*Original Research Article*

Ornamental Fish Diversity and Scope for its Development in Andhra Pradesh

.

Abstract

|  |
| --- |
| Andhra Pradesh is endowed with wealth of water resources including rivers, canals, reservoirs, ponds and tanks, two large estuarine systems (Godavari and Krishna), backwaters near Kakinada and Visakhapatnam. These water bodies are home to a rich biodiversity of ichthyofauna. Among, these natural resources the diverse and unique group of fishes are found those having economic importance to aquarium sector. Keeping ornamental fishes as a hobby is gaining popularity in the world, hence this sector assumed significant importance in fisheries. The Pradhan Mantri Matsya Sampada Yojana (PMMSY) was launched in India in the year 2020-21 and implemented for a period of five years, till 2024-25, which has enhanced the ornamental fish production and trade. With the presence of indigenous fishes and suitable environment for seed production of these ornamental fishes few coastal states such as West Bengal, Tamil Nadu, Maharashtra, Karnataka and from the North-Eastern states are contributing this sector in our country. The entrepreneurs in the state are highly focused on production of food fish activities from both the culture and capture, this might be the reason that ornamental fish sector has received less attention. Currently, the demand of aquarium fishes in the state are largely fulfilled by the importing the fishes from other states. Approximately 175 numbers of ornamental fish aquarium shops are mainly trading exotic varieties of fishes in the state. With the growing demand for aquarium fishes in domestic and international market, by promoting this sector with the setting up of breeding and rearing units in the state may create employment and livelihoods especially in rural and semi-rural areas. Considering the importance of this sector and presence of favorable environmental conditions for breeding and rearing of ornamental fishes, the sector has ample scope for the development in the state of Andhra Pradesh.  |

*Keywords: ornamental fish, diversity, scope, development, Andhra Pradesh*

1. INTRODUCTION

Human being have been keeping fish in captivity since prehistoric times, as Egyptians did for food and enjoyment (Butler, 2015; El-Sayed, 2013); Romans kept fishes in specially built ponds (Balon, 2004); Mesopotamian civilizations (Sumer, Assyria and Babylon) also created fish ponds (Nash, 2011); Gold fish were kept in captivity in China (Chen et al 2020); methods for fattening fish in ponds in India (Nash, 2011; Rogers, 2024). Keeping ornamental fish is an enjoyable hobby that has become second in the world next to photography (Swain et al., 2017). Ornamental fish is defined as attractive colourful fish of peaceful nature that are kept in an aquariums or garden pool with the purpose of enjoying their beauty for fun and fancy (Dey, 1996; Roy et al., 2015). Ornamental fishes are usually kept in glass aquariums and hence popularly known as ‘’Aquarium Fishes’’ (Swain et al., 2008). India possesses rich resources, viz., rivers, streams, the lagoons and coral reefs that are abound with highly attractive and varied species of ornamental fishes (Nasser et al., 2001; Pandey and Mandal, 2017; Ghatge, et al., 2013). Indian waters possess a rich diversity of ornamental fish, with over 195 indigenous varieties reported from the NE region and Western Ghats, and nearly 400 species from marine ecosystems. The major fish exported from India are of wild varieties collected from rivers of the North-east and Southern States that contribute about 85% to the total export of all types of ornamental fish from the country (Swain et al., 2008; DoF, 2017; Pandey and Mandal, 2017).

Andhra Pradesh state is located in peninsular India and blessed with enormous water resources comprising rivers, canals, tanks and ponds, reservoirs and brackishwater (Khan, 2024). It is a riverine state with total 40 major, medium and minor rivers flowing through the state while Godavari, Krishna, Vamsadhara, Nagavali and Pennar are major interstate rivers in Andhra Pradesh (Prasuna, et al., 2018). The state is contributing about 38.93% (51.06 lakh ton) fish production of a total 131.13 lakh tons fish production from the inland sector and 15.13% (5.64 lakh ton) of fish production from marine waters in India during 2022-23. There are a total 116 reservoirs from which 26 are major & medium and 90 are small reservoirs covering water spread area of 1.31 lakh ha and 0.35 lakh ha respectively (DoF, 2023). These water bodies conserve a rich variety of fish species, including food fishes and ornamental fishes (Rao et al., 2013 & 2014; Sanapala et al., 2021; Chatla and Padmavathi, 2021). Considering the importance of ornamental fish sector, the present investigation deals with the presence of ornamental fish fauna, current ornamental fish trade and scope for development in the state of Andhra Pradesh.

2. material and methods

The present investigation is based on the primary and secondary data associated with water resources, ornamental fish diversity, ornamental fish trade and other related information collected from annual reports, scientific publications and other related published literature by the scientific community, policy makers, various Andhra Pradesh State Departments, different Central Governmental Agencies. The collected data were analyzed, interpreted and summarized with the help of SPSS 16.0 statistical tools and presented in tabular and pie diagram form.

3. results and discussion

**3.1 Ornamental Fish Diversity in Andhra Pradesh**

Due to the presence of vast water resources in the state of Andhra Pradesh, the state is also rich in ornamental fish diversity, like other blessed parts of Indian waters (Kumar et al., 2015; Chatla and Padmavathi, 2021). The ornamental fishes reported in Andhra Pradesh mainly belong to order (Fig. 1), the composition of families, genera and species of ornamental fish under various orders (Table 1) and ornamental fish species was reported by Nasser and Rajkumar, 2001; Prasad et al., 2012; Rao et al., 2013 & 2014; Raju el al., 2014; Kumar et al., 2015; Ramaneswari and Sridhar, 2015; Sanapala et al., 2021; Chatla and Padmavathi, 2021; Ray et al., 2022.

 

**Fig. 1. Ornamental fishes belong to order in the state of Andhra Pradesh**

**Table 1. The composition of families, genera and species of ornamental fish under various orders**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Order | Families | Genus | Species | % of species in an order |
| Cypriniformies | 4 | 25 | 47 | 40.17 |
| Beloniformes | 3 | 3 | 3 | 2.56 |
| Cyprinodontiformes | 1 | 1 | 2 | 1.71 |
| Osteoglossiformes | 1 | 1 | 1 | 0.85 |
| Perciformes | 4 | 6 | 6 | 5.13 |
| Centrarchiformes | 1 | 1 | 1 | 0.85 |
| Anabantiformes | 5 | 6 | 12 | 10.26 |
| Cichliformes  | 1 | 1 | 3 | 2.56 |
| Siluriformes | 6 | 9 | 19 | 16.24 |
| Synbranchiformes | 1 | 2 | 4 | 3.42 |
| Gobiiformes  | 1 | 3 | 3 | 2.56 |
| Anguilliformes | 2 | 2 | 2 | 1.71 |
| Tetraodontiformes  | 3 | 4 | 4 | 3.42 |
| Acanthuriformes | 4 | 5 | 7 | 5.98 |
| Mulliformes | 1 | 1 | 2 | 1.71 |
| Syngnathiformes | 1 | 1 | 1 | 0.85 |
| Total | 39 | 70 | 117 | 100 |

**3.2 Conservation of Indigenous ornamental fish species**

Indigenous ornamental fish species, which are native to the region’s freshwater ecosystems, have significant ecological, cultural, and commercial value (Swain, et al., 2008; Pandey and Mandal, 2017; Sarkar et al., 2024). Many of these species are sought after in the ornamental fish trade for their beauty, which has led to over-exploitation and a decline in their populations in some areas (Swain et al, 2008; Rao, et al., 2013; Pandey and Mandal, 2017). According to the IUCN Red List of Threatened species (Table 2), 1.71% (2) are vulnerable, 0.85% (1) critically endangered, 4.27% (5) species are near threatened, 1.71% (2) endangered, 5.13% (6) are not evaluated, 82.91% (97) least concern, and for 3.42% (4) species data is deficient (Nasser and Rajkumar, 2001; Prasad et al., 2012; Rao et al., 2013 & 2014; Raju el al., 2014; Kumar et al., 2015; Ramaneswari and Sridhar, 2015; Sanapala et al., 2021; Chatla and Padmavathi, 2021).

**Table 2. List of ornamental fishes reported in Andhra Pradesh**

|  |  |  |  |
| --- | --- | --- | --- |
| Scientific name | Common name | Habitat | IUCN Status |
| *Pethia conchonius* | Rosy barb | FW | LC |
| *Pethia guganio* | Glass Barb | FW | LC |
| *Puntius gelius*  | Golden dwarf barb | FW | LC |
| *Puntius chola*  | Swamp barb | FW | LC |
| *Puntius ticto*  | Two spot / Fire fin barb | FW, BW | LC |
| *Puntius parrah* | Parrah barb | FW | LC |
| *Puntius vittatus*  | Green Stripe Barb | FW, BW | LC |
| *Puntius amphibius* | Scarlet-banded barb | FW, BW | DD |
| *Puntius sophore*  | Spot fin swamp barb | FW, BW | LC |
| *Puntius terio*  | One spot barb | FW | LC |
| *Puntius dorsalis* | Long snouted barb | FW | LC |
| *Systomus* *sarana* | Olive barb | FW, BW | LC |
| *Salmostoma bacaila* | Large razorbelly minnow | FW, BW | LC |
| *Salmostoma phulo* | Finescale razorbelly minnow | FW | LC |
| *Labeo boga*  | Boga labeo | FW | LC |
| *Labeo angra*  | Angra labeo | FW | LC |
| *Devario devario*  | Bengal Danio | FW | LC |
| *Danio rerio* | Zebra danio | FW | LC |
| *Chela cachius*  | Silver hatchet chela | FW, BW | LC |
| *Chela laubuca*  | Indian glass barb | FW, BW | LC |
| *Esomus danricus*  | Flying barb | FW, BW | LC |
| *Esomus barbatus* | South Indian Flying barb | FW | LC |
| *Rasbora daniconius*  | Black line rasbora | FW, BW | NE |
| *Osteobrama cotio*  | Cotio | FW | NE |
| *Amblypharyngodon microlepis* | Indian carplet | FW | LC |
| *Garra gotyla*  | Sucker head | FW | LC |
| *Garra mullya* | Sucker fish | FW | LC |
| *Garra mcclellandi* | Cauvery garra | FW | LC |
| *Crossocheilis latius*  | Stone roller | FW, BW | LC |
| *Barilius bakeri* | Malabar baril | FW | LC |
| *Barilius barila*  | Barred Barila | FW | LC |
| *Barilius bendelisis*  | Hamilton's Barila | FW | LC |
| *Tor tor*  | Tor barb/Tor mahseer | FW | DD |
| *Lepidocephalichthys guntea* | Guntea loach | FW, BW | LC |
| *Lepidocephalichthys thermalis* | Common spiny loach | FW | LC |
| *Lepidocephalichthys berdmorei* | Burmese loach | FW | LC |
| *Acanthocobitis botia*  | Mottled loach | FW | LC |
| *Acanthocobitis mooreh* | Maharashtra Zipper loach | FW | LC |
| *Indoreonectes evezardi* | Hill stream loach | FW | LC |
| *Nemacheilus anguilla* | Black lined loach | FW | LC |
| *Nemacheilus corica* | Stone Loach | FW | LC |
| *Schistura denisoni* |  | FW | LC |
| *Oreichthys cosuatis* | Indian Hi-fin barb | FW | LC |
| *Dawkinsia filamentosa* | Blackspot barb | FW, BW | LC |
| *Hypselobarbus curmuca* | Curmuca barb | FW | EN |
| *Hypselobarbus jerdoni* | Jerdon's carp | FW | LC |
| *Haludaria melanampyx* |  | FW | DD |
| *Xenentodon cancila* | Freshwater garfish | FW, BW | LC |
| *Hyporamphus limbatus* | Congaturi halfbeak | FW, BW, MW | LC |
| *Oryzias dancena* | Indian rice fish | FW, BW | LC |
| *Aplocheilus panchax* | Blue Panchax | FW, BW | LC |
| *Aplocheilus lineatus* | Striped panchax | FW, BW | LC |
| *Notopterus notopterus* | Bronze featherback  | FW, BW | LC |
| *Chanda nama* | Elongate glass-perchlet | FW, BW | LC |
| *Parambassis ranga* | Indian glassy fish | FW, BW | LC |
| *Ambassis nalua* | Scalloped perchlet | MW, BW, FW | LC |
| *Terapon jarbua* | Jarbua terapon | MW, BW, FW | LC |
| *Scatophagus argus* | Spotted scat | MW, BW, FW | LC |
| *Nandus nandus* | Gangetic leaffish | FW, BW | LC |
| *Badis badis* | Badis | FW | LC |
| *Etroplus suratensis* | Pearlspot | BW | LC |
| *Etroplus canarensis* | Canara pearlspot | FW | EN |
| *Etroplus maculatus* | Orange chromide | FW, BW | LC |
| *Mystus bleekeri* | Day's mystus | FW | LC |
| *Mystus tengara* | Tengara catfish | FW | LC |
| *Mystus cavasius* | Gangetic mystus | FW, BW | LC |
| *Mystus armatus* | Kerala mystus | FW, BW | LC |
| *Mystus gulio* | Long whiskers catfish | FW, BW | LC |
| *Mystus vittatus* | Striped dwarf catfish | FW, BW | LC |
| *Mystus malabaricus* | Jerdon's catfish | FW, BW | NT |
| *Mystus montanus* | Wynaad mystus | FW, BW | LC |
| *Hemibagrus menoda* | Menoda catfish | FW | LC |
| *Hemibagrus punctatus* | Nilgiri mystus | FW | CR |
| *Sperata aor* | Long-whiskered catfish | FW | LC |
| *Ompok bimaculatus* | Butter catfish | FW, BW | NT |
| *Ompok pabda* | Pabdah catfish | FW | NT |
| *Ompok pabo* | Pabo catfish | FW | NT |
| *Clarias batrachus* | Walking catfish/Magur | FW, BW | LC |
| *Heteropneustes fossilis* | Stinging catfish | FW, BW | LC |
| *Pseudeutropius atherinoides* | Indian potasi | FW, BW | LC |
| *Eutropiichthys vacha* | Batchwa vacha | FW, BW | LC |
| *Pangasius pangasius* | Pangas catfish | FW, BW | LC |
| *Macrognathus aral* | One-stripe spinyeel | FW, BW | LC |
| *Macrognathus pancalus* | Barred spiny eel | FW, BW | LC |
| *Mastacembelus armatus* | Zig-zag eel | FW, BW | LC |
| *Macrognathus aculates* | Lesser spiny eel | FW, BW | LC |
| *Trichogaster* *fasciata* | Banded gourami | FW | LC |
| *Trichogaster* *labiosa* | Thick lipped gourami | FW | LC |
| *Trichogaster lalius* | Dwarf gourami | FW | LC |
| *Pseudosphromenus**Cupanus* | Spiketail paradisefish | FW, BW | LC |
| *Channa gachua* | Dwarf snakehead | FW | LC |
| *Channa punctatus* | Spotted snakehead | FW, BW | LC |
| *Channa striatus* | Striped snakehead | FW, BW | LC |
| *Channa orienalis* | Walking snakehead | FW, BW | VU |
| *Channa marulius* | Great snakehead | FW | LC |
| *Glossogobius guiris* | Tank/Bar-eyed goby | FW, BW | LC |
| *Stigmatogobius sadanundio* | Knight Goby | FW, BW | NE |
| *Gobiopsis macrostoma* | Longjaw goby | MW, BW, FW | LC |
| *Anabas cobojius* | Gangetic koi | FW | DD |
| *Moringua raitaborua* | Purple spaghetti-eel | FW, BW | NE |
| *Anguilla bicolor* | Indonesian shortfin eel | MW, BW, FW | NT |
| *Leiodon cutcutia* | Ocellated pufferfish | FW, BW | LC |
| *Arothron immaculatus* | Immaculate puffer | MW, BW | LC |
| *Chaetodon vagabundus* | Vagabond butterflyfish | MW | LC |
| *Chaetodon auriga* | Threadfin butterflyfish | MW | LC |
| *Chaetodon ineolatus* | Lined butterflyfish | MW | LC |
| *Heniochus acuminatus* | Pennant coralfish | MW, BW | LC |
| *Pomacanthus annularis* | Bluering angelfish | MW | LC |
| *Pterios volitans* | Red lionfish | MW | LC |
| *Abudefduf sexfasciatus* | Scissortail sergeant | MW | LC |
| *Acanthurus nigricauda* | Epaulette surgeonfish | MW, BW | LC |
| *Balistapus undulatus* | Orange-lined triggerfish | MW | NE |
| *Lactoria cornuta* | Longhorn cowfish | MW, BW | NE |
| *Upeneus sulphureus* | Sulphur goatfish | MW, BW | LC |
| *Upeneus tragula* | Freckled goatfish | MW, BW | LC |
| *Hippocampus kuda* | Spotted seahorse | MW, BW | VU |

\* EN – Endangered; CR- Critically Endangered; VU – Vulnerable; LC – Least Concern, DD – Data deficient; NE – Not evaluated, NT- near threatened

(Nasser and Rajkumar, 2001; Prasad et al., 2012; Rao et al., 2013 & 2014; Raju el al., 2014; Kumar et al., 2015; Ramaneswari and Sridhar, 2015; Sanapala et al., 2021; Chatla and Padmavathi, 2021; Ray et al., 2022)

Hence, it high times to make the sustainable conservation efforts and strategies viz., establishing protected areas, such as fish sanctuaries, along key rivers and lakes in Andhra Pradesh can help safeguard the habitats of indigenous ornamental fish, community-based conservation programs that focus on education and awareness can promote responsible harvesting and breeding of ornamental fish, promotion of eco-friendly farming practices in ornamental fish culture can reduce the pressure on wild populations, establishing captive breeding programs for endangered indigenous ornamental fish species can reduce the pressure on wild populations and ensure their availability for trade, successful breeding programs can be set up in collaboration with aquaculture farms, research institutions, and NGOs, documenting the various ornamental fish species in Andhra Pradesh and their current population status can help in prioritizing conservation efforts for the most threatened species, awareness campaigns targeting local communities, public and ornamental fish traders can encourage responsible purchasing and breeding practices, as well as the importance of conserving indigenous species (Sarkar et al., 2024; Swain et al., 2008; Pandey and Mandal, 2017; Raju et al., 2014; Nasser and Rajkumar, 2001; Ray et al., 2022; Parappurathu, et al., 2021).

**3.3 Breeding technology of Indigenous ornamental fishes by ICAR-CIFA**

ICAR-Central Institute of Freshwater Aquaculture (ICAR-CIFA) is playing a pivotal role in ensuring that aquarium keeping of ornamental fish as a hobby becomes much more popular and contributes more in entrepreneurial development. ICAR-CIFA is a premier research Institute in freshwater aquaculture in India under the administrative control of Indian Council of Agricultural Research (ICAR), New Delhi. Special efforts are being made to breed some of the indigenous varieties in captive condition. Success in breeding and larval rearing has been achieved in more than 17 indigenous species which include gourami, barbs, rasbora, danio etc. Recent developments include broodstock development and captive breeding of Filament barb (*Dawkinsia filamentosa*), Tambraparni Barb (*Dawkinsia tambraparniei*), Narayan barb (*Pethia narayani*), honey gourami (*Trichogaster chuna*), Moustached danio (*Danio dangila*) and also captive breeding of indigenous ornamental murrel fish from North Eastern region, *Channa stewartii*. The technology of commercial breeding of many ornamental fish species will contribute in a major way by reducing exploitation of natural stock, thereby helping in conserving precious biodiversity. The commercialization of the technology offers a huge potential in economic development of the people involved in production, trade and marketing of ornamental fishes. To add further achievement, a new variety of Rosy barb (*Pethia conchonius*) has been developed through selection and named it as Shining barb whose market value is better than the normal rosy barb. To control the bacterial and fungal disease a medicine has been developed and commercialized as CIFACURE. Every year selected farmers are trained on recent techniques in ornamental aquaculture for upgrading their farming practices. Recently ICAR-CIFA has established ornamental field school at Jalpaigudi (West Bengal), Cuttak (Odisha) and Madurai (Tamilnadu) where nominated and trained progressive farmer of ICAR-CIFA helps other farmers who are interested in ornamental fish farming by providing them training and initial input at reasonable price. The institution presently joined hands with seven sister institutes under one platform for Network Project on Ornamental Fish Breeding and Culture by emphasizing breeding and larval rearing of indigenous fishes. Also, ICAR-CIFA has contributed in improving the database of ornamental fish trade with the Department of Fisheries, Ministry of Agriculture and Farmers Welfare (Swain, et al., 2008 & 2020).

**3.4 Status of ornamental fish trends in Andhra Pradesh**

Most of the aquarium fish shops are located in major cities of the state like Visakhapatnam, Vijayawada, Guntur, Nellore and Rajamahendravaram. There are around 175 ornamental fish shops in the state, most of these shops are also selling ornamental fishes as well as pets like dogs, cats, rats, rabbits, etc. and some species of birds. Apart from ornamental fish, these shops also sell aquariums of different sizes, aquarium decorative and maintenance accessories like aquarium roofs, stands/cupboard, different types of lighting equipment’s, air pumps, heaters, thermometers, gravel/pebbles/stones, plants (live aquatic plants and plastic plants), maintenance items like algae scrubbers, siphon pipes, fish nets, water testing kits, buckets, water treatment chemicals, etc. These shops are mainly dealing in exotic fishes like goldfish, guppies, mollies, tiger sharks, rainbow sharks, etc. and a small number of indigenous fishes like rosy barb, danio, etc. Almost all the aquarium shop owners are buying ornamental fishes and accessories mainly from Chennai, Kolkata and Mumbai and selling them in the state (Swain, et al 2020; Thriveni, et al., 2020; Chaudhari, et al., 2023; Parappurathu et al., 2021; DoF, 2020).

The state of Andhra Pradesh has an abundance of natural resources like suitable climate, natural rivers and traditional experience in fish farming, which allows the farmers of the state to easily take up aquarium fish farming. At present, ornamental fish farming in the state exists on a small scale in limited districts; hence, ornamental fish traders are largely dependent on outside the state. Considering the importance of this newly emerging sector, many farmers are involved in the aquarium fish business and aquarium fish business has become very popular in major and emerging cities of the states (DF, 2020; Swain, et al., 2017).

**3.5 Prospects and opportunities for the development of ornamental fish sector**

Earlier, only high-income families used to keep ornamental fish in their homes, but now the trend is changing; middle and low-income families also keep aquariums in their homes as a status symbol or to improve the interior appearance of the house or as a hobby. Moreover, now aquariums are kept in high quality diagnostic centers, some educational institutions, shopping centers, cinema halls, seminar and conference halls etc. Therefore, there are great opportunities in the ornamental fish business. Following are some steps that should be emphasized at the state level to develop the ornamental fish sector (Swain, et al., 2008; DoF, 2020; Swain, et al., 2017; Swain, et al 2020; Thriveni, et al., 2020; Dey, 1996; Nasser and Rajkumar, 2001; Pandey and Mandal, 2017; Parappurathu et al., 2021).

1. To popularize ornamental fish, public aquariums should be developed in every district town and every major metropolitan city of the state for the public, students, entrepreneurs and hobbyists. Exhibitions of ornamental fish can also be organized at various places in the state which will increase the state demand for ornamental fish.

2. Set up ornamental fish hatcheries in the state and produce commercially important ornamental fish.

3. Develop skilled manpower in ornamental fish care, breeding and farming practices through training, demonstrations and workshops with the help of research institutes, universities, fisheries colleges, Krishi Vigyan Kendra’s and the State fisheries department.

4. Based on community centered group farming on freshwater ornamental fish in Howrah, 24 Parganas and Kharagpur in West Bengal; in Andhra Pradesh state also some unemployed youth of the village, low-income groups and rural women can also be trained. Ornamental fish farming can be done in the backyard of the house which will help in producing large quantity through group farming. These villages can also be identified as ornamental fish village in the states, so that they can also sell their fish in the domestic market through public-private partnership mode.

5. Various schemes are available under Pradhan Mantri Matsya Sampada Yojana, under which unemployed youth, low-income group and rural women can take advantage of these schemes by forming self-help groups.

6. The cognizant can play an important role by providing all kinds of services, for example technical and inputs to the producers through the establishment of symbolic field school at village level. In this regard, ICAR-Central Institute Freshwater Aquaculture, Bhubaneswar, Odisha is providing all kinds of support.

7. For the establishment of ornamental fish breeding, seed production and culture units the NFDB, NABARD, MPEDA, State Fisheries Departments are providing the financial support and the technical assistance provided by ICAR Fisheries Institutes and Fisheries Colleges.

4. Conclusion

Andhra Pradesh demonstrates a rich and diverse ornamental fish biodiversity that presents considerable potential for both local and export markets. However, despite this natural abundance, the sector remains underdeveloped with untapped opportunities for growth in breeding, trade, and export. To capitalize on this potential, it is essential to focus on sustainable captive breeding practices of different potential indigenous fish species, High value commercial ornamental fish species, enhanced research on species adaptation, and the development of proper infrastructure for the industry. Additionally, increasing awareness about the ornamental fish trade, improving skills in fish farming, and establishing regulations for quality control will play crucial roles in ensuring long-term growth. With concerted efforts from the government, industry stakeholders, and research institutions like ICAR-CIFA, ICAR-NBFGR, ICAR-CIFE and ICAR-CIFRI dealing with freshwater captive breeding technologies, the ornamental fish sector in Andhra Pradesh can only contribute significantly in the ornamental fish production and trade. Thus, the future of ornamental fish development in Andhra Pradesh holds immense promise, and with the right investment and policy support, it can flourish into a major industry.

References

Balon, E. K., 2004. About the oldest domesticates among fishes. *Journal of Fish Biology*. 65 (Supplement A): 1–27. <https://doi.org/10.1111/j.0022-1112.2004.00563.x>

Chatla, D., and Padmavathi, P., 2021. Fish Diversity of Coastal Andhra Pradesh, Southeast Coast of India. *Advances in Animal and Veterinary Sciences*. 9(9): 1424-1436.

Chaudhari, A.K., Ail, S.K.S, Misra, C.K., De, H.K., Rathod, R., Bhatt, J. H. and Swain, S.K., 2023. Status of Freshwater Aquaculture in Gujarat: A Trend Analysis and Potential. *International Journal of Bio-resource and Stress Management*. 14(1): 059-067.

Chen, D., Zhang, Q., Tang, W., Huang, Z., Wang, G., Wang, Y., Shi, J., Xu, H., Lin, L., Li, Z., Chi, W., Huang, L., Xia, J., Zhang, X., Guo, L., Wang, Y., Ma, P., Tang, J., Zhou, G., Liu, M., Liu, F., Hua, X., Wang, B., Shen, Q., Jiang, Q., Lin, J., Chen, X., Wang, H., Dou, M., Liu, L., Pan, H., Qi, Y., Wu, B., Fang, J., Zhou, Y., Cen, W., He, W., Zang, Q., Xue, T., Lin, G., Zang, W., Liu, Z., Qu, L., Wang, A., Ye, Q., Chen, J., Zhang, Y., Ming, R., Montagu, M.V., Tang, H., Van de Peer, Y., Chen, Y. and Zhang, J., 2020. The evolutionary origin and domestication history of goldfish (*Carassius auratus*). *Proceedings of the National Academy of Sciences*. 117(47):29775-29785. <https://doi.org/10.1073/pnas.2005545117>

Department of Fisheries, 2020. Compendium on Ornamental Fishes. Department of Fisheries, Government of Andhra Pradesh.

Department of Fisheries, 2017. Mission Ornamental Fisheries, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture & Farmers Welfare Fisheries, Government of India.

Department of Fisheries, 2023. Handbook on Fisheries Statistics. Department of Fisheries, Government of India.

Dey, V.K., 1996. Ornamental fishes and Handbook of Aqua farming. The Marine Products Export Development Authority, Cochin.

El-Sayed, A., 2013. On-farm feed management practices for Nile tilapia (*Oreochromis niloticus*) in Egypt. In Hasan, M. R., and New, M. B. (eds.), On-farm Feeding and Feed Management in Aquaculture, FAO Fisheries and Aquaculture Technical Paper No. 583, Rome, pp. 101–129.

Ghatge, S.S., Shelke, S.T., Jadhav, S.S., Pawar, N.A. and Chaudhari, A.K., 2013. Inventory of endemic freshwater fish fauna of Maharashtra state, India. *Records of Zoological Survey of India*. 113:79-92.

Khan, M., 2024. Andhra Pradesh: The Territories and States of India (4th ed.). Routledge. London <https://doi.org/10.4324/9781003476900>

Kumar, V. H., Krishna, P.V. and Rao, K.M., 2015. Fish faunal Diversity and Conservation Status of River Krishna at Vijayawada Region, Andhra Pradesh, India. *International Journal of Advanced Research*. 3(8):1040 – 1045.

Nasser, A. K. V. and Rajkumar, U., 2001. Ornamental Fish - Prospects for Culture. Souvenir, Visakhapatnam Regional Centre of CMFRl. 24-26.

Nash, C. E., 2011. The History of Aquaculture, Wiley-Blackwell, Ames, IA. Page 15-16.

Parappurathu, S., Baiju, K. K. and Vijayagopal, P., 2021. Status and prospects of ornamental fish and fish feed industry in Southern India. ICAR-CMFRI Marine Fisheries Information Service Technical & Extension Series No. 248: 7-11.

Pandey, P. and Mandal, S., 2017. Present status, challenges and scope of ornamental fish trade in India. In Conference: Aqua Aquaria India, At Mangalore. Pp. 1-10.

Prasad, K.S.K., Ramulu, K. N, and Benarjee, G., 2012. Icthyofauna Diversity and Its Abundance in East Godavari District, Andhra Pradesh. *Nature Environment and Pollution Technology*. 11(4): 675-679.

Prasuna, V., Suneetha, B, Madhavi. K, Haritha, G.S. and Ramakrishna Murthy, G.R., 2018. Irrigation status, issues and management in Andhra Pradesh. *Journal of Pharmacognosy and Phytochemistry*. SP1: 304-309.

Rao, J.C.S., Simhachalam, G. and Raju, C. S., 2013. Ornamental Fish Diversity of Lake Kolleru, the only Ramsar site in Andhra Pradesh, India. *Bulletin of Environment, Pharmacology and Life Sciences*. 2 (7):48- 55.

Rao, J.C.S., Simhachalam, G. and Raju, C. S., 2014. A study on Ichthyofaunal diversity, conservation status and anthropogenic stress of river Champavathi, Vijayanagaram District (AP) India. *Asian Journal of Experimental Biological Science*. 4(3):418-425.

 Rao, R.K., 2018. Ichthyo faunal diversity in the Kalinga Dal reservoir at foot hills of Mahendragiri, Mandasa Mandal, Andhra Pradesh State: India. *International Journal of Fauna and Biological Studies*. 5(2): 89-96.

Rao, K. R. and Rao, R. R., 2021. Ichthyofaunal Diversity of Narayanapuram Anicut at Nagavali River, Srikakulam District of Andhra Pradesh, India. *Uttar Pradesh Journal of Zoology*. 42(19): 24-35.

Raju, C. S., Rao, J.C.S. and Simhachalam, G., 2014. Biodiversity and Conservation status of Ichthyofauna of Lake Kolleru, Andhra Pradesh, India. *International Journal of Scientific Research*. 3(5): 2277-8179.

Ramaneswari, K. and Sridhar, D., 2015. A Typical Study on Fish Faunal Biodiversity of Thotapalli and Gotta Reservoirs of Vizianagaram and Srikakulam Districts of Andhra Pradesh, India. *International Journal of Recent Scientific Research*. 6(4):3529-3533.

Ray, P., Malla, G., Johnson, J.A. and Sivakumar, K., 2022. An overview of the fish diversity and their threats in the Gowthami-Godavari Estuary in Andhra Pradesh, India. Journal of Threatened Taxa. 14(8):21588–21604. <https://doi.org/10.11609/jott.7842.14.8.21588-21604>

Rogers, A.J., 2024. Aquaculture in the Ancient World: Ecosystem Engineering, Domesticated Landscapes, and the First Blue Revolution. *Journal of Archaeological Research*. 32:427–491 <https://doi.org/10.1007/s10814-023-09191-1>

Roy, S.D., Panigrahi, A.K., and Mandal, A., 2015. Studies on the Socio-Economic Condition of Fishermen Community of Ornamental Fish Culture of West Bengal. *Indian Journal of Biology*. 2(1):5-12. DOI: <https://dx.doi.org/10.21088/ijb.2394.1391.2115.1>

Sanapala, C., Pedda, L. C., Babu, K., Paidi, S. and Kanti, P. K., 2022. The study on fish diversity of Madduvalasa reservoir Srikakulam district, Andhra Pradesh, India. *International Journal of Fisheries and Aquatic Studies*. 10(2): 122-124. DOI: 10.22271/fish.2022.v10.i2b.2653

Sarkar, U.K., Chandran, R., Teena Jayakumar, T.K., Ravi, C., 2024. In Situ Conservation: Tools, Strategies, and Challenges. In: Sarkar, U.K., Kumar, T.T.A., Sood, N., Singh, R.K., Kumar, R., Tyagi, L.K. (eds) Sustainable Management of Fish Genetic Resources. Springer, Singapore. <https://doi.org/10.1007/978-981-97-5250-8_5>

Swain, S.K., Bairwa, M.K., Sivaraman, Pillai, B.R., 2017. Ornamental Aquaculture: A Potential Entrepreneur Avenue. ICAR-CIFA, Extension Series-34. ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha. 1-4.

Swain, S.K., Singh, S. K., Routray, P. and Barik, N. K., 2008. Indigenous ornamental fishes: status, issues and strategies for propagation and conservation. *e-planet*. 6(2): 20 -26.

Swain, S.K., Ail, S.S. and Bairwa, M.K., 2020. Ornamental aquaculture: An alternative avenue for livelihood support. *Indian Farming*. 70(11):34–37.

Thriveni, K., Jayaraman, R., Rajakumar, M., Haribabu, P., Reddy, D.R.K. and Jesintha, N., 2020. Economic Analysis of Aquaculture in Nellore District, Andhra Pradesh. *International Journal of Agriculture Sciences*. 12(16):10130-10133.

https://tropicalfreshwaterfish.com/intro.htm#:~:text=Ancient%20Egyptians%20were%20the%20first,at%20least%20the%2010th%20century.