

National Mariculture Policy 2019 (NMP 2019) – Revised Draft

1. Preamble

The goal of a National Mariculture Policy (NMP), 2019 is to ensure sustainable farmed seafood production for the benefit of food and nutritional security of the Nation and to provide additional livelihood and entrepreneurial opportunities to the coastal communities for better living. The overall strategy of NMP is to increase seafood production in sustainable and responsible manner, ensure socio-economic development, enhance food, health and nutritional security and safeguard gender, social equity and environment.

The Vision and Mission of NMP have been drafted for increasing farmed seafood production in the country-based on the following:

- Recognising that the demand for seafood is increasing year after year,
- Realising that additional seafood requirement of the country in future years cannot be met by capture fisheries and inland aquaculture alone,
- Recognising that to enhance the living conditions of coastal fishermen, additional livelihood options are needed,
- Noting further that sea farming sector is still in its infancy in the country,
- Acknowledging that there is immense potential for sea farming in the country,
- Recalling that there are many mariculture technologies developed in the country which can be commercialised,
- Viewing with appreciation that mariculture has already contributed to substantial seafood production in many countries and is growing,

2. Vision

A sustainable and responsible mariculture sector that contributes to the food and nutritional security of the country and enhances the quality of life of the stakeholders.

3. Mission

A policy framework leading to wide spread adoption of mariculture technologies to meet the additional seafood demand while ensuring the environmental sustainability, socio-economic upliftment of stakeholders and facilitating the responsible development, co-ordination and management of mariculture production in the country.

4. Definition and Scope

Mariculture is a specialised branch of aquaculture involving the cultivation of economically important marine plants and animals in the sea or any other natural water body having tidal influence and includes onshore facilities like brood banks, hatcheries, nursery rearing and grow out systems using seawater.

Mariculture involves three phases using the following types of facilities in land or in the sea and distinct skill sets:

- (i) *Brood bank and Hatchery*, which involves land-based facilities to rear broodstock and produce seeds of marine finfish and shellfish such as bivalves, gastropods and crustaceans.
- (ii) *Nursery* which involves rearing of juveniles to a size conducive to stocking in the grow-out systems which are land based or inshore and
- (iii) *Grow-out* which Includes aquaculture of marine plants and animals in the sea open water bodies with tidal influence and closed land based Recirculating Aquaculture Systems (RAS) systems using seawater.

Besides conventional mariculture, using the same type of facilities and skill sets, other activities that can be promoted are (i) Culture Based Fisheries (CBF) which is the practice to enhance fish stocks in waters that do not have enough natural recruitment to sustain a fishery; (ii) Capture Based Aquaculture (CBA) which is the practice of collecting "seed" material from the wild, and growing to marketable size in captivity, using aquaculture techniques; (iii) Conservation Mariculture which is the practice of stock enhancement of endangered, threatened and protected (ETP) species and depleted marine fish stocks for replenishment; (iv) farming of non-food species such as microbes, micro algae and seaweeds for extraction of bioactive compounds, biomarkers, biofuels, biochemicals, nutraceuticals and natural growth promoters; and (v) farming of marine ornamental fishes and invertebrates; pearl oysters and sea weeds. Along with mariculture, CBF, CBA, conservation mariculture and farming of non-food species need to be promoted.

The mariculture activities covered under this policy do not include pond based brackishwater aquaculture including coastal shrimp farming. The term 'fish farmer' mentioned in this document denotes those undertaking mariculture activities.

5. Status and Opportunities of Mariculture in India

Globally, aquaculture has emerged as the fastest growing food production sector with an annual growth rate of >6% in the last two decades. In India, inland aquaculture has emerged as a fast growing sector and it has shown steady growth over the years and has become a viable alternative to declining capture fisheries. It started at a modest production of 0.75 million tonnes in 1951 and reached 4.9 million tonnes in 2017 and India is the third largest producer in the world. Similarly, coastal shrimp aquaculture production has grown steadily and crossed 0.5 million tonnes in the last couple of years.

Mariculture is the fastest growing subsector of aquaculture and has very high growth potential. In 2016, mariculture contributed around 28.7 million tonnes of food fish which formed about 35.8% of the global food fish aquaculture production. The total mariculture production including seaweeds was 58.7 million tonnes, which constituted 53.4% of the total world aquaculture production during 2016.

It is evident that mariculture presents a great opportunity for increasing seafood production in the face of growing demand for marine protein and limited scope for expanding wild fishery harvests. The projected mariculture production based on area available in the Indian region is 4 to 8 million tonnes whereas the current mariculture production is less than 0.01 million tonne. The success in the development of inland and brackishwater aquaculture in India also corroborates with the prospects of the emergence of a mariculture production sector. In addition, the development of a mariculture sector also strengthens the Blue Revolution Scheme of Government of India (GOI).

Mariculture activities in India were initiated by the research and development made by CSIR-CSMCRI in 1970s by near shore culture of seaweed *Gracilaria edulis* in Krusadi Island, Tamil Nadu coast, followed by the Indian Council of Agricultural Research-Central Marine Fisheries Research Institute (ICAR-CMFRI) in the early 1980s by small-scale commercial culture of bivalves. Additionally, in 1990s, Central Institute of Brackishwater Aquaculture (ICAR-CIBA), National Institute of Ocean Technology (NIOT) and the Marine Products Export Development Authority (MPEDA) also significantly contributed to the development of mariculture. Open sea mariculture was initiated for the first time in India by ICAR-CMFRI in 2005 by establishing the first open sea floating cage in Visakhapatnam with funding support from the Department of Animal Husbandry, Dairying and Fisheries (DADF), Ministry of Agriculture, Government of India. Further refining technologies by CMFRI and adoption have led to rapid spread of cage mariculture along both coasts in near shore waters by self-help groups, fisher societies and small entrepreneurs. Available technologies by CMFRI include seed production and farming of finfishes such as cobia, pompano, sea bass, groupers, snappers, breams and ornamental fishes, shell fishes such as mussels, oysters, clams, green tiger shrimp, blue swimmer crab and ornamental shrimps. Technologies for marine pearl production and seaweed farming are also available in the country.

India needs to produce about 18 million tonnes of fish by 2030 as compared to the 10 million tonnes that are produced through wild harvest and aquaculture today. The additional fish production has to come exclusively from aquaculture. As stated in the National Policy on Marine Fisheries 2017 (NPMF, 2017), assessment of the exploited fish stocks in the Indian Exclusive Economic Zone

(EEZ) indicated overcapacity in the territorial waters with respect to different categories of mechanised fishing vessels in all maritime states/Union Territories and indicated that further increase in production from capture fisheries has limited scope. Hence, steps for the promotion and further development of a mariculture production sector are the only options for meeting the demand for fish in the coming years. Considering this, it is stated in the NPMF 2017 that *“Mariculture if carried out can play an important role in increasing fish production from the coastal waters. Government will encourage schemes to set up mariculture farms /parks and setting up hatcheries for supply of seeds for the development of the sector. Institutional and commercial needs of this emerging sector, which will include leasing rights policies, spatial planning, technological inputs such as husbandry, seed, feed and health management, environmental and social impacts, capacity building of local fishers and local entrepreneurs to take up mariculture; and development of local markets and value chains will be addressed in consultation with coastal states/Union Territories (UTs) and concerned stakeholders. Participation of small fishing communities, fishermen groups, fishery co-operatives or government organisations will be specifically encouraged and supported.”* Therefore, it is the need of the hour to formulate a robust and implementable policy for guiding the development of mariculture in India.

6. Objectives

1. To enhance mariculture production in the country and increase income, employment and entrepreneurship opportunities in a sustainable and responsible manner.
2. To promote cooperative partnership in mariculture by encouraging the infrastructural, technical and financial inputs.
3. To adopt an environmentally sustainable approach for development of mariculture.
4. To provide an enabling environment for sustainable development of mariculture in India by providing the required policy and legal framework and support to entrepreneurs venturing to the area of mariculture.

7. Mariculture Area Development

- 7.1. Suitable potential mariculture sites will be demarcated for different mariculture activities such as cage farming, bivalve farming, pen culture, seaweed culture, hatcheries and nurseries as mariculture zones, in consultation with local area planning departments, traditional fishers/fishermen cooperatives, coastal dwellers, relevant State and Central government departments and other stakeholders.

- 7.2. The mariculture zones will be demarcated based on evaluation of environmental parameters suitable for the type of farming and impact on environment. The demarcation of zones will also factor in socio-cultural attributes, local area master plans and other logistics, with consideration to protect the livelihoods of local fishing communities and their access to fishing grounds and avoiding conflict with other users. Satellite remote sensing data and Geographic Information System (GIS) will be employed to provide essential tools to support the demarcation.
- 7.3. The state governments will prepare Marine Spatial Plans (MSP) based on guidelines prepared by the central government for data management, analysis, modelling and decision making taking cognizance of Coastal Regulation Zone (CRZ).
- 7.4. Such mariculture zones earmarked in the inshore/coastal areas shall exclude Marine Protected Areas (MPA), ecologically sensitive areas like coral reefs, mangroves, sea grass beds, turtle breeding/nesting grounds, navigational channels, port and harbour entry, major fishing grounds and other coastal areas with strategic interests.
- 7.5. Within the identified mariculture zones, the government shall designate certain areas as mariculture technology parks with all support infrastructure for breeding, culture, packaging, trade and necessary logistic support for mariculture activities including fish processing units. Government shall also encourage the setting up of off-shore technology parks.

8. Leasing Policy

- 8.1. States are empowered to manage and promote marine fisheries and allied activities, which include mariculture within 12 nautical miles. The fisheries departments of the coastal states will lease out the waters for mariculture as per guidelines formulated by the Union Government under this policy. The state could also involve the Panchayat Raj Institutions (PRI) or other local governing bodies for promoting mariculture in natural water bodies with tidal influence. In such leasing, priority will be given to local groups/dwellers. Leasing of areas for mariculture parks will be subject to review before renewal.
- 8.2. In developing mariculture activities, the policy will take into account, the interest of all stakeholders as well as principles of responsible fishing, ensure limits to biological production based on carrying capacity and environmental sustainability.

9. Mariculture Systems and Species

- 9.1. Mariculture systems currently in use are different types of cages, longlines, rafts, racks, pens, raceways, Recirculating Aquaculture Systems (RAS), Integrated Multi Trophic Aquaculture (IMTA) *etc.* Major focus will be given for the improvement of existing technologies to be on par with international standards, biosecurity and code of practices. In view of the versatility and efficiency of cage culture systems to produce both high volume and high value species in different environments, cage farming will be promoted. New aquaculture systems will be promoted in identified areas after their farm level validation.
- 9.2. All native food and non-food marine species having mariculture potential will be promoted. Recognising the active role of coastal women and enterprising family members of the coastal fishers in taking up mariculture of oysters, mussel and seaweeds, and in view of the demonstrated potential of mariculture of these species for alternative income and social empowerment, financial and technical support will be provided for these activities.
- 9.3. In view of the higher risk of escapees from the culture systems, especially during natural calamities like cyclones, floods and their likely establishment in wild, exotic and Genetically Modified (GM) species will not be allowed for any mariculture activity in open systems; but, exotic species may be considered after stringent risk assessment and monitoring in land-based closed mariculture systems, such as Recirculating Aquaculture System (RAS). Such approvals will be subject to the relevant national rules governing exotics and GMOs.
- 9.4. Diversification of species will be encouraged based on site suitability, availability of technology, demand and commercial feasibility, ecological impacts and social and economic benefits.
- 9.5. Marine ornamentals have significant market globally. Considering the risk of over-exploitation of wild ornamental species, hatchery production of ornamental species and pearl oysters for which technologies are available, will be promoted. Special schemes will be drawn to establish marine ornamental sector. Appropriate mechanism will be put in place to detect, pre-empt and regulate trade of wild-caught ornamentals.
- 9.6. For expansion of seaweed culture, potential areas will be identified and culture technologies for native species (edible and non-food use) will be improved, particularly with regard to regulation of invasive species, techniques to control grazing by fishes and avoid use of fertigation.

10. Precautionary Approach to Environmental sustainability

- 10.1. According to the FAO, an *Ecosystem Approach to Aquaculture (EAA)* is a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable and responsible development, equity and resilience of interlinked social-ecological systems. When applied to mariculture, these are also to be in conformity with article 9 of the Code of Conduct for Responsible Fisheries (CCRF) of the Food and Agriculture Organization (FAO). Incorporating the principles of ecosystem approach in mariculture will promote a process of enhanced sectoral management at different scales, taking into account environmental limits and the interests of other users and stakeholders. It will also aim to improve human well-being and equity for all stakeholders and mariculture will be developed in alignment with other crosscutting sectors, policies and legal provisions.
- 10.2. In order to promote ecologically sustainable mariculture with least ecological footprints, the baseline status of the demarcated mariculture zones will be assessed comprehensively. Necessary guidelines will be put in place for assessment, monitoring and implementing regulations covering the ecological and social impacts of water use, user conflicts, use of drugs and chemicals, organic load, disposal of used cages, nets and plastics from mariculture activities. Capacity of fishers/farmers through their co-operatives will be strengthened to take up science-based activities to address climate related issues.
- 10.3. In order to tap export markets and ensure food safety for the domestic markets, farmed bivalves are required to meet strict quality criteria with respect to microbial, heavy metal and other pollutants in the growing water bodies. In order to promote export of farmed bivalves, major farming regions will be continuously monitored to meet the water quality criteria set by national and international agencies. Adequate depuration facilities will be developed near such culture sites to help farmers depurate the harvested bivalves before marketing.

11. Seed and Feed

- 11.1. Ensuring availability of seed material for the targeted mariculture species is critical to sustain the momentum of proposed expansion of mariculture sector in the country. State-run finfish/shellfish hatcheries, seed farms; rearing units and specific pathogen free (SPF)/specific pathogen resistant (SPR)/genetically improved brood banks will be established.
- 11.2. Schemes will be taken up for attracting entrepreneurs to start establishing finfish /shellfish hatcheries and nursery units.

- 11.3. Centres for the supply of fresh stock of planting materials of seaweeds will be set up for southeast and northwest coasts.
- 11.4. A system of seed certification will be developed as per policy in order to ensure supply of quality seed.
- 11.5. To increase seed availability for mariculture species, schemes will be developed to construct new facilities by providing financial support.
- 11.6. To make seeds of new candidate species available to fish farmers, financial support will be extended for new hatcheries and farmers' co-operatives.
- 11.7. Availability of stockable size fingerlings for farming is to be assured through establishment of nursery rearing in indoor facilities and earthen ponds.
- 11.8. Currently, farmed bivalve production is entirely dependent on seeds collected from the wild, and this has become a limiting factor in the expansion of production. Technologies for bivalve seed production have already been developed by research institutions. Financial and technical backstopping will be provided to establish bivalve hatcheries in major bivalve growing areas.
- 11.9. Since seed production technologies of many species are either not standardised or commercially viable, the practice of CBA will be permitted with regulations, licenses and proper management to ensure the sustainability of the wild stocks of the concerned species. Impact of such seed collection on the stock and environment will be studied before such licenses are issued. Capacity building of fishers will be promoted for sustainable collection of seed and growing to stockable size in captivity. Collection of wild seed for CBA, where allowed, will be reviewed after five years.
- 11.10. In implementing conservation mariculture, care will be taken to ensure that the natural genetic variability and integrity are not altered through sea ranching operations of hatchery raised seed.
- 11.11. Taking into account the policy of the GOI (NPMF, 2017) to control the use of lower trophic level food fishes as source of fishmeal in fish feed for mariculture, sourcing alternate, sustainably caught fish species for fishmeal preparation will be promoted. Utilization of low value fishes for alternative feed for the candidate species will be discouraged and development of formulated feed encouraged.
- 11.12. Replacement of fish meal with other protein sources of plant and animal origin will also be taken as and when these technologies are scaled up.

- 11.13. Feed quality standards are available only for shrimp and Indian major carps (IMC). Standards for marine fish feed and feed supplements will be developed and issued as per policy for the growth of mariculture with inputs from research institutions.
- 11.14. The Government will also evolve guidelines for use of feed ingredients based on local availability, mineral mixture and other nutrient supplements, based on the research advancements made by national and state level research and academic institutions. To ensure the availability of cost effective marine finfish feeds the existing aquafeed mills, establishment of new units and feed storage facilities will be supported. Schemes to supply feed to small-scale cage farmers will be taken up.
- 11.15. Quality of the finished feed and traceability of the feed stuffs used will be ensured by suitable means so that eco-labelling of suitable mariculture production systems will be promoted to ensure premium prices for such produce.

12. Food Safety and Health Management

- 12.1. Traceability and record-keeping of farming activities and inputs which impact food safety will be ensured by documenting the source of inputs such as feed, seed, permitted veterinary drugs and antibiotics, additives and chemicals. Also, the type, concentration, dosage, method of administration and the rationale for their use of these inputs will be recorded.
- 12.2. Mariculture activities will be conducted in a manner that ensures food safety by implementing appropriate national (Food Safety and Standards Authority of India (FSSAI)) or international standards and regulations including those defined by FAO/World Health Organization (WHO) *Codex Alimentarius*.
- 12.3. Mariculture operations will implement aquatic animal health management programmes set up in compliance with relevant national legislation and regulations, taking into account the FAO-CCRF Technical Guidelines on Health Management for Responsible Movement of Live Aquatic Animals and relevant standards of The World Organization for Animal Health (OIE).
- 12.4. To reduce the risks of introduction and spread of aquatic animal diseases, species-specific Good Aquaculture Practices (GAPs)/ Best Management Practices (BMP) will be developed and implemented. Preparedness including diagnostic capability and treatment for emerging diseases and parasites will be given emphasis. Use of species in polyculture or IMTA will be carefully considered in order to reduce potential disease transmission between cultured species.

- 12.5. Use of medicines in mariculture will be in accordance with applicable national legislation that ensures effectiveness, safety of public and animal health and protection of the environment.

13. Capacity Building and Extension

- 13.1. The Government will strive to enhance the skills and capabilities of the traditional fishers and other potential stakeholders to undertake mariculture and popularize the vocation in India. This will enable interested fishers to move from fishing to more economic and efficient mariculture activities.
- 13.2. The government will facilitate formation of mariculture cooperatives through skill development and technical /financial support, wherever necessary.
- 13.3. Planned and concerted effort will be undertaken in order to develop adequate human capital with necessary skills and entrepreneurship to meet the skilled human capital requirements for the mariculture sector.
- 13.4. A tailor-made capacity building module will be developed by National Fisheries Development Board (NFDB) by involving CMFRI and other expert academic bodies to impart core knowledge related to the mariculture operations and governance to functionaries of the fisheries department from the coastal states and UTs.
- 13.5. In order to provide thrust and impetus to new candidate species/technologies /areas for mariculture, frontline participatory demonstrations and technology transfer will be taken up.

14. Ecolabelling and Certification

- 14.1. The GOI will develop new voluntary sustainability standards (VSS) to gain competitiveness in the global seafood market. Till such time, the standards that are compliant to FAO, viz., Aquaculture Stewardship Council (ASC) and Global Aquaculture Alliance (GAA) will be complied with.

15. Insurance and Financial Support

- 15.1. Mariculture is an emerging sector that requires considerable support from the government. It is to be treated on par with agriculture and being a capital-intensive enterprise, all institutional support in the form of affordable finance and investment subsidies will be extended. In this regard, National Bank of Agriculture and Rural Development (NABARD) will be encouraged to develop new schemes to support mariculture institutions. Priority and special assistance will be extended to fish farmer groups.
- 15.2. Mariculture activities are capital intensive and susceptible to the risks of natural calamities and anthropogenic activities. Currently, there are no

substantial initiatives from the insurance industry to cover these risks and those customized products available are with highly prohibitive premium rates. The government will introduce suitable schemes to plug this gap and will encourage private insurance companies to develop insurance solutions for the sector.

- 15.3. In view of the long gestation period and high investments required for cultured marine pearls, adequate financial support including low interest loans will be offered to entrepreneurs.
- 15.4. Technological interventions such as geo-spatial tools and protocols for mapping damages and interactive Information and Communications Technology (ICT) tools and mobile applications for real-time damage assessment and quick processing of insurance claims will be used.
- 15.5. Personal/group insurance schemes will be extended to cover life/accident risks of personnel involved in mariculture activities.

16. Processing, Value Addition and Market Support

- 16.1. Value addition and efficient market logistics will be promoted to minimize post-harvest losses and preserving the nutritional quality and value of fish. Awareness on nutritional value of fish will be generated with public campaigns.
- 16.2. The existing capacity of processing infrastructure in the exporting units in the country will be harnessed for developing frozen, live, chilled and value added products suiting both domestic and export sectors.
- 16.3. In order to increase the domestic consumption of bivalves, promotional schemes highlighting their health benefits will be introduced. Also monitoring of culture sites for shellfish poisoning due to dinoflagellate blooms will be taken up.
- 16.4. Institutional support will be extended for development of domestic market infrastructure for hygienic handling, processing and cold storage.
- 16.5. Cost-effective preservation and packaging facilities will be developed under PPP mode to enhance shelf-life of fish and fish products.
- 16.6. Appropriate measures will be taken for product diversification, branding, certification and for strengthening market intelligence. Brand building of fish will be promoted by introducing '*FishMark*', a certification mark for fish and products, and state-of-the-art marketing facilities will be developed to sell the branded products.

- 16.7. Financial assistance, capacity building, technical guidance and institutional support will be extended to stakeholders involved in the mariculture value chains. There will be a focus on development of co-operative marketing network to get a better price for the produce. Involvement of small scale fish vendors in cooperative marketing network will be promoted.
- 16.8. Marketing of fish through institutional sales channels or online web portals will be encouraged for reducing the exploitation by intermediaries.

17. Institutional Mechanisms

- 17.1. Mariculture is a component of marine fisheries that comes largely under the newly constituted Department of Fisheries (DoF) under the Ministry of Agriculture and Farmers' Welfare (MoAFW), GOI; other Central Ministries, the coastal states, and the UTs. The Ministry of Agriculture and Farmers' Welfare (MoAFW), Ministry of Earth Sciences (MoES), the Ministry of Science and Technology (MoST), Ministry of Environment, Forest and Climate Change (MoEF&CC) and the Ministry of Commerce and Industry (MoCI) have significant roles in technology development and promotion in mariculture, while the regulation of activities in the marine area come under the purview of Ministry of Environment and Forests. These agencies will work closely and in a synchronised manner to promote mariculture.
- 17.2. The Department of Fisheries - DoF will be a prime mover in providing support to the new initiatives in mariculture. The NFDB, along with financial institutions are expected to design new packages for expansion of mariculture. It is also essential to leverage support from government and private financial institutions and fishermen cooperative societies for rapid expansion of mariculture.
- 17.3. In mariculture species health management, early diagnostics and tested remedial measures will be put in place. The role of the ICAR research institutes, MoST, and the universities will be dovetailed for all of the above and for productivity enhancement.
- 17.4. Mapping of suitable areas for taking up mariculture will be done and a road map prepared for phase-wise expansion of mariculture to reach the targeted production. Onshore infrastructure, power, feed storage and other facilities will be created to support mariculture activities.
- 17.5. Effective monitoring of mariculture activities will require a paradigm shift in the extent of skill and inter-departmental coordination, given its location, and issues in access. As this effort cannot be handled as an add-on activity of any agency or department, as an interim measure, a separate Task Force is to be constituted by DoF and coordinated by NFDB involving the

concerned research institutes and development agencies of MoAFW, MoES, MoCI and MoEF&CC. The taskforce will also draw representatives from the maritime states.

- 17.6. In order to realize the projected potential of mariculture under the blue revolution scheme of GOI and to enable a single-window system, a unified promotional authority - Mariculture Authority of India- will be created. This will be the implementing agency for development and expansion of mariculture. Until then, a separate Division under NFDB will take care of the promotional functions.
- 17.7. An appropriate coordination mechanism at state level will be evolved that involves Departments of Fisheries of the maritime States/UTs, Coastal Marine Police and Indian Coast Guard (ICG).An institutional mechanism for monitoring and review with the inclusion of all stakeholders including the coastal community and fishers will be established.
- 17.8. Mariculture shall be part of the integrated coastal/fisheries development plans developed by the maritime states/UTs to enhance their economy. Mariculture will be promoted as a potential livelihood option under the Integrated Coastal Zone Management (ICZM) program of GOI.

18. Legal Frame Work

- 18.1. Mariculture in India shall be promoted in consonance with the relevant national and global instruments and other guidelines.
- 18.2. The States/UTs are empowered to regulate and manage marine fisheries in their territorial waters extending up to 12 nautical miles off the coastline towards the sea. To facilitate this, the central government will bring a model bill factoring the relevant international/voluntary agreements, laws and standards. All existing aquaculture/mariculture acts of the maritime states will be aligned with the proposed legislation.
- 18.3. The Central Government is mandated to regulate the fisheries activities in the EEZ *i.e.*, 12- 200 nautical miles. DoF, MoAFW will draft the guidelines in consultation with the Ministry of Shipping, Coast Guard, Indian Navy, Ministry of Forests & Environment for undertaking mariculture activities in the EEZ.
- 18.4. In consonance with the initiative of the GOI for holistic development of islands, mariculture will be made a key developmental activity apart from tourism and capture fisheries.

- 18.5. Government will make necessary amendments in the extant rules to permit mariculture with adequate safeguards to ensure that the conservation efforts are not compromised.

19. Research and Development (R&D)

- 19.1. Mariculture is an emerging sector and in order to realize the vast potential of mariculture, towards meeting the Blue Revolution Scheme targets, significant impetus will be provided for R&D activities. The following areas needing additional focus and funding are: development of breeding technologies for new species, innovative farming technologies such as RAS and IMTA, live feeds, cost-effective larval and grow-out feeds, fishmeal and fish oil replacement, selective breeding technologies, disease diagnostic tools, SPF and SPR varieties, culture of micro-organisms for development of non-food commercial products, protocols for low-cost depuration of farmed bivalves, post-harvest technologies including value addition and zero wastage, models for assessing carrying capacity, development of climate resilient species, systems and practices, innovative cage designs, offshore mariculture facilities and efficient mooring systems as well as automation of cage operations and preparedness for emerging diseases and parasites.
- 19.2. The government shall also strive to scout established mariculture technologies from other parts of the globe, and institutionalize mechanisms to validate and adapt to the national needs.

