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Popular Article

Utilization of Formulated feed in Aquaculture: current status and practices in Andhra Pradesh

¹Santhipriya Gollapalli, ¹Shivendra Kumar, ^{1*}Patekar Prakash, ¹Sanayaima Singha,
¹Swathi Moodu, ¹Soumya Rai

¹College of Fisheries, Dr. Rajendra Prasad Central Agricultural University, Dholi, Bihar,
India

*Corresponding Email: patekarcof31@rpcau.ac.in
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Abstract

Andhra Pradesh, India's leading aquaculture-producing state, has witnessed a significant transition from traditional farm-made feeds to scientifically formulated feeds, particularly in shrimp and carp farming. Formulated feeds provide balanced nutrition, improved digestibility, enhanced growth performance, and lower feed conversion ratios (FCR), contributing to greater production efficiency. Their utilization is influenced by factors such as ingredient quality, species-specific nutritional requirements, feeding management practices, water quality, and overall fish health. The rapid expansion of aquaculture in the state has increased the demand for commercial pelleted and extruded feeds, supported by modern feeding technologies such as feeding trays and automated feeders. Consequently, the adoption of formulated feeds has improved productivity, profitability, sustainability, and resource-use efficiency, strengthening the growth and competitiveness of Andhra Pradesh's aquaculture sector.

Keywords: Aquaculture, Formulated Feeds, Feed Conversion Ratio (FCR), Shrimp Farming

Introduction

Andhra Pradesh has increasingly transitioned from traditional mash-based diets to more scientifically optimized formulated feeds, especially in shrimp aquaculture. The continued use of expensive, farm-made feed, such as de-oiled rice bran, underscores that freshwater carp farming still faces critical limitations despite recent advancements. The state is India's top fisheries-generating state, accounting for between 40 and 41 percent of the nation's overall fisheries and aquaculture output with an annual fish production of roughly 5.1



million Tons. This strong position is reinforced by its extensive coastline, significant freshwater pond farming in the Krishna-Godavari delta region, and the quick development of both shrimp and carp production systems. Due to its high concentration of commercial farms and feed manufacturing facilities, Andhra Pradesh has been identified as India's largest consumer of aquaculture feed. The state's increased aquaculture activity has also increased demand for aquafeeds. Due to the expansion of agricultural operations, especially in shrimp farming, which accounts for roughly 60-65% of the total production cost, feed has emerged as the primary operational expense (ICAR-CIBA, 2017).

What are Formulated Feeds

A range of feed ingredients, including grain leftovers, oilseed cakes, fish flour, vegetable protein sources, and additional micronutrients, are blended in preset ratios to generate manufactured diets, which are scientifically engineered nutritional formulations. These ingredients are mixed homogeneously, then shaped into pellets or extruded bites, and tested to ensure they meet the dietary needs of the target aquatic species at each developmental stage. Manufactured diets provide a well-balanced source of protein, energy, vitamins, and minerals with improved digestibility and nutrient uptake, in contrast to traditional on-farm mixes that primarily consist of rice bran and oilseed cake. Because of this balanced composition, they boost growth outcomes and feed efficiency, yielding a lower feed conversion ratio (FCR). Formulated feeds for Indian major carps generally achieve FCR values of about 1.5–2.0, whereas traditional feeds often range from 2.5–3.5 (De Silva and Anderson, T. A., 1995)

Formulated feeds are utilized for several key reasons:

1. They help lower feeding costs by using cost-effective formulations based on ingredient composition data, while still maintaining good production performance (Catacutan, 2002; Agbayani, 2002).
2. Compared to non-formulated feeds or trash fish, they promote faster growth, better feed conversion efficiency, and higher-quality harvests (Tacon & Metian, 2008; New, 1987).
3. They ensure consistent feeds or trash fish, they promote faster growth, better feed conversion efficiency, and higher-quality harvests (De Silva & Hasan, 2007).
4. They allow the inclusion of beneficial additives such as probiotics, enzymes, immune enhancers, and therapeutic compounds to support better health management in aquaculture (Ringo et al., 2010).



Factors Affecting Feed Utilization

Feed Ingredient Quality

Feed utilization is influenced by several factors, particularly the quality of the feed and its ingredients. Effective use of feed relies on having the right nutrient density, good digestibility, and bioavailability of ingredients, while avoiding any antinutritional or toxic substances (Lall & Dumas, 2015). The process of pelleting or extrusion must produce pellets that are stable in water, correctly sized, and have the proper density and hardness (Sorensen, 2012; Tacon, 1987). This ensures that fish can consume the pellets before they break down or lose nutrients through leaching (Lovell, R. T., 1989). Fish do not eat particles and broken pellets when the feed is of low physical quality, which raises the feed conversion ratio (FCR) and causes waste to accumulate (Tacon & Metian, 2015).

Species, Size and Culture System

Nutritional needs of fish vary significantly by species, such as carps compared to salmonids, particularly in how they process proteins, fats, and carbohydrates (Smith, 1989; Phan et al., 2019). Consequently, these differences must guide both feed manufacturing and daily feeding regimes. Prepared pellets are usually used in semi-intensive pond conditions as an additional source of nutrients in addition to naturally available wild food (De Silva & Hasan, 2007). On the other hand, the fish in extremely intensive tank or cage operations almost entirely depend on manufactured, fully balanced meals (De Silva & Anderson, 1995; Tacon & Forster, 2003). Additionally, omnivorous and plant-eating species, such as carps, can survive on artificial diets that contain minimal or even no fish meal, while predatory species still require highly digestible protein and essential fatty acids from premium plant sources and animal ingredients (Naylor et al., 2009; Gatlin et al., 2007).

Feeding Management

The utilization of prepared feed is greatly impacted by handling, feeding rate, frequency, and technique (broadcasting, trays, demand feeders) (Halver & Hardy, 2002). Undernutrition impedes growth. However, overfeeding results in excess excretion and uneaten feed, which raises FCR, deteriorates water quality, and raises production costs (Boyd & Tucker, 1998).

Water Quality and Health

Fish consumption is directly impacted by poor water conditions (Boyd, 2015). Fish stop feeding when oxygen levels fall, ammonia levels rise, or temperatures deviate from ideal ranges because their hunger decreases and their capacity to digest food is compromised



(Wedemeyer, 1996). Poor management practices make things worse. When excess feed and waste accumulate, they increase the organic burden in the water. This creates a cycle of oxygen depletion, rising ammonia, and vulnerability to disease (Boyd & Tucker, 1998). Adding beneficial supplements to feed- like probiotics, organic acids, enzymes, and immunostimulants – supports better gut function, improves nutrient absorption, and strengthens the immune system. These benefits translate to better feed efficiency and higher survival rates (Merrifield et al.,2010; Ringo et al.,2018).

Current Situation

Andhra Pradesh has more than 2 million metric tons of aquafeed manufacturing capability per day, driven by its 1.8 million metric tons of aquaculture production. Due to coastal farming, the feed market for India's aquaculture industry, which is heavily influenced by the state, was valued at USD 3.47 billion in 2026 and is projected to increase at a 6.83% CAGR to USD 4.84 billion by 2031, with South India (led by Andhra Pradesh) leading the way. Shrimp feed has the fastest growth rate (9.86% CAGR), led by exports of USD 8.09 billion nationwide in 2024, while fish feed has a 53.78% market share for local carp and tilapia (Mordor Intelligence, 2026). Farmers are increasingly choosing pelleted and extruded (floating) feeds, which make up 62.75% of the market and enable better feed management through check trays and auto- feeders. In feed formulations, soybean meal (34.92% component), premium fishmeal, and beneficial additives like probiotics are typically prioritized. Profitable export farms can attain feed conversion ratios greater than 1.5:1, and most commercial diets have a protein percentage of 28-32%. Furthermore, the industry employs specialized feeds to fulfil certain life cycle requirements: starter formulas for hatcheries that show 10.35% growth, grower feeds that dominate at 50.78% share, and finisher feeds for final growth phases. Ongoing developments centre on fortified pellets designed specially to enhance the health of India's primary carp species.

Practical Feeding Practices in Shrimp Farming

Commercial shrimp farms typically employ sinking or slow- sinking pellets, numerous feedings per day, and feeding trays to monitor consumption and adjust ration, as observed in significant shrimp districts as part of better management practices that support the relatively high technical efficiency. Improved feed management and biosecurity are given top priority in ASC/SFP's landscape- level development activities in Andhra Pradesh because the shrimp business is predicted to grow dramatically by 2030 (MPEDA, 2026).

Feeding Practices and Management



Producers are using more regulated feeding techniques rather than just dispersing pellets or mash (De Silva & Anderson, 1995). Feeding trays are now used by shrimp farmers, bags suspended in ponds are used by those who rely on mash, and automated feeders have lately been used by several intensive businesses. These contemporary methods try to preserve excellent water quality while reducing feed waste. The precise life stage being farmed, the current water circumstances, and appropriate feed application stress matching ration quantities with total circumstance and approximate biomass are all covered by extension resources. They stress that in semi- intensive setups, natural pond productivity continues to be a major source of nutrition; consequently, prepared meals should supplement rather than completely replace this naturally occurring food source. Sustainable practices- improving feed conversion ratios, lowering nutrient pollution in water bodies, and optimizing feed ingredient utilization are receiving more attention as Andhra Pradesh must significantly expand its aquaculture area, especially for shrimp production, which could otherwise put additional strain on the environment (Tacon & Metian, 2008; Boyd et al., 2020).

Conclusion

Formulated feeds have become a key driver of modernization in Andhra Pradesh's aquaculture sector, replacing less efficient traditional feeding practices. Their ability to provide balanced nutrition has contributed to improved growth rates, better feed utilization, and enhanced economic returns for farmers. Combined with advances in feeding technologies and farm management, these feeds support healthier aquatic stocks and more efficient production systems. Looking ahead, continued innovation in feed development and sustainable feeding strategies will be crucial for meeting rising aquaculture demands while ensuring environmental and economic sustainability.

Reference

- Agbayani, R. F. (2002). Economics of feeding. In O. M. Millamena, R. M. Coloso, & F. P. Pascual (Eds.), *Nutrition in tropical aquaculture: Essentials of fish nutrition, feeds, and feeding of tropical aquatic species* (pp. 209–221). Aquaculture Department, Southeast Asian Fisheries Development Center
- Boyd, C. E. (2020). *Water quality: An introduction* (3rd ed.). Springer Nature.
- Boyd, C. E., & Tucker, C. S. (1998). Ecology of aquaculture ponds. In *Pond aquaculture water quality management* (pp. 8-86). Boston, MA: Springer US.
- Catacutan, M. R. (2002). Formulation of aquafeeds. In O. M. Millamena, R. M. Coloso, & F. P. Pascual (Eds.), *Nutrition in tropical aquaculture: Essentials of fish nutrition, feeds, and feeding of tropical aquatic species* (pp. 99–123). Aquaculture Department, Southeast Asian Fisheries Development Center.
- Dawood, M. A. O., & Koshio, S. (2016). Recent advances in the role of probiotics and prebiotics in carp aquaculture: A review. *Aquaculture*, 454, 243–251.
- De Silva, S. S., & Anderson, T. A. (1995). *Fish nutrition in aquaculture*. Chapman & Hall.



- De Silva, S. S., & Hasan, M. R. (2007). *Feeding strategies in freshwater finfish aquaculture in the Asia-Pacific region*. Food and Agriculture Organization of the United Nations.
- De Silva, S. S., & Anderson, T. A. (1994). *Fish nutrition in aquaculture* (Vol. 1). Springer Science & Business Media.
- Gatlin, D. M., Barrows, F. T., Brown, P., Dabrowski, K., Gaylord, T. G., Hardy, R. W., Herman, E., Hu, G., Krogh, A., Nelson, R., Overturf, K., Rust, M., Sealey, W., Skonberg, D., Souza, E. J., Stone, D., Wilson, R., & Wurtele, E. (2007). Expanding the utilization of sustainable plant products in aquafeeds: A review. *Aquaculture Research*, 38(6), 551–579.
- Giri, S. S. (2024). Sustainable aquaculture practices in South Asia: A comparative analysis of feed formulation and utilization. *Animal Frontiers*, 14(4), 6–16.
- Halver, J. E., & Hardy, R. W. (Eds.). (2002). *Fish nutrition* (3rd ed.).
- Hardy, R. W., & Barrows, F. T. (2002). *Diet formulation and manufacture*. In J. E. Halver & R. W. Hardy (Eds.), *Fish nutrition* (3rd ed., pp. 505–600).
- ICAR-Central Institute of Brackishwater Aquaculture (CIBA). 2017. *Best Management Practices (BMPs) for Shrimp Farming*. ICAR-CIBA, Chennai, India.
- Lall, S. P., & Dumas, A. (2015). Nutritional requirements of cultured fish. In *Feed and feeding practices in aquaculture* (pp. 53–109).
- Lovell, R. T. (1989). *Nutrition and feeding of fish*. Van Nostrand Reinhold.
- Marine Products Export Development Authority. (2023). *Yearbook of Indian marine products exports 2022–23*. MPEDA.
- Marine Products Export Development Authority. (2025). *Marine products export performance of India*.
- Merrifield, D. L., Dimitroglou, A., Foey, A., Davies, S. J., Baker, R. T. M., Børgwald, J., Castex, M., & Ringø, E. (2010). The current status and future focus of probiotic and prebiotic applications for salmonids. *Aquaculture*, 302(1–2), 1–18.
- Naylor, R. L., Hardy, R. W., Bureau, D. P., Chiu, A., Elliott, M., Farrell, A. P., Forster, I., Gatlin, D. M., Goldberg, R. J., Hua, K., & Nichols, P. D. (2009). Feeding aquaculture in an era of finite resources. *Proceedings of the National Academy of Sciences*, 106(36), 15103–15110.
- Phan, L. T. T., Groot, R., Konnert, G. D. P., Masagounder, K., Figueiredo-Silva, A. C., Glencross, B. D., & Schrama, J. W. (2019). Differences in energy utilisation efficiencies of digestible macronutrients in common carp (*Cyprinus carpio*) and barramundi (*Lates calcarifer*). *Aquaculture*, 511, 734238.
- Reis, L. M., Reutebuch, E. M., & Lovell, R. T. (1989). Protein-to-energy ratios in production diets and growth, feed conversion and body composition of channel catfish, *Ictalurus punctatus*. *Aquaculture*, 77(1), 21-27.
- Ringø, E., Olsen, R. E., Gifstad, T. Ø., Dalmo, R. A., Amlund, H., Hemre, G. I., & Bakke, A. M. (2010). Prebiotics in aquaculture: a review. *Aquaculture nutrition*, 16(2), 117-136.
- Smith, R. R. (1989). Nutritional bioenergetics in fish. In J. E. Halver (Ed.), *Fish nutrition* (2nd ed.).
- Tacon, A. G. J. (1987). *The nutrition and feeding of farmed fish and shrimp: A training manual* (Vol. 1). Food and Agriculture Organization of the United Nations.
- Tacon, A. G. J., & Forster, I. P. (2003). Aquafeeds and the environment: Policy implications. *Aquaculture*, 226(1–4), 181–189.
- Tacon, A. G. J., & Metian, M. (2008). Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: Trends and prospects. *Aquaculture*, 285(1–4), 146–158.
- Tacon, A. G. J., & Metian, M. (2015). Feed matters: Satisfying the feed demand of aquaculture. *Reviews in Fisheries Science & Aquaculture*, 23(1), 1–10.



- Tacon, A. G. J., Metian, M., & Hasan, M. R. (2009). *Feed ingredients and fertilizers for farmed aquatic animals: Sources and composition*. Food and Agriculture Organization of the United Nations.
- Tacon, A. G., & Metian, M. (2015). Feed matters: satisfying the feed demand of aquaculture. *Reviews in Fisheries Science & Aquaculture*, 23(1), 1-10.
- Times of India. (2024, June 23). *Big fish: With 41% share, Andhra tops in fishing and aquaculture*. Times of India.
- Turchini, G. M., Trushenski, J. T., & Glencross, B. D. (2019). Thoughts for the future of aquaculture nutrition: Realigning perspectives to reflect contemporary issues related to judicious use of marine resources in aquafeeds. *North American Journal of Aquaculture*, 81(1), 13–39.
- Wedemeyer, G. A. (1996). *Physiology of fish in intensive culture systems*. Chapman & Hall.

