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MARINE ORNAMENTAL FISHES OF INDIA

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INTRODUCTION

In the context of increasing popularity of keeping ornamental fishes in home aquaria in several countries, the demand for them has been increasing and substantial trade for these fishes has developed in several parts of the world. It has been estimated that the world trade on ornamental fishes is around US \$ 4.5 billion (Srivastava, 1994), of which freshwater ornamental fish trade forms about 85%. India's contribution to the world trade of ornamental fishes is about Rs. 10 crore (Srivastava, 1994) and almost the entire trade is based on freshwater ornamental fish. There is considerable scope for initiating and developing export of marine ornamental fish from India (Tomey, 1985, 1986) and to initiate exploitation and export of these fishes, a training mission for ornamental fish export to Netherlands was also organised (Anon. 1986). The National Seminar on "Planning Export Strategy of Indian Marine Fishes" recommended the development of export of ornamental fish (Anon. 1988). The marine ornamental fishes are inhabitants of coral and rocky areas and also among marine plants. They are abundant in the Gulf of Mannar, Palk Bay and Gulf of Kutch along the mainland coast and in the Lakshadweep and Andaman islands. Among all these regions, the lagoons and reef flats in the Lakshadweep group of islands are the richest both in regard to number of species and their numerical abundance (Murty *et al.* 1989; Vijayanand and Varghese, 1990).

DISTRIBUTION

1. *Lakshadweep islands* : Of over 600 species of marine fishes reported from this region (Jones and Kumaran, 1980), over 300 species belonging to about 35 families are known for their attractive colours and shapes. There are 36 islands in this region and the lagoons and reef flats harbour rich ornamental fish fauna. Among them, the wrasses (Labridae), constitute the largest group with 45 species followed by damsel fish (Pomacentridae; 35 species), cardinal fish (Apogonidae; 22 species), groupers (Serranidae; 21 species), blennies (Blennidae; 20 species), surgeon or unicorn fishes (Acanthuridae; 19 species), butterfly fish (Chaetodontidae; 16 species), goat fish (Mullidae; 14 species), gobies (Gobiidae; 14 species), scorpion fish (Scorpaenidae; 14 species), trigger fishes (Balistidae; 10 species), squirrel fishes (Holocentridae; 9 species) and others. The Central Marine Fisheries Research Institute is presently engaged in the survey of ornamental fish resources of Lakshadweep; the study carried out so far from 8 islands shows that :

1. Of a total of over 300 species known, surgeon fish, parrot fish, puffer fish, butterfly fish, squirrel fish, wrasses, trigger fish, file fish, goat fish, angel fish, damsel fish, groupers and moonish idol comprising of 199 species are common in these islands.

2. Among the above fishes the wrasses are the most dominant numerically constituting 37% of total population, followed by damsel fish (31.9%), parrot fish (8.4%), goat fish (8.2%), squirrel fish (4.7%), surgeon fish (4.6%), butterfly fish (2.1%), groupers (1.2%), trigger fish (0.8%), puffer fish or blaspops (0.6%), moorish idol (0.4%) and angel fish (0.1%).
3. Of the eight islands surveyed so far, Kalpeni is richest in regard to numerical abundance of the above groups of fishes harbouring 28.8% of the population in all the eight islands followed by Amini (27.6%), Kadamat (15.4%), Chetlat (9.2%), Kavaratti (7.4%), Agatti (6.3%), Kiltan (3.2%) and Bitra (2.2%).

Though the survey and analyses are yet to be completed and the above results can only be preliminary, it has also been observed, on the basis of available information, that :

1. of the above eight islands, Kadamat has the largest lagoon and Chetlat has the smallest lagoon but Kadamat occupies third position in regard to population size and Chetlat the fourth; Kalpeni which occupies fourth position in regard to lagoon area, has the largest population size of ornamental fishes.
2. the bulk of the ornamental fishes from these islands are constituted by wrasses, damsel fish, parrot fish and goat fish which together form about 85% of the population of the above mentioned 13 groups in the eight islands.
3. Amini island is rich in labrid fishes (wrasses) (over 80% of the total population in the lagoon) particularly in the intertidal region along the eastern side, and

4. of the 199 species of the above thirteen groups, 72 species (Table 1) are dominant numerically and offer considerable scope for exploitation and export.

2. *Andaman group of islands* : These islands situated in the Bay of Bengal offer a variety of habitats such as rocky coasts with tidal pools, extensive backwaters, bays and mudflats which provide potential areas for exploitation of rich and varied marine fishes. About 150 species of ornamental fishes are known to be available in these islands which belong to families Holocentridae, Scorpaenidae, Serranidae, Chaetodontidae, Ehippidae, Pomacanthidae, Pomacentridae, Labridae, Blennidae, Acanthuridae, Siganidae, Balistidae, Ostraciidae, Tetrodontidae and others (Sen, 1973, Dorairaj 1994). In the marine National Park, Wandoor, Andamans, Angel fishes were found to be most abundant forming 32% of the total population followed by snappers and fusiliers (19%), Surgeon fish (18%), coral fishes (12%), spine foot (4%), wrasses (3%) and others (2%) (Dorairaj, 1994); majority of these fishes are ornamental fishes (Table 2).

3. *Gulf of Mannar and Palk Bay* : This region has several islands with extensive coral reefs around them. About 100 species of ornamental fishes belonging to about 30 families (Table 3) are known from this region (Murty, 1969) and butterfly fish, wrasses, damsel fish, rabbit fish, scorpion fish and puffer fish are among the dominant ones (Mahadevan and Nayar 1965, 1967a, b, 1968; Nayar and Mahadevan, 1965, 1967).

ECOLOGY OF ORNAMENTAL FISHES

Most of the ornamental fishes being inhabitants of coral and rocky areas, their feeding habits and food are associated with the

TABLE 1. Dominant species of ornamental fishes in the Lakshadweep

S.No.	Family	Popular name	Dominant species
1.	Acanthuridae	Surgeon fish	<i>Acanthurus triostegus</i>
2.			<i>Ctenochaetus strigosus</i>
3.			<i>Acanthurus matoides</i>
4.			<i>A. leucosternon</i>
5.			<i>A. lineatus</i>
6.			<i>A. nigricauda</i>
7.			<i>A. elongatus</i>
8.			<i>Zebrasoma veliferum</i>
9.			<i>Naso lituratus</i>
10.			<i>N. unicornis</i>
11.			<i>N. brevirostris</i>
12.			<i>N. tuberosus</i>
13.	Balistidae	Trigger fish	<i>Rhineacanthus aculeatus</i>
14.			<i>R. rectangulus</i>
15.			<i>Balistapus undulatus</i>
16.			<i>Balistooides viridescens</i>
17.	Callyodontidae	Parrot fish	<i>Callyodon taeniurus</i>
18.			<i>C. bataviensis</i>
19.			<i>Cryptotomus spinidens</i>
20.			<i>Callyodon sordidus</i>
21.			<i>Leptoscarus vaigiensis</i>
22.			<i>Callyodon scaber</i>
23.	Chaetodontidae	Butterfly fish	<i>Chaetodon auriga</i>
24.			<i>C. trifasciatus</i>
25.			<i>C. falcula</i>
26.			<i>C. citrinellus</i>
27.			<i>C. lunula</i>
28.			<i>Megaprotodon strigangulus</i>
29.			<i>Heniochus acuminatus</i>
30.	Pomacanthidae	Angel fish	<i>Centropyge multispinis</i>
31.			<i>Pomacanthodes imperator</i>
32.	Holocentridae	Squirrel fish	<i>Neoniphon sammara</i>
33.			<i>Myripristis murdjan</i>
34.			<i>Sargocentron punctatissimum</i>
35.			<i>S. caudimaculata</i>
36.			<i>S. diadema</i>
37.			<i>S. violaceus</i>
38.			<i>S. spinifer</i>

39.			<i>Myripristis adustus</i>
40.	Labridae	Wrasses	<i>Halichoeres scapularis</i>
41.			<i>H. centriquadrus</i>
42.			<i>H. marginatus</i>
43.			<i>Thalassoma hardwickii</i>
44.			<i>Gomphosus caeruleus</i>
45.			<i>G. varius</i>
46.			<i>Stethojulis trilineata</i>
47.			<i>S. albovittata</i>
48.			<i>S. strigiventer</i>
49.			<i>Cheilinus trilobatus</i>
50.	Pomacentridae	Damsel fish	<i>Dascyllus reticulatus</i>
51.			<i>D. aruanus</i>
52.			<i>Chromis caeruleus</i>
53.			<i>C. chrysurus</i>
54.			<i>Pomacentrus nigricans</i>
55.			<i>P. albicaudatus</i>
56.			<i>P. melanopterus</i>
57.			<i>Abudefduf sexfasciatus</i>
58.			<i>A. lacrymatus</i>
59.			<i>A. dickii</i>
60.			<i>A. biocellatus</i>
61.			<i>A. xanthozona</i>
62.			<i>A. glaucus</i>
63.	Mullidae	Goat fish	<i>Mulloidichthys samoensis</i>
64.			<i>M. auriflamma</i>
65.			<i>Parupeneus barberinus</i>
66.			<i>P. macronemus</i>
67.			<i>P. bifasciatus</i>
68.	Serranidae	Groupers	<i>Epinephelus merra</i>
69.			<i>E. hexagonatus</i>
70.			<i>Cephalopholis argus</i>
71.	Canthigasteridae	Puffer fish	<i>Canthigaster margaritatus</i>
72.	Zanclidae	Moorish idol	<i>Zanclus cornutus</i>

TABLE 2. Common ornamental fishes from Wandoor Marine National Park Andamans (From Dorairaj, 1994).

S.No.	Family	Popular Name	Species
1.	Syngnathidae	Sea horse/pipe fish	<i>Hippocampus kuda</i>
2.			<i>Microphis brachiurus</i>
3.	Holocentridae	Squirrel fish	<i>Holocentrus rubrum</i>
4.	Serranidae	Groupers	<i>Cephalopholis argus</i>
5.			<i>C. leopardus</i>
6.			<i>C. miniata</i>
7.			<i>Epinephelus merra</i>
8.	Ephippidae	Bat fish	<i>Platax orbicularis</i>
9.	Pomacanthidae	Angel fish	<i>Pomacanthodes imperator</i>
10.			<i>Pomacanthus annularis</i>
11.	Chaetodontidae	Butterfly fish	<i>Chaetodon auriga</i>
12.			<i>C. falcula</i>
13.			<i>C. trifasciatus</i>
14.			<i>C. vagabunda</i>
15.			<i>C. lineolatus</i>
16.			<i>Heniochus acuminatus</i>
17.	Pomacentridae	Damsel fish	<i>Abudefduf saxatilis</i>
18.			<i>Amphiprion percula</i>
19.			<i>Chromis dimidiatus</i>
20.			<i>C. caeruleus</i>
21.			<i>Dascyllus aruanus</i>
22.	Labridae	Wrasses	<i>Anampses caeruleopunctatus</i>
23.			<i>Gomphosus caeruleus</i>
24.			<i>G. varius</i>
25.			<i>Thalassoma hardwickii</i>
26.	Callyodontidae	Parrot fish	<i>Callyodon sordidus</i>
27.	Siganidae	Rabbit fish	<i>Siganus spinus</i>
28.			<i>S. stellatus</i>
29.			<i>S. virgatus</i>
30.	Zanclidae	Moorish idol	<i>Zanclus cornutus</i>
31.	Acanthuridae	Surgeon fish	<i>Acanthurus leucosternon</i>
32.			<i>A. lineatus</i>
33.			<i>A. triostegus</i>
34.			<i>Ctenochaetus strigosus</i>
35.			<i>Naso unicornis</i>
36.			<i>Zebrasoma veliferum</i>
37.	Scorpaenidae	Scorpiian fish	<i>Pterois volitans</i>
38.	Balistidae	Trigger fish	<i>Balistapus undulatus</i>
39.			<i>B. viridis</i>

TABLE 3. Important ornamental fishes known from Gulf of Mannar and Palk Bay

S.No.	Family	Popular name	Scientific name
1.	Syngnathidae	Sea horse/pipe fish	<i>Micrognathus brevirostris</i>
2.			<i>Syngnathoides biaculeatus</i>
3.	Holocentridae	Squirrel fish	<i>Sargocentron diadema</i>
4.			<i>Holocentrum rubrum</i>
5.	Serranidae	Groupers	<i>Cephalopholis boenack</i>
6.			<i>C. pachycentron</i>
7.			<i>Epinephelus undulosus</i>
8.			<i>E. merra</i>
9.			<i>E. miniatus</i>
10.	Mullidae	Goat fish	<i>Upeneus tragula</i>
11.			<i>U. sulphureus</i>
12.			<i>U. vittatus</i>
13.			<i>U. displurus</i>
14.			<i>U. bensasi</i>
15.			<i>U. oligospilus</i>
16.			<i>U. luzonius</i>
17.			<i>U. sundaicus</i>
18.			<i>Parupeneus indicus</i>
19.			<i>P. pleurospilus</i>
20.			<i>Mulloidichthys flavolineatus</i>
21.	Platacidae	Bat fish	<i>Platax tiera</i>
22.			<i>P. orbicularis</i>
23.	Chaetodontidae	Butterfly fish	<i>Heniochus acuminatus</i>
24.			<i>Chaetodon auriga</i>
25.			<i>C. trifasciatus</i>
26.			<i>C. plebeius</i>
27.			<i>C. octofasciatus</i>
28.			<i>C. melanotus</i>
29.			<i>C. xanthocephalus</i>
30.			<i>C. collare</i>
31.	Pomacentridae	Damsel fish	<i>Amphiprion sebae</i>
32.			<i>Abudefduf saxatilis</i>
33.			<i>A. septemfasciatus</i>
34.			<i>A. biocellatus</i>
35.	Pomacanthidae	Angel fish	<i>Pomacanthodes annularis</i>
36.	Labridae	Wrasses	<i>Stethojulis axillaris</i>
37.			<i>S. phaekadopleura</i>
38.			<i>S. interrupta</i>
39.			<i>Cheilinus chlorurus</i>

40.			<i>C. trilobatus</i>
41.			<i>C. undulatus</i>
42.			<i>Epibulus insidiator</i>
43.			<i>Thalassoma lunare</i>
44.			<i>Cheilio inermis</i>
45.			<i>Halichoeres nigriscens</i>
46.			<i>H. leucurus</i>
47.	Callyodontidae	Parrot fishes	<i>Callyodon ghobban</i>
48.			<i>C. dussumieri</i>
49.			<i>Leptoscarus vaigiensis</i>
50.	Siganidae	Rabbit fish	<i>Siganus oramin</i>
51.			<i>S. javus</i>
52.	Zanclidae	Moorish idol	<i>Zanclus cornutus</i>
53.	Acanthuridae	Surgeon fish	<i>Acanthurus matoides</i>
54.			<i>A. gahm</i>
55.			<i>A. strigosus</i>
56.			<i>Naso brevirostris</i>
57.			<i>Zebrasoma veliferum</i>
58.	Scorpaenidae	Scorpioid fish	<i>Pterois volitans</i>
59.			<i>P. miles</i>
60.			<i>Gymnapistes dracaena</i>
61.	Balistidae	Trigger fish	<i>Odonus niger</i>
62.			<i>Balistes flavimarginatus</i>
63.	Monacanthidae	File fish	<i>Osbeckia scripta</i>
64.			<i>Paramonocanthus choirocephalis</i>
65.	Ostraciidae	Box fish	<i>Rhyncostracion nasus</i>
66.			<i>Lactoria cornuta</i>
67.	Tetradontidae	Puffer fish	<i>Tetradon immaculatus</i>
68.			<i>T. hispidus</i>
69.			<i>T. reticularis</i>
70.	Canthigasteridae	Puffer fish	<i>Canthigaster margaritatus</i>

organisms associated with corals. On the basis of observations made at Minicoy (Pillai *et al.* 1983, 1987, Madan Mohan *et al.* 1986, Pillai and Madan Mohan 1990, Pillai *et al.* 1992), Marshall islands (Haitt and Strasburg 1960) and in the Caribbean Coral reefs (Wyatt, 1983; Thompson and Munro, 1983; Munro, 1983;

Aiken, 1983a, 1983b and Reeson 1983a, 1983b), brief notes on natural history of major ornamental fish groups is summarised below in view of the importance of this knowledge in maintenance of aquaria. The observations of Edwards and Shepherd (1992) from the Maldives are also utilised.

1. *Pomacentridae* (Damsel fish) : These fishes are solitary, some form small aggregations and some (like *Chromis caeruleus* and *Dascyllus aruanus*) form large schools and live in interstices of branching corals. These fishes feed on filamentous and coralline algae, crabs, copepods and amphipods. *Chromis caeruleus* is a typical zooplankton feeder with copepods, *Lucifer*, mysids, foraminifera and filamentous algae being the important food items. This species spawns round the year in the Minicoy lagoon with active period during August-April. In the study in Lakshadweep islands by the author, a large number of fishes of this species with egg masses of the same species in developing condition in stomachs were found during October-January. *Chromis caeruleus* is known to coexist with *Dascyllus aruanus* in live branching corals. *D. aruanus* is known to live among the dead corals also and spawn during April-January actively. *Abudefduf glaucus* is essentially a herbivore feeding mainly on encrusting and filamentous algae found on corals. This species also spawns throughout the year with peaks during September-December and February-March in Minicoy.

2. *Acanthuridae* (Surgeon fish) : These fishes are diurnal feeders, almost entirely herbivorous and well adapted for browsing and grazing algae by means of spatulate teeth (Reeson, 1983 a). Filamentous and coralline algae form important food in the Minicoy (Pillai et al. 1992). According to Haitt and Strasburg (1960), the surgeon fishes are principally herbivores, some feeding on compact sandy bottom on which a carpet of short algal filaments grow. *Ctenochaetus* spp. are detritus feeders and some are zooplankton feeders.

Some species were observed to be in ripe oozing stage in the lagoons of Lakshadweep islands during October-January.

3. *Labridae* (Wrasses) : Some species are known to bury themselves in the sand during night; some species are known to be cleaners of ectoparasites of other fishes. In the Minicoy, these fishes feed on crabs, alghids, fish larvae, fish and mysids. The labrids are also known to be feeders of zooplankton and a great variety of invertebrates including coral polyps.

4. *Callyodontidae* (Parrot fishes) : The parrot fishes, with their characteristic teeth, scrape algal mats on the live as well as dead corals. They also feed on algal films on compacted sand substrata or on sea grasses. Some are known to feed on coral polyps. A large number of *Callyodon taeniurus* were observed to be in ripe oozing stage in the lagoons of Lakshadweep particularly in Kavaratti during October-November. The ripe eggs are oval in shape.

5. *Chaetodontidae* (Butterfly fish) : These fishes occur singly or in pairs wherever coral growth is luxuriant. Coral polyps are the favourite food of butterfly fish but these fishes also feed on small invertebrates and algae. Juveniles of some species are cleaners of ectoparasites on other fish. In the Minicoy lagoon, these fishes were observed to be feeding on filamentous algae, copepods, polychaetes and sponges.

According to Wood (1985), some species such as *Chaetodon collare*, *C. trifasciatus* and others feed exclusively on coral polyps and it is not possible to feed in captivity. Though it was observed that it would not be possible to maintain butterfly fishes in captivity, because of their feeding habits, some species can thrive in captivity.

6. *Pomacanthidae* (Angel fishes) : These are bottom feeders mainly subsisting on algae and invertebrates such as sponges, bryozoans, gorgonians, echinoderms, tunicates and crustaceans.

7. *Holocentridae* (Squirrel fish) : These fishes are known to hide in crevices during day and come out in the night to feed on larger zooplankters. All species are carnivores taking a variety of crustaceans, polychaetes, small fish and gastropods. These fishes mainly feed during night and do not feed on corals. In the Minicoy the food items were observed to be crabs, prawns and alphiids.

8. *Siganidae* (Rabbit fishes) : The siganids feed on sea weeds and grasses. They are browsers on algae-covered rocky bottoms. In the confinement these fishes are known to feed on and subsist on waste meat.

9. *Mullidae* (Goat fish) : The goat fish live in sandy areas and feed at the bottom taking surface or subsurface dwelling invertebrates. The barbels are used in stirring the bottom and in detecting the prey.

10. *Serranidae* (Groupers) : Some species prefer sea grass beds, some muddy or sandy bottoms. Most species are inhabitants of coral reefs and rocky bottom. Some species are synchronous hermaphrodites and some undergo sex reversal. These fishes are rapid swimmers and conceal themselves in crevices, holes in corals and under the rocks in coral rubble. Serranids are voracious carnivores feeding on crustaceans and coral dwelling fishes.

11. *Balistidae* (Trigger fish) : The trigger fishes live in the bottom under the corals or

rocks fixing themselves against the substratum by locking with the dorsal spine. These fishes are omnivores feeding on algae, coral polyps, crustaceans, molluscs, fish and sea urchins.

EXPLOITATION AND MANAGEMENT

In India the marine ornamental fishes are known to be abundant in coral reef areas in shallow waters in the Gulf of Mannar and Palk Bay, around Andaman islands and the lagoons and reef flats of Lakshadweep group of islands. Among these areas, Lakshadweep region is the most important one in regard to abundance of ornamental fishes and in the diversity of species. This region being very shallow, is vulnerable for environmental degradation by human intervention. Hence, the exploitation on a commercial scale is likely to result not only in quick overexploitation of the fish species but also in the destruction of coral environment. Edwards and Shepherd (1992) dealt with the environmental implications of aquarium fish exploitation in the neighbouring Maldives and suggested certain measures of regulation, as the trade which started around 1980 lead to near overexploitation of 27 species of a total of about 65 species by 1989. The policy of exploitation and export of ornamental fish from marine environments should therefore consider:

i. *Protection of environment* : The clown fish (*Amphiprion* spp) are known to be symbiotic with sea anemones; most of the damsel fish live among coral colonies and any disturbance makes them hide deep in the corals rendering it virtually impossible to catch them. Similarly the surgeon fish, snappers, wrasses, squirrel fish and such others also live among corals. The exploitation therefore tends to destroy the corals and eventually the environment. The

exploitation strategy should first consider proper measures to monitor the exploitation, and protection of environment; the formulated measures should be strictly implemented right from the very beginning instead of waiting till the adverse affects are realised.

ii. *Exploitation* : Only non destructive methods of exploitation should be permitted. Any damage caused to the corals should be taken note of seriously and concerned punished severely. Among the non destructive methods, trap fishing is one of the best; however, some fish do not enter traps. In such cases net enclosures should be permitted. Though the marine ornamental fishes are abundant in the island ecosystems, their exploitation and export on a small scale may have to be initiated in the mainland coast particularly the Gulf of Mannar and Palk Bay and on the basis of experience gained, the same can be extended to the islands.

iii. *Monitoring the exploitation and export* : In view of the lucrative nature of the marine ornamental fish trade, several firms are likely to enter the trade and the exports may be channelised through different centres to different destinations. For the purpose of monitoring the exploitation and export, a single agency has to be created to monitor and oversee everything related to ornamental fish trade. The entire transportation, both domestic and abroad should be channelised through this agency. Data on location of fishing, specieswise number of fish transported along with the length of each specimen transported should be collected and

maintained for future use. Total allowable catches for each ornamental fish species has to be fixed in the very beginning for each of the ecosystems so that the exploitation does not reach unmanageable levels.

iv. *Breeding and culture* : As the demand for ornamental fishes is increasing rapidly, the wild stocks will not be able to sustain the exploitation in course of time and the fast developing industry would face severe problems of nonavailability of material and conflicts among different groups. Simultaneously, with the steps to initiate exploitation, steps to develop technology for breeding, seed production and culture of marine ornamental fishes in suitable localities, preferably in the Gulf of Mannar and Palk Bay areas, should receive the highest priority attention to save the wild stocks from depletion, to save the fragile coral environments from destruction, to avoid conflicts, to facilitate increased export of marine ornamental fishes and to provide continuous and increased employment opportunities.

v. *Sanctuaries* : One or two lagoons of the Lakshadweep islands, particularly the Bangaram which is open for tourists, to be identified as sanctuaries and all necessary steps to be taken to protect the lagoons from any sort of human intervention. The marine park in the Gulf of Mannar and the one in the Wandoor National Park in Andamans should receive further support to strengthening the conservation of marine biodiversity.

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