Tiger Shrimp Aquaculture Profile

Figure 1: Penaeus monodon (tiger prawn) (Source: Mitra [11]).

Penaeus monodon is a large species of shrimp found in South-East Asian waters, reaching up to 270mm in length and 260g in weight, owing to their common name, giant tiger prawns. *P monodon* has a life cycle that includes six phases with adolescent prawns inhabiting surface waters while the adults inhabit deeper waters at around 160m. Giant tiger shrimp spawning occurs at night, with female shrimps excreting up to 800,000 eggs to be fertilized externally in the water. *P monodon* are carnivorous, with their diet mainly consisting of small, slow moving benthic invertebrates such as shrimp, molluscs, and crabs.

While the aquaculture practices surrounding giant tiger prawns vary, one study conducted in Taiwan assessed a culture of *P monodon* in an intensified system (Chen, 1988). This system reared 600,000 post larvae shrimp in six 0.14ha (hectare) ponds equipped with paddle wheels to oxygenate the water and fed commercially supplied and formulated feed. Over four and a half months of observation, the six ponds yielded 8657 kg/ha which is higher than other studies covering giant tiger shrimp aquaculture practices. Notably, the study found a significant linear relationship between both stocking density and unit production with an additional correlation between pond depth and production. This is likely due to a strong microbial balance in the gut, giving giant tiger shrimp efficient food absorption which is essential for thriving in high stocking densities in intensive aquaculture systems.

Additionally, past research has found ways of enhancing immune responses of shrimp through the use of Bacillus S11, resulting in higher growth and survival rates compared to non-treated shrimp, especially following pathogen challenges (Rengpipat, 2000). In intensive systems, the inclusion of this bacteria in feed is a preferable alternative to antibiotics for improving shrimp health and disease resistance. Further past studies have found the optimum balance of essential amino acids in manufactured feed that maximize the growth rate of giant tiger shrimp (Millamena, 1999). The results of these studies have helped improve the efficiency of commercial shrimp feed to maximize the nutritional value, improving shrimp yields, reducing operational costs, and improving the shrimp feed conversion ratio within an intensive aquaculture system. This shows that there is lots of potential for intensive shrimp farming in limited land areas by increasing the density and depths of ponds, something that is very relevant in regions within South-East Asia, where agricultural land is limited.

Socio-economic factors play a crucial role in determining the potential of *P monodon* when it comes to large scale aquaculture farming. The high yield observed in intensified systems, such as the one studied in Taiwan, demonstrates the profitability of intensive shrimp farming, especially in areas where land is scarce and expensive.

Additionally, by closing off the system from the environment, intensive aquaculture systems avoid environmental issues that come from open aquaculture systems such as eutrophication, external diseases, and unpredictable water quality due to climate change and pollution. Moreover, a very high international market demand for giant tiger shrimp promotes expansion of aquaculture industries around the species in areas where they are feasible to cultivate. This economic demand will help stimulate job creation in the form of hatcheries, commercial feed production, pond maintenance, etc. However, for an intensive aquaculture system, the initial investment required, including pond infrastructure, aeration systems, formulated feed, and water quality management, can be a significant barrier for small-scale farmers.

On the other hand, other studies have proved that culturing giant tiger prawns in ponds with a greater reliance on natural systems is a viable source of feed in extensive aquaculture systems (Abualreesh, 2021). These systems depend on the natural productivity of pond ecosystems, utilizing zooplankton that prey on phytoplankton as a primary food source for juvenile giant tiger prawns. The natural environments of these ponds additionally provide macrobenthos such as gastropods, insects, and crab larvae that provide a trophic linking service to the pod ecosystem while also acting as a nutrient dense food source for more mature giant tiger prawns. Additionally, this approach to extensive aquaculture is very beneficial in regions where resources are limited, as extensive systems can be managed with lower operational costs while still achieving high production levels without the inputs required to upkeep an intensive system.

Despite being one of the most sought after shrimp in the international seafood market, giant tiger prawns face challenges surrounding the culturing of the species. While *P monodon* is a highly marketable shrimp due to its size, appearance, and strong nutritional value, another shrimp, *L vannamei* (whiteleg shrimp), offers higher average net returns due to its shorter production cycle, making it a stronger focus in the shrimp farming industry. Additionally, diseases pose a large threat to *P monodon* farming operations as there is no commercially available pathogen free *P monodon* strain which is compounded by the existence of high risk viruses with no known cures. Furthermore, due to the popularity of giant tiger shrimp, it has been introduced to aquaculture operations outside its native habitats, raising concerns surrounding its escape which could create an invasive species problem. While *P monodon* has significant potential for profitable aquaculture through both intensive and extensive systems, challenges posed socio-economic and environmental risks highlight the need for more research to be conducted surrounding the captive culture of the species in more environmentally minded and efficient ways.

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