egg-yolk precursor deposited in developing oocytes.

However, nutritional composition differs considerably among polychaete species. Li et al. (2025) compared three species and found that *Marphysa maxidenticulata*, which contained favourable levels of protein and polyunsaturated fatty acids, produced better growth and reproductive responses in female Pacific white shrimp, *Penaeus vannamei*. Therefore, selecting the right polychaete species is important.

Essential fatty acids

One of the most valuable features of polychaetes is their content of long-chain polyunsaturated fatty acids, particularly:

- Arachidonic acid (ARA)
- Eicosapentaenoic acid (EPA)
- Docosahexaenoic acid (DHA)

These fatty acids are involved in cell membrane formation, ovarian maturation, embryonic development and larval growth. ARA is also a precursor of hormone-like compounds called eicosanoids, which participate in several reproductive processes. Dietary ARA has been shown to improve the reproductive performance of *P. vannamei* broodstock (Xu et al., 2017). EPA and DHA contribute to the development of eggs and embryos and provide

energy to newly hatched larvae. The balance among ARA, EPA and DHA is therefore more important than simply providing a high level of dietary lipid.

Cholesterol and phospholipids

Shrimps have a limited ability to synthesise cholesterol and must obtain it through their diet. Cholesterol is required for cell membranes and for producing moulting and reproductive hormones. Phospholipids help shrimp digest, transport and utilise dietary lipids. They are also major structural components of egg and embryonic cell membranes. Together, cholesterol and phospholipids support ovarian maturation, egg formation and embryonic survival.

Vitamins and minerals

Polychaetes contain vitamins and minerals involved in metabolism, antioxidant defence and reproduction. Some species may also provide carotenoids and other biologically active substances. Extracts from marine polychaetes have been reported to stimulate reproductive processes in penaeid shrimp, although the active compounds and their precise mechanisms are not yet fully understood (Nguyen et al., 2012).

Reproductive Benefits

Faster ovarian maturation and spawning

The protein, fatty acids, cholesterol and phospholipids supplied by polychaetes support vitellogenesis and oocyte development. Females receiving nutritionally suitable worms may therefore attain advanced stages of ovarian maturation more efficiently. Li et al. (2025) observed that female *P. vannamei* fed *M. maxidenticulata* had greater ovarian accumulation of triglycerides, estradiol and vitellogenin, as well as larger mature oocytes, than shrimp fed the other polychaetes tested.

Well-nourished females are more likely to spawn consistently and recover between spawning events. Nevertheless, reproduction is also influenced by broodstock age, genetics, health, water quality, stocking density and hatchery management. Polychaetes should therefore be considered part of a comprehensive broodstock programme rather than a stand-alone solution.

Improved egg and larval quality

Nutrients obtained from the maternal diet are transferred to developing eggs. Eggs containing an appropriate balance of amino acids, fatty acids and phospholipids are more likely to undergo normal embryonic development and produce healthy nauplii. The benefits of polychaete feeding can therefore extend to fertilisation, hatching, larval activity and stress tolerance. Hatcheries should assess not only the number of nauplii produced but also their uniformity, activity, survival and subsequent developmental performance.

Benefits to male broodstock

Male shrimp also benefit from polychaete supplementation. Protein and essential fatty acids support the development of testes, sperm and spermatophores. Polychaete feeding has been associated with improved sperm performance and reproductive condition in male black tiger shrimp, *P. monodon* (Leelatanawit et al., 2014).

Biosecurity Concerns

Despite their nutritional benefits, wild polychaetes may present serious biosecurity risks. Worms collected near shrimp farms or from contaminated sediments can carry shrimp pathogens, including white spot syndrome virus, *Enterocytozoon hepatopenaei* (EHP) and bacteria associated with acute hepatopancreatic necrosis disease (Desrina et al., 2018). A study conducted in India detected EHP and WSSV in wild polychaetes. Experimental evidence also demonstrated that EHP-contaminated worms could transmit the pathogen to healthy shrimp. The researchers concluded that feeding wild-caught polychaetes could increase the risk of introducing EHP into shrimp hatcheries (Krishnan et al., 2021).

Freezing cannot automatically be assumed to eliminate every pathogen. Hatcheries should obtain worms from traceable sources and follow appropriate screening, processing, storage and hygiene procedures. PCR-based screening for major shrimp pathogens is particularly important for worms intended for specific-pathogen-free broodstock.

Conclusion

Polychaetes are far more than ordinary marine worms. They are natural packages of protein, essential fatty acids, cholesterol, phospholipids, vitamins and minerals needed for shrimp reproduction. When included in a balanced maturation diet, they can support ovarian development, spawning, egg quality, hatchability, sperm performance and larval quality.

However, dependence on wild worms raises concerns regarding pathogen transmission, inconsistent supply and environmental damage. The future lies in the controlled, biosecure and sustainable farming of nutritionally enriched polychaetes.

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