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Green Certified Marine Ornamental
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Indian Council of Agricultural Research

Central Marine Fisheries Research Institute

GUIDELINES FOR
GREEN CERTIFICATION
OF MARINE ORNAMENTAL SPECIES



GUIDELINES FOR GREEN CERTIFICATION OF MARINE ORNAMENTAL SPECIES

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FOREWORD



"A thing of beauty is a joy forever"
JOHN KEATS

Ornamental fish keeping, which started in China in 1163, is still going strong, being the second most popular hobby next only to photography. In fact, the global ornamental fish trade is a multibillion-dollar industry which comprises of both freshwater and marine forms; with the freshwater ornamentals dominating global trade with marine forms better in terms of unit value. It is estimated that around 2 million people keep marine aquaria in the world. The lion's share of the marine ornamental fish trade (more than 90%) is contributed by wild caught fishes, in contrast to the freshwater sector, wherein the trade is dominated by captive bred or hatchery produced fishes.

As the trade is a variety oriented one, the dependence on wild collection for sourcing of fishes will continue but responsible collection practices are necessary from a sustainability perspective. A gradual transformation from wild collection to hatchery production would be the best solution to address this issue. Nearly 2500 species are being traded and, captive breeding technology for 338 marine ornamental species belonging to 37 families have been developed out of which only 134 are commercially available and only 18% of them are regularly available in the market. In the Indian scenario, ICAR-Central Marine Fisheries Research Institute (CMFRI) has taken pioneering steps in captive breeding of marine ornamentals and has developed the captive breeding and seed production technology for more than 25 species of marine ornamentals, which includes clown fishes, damsel fishes, Anthias, gobies, fire fish, the highly expensive designer clowns (Picasso Platinum, Snowflake etc.) hybrids, cross-breds, ornamental shrimps and sea anemones. Furthermore, an exclusive brood bank and breeding facility for damsel fishes has also been established by ICAR-CMFRI. These initiatives were brought forth with an objective to reduce the dependency on wild harvest of marine ornamentals for the sustainable development of the sector.

Green certification is a tool to ensure sustainable development of the marine ornamental sector by addressing the environmental and socio-economic concerns. Here all segments of the value chain, *viz.*, collection, handling centres, captive breeding units, transportation, and marketing of the ornamental fishes are covered under green certification. Until the hatchery production can replace wild harvest for supply of fishes to the trade, green certification of the collectors and collection practices can ensure sustainability of the trade. In this document, the authors have provided guidelines for an objective and transparent Green Certification system in India. I hope, this document would be of use for academicians, policy makers, students, researchers and all other stakeholders of the sector such as collectors, handling centres, captive breeding units and traders. I congratulate all those who had put in their best efforts for preparation of this document.

Dr. A. Gopalakrishnan
Director, ICAR-CMFRI

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1.PREFACE

The trade of marine ornamental species is fast expanding globally, and consequently, demand for tropical marine ornamentalshas been increasing in recent years. Globally, over 46 million organisms representing 2500 species are traded annually with a value exceeding 300 million US $. Wild-collected species contribute more than 90% of the trade, majority of which are collected from ecologically sensitive habitats like coral reefs, raising concern on the trade's sustainability. It has been reported that indiscriminate and negligent collection practices have caused coral reef destruction in places where the wild collection is prevalent.

Even though, India is blessed with rich resources of high-value marine ornamental species; our global trade share is insignificant because we have not yet ventured into organised trade. In this regard, the sustainable development of India's marine ornamental trade provides a lucrative opportunity which needs to be nurtured preferentially. The trade from hatchery-produced fish is the best option for a long term sustainable industry. However, even globally, commercial level hatchery production technologies have been developed only for a limited number of species. Considering that the marine ornamental trade is a variety-oriented one, the hatchery production of a few species alone cannot meet demand for all the different varieties. The demand can be bolstered with sustainable exploitation of additional species from natural habitats like coral reefs without causing damage to these ecosystems. Hence, while developing an organised marine ornamental fish trade in the country, the option of a green-certified wild collection policy can also be considered, along with the promotion of hatchery production of species for which viable technologies are available. The green certified wild collection can be complementary to hatchery production for the development of sustainable trade. It is also mandatory that the hatchery protocols are also green certified. The logic behind the guidelines is that the approach of Green Certification would be highly beneficial for the sector and would cover all the stakeholders in the value chain, from collectors to consumers. Awareness creation among the consumers about Green Certification shall be taken up regularly by government agencies, thereby creating a demand for green-certified fishes commanding premium prices. This will invariably give an impetus to the other stakeholders in the value chain (*viz*. Collectors, Holding centre, Captive breeding units, exporters or marketers) to adopt Green Certification and thereby, in the long run, all the entities in the chain of custody will be green certified.

The green certification guidelines outlined in this publication aim to develop acertified sustainable trade of marine ornamentals in India. An integrated approach led by the concerned State / Union territory departments with the relevant national agencies can initiate green certification in a step-by-step manner so that a lucrative and sustainable marine ornamental business sector will emerge in the country in the near future.

Dr. G. Gopakumar
Chairman, Core Team

2.VISION & MISSION

Vision

Sustainable development of an organised and certified business sector of marine ornamentals ensuring healthy marine ecosystems and sustainable trade in India.

Mission

Evolving guidelines and certification protocols for establishing a green certification system in India which the collection, culture and conservation protocols lead to the development of a sustainable marine ornamental species trade.



3. EXECUTIVE SUMMARY

"The nearer a man comes to a calm mind, the closer he is to strength."

- Marcus Aurelius

As rightly said by the Roman emperor, Marcus Aurelius, this statement still holds good in the present day world since peace of mind or mental well being is the primary requirement for treating many of the so-called life -style diseases. The importance of mental well being is increasingly becoming a part of treatment procedures the world over, and people are turning to their favourite pastime hobbies to ease the mental tensions. Aquarium keeping is one of such hobbies where you can watch, appreciate and enjoy nature's beauty in your home at your convenience.Increasing awareness about such benefits of aquarium keeping has paved the way for developing the ornamental fish trade as a multibillion-dollar industry in the world. Both freshwater and marine species are traded globally, wherein the freshwater forms contribute the significant share in terms of quantity. However, in terms of unit value, the marine ornamental species command a better position in the trade.

A lucrative marine ornamental trade has been developed globally, and the same is gaining momentum annually. Almost the entire trade is contributed by wild-collected species, especially from coral reef areas. The indiscriminate collection of ornamental species from these habitats leads to the degradation of sensitive coral reef ecosystems. Hence, the ecosystem has to be safeguarded and appropriate measures for sustainability need to be taken while promoting wild collection. Even though hatchery-produced trade is the best long term sustainable option, it remains a fact that breeding and seed production technologies have been developed only for a few species. The marine ornamental trade, being a variety oriented one, hatchery production of a few species alone cannot meet the trade requirement at present. Hence, it can be reasonably predicted that the percentage of wild-caught marine ornamental species will continue to dominate the sector on a global basis in the near future. In India, at present, there is no organised marine ornamental trade. We have a fairly good resource of marine ornamentals distributed in our coral reef areas. When we are planning to develop a trade, it is of prime importance to take precautions to prevent the degradation of reef habitats,thereby sustaining both the environment and trade. The hatchery production of marine ornamental species can be complementary but may not be a full replacement for the wild collection. Guidelines are needed for the sustainable hatchery production of species for which breeding technologies are available. Hence,a need for green certification guidelines was felt essential for developing an organised trade of marine ornamentals in India.

The certifications schemes/ bodies which are concerned with fisheries or aquaculture currently in vogue include the MSC (Marine Stewardship Council), ASC (Aquaculture Stewardship Council), OBP (Ocean Bound Plastic – by Control Union Certifications), Friend of the Sea certification programmes etc. In the case of ornamental fish trade, there are no specific schemes or programmes currently being practised anywhere in the world. The Marine Aquarium Council (MAC) formed in

1996 and which existed till 2008 had set a good example for the green certification of marine ornamentals. The initiatives taken by the MAC by developing standards for certification of the marine ornamental fish trade is worth mentioning even though MAC does not exist now. For the fresh water ornamental fishes, Guidelines for Green Certification has been brought out by the Marine Products Export Development Authority (MPEDA), under the Ministry of Commerce & Industry, Govt. of India, whereas for the marine ornamental sector initiatives for preparation of such a guideline has not been taken so far. Under these circumstances, ICAR-CMFRI proactively took the initiative to prepare the Guidelines for Green Certification of marine ornamental species. A Core team was constituted consisting of scientists from relevant disciplines, and these guidelines were prepared by the team after a series of discussions and deliberations.

The guidelines have a Vision and Mission statement followed by an Introduction. The guidelines *perse* has been detailed under five sections *viz*. Guidelines for Collection of marine ornamentals, Guidelines for Holding and conditioning centre, Guidelines for Captive breeding and seed production, Guidelines for Transportation and Guidelines for Marketing. There are twenty-eight Annexures to the guidelines which consist of supplementary information such as list of marine ornamental species with their photographs, list of harmful/unsuitable species, list of protected/prohibited species, Model layout/design of Holding centre, Captive breeding unit and Marketing facility, Formats for different documents to be maintained such as Logbooks, Licence, Lease agreements, No Objection Certificate, Equipment Registers, Calibration records, score cards for assessment of the facilities etc. Briefly, the contents of the guidelines are given here under:

GUIDELINES FOR COLLECTION OF MARINE ORNAMENTAL SPECIES:

The various aspects covered under this section include collection area, collection area management plan, collectors, licensing of collectors and detailed description about the marine ornamentals available, prohibited species and harmful species supported by annexures. The ideal and eco-friendly methods of harvesting, handling and transportation of the marine ornamentals are also described.

GUIDELINES FOR HOLDING AND CONDITIONING CENTRES OF ORNAMENTAL SPECIES

Holding and Conditioning Centre refers to any facility where the marine ornamentals are held for conditioning, sorting and holding after collection till they are packed for transportation. The various aspects of establishing and management of a holding centre is described here. The infrastructure requirements such as building/shed, its lay out and design, water source, water filtration, airblowers, filters, tanks etc. are described in detail. The description of a quarantine section in the holding facility is given with specific infrastructure requirements and a detailed description of the quarantine protocols. The documentation requirements, and capacity building of personnel manning the facility is also described.

GUIDELINES FOR CAPTIVE BREEDING AND SEED PRODUCTION OF MARINE ORNAMENTAL SPECIES

The hatchery production of the marine ornamental fishes is the only long term option for a sustainable marine ornamental fish trade. Hence an appropriate guiding document for

proper management of the facility is imperative for the sustainable development of the trade.

This section describes all requirements for establishing and operating a captive breeding unit of marine ornamentals. The basic criteria for site selection, building construction, water source selection, etc. are given here with a model lay out for designing a captive breeding unit. All the quipments essential for the hatchery, such as air blowers, filters, lighting, water supply lines, water treatment system etc., are meticulously described in detail. The operational part of the hatchery, such as broodstock development, breeding, larval rearing, nursery rearing, live feed culture, health management etc., is comprehensively covered under this section. The documentation requirements have been described with formats of log books, registers, records, land documents etc.

GUIDELINES FOR TRANSPORTATION OF MARINE ORNAMENTAL SPECIES

The overall success of the marine ornamental fish trade is completely dependent on an efficient mechanism for transporting the fish from one place to another. An incorrect method or protocols employed for transportation will lead to a complete failure of the entire efforts put in by other segments of the value chain.Therefore transportation is an integral part of the trade, and under this section, all relevant information about an efficient fish transportation system has been described. The topics covered include prerequisites for transportation, preparation of the fish for transport, packing density, packing materials, use of anaesthetics for transportation etc. A detailed description of the packing protocol and the procedure for acclimatising the fish before release to the tanks after transport have also been provided in this section.

GUIDELINES FOR MARKETING OF MARINE ORNAMENTAL SPECIES

The marine ornamental fish trade comprises different types of stakeholders, from the fishermen to the hobbyist. Marketing is the act or process of selling or purchasing wild collected and hatchery-produced marine ornamental fishes.The cardinal principles of an efficient marketing system for ensuring sustainable development of the sector are described here. A model layout for establishing a marketing facility of marine ornamental fish is also provided, along with the format of logbooks to be maintained.

After the guidelines for various segments have been described, After the guidelines section, a section on “Way Forward” has been given on how to implement the proposed guidelines. Here the plan of implementation of Green Certification has been described in detail, which comprises of the certification procedure, Collection Area Management Plan, formation of Green Certification Authority etc. It is suggested that the implementation process in India can be vested with a special wing of the concerned state fisheries departments of maritime states and Union Territories. The technical expertise of the central agencies like CMFRI, NBFGR, MPEDA and financial assistance from NFDB and NABARD can be obtained by the concerned State/Union Territories for implementation of green certification. Before implementing Green certification guidelines, a policy on the development of marine ornamentals in the country has to be formulated, following which the green certification program can be implemented in a phased manner in the country. Initially, awareness creation among all the stakeholders of the sector about the relevance and scope of Green Certification needs to be done, followed by training of the

stakeholders. The facility/person willing to get a Green certification license must meet the prescribed requirements as laid out in the Guidelines for Green certification. The compliance to the standards will be verified by an accredited person/agency after which Green Certification label will be awarded by the Green Certification Authority, the constitution of which has also been given.It is suggested that the government shall promote the adoption of Green Certification through measures such as tax exemption on Green Certified products in the value chain.The Green certification can be voluntary initially and should be made mandatory for the trade with, in due course so that sustainable development of the sector could be ensured.

It is anticipated that in the near future, India can emerge as one of the primary source countries for a sustainable marine ornamental trade if we take appropriate steps towards the emergence of a green-certified wild collection system and also by sustainable commercial hatchery-production of the species for which breeding technologies are available.

4. INTRODUCTION

The three key activities associated with marine ornamental trade are collection, culture and conservation. The marine ornamentals are distributed in the coral reef habitat which is, one of the most vulnerable delicate marine ecosystems. Less than 10 % of marine ornamentals in the trade are hatchery produced, and the bulk is contributed by wild collection. The trade is a variety oriented one, and we need many species which are demanded in the trade. It is evident that due to the complexities involved in the hatchery production of different species, technology development for seed production of all the species demanded in the trade may not be a viable option. Hence,for the forseeable future wild collection will continue to be the primary option for the trade of marine ornamentals. Destructive collection practices, overexploitation, lack of scientific information on many species collected and the threat of extinction of target species are the current major problems of the marine ornamental trade. Destructive fishing techniques include the use of sodium cyanide and other chemicals to stun and catch fish. Even though cyanide only stuns the fishes, high post-capture mortality is recorded. It may destroy the coral reef habitat by poisoning and killing non-target animals, including corals. During the collection of coral pieces for the coral trade, many more colonies may be damaged or broken than are harvested. Corals are also broken for easy access to capture fish. This is more common with branching species in which small species such as Dascyllus and Chromis take refuge (Edwards and Shepherd, 1992). The collection of live rock has been considered potentially destructive as it may lead to increased erosion and loss of important ffish habitats. In this context, a green- certification system aimed at eco-friendly collection, conditioning and trading will help in the long term sustainability of the trade. Green certification is the certification given to a product to ensure its environmental and socio-economic sustainability. It is a procedure by which a third party gives written or equivalent assurance that the operation conforms to the relevant standards about social issues,environmental impacts andanimal (fish) welfare. It ensures product quality, safety and traceability.

GLOBAL SCENARIO

It is estimated that around 2 million people keep marine aquaria worldwide.The marine ornamental trade is a multimillion-dollar industry which started in the 1930's in Sri Lanka and has expanded tremendously during the last few decades. It is estimated that over 46 million organisms representing 2500 species are traded annually with a value exceeding US $ 300million (Pouil et al, 2020). These comprise more than 1800 species of fishes and over 700 invertebrate species. Most of these species are associated with coral reefs. However, a relatively high number of species are associated with other habitats such as sea grass beds, mangroves and mud flats. According to the data provided by exporters, the Philippines, Indonesia, the Solomon Islands, Sri Lanka, Australia, Fiji, the Maldives and Palau supplied more than 98% of the total number of fish exported. GMAD (Global Marine Aquarium Database) trade recorded from importers for the years 1997-2002 showed that the United States, the United Kingdom, the Netherlands, France and Germany were the most important countries of destination, comprising 99% of all imports of marine ornamental fishes. (Collette *et al.,* 2003).

Among the most commonly traded fish families, Pomacentridae dominates, accounting for 43% of all fish traded. They are followed by species belonging to Pomacanthidae (8%), Acanthuridae (8%), Labridae (6%) Gobiidae (5%), Chaetodontidae (4%), Callionymidae(3%), Microdesmidae (2%), Serranidae (2%) and Blennidae (2%). The most-traded species are the blue-green damselfish (*Chromis viridis*), clown anemone fish (*Amphiprion ocellaris*), whitetail dascyllus (*Dascyllus aruanus*), sapphire devil (*Chrysiptera cyanea*), threespot damsel (*Dascyllus trimaculatus*),orange clownfish(*Amphiprion percula*), palette surgeonfish(*Paracanthurus hepatus*), white-spotted damsel(*Dascyllus albisella*), Yellow tang (*Zebrasoma flavescens*), cleaner wrasse(*Labroides dimidiatus*) powder blue surgeon (*Acanthurus leucosterno*n),sea goldie*(Pseudanthias squamipinnis*),fire goby (*Nemeteleotris magnifica*), and mandarin dragonet (*Synchiropus splendidus*).These species together account for 36% of all fish traded from 1997 to 2002.

According to GMAD, 61 species of soft corals, 140 species of stony corals, eight genera of sea fans and 516 species of ornamental invertebrates are in the trade(Collette *et al.,* 2003).When exploitation is at a lower level in comparison to the resource available, there will not be any negative impact on reef fish populations. A study of the Cook Islands showed that the total catch per unit effort remained constant between 1990 and 1994 (Bertram, 1996). In Australia, due to the permit system, the current aquarium fishery is at a sustainable level (Queensland Fisheries Management Authority, 1999). But, Australia is a rare case as the Great Barrier Reef is the largest reef system in the world. It is well known that not all fish are equally available or equally attractive to the industry, and the most common fish need not be those favoured by hobbyists. As a result, the effect of the collection of ornamentals should be measured with respect to their potential to deplete particular species or locations. Several countries in Asia and South America have begun implementing collection restrictions of certain ornamental fish species (Corbin and Young, 1995; Friedlander, 2001, Ogawa and Brown, 2001). Although no marine species collected for the aquarium trade have been driven to global extinction, studies carried out in Sri Lanka, Kenya, the Philippines, Indonesia, Hawaii, and Australia have reported localized depletion of several target aquarium species of fish like butterflyfish and angelfish due to heavy collection pressure (Lubbock and Polunin, 1975; Rubec, 1987; Vallejo, 1997; Soegiarto and Polunin, 1982, Tissot and Hallacher, 1999). The only systematic study assessing the effects of harvesting fish for the aquarium trade on resource populations was carried out in Hawaii (Tissot, 1999). The study reported that eight of the ten species most targeted by collectors showed a decline in abundance at exploited sites relative to control sites. The GMAD could not be sustained due to various reasons. However, a more recent initiative called Marine Aquarium Biodiversity and Trade Flow by the Roger Williams University, USA (www.aquariumtradedata.org) provide more recent data on the marine aquarium trade.

A more significant part of the trade of ornamentals is centered on individual species. The species' vulnerability to the collection will depend on several life-history parameters like growth, reproduction and recruitment (Harriott, 2003). Eventhough reef fish exhibit many mating strategies, the larvae are distributed through wave and wind-driven ocean currents (Hutchings, 2002). This makes replenishment of reefs with new fish larvae highly dependent on these currents, and hence the availability of fish for sustainable aquarium collection is highly variable. The effects of fishing are significantly

different for species that are hermaphroditic compared with species that do not change sex. A fishery selectively removing larger animals first will mean that animals will have to start changing sex at smaller sizes, possibly reducing the fitness of individuals and thus making hermaphroditic stocks more vulnerable to overfishing.

Trade in ornamental marine fishes is characterized by extreme selective harvesting. For many species, juveniles are preferred by aquarium fish collectors due to their distinctive colouration and ease of maintenance. Consistent harvesting of juveniles may leave only a limited number of young ones to reach adult size and replenish the adult stock.

Even though most coral reef fishes have broad distribution, a few species are endemics. Some species are naturally rare, occurring only in very restricted locations or naturally occur in lower numbers eventhough they may be widely distributed (Wood, 2001). Other species may be abundant at different sites, but their distribution is limited to specific habitats. The more widespread/ or abundant a species is, the less vulnerable it is to exploitation. Increased rarity often implies higher prices and hence vulnerable to over exploitation. Males of many coral reef fishes tend to be preferred due to their distinctive colouration. Selective harvesting for males of particular populations regularly, may lead to reproductive failure and ultimate population collapse due to heavily biased sex ratios in the remaining population.

Many factors lead to post-harvest mortality, such as physical damage and use of chemicals during collection, poor handling practice and disease. Even when collected in an environmentally sound manner, aquarium organisms often suffer from poor handling and transport practices resulting in stress and poor health of fishes. Research on the marine ornamental trade between Sri Lanka and the UK demonstrated that in the mid 1980s about 15% of fish died during and immediately after collection, another 10% died during transit and a further 5% in holding facilities (Wood, 1985). As a result of such mortality, more fish are required to be collected than would be necessary to meet the market demand. On the other hand, when organisms are collected, stored, handled by adequately trained individuals, and transported in appropriate containers, fish mortality has been very low. The post-harvest conditioning facilities should include modern gadgets such as UV lighting systems, protein skimmers and carbon filters.

An analysis of the wild-collected marine ornamental fish trade revealed the following: (i)No species collected for the aquarium trade is yet known to be at risk from global extinction; (ii)In some cases, excessive wild collection of ornamental fishes with destructive fishing methods have led to the depletion of certain species (e.g. Banggai cardinal fish from Indonesia); (iii) Traders in the Philippines reported lower catches of some most valuable species and potential loss of varieties; (iv) Excessive coral collection in Philippines altered community structure; (v) Due to global concerns about overexploitation all international trade of the three aquarium taxa *viz*. sea horses, scleractinian corals and giant clams are controlled under CITES Appendix II (Cato and Brown, 2003).

The primary concerns from the global scenario of wild-collected trade are:

I. Use of cyanide and other destructive collection methods
II. Poor handling and husbandry practices;
III. Unnecessary animal mortality;
IV. Collection of unwanted and/or unsuitable species;

V. Potential for stock depletion;

VI. Ecosystem effect of live coral and live rock exports;

VII. Potential for alien species introduction;

VIII. Lack of reliable data on the resources and trade and

IX. Limited government capacity for reef management and enforcement

A certification system aimed at eco-friendly collection, conditioning and trading will help in the long term sustainability of the trade. It is assumed that most purchasers of marine aquarium organisms prefer that the animals and the reefs that provide them are healthy and that collection practices do not contribute to their degradation. There is thus significant potential to utilize consumer demand for certified marine aquarium products and practices to ensure optimal health of the organisms and environmentally sound and sustainable industry.In this context, the Marine Aquarium Council (MAC) is a golden example of green certification. The Marine Aquarium Council (MAC) has developed a certification scheme that will track an animal from collector to hobbyist.

Established in 1996, the goals of MAC were to develop standards for quality products and sustainable practices and a system to certify compliance with these standards and create consumer demand for certified products. With a network of 2600 stakeholders in more than 60 countries, it is recognized as the lead organization for developing and coordinating efforts to ensure that the international trade in ornamental marine organisms is sustainable. MAC certification covers both practices and products. Even though it stopped functioning in 2008, we can get a lot of information on green certification protocols of marine ornamental fishes from the norms and procedures evolved by MAC.The objectives and the standards developed for certification by MAC are beneficial for formulating guidelines for green certification of marine ornamentals in India. The three types of certification as defined by MAC are as follows:

FIRST PARTY: This type of certification is based upon a self-declaration by the producer that it meets the requirements of a certain standard. This type of claim is generally of limited value, as most consumers do not trust self-declaration. In the case of environmental issues, self-declaration is usually seen as a "green wash" approach, i.e., giving only a nominal service to certain issues such as sustainability.

SECOND PARTY: This type of certification is based upon an assessment that the producer meets the requirements of a standard set by a group of consumers, by government or by a non-government organization. This type of certification is usually better than the first-party certification because the producers do not make the standards and assessment of compliance themselves. However, the standards are often less than objective and comprehensive as they are often subject to the interests of the group that sets them and assesses compliance.

THIRD-PARTY: This type of certification is based upon internationally accepted standards created by a transparent, inclusive, international, multi-stakeholder process. Compliance with the standards is voluntary and is assessed by an accredited, independent third party that has no vested interest in the standards, certification, product or any particular stakeholder group. The International Organization for Standardization (ISO) defines third-party certification as the highest order for proof of compliance.

MAC International Standards outline the requirements for third-party certification

of quality and sustainability in the marine aquarium industry from reef to retail. The four International Standards as fixed by MAC are:

i) The Ecosystem and Fishery Management (EFM) international Standard addresses in-*situ* habitat, stock and species management and conservation by verifying that the collection area is managed according to principles that ensure ecosystem health and the sustainable use of the marine aquarium fishery.

ii) The Collection, Fishing and Handling (CFH) international Standard addresses harvesting of fish, coral, live rock and other coral reef organisms, handling prior to export, holding, plus packaging and transport to ensure the health of the collection area, sustainable use of the marine aquarium fishery and optimal health of the harvested organisms.

iii) The Handling, Husbandry and Transport (HHT) international Standard addresses the handling and tracing of marine life during export, import and retail to ensure their optimal health, their segregation from uncertified organisms and proper documentation to show that they pass only from one MAC Certified industry operator to another.

iv) The Mariculture and Aquaculture Management international Standard addresses the propagation, collection, and culturing of marine aquarium organisms and specifies requirements from broodstock/post-larvae receipt through to grow-out for market; packaging and transport of cultured marine ornamentals.

Certification of practices by industry operators at any link in the chain of custody (collectors, exporters, importers, retailers, etc.) can seek to become MAC Certified by being evaluated for compliance with the appropriate MAC InternationalStandard. MAC Certified marine ornamentals must be harvested from a MAC Certified collection area,or cultured in a MAC Certified facility and pass from one MAC Certified operation to another, e.g., from collector to exporter to importer to retailer. MAC Certified marine organisms bear the 'MAC Certified' label on the tanks and boxes in which they are kept and shipped. MAC Certification covers both products and practices, in other words, both the aquarium organisms and the industry operators involved in supplying those organisms. Industry operators at each link in the chain of custody will be evaluated for compliance with the appropriate MAC Standard. If the company is certified, the facility will display the MAC Certification label on its premises, letterhead, website, etc. Example: from collector to exporter to importer to retailer can be considered "MAC Certified". For the aquarist, this means seeking out a "MAC Certified" retailer and then looking for the tanks with "MAC Certified" organisms in that shop.

MAC was formed primarily to deal with the following weaknesses of the trade:

- Use of cyanide and other destructive collection methods
- Poor handling and husbandry practices
- Unnecessary animal mortality
- Collection of unwanted and/or unsuitable species
- Potential for stock depletion
- Ecosystem effects of live coral and live rock exports
- Potential for alien species introduction
- Lack of reliable data on the resources and the trade
- Limited government capacity for reef

management and enforcement

- Potential for government trade restrictions

All of these are still problems in the marine aquarium trade today. MAC brought about some valuable changes in the industry and produced helpful documentation and trade information. Still, it could not systemically change the way the trade did business. It ceased operation in 2008.A critical analysis of the failure of MAC revealed the following changes to be brought in for any future agency to be successful in this regard (adapted from David Vosseler, 2015).

(i) Focus on moving the trade toward sustainability

- Improved fisher training: training in net harvest and treatment of the reef-no chemical use, no breaking of corals, etc.
- More reef restoration activities: restoring vibrant reefs by replanting corals and mangroves to limit land-based runoff along with no go reef zones (in active partnership with local and international NGOs and governments).
- Produce area management plans: developing adaptive management plans for collection areas using local traditions and social conditions to direct how management systems operate.
- More use of individual species total allowable catch (TAC) limits: setting individual species TACs in management zones-there are a couple of systems that can do this.
- Improve and simplify traceability systems: provide a simple mechanism for industry traceability-needs active trade involvement for this critical mechanism to work.
- Focus on exporter improvement: improve exporter's ability to handle and trace fish; improve exporter profitability (business side of sustainability); support new entries into the market.
- Simplify certification into two parts: fishing areas and fishers, and exporters.
- Active support for better fisher pay-important social condition required for claiming sustainability.
- Develop a more active board and target specific action committees with much more trade involvement
- Actively support efforts that promote sustainable marine reef educational opportunities by partnering with NGOs, schools, governments, and individuals, including small grants.
- Define sustainability and work towards that as the organizational goal

(ii) Remove the mortality requirement

- MAC had a 1% DOA and a 1% DAA requirement at each link of the market chain. While a laudable goal, it put too much pressure on the entire chain of custody to be almost perfect before a fish could be sold at retail. This was an onerous and challenging requirement for most to reach.

(iii) Others

- Keep the traceability requirement through to the importer. If an importer wants to carry the MAC name on fish, they will need traceability; if they don't, no traceability is required but they cannot advertise using MAC fish. Same with retailers, they must show the ability to trace and separate fish.
- Secondary but equally important focus on improving and defending the trade against all challenges, legislative and others Work closely with the trade NGOs to develop

improved working relationships and positive legislation.

- Problems with the original MAC were internal disagreements on direction and objectives, including choices of countries to focus initial efforts and identifying which NGO partners to work with. External issues involved mostly uninterested exporters with some notable exceptions; too much emphasis on certifying importers and retailers and a top-heavy approach with not enough trainers and doers at the local level.
- The marine aquarium trade can help in coral reef conservation through implementation of appropriate managment changes which can indirectly ensure resource sustainability in the long run.

INDIAN SCENARIO

India is endowed with vast resource potential of marine ornamentals distributed in the coral seas and rocky coasts with patchy coral formations (Murty, 2002; Gopakumar, 2007). The major oceanic areas of coral reef distribution in India are the Lakshadweep Islands and the Andaman – Nicobar groups of Islands. The other areas are the coastal areas of fringing or patch reefs of Gulf of Kutch to Mumbai, areas of Central West Coast between Mumbai to Goa, certain locations of South West Coast and Gulf of Mannar and Palk Bay. In this context of the expanding global scenario, it appears very much lucrative for India to venture into this industry. In India, the government's regulatory framework about marine ornamental fish trade presently confines only those sections mentioned in the Indian Wild Life (Protection) Act, 1972. The species included in the schedules are prohibited from wild capture and use in trade. Also, the Act provides for demarcating certain areas as protected marine national parks, from which fish capture is restricted.

Why is green certification essential in the development of the Marine Ornamental Fish Trade in India?

I. We have excellent resources of marine ornamental fishes in our coral reef habitats and patchy reefs along our coast

II. Marine ornamental fish trade is a variety-oriented trade. Even though, hatchery production and trade is most ideal, technology development for hatchery production is confined only to a few species.

III. Even though there is no organised marine ornamental fish trade by collection from the wild in India, many illegal supplies are being practised, which is doing more harm to the resources and habitat.

IV. There are no guidelines for better management practices in the hatchery production of marine ornamental fishes.

V. There are no guidelines on the implementation of the green certification process

HATCHERY PRODUCTION TECHNOLOGIES OF MARINE ORNAMENTAL FISHES AVAILABLE IN INDIA

1) Clownfishes

The technologies for hatchery production of ten species of clownfishes and a few hybrid clownfishes are standardised and hence can be scaled up for commercial level production and a hatchery-produced marine ornamental fish trade could be developed in the country. (Gopakumar*et al.,* 2001; Gopakumar*et al.,* 2008;Ignatius *et al.,* 2001;Madhu and Rema 2002; Rema Madhu *et al.,* 2007; Rema Madhu *et al.,* 2008; Madhu *et al.,* 2008; Ajithkumar and Balasubramonian 2009; Ajithkumar and Gunasundari, 2013; Dhaneesh *et al.,* 2012a;

Dhaneesh *et al.,* 2012b; Swagat Ghosh *et al.,* 2012a and Swagat Ghosh *et al.,* 2012b).

Species of clownfish for which hatchery technologies are developed and standardized in India

Sl. No.	Species name	Common name
1	*Amphiprion Sebae*	*Sebae clownfish*
2	*A.clarkii*	*Clark's anemonefish / yellowtail clownfish*
3	*A.percula*	*Orange clownfish*
4	*A.ocellaris*	*Ocellaris clownfish/false percula clownfish*
5	*A.frenatus*	*Tomato clownfish*
6	*A.perideraion*	*Pink skunk clownfish*
7	*A.nigripes*	*Maldive anemonefish / black finned anemonefish*
8	*A.ephippeum*	*Red saddle anemonefish/ Fire clown*
9	*A.akallopsisos*	*Skunk clownfish*
10	*Premnas biaculeatus*	*Spine cheeked anemonefish/ maroon clownfish*

Recently the ICAR CMFRI has successfully produced designer clown fishes and the protocols for larval rearing and fingerling production have been standardised. The designer clowns such as Picasso, platinum, snowflake, etc are highly sought-after varieties in the domestic as well as international markets.

ii) Damselfishes

The damselfishes belonging to the Family Pomacentridae, are very popular among aquarists due to their small size, bright colours, quick acclimation to captivity and interesting behaviour. The majority of species inhabit the Indo-Pacific region; about 100 species representing 18 genera have been recorded from the Indian Ocean. More than 30 species belonging to the genera *Pomacentrus, Neopomacentrus, Chromis, Abudefduf* and *Chrysipteraare* commonly available from Indian coral seas. Broodstock development and larval rearing were achieved in India for the following species of damselfishes,viz., the three spot damsel (*Dascyllus trimaculatus*), striped damsel (D. *aruanus*), the clowdy damsel, D. *carneus,* the blue damsel (*Pomacentrus caeruleus*), the peacock damsel (P. *pavo*), the bluegreen damsel (*Chromis viridis*), the filamentous tail damsel *Neopomacentrus cyanomos*, the yellowtail damsel (N. *nemurus*), the Sapphire devil damsel (*Chrysiptera cyanea*), Black bar chromis (*Pycnochromis retrofasciatus*), Maldives damselfish (*Amblyglyphidodon indicus*) and Azure damsel (*Chrysiptera hemicyanea)* (Gopakumar and Santhosi, 2009; Gopakumar *et al.,* 2009; Gopakumar *et al.,* 2002; PananghatVijayagopal *et al.,* 2008; Muhammed Anzeer *et al.,* 2019). However, the survival rates during larviculture were comparatively low and not consistent, and hence further up-gradation of techniques are needed before commercialization.

iii) Other fishes

Captive breeding was achieved in the purple firefish *Nemeteleotris decora* (Madhu and Rema Madhu, 2014) and breeding and larval rearing in *Pseudochromis dialectus* (Madhu *et al.,* 2016), *Pseudanthias marcia* (Anil *et al.,* 2018) and *P squamipinnis.* (iv) Ornamental shrimps

The broodstock development and seed production of the camel *shrimp Rhyncocinetes durbanensis* has been achieved by ICAR-CMFRI (CMFRI, 2018). ICAR NBFGR has reported the successful captive breeding of *Thor hainanensis* and *Ancylocaris brevicarpalis.* (ICAR webportal : *https://www.icar.org.in/hi/content/exploring-captive-propagation-marine-ornamental-shrimps-lakshadweep-technology-innovation)*

Hatchery production of marine ornamental fishes can be a lucrative additional source of income for the coastal fishermen. The

immediate way forward for the development of a hatchery produced marine ornamental fish trade in the country includes imparting necessary training to prospective entrepreneurs, supplying brooders/ newly hatched larvae to the trained entrepreneurs, promoting the establishment of a few small-scale hatcheries and establishing appropriate marketing channels. There is a need for establishing for good hatchery practises leading to certification of the same in future.

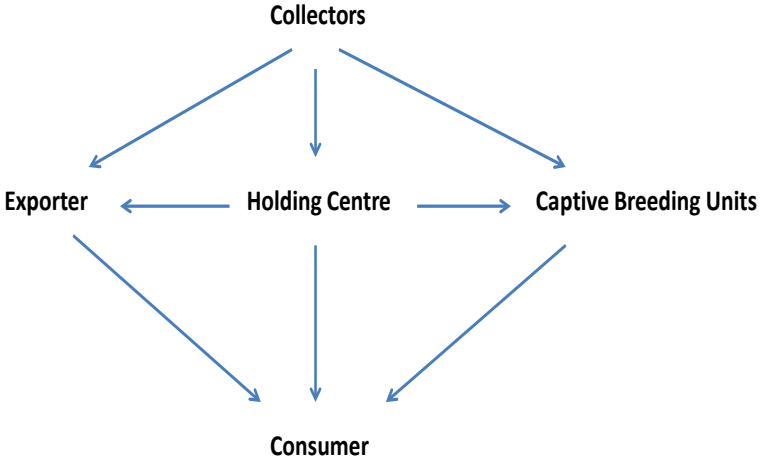
Based on the current technologies, it is neither possible nor economically viable to hatchery produce all the species required for the trade. Hence, the hatchery production of marine ornamental species can be complementary, but may not replace the wild collection. The wild-caught sector and tank reared sector of the aquarium industry should be mutually supportive. In the immediate future, India can emerge as one of the major source countries for a sustainable marine ornamental trade if we take appropriate steps in light of the current global scenario by formulating appropriate policies and certification guidelines for wild collection of species and also by commercial hatchery-production of concerned species.

In this context, it is worth mentioning that a pioneering effort has been made by the Marine Products Export Development Authority (MPEDA), Ministry of Commerce & Industry, Govt.of India, on formulating the guidelines for green certification of freshwater ornamental fishes (Silas *et al.,* 2011). Similarly, a document on the guidelines for collection from the wild, handling, transport, holding, conditioning for export, breeding and culture facilities of marine ornamentals is vital. It is the need of the hour for the development of an organized marine ornamental fish trade in India.

The objectives of this document are:

1. Developing the framework for an environmentally sound and socio-economically viable trade of marine ornamental species.
2. Providing guidelines for green certification standards for the different stages involving collection, holding, conditioning, hatchery production, transportation and marketing.
3. Suggesting procedures on the way forward to green certification protocols.

Hence, the document will provide essential information for developing a certified marine ornamental fish industry in the country.



Chain of custody in the marine ornamental fish sector

5. GUIDELINES

5.1. GUIDELINES FOR COLLECTION OF ORNAMENTAL SPECIES

It is well understood that the bulk of global trade in marine ornamentals is contributed by wild collection, and hatchery technologies are available only for a few species, which indicate that the wild collection will continue to dominate the global trade. It is also widely accepted that indiscriminate or unscientific collection practices pose a significant threat to the sustainable development of the sector. Hence, the development of appropriate guidelines for collecting fishes and other marine invertebrates without damaging the environment is essential to ensure the sustainability of resources and promote the marine ornamental fishtrade.

This section describes the guidelines on all aspects related to the collection of marine ornamental species

"Collection" means the removal of live marine ornamental species belonging to finfish, shellfish, cnidarians (sea anemones, soft corals, jellyfishes etc.), live rock and other marine invertebrates from their natural ecosystem for ornamental trade.

5.1.1. Collection area

Collection area means the geographical location of the natural marine ecosystem with defined boundaries from which the marine ornamentals are collected.

5.1.1.1 Collection area includes coral reef ecosystems, seagrass beds, seaweeds, mangroves, salt marshes and the inter-tidal regions excluding the marine protected areas (MPA's) and any other site declared as sensitive by the Government.

5.1.1.2 Collection area should be free from pollutants.

5.1.1.3 Collection should comply with the Central/State Acts and Regulations and the respective Collection Area Management Plans, if any.

The central/state acts and regulations include the Environment (Protection) Act 1986, the Biological Diversity Act 2002, Wildlife (Protection) Act 1972, Marine Fishing Regulation Act of Maritime states & Union territories, and the rules and regulations framed by Coastal Aquaculture Authority, Department of Fisheries, Government of India.

5.1.2 Marine ornamentals for collection

Marine ornamentals mean any marine finfishes & shellfishes, cnidarians (like sea anemones, soft corals, jellyfishes etc.) and other marine invertebrates or marine flora removed from its natural ecosystem for commercial purposes (Refer to Annexure 1 & 2 for a list of marine ornamental species and their photos).

Some marine ornamental species are protected by Wildlife (Protection) Act 1972 in different schedules based on the level of protection status, so the collection of such marine ornamentals should be done in compliance with the Act. India is a signatory to the international agreement CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), which aims to ensure the international trade in specimens of wild animals and plants, does not threaten their survival and hence species listed in the Appendices should be carefully collected and traded as per the prescribed norms. The list of protected species is given in Annexure 3.

5.1.3 Harvesting, Handling, and Transportation to the holding centres

The coral reef ecosystems and other natural habitats which harbor most of the marine ornamentals are very sensitive when it gets disturbed during harvesting. Hence, destructive collection practices should not be practiced. Collection of live rocks and over-exploitation of targeted species should be avoided. Harvesting methods and quantum of marine ornamentals harvested should be eco-friendly and ecosystem sustainable. Moreover, the optimal health of the collected marine ornamentals should be maintained during field handling and transportation to the holding centre.

The term “live rock” applies to any piece of hard substrate that will assist the development of an architectural structure for aquariums and aquaculture tanks and that has been underwater long enough to develop a community capable of processing and recycling water-born waste chemicals such as nitrogen compounds, amongst others. The community consists of the attached bacterial biofilm and a myriad of larger aquatic algae and invertebrate fauna. The term “live rock” usually is specific to the marine aquarium business. Live rock is acquired for tank water quality maintenance purposes, contributing a large surface area substrate that facilitates active biological filtration within the aquarium environment and stabilizes its water chemistry. The aesthetic part is also essential, shaping the “layout” of the aquarium or “aquascaping” and providing a base to attach other corals, sponges, anemones and clams, and providing shelter for other inhabitants of the reef aquarium.

“Destructive collection practices” means the collection of live marine ornamentals through methods that are environmentally destructive or harmful, which includes practices such as the use of poison, explosives, breaking the coral branches,reef dredging, which results in physical damage to non-target organisms, especially corals or other sessile invertebrates.

5.1.4 Harvesting

5.1.4.1 Collections should be made by hand picking, snorkelling, skin or SCUBA diving using hand nets or by employing traps without harming non-targeted species, including Endangered, Threatened and Protected (ETP) species avoiding inadvertent damage to corals.

5.1.4.2 Destructive gears such as cast nets, gillnets, trawl nets etc. and other gears which physically damage the coral reef ecosystem should not be used.

Handpicking

Sedentary organisms like gastropods, few invertebrates, echinoderms like starfish etc, which are hide in submerged rocks and shells at the seashore can be caught or picked up by hand using hand gloves.

Snorkelling&Diving

Snorkeling is restricted to hand picking or with hand-held nets. At slightly greater depths, SCUBA diving is the primary way to catch fish, again with hand-held nets or to collect marine ornamentals by using hand gloves.

Traps

Traps are set either with bait to lure fish into them or to capitalise on the fish's natural behaviour.

5.1.5 Handling

5.1.5.1 While transferring to the holding tanks or containers, the captured marine ornamentals should be handled gently with a fine-meshed hand net made of soft material like bolting silk without getting exposed to air.

5.1.5.2 Good quality water with sufficient aeration should be kept ready for holding the fish after capture with the hand net.

5.1.5.3 In case of an extended collection period (maximum 12 hours), the collected fishes should be stocked in the natural system/collection area by a holding netcage for temporary storage.

5.1.5.4 Injury during collection should be minimal; if any marine ornamental is injured, it should be treated appropriately.

5.1.5.5 Avoid collecting fishes from deeper waters (more than 10-metre depth) to prevent the bursting of the swim bladder (barotrauma), since the survival rate of such fishes after capture and transport will be low due to damage of internal organs

5.1.6 Transportation

5.1.6.1 The water temperature in the containers for transportation should be the same or slightly reduced (2 to 3^{o}C) from that of the collection area. The temperature reduction may be made by adding sea water ice.

5.1.6.2 If the time of transportation to the holding facility is more than six hours, then it is advisable to do oxygen packing with battery aerators or oxygen cylinders.

5.1.6.3 Marine ornamentals should be packed in double-layer packing bags to ensure maximum safety.

5.1.6.4 Overcrowding should be avoided during transportation from the collection area to the holding centre. Packing density should be adjusted according to the size of the fish. For example, clown fishes of about 3 cm can be packed at a rate of 25 numbers in 8 to 10 litres of water with oxygen (1:3) for a maximum of 6 hours of transportation.

5.1.6.5 Compatible species should be packed together, while aggressive species like Pomacanthids and species with sharp spines like Acanthurids should be packed separately.

5.1.6.6 Use of Anaesthetics for fish transportation

Transportation is a strong trigger for stress in fish, leading to decreased immune system function, resulting in sickness and death. The use of anesthesia reduces metabolic rate, need for oxygen, activity, and response to stress. Commonly used anaesthetics include Tricainemethanesulfonate (MS-222), Clove oil, Benzocaine, Eugenol etc. The ideal anesthetic should produce rapid anesthesia (1–5 min) and rapid recovery (< 5 min), and be cheap, practical to use, water-soluble, and leave no residue in fish, humans, or the environment. The dosage of each varies according to the species, size of the fish, water salinity etc. Hence the dosage needs to be standardized for each species. An indicative dose of various anasthetics used by different workers is given below (Adapted from Purbosari *et al.,* 2019):

Sl. No.	Name of Anaesthetic	Fish	Dose (mg/L)
1	*MS -222*	*Goldfish (Carassius auratus)*	*200*
		Guppy (Poecilia vivipara)	*100*
2	*Eugenol*	*Oreochromis sp.*	*100*
		Guppy (Poecilia vivipara)	*100 -200*
		Lesser guitarfish Zaptery Brevirostris	*85*
3	*Benzocaine*	*Oreochromis sp.*	*100*
		Guppy(Poecilia vivipara)	*100 -200*
4	*Clove oil*	*Hyphessobrycon sp.*	*100*
		Hemigrammus sp.	*100*
		Oryzias Dancena	*125*
		Oreochromis Niloticus	*1239*
		Epinephelus Akaara	*75*
5	*Clove powder*	*Clarias gariepinus*	*80-140*
6	*Nutmeg extract*	*Notopterus chitala*	*7*

5.1.7 Collectors

Marine ornamental species collector means an individual engaged in removing marine aquarium organisms from their natural habitat for commercial purposes. The collector should be a certified person so that the collection's origin can be traced for proper management of the Collection Area. A few trainees can be selected, and appropriate skill development should be imparted in the ecofriendly collection and handling methods jointly by State fisheries departments in collaboration with institutions like ICAR-CMFRI. These trained persons can be licensed as green-certified collectors to collect the fish from the reef habitats.

5.1.7.1 Only trained and certified personnel should be allowed to collect the marine ornamentals from the coral reef ecosystem. Documentary proof for the same (Licensed collector) may be furnished as given in Annexure 4.

5.1.7.2 Marine ornamental collectors should be aware of the importance of suitable, unsuitable and harmful marine ornamental fishes from the collection area. An indicative list of unsuitable and harmful marine ornamental species is given in Annexure 5

"Unsuitable species" means inappropriate for marine ornamental species trade

"Harmful species" means marine ornamental species that can cause harm to the collectors.

5.1.7.3 Collectors should properly maintain a log book as prescribed in the format for the collection of marine ornamentals (Annexure 6).

5.2. GUIDELINES FOR HOLDING AND CONDITIONING CENTRES OF ORNAMENTAL SPECIES

In this document, Holding and Conditioning Centre refers to any facility where the marine ornamentals are held for conditioning, sorting and holding after collection till they are packed for transportation to the traders.

Proper holding and conditioning facility and protocol is the key to the survival of captured ornamental species. A setback in this vital aspect causes very high initial mortality and predisposes the fish to delayed mortality. It is well understood that saving the captured fish adds to conservation and also to profitability.

This section of the guidelines specifies the technical requirements, procedures or protocols in a holding and conditioning centre, which would help the stakeholder successfully improve the survival, health and marketability of the fishes, thus ensuring the overall development of the trade.

5.2.1 Infrastructure

5.2.1.1 Building/Shed: There shall be a proper building/shed to keep the tanks in the holding centre. It shall be properly covered from all sides and top to prevent the entry of other animals/ birds. The flow of material (animals and water) should be designed in such a manner to avoid any chances of cross contamination. A model lay out for designing a holding centre is given in Annexure 7.

The legal documents pertaining to the ownership of the land and building of the holding centre shall be in the name of the applicant. No Objection Certificate from the owner/local clearance may be obtained if necessary, format of the same is given in Annexure - 8. It shall be the sole responsibility of the applicant to ensure legal validity of the documents pertaining to the ownership of the facility and/land

5.2.1.2 Water source: The facility should be set up in an area that has access to clean and pollution-free sea water. The incoming water from the source should pass through a rapid sand filter or a settling tank (minimum 24 hours) before being pumped to the overhead tank

5.2.1.3 Tanks: The facility should have adequate tanks for stocking and conditioning the fish brought by fish collectors. The tanks can be glass tanks, FRP tanks or cement tanks with an epoxy coated smooth inner surface for ease of cleaning and to prevent injury to fish due to brushing against sharp projections/edges. Few tanks should be exclusively maintained for quarantining. The tanks used can range from 100 litres to 1000 litres, with a minimum depth of 50cm or more as per the fishes' size.

The number and capacity of the tanks should commensurate with the number and type of fishes being traded through the holding centre. This will be subjected to verification and approval by the certification officials

5.2.1.4 Aerators: A 24-hour oil-free aeration system is essential to maintain dissolved oxygen levels above 5 ppm in all the tanks. Electrically operated aerators of varying capacitie scan be used. The capacity of the aeration

system will depend on the overall requirement of air in the facility. The aeration line grid should be installed insuch a place where it is not liable to be damaged due to the movement of people and other hatchery items.

5.2.1.5 Filters: It is essential to provide filtration arrangements for maintaining better water quality **(Table.1)** in the fish holding tanks. This may include physical, chemical and biological filters, cartridge filters, bead filters, UV filters etc

5.2.1.6 Power back up: The holding and conditioning centre needs a round-the-clock power supply to operate the aeration and water distribution system. Even for a short duration, power breakdowns reduce/ completely cut down the oxygen supply and lead to mortality. The diesel generators can support power backup for a sufficient period. The generators are to be installed at a suitable place slightly away from the main building to minimize sound and air pollution.

Table.1 Optimum range of water quality parameters for marine ornamental fish holding/conditioning centre

Sl. No.	Parameter	Values
1	*Temperature*	*26-30 ºC*
2	*Salinity*	*32 – 35 ppt*
3	*pH*	*7.5 - 8.5*
4	*Dissolved Oxygen*	*> 5 ppm*
5	*Ammonia*	*0 ppm*
6	*Nitrite*	*0 ppm*
7	*Nitrate*	*< 25 ppm*

5.2.2 Quarantine Section

Quarantine means maintaining a group of aquatic animals in isolation with no direct or indirect contact with other aquatic animals in order to undergo observation for a specified length of time and, if appropriate, testing and treatment, including proper treatment of effluent waters. The quarantine of newly captured ornamentals is the first step to be undertaken before conditioning. It is an essential biosecurity measure to prevent the introduction of disease into the facility from the different batches of introductions. This will cut down mortality and increase profitability.

The basic requirements for effective quarantine include:

- Physical infrastructure to the level of containment required (e.g. secures facilities, secure intake water source, etc.);
- Established operating protocols (including traceability and chain of custody)
- Well-trained staff.

5.2.2.1 Specific construction and equipment requirements

The area designated for quarantine should be completely isolated from the rest of the holding and conditioning facilities since it has a high risk for disease transmission. Isolation includes the spatial separation as well as the separation of water and air lines. If this is not possible, the design should be altered to avoid contamination from the

quarantine to the conditioning area. The number and capacity of the tanks in the quarantine section should be commensurate with the volume/ quantity of the fish movement through the holding centre.

- The quarantine facility should be in an enclosed and covered building with only one controlled and monitored access. It should be adequately isolated from conditioning areas to avoid any possibility of cross-contamination.
- Facilities for disinfection of feet (footbaths containing hypochlorite solution at >50 ppm active ingredient) and hands (bottles containing povidone-iodine (20 ppm and/or 70 percent alcohol) should be provided for use upon entering and exiting the unit.
- Entry into the quarantine facility should be via a staff dressing room equipped with lockers and shower facilities. This room should lead into a second dressing room where working clothes and boots are stored, which in turn leads into the quarantine area proper
- Plastic buckets and other similar containers should be available in adequate numbers in the quarantine room to facilitate effective routine fish movement in and out of the facility.
- The Quarantine Facility should have an independent supply of water and air, with separate treatment and disinfection systems and a system for the treatment of effluents to prevent the potential escape of pathogens into the environment
- All implements used in the Quarantine Facility must be marked and should remain in the quarantine area. Facilities for disinfection of all equipment at the end of each day should be available.
- Entrance to the quarantine area should be restricted to the personnel assigned to work exclusively in this area. Quarantine staff should enter through a dressing room where they remove their street clothes and take a shower before entering a second dressing room to put on working clothes and boots.
- No container or nets can be introduced in this section without disinfection. Used plastic containers and hoses should be washed and disinfected before reuse. Hypochlorite solution (20 ppm) can be used for disinfection.

5.2.2.2 Quarantine Operation Protocols

- The new fishes should be kept for observation for at least one week in the quarantine section for any signs of diseases.
- They shall be given dip treatments in freshwater or formalin or Clove oil to remove any external parasites. The duration of dip treatment and doses varies according to the species and size of fish. Hence it needs to be standardised for each species.

- Formalin can be used as an indefinite bath with a concentration of 12.5 mg/l to 25 mg/l or in a short-term bath (30–60 minutes) at a concentration up to 250 mg/l.
- Weak fishes in the incoming stock should be culled out to give extra care and shall be held in isolation and mixed with the healthy ones only if they recover fully.
- On introduction into the quarantine area, the ornamentals must be well acclimatized. The duration of acclimatization depends upon the temperature and salinity of the transport water. To stabilise the temperature difference between the transport water and receiving tank water, float the polythene bags with fish in the tanks for some time (5 minutes). Care must be taken to ensure that the water's salinity in the receiving tanks and transport water is the same. Once the temperature stabilises between the transport water and receiving tank water, slowly open the bag and allow the waters to mix. Open the bag so that the fishes swim out of the packing bags to the tank water.
- Fresh /sterilized feeds are to be given to the fishes, feeding little and often to demand to maintain water quality. Handling of fishes should be reduced to a minimum at all times and dissolved oxygen concentrations maintained at saturation. Staff working in the quarantine area should not be permitted to enter other sections and should follow sanitary protocols at all times.
- Seawater to be used in the facility should enter a storage tank where it should be treated with hypochlorite solution (30 ppm active ingredient for not less than 30 min) before inactivating with sodium thiosulphate (1 ppm for every 1 ppm of residual chlorine) and vigorous aeration.
- Water quality requirements in the quarantine system are a temperature of 27–29^{o}C, the salinity of 29–34 ppt and a pH of 7.5–8.5, maintained by 200–300 percent of water (filtered to <20 µm) exchange daily (on a flow-through rather than rapid-change basis or preferably RAS), permitting adequate feeding of the fishes while maintaining optimal and stable water quality.
- Wastewater from the quarantine facility should be released into a special concrete or lined sedimentation tank. From the sedimentation tank, it should overflow into a treatment tank where it should be chlorinated (>20 ppm active chlorine for >60 min or 50 ppm for 30 min) and then dechlorinated through aeration or neutralization using sodium thiosulphate to achieve a residual chlorine concentration < 5 ppm before discharge.
- All mortalities or infected animals should be incinerated or buried.

5.2.2.3 Water quality

- The water quality in the fish holding tanks is the most important aspect which determines the success of the venture. The deteriorated water quality leads to stress to the fishes and attack by opportunistic pathogens, ultimately resulting in low survival and financial loss to the stakeholder. Good water quality can be ensured if proper care is taken while setting up aeration and filtration arrangements apart from following good management practices. It is advisable to set up recirculation systems to reduce water usage and further enhance biosecurity, especially in quarantine areas. Essential components of a marine recirculation system include a particle filter (to filter out particulate matter), a biological filter

(to reduce toxic ammonia levels) and a protein skimmer.

Table 2.An indicative list of equipments for water quality monitoring in a holding facility of marine ornamental fish.

Sl. No.	Name of the equipment	Purpose
1	*pH meter*	*To monitor the pH of the water*
2	*Refractometer*	*To monitor the salinity of the water*
3	*Thermometer*	*To monitor the temperature of the water*
4	*Dissolved Oxygen meter*	*To monitor the dissolved oxygen in the water*
5	*Alkalinity Test kits*	*To monitor the alkalinity in the water*
6	*Hardness test kits*	*To monitor the hardness in the water*
7	*Ammonia test kits*	*To monitor the ammonia levels in the water*
8	*Chlorine test strips*	*To monitor the chlorine levels in the water*

Water quality of the source water (as regards to presence of pollutants or pathogens) may be tested from reputed testing lab/ labs once in six months and test reports shall be documented for verification by the certifying officials. Water quality in the rearing/holding tanks shall be monitored weekly and documented for verification by the certification officials. Discharge water should be held temporarily and treated with hypochlorite solution (>20 ppm active chlorine for not less than 60 min) or another

5.2.2.4 Stocking Density

- The stocking density refers to the number or weight of fishes stocked per unit volume of water such as numbers per litre or grams per litre of water.
- The stocking density varies according to the fish variety and water quality management strategy employed at the facility. If there is an excellent aeration and filtration system, the stocking density can be more, where as if the aeration and filtration arrangements are minimal, stocking density need to be kept low. Hence, the best practice to follow with regard to

stocking density is that; maintain a stocking density which will not lead to alteration of the water quality parameters beyond the optimum levels.

- The space requirement of the fishes for their normal movement also should be taken into consideration. For example, an indicative stocking density for clown fish can be 1 fish per litre of sea water for a fish of 1 cm size, whereas for a 3 cm sized fish, it needs to be reduced to 1 fish per 2 litres of sea water.

5.2.2.5 Feeding

- The fishes maintained in the holding centre shall be fed on suitable diets as per the feeding habits of the species being maintained. Wild collected fishes normally needs some time to adjust to the captive conditions to start feeding, whereas hatchery produced fishes can be fed on readily available pellet feeds.
- Wild collected fishes need to be weaned to artificial feeds. The pellet size is decided based on the mouth size of the concerned fish.
- Fresh feeds such as minced fish/ shrimp, clam meat etc. can also be fed to the fishes. Care has to be taken to ensure that these fresh feeds do not pose any health risks to the fishes
- Feeding frequency shall be 3 - 4 times a day. Juveniles can be fed ad-*libitum,* whereas adults shall be fed @ 2-5 % of body weight.

The fishes received at the facility shall be from a Green Certified Collector of marine ornamental fishes. The details of incoming fishes, quarantine treatments given shall be properly documented as per the format given in **Annexure - 9**

The number and capacity of the tanks used for quarantine section as well as the positioning of the same in the holding centre shall be verified for compliance by the certification officials.

5.2.2.6 Documentation requirements

Proper documentation of the activities in the holding centre is essential to ensure proper management of the facility. It also helps to track the history of treatments given to fishes and devise new methodologies to refine the overall working protocols in the facility. Formats of the documents to be kept in a holding centre are given in **Annexures 10 to 12**

A copy of the legal documents pertaining to the ownership of land or facility shall be made available for verification at the site. All other mandatory documents/ Log books pertaining to various activities shall be maintained at the facility.

5.2.2.7 Capacity building

Capacity building is an essential component to ensure success and sustainability in the trade. Hence the capacity of infrastructure and personnel needs to be upgraded periodically to keep up with the latest techniques, rules and regulations. The

personnel manning the facility shall be given proper training on all aspects of fish handling, health management, quarantine treatments, biosecurity, water quality monitoring and management. The equipment used for monitoring water quality parameters (such as temperature, D.O, pH, Ammonia, Nitrite, Nitrate, etc) needs to be calibrated periodically to ensure the correctness of the values. Repair and maintenance of the aerators/ blowers, filtration arrangements is essential at regular intervals shall be carried out to maintain the efficiency of the equipment.

Records on periodical maintenance of equipments, calibration records of equipments, etc shall be maintained at the facility for verification by the certification officials. Documentary proof of training of the personnel manning the facility shall be maintained at the facility for verification by the certification officials.

5.3. GUIDELINES FOR CAPTIVE BREEDING AND SEED PRODUCTION UNITS OF MARINE ORNAMENTAL SPECIES

In this document, captive breeding and seed production means the broodstock development and production of young ones of marine ornamental species.

The hatchery production of marine ornamental fishes is the only long-term option for sustainable marine ornamental fish trade. However, captive breeding and seed production face many challenges over decades, especially in domestication for maturation (broodstock development), breeding, spawning, larval and juvenile rearing, management of diseases, water quality etc. Hence an appropriate guiding document for proper management of the facility is imperative for the sustainable development of the trade.

This section provides the guidelines for green certification of a captive breeding and seed production unit of marine ornamental species.

5.3.1 Selection of site/ location

5.3.1.1 The site for establishing ornamental fish breeding unit should have easy access to seawater source

5.3.1.2 The place should be well connected by rail, flight and bus services for enabling transport of seed/feed/or accessories.

5.3.1.3 The site should be free from pollution

5.3.2 Building/Shed

5.3.2.1 The building/shed should have a proper concrete floor to keep the tanks in which the broodstock, breeding pairs, larvae and juveniles are reared.

5.3.2.2 All sides and top should be properly covered to prevent the entry of other animals/birds, safeguard from rainwater, and maintain temperature and other environmental parameters. Sufficient ventilation shall also be provided.

5.3.2.3 The building should be designed and constructed in such a way to accommodate all the sections of the hatchery *viz*, Quarantine section, Brood stock holding and breeding section, Larval rearing section, Grow-out Live feed section and Packing section.

The owner/ applicant should have all legal documents in his or her name such as original deed, location sketch, possession certificate, land and building receipt, encumbrance(10years),etc. which are needed to be obtained from the competent authority of revenue department of concerned area.
If not, No Objection Certificate and legal valid agreement in stamp paper from the owner may be obtained, for which the format is given in **Annexure 13 & 14.**

5.3.3.1 The sea water should be pellucid, free from all types of contamination/ pollution

5.3.3.2 Collection site of sea water should be an area with rocky substratum (preferably) to avoid cloudy water.

5.3.4 Tanks

5.3.4.1 Assorted sized tanks (size also depends on size of the candidate species) should be available in fish breeding unit. For example, a broodstock development tank for one pair of clownfish requires a glass tank of 150 to 200 Litre capacity (Dimensions: 3 ft x 1.5.ft x 1.5 ft)

5.3.4.2 All tanks should be cleaned and maintained properly

5.3.4.3 Perspex, glass and FRP tanks with inner surface of blue, yellow/ black/ white colour, and epoxy coated cement tanks canbe used in the hatchery.

5.3.4.4 Marine and freshwater overhead tanks (5000 to 10,000 litre capacity) should be provided to distribute water in the entire hatchery with gravitational pull without the expense of electricity.

5.3.5 Structural support for keeping tanks and its location

5.3.5.1 The cement or wooden stand or platform (with a height of 30 to 40cm) to place the tank should be strong enough to support weight of tanks.

5.3.5.2 Tanks should be kept at an elevated (30-40cm height) place without causing any hindrance to the daily cleaning/siphoning of tanks and away from direct sunlight to reduce the algal growth.

5.3.6 Power backup:

Breeding unit should have round the clock aeration without any interruption of power supply. Hence,alternative power source (like generator)is a must in a breeding unit.

5.3.8 Exhausters:

Hatchery should have exhausters to reduce the evaporation rates of marine water in tanks, especially in warmer months. This will also help reduce the labour work for daily refilling the tanks, which will affect the water quality and gonadal maturation of the brooders and increase the chances of pathogen introduction into the system.

5.3.7 Aerators

Aeration should be provided through air tubes and perforated air stones for medium sized bubbles between ½ and 1 mm in diameter.

5.3.9 Filters

Efficient filtration is mandatory in a marine aquarium to remove two basic types of contaminants in aquarium, *viz*. suspended physical particles and dissolved chemical compounds.

5.3.9.1 Mechanical filtration

A mechanical filter should be used with power filters, motor, sand, gravel, sponge or glass-wool to remove very small particles like algae, bacteria, free-swimming parasites, accumulated dirt and detritus. A cartridge filter also can be used with pore sizes such as 10 microns, 5 microns, 1 micron etc. The filter should be cleaned once in 15 days to avoid clogging in filter materials

5.3.9.2 Chemical filtration

Activated carbon can be used to remove dissolved compounds, toxins and colour, and regulate pH. The filter materials should be cleaned and renewed every three months to avoid clogging. The carbon filter or box filter or canister filter can also be provided either inside or outside the aquarium

5.3.9.3 Biological Filtration/ Undergravel filtration

5.3.9.3.1 The components of this filter system consist of fine and coarse sand, gravel of about 1-4mm in diameter, oyster shell, small charcoal bag, muslin cloth, pebbles, PVC pipes, air pump and tube.

5.3.9.3.2 In order to have optimum water flow through this filter, materials should be arranged in the following manner from bottom to top: oyster shell, pebbles, small charcoal bag, muslin cloth, coarse sand, muslin cloth and fine sand.

5.3.9.3.3 Inlet pipe and outlet pipe should be fixed at bottom and upper part of the tank respectively.Outlet pipe should be above the water level (2 to 5cm height). Through the outlet pipe one air stone should be placed at the bottom of this pipe to pull out the filtered seawater

5.3.9.3.4 Filter materials should be washed with hot water (50-60^{o}C) once in 6 months. In case of more stocking density of fish, it should be washed once in 3 months

5.3.10 Broodstock development and maintenance

The breeding unit should have a log book as prescribed in **Annexure- 15,** and daily activities in broodstock, microalgal and zooplankton unit should be documented as mentioned in **Annexure 16, 17 and 18,** respectively.

5.3.10.1 The broodstocks/ spawning tanks need to be kept in an apt place where the fish receive natural lighting to facilitate the influence of the full moon/new moon phase or any such environmental cues for breeding.

5.3.10.2 Suitable host species should be provided, such as sea anemones for clownfishes

5.3.10.3 In the case of clownfish, broodstocks or spawning tanks should be 250 to 500 L capacity and also be provided with a layer of coral sand on the bottom, a healthy anemone (not an inevitable factor for breeding), the substratum for egg deposition, bright lighting and suitable filtration arrangements.

5.3.10.4 Proper hiding places like earthen pots or tile should be provided in the absence of anemones in the tanks.

5.3.10.5 Only one pair (male and female) of same species should be allowed in the breeding tanks in the case of monogamous pairs whereas in the case of harem breeders, more than two male and female can be allowed in a tank which is also dependent on the size of the tanks. Five to nine fish (5 to 15cm size) can be allowed in a 500-litre capacity tank.

5.3.10.6 The pairs should be fed with wet feeds such as meat of green mussel, shrimp, clam meat and fish egg mass, and also formulated feeds enriched with vitamins,minerals and algal powder at the rate of 5 to 10% of their body weight and supplied at an interval of every 3 hrs during day time. Care must be taken toensure the use of pathogen free wet feeds.

5.3.11 Water quality parameters

For broodstock development and breeding, the water quality has to be maintained as given below:

Parameters	Range
Temperature	*26 to 29°C,*
Dissolved oxygen	*4.6 to 6.2 ml/L*
pH	*8.1 to 8.4*
Salinity	*33 to 35 ppt*

5.3.12 Substrate for egg deposition

Substratum like tiles or earthen pots or shells of oyster or PVC pipes or natural rocks should be provided for egg deposition which will also be helpful for transfer of deposited egg to hatching tank

5.3.13 Scattered or broadcasting eggs

The fishes such as angel fishes and wrasses are broadcast spawners. After spawning, parents should be transferred immediately after fertilization of eggs. The eggs should be scooped, washed and reared separately in a hatching tank with adequate aeration for incubation and embryonic development

5.3.14 Parental care and egg morphology

5.3.14.1 The parents should be allowed to remain in the spawning tank itself as parental care is inevitable for hatching out of the larvae during incubation period (Example: Clown fish, Damsel fishes, fire fish, etc.).

5.3.14.2 In order to identify the healthy eggs, its colour change should be noticed. In case of clownfishes , the newly spawned eggs are white to bright orange, then it turns to black and later to silvery colour during incubation.

5.3.14.3 In case of fishes like dottyback, the male along with egg bunch should be safeguarded from the female. The female should be removed and reared in the same tank itself with a transparent separation during the period of incubation.

5.3.15 Egg hatching

In the case of clownfishes, on the expected day of hatching, two hours before sunset, the eggs along with substratum/ egg bunch should be transferred from the parental tank to hatchingtanks (100 L) provided with complete dark environment for accelerating the hatching. Larval rearing facilities should be ready before hatching, and the peak hatching takes place shortly after sunset

5.3.16 Larval rearing

The larval rearing can be carried out in three ways

- Same tank (parental tank) method in which parents are removed before larval rearing.
- Transferring of eggs to hatching tank and subsequent larval rearing
- Transferring of larvae from the brood stock tank to the larval rearing tank under green water system

5.3.16.1 Every day, larval rearing tank should be cleaned with cotton or bottom siphoned off to remove dead larvae, detritus and feces.

5.3.16.2 Water exchange should be done at the rateof 25% per day.

5.3.16.3 Every day fresh algae should be added without causing any temperature change in the larval rearing tanks

5.3.16.4 Seawater should be filtered through a series of sand filters and cartridge filters before being taken to the larval rearing tank.

5.3.16.5 Maximum care should be given when the larvae change in feeding behavior from endogenous to exogenous. In the case of clown fishes, 3rd to 8th day of post hatching (dph) will be critical.

5.3.16.6 As most of the marine ornamental fish larvae have less yolk reserves,it starts feeding within few hour after hatching. Hence feed should be given soon after the hatching.

5.3.16.7 Selection of live feed should be based on its nutritional quality and size which is suitable for the mouth gape of fish larvae. Size of zooplankton given as live feed should be less than 80µ for its active feeding by newly hatched larvae. Live feed such as Copepods, Rotifers and Artemianauplii can be given for larval rearing.

5.3.16.8 The medium used for larval rearing should be fortified with microalgae such as Nannochloropsis oculata, Chlorella salina and Isochrysis galbana in 1: 1: 0.5 ratio from 0 to 20dph(green water technique)

5.3.16.9 Microalgal culture

The micro algae or phytoplankton forms the feed of the zooplankton such as rotifers and copepods which are given as first feed to the fish larvae. The important species widely used in marine ornamental fish hatcheries include *Nannochloropsis oculata, N salina, Chlorella sp, Isochrysis galbana, Tetraselmis sp,* etc. There shall be a pure/stock culture section to maintain the pure strains without contamination and a mass culture section to supply adequate quantity of microalgae for culture of zooplankton as well as to the larval rearing tanks to maintain optimum algal density.

- The stock culture maintenance shall be carried out with utmost care by following aseptic handling protocols and with sterile utensils and culture media to avoid any chances of contamination. This section shall be a closed room with air-conditioning facility to maintain a room temperature of 22-24^{o}C. The pure cultures are usually maintained in test tubes, from which the quantity can be scaled up systematically to conical flasks, Erlenmeyer flasks (5L capacity) and Plastic carbuoys of 20L, which forms the inoculum for the mass culture. Different types of culture media are available such as Conway-Walne's media, Miquel media, F/2 media etc. Pure inoculum is added to sterilised sea water with culture media according to the prescribed dose for each media, which is then kept exposed to a light source (1200

-1500 lux) for the algae to grow by photosynthesis.

- Mass culture is done in tanks which are usually kept outdoors exposed to sunlight. Here inoculum from stock culture section is added to sterilised sea water. The nutrients for algal growth can be added either in the form of culture media or commercially available fertilizers such as ammonium sulphate, Urea, super phosphate etc can be used in order to reduce the production cost.
- A simplified methodology for preparation of microalgal culture media and dose of adding commercial fertilisers is given in Annexure – 19.

5.3.16.10 Rotifer culture

Rotifers are the most widely cultured live feed for the seed production of marine finfishes. More than 1000 species have been described, 90 % of which inhabit freshwater habitats. The two species widely used for marine fish larviculture are *Brachionus plicatili sand B. rotundiformis.* The mode of reproduction is both sexual and asexual (parthenogenesis), the latter being more common. The culture technique comprises of stock culture and mass culture.

- Small stock cultures must be kept in closed vials in an isolated room to prevent contamination with bacteria and/or ciliates. Further upscaling is essential for the regular mass-production of rotifer. The wild-collected rotifers must be disinfected with a cocktail of antibiotics (e.g. Erythromycin-10 mg/l, Chloramphenicol-10 mg/l, Sodium oxolinate-10 mg/l, Penicillin-100 mg/l, Streptomycin-20 mg/l) or a disinfectant before being used for stock culture.
- The culture water (seawater diluted with tap water to a salinity of 25 ppt) is aerated, pre-filtered over a one µm filter bag and disinfected overnight with 5 mg/l NaOCl. The excess of NaOCl is neutralized with $Na_2S_2O_3$, The vials (50 ml conical centrifuge tubes), previously autoclaved and filled with 20 ml of culture water, are inoculated with an initial density of 2 rotifers/ml. The vials are exposed to the light of two fluorescent light tubes at a distance of 20 cm (light intensity of 3000 lux on the tubes). The food consists of marine Chlorella or *Nannochloropsis* or *Isochrysis*, around 4ml good cultures are to be added. Shaking is needed to mix with enclosed air to provide enough oxygen for the rotifers. The stock cultures for rotifers are to be kept in a temperature-controlled room ($28^{o}C \pm 1^{o}C$). The rotifers are rinsed, a small part is used to maintain the stock, and the remaining rotifers can be used for upscaling. After some months of regular culture, the stock cultures have to be disinfected to keep them healthy and clean.
- Rotifer mass culture is carried out in large tanks (1-2t). The rearing

can be done using microalgae, baker's yeast or an artificial diet. Clean sterilised seawater (salinity adjusted to around 25ppt) shall be filled in the culture tank. Inoculate the tank with the stock culture and algal culture @ 20% of tank volume shall be added, and on next day onwards yeast can be added. On subsequent days the water level can be increased with the addition of feed. The harvest can be started from the 4th day onwards. Bottom siphoning to remove settled yeast particles and water exchange will reduce ammonia's build-up, which is detrimental to the multiplication of rotifers. The harvested rotifers are to be washed and enriched before feeding to the fish larvae.

5.3.16.11 Artemia

Artemia salina, popularly known as brine shrimp, is the most popular and globally accepted live feed and lifeline of aquaculture. The unique property of Artemia to form dormant embryos, called 'cysts', is the reason for making it the popular live feed. The cysts are available year-round in large quantities along the shorelines of hypersaline lakes, coastal lagoons and solar salt works scattered over the five continents. After harvesting and processing, cysts are made available in cans as storable 'on demand' live feed. Upon some 24-h incubation in seawater, these cysts release free-swimming nauplii that can directly be fed as a nutritious live feed to the larvae of a variety of marine as well as freshwater organisms.

For artemia cyst hatching, use a transparent or translucent cylindroconical tank. Supply air through an open aeration line down to the tip of the conical part of the tank; oxygen level should be maintained above 2ppm and apply vigorous aeration. Hydrate cysts before hatching by incubation in tap water for 1-2 hours and use filtered natural seawater for hatching. Incubate cysts at a density of 2 to 5 g/L. Incubate for a fixed time period (e.g. 20 hr). Remove the aeration prior to harvesting, wait to separate between nauplii and unhatched cysts. Nauplii will go down to the bottom and unhatched cysts will float. Concentrate nauplii using a light source, sieve nauplii and rinse well with tap water.

When hatching large quantities of cysts, an impressive bacterial load rapidly develops. Reducing bacterial development during hatching will improve the hygienic status of nauplii and may result in better hatching yields. It can be achieved through simple disinfection of the cysts using liquid bleach solution or through decapsulation. This can be done as follows:

Prepare 200 ppm hypochlorite solution, Soak cysts for 30 min. at a density of ± 50 g cysts/L, Wash cysts thoroughly with tap water on a 125 µm screen; Cysts are ready for hatching incubation.

5.3.16.12 Copepod culture

Many ornamental fishes such as damsel fishes have smaller larval mouth size when compared to clown fish, due to which the live feed given should be smaller than rotifers. The best option for this is the use of copepod nauplii/ copepodite of suitable size and nutritional value. Techniques for culture of copepod species with suitable size and nutritional value, such as *Parvocalanus crassirostris, Acartia spinicauda, Pseudodiaptomus serricaudatus, Temora turbinata, Euterpina acutifrons* etc have been developed by Vizhinjam Research Centre of ICAR CMFRI (Santhosh *et al*, 2018). The primary requirement for copepod culture is the isolation and maintenance of pure strains of the desired species, which then can be cultured on mass scale by feeding with microalgae such as *Nannochloropsis oculata, N salina* or *Isochrysis galbana*. Utmost care may be taken to avoid contamination of the copepod culture tanks with other zooplankton species which can cause total crash of the culture. Clean filtered and sterilized sea water is to be filled into the culture tanks initially and then the pure strains of copepods can be inoculated to these tanks followed by addition of microalgae. The copepod culture tanks may be placed at geographically separated place from rotifer culture section to avoid cross contamination. The copepod nauplii can be harvested by filtering with sieves of suitable mesh size and can be fed to the fish larvae.

5.3.16.13 Bio enrichment of live feeds

Mixed microalgae such as *Chlorella salina, C. marina, Nannochloropsis oculata* (1x 10^6 cells/ ml) in a circular transparent tank should be used as a medium for enrichment. Duration of enrichment should be 3 to 6 hours

5.3.16.14 The water quality parameters in the larval rearing tanks may be maintained as given below

Parameters	Range
Temperature	*26-30 ºC*
Salinity	*32 – 35 ppt*
pH	*7.5 - 8.5*
Dissolved Oxygen	*> 5 ppm*
Ammonia	*0 ppm*
Nitrite	*0 ppm*
Nitrate	*< 25 ppm*

5.3.17 Light intensity

Low-intensity light is ideal for larval rearing. All the four sides of the tanks should be covered with black cloth or painted black to avoid reflection of the light, if larval rearing is done in glass/ perspex tanks

5.3.18 Juvenile rearing

5.3.18.1 Juvenile fishes can be reared in 250 to 1000 litre capacity glass, perspex, or FRP tanks with biological filters at a stocking density of 1-2 fish per litre.

5.3.18.2 Tanks should be cleaned once in 24 hrs, water quality parameters should be maintained as in the case of larval rearing tanks.

5.3.18.3 Some marine ornamental fishes (e.g. Clownfishes) exhibit social hierarchy, ie, dominant fish will grow faster and suppress the growth of smaller ones. This can be overcome by size grading and rearing them in separate size groups

5.3.18.4 Once a week, one-third of water should be removed and refilled with the same quantity of filtered seawater in all juvenile rearing tanks.

5.3.18.5 Juvenile feeding:

Juveniles can be fed with special formulated feeds such as Varna feed developed by ICAR-CMFRI. Wet feeds such as mussel meat, prawn muscle, fish eggs and minced flesh of trash fish can also be used at the rate of 10 to 15 % of body weight.

5.3.19 Capacity building

5.3.19.1 Since breeding of marine ornamental fishes is a highly skill-oriented activity, personnel engaged in breeding, larval rearing and live feed units should be adequately trained on these aspects. Periodically, their knowledge shall be updated to the latest trends in the sector.

5.3.19.2 The equipment used for monitoring of water quality parameters (such as temperature, D.O, pH, Ammonia, Nitrite, Nitrate etc.) should be calibrated periodically to ensure the correctness of the values

5.3.19.3 Repair and maintenance of the aerators/blowers, filtration arrangements is essential at regular intervals and need to be carried out to maintain the efficiency of the equipment.

5.3.20 Model layout of a marine ornamental fish breeding unit is given in **Annexure- 20**

5.3.21 Documentation requirements

Proper documentation of the activities in the captive breeding facility is essential to ensure proper management of the facility. It also helps to track the history of treatments given to fishes as well as to devise new methodologies to refine the overall working protocols in the facility.

A copy of the legal documents pertaining to the ownership of land or facility shall be made available for verification at the site. All other mandatory documents/ Log books pertaining to various activities shall be maintained at the facility.

5.4. GUIDELINES FOR PACKING AND TRANSPORTATION OF MARINE ORNAMENTAL SPECIES

The overall success of the marine ornamental fish trade is completely dependent on an efficient mechanism for the transportation of the fishes from one place to another. An efficient mechanism of live fish transportation aims to transport the maximum number of fishes to the destination with the lowest possible mortality at minimum expenditure. DOA (Dead On Arrival) and DAA (Dead After Arrival) are the two yardsticks employed by the live fish traders to assess transportation efficiency. If the consignments do not conform to the prescribed percentage of DOA and DAA, it is likely to be rejected which results in huge loss to the seller/exporter. Transportation without optimum water volume, oxygen and packing densities may lead to metabolic disturbance and mortalities (Berka, 1986; Ayson *et al.,* 1990; Gou *et al.,* 1995; Kaiser and Vine, 1998). Hence incorrect methods or protocols employed for transportation will lead to a complete failure of the entire efforts put in by other segments of the value chain.

The transportation can be done either in open containers with adequate arrangement for oxygenation of the transport water or in closed containers. Most of the ornamental fish traders use the closed system for transportation. During transportation in a closed system, the fish are confined within plastic bags charged with oxygen. The water in these closed containers may become oxygen-depleted, accumulate excessive carbon dioxide, and therefore reduce pH. Metabolic activity may also lead to elevated ammonia levels in the water, damaging fish health or becoming lethal in extreme cases. The factors influencing the success of live fish transport are transportation time, size of the fishes, freight charges and the health and welfare of the fishes. The critical limiting factor in increasing the fish loading density in a live-fish transport system is the deterioration of the quality of transport water due to the accumulation of metabolic wastes. The current marine ornamental fish packaging practice focuses mainly on controlling the quality of transport water and reducing the amount of metabolic wastes in transport water, such as fasting and lowering the temperature of transport water.

This section of the guidelines specifies the technical requirements, procedures or protocols for transportation of marine ornamental fish, which would help the stakeholder progress successfully and sustainably in the trade by ensuring the health and welfare of the fishes ultimately ensuring the DOA and DAA are within the allowable limits. As packing and transportation are performed at all points in the chain of custody, this section will act like a reference/guidance document for all stakeholders of the sector, *viz*, collector, holding centre, captive breeding units, exporter and retailer.

5.4.1 Pre-requisites for packing

This involves the protocols and necessary preparatory steps before packing the fish. It is an important step in quality control. Fish that fail to adapt to the packaging conditions and show signs of sickness are eliminated from the transport to reduce the risk of mass mortality.

5.4.1.1 There should be a separate area earmarked for packing in a holding centre/breeding unit/marketing facility

5.4.1.2 Before harvesting and packing, it is important to make sure that all required materials for packing are available. Suitable bags for packing should be in stock, as well as the insulated styrofoam inserts and outer boxes. Other critical supplies include a full oxygen cylinder and regulator to inflate the bags, rubber bands to seal the bags and tape to seal the boxes. If any of these items are missing, packing should not be attempted.

5.4.1.3 To ensure safe transportation, the fishes should be placed in double bags (one inside the other sealed independently or together) to reduce the possibility of a puncture and leakage

5.3.16.4 The fishes selected for transport should be inspected for any signs of health problems, external parasites, bruises, lesions etc and only the healthy ones shall be selected for transport since weak ones will not be able to withstand the transport stress.

5.4.1.5 The pre-harvest inspection should be done at least one week before the actual packing date.

5.4.1.6 The fishes should be starved for 24 hrs or more depending on the species before packing to remove all faecal matter and to ensure optimum water quality during transport

5.4.2 Packing protocol

The system used for packaging marine ornamental fish for transport is a closed one in which all factors to meet the requirements of the fish for survival are self-sustained. It involves packing the fish in sealed polyethene bags filled with clean filtered seawater.

5.4.2.1 The objective of live fish transport is to maximize loading density and concurrently to maintain the fish in good condition on arrival. High water temperature reduces the loading density of fish due to the increased metabolic rate of fish. It results in faster bacterial growth and lowers dissolved oxygen levels, leading to increased waste production and decreased oxygen availability to the fish. Hence, the temperature of transport water is usually reduced to the level that the fish can tolerate, 22^{o}C to 24^{o}C for tropical fish and 15 to 18^{o}C for temperate species.

5.4.2.2 Sudden temperature changes stress the fish, suppress its immune system and can lead to disease and death. Therefore, fish are allowed to acclimate to the packaging temperature in an air-conditioned room for 4 to 6 h. After that, they are packed in water that has been cooled to the desired temperature at the packaging.

5.4.2.3 The pre-packaging acclimatization can be done by packing the fish in oxygen-filled bags and keeping them in racks in the air-conditioned room. Before final packing, inspect the bags for any weak fishes which could not with stand the packing stress. Those fishes need to be culled out.

5.4.2.4 Once the fishes are acclimated to the packing temperature, the required number of fishes are counted and introduced into the packing bag after filling the required quantity of packing water.

5.4.2.5 Oxygen is then passed through the mouth of the bag through a polythene tube immersed fully in water. After filling, the swollen bag is firmly twisted, folded and tied with the help of a thick thread or rubber band. The filled-in oxygen in the inflated bag gradually gets dissolved in water. During the transport, the fishes use the diffusing oxygen in the water for respiration

5.4.2.6 Packing can be done one fish per bag also according to the size of bag and fish. This is more time consuming, but the advantage is that, mortality or illness of one fish does not affect the other fish being transported. This is more often done if there is a fighting nature among fishes in the same bag. It is also advisable in case of fishes with very delicate and fragile fins which may get damaged during transport so as to retain the attractive finnage of the fish.

5.4.2.7 After packing, it is advisable to keep the bags in a Styrofoam (polystyrene) box to provide thermal insulation to prevent sudden changes in the temperature of the transport water. It can also be packed in carton boxes or troughs if it is not meant for transport by air.

5.4.2.8 Maintaining transport water temperature throughout transit is a significant problem of the fish packaging system. Hence, it is imperative that styrofoam boxes used for ornamental fish packaging shouldprovide good thermal insulation during the transit time.

5.4.2.9 For short-distance transport, where temperature reduction is not highly necessary, the bags can be packed in hardboard carton boxes also.

5.4.2.10 Estimate the optimum fish density in the transport container based on the total transport time or shipping time. This can be streamlined by conducting packing trials. The volume of transport water limits the number of fish that can be packed. The loading density of fish is expressed as the biomass of fish (g) per unit volume of water (L). For example, 50 numbers of clownfishes (1-1.5 gm size) can be packed in a polythene bag with 8-10 litres of clean filtered seawater for a total transport time of 18hrs duration.

5.4.2.11 The most important factor in live-fish transport is an adequate supply of dissolved oxygen. The dissolved oxygen required is dependent on the number, size and species of fish being transported. Generally, the water is supersaturated with oxygen such that, after the transport when the bag is opened, a dissolved oxygen level of 5-6ppm is maintained. The volume of pure oxygen supplied to the transport bag can be up to three to four times the volume of water. The amount of oxygen that water can hold is dependent on temperature, salinity, and pressure

5.4.2.12 Shipping additives, if any can be placed into the bag at this time. The additives can be anaesthetics such as MS 222 (Tricainemethanesulfonate) and Quinaldinesulphate; or zeolite chips (for ammonia reduction), Methylene blue or acriflavine to

prevent bacterial bloom. But certain countries restrict the use of drugs in transport water, and hence the relevant rules and regulations should be strictly adhered to while using such additives. Please refer to section 5.1.6.6 for details of anaesthetics used in fish transportation

5.4.2.13 The bag is purged of air, and pure oxygen is injected into the bag below the water surface. The bag is then sealed using rubber bands or one of the commercial-grade sealers and placed in its box. Ice can be placed inside the box to reduce the temperature for best results.

5.4.2.14 Nutritional prophylaxis using vitamin C supplementation works well in enhancing the stress resistance during fish collection for packing. Anaesthetics have also been shown to lower metabolic rates, reducing the quantum of metabolic waste production and the resultant deterioration of water quality.

- The maximum allowable shipping time should be clearly given on the label of the package
- The label should give the name of the species/variety that is transported and number of pieces in each bag/box
- The label should show the Green Certification Registration number of the firm transporting the fish
- If the salinity of the packing water is different from that of the water in which fishes are reared, then the fishes should be acclimated to the packing water salinity, provided it is within the tolerable limits of the species being transported.

5.4.3 Packaging materials

5.4.3.1 The selection of proper packing material is crucial to ensure the success of transportation. Low-Density Polyethylene (LDPE) bags are generally used, kept either in corrugated paper boxes or polystyrene boxes. LDPE is relatively economical and has many desirable qualities such as transparency, water vapour impermeability, heat sealability, and chemical inertness. Linear Low-Density Polyethylene (LLDPE) has better mechanical strength and heat sealability than LDPE. Hence blending these two can have better quality material. The thickness of the bag material shall not be less than 0.1mm.

5.4.3.2 The boxes for transport can be either made from corrugated cardboard or Styrofoam boxes (Thermocol boxes). Styrofoam boxes can maintain the temperature besides being mechanically robust. So for export consignments or long distance transport, a styrofoam box is preferred.

5.4.4 Receiving and acclimating the fish into holding systems

5.4.4.1 The acclimation process involves placing the transport container in front of or in the holding tank, adding an aeration line and gradually adding water from the holding tank into the transport container. The aeration line will help maintain adequate dissolved oxygen levels and mixing the waters will prevent rapid temperature and pH changes. If the temperature

difference is greater than 10°C, then ideally, acclimation should proceed slowly over a period of two or more hours.

5.4.4.2 It is essential to be aware of the temperature, pH and salinity differences between the water in the transporting bag and the receiving water. The recommended method for acclimating fish is to float the sealed bag in the tank or pond that is to receive them for at least five minutes per degree of temperature difference or until the bag's temperature is within two degrees of the receiving water. The bag should be kept out of direct sunlight to avoid photic shock to the fish and elevation of water temperature in the bag.

5.4.4.3 Fish should also be inspected under the microscope for any parasites or disease and the proper treatment applied

5.4.5 Documentation requirements;

Proper documentation of the activities in the packing & transportation facilityis essential to ensure proper management of the facility.

A copy of the legal documents pertaining to the ownership of land or facility shall be made available for verification at the site. All other mandatory documents/ Log books pertaining to various activities shall be maintained at the facility.

5.5. GUIDELINES FOR MARKETING OF MARINE ORNAMENTALS

Marketing of marine ornamental fishes is the act or process of selling or promoting wild collected and hatchery-produced marine ornamental fishes. The value chain or supply chain in the ornamental fish trade is highly specialized and varied; multiple actors come into play, from the fisherman to the aquarium hobbyist (the end-user). Hence an appropriate guiding document for marketing would help in ensuring a sustainable marine ornamental fish trade.

In this chapter, guidelines for marketing of marine ornamentals have been given.

5.5.1. Existing marketing channel in the marine ornamental fish trade can be listed as follows:



(i) Collection / Culture → Commission Agent → Wholesaler → Retail Shop → Consumer

(ii) Collection / Culture → Commission Agent → Wholesaler → Retail Shop → Export

(iii) Collection / Culture → Commission Agent → Wholesaler → Export

(iv) Collection / Culture → Commission Agent → Retail Shop → Consumer

(v) Collection / Culture → Wholesaler → Retail Shop → Export



(vi) Collection / Culture → Wholesaler → Retail Shop → Consumer



(vii) Collection → Retail Shop → Consumer



(viii) Importer → Wholesaler → Commission Agent → Retail Shop Shop → Consumer



(ix) Importer → Wholesaler → Retail Shop → Consumer



(x) Importer → Retail Shop → Consumer

5.5.2. At each level in the marketing channel of wild-collected fishes (Collection, Wholesale, Retail), the number of licenses issued shall be restricted to a limit as decided by the Green Certification Authority.

5.5.3. There shall be a cap on the maximum number of wild-collected marine ornamental fishes traded per year at each level in the marketing channel to encourage trade in hatchery-produced fishes. This will be fixed by the Green Certification Authority and reviewed periodically.

5.5.4. For hatchery-produced ornamental fish, there will not be any restriction on the number of fishes that can be marketed in a year. In such cases, the traceability of the fish should be established by the marketer.

5.5.5. Trading of juveniles/larvae of ornamental fishes should be avoided.

5.5.6. There will be no restriction on the number of licenses for marketing the hatchery produced by marine ornamental fishes.

5.5.7. Marine ornamental fishes in the trade should be sourced from a green-certified facility.

5.5.8. The model design for marine ornamental fish marketing facility (Wholesale & retail unit) is given in **Annexure 21.**

5.5.9. The log-book format for the marine ornamental fish marketing facility (Wholesale & retail unit) is given in **Annexure 22 .**

A copy of the legal documents pertaining to the ownership of land or facility shall be made available for verification at the site. All other mandatory documents/ Log books pertaining to various activities shall be maintained at the facility.

6. GREEN CERTIFICATION: THE WAY FORWARD

Marine aquarium keeping has become one of the world's most popular hobbies and is expanding faster in recent years. Consequently, the demand for marine ornamentals is increasing, and more than 90% of the trade requirement is currently obtained from the wild. Over 46,000,000 organisms representing 2500 species are traded annually with a value exceeding US $ 300,000,000. Philippines and Indonesia supply the majority of livestock, with most specimens being consumed by the USA, Europe, and Japan (Calado *et al.,* 2017). The habitat of marine ornamental fishes is the coral reef ecosystem, and the exploitation of marine ornamentals from coral reef areas causes concern about the sustainability of the trade. Unfortunately, irresponsible and negligent collection practices have caused coral reef destruction in places where the wild collection is prevalent (Colette *et al.,* 2003) . Even though India is blessed with rich resources of highly valuable marine ornamentals, our share in the global trade is insignificant. India has not yet ventured into an organised trade of marine ornamentals. In this context, the development of sustainable trade in India deserves prime attention. It is well established that the development of the trade from hatchery produced fish will be the best option for a long term sustainable industry. However, even on a global basis, the commercial level hatchery production technologies have been evolved only for a limited number of species. Considering the fact that the marine ornamental trade is a variety oriented one and hence hatchery production of a few species alone may not be a complete option for meeting the demand for the different species. Moreover, it is well accepted that the coral reef habitat can be sustainably exploited for various resources without damaging the ecosystem. Hence while developing an organised marine ornamental fish trade in the country, the option of a certified wild collection policy can be included in addition to the hatchery production of species for which viable technologies are available. The green certification guidelines outlined in this publication is aimed at the development of a certified trade of marine ornamentals, which will lead to the development of the marine ornamental industry and at the same time safeguard the ecosystem and ensure sustainability.

The logic behind the guidelines is that the approach of Green Certification would be highly beneficial for the sector and would cover all the stakeholders in the value chain from collectors to consumers in the light of the following points:

- All the places where marine ornamentals are collected for trade are the reef areas which are very sensitive ecosystems or biodiversity hotspots. These areas are to be conserved for the well being of the various types of organisms inhabiting these places.
- The collection process directly or indirectly results in habitat damage or habitat destruction of many non-targeted species in the area.
- There exist considerable risks to the environmental sustainability of the reef ecosystems internationally where the collection is prevalent.

Implementation of green certification

Before the implementation of Green certification guidelines, a policy on the development of marine ornamentals in the country has to be formulated. The policy should be based on the following vital aspects

- Ensure that the trade development is not threatening the coral reef ecosystem
- Destructive collection practices should be banned
- The impact of exploitation on the population due to selective harvesting has to be regulated
- Regulations for avoiding the collection of unsuitable species
- Regulations to avoid post-harvest mortality

It is suggested that the implementation process in India can be vested with a special wing of the concerned state fisheries departments of maritime states and Union Territories. The technical expertise of the central agencies like ICAR-CMFRI, NBFGR, MPEDA and financial assistance from NFDB and NABARD can be obtained by the concerned State/ Union Territories for implementation of green certification.

In India, to date, no organized trade of marine ornamentals has been initiated. But it is a fact that a great deal of illegal collections of marine ornamentals is in vogue in many parts of our reef ecosystem. No data regarding the same is available. This is a matter of great concern due to the indiscriminate nature of exploitation and ecohostile methods of collection that damage the reef ecosystem. In addition to this, lack of knowledge on appropriate post-harvest husbandry practices leads to large scale mortality of the collected animals. It is time to evolve a marine ornamental fisheries policy in the country for developing an organized trade of marine ornamentals. In recent years the government/developmental agencies have taken a few steps towards the promotion of marine ornamental fisheries. These include the awareness programme on marine aquarium fishes and marine aquarium gadgets through events like aqua show. The training programmes organized by R&D institutions have played a significant role in creating awareness and realizing the potential of marine ornamental fishes. Developmental agencies like NFDB, NABARD have also started financing programmes to develop marine ornamental trade.

In developing a marine ornamental industry in India it is inevitable to formulate legislation on these issues, which are of vital concern to the sustainability of the trade. It is suggested that a few entrepreneurs can be licensed to collect suitable species from selected areas and trained on eco-friendly collection methods, conditioning and maintaining harvested species in healthy conditions. The present green certification guidelines developed for the various chain of custody can be insisted at each level.

- The species collected and maintained by trained collectors and entrepreneurs can be certified by an authorised body (Green Certification Authority),and MPEDA could develop an export as well as domestic trade for the same
- The impact of exploitation has to be closely monitored by CMFRI and management measures to be implemented as and when required.
- There shall be a Collection Area Management Plan and collection should be carried out in

line with the Collection Area Management Plan for the sustainable use and harvest of the marine ornamentals. It is to ensure that the collection area is managed according to the principles of the Green Certification Standards. The collection Area Management Plan is to be prepared by the local authority entrusted with conservation and management of the marine resources in the respective area. The details of information to be collected and collated for preparation of the Collection Area Management Plan is given in Annexure – 23

- The collectors should maintain a species/ groupwise log of the collected fishes, based on which scientific institutions can assess the stock position of the species and catch quota should be fixed accordingly to avoid overexploitation of more demanded species
- Since breeding of marine ornamental fishes is a highly skilled activity, persons engaged in breeding , larval rearing, and live feed unit should be trained in modern hatcheries. Their knowledge on the same shall be periodically updated.
- The marketing of hatchery-produced marine ornamental fishes be exempted from tax to promote the trade in hatchery produced fishes, which will help reduce the fishing pressure on wild stock.
- Government shall formulate appropriate policy guidelines to provide insurance coverage, minimum support price etc., for the hatchery-produced fishes in the marine ornamental fish trade.
- The existing schemes under National Fisheries Development Board (NFDB) can be continued for promoting the hatchery-produced fishes in the trade
- The guidelines for introducing exotics aquatic ornamental animals in the country shall be strictly adhered to to import marine ornamentals.

The Green certification of marine ornamentals is a new venture and hence can be implemented in a phased manner as follows:

- Initially, awareness creation among all the stakeholders of the sector about the relevance and scope of Green Certification needs to be done.
- Then training programmes can be arranged on best (ecofriendly) collection methods, Best Management Practices (BMPs) in marine ornamental fish breeding & seed production(hatchery), packing, transportation, marketing etc. to all the stakeholders. The training programmes can be conducted by ICAR - CMFRI.
- The facility/person willing to get a Green certification license (*viz*; Collector, Holding & conditoning centre, Breeding unit, exporter or marketer) has to meet the prescribed requirements as laid out in the Guidelines for Green certification.
- The verification/assessment of the compliance to all requirements will be done by an agency/person (Green Certification Inspector) accredited by the Green CertificationAuthority.
- The Green Certification Authority shall be constituted with representatives from different organisations as given below:
    - **ICAR-CMFRI – Chairman**
    - **ICAR-CIBA – Member**
    - **ICAR-NBFGR – Member**
    - **NFDB, Hyderabad - Member**

- Marine Products Export Development Authority - **Member**
- Zoological Survey of India - **Member**
- EIC/EIA - **Member**
- State Fisheries Department - **Member**
- Coastal Aquaculture Authority, Chennai- **Member**
- Department of Fisheries, Govt.of India- **Member**
- State Fisheries Departments - **Member**

- The verification for compliance to the standards will be done with the help of scorecards prescribed in the Guidelines for the respective facility. The formats for Score Cards of a various chains of custody in the sector are given at Annexures 24 to 27
- The Green Certification Committee shall give the Green Certification approval to the applicant on receipt of the verification report by the Green Certification Inspector confirming the satisfactory compliance to the prescribed requirements.
- A Green Certification Logo shall be affixed on those entities /products approved by the Green Certification committee. The Logo is given at Annexure 28
- The Green certification can be voluntary initially and should be made mandatory for the trade-in due course
- Government shall promote the adoption of Green Certification through measures such as tax exemption on Green Certified entities in the value chain.
- An agency at the government level [preferably a wing of Marine Products Export Development Authority (MPEDA)] can be established to consolidate the demand and channelize the supply to the consumer (national and international)

Awareness creation among the consumers about Green Certification shall be taken up regularly by government agencies, thereby creating a demand for green-certified fishes commanding premium prices. This will invariably give an impetus to the other stakeholders in the value chain (*viz*; Collectors, Holding centre, Captive breeding units, exporters or marketers) to adopt Green certification and thereby, in the long run, all the entities in the chain of custody will be green certified. An integrated approach led by the concerned State /Union territory departments with the relevant national agencies can initiate the process of green certification in a step by step manner so that a lucrative and sustainable marine ornamental sector will emerge in the country in the near future.

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Annexure 1

The list of major marine ornamental species from Indian waters

Phylum: Chordata

BONYFISHES

Sl No	Scientific name	Common name
FAMILY: ACANTHURIDAE		
1.	*Acanthurus dussumieri* Valenciennes, 1835	Eyestripe surgeonfish
2.	*Acanthurus gahhm* (Forsskål, 1775)	Black surgeonfish
3.	*Acanthurus leucosternon* Bennett, 1833	Powderblue surgeonfish
4.	*Acanthurus lineatus* (Linnaeus, 1758)	Lined surgeonfish
5.	*Acanthurus mata* (Cuvier, 1829)	Elongate surgeonfish
6.	*Acanthurus nigricauda* Duncker & Mohr, 1929	Epaulette surgeonfish
7.	*Acanthurus nigrofuscus* (Forsskål, 1775)	Brown surgeonfish
8.	*Acanthurus triostegus* (Linnaeus, 1758)	Convict surgeonfish
9.	*Acanthurus xanthopterus* Valenciennes, 1835	Yellowfin surgeonfish
10.	*Ctenochaetus strigosus* (Bennett, 1828)	Spotted surgeonfish
11.	*Naso annulatus* (Quoy & Gaimard, 1825)	Whitemargin unicornfish
12.	*Naso brevirostris* (Cuvier, 1829)	Spotted unicornfish
13.	*Naso hexacanthus* (Bleeker, 1855)	Sleek unicornfish
14.	*Naso lituratus* (Forster, 1801)	Orangespine unicornfish
15.	*Naso tuberosus* Lacepède, 1801	Humpnose unicornfish
16.	*Naso unicornis* (Forsskål, 1775)	Bluespine unicornfish
17.	*Zebrasoma veliferum* (Bloch, 1795)	Sailfin tang
FAMILY: ANTENNARIIDAE		
18.	*Antennarius nummifer* (Cuvier, 1817)	Spotfin frogfish
19.	*Histrio histrio* (Linnaeus, 1758)	Sargassumfish
FAMILY: APOGONIDAE		
20.	*Apogonichthyoides pseudotaeniatus* (Gon, 1986)	Doubl bar cardinalfish
21.	*Cheilodipterus macrodon* (Lacepède, 1802)	Largetoothed cardinalfish
22.	*Ostorhinchus aureus* (Lacepède, 1802)	Ringtailed cardinalfish
23.	*Ostorhinchus endekataenia* (Bleeker, 1852)	Candystripe cardinalfish
24.	*Ostorhinchus fleurieu* Lacepède, 1802	Flower cardinalfish
25.	*Ostorhinchus taeniophorus* (Regan, 1908)	Reef-flat cardinalfish

FAMILY: BALISTIDAE

26.	*Abalistes stellatus* (Anonymous, 1798)	Starry triggerfish
27.	*Balistapus undulatus* (Park, 1797)	Orange-lined triggerfish
28.	*Balistoides viridescens* (Bloch & Schneider, 1801)	Titan triggerfish
29.	*Canthidermis maculata* (Bloch, 1786)	Rough triggerfish
30.	*Odonus niger* (Rüppell, 1836)	Red-toothed triggerfish
31.	*Pseudobalistes flavimarginatus* (Rüppell, 1829)	Yellowmargin triggerfish
32.	*Rhinecanthus aculeatus* (Linnaeus, 1758)	White-banded triggerfish
33.	*Rhinecanthus rectangulus* (Bloch & Schneider, 1801)	Wedge-tail triggerfish
34.	*Sufflamen chrysopterum* (Bloch & Schneider, 1801)	Halfmoon triggerfish
35.	*Sufflamen fraenatum* (Latreille, 1804)	Masked triggerfish

FAMILY: BLENNIDAE

36.	*Ecsenius bicolor* (Day, 1888)	Bicolor blenny
37.	*Petroscirtes mitratus* Rüppell, 1830	Floral blenny

FAMILY: CARANGIDAE

38.	*Gnathanodon speciosus* (Forsskål, 1775)	Golden trevally
39.	*Trachinotus blochii* (Lacepède, 1801)	Snubnose pampano

FAMILY: CHAETODONTIDAE

40.	*Chaetodon auriga* Forsskål, 1775	Threadfin butterflyfish
41.	*Chaetodon citrinellus* Cuvier, 1831	Speckled butterflyfish
42.	*Chaetodon collare* Bloch, 1787	Redtail butterflyfish
43.	*Chaetodon decussatus* Cuvier, 1829	Indian vagabond butterflyfish
44.	*Chaetodon falcula* Bloch, 1795	Blackwedged butterflyfish
45.	*Chaetodon gardineri* Norman, 1939	Gardner's butterflyfish
46.	*Chaetodon kleinii* Bloch, 1790	Sunburst butterflyfish
47.	*Chaetodon lineolatus Cuvier, 1831*	Lined butterflyfish
48.	*Chaetodon lunula* (Lacepède, 1802)	Raccoon butterflyfish
49.	*Chaetodon melannotus* Bloch & Schneider, 1801	Blackback butterflyfish
50.	*Chaetodon meyeri* Bloch & Schneider, 1801	Scrawled butterflyfish
51.	*Chaetodon octofasciatus* Bloch, 1787	Eightband butterflyfish
52.	*Chaetodon oxycephalus* Bleeker, 1853	Spot-nape butterflyfish
53.	*Chaetodon plebeius* Cuvier, 1831	Blueblotch butterflyfish

54.	*Chaetodon trifascialis* Quoy & Gaimard, 1825	Chevron butterflyfish
55.	*Chaetodon trifasciatus* Park, 1797	Melon butterflyfish
56.	*Chaetodon vagabundus* Linnaeus, 1758	Vagabond butterflyfish
57.	*Chaetodon xanthocephalus* Bennett, 1833	Yellowhead butterflyfish
58.	*Forcipiger flavissimus* Jordan & McGregor, 1898	Longnose butterflyfish
59.	*Heniochus acuminatus* (Linnaeus, 1758)	Pennant coralfish
60.	*Heniochus monoceros* Cuvier, 1831	Masked bannerfish
61.	*Heniochus pleurotaenia* Ahl, 1923	Phantom bannerfish
62.	*Heniochus singularius* Smith & Radcliffe, 1911	Singular bannerfish
63.	*Heniochus varius* (Cuvier, 1829)	Humphead bannerfish
FAMILY: CIRRHITIDAE		
64.	*Cirrhitichthys aureus* (Temminck & Schlegel, 1842)	Yellow hawkfish
65.	*Cirrhitichthys bleekeri* Day, 1874	Bleekeri Hawkfish
FAMILY: DIODONTIDAE		
66.	*Diodon holocanthus* Linnaeus, 1758	Longspined porcupinefish
67.	*Diodon hystrix* Linnaeus, 1758	Spot-fin porcupinefish
68.	*Lophodiodon calori* (Bianconi, 1854)	Fourbar porcupine fish
FAMILY: ECHENEIDAE		
69.	*Echeneis naucrates* Linnaeus, 1758	Slender sharksucker
70.	*Remora remora* (Linnaeus, 1758)	Shark sucker
FAMILY: EPHIPPIDAE		
71.	*Platax orbicularis* (Forsskål, 1775)	Orbicular batfish
72.	*Platax teira* (Forsskål, 1775)	Longfin batfish
FAMILY: GOBIIDAE		
73.	*Valenciennea helsdingenii* (Bleeker, 1858)	Twostripe goby
FAMILY: HAEMULIDAE		
74.	*Diagramma pictum* (Thunberg, 1792)	Painted sweetlips
75.	*Plectorhinchus lineatus* (Linnaeus, 1758)	Yellowbanded sweetlips
76.	*Plectorhinchus vittatus* (Linnaeus, 1758)	Indian Ocean oriental sweetlips
FAMILY: HOLOCENTRIDAE		
77.	*Myripristis adusta* Bleeker, 1853	Shadowfin soldierfish
78.	*Myripristis murdjan* (Forsskål, 1775)	Pinecone soldierfish
79.	*Neoniphon sammara* (Forsskål, 1775)	Sammara squirrelfish

80.	*Sargocentron caudimaculatum* (Rüppell, 1838)	Silverspot squirrelfish
81.	*Sargocentron diadema* (Lacepède, 1802)	Crown squirrelfish
82.	*Sargocentron punctatissimum* (Cuvier, 1829)	Speckled squirrelfish
83.	*Sargocentron rubrum* (Forsskål, 1775)	Redcoat
84.	*Sargocentron spiniferum* (Forsskål, 1775)	Sabre squirrelfish
85.	*Sargocentron violaceum* (Bleeker, 1853)	Violet squirrelfish

FAMILY: LABRIDAE

86.	*Anampses caeruleopunctatus* Rüppell, 1829	Bluespotted wrasse
87.	*Anampses lineatus* Randall, 1972	Lined wrasse
88.	*Bodianus neilli* (Day, 1867)	Bay of Bengal hogfish
89.	*Bodianus speciosus* (Bowdich, 1825)	Blackbar hogfish
90.	*Cheilinus chlorourus* (Bloch, 1791)	Floral wrasse
91.	*Cheilinus oxycephalus* Bleeker, 1853	Snooty wrasse
92.	*Cheilinus trilobatus* Lacepède, 1801	Tripletail wrasse
93.	*Cheilinus undulatus* Rüppell, 1835	Humphead wrasse
94.	*Cheilio inermis* (Forsskål, 1775)	Cigar wrasse
95.	*Choerodon robustus* (Günther, 1862)	Robust tuskfish
96.	*Coris dorsomacula* Fowler, 1908	Pale-barred coris
97.	*Coris formosa* (Bennett, 1830)	Queen coris
98.	*Epibulus insidiator* (Pallas, 1770)	Sling-jaw wrasse
99.	*Gomphosus caeruleus* Lacepède, 1801	Green birdmouth wrasse
100.	*Gomphosus varius* Lacepède, 1801	Bird wrasse
101.	*Halichoeres chrysus* Randall, 1981	Canary wrasse
102.	*Halichoeres hortulanus* (Lacepède, 1801)	Checkerboard wrasse
103.	*Halichoeres leucurus* (Walbaum, 1792)	Greyhead wrasse
104.	*Halichoeres marginatus* Rüppell, 1835	Dusky wrasse
105.	*Halichoeres melanochir* Fowler & Bean, 1928	Orange fin wrasse
106.	*Halichoeres nigrescens* (Bloch & Schneider, 1801)	Bubblefin wrasse
107.	*Halichoeres scapularis* (Bennett, 1832)	Zigzag wrasse
108.	*Halichoeres zeylonicus* (Bennett, 1833)	Goldstripe wrasse
109.	*Hemigymnus fasciatus* (Bloch, 1792)	Barred thicklip
110.	*Hemigymnus melapterus* (Bloch, 1791)	Blackeye thicklip wrasse
111.	*Iniistius bimaculatus* (Rüppell, 1829)	Two-spot razorfish
112.	*Iniistius pavo* (Valenciennes, 1840)	Peacock wrasse

113.	*Labroides bicolor* fowler & Bean, 1928	Bicolor cleaner wrasse
114.	*Labroides dimidiatus* (Valenciennes, 1839)	Bluestreak cleaner wrasse
115.	*Macropharyngodon meleagris* (Valenciennes, 1839)	Blackspotted wrasse
116.	*Stethojulis albovittata* (Bonnaterre, 1788)	Bluelined wrasse
117.	*Stethojulis balteata* (Quoy & Gaimard, 1824)	Belted wrasse
118.	*Stethojulis interrupta* (Bleeker, 1851)	Cutribbon wrasse
119.	*Stethojulis strigiventer* (Bennett, 1833)	Three-ribbon wrasse
120.	*Stethojulis trilineata* (Bloch & Schneider, 1801)	Three-lined rainbowfish
121.	*Thalassoma hardwicke* (Bennett, 1830)	Sixbar wrasse
122.	*Thalassoma jansenii* (Bleeker, 1856)	Jansen's wrasse
123.	*Thalassoma lunare* (Linnaeus, 1758)	Moon wrasse
124.	*Thalassoma purpureum* (Forsskål, 1775)	Surge wrasse
125.	*Xyrichtys novacula* (Linnaeus, 1758)	Pearly razorfish
FAMILY: LUTJANIDAE		
126.	*Lutjanus bengalensis* (Bloch, 1790)	Bengal snapper
127.	*Lutjanus decussatus* (Cuvier, 1828)	Checkered snapper
128.	*Lutjanus ehrenbergii* (Peters, 1869)	Blackspot snapper
129.	*Lutjanus fulviflammus* (Forsskål, 1775)	Dory snapper
130.	*Lutjanus quinquelineatus* (Bloch, 1790)	Five-lined snapper
131.	*Lutjanus rivulatus* (Cuvier, 1828)	Blubberlip snapper
132.	*Lutjanus stellatus* Akazaki, 1983	Star snapper
133.	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Brownstripe red snapper
FAMILY: MALACANTHIDAE		
134.	*Malacanthus latovittatus* (Lacepède, 1801)	Blue blanquillo
FAMILY: MONOCANTHIDAE		
135.	*Aluterus scriptus* (Osbeck, 1765)	Scribbled leatherjacket filefish
136.	*Paramonacanthus choirocephalus* (Bleeker, 1851)	Pig faced leather jacket
137.	*Cantherhines sandwichiensis* (Quoy & Gaimard, 1824)	Sandwich isle file
138.	*Pervagor melanocephalus* (Bleeker, 1853)	Redtail filefish
FAMILY: MONODACTYLIDAE		
139.	*Monodactylus argenteus* (Linnaeus, 1758)	Silver moony

FAMILY: MULLIDAE

140.	*Parupeneus indicus* (Shaw, 1803)	Indian goatfish
141.	*Mulloidichthys flavolineatus* (Lacepède, 1801)	Yellowstripe goatfish
142.	*Parupeneus barberinus* (Lacepède, 1801)	Dash-and-dot goatfish
143.	*Parupeneus forsskali* (Fourmanoir & Guézé, 1976)	Red Sea goatfish
144.	*Parupeneus heptacanthus* (Lacepède, 1802)	Cinnabar goatfish
145.	*Parupeneus macronemus* (Lacepède, 1801)	Long-barbel goatfish
146.	*Parupeneus trifasciatus* (Lacepède, 1801)	Doublebar goatfish
147.	*Upeneus japonicus* (Houttuyn, 1782)	Japanese goatfish
148.	*Upeneus luzonius* Jordan & Seale, 1907	Dark-barred goatfish
149.	*Upeneus oligospilus* Lachner, 1954	Short-fin goatfish
150.	*Upeneus sulphureus* Cuvier, 1829	Sulphur goatfish
151.	*Upeneus sundaicus* (Bleeker, 1855)	Ochrebanded goatfish
152.	*Upeneus tragula* Richardson, 1846	Freckled goatfish
153.	*Upeneus vittatus* (Forsskål, 1775)	Yellowstriped goatfish

FAMILY: MURAENIDAE

154.	*Echidna nebulosa* (Ahl, 1789)	Starry moray
155.	*Gymnothorax favagineus* Bloch & Schneider, 1801	Laced moray
156.	*Gymnothorax flavimarginatus* (Rüppell, 1830)	Yellow edged moray
157.	*Gymnothorax javanicus* (Bleeker, 1859)	Giant moray
158.	*Gymnothorax meleagris* (Shaw, 1795)	Turkey moray

FAMILY: OSTRACIIDAE

159.	*Lactoria cornuta* (Linnaeus, 1758)	Longhorn cowfish
160.	*Ostracion cubicus* Linnaeus, 1758	Yellow box fish
161.	*Rhynchostracion nasus* (Bloch, 1785)	Shortnose boxfish
162.	*Tetrosomus gibbosus* (Linnaeus, 1758)	Humpback turretfish

FAMILY: PEMPHERIDAE

163.	*Pempheris vanicolensis* Cuvier, 1831	Vanikoro sweeper
164.	*Pempheris oualensis* Cuvier, 1831	Silver sweeper

FAMILY: PLOTOSIDAE

165.	*Plotosus lineatus* (Thunberg, 1787)	Striped eel catfish

FAMILY: POMACANTHIDAE

166.	*Apolemichthys xanthurus* (Bennett, 1833)	Yellowtail angelfish

167.	*Centropyge flavipectoralis* Randall & Klausewitz, 1977	Yellowfin angelfish
168.	*Centropyge multispinis* (Playfair, 1867)	Dusky angelfish
169.	*Pomacanthus annularis* (Bloch, 1787)	Bluering angelfish
170.	*Pomacanthus imperator* (Bloch, 1787)	Emperor angelfish
171.	*Pomacanthus semicirculatus* (Cuvier, 1831)	Semicircle angelfish

FAMILY: POMACENTRIDAE

172.	*Abudefduf bengalensis* (Bloch, 1787)	Bengal sergeant
173.	*Abudefduf saxatilis* (Linnaeus, 1758)	Sergeant-major
174.	*Abudefduf septemfasciatus* (Cuvier, 1830)	Banded sergeant
175.	*Abudefduf sexfasciatus* (Lacepède, 1801)	Scissortail sergeant
176.	*Abudefduf sordidus* (Forsskål, 1775)	Blackspot sergeant
177.	*Abudefduf vaigiensis* (Quoy & Gaimard, 1825)	Indo-Pacific sergeant
178.	*Amphiprion akallopisos* Bleeker, 1853	Skunk anemone fish
179.	*Amphiprion akindynos* Allen, 1972	Barrier reef anemone fish
180.	*Amphiprion allardi* Klausewitz, 1970	Allard's anemone fish
181.	*Amphiprion bicinctus* Rüppell, 1830	Two banded anemone fish
182.	*Amphiprion chagosensis* Allen, 1972	Chagos anemone fish
183.	*Amphiprion chrysogaster* Cuvier, 1830	Mauritian anemone fish
184.	*Amphiprion chrysopterus* Cuvier, 1830	Orange fin anemone fish
185.	*Amphiprion clarkii* (Bennett, 1830)	Yellowtail clownfish
186.	*Amphiprion ephippium* (Bloch, 1790)	Red saddleback anemone fish
187.	*Amphiprion frenatus* Brevoort, 1856	Tomato clown
188.	*Amphiprion fuscocaudatus* Allen, 1972	Seychelles anemone fish
189.	*Amphiprion latezonatus* Waite, 1900	Wide band anemone fish
190.	*Amphiprion latifasciatus* Allen, 1972	Madagascar anemone fish
191.	*Amphiprion leucokranos* Allen, 1973	White bonnet anemone fish
192.	*Amphiprion mccullochi* Whitley, 1929	McCulloch's anemone fish
193.	*Amphiprion melanopus* Bleeker, 1852	Red and black anemone fish
194.	*Amphiprion nigripes* Regan, 1908	Blackfinned anemone fish
195.	*Amphiprion ocellaris* Cuvier, 1830	Clown anemone fish
196.	*Amphiprion omanensis* Allen & Mee, 1991	Oman anemone fish
197.	*Amphiprion percula* (Lacepède, 1802)	Orange clownfish
198.	*Amphiprion perideraion* Bleeker, 1855	Pink anemone fish

199.	*Amphiprion polymnus* (Linnaeus, 1758)	Saddleback clownfish
200.	*Amphiprion rubrocinctus* Richardson, 1842	Australian anemone fish
201.	*Amphiprion sandaracinos* Allen, 1972	Yellow clownfish
202.	*Amphiprion sebae* Bleeker, 1853	Sebae anemonefish
203.	*Amphiprion thiellei* Burgess, 1981	Thielle's anemone fish
204.	*Amphiprion tricinctus* Schultz & Welander, 1953	Three banded anemone fish
205.	*Chromis caerulea* (Cuvier, 1830)	Blue-green chromis
206.	*Chromis chrysura* (Bliss, 1883)	Stout chromis
207.	*Chromis dimidiata* (Klunzinger, 1871)	Chocolatedip chromis
208.	*Chromis viridis* (Cuvier, 1830)	Blue green damselfish
209.	*Chrysiptera biocellata* (Quoy & Gaimard, 1825)	Twinspot damselfish
210.	*Chrysiptera brownriggii* (Bennett, 1828)	Surge damselfish
211.	*Chrysiptera cyanea* (Quoy & Gaimard, 1825)	Sapphire devil
212.	*Chrysiptera glauca* (Cuvier, 1830)	Grey demoiselle
213.	*Chrysiptera unimaculata* (Cuvier, 1830)	One spot demoiselle
214.	*Dascyllus aruanus* (Linnaeus, 1758)	Whitetail dascyllus
215.	*Dascyllus carneus* Fischer, 1885	Cloudy dascyllus
216.	*Dascyllus reticulatus* (Richardson, 1846)	Reticulate dascyllus
217.	*Dascyllus trimaculatus* (Rüppell, 1829)	Threespot dascyllus
218.	*Neopomacentrus filamentosus* (MacLeay, 1882)	Brown demoiselle
219.	*Neopomacentrus nemurus* (Bleeker, 1857)	Coral demoiselle
220.	*Plectroglyphidodon dickii* (Liénard, 1839).	Blackbar devil
221.	*Plectroglyphidodon lacrymatus* (Quoy & Gaimard, 1825	Whitespotted devil
222.	*Pomacentrus albicaudatus* Baschieri-Salvadori, 1955	Whitefin damsel
223.	*Pomacentrus brachialis* Cuvier, 1830	Charcoal damsel
224.	*Pomacentrus caeruleus* Quoy & Gaimard, 1825	Caerulean damsel
225.	*Pomacentrus pavo* (Bloch, 1787)	Sapphire damsel
226.	*Premnas biaculeatus* (Bloch, 1790)	Maroon clown
227.	*Stegastes nigricans* (Lacepède, 1802)	Dusky farmerfish
228.	*Stegastes variabilis* (Castelnau, 1855)	Cocoa damselfish
FAMILY: PSEUDOCHROMATIDAE		
229.	*Pseudochromis dilectus* Lubbock, 1976	Dotty back

FAMILY: SCARIDAE		
230.	*Chlorurus gibbus* (Rüppell, 1829)	Heavybeak parrotfish
231.	*Chlorurus sordidus* (Forsskål, 1775)	Daisy parrot fish
232.	*Scarus ghobban* Forsskål, 1775	Blue-barred parrotfish
233.	*Scarus russelii* Valenciennes, 1840	Eclipse parrotfish
234.	*Calotomus spinidens* (Quoy & Gaimard, 1824)	Spinytooth parrotfish
235.	*Chlorurus sordidus* (Forsskål, 1775)	Daisy parrotfish
236.	*Leptoscarus vaigiensis* (Quoy & Gaimard, 1824)	Marbled parrotfish
237.	*Scarus ghobban* Forsskål, 1775	Blue-barred parrotfish
238.	*Scarus psittacus* Forsskål, 1775	Common parrotfish
239.	*Scarus scaber* Valenciennes, 1840	Fivesaddle parrotfish
FAMILY: SCATOPHAGIDAE		
240.	*Scatophagus argus* (Linnaeus, 1766)	Spotted scat
FAMILY: SCORPAENIDAE		
241.	*Dendrochirus brachypterus* (Cuvier, 1829)	Dwarf lionfish
242.	*Pterois russellii* Bennett, 1831	Plaintail turkeyfish
243.	*Pterois volitans* (Linnaeus, 1758)	Red lionfish
244.	*Pterois miles* (Bennett, 1828)	Devil firefish
245.	*Dendrochirus zebra* (Cuvier, 1829)	Zebra turkey fish
246.	*Parapterois heterura* (Bleeker, 1856)	Blackfoot firefish
247.	*Pterois antennata* (Bloch, 1787)	Broadbarred firefish
248.	*Scorpaenopsis gibbosa* (Bloch & Schneider, 1801)	Humphead scorpion fish
FAMILY: SERRANIDAE		
249.	*Cephalopholis argus* Schneider, 1801	Peacock hind
250.	*Cephalopholis boenak* (Bloch, 1790)	Chocolate hind
251.	*Cephalopholis formosa* (Shaw, 1812)	Bluelined hind
252.	*Cephalopholis leopardus* (Lacepède, 1801)	Leopard hind
253.	*Cephalopholis miniata* (Forsskål, 1775)	Coral hind
254.	*Cephalopholis sonnerati* (Valenciennes, 1828)	Tomato hind
255.	*Cromileptes altivelis* (Valenciennes, 1828)	Humpback grouper
256.	*Epinephelus coeruleopunctatus* (Bloch, 1790)	Whitespotted grouper
257.	*Epinephelus hexagonatus* (Forster, 1801)	Starspotted grouper
258.	*Epinephelus malabaricus* (Bloch & Schneider, 1801)	Malabar grouper

259.	*Epinephelus merra* Bloch, 1793	Honeycomb grouper
260.	*Epinephelus undulosus* (Quoy & Gaimard, 1824)	Wavy-lined grouper
261.	*Grammistes sexlineatus* (Thunberg, 1792)	Goldenstriped soapfish
262.	*Pogonoperca punctata* (Valenciennes, 1830)	Spotted soapfish
263.	*Pseudanthias bimaculatus* (Smith, 1955)	Two-spot basslet
264.	*Pseudanthias marcia* Randall & Hoover, 1993	Marcia's anthias
265.	*Pseudanthias squamipinnis* (Peters, 1855)	Sea goldie
FAMILY: SIGANIDAE		
266.	*Siganus canaliculatus* (Park, 1797)	White-spotted spinefoot
267.	*Siganus javus* (Linnaeus, 1766)	Streaked spinefoot
268.	*Siganus punctatus* (Schneider & Forster, 1801)	Goldspotted spinefoot
269.	*Siganus spinus* (Linnaeus, 1758)	Little spinefoot
270.	*Siganus stellatus* (Forsskål, 1775)	Brown-spotted spinefoot
271.	*Siganus virgatus* (Valenciennes, 1835)	Barhead spinefoot
FAMILY: SYNGNATHIDAE (SCHEDULED)		
272.	*Corythoichthys flavofasciatus* (Ruppell, 1838)	Banded pipe fish
273.	*Hippocampus kuda* Bleeker, 1852	Spotted seahorse
274.	*Micrognathus brevirostris* (Rüppell, 1838)	Thorntail pipefish
275.	*Microphis brachyurus* (Bleeker, 1854)	Short-tailed pipefish
276.	*Syngnathoides biaculeatus* (Bloch, 1785)	Alligator pipefish
FAMILY: TERAPONTIDAE		
277.	*Terapon jarbua* (Forsskål, 1775)	Jarbua terapon
FAMILY: TETRAODONTIDAE		
278.	*Arothron hispidus* (Linnaeus, 1758)	White-spotted puffer
279.	*Arothron immaculatus* (Bloch & Schneider, 1801)	Immaculate puffer
280.	*Arothron nigropunctatus* (Bloch & Schneider, 1801)	Blackspotted puffer
281.	*Arothron reticularis* (Bloch & Schneider, 1801)	Reticulated pufferfish
282.	*Canthigaster margaritata* (Rüppell, 1829)	Pearl loby
283.	*Canthigaster solandri* (Richardson, 1845)	Spotted sharpnose
FAMILY: TRIACANTHIDAE		
284.	*Triacanthus brevirostris* Temminck & Schlegel, 1850	Short-nosed tripodfish
FAMILY: ZANCLIDAE		
285.	*Zanclus cornutus* (Linnaeus, 1758)	Moorish idol

FAMILY: DASYATIDAE		
286.	*Brevitrygon walga* (Müller & Henle, 1841)	Scaly whipray
287.	*Himantura uarnak* (Gmelin, 1789)	Honeycomb stingray
288.	*Maculabatis gerrardi* (Gray, 1851)	Sharpnose stingray
FAMILY: GYMNURIDAE		
289.	*Glaucostegus granulatus* (Cuvier, 1829)	Granulated guitarfish
290.	*Gymnura japonica* (Temminck & Schlegel, 1850)	Japanese butterfly ray
291.	*Gymnura poecilura* (Shaw, 1804)	Long-tailed butterfly ray

Phylum: Arthropoda

Sl No	Scientific name	Common name
FAMILY: DIOGENIDAE		
292.	*Clibanarius clibanarius* (Herbst, 1791)	Hermit crab
293.	*Clibanarius infraspinatus* (Hilgendorf, 1869)	Orange-striped Hermit crab
294.	*Clibanarius padavensis de Man, 1888*	Blue-legged hermit crab
295.	*Diogenes custos (Fabricius, 1798)*	Hermit crab
296.	*Diogenes planimanus Henderson, 1893*	Hermit crab
Family: GNATHOPHYLLIDAE		
297.	*Gnathophylloides mineri* Schmitt, 1933	Squat urchin shrimp
298.	*Gnathophyllum americanum* Guérin-Méneville, 1855	Bumble bee shrimp
299.	*Pycnocaris chagoae* Bruce, 1972	Cucumber shrimp
FAMILY:HIPPOLYTIDAE		
300.	*Saron marmoratus* (Olivier, 1811)	Marbled shrimp
301.	*Thor amboinensis* (de Man, 1888)	Squat shrimp
FAMILY: HYMENOCERIDAE		
302.	*Hymenocera picta* Dana, 1852	Harlequin shrimp
FAMILY: LYSMATIDAE		
303.	*Lysmata amboinensis* (de Man, 1888)	Scarlet cleaner shrimp
304.	*Lysmata debelius* Bruce, 1983	Blood Red shrimp
FAMILY: OCYPODIDAE		
305.	*Ocypode macrocera* H. Milne Edwards, 1852	Ghost crab

FAMILY: PALAEMONIDAE		
306.	*Ancylocaris brevicarpalis* Schenkel, 1902	Glass Anemone shrimp
307.	*Ancylomenes magnificus* (Bruce, 1979)	Magnificent shrimp
308.	*Stegopontonia commensalis* Nobili, 1906	Needle shrimp
309.	*Zenopontonia soror* (Nobili, 1904)	Starfish shrimp
FAMILY: PALINURIDAE		
310.	*Panulirus versicolor* (Latreille, 1804)	Reef lobster
311.	*Panulirus homarus* (Linnaeus, 1758)	Scalloped spiny lobster
312.	*Panulirus polyphagus* (Herbst, 1793)	Mud spiny lobster
FAMILY: PORTUNIDAE		
313.	*Charybdis (Charybdis) feriata* (Linnaeus, 1758)	Flower crab
314.	*Portunus pelagicus* (Linnaeus, 1758)	Blue swimming crab
315.	*Portunus sanguinolentus* (Herbst, 1783)	Red-spotted swimming crab
316.	*Scylla tranquebarica* (Fabricius, 1798)	Serrated swimming crab
FAMILY: RHYNCHOCINETIDAE		
317.	Rhynchocinetes durbanensis Gordon, 1936	Hingebeak shrimp
FAMILY: SQUILLIDAE		
318.	*Alimopsis supplex* (Wood-Mason, 1875)	Mantis shrimp
319.	*Miyakella nepa* (Latreille in Latreille, Le Peletier, Serville & Guérin, 1828)	Smalleyed squillid
320.	*Oratosquillina perpensa* (Kemp, 1911)	Mantis shrimp
FAMILY: STENOPODIDAE		
321.	Stenopus hispidus (Olivier, 1811)	Boxer shrimp

Phylum: Mollusca

Sl No	Scientific name	Common name
FAMILY: BABYLONIIDAE		
322.	*Babylonia spirata (Linnaeus, 1758)*	Spiral babylon
FAMILY: BURSIDAE		
323.	Bufonaria echinata (Link, 1807)	Spiny frog shell

FAMILY: HALIOTIDAE		
324.	*Haliotis varia* Linnaeus, 1758	Variable abalone
FAMILY: MELONGENIDAE		
325.	*Hemifusus ternatanus* (Gmelin, 1791)	
326.	*Volegalea cochlidium* (Linnaeus, 1758)	Spiral melongena
FAMILY: MURICIDAE		
327.	*Indothais lacera* (Born, 1778)	Carinate rock shell
FAMILY: OCTOPODIDAE		
328.	*Octopus globosus* Appellof, 1886	Globe octopus
329.	*Octopus vulgaris* Cuvier, 1797	Common octopus
FAMILY: PHYLLIDIDAE		
330.	*Phyllidia varicosa* Lamarck, 1801	Varicose phyllidia
FAMILY: STROMBIDAE		
331.	*Lambis lambis* (Linnaeus, 1758)	Spider conch
332.	*Margistrombus marginatus* (Linnaeus, 1758)	Marginate conch
FAMILY: TONNIDAE		
333.	*Tonna dolium* (Linnaeus, 1758)	Spotted tun
334.	*Trochus radiatus* Gmelin, 1791	Radiate top shell
FAMILY: TURBINIDAE		
335.	*Turbo intercostalis* Menke, 1846	Ribbed turban

Phylum : Echinodermata

Sl No	Scientific name	Common name
FAMILY: ASTROPECTINIDAE		
336.	*Astropecten euryacanthus* Lutken, 1871	Starfish
337.	*Astropecten indicus* Döderlein, 1888	Starfish
FAMILY: GONIASTERIDAE		
338.	*Fromia milleporella* (Lamarck, 1816)	Black spotted starfish
FAMILY: OPHIDIASTERIDAE		
339.	*Linckia laevigata* (Linnaeus, 1758)	Blue seastar
340.	*Linckia multifora* (Lamarck, 1816)	Multicolor seastar

341.	*Ophidiaster confertus* H.L. Clark, 1916	Orange seastar
FAMILY: OREASTERIDAE		
342.	*Pentaceraster tuberculatus* (Müller & Troschel, 1842)	Horned star
343.	*Protoreaster lincki* (Blainville, 1830)	Crimson knobbed star
344.	*Protoreaster nodosus* (Linnaeus, 1758)	Chocolate chip sea star

Phylum: Cnidaria

Sl No	Scientific name	Common name
FAMILY: ACTINIIDAE		
345.	*Anthopleura anjunae Den* Hartog & Vennam, 1993	Sea anemone
346.	*Bunodosoma goanense den* Hartog & Vennam, 1993	Burgundy anemone
347.	*Entacmaea quadricolor* (Leuckart in Rüppell & Leuckart, 1828)	Bubble-tip anemone
348.	*Paracondylactis sinensis* Carlgren, 1934	Sea anemone
349.	*Synantheopsis parulekari* Den Hartog & Vennam, 1993	Sea anemone
FAMILY: EDWARDSIIDAE		
350.	*Edwardsia jonesii* Seshaiya & Cuttress, 1969	Sea anemone
351.	*Edwardsia tinctrix* Annandale, 1915	Sea anemone
352.	*Heteractis crispa* (Hemprich & Ehrenberg in Ehrenberg, 1834)	Beaded anemone
353.	*Stichodactyla haddoni* (Saville-Kent, 1893)	Haddon's sea anemone
354.	*Heteractis magnifica* (Quoy & Gaimard, 1833)	Ritteri anemone

Phylum: Annelida

Sl No	Scientific name	Common name
FAMILY: SABELLIDAE		
355.	*Sabellastarte spectabilis* (Grube, 1878)	Feather duster worm

Annexure 2

Photographs of major marine ornamental fishes from Indian waters



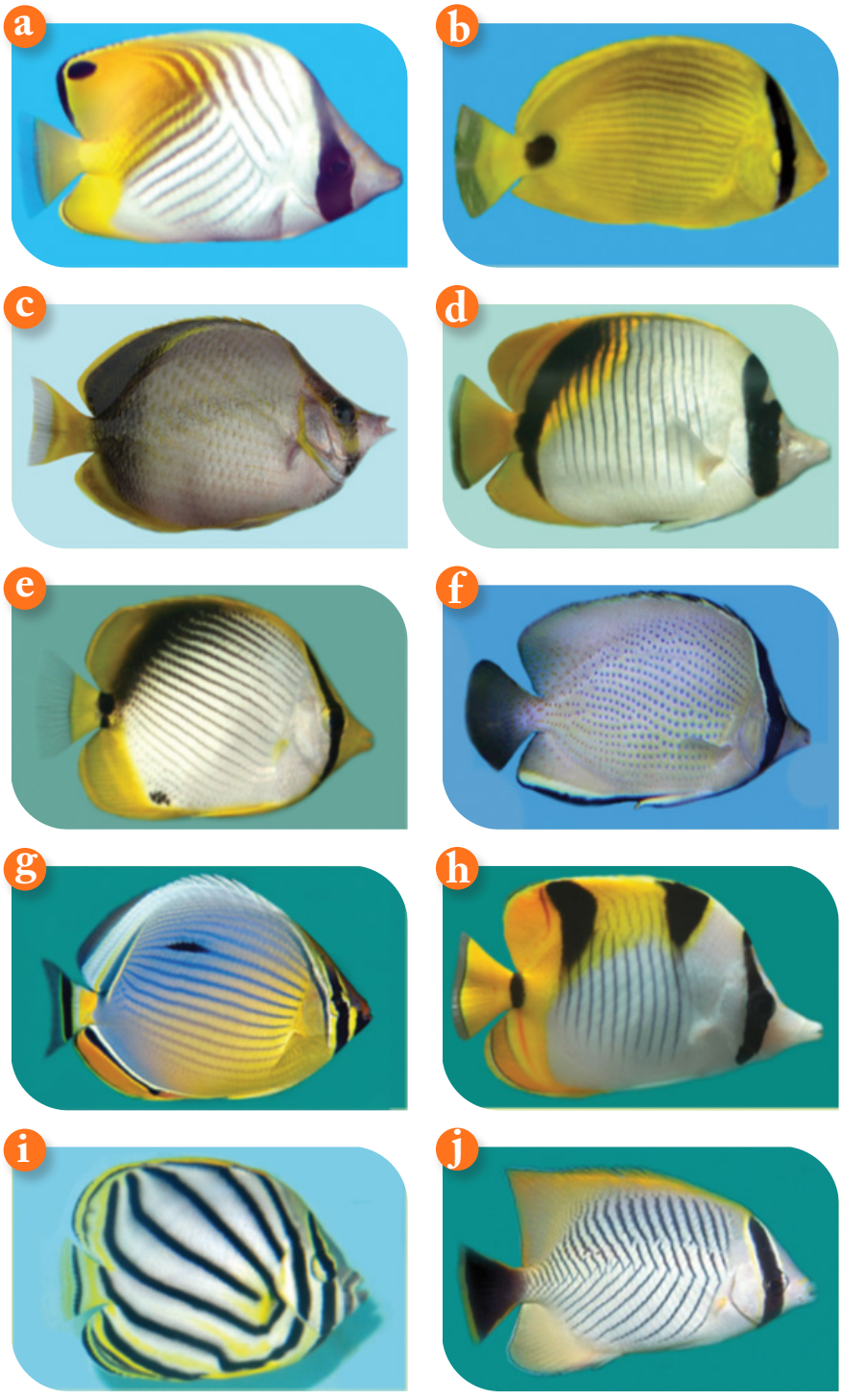
(a) *Acanthurus leucosternon* | **(b)** *Acanthurus triostegus* | **(c)** *Acanthurus lineatus*
(d) *Acanthurus mata* | **(e)** *Naso annulatus* | **(f)** *Zebrasoma velifer*
(g) *Antennarius nummifer* | **(h)** *Histrio histrio*



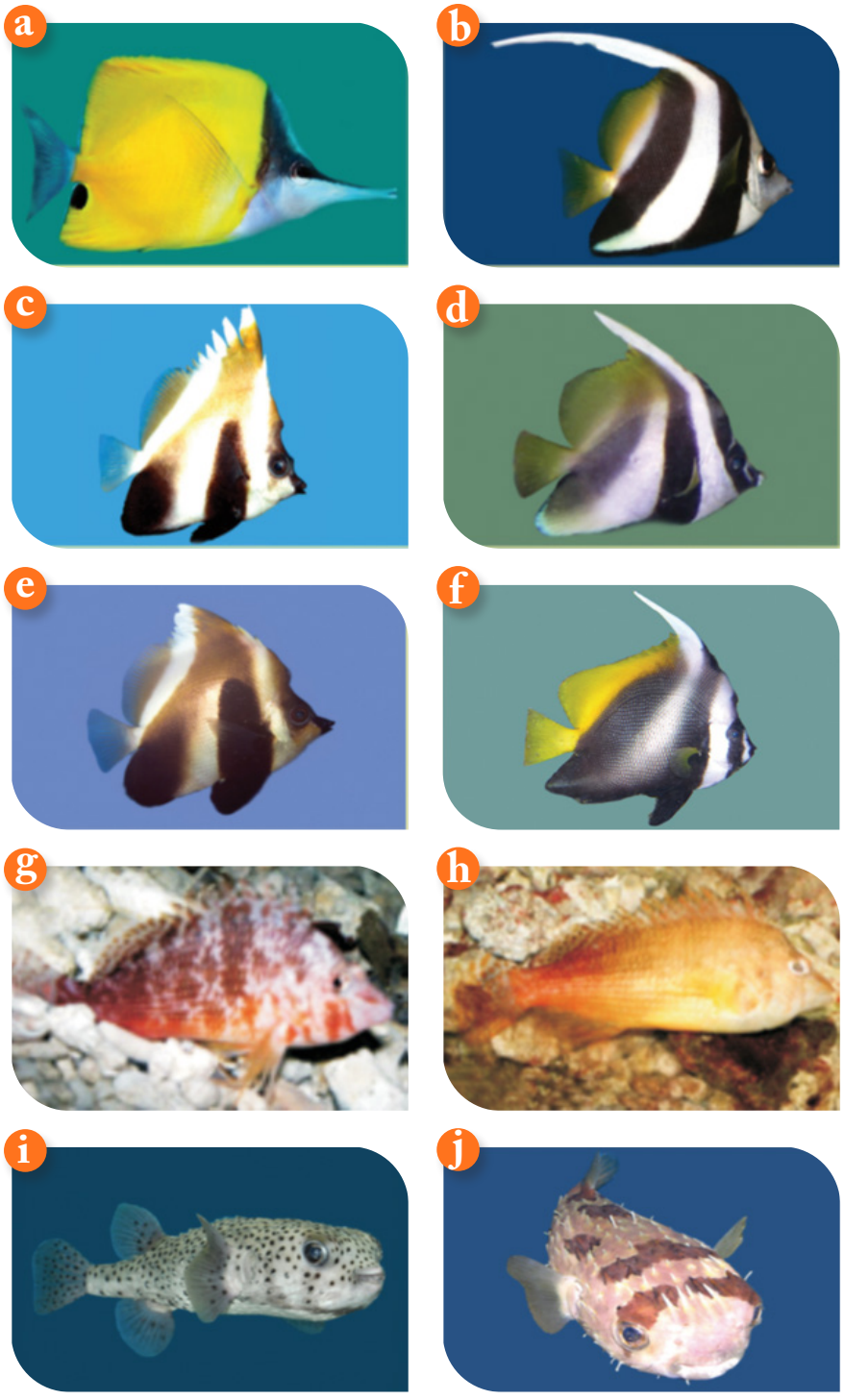
(a) *Apogon endekataenia* | **(b)** *Apogonichthyoides pseudotaeniatus* | **(c)** *Cheilodipterus macrodon*
(d) *Ostorhinchus aureus* | **(e)** *Abalistes stellatus* | **(f)** *Balistapus undulatus* | **(g)** *Odonus niger*
(h) *Pseudobalistes flavimarginatus* | **(i)** *Rhineacanthus aculeatus* | **(j)** *Rhineacanthus rectangulus*



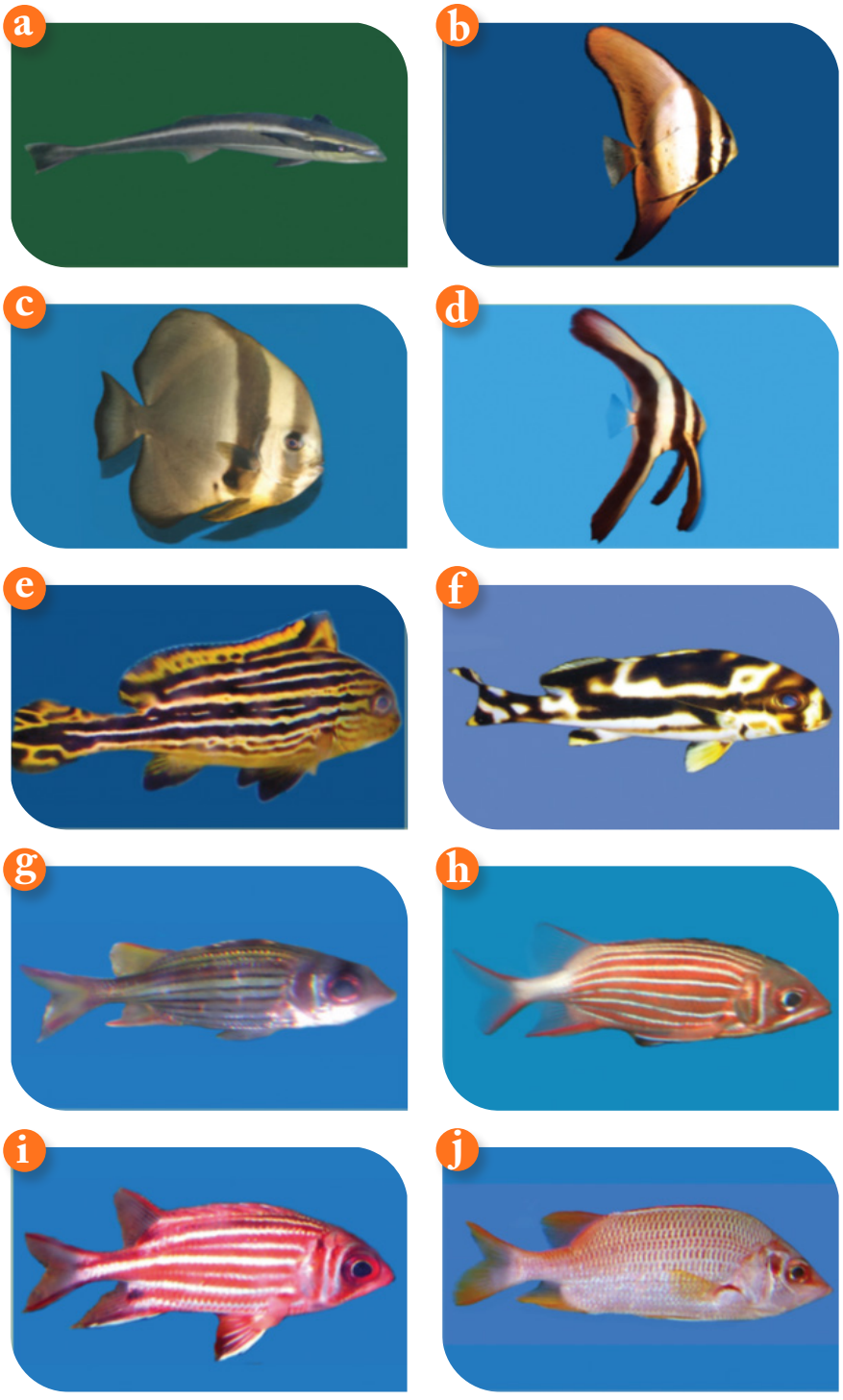
(a) *Sufflamen fraenatum* | **(b)** *Gnathanodon speciosus* | **(c)** *Trachinotus blochii*
(d) *Chaetodon lunula* | **(e)** *Chaetodon kleinii* | **(f)** *Chaetodon decussatus* | **(g)** *Chaetodon collare*
(h) *Chaetodon xanthocephalus* | **(i)** *Chaetodon vagabundus* | **(j)** *Chaetodon octofasciatus*



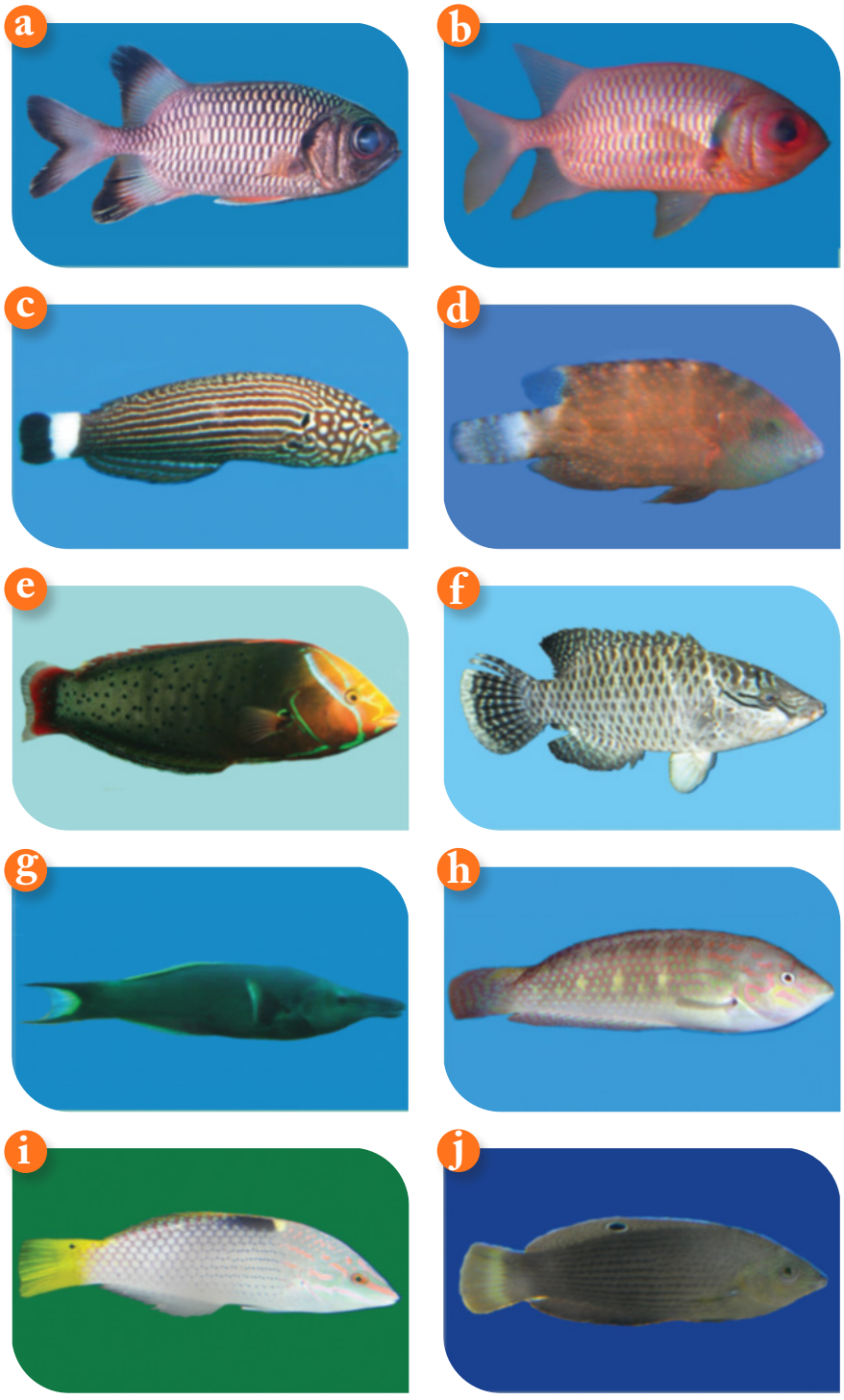
(a) *Chaetodon auriga* | **(b)** *Chaetodon plebeius* | **(c)** *Chaetodon gardineri*
(d) *Chaetodon lineolatus* | **(e)** *Chaetodon melannotus* | **(f)** *Chaetodon citrinellus*
(g) *Chaetodon trifasciatus* | **(h)** *Chaetodon falcula* | **(i)** *Chaetodon meyeri*
(j) *Chaetodon trifascialis*



(a) *Forcipiger flavissimus* | **(b)** *Heniochus acuminatus* | **(c)** *Heniochus varius*
(d) *Heniochus monoceros* | **(e)** *Heniochus pleurotaenia* | **(f)** *Heniochus singularius*
(g) *Cirrhitichthys bleekeri* | **(h)** *Cirrhitichthys aureus* | **(i)** *Diodon hystrix* | **(j)** *Lophodiodon calori*



(a) *Echeneis naucrates* | **(b)** *Platax orbicularis* | **(c)** *Platax teira* (Adult)
(d) *Platax teira* (Juvenile) | **(e)** *Plectorhynchus lineatus* | **(f)** *Plectorhynchus vittatus*
(g) *Neoniphon sammara* | **(h)** *Sargocentron diadema* | **(i)** *Sargocentron rubrum*
(j) *Sargocentron spiniferum*



(a) *Myripristis adustus* | **(b)** *Myripristis murdjan* | **(c)** *Anampses lineatus*

(d) *Cheilinus chlorurus* | **(e)** *Coris formosa* | **(f)** *Cheilinus undulatus*

(g) *Gomphosus varius* | **(h)** *Halichoeres biocellatus* | **(i)** *Halichoeres hortulanus*

(j) *Halichoeres marginatus (Female)*

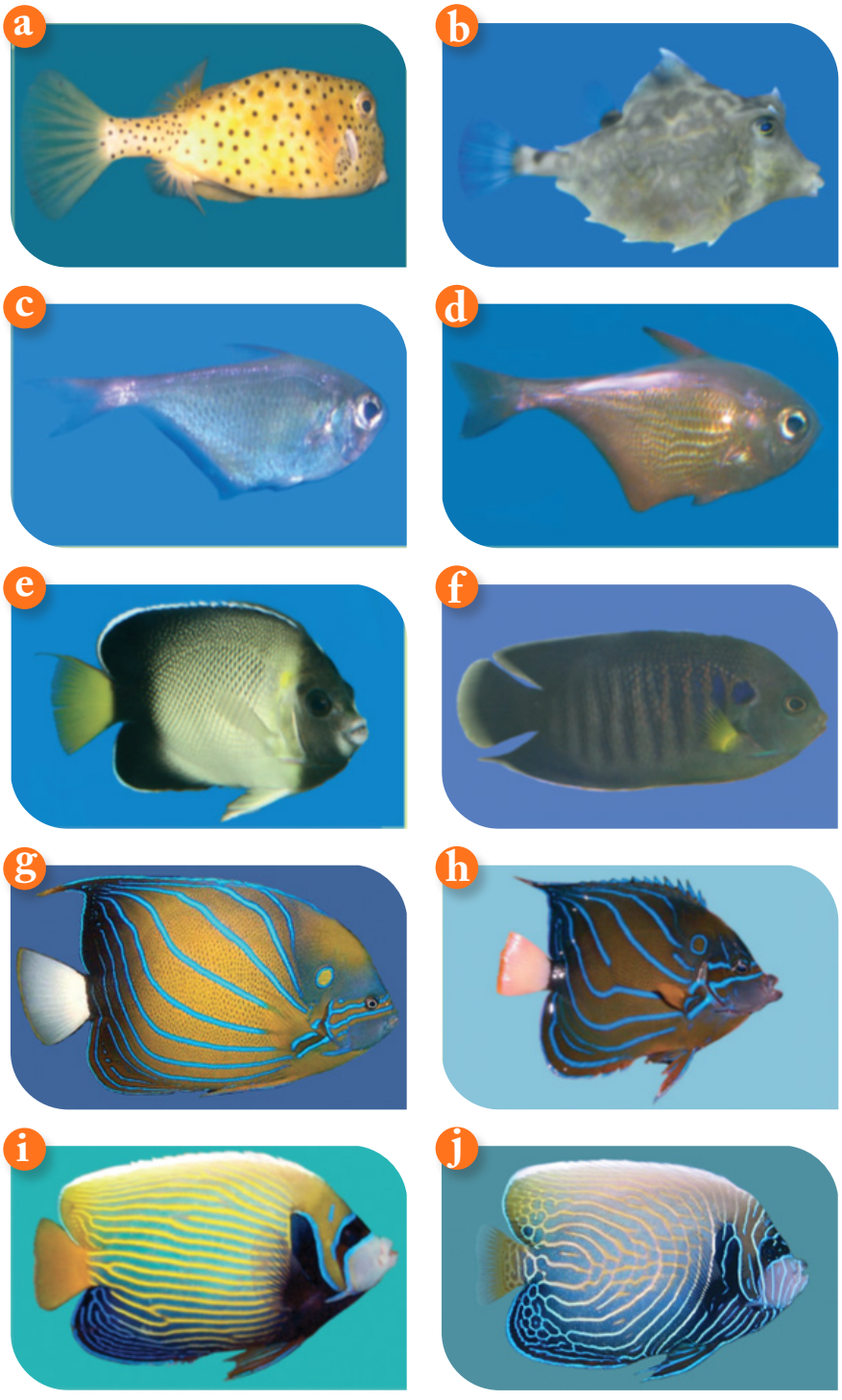


(a) *Halichoeres marginatus (Male)*
(b) *Halichoeres melanochir*
(c) *Hemigymnus melapterus*
(d) *Halichoeres zeylonicus* | **(e)** *Labroides dimidiatus*
(f) *Thalassoma jansenii* | **(g)** *Thalassoma lunare*
(h) *Xyrichtys novacula* | **(i)** *Bodianus neilli*

Source: No of photos 1 to 67 Anil, M K and Jasmine, S and George, Rani Mary and Raju, B and Kingsly, H Jose and Salini, K P (2014) Ornamental Fishes of Indian Coast-1. [Image]



(a) *Monodactylus argenteus* | **(b)** *Cantherhines sandwichiensis* | **(c)** *Canthidermis maculata*
(d) *Pervagor melanocephalus* | **(e)** *Echidna nebulosa* | **(f)** *Gymnothorax favagineus*
(g) *Gymnothorax flavimarginatus* | **(h)** *Gymnothorax javanicus* | **(i)** *Gymnothorax meleagris*
(j) *Lactoria cornuta*



(a) *Ostracion cubicus* | **(b)** *Tetrosomus gibbosus* | **(c)** *Pempheris oualensis*

(d) *Pempheris vanicolensis* | **(e)** *Apoiemichthys xanthurus* | **(f)** *Centropyge flaipectoralis*

(g) *Pomacanthus annularis (Adult)* | **(h)** *Pomacanthus annularis (Juvenile)*

(i) *Pomacanthus imperator (Adult)* | **(j)** *Pomacanthus imperator (Sub - adult)*

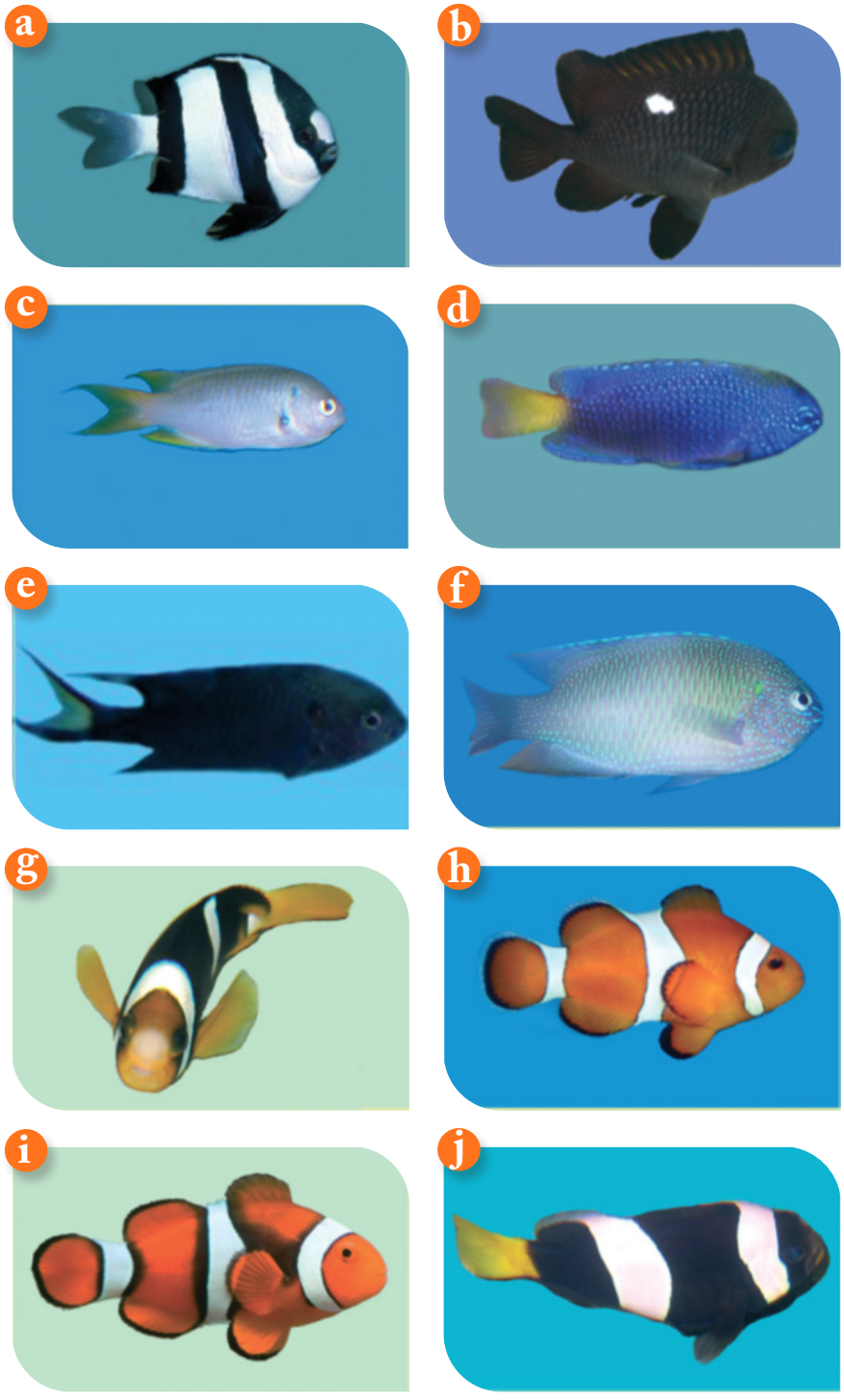


(a) *Pomacanthus imperator (Juvenile)* | **(b)** *Pomacanthus semicirculatus (Adult)*

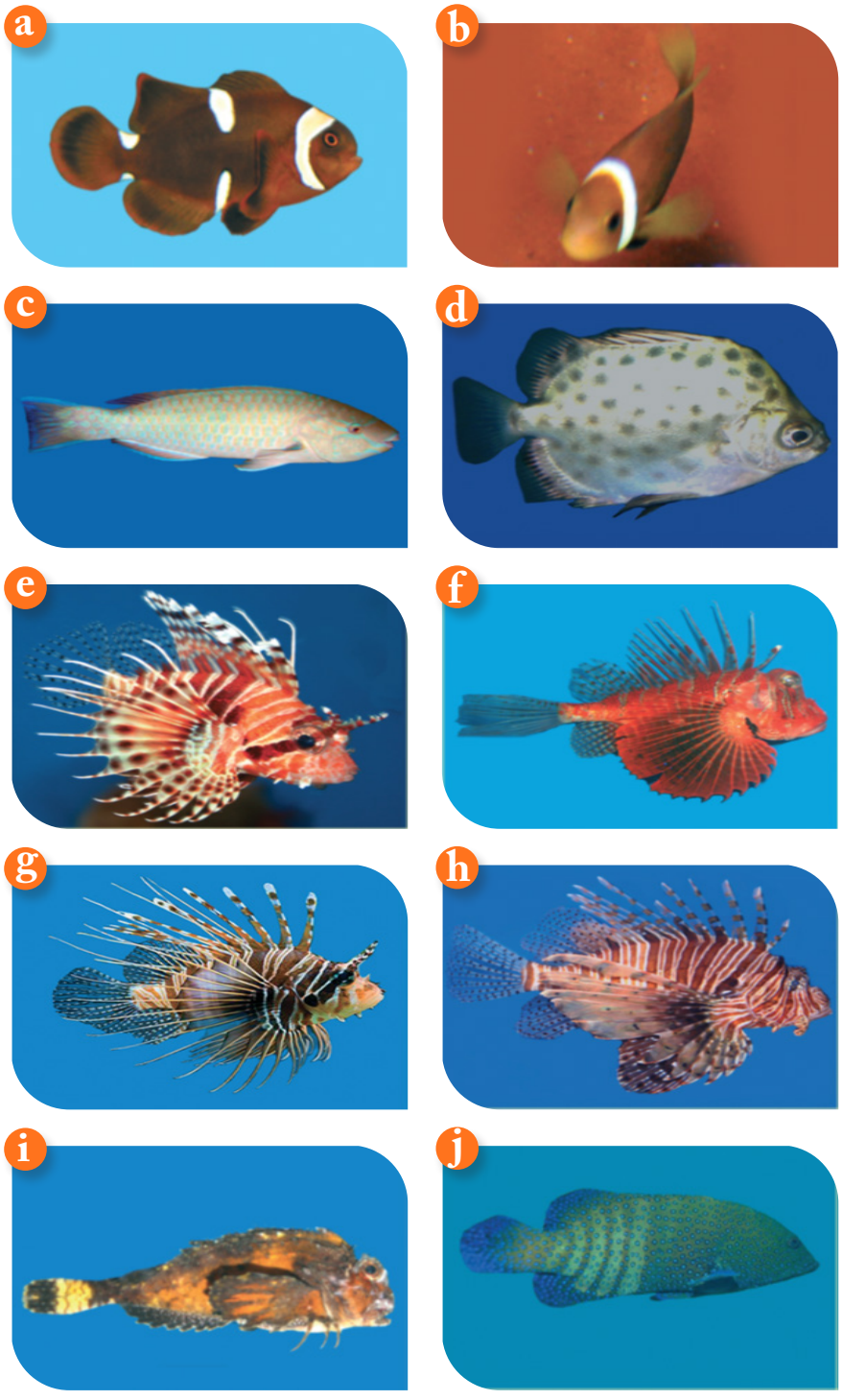
(c) *Pomacanthus semicirculatus* (Sub-adult) | **(d)** *Pomacanthus semicirculatus (Juvenile)*

(e) *Abudefduf bengalensis* | **(f)** *Abudefduf vaigiensis* | **(g)** *Abudefduf sordidus* | **(h)** *Chromis viridis*

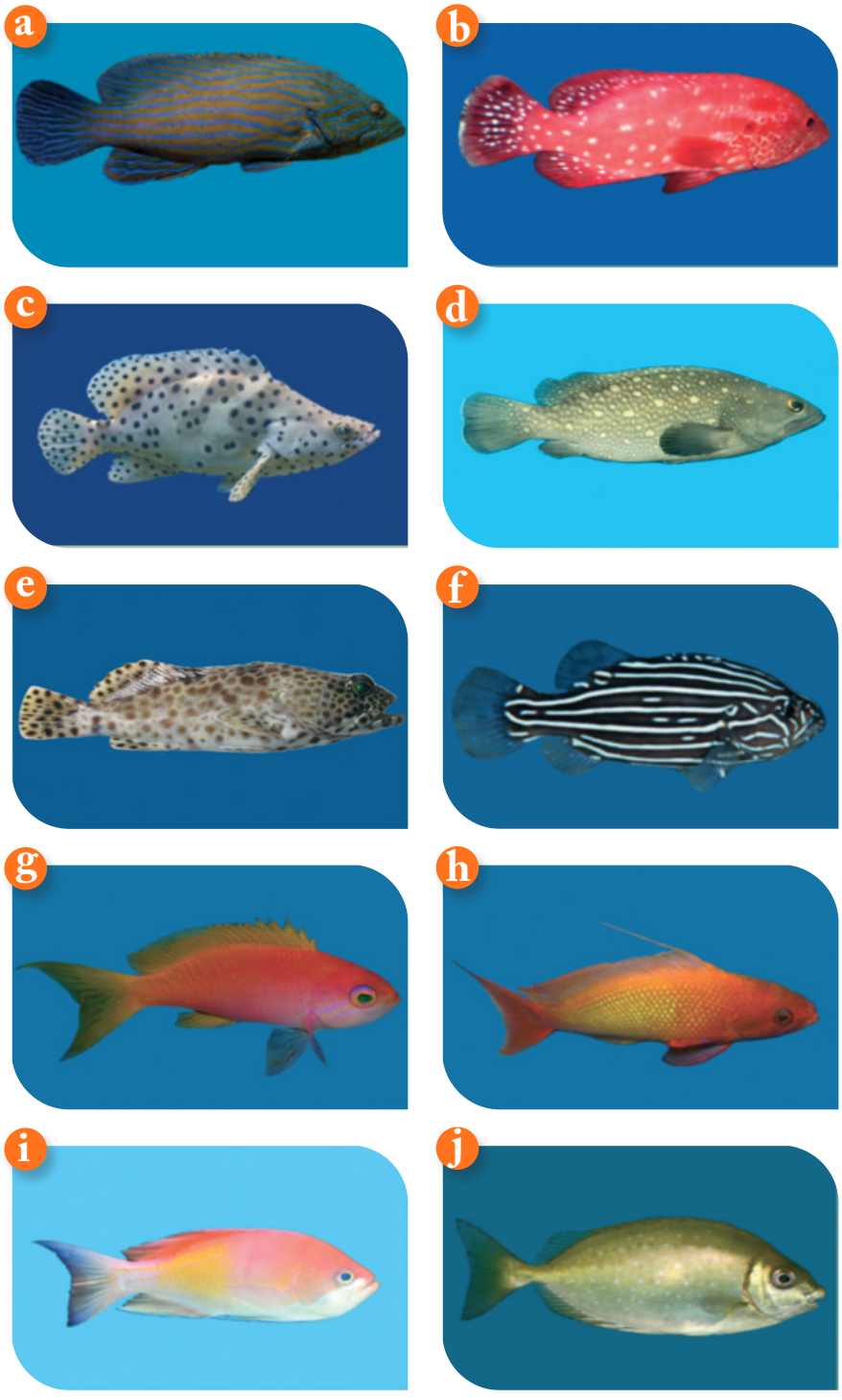
(i) *Chrysiptera cyanea* | **(j)** *Chrysiptera unimaculata*



(a) *Dascyllus aruanus* | **(b)** *Dascyllus trimaculantus* | **(c)** *Nepomacentrus nemurus*
(d) *Pomacentrus caeruleus* | **(e)** *Nepomacentrus filamentosus* | **(f)** *Pomacentrus pavo*
(g) *Amphiprion clarkii* | **(h)** *Amphiprion ocellaris* | **(i)** *Amphiprion percula* | **(j)** *Amphiprion sebae*



(a) *Premnas biaculeatus* | **(b)** *Amphiprion nigripes* | **(c)** *Chlorurus sordidus*
(d) *Scatophagus argus* | **(e)** *Dendrochirus zebra* | **(f)** *Parapterois heterura*
(g) *Pterois antennata* | **(h)** *Pterois volitans* | **(i)** *Scorpaenopsis gibbosa* | **(j)** *Cephalopholis argus*

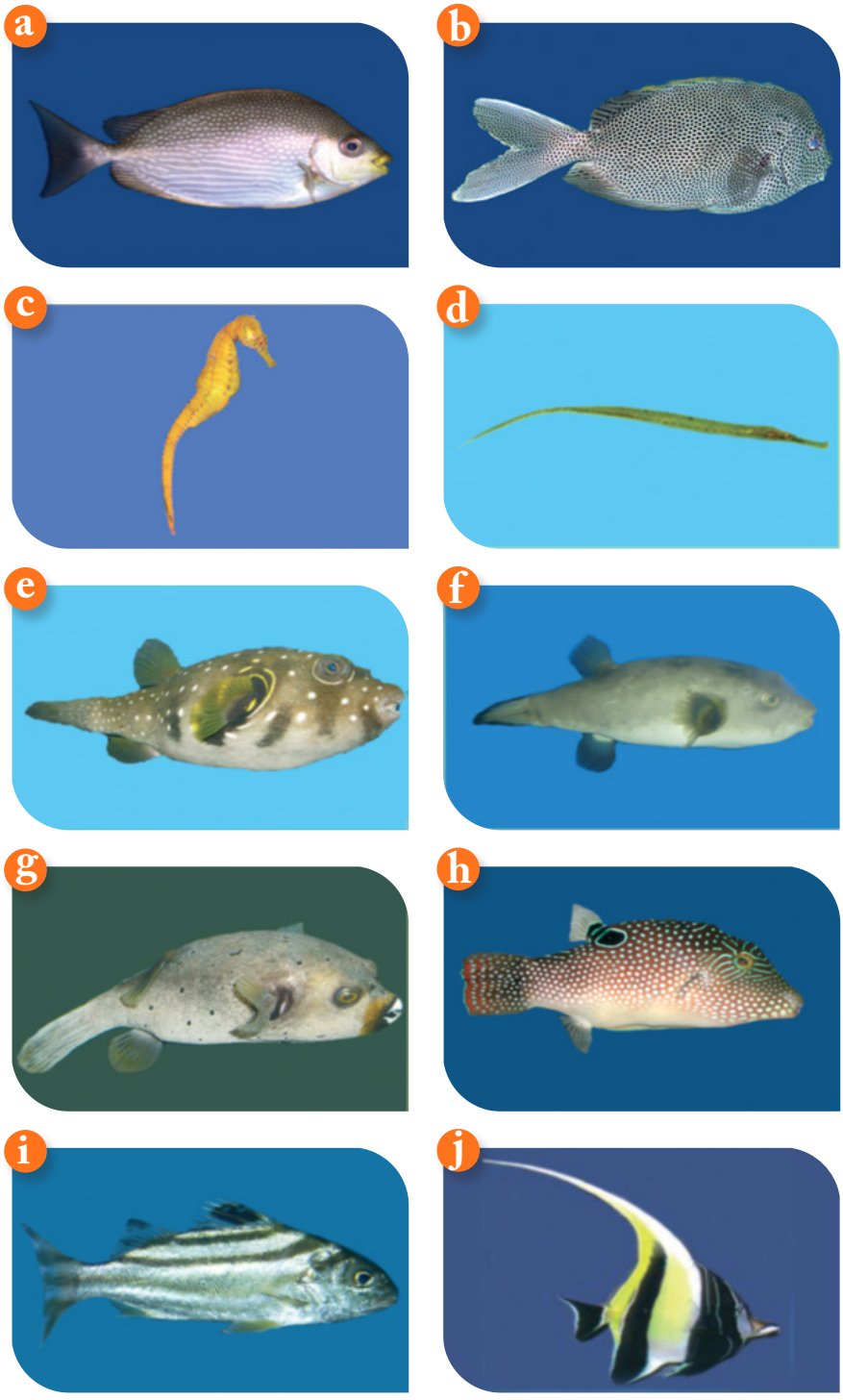


(a) *Cephalopholis formosa* | **(b)** *Cephalopholis sonnerati* | **(c)** *Cromileptis altivelis*

(d) *Epinephelus coeruleopunctatus* | **(e)** *Epinephelus merra* | **(f)** *Grammistes sexlineatus*

(g) *Pseudanthias bimaculatus* | **(h)** *Pseudanthias squamipinnis* | **(i)** *Pseudanthias sp.*

(j) *Siganus canaliculatus*



(a) *Siganus javus*
(b) *Siganus punctatus*
(c) *Hippocampus kuda*
(d) *Syngnathoides biaculeatus* | **(e)** *Arothron hispidus* | **(f)** *Arothron immaculatus*
(g) *Arothron nigropunctatus* | **(h)** *Canthigaster solandri* | **(i)** *Terapon jarubua* | **(j)** *Zanclus cornutus*

Source: No of photos 1 to 66 Anil, M K and Jasmine, S and George, Rani Mary and Raju, B and Kingsly, H Jose and Salini, K P (2014) Ornamental Fishes of Indian Coast-2. [Image]

Annexure 3

List of protected species under Wild Life Protection Act

Scientific Name	Common name	WLPA, 1972	WLPA, 2022
Elasmobranchii			
Rhynchobatus australiae	Bottlenose Wedgefish	Not listed	Sch I (Part E:Fishes)
Rhina ancylostoma	Bowmouth Guitarfish	Not listed	Sch I (Part E:Fishes)
Glaucostegus thouin	Clubnose Guitarfish	Not listed	Sch I (Part E:Fishes)
Himantura fluviatilis	Ganges Stingray	Sch I (Part IIA)	Sch I (Part E:Fishes)
Urogymnus polylepis	Giant Freshwater whipray	Not listed	Sch I (Part E:Fishes)
Rhynchobatus djiddensis	Giant Guitarfish	Sch I (Part IIA)	Sch I (Part E:Fishes)
Mobula birostris	Giant Manta	Not listed	Sch I (Part E:Fishes)
Urogymnus asperrimus	Porcupine Whipray	Sch I (Part IIA)	Sch I (Part E:Fishes)
Mobula alfredi	Reef Manta	Not listed	Sch I (Part E:Fishes)
Rhynchobatus laevis	Smoothnose Wedgefish	Not listed	Sch I (Part E:Fishes)
Glaucostegus obtusus	Widenose Guitarfish	Not listed	Sch I (Part E:Fishes)
Coelenterata			
All species of the Order *Scleractinia*	Reef-building corals	Sch I (Part IVA)	Sch I (Part K:Corals)
All species of the Order *Antipatharia*	Black corals	Sch I (Part IVA)	Sch I (Part K:Corals)
Tubipora musica	Organ Pipe corals	Sch I (Part IVA)	Sch I (Part K:Corals)
All species of the Genus *Millepora*	Fire corals	Sch I (Part IVA)	Sch I (Part K:Corals)
All *Gorgonians*	Sea fans	Sch I (Part IVA)	Not Listed
All species from the following Families in the Order *Helioporacea, Aulopsammiidae, Helioporidae* and *Lithotelestidae*	Blue Coral	Not Listed	Sch I (Part K:Corals)
All species of the Order *Corallimorpharia*	False Corals	Not Listed	Sch I (Part K:Corals)

All species from the following Families in the Order *Actiniaria, Actinernidae, Halcuriidae* and *Edwardsiidae*	Sea Anemones	Not Listed	Sch I (Part K:Corals)
All species from the following Families in the Order *Pennatulacea, Anthoptilidae, Chunellidae, Echinoptilidae, Funiculinidae, Kophobelemnidae, Protoptilidae, Pseudumbellulidae, Renillidae, Scleroptilidae, Stachyptilidae, Umbellulidae,·Veretillidae, Balticinidae, Pennatulidae,* and *Virgulariidae*	Sea Pens	Not Listed	Sch I (Part K:Corals)
All species from the following Families in the Order *Alcyonacea: Acanthoaxiidae, Chelidonisididae, Pamsphaerascleridae, Nephtheidae, Alcyoniidae, Clavulariidae, Xeniidae, Comulariidae, Subergorgiidae, Pleaxauridae, Ellisellidae, Melithaeidae,* and *Briareidae*	Soft Corals	Not Listed	Sch I (Part K:Corals)
All species of the following Families of the Order *Penicillaria, Pennatulidae, Anthoptilidae, Scleroptilidae, Spirularia, Halipteridae,* and *Protoptilidae*	Tube-dwelling Anemones	Not Listed	Sch I (Part K:Corals)
All species of the Order *Zooantharia*	Zoanthids	Not Listed	Sch I (Part K:Corals)

Porifera			
All species of the Class *Calcarea*	Sponges	Sch III	Sch II (Part I:Porifera)
Mollusca			
Gastropoda			
Hippopus hippopus	Horse's Hoof Clam	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Conus milneedwardsi	Glory of India	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Cassis cornuta	Horned Helmet Shell/King Shell	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Nautilus pompilius	Emperor Nautilus/Chambered nautilus	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Cypraecassis rufa	Bull Mouth Helmet/ Queenshell	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Charonia tritonis	Triton's Trumpet shell	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Harpago arthriticus	Arthritic Spider Conch	Sch IV	Sch II (Part F:Mollusca)
Harpago chiragra	Chiragra Spider Conch	Sch IV	Sch II (Part F:Mollusca)
Lambis millepeda	Millepede Spider Conch	Sch IV	Sch II (Part F:Mollusca)
Lambis crocata	Orange Spider Conch	Sch IV	Sch II (Part F:Mollusca)
Lambis scorpius	Scorpion Spider Conch	Sch IV	Sch II (Part F:Mollusca)
Dolomena plicata sibbaldii	Sibald's Conch/Pigeon Conch	Sch IV	Sch II (Part F:Mollusca)
Pleuroploca trapezium	Trapezium Horse Conch	Sch IV	Sch II (Part F:Mollusca)
Lambis truncata	Giant Spider Conch	Sch IV	Sch II (Part F:Mollusca)
Staphylaea limacina	Slug-like Cowrie	Sch IV	Sch II (Part F:Mollusca)

Leporicypraea mappa	Map Cowrie	Sch IV	Sch II (Part F:Mollusca)
Talparia talpa	Mole Cowrie	Sch IV	Sch II (Part F:Mollusca)
Tectus niloticus	Commercial Top Shell	Sch IV	Sch II (Part F:Mollusca)
Turbo marmospratus	Green Turban Snail	Sch IV	Sch II (Part F:Mollusca)
Harpulina arausica	Vaxillate Volute/Gold Banded Volute	Sch IV	Sch II (Part F:Mollusca)
Bivalvia			
Tridacna squamosa	Fluted Giant Clam or Scaly Clam	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Tridacna maxima	Small Giant Clam	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Tudicla spirillus	Spiral Tudicla	Sch I (Part IVB)	Sch I (Part G:Mollusca)
Placuna placenta	Windowpane Oyster	Sch IV	Sch II (Part F:Mollusca)
Echinodermata			
All species of the Class *Holothuroidea*	Sea cucumbers	Sch I (Part IV C)	Sch I (Part F:Echinodermata)
Arthropoda			
Carcinoscorpius rotundicauda	Mangrove Horseshoe Crabs	Sch IV	Sch I (Part H:Arthropoda)
Tachypleus gigas	Indo-Pacific Horseshoe Crabs	Sch IV	Sch I (Part H:Arthropoda)
Birgus latro	Robber Crab	Sch I	Not listed
Reptilia			
Lepidochelys olivacea	Olive Ridley sea turtle	Sch I	Sch I (Part C:Reptiles)
Chelonia mydas	Green sea turtle	Sch I	Sch I (Part C:Reptiles)
Eretmochelys imbricata	Hawksbill sea turtle	Sch I	Sch I (Part C:Reptiles)

Caretta caretta	Loggerhead sea turtle	Sch I	Sch I (Part C:Reptiles)
Dermochelys coriacea	Leatherback sea turtle	Sch I	Sch I (Part C:Reptiles)
Mammalia			
Lagenodelphis hosei	Fraser's Dolphin	Sch I	sch I (Part A:Mammals)
Platanista gangetica	Gangetic/South Asian River Dolphin	Sch I	sch I (Part A:Mammals)
Tursiops aduncus	Indo-Pacific Bottlenose Dolphin	Sch I	sch I (Part A:Mammals)
Sousa chinensis	Indo-Pacific hump-back Dolphin	Sch I	sch I (Part A:Mammals)
Platanista minor	Indus River Dolphin	Sch I	sch I (Part A:Mammals)
Orcaella brevirostris	Irrawady Dolphin	Sch I	sch I (Part A:Mammals)
Stenella longirostris	Pantropical Spinner Dolphin	Sch I	sch I (Part A:Mammals)
Stenella attenuata	Pantropical Spotted Dolphin	Sch I	sch I (Part A:Mammals)
Grampus griseus	Risso's Dolphin	Sch I	sch I (Part A:Mammals)
Steno bredanensis	Rough-toothed Dolphin	Sch I	sch I (Part A:Mammals)
Delphinus delphis	Short-beaked Saddleback Dolphin/Common Dolphin	Sch I	sch I (Part A:Mammals)
Stenella coeruleoalba	Striped Dolphin	Sch I	sch I (Part A:Mammals)
Dugong dugon	Dugong/Sea Cow	Sch I	sch I (Part A:Mammals)
Neophocaena phocaenoides	Finless Porpoise	Sch I	sch I (Part A:Mammals)
Balaenoptera acutorostrata	Common Minke Whale	Sch I	sch I (Part A:Mammals)
Balaenoptera borealis	Sei Whale	Sch I	sch I (Part A:Mammals)

Balaenoptera edeni	Bryde's Whale	Sch I	sch I (Part A:Mammals)
Balaenoptera musculus	Blue Whale	Sch I	sch I (Part A:Mammals)
Balaenoptera physalus	Fin Whale	Sch I	sch I (Part A:Mammals)
Megaptera novaeangliae	Humpback Whale	Sch I	sch I (Part A:Mammals)
Feresa attenuata	Pygmy Killer Whale	Sch I	sch I (Part A:Mammals)
Globicephala macrorhynchus	Short-finned Pilot Whale	Sch I	sch I (Part A:Mammals)
Orcinus area	Killer Whale	Sch I	sch I (Part A:Mammals)
Peponocephala electra	Melon-headed Whale	Sch I	sch I (Part A:Mammals)
Pseudorca crassidens	False Killer Whale	Sch I	sch I (Part A:Mammals)
Physeter macrocephalus	Sperm Whale/Cachalot	Sch I	sch I (Part A:Mammals)
Kogia breviceps	Pygmy Sperm Whale	Sch I	sch I (Part A:Mammals)
Kogia sima	Dwarf Sperm Whale	Sch I	sch I (Part A:Mammals)
Mesoplodon densirostris	Blainville's Beaked Whale	Sch I	sch I (Part A:Mammals)
Mesoplodon ginkgodens	Ginkgo-toothed Beaked Whale	Sch I	sch I (Part A:Mammals)
Ziphius cavirostris	Cuvier's Beaked Whale	Sch I	sch I (Part A:Mammals)

Annexure 4

Format for licence to be issued to a green certified collector

1. Name :
2. Age :
3. Company name / Residential address :
4. Training undergone (Name of the organisation which offered the training with duration) :
    1. Identification of marine ornamentals :
    2. Harvesting methods :
    3. Handling and transportation of marine ornamentals :
5. Green Certification number allotted (Green Certified Collector) :

Official Seal/Stamp

Name & Signature of the official issuing the licence

Annexure 5

List of unsuitable/harmful marine ornamental groups

Sl. No	Groups	Features
1	Cubozoan box jellyfish and Scyphozoan forms	Envenomation by the stinging nematocysts found the tentacles
2	Hydroid jellyfish mainly Portuguese man-of-war, Physalia physalia	Envenomation by the sting mainly the tentacles
3	Sea snakes	Envenomation by bite
4	Sea ferns	Envenomation by the sting; fronds with tiny polyps
5	Sea anemones*	Envenomation by the stinging tentacles
6	Crow of horns starfish	Sharp spines; can cause injury
7	Cone shells	Envenomation by the sting by the barbs in the base of proboscis
8	Scorpionfish and Stonefishes	Envenomation by toxic spines in the fins
9	Lionfishes*	Envenomation by toxic spines in the fins
10	Moray eels*	Bite; can causes injury
11	Trigger fishes*	Bite; can causes injury
12	Rabbitfishes*	Envenomation by toxic spines in the fins
13	Sting rays*	Sharp barb like spines, at the base of the part of the whip like tail
14	Electric rays	Shock by the electric organ in the animal
15	Striped catfish, Plotosus	Venomous spines in the fins
16	Surgeon fishes*	Envenomation by sharp retractable blades at the caudal peduncle
17	Sea urchins*	Envenomation by toxic sharp spike like spines or stalked appendages
18	Stressed ornamentals	Body damage, Bruised tissue damage, Removed scales, Bulging eye, Fin damage, Torn fin
19	Diseased ornamentals	Diseased animals with different signs and symptoms
20	Marine species listed in CITES appendixes	Appendix I & II of CITES
21	Marine species listed in Indian Wild Life Protection Act, 1972	Scheduled species as listed in the Indian WLPA

**Can be kept in aquarium with proper precautions as prescribed by GC Authority*

Annexure 6

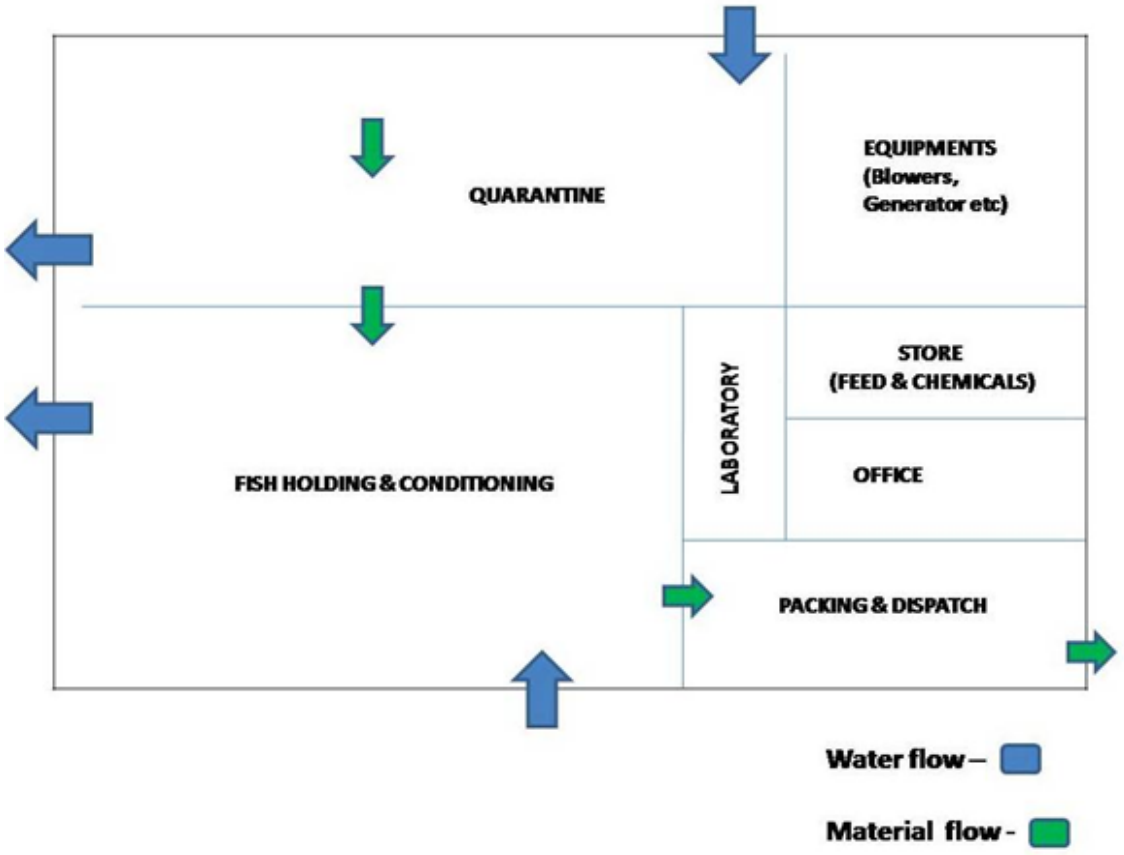
Log book format for collection of marine ornamental species

1	**Name of the collector**						
2	**Green certification number of the collector**						
3	**No. of person accompanying**						
4	**Date**						
5	**Site name (address)**						
6	**Geo-location/Landmark**	**Start**			**End**		
7	**Depth**						
8	**Time of day that work started**						
9	**Time of day that work ended**						
10	**Orientation of collection**	**N to S**		**NE to SW**	**E to W**		**SE to NW**
11	**Distance from shore**						
12	**Weather conditions**	**Sunny**		**Cloudy**	**Raining**		
13	**Nature of the water body (Ecosystem)**	Coral reef (massive/ submassive/ branched)		Sea grass	Sea weeds		Estuaries
		Backwaters / salt marsh / mangroves		Wetlands	Mangroves		Sandy/rubbles/ rocky
14	**Distance to holding centre**						
15	**Water condition**	**Clear**			**Turbid**		**Translucent**
16	**Tide**						
17	**Collection methods**	Hand picking		Snorkelling	Skin/ Scuba diving	Traps	Others
		Drag net		**Cast net**	**Dip net**	**Barrier nets**	
18	**Marine organism caught**	Sl. No		Species/ common name	Number	Size	survival
		1					
		2					
		3					
19	**Mortality (Nos.)**	At the time of capture			From collection site to holding facility		
20	**Marine species caught and released (non-targeted / injured)**						

21	**Quantity of the catch (in numbers or by weight)**	
22	**No. of times the gear operated**	
23	**Additional information or comments**	

Annexure 7

A model lay out for designing a holding centre of marine ornamental species



Annexure 8

No Objection Certificate for use of the land/facility as holding centre of marine ornamental fish

Certified that, I,..... owner of the land/building/shed, located at .....

(Full Address) have No Objection in permitting Sri..... to operate a marine ornamental fish holding /conditioning centre at the above mentioned land / building / shed from .....(date) to ..... (date)

Place:
Date:

Signature:
Name & address

Annexure 9

Quarantine section log book in a holding centre of marine ornamental species

Sl. No	Date	Name/ Green Certification number of fish collector / of supplier	Remarks (regarding health status, treatments given etc)	Mortality details, if any

Annexure 10

Daily activity logbook format for a holding centre of marine ornamental species

Date	Tank no	Name of fish stocked	Avg. size of the fish & Stocking density (Nos/L)	Remarks (mortality if any)

Annexure 11

Water quality monitoring register in holding centre of marine ornamental species

Date: **Time:**

Sl. No	Water quality parameters	Quarantine section					Fish holding section				
		Tank 1	Tank 2	Tank 3	Tank 4	Tank 5	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5
1	Salinity										
2	pH										
3	Temperature										
4	Dissolved Oxygen										
5	Ammonia										
6	Nitrite										
7	Nitrate										

Annexure 12

Repair and calibration records of equipment in a holding centre of marine ornamental species

Sl. No.	Name of equipment	Repair & maintenance details with date	Calibration details with date
1	Blowers/Aerators		
2	Filters		
3	*PH meter*		
4	Salinometer		
5	D.O meter		
6	Thermometer		

Annexure 13

Format for rent agreement for using the land/buildings for operating a captive breeding and seed production unit of marine ornamental species

This Rent Agreement is made on this _____ (date of rent agreement) by_____**(name of the landlord)** S/o_____ (father's name of the landlord), Add: _____ (residential address of the landlord). Herein after called the Lessor / Owner, Party Of the first part

AND

_____ **(Name of the proposed company),** through its proposed director _____ (name of the director) called Lessee/Tenant, Party of the **Second Part**

That the expression of the term, Lessor/Owner and the Lessee/Tenant shall mean and include their legal heirs successors , assigns, representative etc. Whereas the Lessor /Owner is the owner and in possession of the property No: _____ (registered address of the company) and has agreed to let out whole building including office Room, Toilet, Bathroom, etc. Set on said property, to the Lessee/Tenant and the Lessee/Tenant has agreed to take the same on rent of Rs. _____/- (In words) per month.

NOW THIS RENT AGREEMENT WITNESSETH AS UNDER:-

1. That the Tenant/Lessee shall pay as the monthly rent of RS. _____/- (In words) per month, excluding electricity and water charge.
2. That the Tenant /Lessee shall not sub–let any part of the above said demised premised premises to anyone else under any circumstances without the consent of Owner.
3. That the Tenant / Lessee shall abide by all the bye - laws , rules and regulation, of the local authorities in respect of the demised premises and shall not do any illegal activities in the said demised premises.
4. That this Lease is granted for a period of ..... commencing from _____(date of rent commencing from) and this lease can be extended further by both the parties with their mutual consent

5. That the Tenant/Lessee shall keep the said premises in clean & hygienic condition and shall not do or causes to be done any act which may be a nuisance to other.
6. That the Lessee/Tenant Shall not store/Keep any offensive, dangerous, explosive or highly Inflammable articles in the said premises and shall not use the same for any unlawful activities .
7. That both the parties have read over and understood all the contents of this agreement and have signed the same without any force or pressure from any side.

WITNESSES:-

1.
2.

_____ (name of the landlord) _____ (name of the proposed Company)

Lessor Lessee

Annexure 14

No Objection Certificate for use of the land/facility as marine ornamental fish breeding unit

Certified that, I, ... owner of the land/building/shed, located at .... (Full Address) have No Objection in permitting Sri ..... to operate a marine ornamental fish breeding centre at the above mentioned land / building / shed from .....(date) to .....(date)

Place:
Date:

Signature:
Name & address

Annexure 15

Logbook format in a marine ornamental fish hatchery

Sl. No.	Date	Receipt of fishes				Breeding & seed production				Remarks
		Name/ Green certification number fish collector / or supplier	Name of fish (Common name & Scientific name)	Number of fishes & method of collection	Health status, treatments given, etc.	Total no. of spawning	Total no. of eggs produced	Total no. of larvae in stock	Total no. of Juvenile in stock	

Annexure 16

Logbook format in a broodstock section of the marine ornamental fish hatchery

Date	Tank no	No. of fish stocked	Length (cm)	Weight (gm)	Environmental parameters	% of water exchange	Weight of feed and timing	Remarks
					DO- pH- Ammonia- Salinity- Temp -			
					DO- pH- Ammonia- Salinity- Temp-			
					DO- pH- Ammonia- Salinity- Temp			
					DO- pH- Ammonia- Salinity- Temp			

Annexure 17

Logbook format in a microalgal unit for a marine ornamental fish hatchery

Date	Tank no	Name of species stocked	Cell density	Volume of Microalgae	Environmental parameters	Qty of algae harvested	Remarks
					DO- pH- Ammonia- Salinity- Temp -		
					DO- pH- Ammonia- Salinity- Temp-		
					DO- pH- Ammonia- Salinity- Temp		
					DO- pH- Ammonia- Salinity- Temp		

Annexure 18

Logbook format in zooplankton unit for a marine ornamental fish hatchery

Date	Tank no	Name of species stocked	Density of Zooplanktons	Volume of Zooplanktons	Environmental parameters	Amount of zooplankton harvested	Amount of Microalgae given as feed (Cell/ml)	Remarks
					DO- pH- Ammonia- Salinity- Temp -			
					DO- pH- Ammonia- Salinity- Temp-			
					DO- pH- Ammonia- Salinity- Temp			
					DO- pH- Ammonia- Salinity- Temp			

Annexure 19

Methodology for preparation of various culture media for the culture of microalgae

Conway' or Walne's medium	
Solution A.	In 1 litre Dist. water
Potassium nitrate	100 gm
Sodium orthophosphate	20 gm
EDTA (Na)	45 gm
Boric acid	33.4 gm
Ferric chloride	1.3 gm
Manganese chloride	0.36 gm
Solution B.	In 1 litre Dist. water
Zinc chloride	4.2 gm
Cobalt chloride	4.0 gm
Copper sulphate	4.0 gm
Ammonium molybdate	1.8 gm
Solution C.	In 100 ml Dist. water
Vitamin B1 (Thiamine)	20 mg
Vitamin B12 (Cyanocobalamine)	10 mg
Solution D (for culture of diatoms-used in addition to solutions A and C, at 2 ml per liter of culture)	
Sodium metasilicate (Na2SiO3.5H2O)	40.0 g

Make up to 1 litre with distilled water; Shake to dissolve

Prepare stock solution A, B and C (each) in different reagent bottles. Add 1 ml of solution A, 0.5 ml of solution B and 0.1 ml of solution C and 1ml of D (only for diatoms) to 1 litre of filtered and sterilized seawater.

f/2-Si (Guillard, 1975)Medium

To 996ml of sterile seawater aseptically add

Quantity	Compound	Stock solution (sterile)	Final conc. in medium
1.0ml	NaNO3	75.0g/litre H2O	884µM
1.0ml	NaH2PO4.H2O	5.0g/litre H2O	36µM
1.0ml	f/2 trace metal solution	(see recipe below)	(see below)
1.0ml	f/2 vitamin solution	(see recipe below)	(see below)

f/2 trace metal solution

To 950ml distilled H2O add:

Quantity	Compound	Stock solution	Final conc. in medium
3.15g	FeCl3.6H2O	-	11.7µM
4.36g	Na2EDTA.2H2O	-	12µM
1.0ml	CuSO4.5H2O	9.8g/litre H2O	0.04µM
1.0ml	Na2MoO4.2H2O	6.3g/litre H2O	0.03µM
1.0ml	ZnSO4.7H2O	22.0g/litre H2O	0.08µM
1.0ml	CoCl2.6H2O	11.9g/litre H2O	0.05µM
1.0ml	MnCl2.4H2O	178.2g/litre H2O	0.9µM

Make up to 1 litre with distilled H2O, sterilize (autoclave or filter) and store in fridge.

f/2 vitamin solution

To 950ml distilled H2O add

Quantity	Compound	Stock solution	Final conc. in medium
1.0ml	Vit.B12 (cyanocobalamin)	0.5g/litre H2O	0.37nM
1.0ml	Biotin	5.0mg/litre H2O	2.0nM
100.0mg	Thiamine HCl	-	0.3µM

Make up to 1 litre with distilled H2O, filter sterilize into plastic vials and store in freezer

Silicate is specifically used for the growth of diatoms which utilize this compound for production of an external shell.

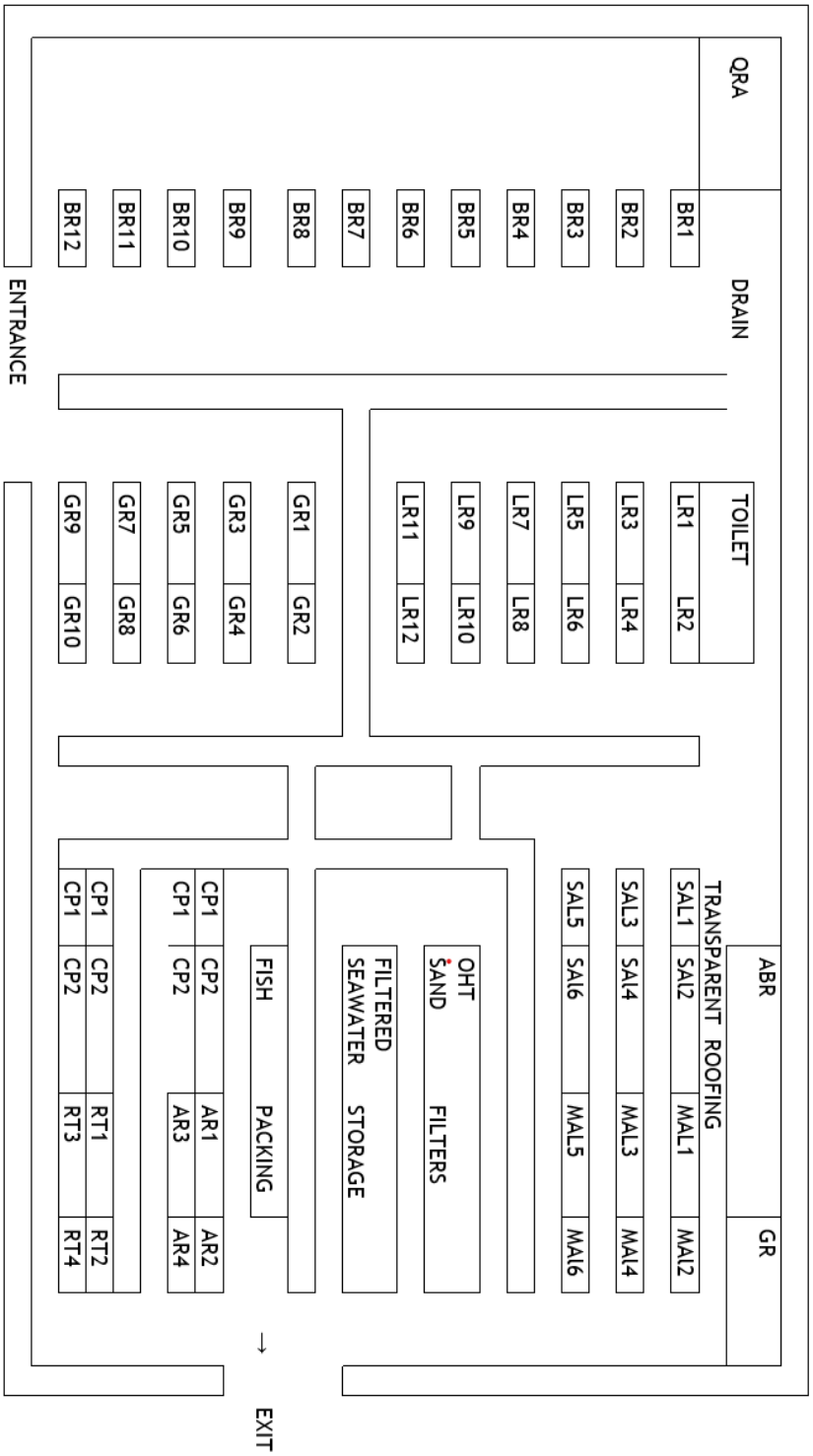
Silicate Solution Working Stock: add 30 g Sodium silicate (Na2SiO3) to 1 liter distilled H2O.

Media for outdoor mass culture

Ammonium sulphate	Urea	Super phosphate
100g/tonne of water	10g/tonne of water	10g/tonne of water

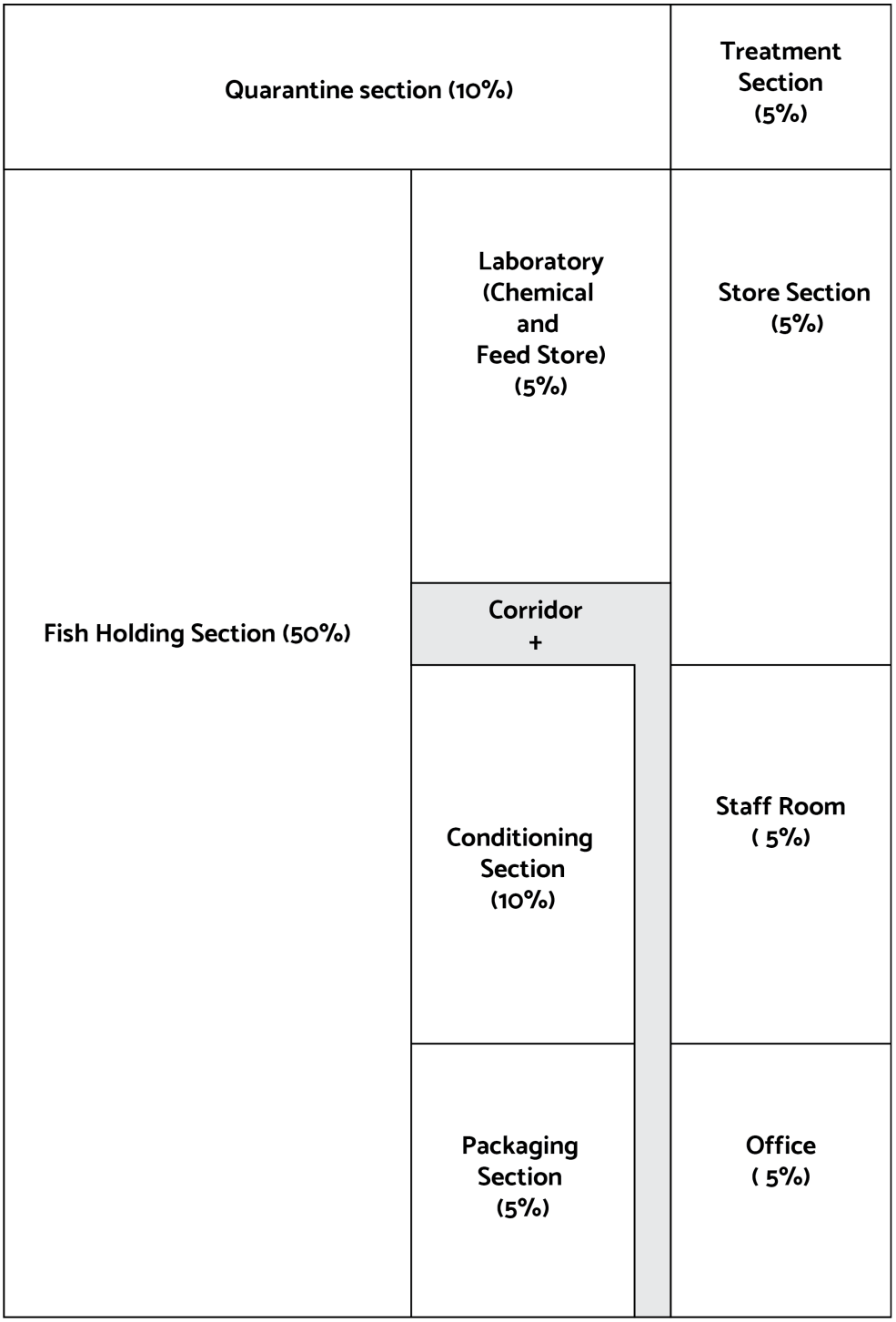
Annexure 20

Model layout of a marine ornamental fish breeding & seed production unit



Annexure 21

Model design for marine ornamental fish marketing facility



Annexure 22

Log book format for a marketing facility of marine ornamental species

Marketing facility (Green Certification No :)

Date:

1. Green Certification numbers of :
   a) Holding facilities linked to this marketing facility:
   b) Collectors linked to this marketing facility:
   c) Breeding and seed production units linked :
2. Green Certification numbers of :
   a) Holding facilities linked to this marketing facility:
   b) Collectors linked to this marketing facility:
   c) Breeding and seed production units linked :
3. Mortality at arrival (% of the total) :
4. Quarantine details:
   a) Method:
   b) Duration (Days / hrs)
   c) Treatments given :
   d) Water Quality :

Parameters	
Temperature	
pH	
Hardness	
DO	
Nitrite	
Ammonia	
Nitrate	

5. Health Status: Active/ Weak/ Injured / Dead
6. Packing water quality : clear/ turbid / frothy/ foul smelling/ No smell
7. Holding of fish (if any) at the marketing facility
   a) Chemicals used if any: a) Duration of holding:
   c) Feed given if any: d) Mortality rate:
8. Date of dispatch:
9. Disease outbreak if any: Give details (Name of the disease, Treatments given etc)

10. Disposal of used water: After treatment/ without treatment/ to open areas/ drainage Channel
11. Details of treatment of used water:
12. Nets and other implements used:
13. Disposal of dead fish: Incinerated / buried/ others (Specify)
14. Packaging method:
15. Packing density (Nos/litre)
16. Chemicals used in the packaging water
17. Details of health certificate obtained

SI no	Certificate No and date	Issued by (Name of the competent authority)	Country of destination
1			
2			
3			

18. Receipt and sale of fishes:

S.No	Species	No	Size	Sex	Sold/exported(nos)
1					
2					
3					

Name:
Signature:
Designation:

Annexure 23

Basic information for preparation of Collection Area Management Plan

Sl. No.	Particulars	Details
1.	**Area of collection** Location and Boundaries	
2.	**Type of Ecosystem** Basic description of the aquatic ecosystem, its status, and any particularly sensitive areas, features, or species influencing or affected by the marine aquarium fishery.	
3.	**Targeted marine ornamentals**	
4.	**Harvested marine ornamentals and their quantities/sizes**	
5.	**Sustainable harvesting practices** Basic description for measures agreed upon for the regulation of the collection and fishing of marine aquarium organisms within the designated collection area.	
6.	**History of collection and management measures for sustainable use** Description of other legitimate uses of the collection area that impact on the collection area ecosystem(s).	
7.	**Fishing rights** Details of those individuals or groups granted rights of access to the marine aquarium fishery, and particulars of the nature of those rights.	
8.	**Stakeholders involved** Particulars of the stakeholders with interests in the marine aquarium collection	
9.	**Consultations with stakeholders** Details of consultations with stakeholders leading to the management of the marine aquarium fishery	
10.	**Managerial decisions** Details of decision-making process or processes, including the recognized participants.	
11.	**Critical ecosystems** Details of any critical environments or sources of concern and required actions to address them.	

12.	**Arrangements and responsibilities for regular monitoring, control and surveillance, and enforcement** New management, monitoring, and surveillance methods that prove to be beneficial to minimizing ecosystem impact and organism mortality shall be adopted.	
13.	**HRD** Details of any planned education and training for stakeholders.	
14.	**Review** Date and nature of next review and audit of the Collection Area Management Plan.	

Annexure 24

Score card format for assessment of collector

Sl. No.	Major attribute	Assessment Criteria	Score	Attributes	Score obtained
I	Environmental integrity (25)	Excellent	25	a) Sustainable collection of marine ornamentals - 5 marks b) Use of eco-friendly gear & methods - 5 marks c) Collection in compliance collection area management plan - 5 marks d) Collection from pollution free environment - 5 marks e) Adequate knowledge of the ecosystem and targeted marine ornamentals - 5 marks	
		Very good	20		
		Good	15		
		Fair	10		
		Poor	5		
II	Handling & transportation (25)	Excellent	25	a) Handling with appropriate gadgets - 5 marks b) Mortality rate should be very minimal - 5 marks c) Appropriate packing density - 5 marks d) Use of aerators and oxygen cylinder - 5 marks e) Stress free transportation - 5 marks	
		Very good	20		
		Good	15		
		Fair	10		
		Poor	5		
III	Water quality maintenance (15)	Excellent	15	a) Dissolved oxygen > 5ppm - 5 marks b) Total ammonia < 0.02 ppm - 5marks c) Clear water - 3 marks d) Odour less - 2 marks	
		Very good	12		
		Good	10		
		Fair	8		
		Poor	5		
IV	Infrastructure (10)	Excellent	10	a) Holding facility - 2 marks b) Quality packaging bag - 2 marks c) Good quality water - 2 marks d) Oxygen cylinder - 2 marks e) Appropriate handling & transportation - 2 marks	
		Very good	8		
		Good	6		
		Fair	4		
		Poor	2		

V	**Documentation (10)**	Excellent	10	a) Proper record of log book for collection of marine ornamentals (as per annexure) - 5 marks b) Proper renewal of license for collector - 3 marks c) Updating the knowledge on collection plan and methodology - 2 marks	
		Very good	8		
		Good	6		
		Fair	4		
		Poor	2		
VI	**Collection skills (10)**	Excellent	10	a) Collection/fishing skill - 5 marks b) Handling skill - 2 marks c) Packing skill - 2 marks d) Transportation skill - 1 mark	
		Very good	8		
		Good	6		
		Fair	4		
		Poor	2		
VII	**Social integrity (5)**	Excellent	5	a) Collection in compliance with the central and state acts and regulations - 2 marks b) Harmony with local community - 1 mark c) Proper release of ETP species and disposal of dead fish - 2 marks	
		Very good	4		
		Good	3		
		Fair	2		
		Poor	1		

Annexure 25

Score card for Holding & Conditioning centre of marine ornamental fish

S. No	Major attribute	Assessment criteria	Score	Attributes	Score obtained
I	Environmental integrity (15)	Excellent	15	a) Flood safe site- 2marks b) Biological inputs (such as Brood stock, larvae, live feed and aquatic plants)Absence of Genetically Modified Organisms-1 mark c) Good waste water treatment system-2 marks d) Rain water harvesting system- 1 mark e) Recirculation system- 5 marks f) Use of non-conventional energy, wind energy and biogas) - 2 mark g) Use of eco-friendly materials and green buildings- 2 marks	
		Very good	12		
		Good	9		
		Fair	6		
		Poor	3		
II	Social integrity (5)	Excellent	5	a) Harmony with local community – 2 marks b) Non utilization of drinking water from public distribution systems – 2 marks c) Proper disposal of dead fish -1 mark	
		Very good	4		
		Good	3		
		Fair	2		
		Poor	1		
III	Infrastructure (30)	Excellent	30	a) Layout and design complies to requirements as per Annexure 7 - 5 marks b) Acclimatization & quarantine facility present - 3 marks c) Fish feed preparation & storage area – 2 marks d) Adequate life support systems such as oxygen cylinders, aerators, blowers & filters- 5 marks	
		Very good	25		
		Good	20		
		Fair	10		
		Poor	5		

				e) Laboratory facility – 3 marks f) Disease treatment facility- 3 marks g) Power backup/Generator facility – 5 marks h) Pre shipment conditioning facility - 2 marks i) Office & accommodation / rest room – 2 marks	
IV	**Documentation (10)**	Excellent	10	a) Log book (as per Annexure 9,10 &11) – 4 marks b) Purchase records- 1 mark c) Sales register- 1 mark d) Stock register of consumables and permanent equipments-1 mark e) Document of daily sanitation & premises cleaning – 1 mark f) Equipment's maintenance & calibration register- 1 mark g) Documents related to legal ownership and relevant government permissions – 1 mark	
		Very good	8		
		Good	6		
		Fair	4		
		Poor	2		
V	**Water quality 10)**	Excellent	10	Maintenance of optimum values of: a) Dissolved Oxygen - 2 marks b) Ammonia - 2 marks c) Temperature – 2 mark d) pH – 2 marks e) Nitrite – 1 marks f) Nitrate – 1 mark	
		Very good	10		
		Good	8		
		Fair	6		
		Poor	4		
VI	**Human resources (8)**	Excellent	8	a) Trained manpower at all sections - 5 marks b) Qualified managerial personnel – 2 marks c) Training records maintenance – 1 mark	
		Very good	6		
		Good	4		
		Fair	2		
		Poor			

VII	**Operations (12)**	Excellent	12	a) Standard feeding protocol – 3 marks b) Mortality rate less than 10 % - 3 marks c) Proper signage and labels – 2 marks d) Operation schedules, cleaning, water quality checking & feeding – 2 marks	
		Very good	10		
		Good	8		
		Fair	6		
		Poor	4		
VIII	**Biosecurity (10)**	Excellent	10	a) Quarantine measures- 3 marks b) Treatment kit - 1 mark c) Proper disposal of dead fishes – 2 marks d) Proper separation of the compound from outside area through fencing/ wall – 1 mark e) Proper pre-shipment conditioning, packing & stacking – 1 mark	
		Very good	8		
		Good	6		
		Fair	4		
		Poor	2		

Annexure 26

Score card for Breeding and seed production unit of marine ornamental fish

S. No	Major attribute	Assessment criteria	Score	Attributes	Score obtained
I	Environmental integrity (15)	Excellent	15	a) Flood safe site - 2 marks b) Biological inputs (such as Broodstock, larvae, live feed and aquatic plants), absence of Genetically Modified Organisms - 1 mark c) Good wastewater treatment system - 2 marks d) Rainwater harvesting system - 1 mark e) Recirculation system- 5 marks f) Use of non-conventional energy, wind energy and biogas) - 2 mark g) Use of eco-friendly materials and green buildings - 2 marks	
		Very good	12		
		Good	9		
		Fair	6		
		Poor	3		
II	Social integrity (5)	Excellent	5	a) Harmony with the local community – 2 marks b) Non-utilization of drinking water from public distribution systems – 2 marks c) Proper disposal of dead fish - 1 mark	
		Very good	4		
		Good	3		
		Fair	2		
		Poor	1		
III	Infrastructure (30)	Excellent	30	a) Layout and design complies with requirements as per Annexure 20 - 5 marks b) Acclimatization & quarantine facility present - 3 marks c) Fish feed preparation & storage area – 2 marks d) Live feed section (Phytoplankton & Zooplankton) maintenance – 2 marks	
		Very good	25		
		Good	20		
		Fair	10		
		Poor	5		

				e) Adequate life support systems such as oxygen cylinders, aerators, blowers & filters - 3 marks f) Laboratory facility – 3 marks g) Disease treatment facility- 3 marks h) Power backup/Generator facility – 5 marks i) Pre-shipment conditioning facility - 2 marks j) Office & accommodation / restroom – 2 marks	
IV	**Documentation (10)**	Excellent	10	a) Log books (as per Annexure 15,16,17 &18) – 4 marks b) Purchase records - 1 mark c) Sales register - 1 mark d) Stock register of consumables and permanent equipment -1 mark e) Document of daily sanitation & premises cleaning – 1 mark f) Equipments maintenance & calibration register - 1 mark g) Documents related to legal ownership and relevant government permissions -1 mark	
		Very good	8		
		Good	6		
		Fair	4		
		Poor	2		
V	**Water quality 10)**	Excellent	10	Maintenance of optimum values of: a) Dissolved Oxygen - 2 marks b) Ammonia - 2marks c) Temperature – 2mark d) pH – 2 marks e) Nitrite – 1 marks f) Nitrate – 1 mark	
		Very good	10		
		Good	8		
		Fair	6		
		Poor	4		
VI	**Human resources (8)**	Excellent	8	a) Trained manpower at all sections - 5 marks b) Qualified managerial personnel – 2 marks c) Training records maintenance – 1 mark	
		Very good	6		
		Good	4		
		Fair	2		
		Poor			

VII	**Operations (12)**	Excellent	12	a) Standard feeding protocol – 3 marks b) Mortality rate less than 10 % - 3 marks c) Proper signage and labels – 2 marks d) Operation schedules, cleaning, water quality checking & feeding – 2 marks	
		Very good	10		
		Good	8		
		Fair	6		
		Poor	4		
VIII	**Biosecurity (10)**	Excellent	10	a) Quarantine measures- 3 marks b) Treatment kit - 1 mark c) Proper disposal of dead fishes – 2 marks d) Proper separation of the compound from outside area through fencing/ wall – 1 mark e) Proper pre-shipment conditioning, packing & stacking – 1 mark	
		Very good	8		
		Good	6		
		Fair	4		
		Poor	2		

Annexure 27

Score card for marketing facility

S. No	Major attribute	Assessment criteria	Score	Attributes	Score obtained
I	Environmental integrity (15)	Excellent	15	a) Flood safe site- 2marks b) Biological inputs (such as Brood stock, larvae, live feed and aquatic plants) Absence of Genetically Modified Organisms-2 mark c) Good waste water treatment system-5 marks d) Rain water harvesting system- 1 mark e) Recirculation system- 1 mark f) Use of non conventional energy, wind energy and biogas)- 2 mark g) Use of eco friendly materials and green buildings- 2 marks	
		Very good	12		
		Good	9		
		Fair	6		
		Poor	3		
II	Social integrity (5)	Excellent	5	a) Harmony with the local community – 2 marks b) Non-utilization of drinking water from public distribution systems – 2 marks c) Proper disposal of dead fish - 1 mark	
		Very good	4		
		Good	3		
		Fair	2		
		Poor	1		
III	Infrastructure (30)	Excellent	30	a) Layout and design complies to requirements as per Annexure 21- 5 marks b) Acclimatization & quarantine facility- 3 marks c) Live feed/ Fish feed preparation& storage area – 2 marks d) Aeration &filtration facility – 3 marks e) e) Adequate life support systems such as oxygen cylinders, aerators, blowers & filters- 4marks	
		Very good	25		
		Good	20		
		Fair	10		
		Poor	5		

				f) Laboratory facility – 2 marks g) Disease treatment facility- 3 marks h) Power backup facility – 3 marks i) Pre shipment conditioning facility - 3 marks j) Office &accommodation / rest room – 2 marks	
IV	**Documentation (15)**	Excellent	15	a) Log book (as per Annexure) – 5 marks b) Purchase records- 3 mark c) Sales register- 2 mark d) Stock register- (consumable and permanent)-1 mark e) Document of daily sanitation & premises cleaning – 1 mark f) Equipments maintenance register- 1 mark g) Documents to prove rejection free export for the preceding 1 year- 2 mark	
		Very good	8		
		Good	6		
		Fair	4		
		Poor	2		
V	**Water quality 10)**	Excellent	10	a) Dissolved Oxygen - 2 marks b) Ammonia -2marks c) Nitrite – 2 marks d) Nitrate – 1 mark e) pH – 1mark f) Hardness - 1mark g) Temperature– 1mark	
		Very good	10		
		Good	8		
		Fair	6		
		Poor	4		
VI	**Human resources (8)**	Excellent	8	a) Presence of qualified technician/s- 5 marks b) Trained manpower at all sections- 3 marks c) Qualified managerial personnel for export marketing – 2 marks	
		Very good	6		
		Good	4		
		Fair	2		
		Poor			

VII	**Holding, Handling & transportation (Operations) (10)**	Excellent	12	a) Standard feeding protocol – 2 marks b) Mortality rate less than 10 % - 2 marks c) Proper signage and labels – 2 marks d) Operation schedules, cleaning, water quality checking & feeding) – 2marks e) Use of temperature controlled vehicle for transportation- 2 marks	
		Very good	10		
		Good	8		
		Fair	6		
		Poor	4		
VIII	**Biosecurity (7)**	Excellent	7	a) Quarantine measures- 2 marks b) Absence of clinical symptoms of disease – 1 mark c) Proper disposal of dead fishes – 2 marks d) Proper pre-shipment conditioning packing & stacking – 2marks	
		Very good	5		
		Good	4		
		Fair	3		
		Poor	2		

Annexure 28

Green Certification Logo





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