

NBFGR Special Publication No. 3

# NATIONAL STRATEGIC PLAN FOR AQUATIC EXOTICS AND QUARANTINE



**National Bureau of Fish Genetic Resources**  
Lucknow - 226 002, U.P., India



# **NATIONAL STRATEGIC PLAN FOR AQUATIC EXOTICS AND QUARANTINE**

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### **Consultation process for finalisation of ‘National Strategic Plan’ document:**

- **An expert committee was constituted under chairmanship of Dr. A.G.Ponniah, Director, NBFGR, Lucknow by Ministry of Agriculture for preparation of ‘National Strategic Plan’ and ‘Guidelines’ for Aquatic Exotics and Quarantine.**
- **The draft ‘Plan’ was sent to ICAR Fisheries Institutes, State Fisheries Departments and experts in the field of aquatic exotics and aquatic animal health. Suggestions and comments were incorporated in the draft plan.**
- **The modified draft was discussed during the meeting of expert committee to formulate strategic plan and guidelines on introduction of exotic species and quarantine arrangement for aquatic organisms held at CIBA, Chennai on 24.05.2001. The following committee members participated in the meeting:**

Dr. G.R.M. Rao, Director, CIBA, Chennai, Dr. M. Sakthivel, Aquaculture Foundation of India, Chennai, Shri U.K. Viswanatha Raju, Anand Group, Bhimavaram, Dr. G. Santhanakrishnan, MPEDA, Cochin (representative from MPEDA), Dr. G.D. Chandrapal, Deputy Commissioner (Fy.) (representative from DAH&D), Dr. S.N. Mohanty, Principal Scientist, CIFA, Bhubaneswar (representative of Director, CIFA) and Dr. A.G. Ponniah, Director, NBFGR, Lucknow
- **The draft was discussed, further modified and endorsed by the members of the National Committee on Introduction of Exotic Aquatic Species in Indian Waters during 5<sup>th</sup> meeting held on 17.07.2001.**
- **The ‘Plan’ was again modified and finalized on basis of discussions held during the brainstorming session on ‘Aquatic Exotics and Quarantine Guidelines’ on 1-2 November 2001 at NBFGR, Lucknow.**

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# **DRAFT NATIONAL STRATEGIC PLAN ON AQUATIC EXOTICS AND QUARANTINE**

## **1. Background**

India is one of the richest countries in the world in terms of fish genetic wealth. But since 19<sup>th</sup> century, there have been introduction of over 350 fish species into the country for sport fishery, aquaculture, ornamental fishery and insect control purposes. Translocation of species across political boundaries of nations has been a centuries old phenomenon. The transboundary movement of species for culture or for aquarium purposes has witnessed a spurt during the past century and is expected to get accelerated in the coming years. With the country's attempt to enhance the yield and with the demand of the fast growing ornamental fish trade, the fishery industry will be keen to import more promising strains/ species.

Some of the introduced species have added to the fish production, but some species proved to be invasive in our open waters, affecting the native species. The potential and real impacts of introducing new species into the aquatic ecosystem have been major issues debated worldwide. The benefits of introduced species are usually immediate and for short duration whereas the adverse impacts of exotics become evident only after a long time. The long-term impacts of the introduced species have not been evaluated till date in our country. Most conclusions regarding beneficial or adverse impacts of exotics are based on individual perceptions and are usually not supported by scientific data. Pre-introductory data to evaluate the impact of introduced species should be taken into consideration before drawing conclusions. In this context, it is necessary to provide feasible guidelines for the import of new species or strains depending on the purpose of import. Under the Convention on Biodiversity (CBD), India has the moral and legal obligations to conserve its biodiversity. There is need to have adequate safeguards to protect the native species from the onslaught of the introduced ones. At the same time the nation must also ensure that the fish yield is enhanced and international trade, especially in ornamental fishery expands. Industry and traders should be allowed to develop and expand the trade for the economic benefit of the country. In India, the policy on introduction of exotic aquatic organisms is not clearly defined. Moreover, there is no policy to tackle exotics already introduced both legally and illegally.

Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries emphasizes the need to minimize the risks of disease transfer and other adverse impacts on the wild and cultured stocks associated with the introduction of non-native species and transport of eggs, larvae or fry, broodstocks or other live materials. The FAO code also adopts the principle that international trade in fish and fishery products should be conducted in accordance with the principles, right and obligations as per international agreements. India is a signatory to a range of trade related agreements under World Trade Organisation (WTO). During recent years, several nations have become cautious of trans-boundary introductions in their concern to protect the native fauna and also to avoid

the entry of exotic pathogens. Though most nations behave in a cautionary manner, these nations understand that trade in fish and fishery products between nations should be conducted in accordance with the principles, rights and obligations established in the WTO agreement and other relevant international agreements. One of the important agreements under WTO is application of Sanitary and Phytosanitary (SPS) measures. The SPS agreement specifies that measures should be applied only to the extent necessary to protect human, animal and plant life or health. SPS agreement uses the standards, guidelines and recommendations developed by Office International des Epizooties (OIE) for animal health and zoonoses as the international benchmark. Each country is, therefore, expected to have acquired facilities for complying with the above conditions and to have evolved appropriate code of practices, either of its own, or as a group of nations. In general, countries cannot apply standards higher than those specified by the code. However, each country has right to adopt its own level of acceptable risk, which may be higher than the international standard, but this must be based on scientific risk analysis. SPS measures should not be trade restrictive. Member countries are obliged under this agreement to deal with trading partner's access request in a transparent, consistent, time bound and scientific manner. Therefore, under this agreement, absence of a disease in the importing country can be used as a trade barrier for shipments of live aquatic organisms and products from our country, if we are not able to demonstrate the absence of the disease. Each country will have to substantiate claims of freedom from major diseases in order to support export certification and quarantine import policy. In such a scenario, each country must be able to demonstrate that adequate level of services exist to detect, diagnose and control aquatic animal diseases. In the absence of such programmes in India, consignments of aquatic organisms and their products carrying pathogens of concern will enter the country or our exports of live animals or fishery products can be restricted on the grounds that they pose risks to importing country. In light of WTO agreement, the human capacity and infrastructure capability in our country to address these aspects needs to be strengthened for supporting risk analysis, health certification, diagnostics, surveillance and disease reporting, in a time bound manner.

Quarantine Guidelines and Codes of practice have been developed and subsequently revised by international agencies. These codes and guidelines have been developed to provide a level of international uniformity and standardisation for preventing disease transfers associated with movement of aquatic organisms. The OIE is an international veterinary organisation, with 157 member countries. It has a Fish Disease Commission\* (FDC\*). The principal policy of OIE is to facilitate international trade on animals and animal products, including aquatic organisms and animal products. Keeping this in view, it has prepared OIE International Aquatic Animal Health Code and Diagnostic Manual for Aquatic Animal Diseases in 1995, which have subsequently been revised in 1997 and thereafter in 2000. These reference documents provide recommendations and protocols for the prevention of the international spread of socio-economically significant diseases of fish, molluscs and crustaceans.

In 1996, FAO had organised a Regional Workshop on Health and Quarantine Guidelines for the Responsible Movement of Aquatic Organisms. Based on the recommendations of this workshop, a regional Technical Cooperation Programme (TCP)

"Assistance for Responsible Movement of Live Aquatic animals" was initiated in 1998. The major contributors to this programme are FAO, Network of Aquaculture Centres in Asia - Pacific (NACA) and OIE. The immediate objectives of this programme are developing national and Asia regional technical guidelines on aquatic animal quarantine and health certification for the responsible movement of aquatic animals. This programme is being implemented by NACA. The outcome of the programme is:

1. Asia Regional Technical Guidelines on health considerations for the responsible movement of live aquatic animals.
2. Manual of procedures for implementation of Asia Regional Guidelines.
3. Asia Regional Aquatic Animal Health Guide.
4. National strategy for implementation of Asia Regional Guidelines.

A list of diseases of finfish, crustaceans and molluscs, which is important to Asia region, together with OIE list of notifiable diseases has been prepared. FAO - NACA Technical Guidelines have indicated the need for developing National Strategies as well as modify or vary FAO - NACA Technical Guidelines to suit their own particular situations and resources. The present document meets this requirement. It also addresses the issue of developing guidelines specifically addressing the issue of introduction and impact of exotic aquatic organisms and biodiversity, which was not covered in the FAO/NACA guidelines but highlighted in the Beijing Consensus, arrived at the FAO/NACA final workshop held at Beijing, PR China, 27<sup>th</sup>-30<sup>th</sup> June, 2000.

To make the plan understandable by all, it has been made as simple as possible. The scientific details are explained in the separate document *Aquatic Exotics and Quarantine Guidelines* prepared by NBFGR. In this strategic plan above document will be referred as '*guidelines*'. After the approval of National Strategic Plan for Aquatic Exotics and Quarantine from Ministry of Agriculture the *guidelines* will be discussed in a brainstorming session at NBFGR, Lucknow as recommended by expert committee. The final draft of the *guidelines* after incorporating all the suggestions will have to be approved by Ministry of Agriculture.

There are various ways to group the different components on aquatic exotics and quarantine since each is interlinked with the other. In the present document, the components are presented in a sequential manner to indicate the course of action. The execution of the whole plan has been divided into two phases. Generally it is proposed that phase I is for initial 2 years; thereafter phase II will start. However depending on requirements and availability of fund, the time frame can differ for individual components.

The involvement of the all stakeholders including industry in preparation and implementation of the plan on exotics and quarantine is vital for the success of the plan.



## 2. Important Exotics and Quarantine Issues Relevant to India

While drawing a national strategic plan for aquatic exotics and quarantine it is important to consider the issues, which are of immediate relevance to India. Though these issues have been dealt under various chapters in the plan, it was also felt that they should be highlighted separately. The important issues are:

### 2.1 Existing Legally/Illegally Introduced Exotics

India has many exotic aquatic organisms, which have been introduced legally or illegally. Some of the legally introduced exotics have become established in natural waters of India and the most widely cited species are *Oreochromis mossambicus*, *Cyprinus carpio* and *Hypophthalmichthys molitrix*. *Clarias gariepinus* is one of the illegally introduced exotics whose culture has spread rapidly to many parts of India and has been banned by Ministry of Agriculture. However, adequate studies have not been carried out on the present and likely future impacts of these exotics. The issue of legally and illegally introduced exotics has to be tackled through scientific, policy and legal mechanisms.

### 2.2 The Requirements of Aquaculture sector

The present requirement of the aquaculture sector is of four kinds.

- a. Live feed like artemia and other products like probiotics.
- b. Seed material for widely cultivated species like *Lates calcarifer* and *Macrobrachium rosenbergii* for which the heavy demand for seed can't be met at the present point of time internally.
- c. For *Penaeus monodon* there is demand for disease-free seed. To meet this we need to import brood stocks of *P. monodon*
- d. Seed/brood stocks of new species likely to be required by the sector. These can be new strains/hybrids of tilapia or marine species like sea bass, abalone, other species of pearl oysters and sea weed etc.

### 2.3 Requirements of Ornamental Fish Culture and Trade

The present requirement of ornamental fish culture and trade are :

- a. Brood stocks/seed material of species already being imported. This is required since the earlier imported brood stocks have lost their colour or new more colourful strains are in demand in the market.
- b. Brood stocks/seed material of new species.

### 2.4 Within Country Movement

This is of two categories namely :

- a) Transport of seed material mostly of major carps or prawns
- b) Transfer of species within India but beyond their natural distribution range.

### 2.5 Regional approach

There is a need for regional approach to tackle spread of exotic species and pathogen. This is especially true for countries like India which share water bodies with many neighbouring countries. Regional organisation like SAARC can be the forum to develop common approaches.

### 3. Scope and Guiding Principles

It is very important that initially the scope of the document is clearly defined and understood by all stakeholders. The present document has presented all issues on aquatic exotics and quarantine in the national perspective. There is a need to understand the guiding principles, since the justification for inclusion of various components given in the present document is based on these.

#### 3.1. Scope

The strategic plan on aquatic exotics and quarantine is to help India protect its aquatic biodiversity from exotic aquatic organisms and pathogens. It is aimed at protecting and promoting India's trade and also provides a mechanism to meet India's international obligations and adapt to changing world scenario in the light of WTO. It has a larger scope compared to the FAO/NACA Asia guidelines in that it addresses issues related to ecological consequences of exotics, spread of aquatic diseases through aquatic animal products and spread of diseases of public health significance through transport of aquatic organisms. It also addresses issues related to introduction of exotics through ballast water. Translocation of species as well as movement of seed within India are covered in view of their ecological and aquatic animal health management concerns. The diseases reportable to OIE/NACA and diseases of concern to India would come under purview of this plan. However, it does not cover within its scope, issues related to aquatic diseases already present in all parts of India, which are not of concern to any other country importing live animals or products from India.

In the present document, the term 'exotics' is used. In international usage, the appropriate term is 'alien' species. Many other terms like non-indigenous, non-native, foreign and introduced are also in usage. For the term 'quarantine' used in the present document, FAO/NACA guidelines use the term "Health management for responsible movement of live aquatic animals"; OIE uses the generic term 'aquatic animal health'. In this document, the terms 'exotic' and 'quarantine' are retained, since both scientific and non-scientific communities in India are more familiar with these terms.

#### 3.2 Definitions *(the following section has been added as per discussion of the expert committee meeting)*

This section provides definitions for the most important terms used in the National Strategic Plan for Aquatic Exotics and Quarantine. All definitions without an \* are from the NACA/FAO – Asia regional technical guidelines on health management for the responsible movement of live aquatic animals and the Beijing consensus and implementation strategy. Those with an \* are new terms or FAO/NACA terms modified with further clarifications added. Even in the NACA-FAO definitions which are retained as such, the term aquatic organism is used instead of aquatic animals.

<b>Term</b>	<b>Definition</b>
Aquaculture site	Hatchery, nursery or grow-out area, including land-based, flow-through and open-water based systems.
*Aquatic organisms	Live aquatic vertebrate (including mammals, reptiles, amphibian, finfish), invertebrates (arthropods, molluscs, echinoderms, annelids, helminthes, coelenterates, poriferans, protozoans) and plants (seaweed, seagrass, phytoplankton). For aquatic vertebrates and invertebrates it would include their reproductive products, fertilized eggs, embryos, larvae and juvenile stages. The aquatic organisms can be from aquaculture sites or from the wild.
Ballast water	Water taken by ship to maintain it's stability, balance and structural integrity when it is empty of cargo.
*Competent authority	National veterinary authority, or other aquatic organism health authority of a country/territory, with the officially approved responsibility and competence to ensure and supervise the implementation of aquatic organism health management in line with the OIE's International Aquatic Animal Health Code and the Technical Guidelines. Unless otherwise legally designated the competent authority on aquatic exotics and quarantine is the Ministry of Agriculture.
Contingency plan	A detailed plan of action for dealing with serious disease outbreaks of aquatic organism.
Diagnosis	Identification of the cause of a specific disease or syndrome.
Disease	Clinical or non-clinical infection with an aetiological agent (as applied to the FAO-NACA Technical Guidelines). NB. The classic definition of disease includes non-infectious pathology, however, this does not normally apply to health management measures related to movement of live aquatic organisms.
*Exotic species	The aquatic organisms that are introduced beyond their native range. It would include trans-boundary introductions. Synonym : Introduced, alien, non indigenous, foreign, non-native.
Exotic strains	Transboundary introduction of strains/ stocks of species native to the country Synonym: Stocks, Varieties, Breed
Health certificate	A certificate issued by an exporting country's competent authority attesting to the health status of a shipment of aquatic organisms.
*Illegal introductions	Trans-boundary introduction of exotics into India without the permission of the competent authority of India.
Import risk analysis (IRA)	The process by which hazards associated with the movement of a particular commodity are identified and mitigative options are assessed. The results of these analyses are communicated to the authorities responsible for approving or rejecting the import.
Introduction	The human-assisted movement of an aquatic organisms to an area outside its natural distribution range.
*Legal	Trans-boundary introduction of exotics into India or translocation

introductions	of native species within India with the permission of the competent authority of India.
Monitoring	Collection and analysis of information necessary to detect changes in prevalence or intensity of infection.
Movement	Human-mediated movement of aquatic organisms including all life cycle stages within or across political borders (international, State/provincial or regional boundaries).
*Native species	Species whose natural distribution range is found in India. Synonym : Indigenous
Pathogen	An infectious agent capable of causing disease.
*Quarantine (= Health management process given in NACA/ FAO guidelines)	Quarantine in its broadest sense, encompasses pre-border (exporter), border and post-border (importer) activities, as well as relevant national and regional capacity-building requirements (infrastructure and specialized expertise) for addressing health management activities, and implementation of effective national and regional policies and regulatory frameworks required to reduce the risk of disease spread through movement (intra and international) of live aquatic organisms.
*Quarantine facilities (=Holding facilities given in NACA/ FAO guidelines)	Facilities used to hold live aquatic organisms for disease inspection. Holding or rearing of aquatic organisms under conditions which prevent their escape, and the escape of any pathogen they may be carrying, into the surrounding environment. This usually involves sterilisation/disinfection of all effluent and quarantine materials.
Quarantine measures	Measures developed as a result of risk analysis to prevent the transfer of disease agents with live aquatic animal movements. This usually refers to trans-boundary movement, with pre-border, border and post-border health management processes, however, such activities are equally applicable to intra-national movements of live aquatic organisms.
Risk	The probability of negative impact(s) on aquatic organism health, environmental biodiversity and habitat and/or socio-economic investment(s).
*Risk assessment	The estimation of likelihood and magnitude of negative impact(s).
Surveillance	Systematic observation and examination of samples of population(s) of aquatic organisms designed to detect the presence of infectious agents or occurrence of clinical disease in order to control disease outbreaks/spread.
Translocated species	The aquatic organisms that are native to India but introduced into parts of the country beyond their natural distribution range.
Zone	An area containing an aquatic species, which has been determined to have a homogenous health profile for a specified pathogen or disease. The pathogens or diseases used to delineate these areas as positive or negative are those considered to pose significant risk if transferred from infected to uninfected populations of the same (or related) species.



	An area of one or more countries/territories comprising : i) an entire catchment area from the source of a waterway to the estuary, ii) more than one catchment area, iii) part of a catchment area from the source of waterway to barrier, iv) a part of a coastal area, or v) an estuary with a precise geographical delimitation, that consists of an homogeneous hydrological system.
Zoning	Identifying zones for disease control purposes.

### 3.3 Guiding Principles

Guiding principles no. 1 to 15 are the same as that given in FAO Fisheries Technical paper 402 "Asia regional technical guidelines on health management for the responsible movement of live aquatic animals and the Beijing consensus and implementation strategy". For the purpose of this document, aquatic animals as given in NACA guidelines would mean aquatic organisms. These guiding principles will be equally applicable for exotic aquatic organisms, whereas relevant.

Additional guiding principles 16 to 23 are added in view of the enlarged scope of the present strategic plan as well as to address the specific requirements for India.

1. Movement of living aquatic animals within and across national boundaries is a necessity for economic, social and development purposes.
2. Such movements may lead to the introduction of new and emerging pathogens and to disease establishment and, therefore, may pose risks to the importing country's animal, plant and human health status.
3. The role of health management is to reduce the risks arising from the entry, establishment or spread of pathogens to a manageable level with the view to protecting animal, plant and human life. Health management should also protect living aquatic resources, the natural aquatic environment and aquatic biodiversity, as well as support the movement of aquatic animals and protect trade.
4. The health management process is defined, in the broad sense, as aquatic animal health management encompassing pre-border (exporter), border and post-border (importer) activities, as well as relevant national and regional capacity-building requirements (infrastructure and specialised expertise) for addressing health management activities, and development and implementation of effective national and regional policies and regulatory frameworks required to reduce the risk of disease spread through movement (intra-and international) of live aquatic animals.
5. Health management measures should be practical, cost-effective and easy to implement by utilising readily available facilities. Individual countries may

need to adopt, modify or vary FAO-NACA Technical Guidelines to suit their own particular situations and resources.

6. The varying capacity of developing countries to implement programmes on health management should be acknowledged by relevant international organizations and financial institutions. These organisations should give full recognition to the special circumstances and requirements of many developing countries.
7. Health management measures shall be based on an assessment of the risk to animal, plant and human life or health. In assessing the risk, prevalence of specific pathogens in both the region of origin and the region of destination shall be a crucial issue. The likelihood of new or emerging pathogens becoming established in the region of destination is a major consideration.
8. All movements of aquatic animals should be conducted within the provisions given in existing relevant international agreements and instruments. Health management measures should not be applied in a manner, which would constitute a disguised restriction on trade. Health management measures should be applied only to the extent necessary to protect animal, plant or human life or health, and must be based on scientific principles and not be maintained without sufficient scientific evidence.
9. In determining the appropriate level (stringency) of health management measures to be applied, relevant economic and ecological factors have to be taken into account. These are, *inter-alia*: potential damage due to loss of production or value, and the cost of control or eradication. A conservative approach should be adopted in cases where insufficient knowledge exists in relation to disease risks posed by a particular import; a higher stringency of health management procedures should be adopted where inadequate knowledge exists.
10. The first movement (introduction) of a new species into a new area will require special health management considerations in light of the need to evaluate scientific evidence regarding the risk of introducing pathogens to new areas.
11. Different regions should attempt to harmonise health management procedures to facilitate safe movement of aquatic animals within and between regions.
12. Considering the free movement of aquatic species in trans-boundary waterways, division of regions into manageable sub-regional units based on factors such as geography, hydrography, ecosystems, epizootiological surveillance and effectiveness of control is necessary for the effective implementation of health management procedures. The basis for the establishment of such units should be uniform, clear and unambiguous.

13. Honest, conscientious and transparent reporting is essential for health management to be effective.
14. Technical co-operation among regional experts is essential to promote exchange of information and expertise.
15. Collaboration among the governments, public institutions, and the private sector, including all stakeholders, is important to achieve the full purpose of implementing effective health management. Opportunities for sharing the benefits of health management among all stakeholders should be explored.
16. Movement of living aquatic animal into India should be considered only after examining options for utilising natural biodiversity of India.
17. The export of live aquatic organisms would have to be considered taking into consideration the provisions under Convention on Biodiversity (CBD) as well as India's proposed Biodiversity Act.
18. In evaluating proposals for introduction, while a precautionary and conservative approach is to be taken, there is no zero risk option. The conservative approach must be based on scientific principles.
19. In evaluating introduction proposals, it must be recognized that there are limitations due to inadequate scientific knowledge and standardized proven methodology for evaluating impacts of exotics. These limitations should not come in the way of the evaluating introduction proposals.
20. In developing the strategic plan it must be realized that there are equally damaging ecological and pathological consequences due to translocation of species or unrestricted transport of seed of widely cultured species within India.
21. As given in guideline 6, due to limited capacity to handle exotics and quarantine, the whole plan should be implemented in a phased manner in tandem with progress in capacity building in terms of manpower and infrastructure, institutional and legal mechanisms and availability of fund.
22. Recognize that all issues covered under exotics and quarantine would have to be considered for both import and export trade.
23. Recognizing that for protecting India's trade interest and as per changed world scenario due to WTO agreement, the issues related to aquatic organisms disease spread through products and spread of pathogens of public health significance through live animal transport need to be considered.

## **4. Documentation**

The FAO Code of Conduct for Responsible Fisheries advocates that the absence of scientific information should not be used as a reason for postponing or failing to take conservation and management measures. The SPS Agreement implies that introductions of exotic species should not be restricted unless import risks are proved through scientific evidences. These provisions underscore the need for compiling all available information in a form, which can be utilized to protect India's aquatic biodiversity from deleterious ecological and pathological effects. Such an effort is also needed to protect India's trade and to meet international obligations.

### **Objectives**

1. To develop a database for planning and executing programmes on exotics and quarantine.
2. To meet India's international obligations for supplying information to Aquatic Animal Pathogen and Quarantine Information System-Asia (AAPQIS-Asia) of NACA and other emerging requirements.

### **Major components**

The major components under documentation are :

1. Database on exotics and quarantine.
2. List of prohibited/approved/potential exotic species/strains for introduction.
3. List of diseases of concern.

#### **4.1 Database on exotics and quarantine**

The exotics database will provide information on exotics introduced in different countries and their impact on ecosystem of importing countries. It will be possible to know the relative success of species/genera/families in establishing free living wild populations. It will also provide information on species currently in demand, thereby, identify potential species that can be introduced in the country in near future. The exotic database will provide useful information on spread of exotics in India. All this information is crucial for evaluating further introduction proposals based on impacts of such introductions elsewhere; it will also assist in contingency planning to control invasive aquatic species. The evaluation of introduction proposals will be more scientific with input from such database.

The quarantine database will provide information on distribution of pathogens within the country and facilitate development of zoning policies for diseases of concern, if reported from some parts of the country. It will be possible to track information on known and potential pathogens of candidate species proposed for introduction in importing and exporting country. The quarantine database will also have information on diseases of concern to the country in addition to OIE listed diseases. All the above



information will be vital for carrying out scientific import risk analysis in accordance with SPS agreement.

**Requirement:**

**Phase I**

1. Strengthening database on exotics and quarantine.
2. Developing mechanism for collecting primary data on these subjects.

**Phase II**

1. Incorporation of data from reporting system into database.

**Mechanism and mode of action**

NBFGR's work on a database on quarantine and exotics needs to be strengthened. Further research projects need to be taken up for collecting primary data on exotics and quarantine by fisheries research institutes. When the full scale reporting system is in place, the data collected under this system with checking and validation will be incorporated into the database by NBFGR.

FAO's Database on introduction of aquatic species (DIAS) includes information regarding species (fish, crustaceans, molluscs or other marine species) introduced or transferred from one country to another; but it does not take into consideration the movement of species inside the same country. The database contains about 3150 records as on 26 April 2001. It is being expanded to include accidental introduction of aquatic organisms.

NACA in association with FAO is developing the online database AAPQIS-Asia which contains information on pathogens from aquatic organisms from all countries of this region for last five years. It is being strengthened by addition of information on quarantine legislation, and list of institutes and research workers working on fish health. NBFGR is the nodal institute for sending AAPQIS entry data entry forms from India to NACA. AAPQIS and DIAS have information of significance at the global or regional level. To address within country requirements of India, NBFGR is working on a more detailed database on quarantine and exotics. Under its database on quarantine it is also working on Indian Fish Pathologists Directory, which will help in creating a diagnostic network.

**4.2 Prohibited /Approved/Potential species/strains**

There is need for a list of prohibited species/strains especially in the aquarium trade. Until legislative and implementing mechanisms are in place to check introduction of dangerous species, such list can increase the awareness of industry and public and can lead to less demand for import of dangerous species like piranha and help industry adopt a voluntary code for import of live fish.

This categorization may be based on relative probability of establishment of the exotic species in the event of escape and the ecological consequences of such feral population. Internationally there are no clear cut guidelines for preparing a list of prohibited/approved species/strains. However, some countries have a list of prohibited species mainly ornamental fishes. Species/strains having a very high or high probability of establishment and proven ecological damage may be put on prohibited list. Species/strains which are required to support aquarium trade and having low/residual probability of establishment may be termed as approved species/strains.

This list of species/strains will be subject to change with availability of new information. The list can be different for different agro climatic regions of the country.

### **Requirement:**

#### **Phase I**

1. Preparation of criteria to categorize fishes into potential/ approved/prohibited species/strains for introduction.
2. Categorization of ornamental fishes into prohibited and approved category.
3. Identification of potential species/strains for introduction

#### **Phase II**

1. Categorization of food aquatic organisms for imports into prohibited and approved category.

### **Mechanism and mode of action**

The criteria to categorise species/strains into potential, approved and prohibited species/strains for introduction is given in *Aquatic exotic and quarantine guidelines*. This criteria along with other documents will be discussed in brainstorming session and finalized by the Scientific sub-committee of the National Committee (see chapter 10) and with its recommendation be approved by the National Committee. It will be incorporated into the proposed national legislation on exotics. Until it is incorporated into national legislation, it will be enforced by voluntary code/executive order. Approved list of species/strains will be prepared only after these are cleared from potential ecological impacts (see Evaluation of Introduction Proposal). Further imports of same species/strains need not undergo ecological evaluation. If any of the species/strains is removed from approved list on the basis of additional information then it needs to undergo ecological risk evaluation. However, before import of each consignment, they will have to undergo disease risk analysis and quarantine with respect to particular diseases. While identifying potential species/strains for introduction, information on their biology, environmental requirements, reproductive capacity, aquaculture potential, compatibility to Indian conditions, tolerance capacity to environmental parameters, export and domestic demand and possible impacts must also be collected and evaluated.

The ornamental fishes will be classified into approved and prohibited categories by NBFGR in collaboration with MPEDA.

The categorization of food aquatic organisms into approved and prohibited categories and identification of potential species/strains for introduction will be done by Scientific sub-committee. The public must be made aware of approved/prohibited list of exotic aquatic organisms.

### **4.3 Diseases of concern**

At present, quarantine is only enforced for OIE notifiable and other significant diseases. But there are other diseases, which are infectious and capable of causing economic and biodiversity loss. These are not included under OIE list. Some of these diseases have been added to the NACA list. Many countries like USA, Australia and European Economic Community (EEC), have prepared their national list of diseases of concern for which quarantine measures are under taken by the respective countries. The list of diseases of concern will be an addition to the OIE listed diseases. The disease of concern should be an infectious disease that is exotic to the country, or which occurs only in a part of country and is subject to strict control programme to reduce or eliminate it from the area affected. The disease in question should exert a significant impact in the country/part of country and is known to have adverse effects on socio-economics and the environment. The disease selected should merit the effort that is required to control the entry, establishment or spread of disease in the country or part of country. There should be a strong scientific basis that diseases included in national list of diseases of concern can cause severe adverse impacts on native fishes, if introduced into the country or part of country. Once this is established these diseases must be given quarantine importance and be reportable at national level. India must also develop capabilities for screening pathogens causing diseases of concern. The list of diseases of concern is subject to change in the light of new information. In case any such disease is reported from India, it must be confirmed as given under reporting. Then, either the disease will be removed from list of diseases of concern, or control measures will be undertaken to control or eradicate the disease.

The list of diseases of concern is important taking into consideration the potential economic loss due to diseases e.g. white spot disease (WSD), epizootic ulcerative syndrome (EUS) in India and crayfish plague in Europe.

#### **Requirement:**

##### **Phase I**

1. Finalize a criteria for identifying diseases of concern.

##### **Phase II**

1. National list of diseases of concern to be prepared.

#### **Mechanism and mode of action**

Based on FAO/NACA regional guidelines, the criteria for the list of diseases of concern is given in the *Aquatic exotics and quarantine guidelines*. These criteria along with other documents will be discussed in brainstorming session and finalized by the Scientific sub-committee of the National Committee and with its recommendation be approved by the National Committee. Preparing the list of diseases of concern would take

more time and will depend on building of database and other developments. The Scientific sub-committee under National Committee would prepare the list of diseases of concern, which would be approved by the National Committee and later incorporated under the acts and rules of quarantine legislation.



## 5. Import Replacement and Prevention of Illegal Introduction

India has a rich aquatic animal diversity. The potential of most species remains to be evaluated for aquaculture and ornamental purposes. This is one reason for import of exotic species. There is also demand for seed of exotic stock of some aquatic organisms like *Macrobrachium rosenbergii* (scampi), *Lates calcarifer* and *Penaeus monodon*, which are cultured or in demand widely in India. Scampi seed is imported because the seed availability in India is less and it is available at cheaper rates from other countries like Thailand. For *P. monodon* due to requirement for disease-free seed, there is demand for exotic stocks of both seed and brood stock. For *L. calcarifer* though the technology for production has been developed, commercial hatcheries are yet to be set up. The import of scampi seed is not being curtailed since under open general license (OGL), there is restriction on introduction of finfish only. Ministry of Agriculture is aware of its implications and is interacting with Ministry of Commerce to resolve this issue. The proposed Quarantine Act, 2000 would address this problem more effectively.

If culture potential and ornamental value of the native aquatic organisms is fully explored and the practices for producing seed can be made economically competitive, then the demand for import of aquatic organisms will decline. Thereby, adverse impacts of exotics can be avoided. NBFGR under National Agricultural Technology Project (NATP) initiated in 2000 is already exploring the potential of some endemic fishes from North-East and Western Ghats for use in aquaculture and for ornamental purposes. Central Institute of Freshwater Aquaculture (CIFA) has also programmes for evaluating native species for their aquaculture potential. There is demand for Indian native freshwater and marine fishes in the international aquarium trade. With comparatively little investment, attractive strains can be developed from potential fresh water aquarium species.

Many exotics have gained entry into India due to lack of awareness, legislation and institutional mechanisms. Before the ban on illegally introduced *Clarias gariepinus* was imposed by Ministry of Agriculture, State Fisheries Departments and agricultural universities had propagated their culture. Once its culture was banned by Ministry of Agriculture through an executive order, State Governments initiated measures for imposing the ban. Due to lack of appropriate legislation, the matter has been challenged in the court. Tilapia (*Oreochromis mossambicus*) was introduced in 1950's and has established in many water bodies. In some, it had adverse impacts on native freshwater biodiversity. Since there are other tilapia species or strains with good potential for export trade, the industry would like to import them. There is a need for debate and a policy paper on existing naturalized stocks of exotics as well as those widely used in culture to prevent/mitigate adverse impacts and give directions for future introduction.

### Objectives:

1. To promote native species and to reduce the impact of exotics.

## **Requirements:**

### **Phase I and II**

1. Evaluation of native species for aquaculture and ornamental value (I and II).
2. Develop economically viable seed production and (I and II) culture practices for species already being cultured and for new candidate species.
3. Policy paper on already existing exotic species (I).
4. Prevent illegal introduction of exotics and to take mitigative steps to reduce impacts of exotic species on native aquatic organisms (I and II)

### **Mechanisms and Mode of Action:**

Ministry of Agriculture in consultation with State Governments, funding organisations and private industry should develop projects for popularizing and upscaling of seed production and culture technology of new candidate species for both aquaculture and ornamental fish culture and trade. The Policy sub-committee of National Committee should analyse the demands for live aquatic organisms as well as products both within the country and globally. Based on this, specific information on a particular species can be built in the exotics database and future scenario can be worked out for possible steps to either promote or prevent the same. The State Government fishery officials should also give feedback on changing farmer and market demand to the Policy sub-committee of National Committee. The fishery research institutes and industry must identify the potential species to cater to the changing farmer and market demand and make breeding and culture practices of these species economical. The potential aquatic organisms for different purposes alongwith package of practices should be given wide publicity and offered to the industry for culture.

There are species native to India like *M. rosenbergii*, *P. monodon* and *Lates calcarifer* for which there is a heavy demand for seed. For such species, breeding practices should be made economical so that cost of seed is competitive to other countries. Research efforts must be directed to cater to this demand. In such a scenario, the demand of imported seed from other countries will recede.

Since there are chances of spread of exotic species and exotic diseases from neighbouring countries, this issue should be addressed in regional forums like SAARC and NACA. Before evaluating exotic aquatic organism, it must be first assessed if the same objective can be met with native species.

Since many State Governments are not clear as to what should be done with species like Tilapia (*O. mossambicus*) or illegally introduced species like exotic magur (*C. gariepinus* and *Pangasius suchi*), a policy paper may be prepared by Policy sub-committee. To prevent further spread of already introduced exotics, detailed action plan may be prepared by the Policy sub-committee incorporating the following points:

1. Mechanism to ensure that information on such exotics and their subsequent spread is passed on to the competent authority at the earliest. State Government fishery officials who have a day to day contact with fish farmers should inform Ministry of Agriculture whenever any exotic species or exotic stocks of native

- species are being imported for culture in their area of operation so that competent authorities can take immediate action. Industry should also report illegal introduction.
2. State Governments, Agricultural Universities and Research Institutes should undertake programmes for increasing the awareness to prevent illegal introduction and spread of exotics through television/radio talks, distribution of pamphlets, wall posters and articles/advertisements in newspapers.
  3. Spread and impact of exotics should be quantified by fishery research institutes with the help of State Governments.
  4. When Ministry of Agriculture imposes a ban, destruction of brood stocks and all life cycle stages should be carried out by State Fisheries Department ensuring that live brood stocks and all other stages are not dumped into natural water for fear of official action.
  5. Ban should be extended to markets by State Fisheries Department so that no illegally introduced fish is sold in fish markets. Since ban on culture is difficult to enforce, unless accompanied by ban on sale which will act as great disincentive to culture. Fish markets should be brought under excise control of State Fisheries Department.
  6. Competent legal expertise is obtained even from private sources by State Fisheries Department to fight such cases in courts, if the ban is challenged.
  7. Powers to enforce the above ban are incorporated in the appropriate legislation by Ministry of Agriculture. It should empower State fishery officials to initiate legal proceedings against such traders and local police stations should be directed to help State fishery officials.
  8. Permission of the Central/State Government for transport of seed is made mandatory in the legislation to be enacted. This would check translocations, spread of exotics and diseased seed.

## **6. Evaluation of Introduction Proposal**

Introduction of exotics has both benefits as well as adverse impacts. Exotic species introduced for aquaculture have higher growth rates. The exotic stocks may be introduced for genetic upgradation of local stocks of native or earlier introduced exotic aquatic species. The exotic species have also been introduced in some areas to control aquatic weeds and insects like mosquitoes. The ornamental fish culture and trade and related ancillary industries are based on exotic aquatic organisms to a great extent.

The import of live aquatic organisms into India is of two types i.e. exotic species and exotic stocks of native species. These may be for aquaculture or ornamental fish trade or biological control. This can be in the form of only one time consignment for building brood stock for any of these purposes or repeated import for direct use in culture/ornamental/biological control. The importing organisations can be aquaculture/ornamental fish industry, State Fisheries Departments and research organisations.

Escape of exotic species to natural open water systems, can lead to their establishment in the wild. The resulting adverse impacts associated with introduction of exotic organisms can be divided into 3 main categories i.e. genetic, ecological and fish health. Ecological impacts may be due to habitat alteration or effect on native species due to competition or, predation. Sometimes exotic species may affect a native species having pivotal ecological role. The initial effects on the native species may then cascade throughout the system. The genetic impacts of introductions can be in the form of loss of genetic diversity and genetic adaptation evolved over a substantial period of time due to hybridisation with local stocks of native species. It must be recognized that there are higher risks of genetic contamination in fishes than in plants and animals, due to ease of interspecific and intergeneric hybridization in fishes. During evaluation of introduction proposals, this risk must also be considered. The hybrids may be less viable or even sterile. The exotic species may introduce pathogens of concern to open water systems and subsequently infect the native species. The introduction of exotic disease may cause economic loss to the aquaculture sector and decline in the number of native species or their abundance.

General guidelines for carrying out disease risk analysis have been outlined in OIE International Aquatic Animal Health Code and FAO/NACA Manual of procedures. The objective of risk evaluation is to provide a standardized process for evaluating the risk of introducing exotic organisms into the new environment and to determine the risk management steps to mitigate the risks. The methodology in making a risk judgment may be qualitative, quantitative or a combination of both. The information is placed in a format. The risk assessment clarifies possible outcomes, estimates their probabilities of occurrence and succeeds in recording the degree of uncertainty involved in making predictions.

There are no published reports on ecological risk assessment of exotics though disease risk assessment reports are available. The risk assessment and management committee of Aquatic Nuisance Species Taskforce of USA has adopted risk analysis process on basis of probability of establishment of exotic species and likely impacts if it gets established. However, in the absence of specific data, as per FAO Code of Conduct for Responsible Fisheries, the precautionary approach is applied. In many developed countries, the review process is transparent.

Control on importation of exotic aquatic organisms is under the purview of existing National Committee. This Committee comprising Directors of ICAR fishery institutes and experts examines all new applications for introduction of aquatic organisms. Based on decisions taken by the committee, the introduction proposals are cleared or rejected.

In India the introduced aquatic organisms are not put under quarantine upon arrival from exporting country. There are no quarantine facilities in the country for aquatic organisms. Existing quarantine for importation of aquatic organisms in India is based on pre-border quarantine and certification.

### **Objective**

1. Development of a system for evaluating and monitoring introduction of exotic aquatic organisms.

### **Components**

- 6.1 Ecological risk evaluation
- 6.2 Disease risk analysis

#### **6.1 Ecological risk evaluation :**

Before carrying out ecological risk assessment, it must be ascertained if the same objectives can be met with native species. If there is no native species to substitute the exotic species, ecological risk assessment of the exotic aquatic organism proposed to be introduced should be undertaken. The major considerations in ecological risk evaluation are probability of establishment and consequences of establishment. Consequences of establishment must take into account both negative positive impacts of exotic organisms. This process can be helpful to know the cost, benefits and risks of introducing exotic organisms. It has to be undertaken for exotics as well as species transplanted within the country. However, while evaluating ecological risk, difference between risk due to exotic species against those due to exotic stocks of species already found in India like *Lates calcarifer*, *M. rosenbergii* and *P. monodon* has to be made. Along with ecological risk assessment there is a need to assess production parameters. The possibility that the imported exotic stock is a distinct genetic unit different from that available in India, also needs to be evaluated.

If an improved or a new variety/ strain/ subspecies of an earlier legally introduced species is to be considered for introduction, it should be ascertained how far it has changed from the earlier introduced stock with respect to life history traits and genetic makeup. Based on this, risk assessment may need to be carried out. If the imported species has been genetically modified, it will also need the clearance from the committee set up by Government of India.

## **Requirements**

### **Phase I and Phase II**

1. Development of a process for ecological risk evaluation of live aquatic organisms (I).
2. Ecological risk assessment of candidate species for import (I and II).

In Phase I, small number of medium risk and large number of low risk categories may be allowed for introduction. In Phase II, large number of medium risk and small number of higher risk categories may also be allowed for import.

## **6.2 Disease risk analysis:**

The objective of undertaking disease risk analysis is to evaluate the risk of entry, establishment and spread of OIE listed and national diseases of concern. It will provide the country with an objective and defensive method of assessing disease risks associated with importation and help determine ways by which these risks may be managed. This process has to be transparent and scientifically justified in order to provide the exporting country with a clear and documented decision on the conditions imposed on imports, or on what basis it is refused.

The disease risk analysis will be taken up only after the species has been cleared under ecological risk evaluation.

## **Requirements**

### **Phase I and Phase II**

1. Development of a process to undertake disease risk analysis (I).
2. Disease risk assessment for candidate species for import (I and II) .

## **Mechanism and mode of action(for 6.1 and 6.2):**

The format to evaluate ecological and disease risks is given in *Aquatic exotics and quarantine guidelines*. It will be discussed in brainstorming session and finalized by the Scientific sub-committee and with its recommendations, will be approved by National Committee. The categorisation of disease risks into low, medium and high risk categories has been given in '*guidelines*'. All proposals for introductions by the industry will be

routed through Marine Products Export Development Authority (MPEDA) and then by respective State Governments. All requirements by research institutes and State Fisheries Departments will be directly submitted to Ministry of Agriculture. The proposals will be evaluated by the proposed scientific sub-committee under National Committee on Introduction of Exotic Aquatic Organisms. This sub-committee will take the help of subject matter specialists in field of biology and it will evaluate each proposal in the light of its ecological impacts. If required, this can be given as consultancy service to a panel of experts. The report will undergo review by National Committee and result of the evaluation will be put up for public comments and communicated to the party and other stakeholders who can appeal against unfavorable decision with further information. If the data pertaining to biology for predicting ecological risks are found deficient, pilot studies may have to be undertaken under controlled conditions by research organisation and sponsored by industry to fill the information gap.

Once the proposal is approved on the basis of ecological risk assessment, then it will undergo disease risk assessment specific to the location. The proposed Scientific sub-committee with the help of disease experts drawn from different ICAR Fishery Institutes/State agricultural universities/conventional universities will conduct the risk assessment. The outcome of the assessment will be communicated to the party and will be put up for public comments. The final approval of proposal will be based on disease risk assessment report. The whole process will be open, transparent, subject to review in light of additional information and time-bound. It is schematically represented in Annexure I.

The proposal to import an aquatic organism for the first time has to undergo ecological and disease risk assessment. However, subsequent imports of the same aquatic species need not undergo ecological risk evaluation. Such imports will undergo only disease risk analysis.

## 7. Quarantine

Quarantine is holding aquatic organisms in isolation so as to prevent escape of aquatic organisms and associated pathogens. In broader terms it includes pre-border, border and post-border activities, including pre-movement screening, pre-movement certification, movement, confinement on arrival, checking during confinement, release and subsequent monitoring as appropriate. Stringency of quarantine depends on the relative risk of introduction of exotic diseases associated with movement of aquatic organisms. It is a risk management strategy and must be backed by appropriate surveillance, reporting and contingency planning.

Australia has an effective system of quarantine. It has a separate quarantine service, Australian Quarantine Inspection Service (AQIS), which has a mandate for aquatic animal quarantine also. AQIS has undertaken import risk analysis of ornamental fishes and aquatic animal products. An inventory of pathogens of aquatic organisms found in Australia and in other countries has been prepared. It has a system of disease surveillance and reporting for aquatic animal diseases. It is implementing a national strategic plan Aquaplan, which covers all aspects of responsible transboundary and within Australia movement of aquatic organisms and products. Aquavetplan, a sub plan of Aquaplan, is being prepared to control aquatic animal disease outbreaks. Legislation to enforce quarantine is in place. Australia has collaborated with NACA in developing the Asia Regional Technical Guidelines for responsible movement of live aquatic animals and Manual of Procedures for implementation of Asia Regional Guidelines.

India seems to be free of major diseases of aquatic organisms that have been reported from aquatic organisms in other parts of the world. Most of these diseases have not been reported from India till date. This is a national asset worthy of protection. In India, efforts are on to develop an effective national quarantine system.

In this plan, under quarantine the components included are:

1. Quarantine facilities
2. Diagnostics
3. Certification
4. Contingency planning
5. Zoning
6. Ballast water
7. Aquatic animal and plant products
8. Public health significance

The first three components have been covered in detail here based on the present capabilities to initiate action on these. Proposal for minimum contingency plan has been included taking into consideration the difficulties in implementing optimum contingency plan. A separate task force is suggested to implement zoning taking into consideration the requirements for it. Since the issues under ballast water will involve many organisations not under Ministry of Agriculture, a separate task force is suggested. The



last two components have been included here to indicate their significance in international trade. There is a need for consensus on importance of these components among different stakeholders before detailed planning exercise is carried out.

## **7.1 Quarantine Facilities for Live Animals**

To prevent spread of exotic pathogens, exotic animals must be held in quarantine facilities before they are released for the purpose it is imported. These facilities must be microbiologically secure for holding and preventing the escape of aquatic organisms and their pathogens.

Presently, live aquatic organisms exported from India do not undergo quarantine. But in future, the importing countries may require that live animals exported from India should undergo pre-movement quarantine.

The costs involved in setting up quarantine facilities are high. Therefore, quarantine facilities may initially be set up near 2 ports i.e. Mumbai on West Coast and Chennai on East Coast; if these facilities come in private sector, CIFE and CIBA can be identified for supervision of these facilities respectively.

### **Requirement:**

#### **Phase I**

1. Finalising requirements for quarantine facilities.
2. Setting up quarantine facilities to handle small volume of imports by both government and private sector.
3. Develop mechanism to supervise such facilities and to back it up with diagnostic support.
4. The quarantine facilities to be operated by private sector under terms and conditions set by the Government

#### **Phase II**

1. Setting up quarantine facilities for handling large volume of imports

### **Mechanism and mode of action:**

The existing general NACA/FAO guidelines for quarantine facilities will be adopted. Specific requirements and operations of quarantine facilities are given in the accompanying *Aquatic exotics and quarantine guidelines*.

This criteria along with other documents will be discussed in the brainstorming session and finalized by the scientific sub-committee of the National Committee and with its recommendation be approved by the National Committee. During quarantine, diagnosis for diseases identified in import risk analysis will be done by network of fish disease diagnostic laboratories.

Till the quarantine facilities are set up, importation should be preferably from zones or farms certified free of OIE-listed pathogens not present in the country. In addition, surveillance should be taken up in area where introduction is made and importation is allowed only for medium/high secure systems as given under 'Aquatic Exotics and Quarantine Guidelines'

In phase I, quarantine facilities for holding small volume of imports will be set up. Also industry would not be interested in importing organisms of high risk categories since this would require holding brood stock in quarantine until F<sub>1</sub> generation is produced, involving huge costs for operating quarantine facilities for long periods (see *Aquatic exotics and quarantine guidelines*). There is need to set up separate quarantine unit by Ministry of Agriculture similar to that of plants and animals to oversee quarantine regulations at port of entry and to monitor quarantine facilities. The private sector should be encouraged to set up its facilities as per approved norms. The facilities will be periodically checked to ensure that approved norms are being adopted. This would be required since growing trade in live animals including aquarium trade would require pre-border quarantine from country (i.e. India) exporting them.

## **7.2 Diagnostics**

The diagnostic assays for screening pathogens causing diseases of concern should be developed. Such assays should be sensitive, specific, reliable, rapid and should be able to detect asymptomatic carrier. We must acquire diagnostic capabilities to screen pathogens causing OIE - listed diseases at the earliest. These tests will be used for screening imported aquatic organisms and also for surveillance of these diseases in native populations so as to obtain disease free status. The diagnostic kits for only some OIE listed diseases are available commercially. When we prepare a national list of diseases of concern, we must acquire diagnostic capabilities for such diseases also.

FAO-NACA technical guidelines have categorised disease diagnosis into three levels i.e. level I, II & III based on site, activity and expenditure. Level I diagnosis includes observation of animals, environment and gross clinical examination. Level II diagnosis is required for internal pathogens that are not readily identified by level I diagnosis. It includes parasitological, bacteriological, mycological and histopathological examinations. Level III diagnosis is applicable to detect subclinical pathogens using virology, electron microscopy, molecular biology and immunology techniques.

### **Requirement:**

#### **Phase I**

1. Developing screening capabilities for pathogens causing OIE-listed diseases.
2. P-IV Laboratory for handling exotic pathogens to be developed.
3. Organizing network of fish disease diagnostic laboratories.

## **Phase II**

1. Developing diagnostic kits for national diseases of concern.

### **Mechanism and mode of action:**

One of the present bottlenecks is that diagnostic kits are not available commercially for all OIE listed diseases. OIE referral laboratories are in a position to supply antigens/ antibodies for these diseases for limited number of samples. For OIE listed diseases, NBFGR is contacting the OIE referral laboratories for these items. Till the time, the kits for OIE-listed diseases become workable, the samples can be sent to OIE referral laboratory for confirmation, in the event of suspected disease outbreak. The samples are to be sent through NBFGR.

A network of fish disease diagnostic laboratories of different ICAR Institutes, College of Fisheries like that of Mangalore, veterinary and university laboratories with NBFGR as nodal institute needs to be established for screening OIE-listed diseases. It may be done by Ministry of Agriculture in consultation with ICAR. Institutes located at the major ports (CIFRI, CMFRI, CIFT and CIFE) may be assigned specific responsibilities. The database on Directory of fish pathologists is the first step in this direction. The network of diagnostic laboratories will also prepare diagnostic kits for diseases of concern.

The P-IV laboratory may be developed at NBFGR, which will be the Nodal Institute for maintaining exotic disease pathogen cultures and working on exotic diseases. It has already been projected in X plan of the institute. NBFGR has presently the infrastructure and manpower capabilities to screen exotic diseases. Till the time, P-IV laboratory is established at NBFGR, the existing facilities at ICAR High Security Animal Disease laboratory, Bhopal can be utilised. These facilities will be used for handling live exotic pathogens. Care must be taken to ensure that all parts of India are covered by this diagnostic network and area is demarcated for each laboratory.

### **7.3 Certification**

Certification is a documented assurance signed by an official authorized by competent authority of the country that a stock of live aquatic organisms to be moved from one country to another is free of diseases of concern to the importing country. Certification is an essential component of quarantine and will be increasingly required for trade under WTO. For the exports, pre-movement inspection or official health surveillance programme can provide the data to be used in any certification programme. For imports, we should insist on pre-movement certificate for freedom from diseases of concern to our country in addition to OIE listed diseases. Also we should undertake post arrival inspection during quarantine.

Presently the country does not have the capacity to undertake testing for OIE listed diseases barring epizootic ulcerative syndrome (EUS) and white spot disease (WSD). Therefore, in phase I, for exports, it will not be possible to certify absence of OIE

listed diseases based on diagnostic tests. Presently, the certification can only be on basis of absence of gross signs and symptoms and disease history of the farm.

**Requirement:**

**Phase I**

1. A competent authority (CA) needs to be designated and entrusted with legal powers.
2. Certifying Officials having the competence to sign the health certificates on behalf of CA to be designated.
3. Identification, registration and accreditation of laboratories with technical expertise whose report can form the basis of health certificates.

**Phase II**

1. Certification to be done on basis of specific diagnostic tests.

**Mode and mechanism of action:**

Ministry of Agriculture should designate a competent authority, which may be represented by individuals with expertise in fisheries, veterinary sciences, aquatic animal health and quarantine. The competent authority should authorize officials to sign international health certificates. Only certificates signed by authorised officials will be considered as valid. Criteria are to be developed by Scientific sub-committee to register government and private laboratories whose report can be used to certify consignments of aquatic organisms with involvement of MPEDA and industry. These laboratories may or may not be part of diagnostic network and would be constructed from where export of live organisms takes place. Once the diagnostic capabilities have been developed for OIE-listed diseases/diseases of concern, then the certification must be based on these tests.

**7.4 Contingency Planning**

It is a detailed action plan, which outlines the strategy to deal with any serious disease outbreak. This plan must be in place before any disease outbreak takes place. Contingency planning is needed for each disease of concern and OIE listed diseases. Advance planning to deal with serious disease outbreaks can significantly reduce the socio-economic impact of the disease. The prompt action based on contingency planning can reduce the potential spread of the disease. In some instances, contingency planning may be effective in eradicating the disease agent. The consequences of not having contingency planning have been disastrous with disease outbreaks such as EUS and WSD. Under ideal conditions, we need to have optimum contingency planning. It ensures that all the requirements to deal with disease emergencies have been defined, and adequate resources are available in disease emergencies and these resources can be deployed promptly and efficiently. It has a close link with disease surveillance and zoning. Optimum contingency planning is not feasible in the near future in the absence of national list of diseases of concern, active surveillance, zoning and legislation.

**Objective:**

1. To provide a rapid and planned response for containment of disease outbreak.

**Requirements:****Phase I**

1. Minimum contingency plan.

Minimum contingency plan will be common for all the disease outbreaks. It will cover basic measures required for controlling the disease outbreaks. It should also be backed by a legislation. If such plan is in place it can also be used for controlling disease other than exotic, provided it is a highly infectious and is capable of causing economic damage.

**Phase II**

1. Optimum contingency plan taking into consideration specific requirements for each disease of concern and OIE listed disease

The requirements for optimum contingency plan will include:

- i. Effective disease surveillance.
- ii. Adequate reporting structure.
- iii. Experienced and trained manpower.
- iv. An emergency work plan.
- v. Funding for various activities.
- vi. Legal support to execute an eradication campaign.
- vii. Public support and cooperation in containment programmes.
- viii. Adequate diagnostic sources.
- ix. Slaughtering of diseased stocks and provision for compensation.

**Minimum contingency planning** (*the following section has been taken from the draft aquatic exotics and quarantine guidelines and incorporated into the Plan as per discussion of the expert committee meeting*)

Main components of Minimum Contingency Plan would be following-

**Stage I -** Mechanism for bringing information about disease outbreak to notice of the competent authority.

**Stage II -** Steps to contain/eradicate the disease.  
These have been schematically represented in Annexure II.

**Stage I**

- (i) The district fishery officer (DFO) or Executive Officer of BFDA/FFDA based on feedback from fishery inspector or field officer of FFDA/BFDA and MPEDA informs the State Fisheries Director.

- (ii) The Director in turn informs an identified research institute/ laboratory of diagnostic network for that State as well as Fishery Development Commissioner. State Fishery Director and FDC are the key persons for taking action until the disease is contained.
- (iii) Research institute/ laboratory rushes the team to the locality from where the outbreak is reported to investigate and gives its report.
- (iv) Even before getting report of research institute/ laboratory, State Fisheries Director initiates emergency measures indicated in Stage II. These measures can be further extended or withdrawn depending on the report of scientific team.

## **Stage II**

Till it is confirmed that the disease is exotic or endemic, there is restriction on sharing of water, feed and seed supply between the farms from the area affected covering a radius of 5 km or more depending on interconnecting water canals. Each State can decide about the extent of geographic area to be placed under movement restriction and surveillance. If farms outside this area also had the same seed source, they should also be identified and similar restrictions and surveillance must be enforced.

A plan of awareness given in the manual involving Television, Newspapers and farmers meet is initiated.

If the disease is confirmed as exotic in nature, all the aquatic animals from the farm(s) where the disease has been reported are immediately slaughtered and destroyed in an approved manner as indicated in the Manual. If the scientific report indicates that the disease is not exotic, then on the basis of severity and the risks involved, the following options are exercised.

1. Slaughtering and destroying the aquatic organisms in an approved manner.
2. Emergency harvest and evisceration (in fishes)/ removal of cephalo-thorax (in prawns). Sale of the harvested produce should only be for human consumption within their district, or in a manner so as not to spread disease (as given in manual).
3. Treatment of the animals to be undertaken as per severity of case and risks involved.
4. The affected ponds must be disinfected in OIE approved manner as given in contingency manual.
5. DFO to identify the source of seed in the affected farm. The source of infection can be introduced seed or brood stock. These can be from (i) within the State (ii) outside the State (iii) outside the country. Once the farm/hatchery which had supplied the seed or brood stock to affected farm is identified, this information must reach the identified research institute through State Fisheries Director so that emergency sampling is carried out. Till the scientific report is available further movement of seed from the farm/hatchery should be stopped. Decisions regarding slaughter or treatment are taken based on scientific report. DFO should collect information on all the farms, which have received seed from the same hatchery to take appropriate action.
6. If the seed has been supplied by a hatchery outside the State, Director of State Fisheries Department informs the concerned counterpart and Fisheries Development Commissioner (FDC) of Ministry of Agriculture to take action as indicated above.

7. As a general rule, the neighbouring states must be informed about the outbreak of disease even if source of seed had been within the affected State.
8. Once the disease is eradicated (exotic and endemic) or controlled (endemic) then State Fisheries Director in consultation with FDC and research institute takes a decision to discontinue movement restriction and other control measures.
9. Once the minimum contingency plan is approved in principle, the manual will be prepared by Policy sub-committee of the National Committee. The awareness materials should be prepared by State Fisheries Directorate under guidance from Policy sub-committee.

*'This plan can be utilized for all outbreaks irrespective of the fact whether they are exotic or not.'*

### **Requirements for minimum contingency plan**

1. DFO must possess communication information (Tel. No. etc.) and facilities (Fax, E-mail etc.) on a 24 hour basis for communicating directly to State Fisheries Director and District Collector.
2. There must be emergency fund at the disposal of DFO and State Fisheries Director with clear-cut guidelines on its rapid availability and utilization procedures.
3. Legislation empowering the DFO and State Fisheries Director for undertaking actions taken under Stage II must be enacted. Till specific legislation is framed, these may be met through an executive order.
4. System of compensation should be worked out and should be ready in place. This can be in form of cess fund at the discretion of State Fisheries Director or through group insurance mechanism.
5. Ready made awareness material must be available in local language.
6. A contingency manual having procedures and rules must be ready.

### **Measures and Mode of Action:**

The minimum contingency plan outlined above will be discussed in the brainstorming session. Based on above interactions the plan will be examined by the Scientific sub-committee and then it will be approved by the National Committee. A Working Group involving key persons in Ministry of Agriculture and some State Fisheries Department Directors may be constituted to examine the modalities of implementing the minimum contingency plan. This contingency plan, would require establishment of a national level task force, which consists of multidisciplinary teams of specialists seconded from their normal duties. This task force is mobilised only under disease emergency situation. Activities of this task force should be backed by legal provisions. The competent authority must identify key authorities with well defined powers both at Central and State level who would coordinate and execute the contingency plan. Funds for emergency actions have to be earmarked prior to occurrence of such disease emergencies. A manual with instructions should be prepared and provided to all members of emergency task force. Regular training courses for all members of task force have to be arranged through the network of diagnostic laboratories. There is a need to

educate public for their support to emergency action. Based on feedback from implementation of minimum contingency plan and pilot scale studies, Scientific sub-committee will prepare optimum contingency plan.

## **7.5. Zoning**

Zone is a clearly delineated geographical area which contains animals with a particular health status i.e. a zone may be infected with or free of a specific disease. Delineation of zone may vary for different diseases as different diseases have different mode of spread. Usually, a zone is never free of all the diseases. The aim of zoning policy is to facilitate trade while minimizing the introduction and spread of aquatic animal diseases associated with movement of aquatic organisms. The zoning concept allows disease free part of the country to continue trade while the infected zone is placed under movement restriction. One of the principles of SPS agreement under WTO is 'regionalisation'. Regionalisation is the identification and maintenance of pest and disease free areas. It means that absence of disease in parts of the country can be taken into account for refusing imports from countries having disease.

The general requirements for official recognition of disease free zones as specified by OIE are-

1. Disease to be controlled by zoning should be made notifiable.
2. Clear delineation of zones by effective boundaries.
3. Preventing movement of live aquatic organisms across borders.
4. Establishment and enforcement of zones by legislation.
5. Effective system of disease surveillance and control.

European Union (EU) uses the concept of zoning to prevent the spread of diseases within EU and from countries outside EU. The zones may be approved with respect to freedom from infectious diseases on a stated list. Once a zone is approved to be free of a particular disease, it is a requirement that movement of fish or molluscs into the zone be restricted to those from other approved zones and that continuing evidence be provided that the disease in question is still absent. Trade of aquatic organisms can take place between zones with equivalent health status or from a zone with better health status.

It is not possible to meet all the conditions immediately in India. Therefore, it is difficult to evolve zoning concept in the near future. Moreover, India shares major river drainages with neighbouring countries i.e. China, Nepal, Pakistan, Bangladesh & Myanmar. The cooperation of competent authority of these countries is required in establishing the zones. Jurisdictional issues have to be clarified with the neighbouring country while evolving a zone involving area of that country. Regional bodies like SAARC should be involved in developing the zoning concept.

### **Objectives:**

1. Development of an action plan on zoning.

### **Requirement:**



## **Phase I**

1. Policy paper and action plan on zoning.

## **Phase II**

1. Implementation of action plan on zoning.

### **Mechanism and mode of action:**

In view of the complexities and difficulties in zoning which has been recognised in FAO/NACA guidelines it is proposed a separate Task Force be constituted by Ministry of Agriculture to go into depth about zoning and evolve a zoning policy paper and action plan in collaboration with neighbouring countries through SAARC or other regional initiatives. Within India, we may adopt the following strategy to get hands on experience in evolving and maintaining zones. We may operate zoning concept initially in South India since it does not share any river drainage with neighbouring countries. Once an OIE listed disease/national disease of concern is located either in South India or other parts of India, we may develop a zone in South India to see whether the disease can be confined or prevented from entering that zone. The Ministry of Agriculture will implement the action plan on zoning.

## **7.6 Ballast water**

Ballast water is sea water or fresh water pumped into ballast tanks for stabilizing the ship. The water is carried alongwith the ship and it contains animals and plant community from the originating country. Hence it is a major source of exotic aquatic organisms.

About one third of the aquatic species in the Great Lakes of North America are reported to have been introduced with ballast water. A recent study in Oregon Bay, USA showed 367 types of organisms from ballast water of ships arriving from Japan over a 4 hour period. In Canada and the United States, exotic aquatic invasion due to ballast water has been placed on the “top 10” list of environmental problems.

The unwanted aquatic organisms transferred in ballast water can have disastrous ecological impacts. They can wipe out native aquatic organisms. They can also introduce exotic pathogens to new locales. The Zebra mussel (*Dreissena polymorpha*) introduced alongwith ballast water to Great Lakes of North America has caused widespread impact because of its high densities, rapid spread and potential ecological effects on freshwater ecosystems. Municipal and industrial water users were expected to spend between \$2 billion to \$3 billion by the end of last century to clean the clogged water intake due to this mussel.

Certain countries require exchange of ballast water at sea to avoid the problem of unwanted aquatic organisms and pathogens being introduced to marine environments. Under the US Public Law, the US Coast Guard (USCG) issued regulations in May 1993 that requires vessels bound for Great Lakes to exchange their water, if possible on high

seas (in depths greater than 2000 metres) to achieve a minimum salinity of 30 parts per thousand.

**Objectives:**

1. Development of an action plan to control exotic introduction of through ballast water.

**Requirement:**

**Phase I**

1. Development of an action plan on ballast water.
2. Implementation of action plan on ballast water.

**Phase II**

1. Implementation of action plan on ballast water.

**Mechanisms and Mode of Action:**

Many agencies have to be involved in controlling the introduction of exotics through ballast water. The principal agencies are - Department of Ocean Development (DOD) and its research institutions like National Institute of Ocean Technology (NIOT), Ministry of Agriculture, State Fisheries Departments and Fishery Survey of India (FSI), Central Marine Fishery Research Institute (CMFRI) under ICAR, National Institute of Oceanography (NIO) under CSIR and port authorities under the Ministry of Surface Transport. In view of this, it is proposed that separate Task Force involving all the departments may prepare an action plan taking into consideration the existing ballast water guidelines as well as national initiatives already taken. The Task Force should evaluate the risks of introduction of exotics due to ship breaking industry. Possible transfer of exotic organisms and pathogens through fouling organisms attached to ship's hull is also to be examined. The task force will identify the agencies for implementing the action plan and one nodal agency to monitor the process of implementation.

**7.7 Aquatic Animal and Plant Products**

Many exotic pathogens of high quarantine importance are found in freshwater and marine aquatic organisms, often in carrier state. Such agents are generally refractory to freezing and will persist for prolonged period at temperature used for chilling. A number of exotic pathogens of quarantine importance {eg. infectious pancreatic necrosis (IPN) and *Renibacterium salmoninarum*} are particularly heat stable as indicated in Australian review of quarantine policies and practices (1995). So considerable potential exists to introduce exotic pathogens alongwith aquatic animal products.

The types of imported products include:

- 1) Fresh or frozen aquatic organisms or heat-treated or smoked and canned products for human consumption.
- 2) Feedstuffs for aquatic organisms (fish meal).
- 3) Food containing fish or shellfish extracts (highly processed and intended for cooking or for food purposes).
- 4) Baitfish.
- 5) Invertebrate fish feed preparations (brine shrimp, tubificid worms and other invertebrates).

A numbers of aquatic animal diseases are documented to have spread through aquatic animal products for type 2, 3, 4, and 5 given above. Australian review on aquatic animal quarantine indicated that feeding raw salmon carcasses and viscera to juvenile salmon transmitted bacterial kidney disease (BKD). *Myxobolus cerebralis* is recorded as being transmitted through the international movement of fresh or frozen trout. *Yersinia ruckeri* is believed to have been introduced to Europe in American minnows *Pimephales promelas* imported from America as baitfish. Physical carriage of infected material into the main trading centre of Sri Lanka was the most likely mode of introduction of epizootic ulcerative disease as indicated by the Australian review. However, there are no confirmed reports for spread of diseases through aquatic animal products imported exclusively for human consumption (type 1 given above).

Chances of introduction of exotic diseases are more when these products gain direct access to natural aquatic environment or processing waters are discharged without treatment. However, the importation of products with subsequent cooking and consumption by humans represents a negligible risk of introducing exotic disease.

The OIE International Aquatic Animal Health Code takes into consideration the significance of aquatic animal products in spread of diseases from one country to the other. In Australia, permit to import prawns and uncooked prawn products other than dried prawns is only from area that is officially free of white spot disease and yellow head disease as per OIE code. Australian Quarantine Inspection Service (AQIS) has undertaken import risk analysis for prawn products, freshwater crayfish products, nonviable bivalve molluscs and nonviable salmonid products. It has also initiated random sampling of fish products to ensure that pathogen-inactivating treatments have been performed effectively.

Trade in aquatic animal products has two facets in Indian scenario i.e. our products can be blacklisted on account of presence of certain pathogens and secondly, a number of pathogens of quarantine importance may gain access to our environment alongwith these products. Therefore, there is need to include transfer of aquatic diseases through fishery products under the preview of this plan.

## **Objective**

1. To review the need for quarantine policies for aquatic animal products.

## **Requirements:**

### **Phase I**

1. To prepare a policy paper and an action plan for quarantine of aquatic products.

### **Phase II**

1. Implementation of action plan on quarantine of aquatic animal products.

## **Mechanism and Mode of Action:**

Quarantine of aquatic products is a complex issue, which will have far reaching consequences on our trade and also must be clearly understood by all stakeholders. There is a need to identify the aquatic animal products that can gain access to Indian markets as a result of trade liberalization under WTO. The pathogens that can survive different processing conditions should be identified. Then the pathogen inactivation procedures in aquatic animal products must be explored. The inactivation procedures must cover the pathogens of quarantine importance reported from India so that our exports are not adversely affected. Socio economic implications for imposing quarantine on aquatic products must also be considered. To consider this and all relevant issues, it is proposed that separate working group is constituted by Ministry of Agriculture in collaboration with Ministry of Commerce with Central Institute of Fisheries Technology (CIFT) as a nodal agency to go in depth regarding quarantine of aquatic products and evolve a policy paper and action plan. Organisations like Central Food Technology Research Institute (CFTRI) are to be part of this working group.

## **7.8. Public Health Significance**

A number of pathogens of public health significance have been reported from aquatic organisms. These pathogens are important in international trade in aquatic organisms, particularly in relation to aquarium trade. A ban on import of all ornamental fishes from Singapore into Italy was imposed in February, 1998 by Italian authorities following the detection of *Salmonella* in a consignment of ornamental fish sent from Singapore. In response to this ban, a monitoring scheme for *Salmonella* free and *Vibrio cholera* free status was implemented in May, 1998 in Singapore. Our exports of live aquatic organisms can be affected adversely in the light of this development. Similarly, there are chances that some pathogens of human health significance through molluscs and other aquatic organisms not found in India can find their way into India along with imported aquatic organisms. Therefore, there is a need to ensure that the import/export consignments of live aquatic organisms do not carry pathogens capable of causing diseases in humans.

## **Objectives**

1. To prevent the spread of pathogens of public health significance due to transfer of live aquatic organisms.

## **Requirements**

### **Phase I**

1. To prepare an action plan to prevent spread of diseases of public health significance through live aquatic organisms and to protect our trade.

## **Phase II**

1. Implementation of the action plan.

## **Mechanism and Mode of Action**

The action plan must list the risks to human health associated with movement of live aquatic organisms. It must suggest measures so that our exports in live aquatic organisms are not adversely affected. The above activity may be carried out by the scientific sub-committee of the National Committee. The action plan will be implemented by Ministry of Agriculture in consultation with other relevant ministries.

## **8. Surveillance and Reporting**

Surveillance and reporting system assist in the identification of range and distribution of diseases of interest. This helps in focusing efforts to control and reduce the risk of spread of diseases in the country and region. It also provides information on parts in the country or regions having equal status in respect of a particular disease, thereby, allowing trade activities to continue between 'zones of equal status'.

### **8.1 Surveillance**

Surveillance is required to detect exotic pathogens and to implement control measures. Surveillance is essential to consolidate information on distribution of pathogens, to facilitate the development of zoning policies and to develop disease management strategies for protecting the domestic industry and the environment. Under WTO agreement, India will be required to substantiate its claims of freedom from diseases of concern to the importing country. In such scenario, we must be able to demonstrate that adequate services exist to detect, diagnose and control aquatic animal diseases.

In India, there is a system to carry out passive surveillance. This is sufficient to permit the detection of some diseases and to report that the disease is present in the country, if it is found as a result of such passive surveillance. However, failure to find a specific disease in a passive surveillance does not permit declaration of freedom from the disease. To make claim of freedom from disease, active and targeted active surveillance must be under taken.

#### **Objectives**

1. Development of a system of surveillance to identify sources of outbreak of disease, to determine if these diseases are exotic in nature and to take up appropriate action.

#### **Requirements**

##### **Phase I**

1. Pilot scale project in selected parts of the country to understand and build up capacity to undertake active surveillance.
2. Strengthen existing passive surveillance system.
3. Active surveillance of selected farms from where fishes are exported.
4. Develop capacity in terms of manpower and network for supporting surveillance system.

##### **Phase II**

1. Develop capacity to undertake targeted active surveillance for diseases of concern and OIE listed diseases.

2. Targeted active surveillance as per requirement for part/whole of country to meet emerging needs.

### **Mechanism and Mode of Action**

To confirm disease outbreaks reported by surveillance are exotic in nature, the mode of action is given under reporting.

India is a large country and it has limited expert manpower for working on aquatic animal health. Therefore, pilot level active surveillance can be undertaken by network of diagnostic laboratories in selected parts of the country and farms exporting live aquatic organisms at this juncture. The veterinary and university laboratories should also be involved in the diagnostic network. At this stage, capacity for targeted active surveillance exists only for WSD and EUS. For remaining part of the country, passive surveillance to be strengthened with the help of diagnostic network. In the mean time, more manpower must be trained to take up active surveillance and targeted active surveillance.

The diagnostic tests can be as per OIE diagnostic manual for OIE listed pathogens. The diagnostic tests for diseases of concern other than OIE listed diseases have to be standardized. The sampling techniques must be based on OIE Diagnostic Manual.

In the initial phase, ICAR Fishery Institutes and Fisheries Colleges in State Agricultural Universities should take up active surveillance on pilot scale. For diagnostic kits to be used in surveillance refer chapter on Diagnostics (chapter 7.2).

At later stages, active surveillance can be taken up by State Government and industry covering larger geographic area. State Governments to be given incentives by Ministry of Agriculture for undertaking active surveillance programmes.

### **8.2 Reporting:**

The intent of reporting is to facilitate movement of aquatic organisms within the country and also between countries while minimizing the introduction and spread of disease associated with such movement. This reporting has to be for diseases of concern including OIE listed diseases, not for each and every pathogen.

The disease reports have to reach a designated authority. All the data regarding diseases has to be compiled and checked to see if the diseases are exotic in nature and need containment measures. In the present set up, the disease reports are compiled at the State level by Director, State Fisheries Department and sent to the National Coordinator. There is no system in place for confirming the disease reported.

In India, reports are compiled by National Coordinator and quarterly reports are sent to OIE regional representative and NACA.

### **Objectives:**

1. To develop a system for reporting of diseases.

2. Compilation of information on occurrence of diseases of concern and OIE listed diseases in the country.

**Requirements:**

**Phase I**

1. Strengthening the present reporting of diseases at national level.
2. Data administration.
3. Reporting to international organisations.

**Phase II**

1. Development of disease reporting system based on active surveillance.
2. Compilation of National Reports and integrating it with the database.

**Mechanism and Mode of Action:**

The State Fisheries Departments must strengthen the existing reporting system. In event of disease outbreak, Fishery Inspectors or field officers of FFDA/BFDA and MPEDA will inform DFO or Executive Officers of FFDA/BFDA who will immediately inform the Director, State Fishery Department. He will inform the nearest University/ICAR Fishery Institute identified for that area. Fishery Development Commission (FDC) will monitor the overall situation and interact with State Governments as per requirement. The concerned institute after making diagnosis will send the report to Director, State Fishery Department and also to the National Coordinator. In case, it is an OIE listed disease/ disease of concern and has been reported for the first time, it will be referred to OIE referral laboratory for confirmation. The suspected samples may be sent through NBFGR. In case, there is no referral laboratory for disease of concern then the disease will be cross-tested in an approved laboratory for confirmation. Once it is confirmed, it will be reported to International Organisations. The confirmation from OIE referral laboratory or cross testing in approved laboratories will be required, if isolated cases of a OIE-listed disease or disease of concern are reported for the first time. This is essential to negate the adverse fallout on exports in suspected cases. The OIE listed diseases/diseases of concern should not be reported on basis of gross signs and symptoms of the disease. This condition should cover even publication in the scientific journals. There should be a voluntary code of conduct for scientists reporting OIE-listed diseases for the first time from the country. There is need to increase awareness among scientists regarding the voluntary code and need for publishing occurrence of OIE-listed disease in scientific journals for the first time from the country after confirmation.

In case, the disease reported is OIE listed or of concern, then movement restriction should come into force and control measures must be undertaken immediately. The task of integrating national reports with database has to be carried out by NBFGR.

The reporting is schematically shown in Annexure III.



## **9. Awareness, Training, Research and Capacity Building**

Awareness is key to successful implementation of programmes. There have been several illegal introductions of aquatic organisms in the country in the past. As a result, it is feared that several undesirable species have already established in Indian waters. Awareness of the entrepreneurs on the risks and benefits of exotic species' presence in our waters would have deterred them from clandestine introductions and their post-introduction spread. Remedial measures adopted with regard to exotic diseases EUS and WSD at belated stages have caused economic burden to the nation and also to the farmers. One of the difficulties with respect to India for controlling exotic aquatic organisms and pathogens is large number of small-scale farmers in the aquaculture and ornamental sector. These farmers are largely unorganized and in the near future, there is little scope of registering them. This must be taken into consideration while implementing the strategic plan and one of the key components can be creating awareness among these farmers.

Developing a system for managing introduction of exotics and quarantine depends largely on availability of comprehensive scientific information on this subject. Presently it is difficult to carry out import risk analysis since relevant scientific data are not available. For implementing effective control or introduction of exotics and quarantine, India must have sufficient capacity in terms of trained manpower and institutional resources. At present the research input on exotics and quarantine is very limited.

### **Objectives:**

1. To increase awareness on exotics and quarantine among general public and concerned officials.
2. To provide training to officials and other stakeholders.
3. To identify and promote research in the field of exotic introduction and quarantine by government research institutes and industry.
4. To develop capacity in terms of trained manpower and infrastructure.

### **Components**

1. Awareness and Training
2. Research and Capacity building

#### **9.1 Awareness and Training**

##### **Requirements:**

##### **Phase I**

1. Preparation and hosting of a web page on exotics and quarantine.
2. Brochures, pamphlets and other publicity materials on exotics and quarantine.
3. Use of mass media and newspapers to increase awareness.
4. Field identification guide for aquatic animal diseases
5. Training of State fisheries officials for level I and level II diagnosis.
6. Training of scientific personnel for level III diagnosis.

7. Specific training to be given to the industry in diagnostic and other quarantine activities
8. Training for import risk analysis.
9. Training on operating quarantine facilities.
10. Special guidelines for the benefit of exporters and importers.

## **Phase II**

1. Strength awareness and training programmes initiated in 1<sup>st</sup> phase.

## **Mechanism and Mode of Action**

Members of the diagnostic network can be identified to bring out brochures, pamphlets and field identification guide for aquatic animal diseases. Similarly training needs at level I, II and III and to the industry can also be covered by members of diagnostic network of laboratories. Officials engaged in clearing imports (customs/central excise) should be trained in identification of aquatic organisms. There is a potential risk of ornamental aquatic organisms being introduced by individuals along with personal baggage while returning from abroad. Such species can be introduced without undergoing ecological and disease risk evaluation. There is a need to increase awareness on this aspect among general public. Suitable publicity to this effect needs to be made at airports and custom officials need to be sensitized on this issue.

The web page would contain awareness material as well it will be used for posting information regarding proposals being evaluated so that feedback from public and other stakeholders can be obtained. Web page can be hosted by Ministry of Agriculture. All awareness programmes to be carried out by Ministry of Agriculture and State Fisheries Departments.

The training on operating quarantine facilities and for undertaking import risk analysis may be arranged by outside experts from countries like Australia having expertise on these subjects. Fisheries Research Institutes should bring out special guidelines for exporters and importers.

## **9.2 Research and Capacity Building**

### **Phase I**

1. Identifying areas of research work and initiating specific research projects on aquatic exotics and quarantine.
2. Identifying requirements under capacity building and initiating action to meet there.

### **Areas for research identified:**

The following broad areas have been identified:

1. Evaluation of illegal and legally introduced exotics.
2. Surveys to determine which of the exotic species have established in natural waters.
3. Evaluation of native species.

4. Technology to produce competitively priced seed for species being cultured.
5. Baseline data on native species for hill streams, coastal rivulets and back waters to help quantify impact of exotic species.
6. Building a database on exotics and quarantine.
7. Evaluation of exotic species impact under different agro climatic conditions.
8. Evaluation of exotic disease impact.
9. Scientific studies to substantiate import risk analysis process.
10. Development of diagnostic kits for diseases of concern
11. Reproductive containment of exotics.
12. Studies on diseases of public health significance and zoonotic diseases caused by introduction of exotic species/stocks eg. treatment of ornamental aquatic organisms so as to get rid of parasites and pathogens of human health significance.
13. Pilot scale projects on surveillance.
14. Feasibility studies on contingency planning and zoning.
15. Inactivation of pathogens in aquatic products during processing.
16. Ecological interactions between exotic and native species.
17. Effect of ballast water.
18. Whether exotic species of *Artemia* are replacing native species of *Artemia*
19. Potential of imported *Artemia* cysts to introduce diseases of concern
20. Molecular genetic studies to determine the presence of different strains of white spot disease.

### **Capacity building requirement**

1. Diagnostic capability under level 1, 2 and level 3.
2. Establishment of national referral laboratory in India.
3. Trained personnel to carry out import risk analysis.
4. Trained personnel in operating quarantine units.
5. Accreditation of private laboratories for certification.

Since these have been elaborated in the other chapters, details are not given here.

### **Phase II**

1. Strengthen the programmes on research and capacity building initiated in 1<sup>st</sup> phase.

### **Mechanism and Mode of Action**

While drawing the plan it must be recognized that there is a shortage of infrastructure and trained manpower to meet the requirements for carrying out all the activities listed under the National Strategic Plan for aquatic exotics and quarantine. The actual requirements have to be worked out. The areas of research identified have to be included in priority areas of research organizations listed under institutional mechanisms. Separate funding has to be earmarked by Ministry of Agriculture to carry out research in these areas. Ministry of Agriculture should submit a Technical Cooperation project (TCP)

to FAO on exotics and quarantine. In the National Committee, the Scientific sub-committee is to be entrusted with the task of monitoring the above as well as the progress in these projects. The existing capacity in different areas to be compiled and capacity building is to be linked with ongoing and new research areas. Optimum use of existing facilities must also be one of the integral parts of plan. The areas of research identified have to be included in priority areas of research organizations under X plan. Based on the results, the scientific sub committee may make location-specific recommendations regarding culture/ban of each exotic species with respect to different agro climatic regions and coastal regimes or whole of the country.

There is a need for All India Coordinated Research Project (AICRP) to evaluate the culture potential as well as potential ecological impacts of species short-listed for introduction. Based on the evaluation, species can be included in the approved list or prohibited list.

Ministry of Agriculture should identify and arrange programme for capacity building on all aspects of exotics quarantine with countries having expertise like Australia.

## **10. Institutional Mechanism and Linkages**

There is need for appropriate national administrative framework for implementing national plan on exotics and quarantine. Already existing organisational framework has to be interlinked to make a cohesive unit. All the organisations to be involved in the proposed plan must have clearly defined responsibilities and the efforts of all these must be coordinated. It is important to involve all the stakeholders and seek their views.

The following seven main organisational elements identified below need to be involved in the proposed quarantine system.

### **1. Department of Animal Husbandry & Dairying**

This is the nodal department under Ministry of Agriculture in the Central Government concerned with aquatic quarantine. Already there exists a machinery for quarantine of plants as well as animals. For aquatic organisms, an arrangement has to be worked out. Presently, the National Committee on Introduction of Exotic Aquatic organisms into India is looking after the task of evaluating proposals for exotic introduction as well as quarantine. This Committee has experts and Directors of ICAR Fishery Institutes and is chaired by an official of the Ministry. Due to its linkage with State Fisheries Departments, the Ministry has been coordinating the national disease reporting system and has been sending regularly information to NACA. One of the senior officials of the Ministry is also the OIE representative for India.

### **2. Indian Council of Agricultural Research (ICAR)**

The Indian Council of Agricultural Research is under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and is entrusted with the task of research, education and extension. Under its fishery subject matter division, which is headed by the Deputy Director General (Fisheries), there are the following eight Fishery research institutes.

1. Central Inland Capture Fisheries Research Institute (CIFRI)
2. Central Marine Fisheries Research Institute (CMFRI)
3. Central Institute of Freshwater Aquaculture (CIFA)
4. Central Institute of Brackishwater Aquaculture (CIBA)
5. Central Institute of Fisheries Education (CIFE)
6. Central Institute of Fisheries Technology (CIFT)
7. National Research Centre on Coldwater Fisheries (NRC-CWF)
8. National Bureau of Fish Genetic Resources (NBFGR)

All these institutes have research programmes on fish pathology with the focus on capture or culture fisheries. A World Bank funded project for setting up modern fish health laboratories with field surveillance capabilities involving CIFA, CIFRI and CIBA is in the pipeline. These capabilities which are being developed to cater to the need of general aquatic health may be utilized for aquatic quarantine.

National Bureau of Fish Genetic Resources has the specific mandate for monitoring introduction of exotic aquatic species into Indian waters and has been

recognised as a nodal agency within ICAR for undertaking research programmes on aquatic animal quarantine.

### 3. State Fisheries Departments

Fisheries is a State subject and hence the involvement of State fishery officials is crucial for undertaking any quarantine programme. They are the only Government officials who have day-to-day direct contact with the fishermen and fish farmers. Already they are part of the national reporting system to NACA.

### 4. Fish health laboratories of Universities

Some of the Fisheries Colleges in State Agricultural Universities have expertise and infrastructure on fish diagnostics. Among these, the Mangalore Fisheries College has well recognised manpower, infrastructure and good track record in the field of aquatic pathology. In many conventional Universities, earlier fish parasitology was one of the strong areas of work. Many of the veterinary laboratories also have the necessary infrastructure to carry out diagnosis of fish diseases.

### 5. Marine Products Export Development Authority (MPEDA)

Marine Products Export Development Authority (MPEDA) under the Ministry of Commerce is entrusted with promoting export of aquatic animal and plant products. It is also involved in trade of live aquatic organisms. Through its link with aquaculture and ornamental fish culture and trade, it plays a supporting role in all proposals for introduction of exotics and hence is also an important organisation to be considered while undertaking a national quarantine plan.

### 6. Industry

For any aquatic quarantine system to be effective, the participation of both aquaculture sector and ornamental fish culture and trade is essential. The industry has to be made aware of the need for quarantine to prevent disease outbreaks and the implications of globalisation, which can adversely affect their trade.

### 7. Non Governmental Organisations (NGOs)

For creating awareness, the help of NGOs can be taken. M.S. Swaminathan Research Foundation has identified control of aquatic exotic species as one of its priority areas of concern. World Wildlife Foundation (WWF - India) has field level aquatic biodiversity programmes and capacity to monitor introduction of exotics. Aquaculture Foundation of India, Sea Food Exporters Association of India and other NGOs having good interface with the aquaculture sector are also to be included.

### 8. Other Government organizations

Other Government organizations like Zoological Survey of India (ZSI), Fishery Survey of India (FSI), National Bank for Agriculture and Rural Development

(NABARD), National Institute of Oceanography (NIO) and Department of Ocean Development (DOD) also need to be involved.

## **Requirements**

### **Phase I**

1. Strengthening linkage between various identified institutions.
2. Setting up a network of diagnostic laboratories.
3. Setting up of Aquatic Quarantine Inspection Unit (AQIU).

### **Phase II**

1. Strengthening institutional mechanisms and linkages initiated in phase 1.

## **Mechanism and mode of action**

### **Proposed Machinery**

The existing National Committee on Introduction of Exotic Aquatic animals into India to be recast as 'National Committee on Exotic Aquatic organisms and Quarantine' by Ministry of Agriculture. Besides existing members, experts in the area of aquatic animal health should also be incorporated. It would have the following two subcommittees:

1. Scientific sub-committee
2. Policy sub-committee

The Scientific sub-committee to be headed by Director, NBFGR and Policy sub-committee to be headed by official of Ministry of Agriculture. Scientific sub-committee will be entrusted with screening all introduction proposals. The terms of reference as well as procedure for conducting the meeting of National Committee and its sub-committee have to be framed by Ministry of Agriculture. All criteria and lists prepared in connection with exotics and quarantine will be initially examined and recommended by it for approval to national committee. It can recommend taking up specific studies and evaluate all technical reports. The exotics and quarantine work of NBFGR should be strengthened with additional manpower and funds.

The policy committee would be entrusted with developing the machinery for quarantine, promoting linkages with different organisations, preparation of policy papers and draft legislation. It will have members from other Ministries and NGOs and Industries.

All the deliberations of the scientific and Policy sub-committee will have to be approved by Ministry of Agriculture.

### **Network of Diagnostic Laboratories**

Taking into consideration large geographic area and available expertise in different research institutes and universities, a network of diagnostic laboratories needs to be formed to cater to the diagnostic requirements for quarantine and surveillance. Since

NBFGR is the only organisation having a specific mandate to work on exotic diseases, it can play the nodal role in the diagnostic network.

#### **Aquatic Quarantine Inspection Unit (AQIU)**

To implement the decisions of 'National Committee on Exotic Aquatic Organisms and Quarantine' and to interact with State Fisheries Departments as well as concerned international organizations like OIE and NACA, there is a need of a separate unit under Ministry of Agriculture to exclusively deal with exotics and quarantine. This unit will also carry out inspection of quarantine facilities and certify them. In view of the larger quantum of import of aquatic animals through Chennai it is proposed that one nodal unit of AQIU to be set up at Chennai.

If the components of the plan are approved by Ministry of Agriculture, the National Committee will carry out a detailed exercise to work out the fund requirements for each component for 1<sup>st</sup> and 2<sup>nd</sup> phase, respectively. Also these components must be identified as priority areas by the organisations identified so that in the X plan, adequate funding arrangements can be made. Policy sub-committee of the National Committee would interact with industry to work out modalities for sharing of fund requirements. The Policy sub-committee should monitor strengthening of institutional mechanism and linkage.

#### **State Level Bodies**

Besides a central committee at State level, there should be district level committees headed by the Collector with proper powers of enforcement. Representatives of the aquaculture sector should be member of the committee.



## 11. Legislation

To effectively prevent the spread of exotic aquatic organisms and diseases, the responsibilities have to be clearly assigned by legislation, incorporating provisions for enforcing the Act. In light of OIE and WTO, such legislation must be consistent with international standards and obligations. In India, fisheries comes under the preview of State Government. If there are regulations to control the spread of exotic organisms and diseases it will have to be enforced by individual states. One of the main routes of spread of exotic animals and pathogens in India is through fish seed trade.

If an aquatic species having a particular geographic range is moved to outside its natural range, there will be ecological, genetic or disease impacts similar to those caused by introduction of exotics. Similarly the exotics approved for introduction in one part of the country may gain access to a region not originally intended and subsequently establish. A number of pathogens may also spread to new areas along with movement of aquatic organisms. There is no legislation or policy to restrict the movement of infected fish in India, which may result in spread of exotic diseases as has been observed in case of WSD and EUS. The Government must empower the fishery inspectors to inspect all private farms at any time.

With regards to exotic introduction, some developed countries have enacted legislation. USA in response to introduction of Zebra mussels into Great Lakes has enacted the Non indigenous Aquatic Nuisance Prevention and Control Act of 1990. An Interagency Aquatic Nuisance Species Task Force was established to address the problem of non-indigenous aquatic nuisance species through the act. In Australia, the Fisheries Management Act 1994 gives the power to control the sale and possession of noxious species and the import and release of live fish. With regards to quarantine of live aquatic organisms, Australia has Quarantine Act 1908 and the Wildlife Protection Act.

India does not have any specific act to prevent the illegal introduction and spread of legally/illegally introduced exotics. Under the proposed amendment to the Livestock Importation Act, 2000 quarantine of aquatic organisms has been included.

### **Objectives:**

1. To develop the legislative framework for controlling the introduction and spread of exotic aquatic organisms and pathogens.

### **Requirements:**

#### **Phase I**

1. Legal mechanisms for control of both legally and illegally introduced aquatic exotics.
2. Legal mechanisms for enforcing aquatic quarantine.

3. Legal mechanisms to regulate the movement of aquatic organisms within India.
4. Monitoring implementation of legislation

## **Phase II**

1. Monitoring implementation of legislation

### **Mechanisms and Mode of Action:**

Once the Livestock and Live Aquatic Organisms Importation (Amendment) Act, 2000 is passed, quarantine of aquatic organisms will be covered. For control of illegally introduced exotics and management of already introduced exotics, provisions to be incorporated into the Fisheries Act or Ministry of Agriculture may prepare a separate act.

Individual States have to modify their Fisheries Act to regulate the movement of aquatic organisms especially with regard to fish seed within India. The various options have to be examined by Ministry of Agriculture in consultation with Law Department. In drafting the legislation, wherever required, expert opinion from private sector is utilized keeping in perspective the long-term objective. Once an option is chosen, the policy sub-committee of the National Committee can draft the legislation. Once the legislation is passed, the Policy sub-committee will monitor the implementation of the legislation.

M.F.Sc courses on Aquaculture and Fisheries being taught in the country should contain topics relating to Fisheries Law. Scientists and planners are to be exposed to fisheries law through refresher courses. The draft legislation can be placed before Parliamentary Standing Committee on Agriculture.

## **12. Network of Diagnostic Laboratories**

To undertake the screening of imported aquatic organisms and the monitoring of the health status of the native fish population through surveillance programmes, the Network of diagnostic Laboratories needs to be established in India. The proposed Network will help in preventing the entry of exotic pathogens into the country and provide certification of the export consignments in relation to their health status. This certification is needed for facilitating the trade of aquatic organisms as per the requirements of WTO and the OIE. This network will provide support for the effective implementation of aquatic organism quarantine in the country. Besides this, the network will also help in implementing contingency planning in case of disease outbreaks as well as help in diagnosis and control of common aquaculture disease being reported from India.

As India is a large country, it is not possible for a single laboratory to undertake the surveillance of the entire fish population. Keeping this in mind, a network of different laboratories, which can cater the needs of all parts of India, is required. The network of diagnostic laboratories will be implemented in two phases as described below:

### **Phase I**

1. Identification of the Laboratories to be included in the diagnostic network.
2. Finalizing the requirements of Diagnostic Laboratories for Network.
3. Setting of the Network of Diagnostic Laboratories.
4. Developing mechanism for supervision and coordination among the laboratories of the Network.

### **Phase II**

1. Implementation of the Health certification for aquatic organisms and products.
2. Coordination within diagnostic network.

Organizational setup of Network of diagnostic laboratories: The Network of diagnostic laboratories will have nodal centre located at NBFGR for the diagnosis of the exotic diseases of aquatic organisms. This centre will collaborate with the different centres of expertise located strategically around the country for the screening of the health status of the imported as well as exported aquatic organisms. The proposed laboratories will be National centres in their field of specialization. The centres of expertise in their field of specialization will in turn collaborate with surveillance centres for the sample collection from the approved farms and the fish landing sites. Each centre of expertise can have 3 surveillance centres to cover the geographical area allocated for that particular centre of expertise. In view of the present requirements, at present ten centres are proposed including nodal centre at NBFGR. These centres will be as follows:

S.No.	Proposed Centres	Number
1.	Centre for exotic diseases of aquatic organisms (CEDA)	1no.
2.	Centre of expertise for crustacean diseases	3 nos.
3.	Centre of expertise for molluscan diseases	1no.
4.	Centre of expertise for fresh water finfish diseases	2nos.
5.	Centre of expertise for brackish water finfish diseases	1no.
6.	Centre of expertise for fresh water finfish diseases for North Eastern Region	1no.
7.	Centre of expertise for fresh water finfish diseases for Northern region	1no.
	Total Centres	10 nos.

**Mechanism and Mode of action:** There are already a number of laboratories working in the field of aquatic organism health in different parts of the country. The laboratories to be included in the diagnostic network will have to be identified from the already existing laboratories in the country. The concept of the network of Diagnostic laboratories can widely circulated through advertisement in National Dailies and relevant journals. The interested laboratories can apply to the proposed Scientific Sub-Committee that will identify of the labs based on the agreed criteria.

The projected requirements of each lab will have to be met by a one-time grant in Phase-I, so as to make all the laboratories of the network uniform and of accepted international standards. National Bureau of Fish Genetic Resources (NBFGR) can be the nodal centre to coordinate the working of all the centres and for centralized disease reporting system. The standards and the practices being followed in the labs of diagnostic network will have to be monitored regularly by a Scientific Accreditation committee appointed by the Ministry of Agriculture. The Phase II will start after the development of facilities including the manpower, wherein the actual testing and certification process of aquatic organisms and products will begin. When other countries will insist on pre-movement certification and demand for diagnostic testing increase, private sector can be involved. The system of accreditation for private laboratories will be worked out by scientific sub committee.

**Scope of work for Network of Diagnostic laboratories:** The Network of the diagnostic laboratories will have responsibility of the overall health status of aquatic organisms being imported in to the country as well as the aquatic organisms being exported from the country. As far as the development of diagnostic kits is concerned, the work will be limited to only the diseases of concern for the country. The diseases already reported from India and the general aquaculture disease will fall under the purview of the Network of diagnostic laboratories only from the point of surveillance to identify exotic and native pathogens. The key areas where the Network will operate is as follows:

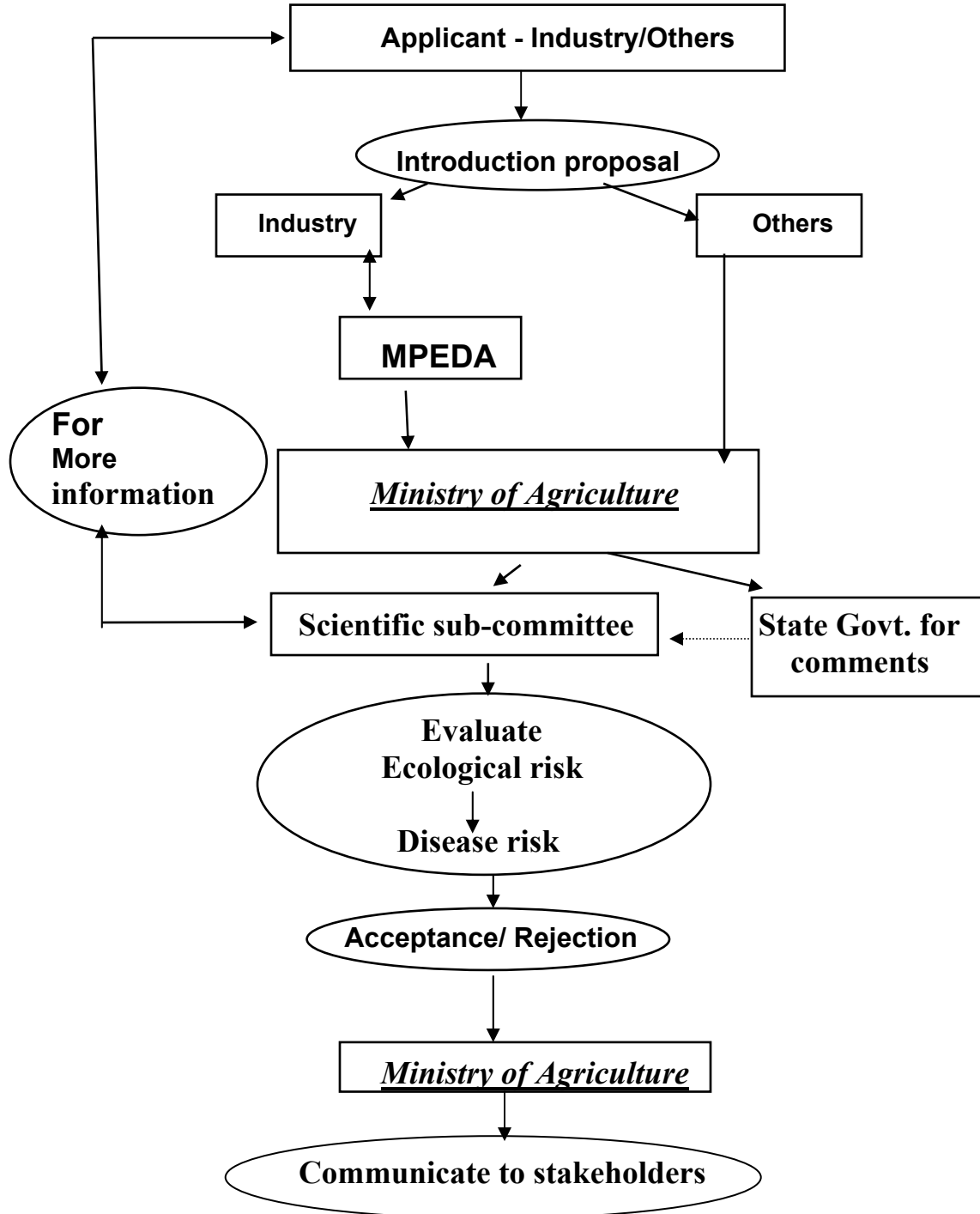
1. **Active surveillance of the approved aquatic organisms farms for health certification:** The concept of approved farms needs to be established in India for responsible trans-boundary movements of aquatic organisms within the country as well as outside the country. Approved farms are those farms where the health status of aquatic organisms is being monitored periodically by active surveillance programmes. Normally the fish culture unit must be inspected and sampled at six

monthly interval for 2 years at the appropriate life stage of the fish and at times of the year when temperature and season offer the best opportunity for observing clinical signs and isolating pathogens.

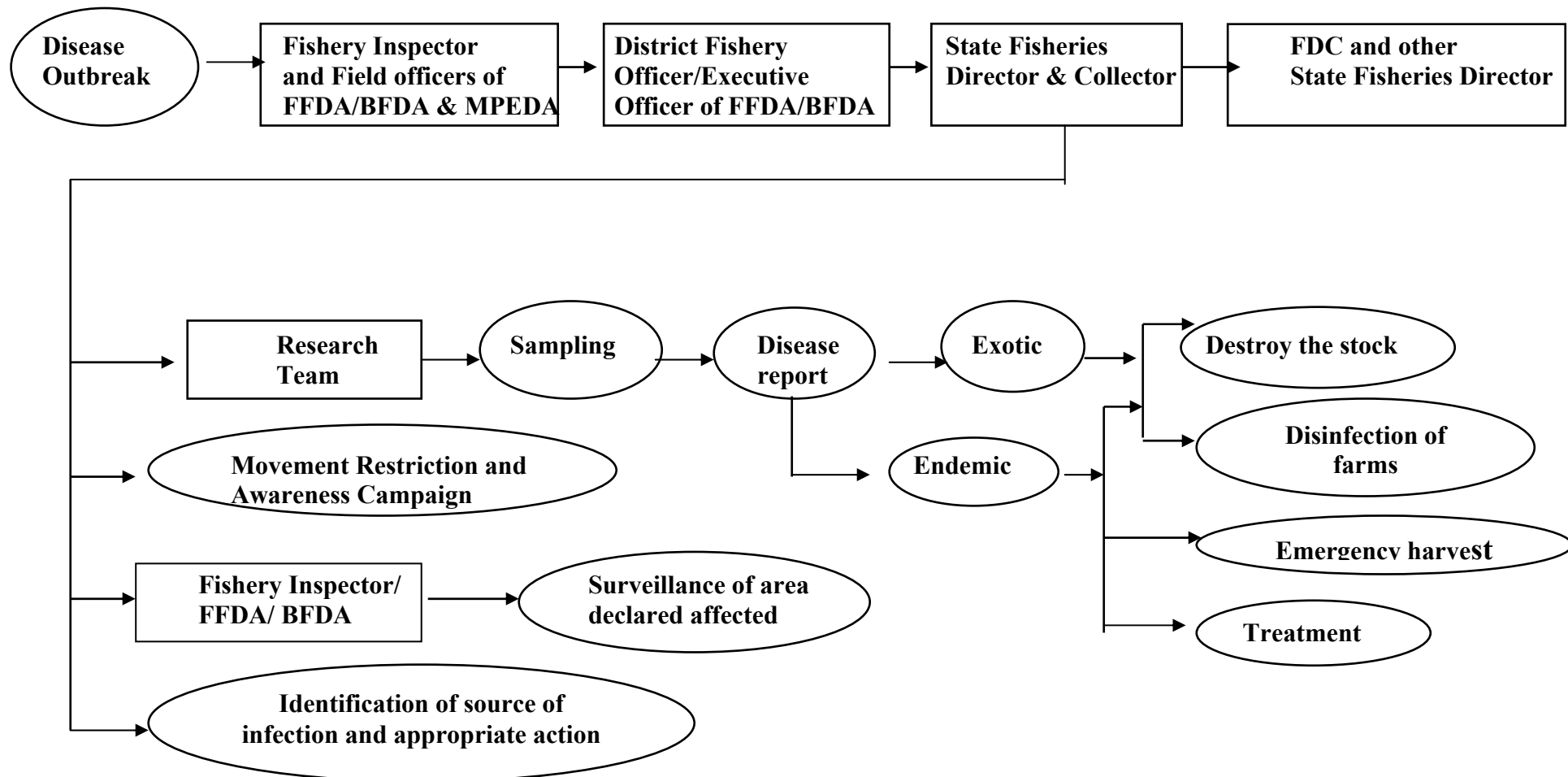
Requirements for the approved farm status

- The farm is being monitored through surveillance programmes periodically for its health status.
  - It is supplied with water by a means that ensures removal or destruction of disease agents.
  - There is a natural or artificial barrier that prevents the entry of any macro-aquatic animals.
  - During the 2-year period, the fish production site may receive only fish from a unit whose health status has been already approved and is equal to or higher than the health status sought for the facility being inspected.
  - The products from the approved farms will have a better health status that is needed for exports under free trade policy of the World trade organization.
2. Health certification of the imported aquatic organisms: To prevent the entry of exotic pathogens into the country, the imported aquatic organism will be screened by the CEDA in the Phase-II. Later the technology can be passed on to the respective Centres of Expertise for the Health certification. The exotic diseases being reported from India can also be confirmed by the CEDA.
  3. Contingency planning and support to the quarantine measures. CEDA along with Centres of Expertise will maintain emergency response capabilities to minimize spread of exotic diseases. It will monitor the quarantine facilities and will undertake diagnostic testing during quarantine.

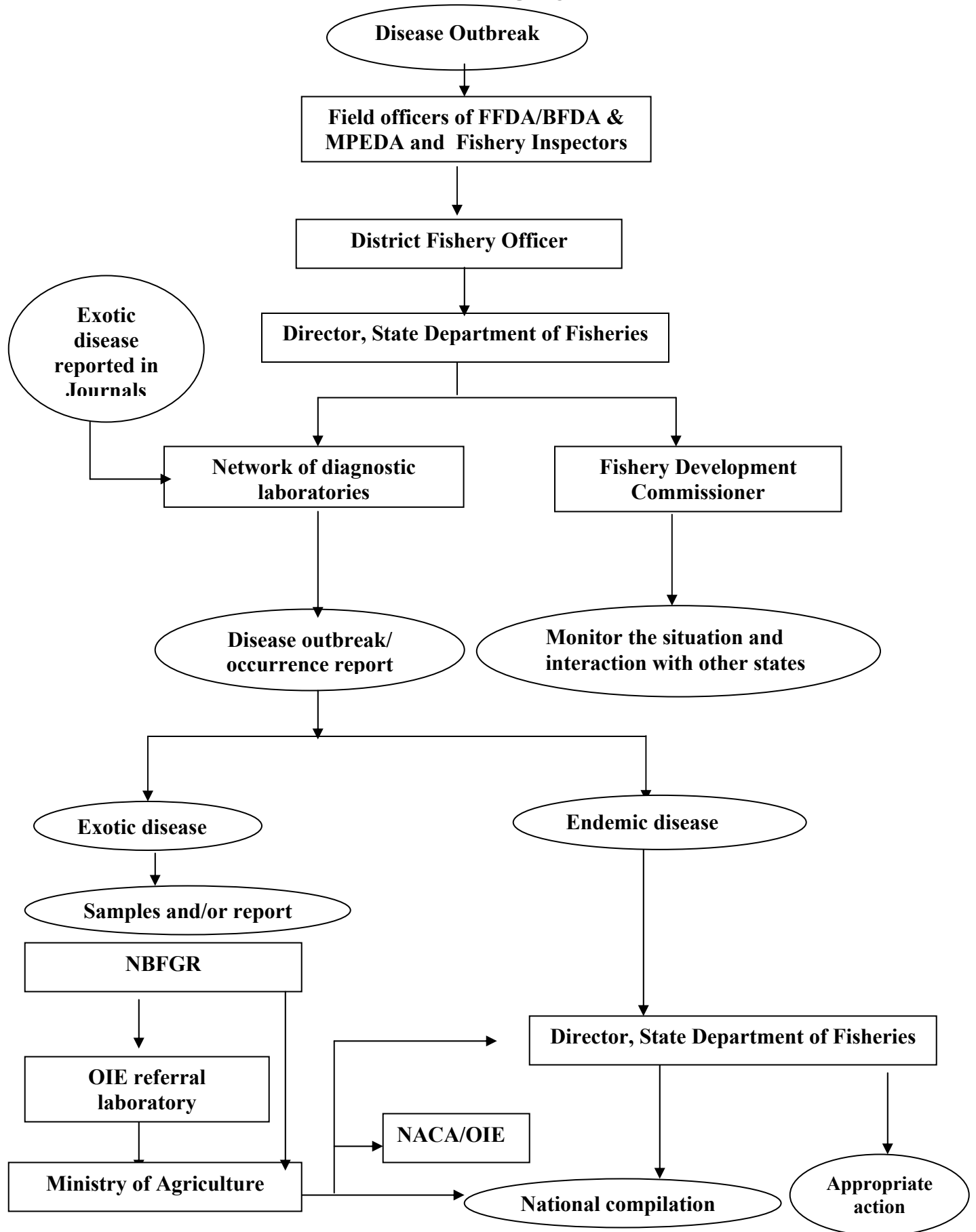
**PROCEDURE FOR EVALUATING PROPOSALS FOR INTRODUCTION OF EXOTIC SPECIES (page 51)**



### MINIMUM CONTINGENCY PLANNING

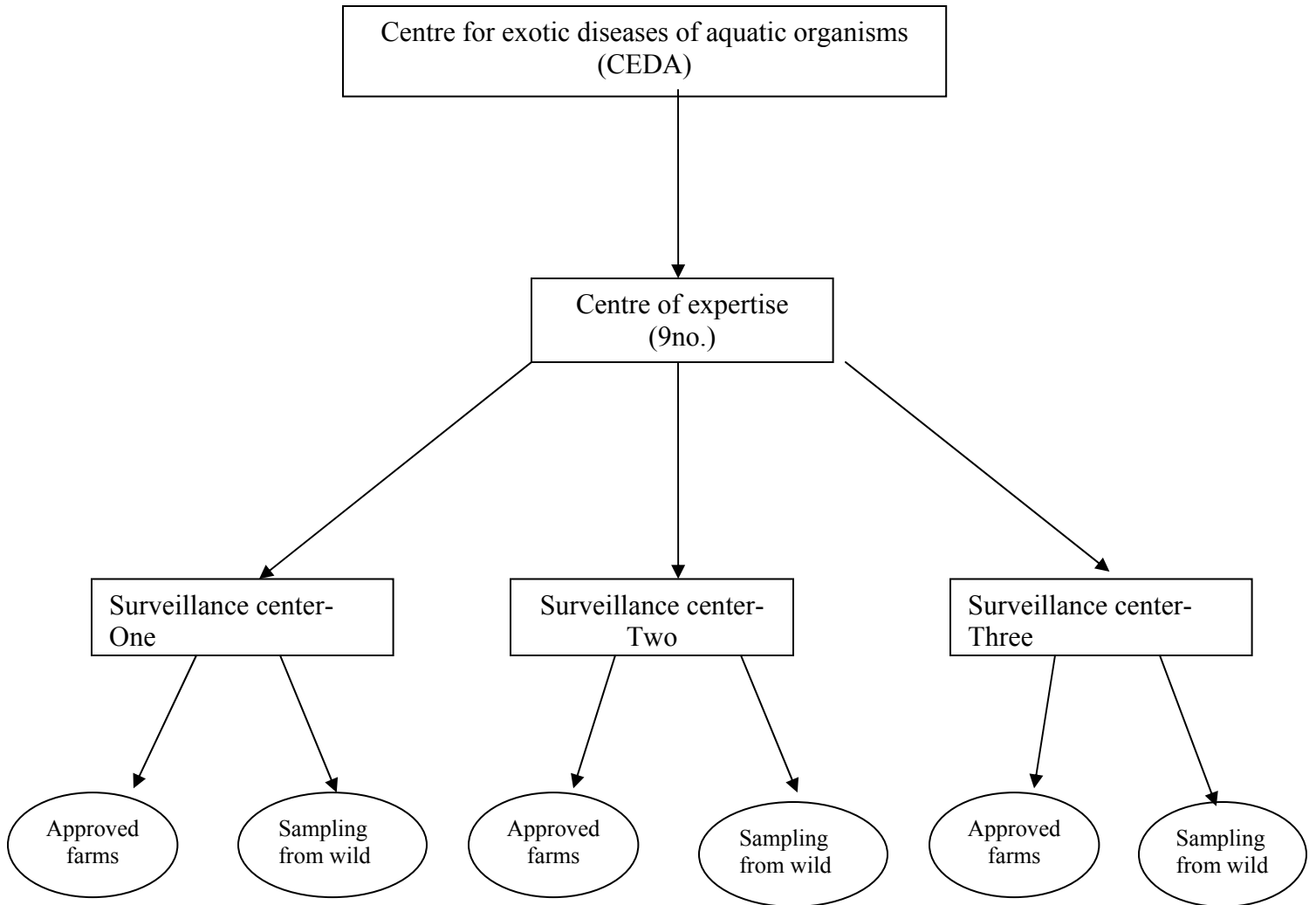


## Disease Reporting System





**Model design of the Network of Diagnostic Laboratories**



**Phase wise Requirements****Phase I**

<b>Sl. No.</b>	<b>Chapter</b>	<b>Main Requirements</b>	<b>Who would do it?</b>
1.	10	1. The existing National Committee on Introduction of Exotic Aquatic organisms into India to be recast as 'National Committee on Exotic Aquatic organisms and Quarantine'. It would have the following two subcommittees: a. Scientific sub-committee b. Policy sub-committee	<ul style="list-style-type: none"> <li>• Ministry of Agriculture</li> </ul>
2.	4.1	1. Strengthening database on exotics and quarantine 2. Developing mechanism for collecting primary data on exotics and quarantine	<ul style="list-style-type: none"> <li>• National Bureau of Fish Genetic Resources, Lucknow</li> <li>• Fisheries research institutes</li> </ul>
3.	4.2	1. Preparation of criteria to categorize fishes into prohibited/ potential/ approved species for introduction. 2. Categorization of ornamental fishes into prohibited and approved category.	<ul style="list-style-type: none"> <li>• Criteria given in 'Guidelines'. To be examined in brainstorming session and to be finalized by Scientific sub-committee of the National Committee</li> <li>• NBFGR and MPEDA</li> </ul>
4.	4.3	1. Finalization of criteria for identifying diseases of concern.	<ul style="list-style-type: none"> <li>• Criteria given in 'Guidelines'. To be examined in brainstorming session and to be finalized by Scientific sub-committee of the National Committee</li> </ul>
5.	5	1. Evaluation of native species for aquaculture, ornamental value 2. Developing economically viable seed production and culture package of practices for species already being cultured and new candidate species. 3. Policy paper on already existing exotic species. 4. Prevention of illegal introduction of exotics and to take mitigative steps to reduce impacts of exotic species on native aquatic organisms	<ul style="list-style-type: none"> <li>• Fisheries Research Institutes</li> <li>• Fisheries Research Institutes</li> <li>• Policy sub-committee</li> <li>• State Fisheries Departments</li> </ul>

6.	6.1	<ol style="list-style-type: none"> <li>1. Development of a process for ecological risk evaluation of live aquatic organisms to be introduced.</li> <li>2. Ecological risk assessment of candidate species</li> </ol>	<ul style="list-style-type: none"> <li>• Format given in 'Guidelines'. To be examined in brainstorming session and to be finalized by Scientific sub-committee of the National Committee</li> <li>• Scientific sub-committee along with a panel of fish biologists.</li> </ul>
7.	6.2	<ol style="list-style-type: none"> <li>1. A process to undertake disease risk analysis to be devised.</li> <li>2. Disease risk assessment for candidate species for import.</li> </ol>	<ul style="list-style-type: none"> <li>• Format given in 'Guidelines'. To be examined in brainstorming session and to be finalized by Scientific sub-committee of the National Committee</li> <li>• Scientific sub-committee along with a panel of fish pathologists</li> </ul>
8.	7.1	<ol style="list-style-type: none"> <li>1. Finalizing requirements for quarantine facilities</li> <li>2. Setting up quarantine facilities to handle small volume of imports by both government and private sector.</li> <li>3. Developing mechanism to supervise such facilities and to back it up with diagnostic support.</li> <li>4. The quarantine facilities to be operated by private sector under terms and conditions set by the Government</li> </ol>	<ul style="list-style-type: none"> <li>• Requirements given in 'Guidelines' To be examined in brainstorming session and to be finalized by Scientific sub-committee of the National Committee</li> <li>• Ministry of Agriculture/Industry/MPEDA</li> <li>• Ministry of Agriculture</li> <li>• Industry/ MPEDA</li> </ul>
9.	7.2	<ol style="list-style-type: none"> <li>1. Diagnostic capabilities for OIE-listed diseases.</li> <li>2. P-IV Laboratory for handling exotic pathogens to be developed.</li> <li>3. Organizing network of fish disease diagnostic laboratories</li> </ol>	<ul style="list-style-type: none"> <li>• Network of diagnostic laboratories</li> <li>• NBFGR</li> <li>• Ministry of Agriculture and ICAR</li> </ul>
10.	7.3	<ol style="list-style-type: none"> <li>1. A competent authority (CA) needs to be designated and entrusted with legal powers.</li> </ol>	<ul style="list-style-type: none"> <li>• Ministry of Agriculture</li> </ul>

		<p>2. Certifying Officials having the competence to sign the health certificates on behalf of CA to be designated.</p> <p>3. Identification, registration and accreditation of laboratories with technical expertise whose report can form the basis of health certificates.</p>	<ul style="list-style-type: none"> <li>• Competent Authority</li> <li>• Competent Authority</li> </ul>
11.	7.4	1. Minimum contingency plan.	<ul style="list-style-type: none"> <li>• Scientific sub-committee</li> </ul>
12.	7.5	1. Policy paper and action plan on zoning.	<ul style="list-style-type: none"> <li>• Task force constituted by Ministry of Agriculture</li> </ul>
13.	7.6	<p>1. Development of an action plan on ballast water.</p> <p>2. Implementation of action plan on ballast water</p>	<ul style="list-style-type: none"> <li>• Task force constituted by Ministry of Agriculture consisting of DOD, CMFRI, NIO and Port Authorities</li> <li>• Agency identified by task force</li> </ul>
14.	7.7	1. To prepare a policy paper and an action plan for quarantine of aquatic products.	<ul style="list-style-type: none"> <li>• A working group constituted by Ministry of Agriculture in collaboration with Ministry of Commerce with CIFT as lead center</li> </ul>
15.	7.8	1. Preparation of an action plan to prevent spread of diseases of public significance through live aquatic organisms and to protect our trade.	<ul style="list-style-type: none"> <li>• Scientific sub-committee</li> </ul>
16.	8.1	<p>1. Pilot scale project in selected parts of the country to understand and build up capacity to undertake active surveillance.</p> <p>2. Strengthening existing passive surveillance for remaining part.</p> <p>3. Active surveillance of selected farms from where fishes are exported.</p> <p>4. Developing capacity in terms of manpower and network for supporting surveillance system.</p>	<ul style="list-style-type: none"> <li>• Network of diagnostic laboratories</li> <li>• Network of diagnostic laboratories</li> <li>• Network of diagnostic laboratories</li> <li>• Network of diagnostic laboratories</li> </ul>
17.	8.2	<p>1. Strengthening the present reporting of disease at national level.</p> <p>2. Data administration.</p> <p>3. Reporting to international organizations</p>	<ul style="list-style-type: none"> <li>• State Fisheries Departments</li> <li>• National Coordinator</li> <li>• National Coordinator</li> </ul>
18.	9.1	<p>1. Preparation and hosting of a web page on exotics and quarantine.</p> <p>2. Brochures, pamphlets and other publicity materials on exotics and quarantine.</p>	<ul style="list-style-type: none"> <li>○ Ministry of Agriculture</li> <li>○ Fisheries research institutes / Network of diagnostic laboratories</li> <li>• Network of diagnostic laboratories</li> </ul>

		<ol style="list-style-type: none"> <li>3. Field identification guide for aquatic animal diseases.</li> <li>4. Training of State fishery officials for level I and scientific personals for level III diagnosis.</li> <li>5. Specific training to be given to the industry in diagnostic and other quarantine activities</li> <li>6. Training for import risk analysis.</li> <li>7. Training on operating quarantine facilities.</li> </ol>	<ul style="list-style-type: none"> <li>• Network of diagnostic laboratories</li> <li>• Network of diagnostic laboratories</li> <li>• Foreign experts to be identified by ICAR</li> <li>• Foreign experts to be identified by ICAR</li> </ul>
19.	9.2	<ol style="list-style-type: none"> <li>1. Identifying areas of research work and initiating specific research projects on aquatic exotics and quarantine.</li> <li>2. Identifying requirements under capacity building and initiating action to meet them.</li> </ol>	<ul style="list-style-type: none"> <li>• Scientific sub-committee</li> <li>• Ministry of Agriculture</li> </ul>
20.	10	<ol style="list-style-type: none"> <li>1. Strengthening linkage between various identified institutions.</li> <li>2. Setting up a network of diagnostic laboratories.</li> <li>3. Setting up of Aquatic Quarantine Inspection Unit (AQIU).</li> </ol>	<ul style="list-style-type: none"> <li>• Ministry of Agriculture</li> <li>• Ministry of Agriculture and ICAR</li> <li>• Ministry of Agriculture</li> </ul>
21.	11	<ol style="list-style-type: none"> <li>1. Legal mechanisms for control of both legally and illegally introduced aquatic exotics.</li> <li>2. Legal mechanisms for enforcing aquatic quarantine.</li> <li>3. Legal mechanisms to regulate the movement of aquatic organisms within India.</li> <li>4. Monitoring implementation of legislation</li> </ol>	<ul style="list-style-type: none"> <li>• Ministry of Agriculture in consultation with legal experts</li> <li>• Ministry of Agriculture</li> <li>• Ministry of Agriculture</li> <li>• Policy sub-committee under Ministry of Agriculture and State fishery departments</li> </ul>
22.	12	<ol style="list-style-type: none"> <li>1. Identification of the Laboratories to be included in the diagnostic network.</li> <li>2. Finalizing the requirements of Diagnostic Laboratories for Network.</li> <li>3. Setting of the Network of Diagnostic Laboratories.</li> <li>4. Developing mechanism for supervision and coordination among the laboratories of the Network.</li> </ol>	<ul style="list-style-type: none"> <li>• Scientific sub-committee</li> <li>• Scientific sub-committee</li> <li>• Ministry of Agriculture</li> <li>• Scientific sub-committee</li> </ul>

**Fisheries research institutes include** ICAR fishery institutes, College/ Department of Fisheries in State Agricultural Universities/ Conventional Universities carrying out fisheries research work

## Phase II

Sl. No.	Chapter	Main Requirements	Who would do it?
1.	4.1	1. Incorporation of data from reporting system into database.	<ul style="list-style-type: none"> <li>• NBFGR</li> </ul>
2.	4.2	1. Categorization of food aquatic organisms for imports into prohibited and approved category. 2. Identification of potential species for introduction.	<ul style="list-style-type: none"> <li>• Scientific sub committee</li> <li>• Scientific sub committee</li> </ul>
3.	4.3	1. National list of diseases of concern to be prepared	<ul style="list-style-type: none"> <li>• Scientific sub committee</li> </ul>
4.	5	1. Evaluating native species for aquaculture, ornamental value and biological control. 2. Developing economically viable seed production and culture package of practices for species already being cultured and new candidate species. 3. Preventing illegal introduction of exotics and to take mitigative steps to reduce impacts of exotic species on native aquatic organisms	<ul style="list-style-type: none"> <li>• Fishery research institutes</li> <li>• Fishery research institutes</li> <li>• State fishery departments</li> </ul>
5.	6	1. Ecological risk evaluation of candidate species for import	<ul style="list-style-type: none"> <li>• Scientific sub committee</li> </ul>
6.	6	1. Disease risk assessment for candidate species for import.	<ul style="list-style-type: none"> <li>• Scientific sub committee</li> </ul>
7.	7.1	1. Setting up quarantine facilities for handling large volume of imports	<ul style="list-style-type: none"> <li>• Industry/ MPEDA</li> </ul>
8.	7.2	1. Developing diagnostic kits for national diseases of concern.	<ul style="list-style-type: none"> <li>• Network of diagnostic laboratories</li> </ul>
9.	7.3	1. Certification to be done on basis of specific diagnostic tests.	<ul style="list-style-type: none"> <li>• Competent Authority</li> </ul>
10.	7.4	1. Optimum contingency plan taking into consideration specific requirements for each disease of concern and OIE listed diseases	<ul style="list-style-type: none"> <li>• Scientific sub-committee</li> </ul>
11.	7.5	1. Implementation of action plan on zoning.	<ul style="list-style-type: none"> <li>• Ministry of Agriculture</li> </ul>
12.	7.6	1. Implementation of action plan on ballast water.	<ul style="list-style-type: none"> <li>• Agency identified by task force</li> </ul>
13.	7.7	1. Implementation of quarantine of aquatic animal products.	<ul style="list-style-type: none"> <li>• Ministry of Agriculture</li> </ul>
14.	7.8	1. Implementation of the action plan for pathogens of human health significance.	<ul style="list-style-type: none"> <li>• Ministry of Agriculture</li> </ul>
15.	8.1	1. Development of capacity to undertake targeted active surveillance for diseases of concern and OIE listed diseases. 2. Targeted active surveillance as per requirement for part/whole of country to meet emerging needs.	<ul style="list-style-type: none"> <li>• Network of diagnostic laboratories</li> <li>• Network of diagnostic laboratories/State Fisheries Departments</li> </ul>
16.	8.2	1. Development of disease reporting system based on active surveillance.	<ul style="list-style-type: none"> <li>• State Fishery Departments</li> </ul>

		2. National compilation of reports and integrating it with the database.	<ul style="list-style-type: none"> <li>• National Coordinator/ NBFGR</li> </ul>
17.	9.1	1. Strengthen awareness and training programmes initiated in 1 <sup>st</sup> phase	<ul style="list-style-type: none"> <li>• Ministry of Agriculture, fishery research institutes and network of diagnostic laboratories</li> </ul>
18.	9.2	1. Strengthen the programmes on research and capacity building initiated in 1 <sup>st</sup> phase	<ul style="list-style-type: none"> <li>• Ministry of Agriculture</li> </ul>
19.	11	1. Monitoring implementation of legislation	<ul style="list-style-type: none"> <li>• Policy sub-committee under Ministry of Agriculture and State fishery departments</li> </ul>
20.	12	1. Implementation of the Health certification for aquatic organisms and products. 2. Coordination within diagnostic network.	<ul style="list-style-type: none"> <li>• Network of diagnostic laboratories</li> <li>• NBFGR</li> </ul>

**Fisheries research institutes include** ICAR fishery institutes, College/Department of Fisheries in State Agricultural Universities/Universities

## Organization-wise Activities

(Summarizing requirements and activities given under mechanism and mode of action, chapter in bracket)

### **Ministry of Agriculture**

#### **Phase I**

- Approval of National Strategic Plan (10)
- Recasting of the National Committee on Introduction of Exotic Aquatic animals with revised terms of reference and procedures for conducting meeting of sub-committee (10).
- Approval of the *Guidelines* based on the brainstorming session and recommendations of the national committee (1)
- Action on the deliberations of the scientific and policy sub committee on items indicated in the plan (10)
- Designation of competent authority (CA) for aquatic organisms quarantine and identifying officials to sign health certificate on behalf of CA (7.3))
- Awareness about approved/prohibited list of exotic aquatic organisms (4.2)
- Discuss issue of illegal introduction of exotic aquatic organisms through neighbouring countries at regional forums like SAARC (5)
- Develop mechanism for carrying out evaluation of native species for aquaculture/ornamental purposes (5).
- Organizing network of fish disease diagnostic laboratories with NBFGR as nodal institute in consultation with ICAR (7.2)
- Approval of minimum contingency plan (7.4).
- Develop mechanism for economically viable seed production and culture practices for species already cultured widely (5).
- Setting up working group of key officials of Ministry of Agriculture and some State Fisheries Directors to work out modalities for implementing minimum contingency plan (7.4).



- Identification, registration and accreditation of laboratories with technical expertise that can issue health certificate (7.3).
- Setting up of Aquatic Quarantine Inspection Unit (AQIU) (10)
- Legislation for controlling illegal introductions and spread of exotic aquatic organisms (11)
- Setting up quarantine facilities for small volume of imports(7.1)
- Develop mechanism to supervise quarantine facilities and to back it up with diagnostic support (7.1)
- Constitution of task force on zoning (7.5) and ballast water (7.6). The task force on ballast water would identify organisations to implement action plan on ballast water.
- Constitution of working group for preparation of policy paper and action plan on quarantine of aquatic products (7.7).
- Preparation and hosting a web page on exotics and quarantine (9.1).
- Use of mass media and newspapers for increasing awareness (9.1).
- Arrange separate funding for research on exotics and quarantine as well as capacity building (9.2).
- Arranging training by outside experts for training in import risk analysis and managing quarantine facilities (9.1).
- Identify and arrange programme for capacity building on all aspects of quarantine with countries having expertise like Australia (9.2).
- Submission of Technical Cooperation Project (TCP) on exotics and quarantine (9.2).
- Develop mechanism for setting up quarantine facilities by private sector (7.1)
- Initiate All India Coordinated Research Project (AICRP) to evaluate culture potential and ecological impacts of species short listed for introduction (9.2)
- Submit draft legislation before Parliamentary Standing Committee on Agriculture (11)
- Utilise expert opinion from private sector in drafting the legislation (11).

**PhaseII**

- Strengthen mechanism for carrying out evaluation of native species for aquaculture/ornamental purposes (5).
- Strengthen mechanism for development of economically viable seed production and culture practices for species already cultured widely (5).
- Certification based on specific diagnostic tests (7.3).
- Implementation of action plan on zoning (7.5)
- Implementation of action plan on quarantine of aquatic animal products (7.7)
- Implementation of action plan on pathogens of public health significance (7.8)
- Strengthening awareness and training programmes initiated in Phase I (9.1).
- Strengthen the programme on research and capacity building initiated in Phase I (9.2).

# National Committee on Exotic Aquatic Organisms and Quarantine

## Phase I

- Work out funding requirements for each component under Phase I and II \*\* (10)
- Preparation of policy paper on already existing exotic species\*\*(5)
- Action for controlling illegal introduction and spread of exotics (5).
- Finalization of criteria to categorize fishes into prohibited/ approved/potential species/strains for introduction\* (4.2)
- Finalize criteria for identifying diseases of concern\* (4.3).
- Analyse demands for live aquatic organisms as well as on products both within the country and globally (5).
- Finalization of process for ecological risk evaluation\* (6.1)
- Ecological risk assessment of candidate species along with a panel of fish biologists\* (6.1)
- Finalization of process for disease risk assessment \* (6.2)
- Disease risk assessment for candidate species for import along with a panel of fish pathologists \* (6.2)
- Finalisation of a panel of experts for undertaking ecological and disease risk analysis (6.2)
- Finalizing requirements for quarantine facilities \* (7.1).
- Finalize criteria to register and accreditate government and private laboratories with the involvement of MPEDA to issue health certificate (7.3)
- Preparation of an action plan to prevent spread of diseases of public significance through live aquatic organisms \* (7.8)
- Preparation of minimum contingency plan manual\*\* (7.4)
- Identify areas of research work on exotics and quarantine as well as work out manpower and infrastructure requirements \*(9.2).

- Location-specific recommendations regarding culture/ban of each exotic species with respect to different agro-climatic regions and coastal regimes or whole of the country (9.2)
- System of accreditation of private laboratories (12)

## **Phase II**

- Categorization of food aquatic organisms for imports into prohibited and approved category \* (4.2)
- Identification of potential species for introduction. \*(4.2)
- Optimum contingency plan taking into consideration specific requirements for each disease of concern and OIE listed disease\* (7.4)
- Ecological risk assessment of candidate species along with a panel of fish biologists \* (6.1)
- Disease risk assessment for candidate species for import along with a panel of fish pathologists \* (6.2)
- National list of diseases of concern to be prepared \*(4.3)  
 (\* indicates activities to be taken up by scientific sub committee and  
 \*\* indicates activities to be taken up by policy sub committee )

## **Network of diagnostic laboratories**

### **Phase I**

- Diagnostic capabilities for OIE-listed diseases (7.2)
- Training members of the emergency task force set up by each State government in measures to be adopted in contingency plan (7.3).
- Strengthen existing passive surveillance system (8.1)
- Active surveillance of selected farms from where fishes are exported (8.1)
- Pilot scale project in selected parts of the country to understand and build up capacity to undertake active surveillance (8.1)
- Develop capacity in terms of manpower and network for supporting surveillance system (8.1)
- Train State government officials and others on active surveillance (8.1).
- Specific training to be given to the industry in diagnostic and other quarantine activities (9.1)
- Training of State fishery officials for level I and level II and scientific personals for level III diagnosis (9.1)
- Field identification guide for aquatic animal diseases (9.1)
- Brochures, pamphlets and other publicity materials on exotics and quarantine (9.1)

### **Phase II**

- Developing diagnostic kits for national diseases of concern (7.2)
- Develop capacity to undertake targeted active surveillance for diseases of concern and OIE listed diseases (8.1)
- Assist State government and industry to carry out targeted active surveillance as per requirement for part/whole of country to meet emerging needs (8.1)

## **State Fisheries Departments**

### **Phase I**

- Prevent illegal introduction of exotics and to take mitigative steps to reduce impact of exotic species on native aquatic organisms (5)
- Strengthening existing passive surveillance system (8.1).
- Utilising existing network of fishery officials develop mechanism for reporting introduction of exotic species and stocks into their State and passing on this information to Ministry of Agriculture for further action (5).
- Undertake awareness programme to prevent illegal introduction of exotics (5).
- Help fishery research institutes to quantify the spread and impact of exotics (5).
- While enforcing ban on culture of illegally introduced exotics, ensure destruction of brood stocks to prevent their dumping into natural water (5).
- Extend ban on sale of illegally introduced exotics (5).
- Obtain competent legal expertise even from private sources to fight cases challenging ban (5).
- Strengthening the present reporting of diseases at national level (8.2)
- Awareness campaigns through mass media and newspapers (9.1).
- Setting up of district level committees headed by Collector with powers of enforcement (10)

### **Phase II**

- Prevent illegal introduction of exotics and to take mitigative steps to reduce impact of exotic species on native aquatic organisms (5)
- Targeted active surveillance as per requirement for part/whole of country to meet emerging needs in coordination with State government (8.1)
- Development of disease reporting system based on active surveillance (8.2)

## **Fisheries Research Institutes**

### **Phase I**

- Organizing a brainstorming session to discuss *Guidelines*\* (1)
- Strengthening database on exotics and quarantine\* (4.1)
- Developing mechanism for collecting primary data on exotics and quarantine (4.1)
- Categorization of ornamental fishes into prohibited and approved category in collaboration of MPEDA \* (4.2).
- Evaluation of native species for aquaculture and ornamental value and develop culture practices (5).
- To develop economically viable seed production and package of culture practices for species already being cultured and new candidate species (5)
- Pilot scale studies under controlled conditions for assessing ecological risks of species being considered for introduction (6).
- Undertake awareness programmes to prevent illegal introduction of exotics (5).
- Spread and impact of exotics to be qualified with help of State governments (5).
- Monitoring of quarantine facilities (7.1)
- Publishing reports of exotic disease in scientific journals only after confirming in a OIE referral laboratory or cross testing in approved laboratories (8.2).
- Voluntary code of conduct for scientists publishing OIE-listed diseases for the first time from the country (8.2)\*
- To include evaluation of ecological impacts of exotics as a priority area of research under X plan (9.2)
- To introduce courses on Fisheries Law for postgraduate students (11)

### **Phase II**

- Incorporation of data from reporting system into database\* (4.1)
- Evaluation of native species for aquaculture, ornamental value (5)

- To develop economically viable seed production and culture package of practices for species already being cultured and new candidate species (5)
- National compilation of reports and integrating it with the database\* (8.2)

(\* indicates activities to be undertaken by NBFGR only)



## **Industry/ MPEDA**

### **Phase I**

- Support research on native species for exploring their potential for culture or ornamental value (5)
- Support research on development of economically viable seed production and culture practices for species already/likely to be cultured widely (5).
- Sponsor research for taking up pilot scale studies under controlled conditions for assessing ecological risks of species being considered for introduction (6).
- Assist scientific subcommittee in finalizing criteria for accreditation of laboratories, which can issue health certificate (7.3).
- Categorization of ornamental fishes into prohibited and approved category in collaboration of MPEDA \* (4.2).
- Setting up quarantine facilities to handle small volume of imports (7.1)
- The quarantine facilities to be operated by private sector under terms and conditions set by the Government (7.1)

### **Phase II**

- Research on native species for exploring their potential for culture or ornamental value (5)
- Support research on development of economically viable seed production and culture practices for species already/likely to be cultured widely (5).
- Sponsor research for taking up pilot scale studies under controlled conditions for assessing ecological risks of species being considered for introduction (6).
- Setting up quarantine facilities to handle large volume of imports (7.1)
- Developing diagnostic capabilities for diseases of concern (7.2)
- Targeted active surveillance as per requirement for part/whole of country to meet emerging needs in coordination with State government (8.1).

(\* Only by MPEDA)

**LIST OF ACRONYMS**

AAPQIS- Aquatic Animal Pathogen and Quarantine Information System  
AQIS- Australian Quarantine Inspection Service  
AQIU- Aquatic Quarantine Inspection Unit  
BFDA- Brackish water Fisheries Development Agency  
BKD- Bacterial Kidney Disease  
CA- Competent Authority  
CBD- Conventional Biodiversity  
CIBA- Central Institute of Brackish water Aquaculture  
CIFA- Central Institute of Freshwater Aquaculture  
CIFA- Central Institute of Freshwater Aquaculture  
CIFE- Central Institute of Fisheries Education  
CIFRI- Central Inland Capture Fisheries Research Institute  
CIFT- Central Institute of Fisheries Technology  
CMFRI- Central Marine Fishery Research Institute  
CSIR- Council for Scientific and Industrial Research  
DARE- Department of Agricultural Research and Education  
DFO- District Fishery Officer  
DIAS- Data base on Introduction of aquatic species  
DOD- Department of Ocean Development  
EEC- European Economic Community  
EU- European Union  
EUS- Epizootic Ulcerative Syndrome  
FAO- Food and Agricultural Organization  
FDC\*- Fish Disease Commission  
FDC- Fishery Development Commissioner  
FFDA- Fish Farmer Development Agency  
FSI – Fishery Survey of India  
ICAR- Indian Council of Agricultural Research-

IPN- Infectious Pancreatic Necrosis  
MPEDA- Marine Products Export Development Authority  
NABARD- National Bank for Agriculture and Rural Development  
NACA- Network of Aquaculture Centers in Asia Pacific  
NATP- National Agricultural Technology Project  
NBFGR- National Bureau of Fish Genetic Resources  
NGOs- Non Governmental Organizations  
NIO- National Institute of Oceanography  
NIOT- National Institute of Ocean Technology  
NRC- CWF- National Research Centre on Coldwater Fisheries  
OGL- Open General License  
OIE- Office International des Epizooties  
SAARC- South Asian Association for Regional Cooperation  
SPS- Sanitary and Phytosanitary Agreement  
TCP- Technical Cooperation Programme  
USCG- US Coast Guard  
WSD- White Spot Disease  
WTO- World Trade Organization  
WWF- World Wildlife Foundation  
ZSI- Zoological Survey of India