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AQUATIC EXOTICS AND QUARANTINE GUIDELINES

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ICAR

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

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Draft Guidelines Prepared by:

Dr. A.G. Ponniah

Dr. V. K. Unnithan

Dr. Neeraj Sood

Consultation process for finalisation of 'Guidelines' document:

- **An expert committee was constituted under chairmanship of Dr. A.G. Ponniah, Director, National Bureau of Fish Genetic Resources (NBFGR), Lucknow by Ministry of Agriculture for preparation of 'National Strategic Plan' and 'Guidelines' for Aquatic Exotics and Quarantine and, NBFGR prepared the draft 'Guidelines'.**

- **The draft 'Guidelines' were presented during the meeting of expert committee to formulate strategic plan and guidelines on introduction of exotic species and quarantine arrangement for fisheries held at CIBA, Chennai on 24.05.2001. Based on the recommendations of the expert committee, a brainstorming session was proposed at NBFGR, Lucknow to discuss the draft 'Guidelines'**

- **The draft 'Guidelines' were sent to ICAR Fishery Institutes, State Fisheries Departments and experts in the field of aquatic exotics and aquatic animal health, Non Governmental Organisations and Aquaculture Sector. Suggestions and comments were incorporated in the draft 'Guidelines'.**

- **The above draft 'Guidelines' were discussed, 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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AQUATIC EXOTICS AND QUARANTINE GUIDELINES

1. BACKGROUND

The handbook 'Aquatic Exotics and Quarantine Guidelines' has been prepared as a complementary document to the draft 'National Strategic Plan for Aquatic Exotics and Quarantine'. The aim of both documents is to provide the framework to regulate the introduction of exotics and quarantine in the country.. This is very important in the wake of liberalization under World Trade Organisation (WTO) so that India is equipped to minimize the ecological and disease risks associated with the likely increased in introduction of live aquatic animals. The quarantine part of the present document is based on the output from Food and Agriculture Organisation (FAO)/ Network of Aquaculture Centres of Asia-Pacific (NACA) initiative in this regard as well as the work of Office International des Epizooties (OIE).

For aquatic quarantine, there has been regional initiative like FAO-NACA programme and an international body responsible(OIE).)On the other hand, there has been no separate inter-governmental initiative at the international level to draw up a code for introduction of aquatic exotics except for provisions under FAO code of conduct and Convention on Biological Diversity (CBD)..

FAO code of conduct for responsible fisheries was adopted by government representatives at FAO conference in October, 1995. The code mentions that there is need to provide a necessary framework for national and international efforts to ensure sustainable exploitation of aquatic living resources in harmony with the environment. The code also emphasises a number of other relevant issues:

- The importance of cooperation with neighbouring countries with regard to the trans-boundary introduction of species
- The need for databases and information networks to collect, share and disseminate relevant aquaculture data at the national, regional and global levels.
- The need for cooperation in the elaboration, adoption and implementation of international codes of practice and procedures for introductions and transfers of aquatic organisms.

FAO in collaboration with NACA had initiated a Regional Technical Cooperation Programme (TCP), 'Assistance for Responsible Movement of Live Aquatic Animals' in January 1998. This programme was based on recommendations of a 1996 Regional Workshop on Health and Quarantine Guidelines for the Responsible Movement of Aquatic Organisms. The following two main documents, are the outcome of this programme:

1. Asia Regional Technical Guidelines.
2. Manual of Procedures.

The topics covered under FAO/ NACA Guidelines and Manual of Procedures include:

- Pathogens
- Disease diagnosis
- Health certification and quarantine measures
- Disease zoning
- Disease surveillance and reporting
- Contingency planning
- Import risk analysis
- Institutional and capacity building requirements
- Regional capacity building
- Implementation strategies.

The FAO/NACA guidelines prescribe effective health management procedures for responsible trans-boundary movement of aquatic animals. However, these guidelines are very general and have been developed taking into consideration the whole Asian region. The Manual of Procedures provides further technical details and outlines a strategy to implement the guidelines.

Guidelines are also available from the OIE, which has recently revised the recommendations and protocols for the prevention of international spread of fish, molluscs and crustaceans diseases. The principal policy of Fish Disease Commission (FDC) of OIE is to facilitate international trade in aquatic animals and their products on the basis of health control and preventive measures. With this objective, OIE has published the following two documents:

1. Aquatic Animal Health Code.
2. Diagnostic Manual for Aquatic Animal Diseases.

The principal topics covered in the OIE Code are

- General definitions
- List of diseases notifiable to the OIE and other significant diseases.
- Notifications and epidemiological information.
- General requirements and principles of certification.
- Import risk analysis.
- Import/ export procedures.
- Contingency plan.
- Conditions for declaring a country or zone or aquacultural establishment free of notifiable diseases.
- Health control and hygiene.
- Model international health certificates approved by OIE.

The purpose of the Diagnostic Manual is to provide a uniform approach to the diagnosis of the diseases listed in the OIE Code so that the requirements for health certification in connection with trade in aquatic animals and aquatic animal products can be met. The OIE Diagnostic Manual contains information on the following topics-

- Quality management in veterinary diagnostic laboratories.
- Principles of validation of diagnostic assays for infectious diseases.
- General basis for fish health surveillance/ control programmes.
- Sampling procedures and sample materials
- Materials and biological products required for the isolation and identification of fish pathogens.
- Serology.
- Standard screening and diagnostic methods for OIE listed pathogens for fish, molluscs and crustaceans.
- List of reference laboratories and collaborating centres for diseases of fish, molluscs and crustaceans.

Though these four documents have provided a wealth of information in relation to aquatic quarantine, to apply them to Indian conditions requires further efforts. These documents also do not address the issue of ecological impact of exotics. On evaluating the four documents, it was felt that the following requirements need to be spelt out: Finalization of potential, approved and prohibited species.

- Finalization of national diseases of concern .
- Methodology for ecological and disease risk assessment
- Management of exotics already present in India
- Quarantine standards and procedures
- Surveillance and reporting forms
- Setting up diagnostic network of laboratories

These topics have been covered in 'Aquatic Exotics and Quarantine Guidelines'.

The various documents consulted in preparing the guidelines are cited in Annexure 1. However, for quarantine facilities Australian Quarantine Inspection Service guidelines have mainly been followed. .

2. CRITERIA FOR FINALISING POTENTIAL, APPROVED AND PROHIBITED SPECIES/STRAINS FOR IMPORTS

There is a need for list of potential/ approved/ prohibited species/ strains in order to speed up the process of evaluating the exotics species. The list of potential species would help the aquaculture sector to know about species/ strains that they can prioritise for importing and the research organizations for collecting more data on these species. This would also facilitate the aquaculture sector and research institutes to jointly evaluate species for the culture potential and the ecological impacts and then categorize them into approved/ prohibited species/ strains. If the list of approved species/ strains is known to the public, there will be no requirement to carry out ecological risk assessment until there is request for introduction into a fresh agro-climatic zone or coastal regime. Only the disease risk assessment would have to be carried out. The prohibited list would sensitize the aquaculture sector and public about aquatic organisms, which are dangerous to human beings, and other components of biodiversity and therefore, these species/ strains are not proposed for introduction.

2.1 Criteria for potential species/strains

There is need to identify species which can be introduced. Collection of information on these species in the exotic database would be helpful in decision making.

The criteria for identifying potential species for import will be:

- Species or strains with desirable characters (*e.g.* growth or ornamental or other value).
- Species or strains having demand in international market.
- Species or strains, which have been widely introduced in other countries having environmental conditions similar to India without any adverse ecological impacts.

For the potential species, ecological evaluation needs to be carried out before introductions are carried out.

Many exotic ornamental species have already been introduced in India, some of them would have been bred for more than 20 generations in India with no evidence of establishment in nature. The ornamental sector requires new more attractive strains of these species to compete in international market. Therefore to promote ornamental fish trade as well as safeguard against any adverse ecological impact, the following criteria may be adopted for evaluating potential strains of ornamental species already introduced into India :

- Ornamental species imported into the country earlier and bred for more than 20 generations and for which there is no evidence of establishment, may be short-listed.
- From the above list, we may identify potential species for introduction, taking into consideration their capacity to establish, spread and be invasive *i.e.,* based on the biology it must be concluded that in the event of establishment these species would not become invasive. These identified potential species need not undergo ecological risk evaluation, provided strains developed do not have qualities different from those introduced earlier.

- Ornamental species, which have been introduced within the time frame indicated above, would need to be evaluated.

Ecological risk evaluation of ornamental species, which have been already introduced in India, should be carried out separately. For introduction of new ornamental species, process of ecological risk evaluation will be same as applicable for other food fish. Information to be given for evaluating ornamental species is given in proforma 4.4

2.2 Criteria for approved species/strains

The potential species and strains proposed to be imported will undergo ecological risk assessment. Based on assessment, the species will be put into approved species for particular regions or whole country. Regions will be based on agro climatic regions already defined.

2.3 Criteria for prohibited species/strains

There is need to identify species/ strains which are prohibited for introduction. Detailed information on these will speed up the process of evaluating proposals for introduction. Any species or strains meeting the following criteria to be put under prohibited list

i) Aquatic organism identified as dangerous if it
   (a) can cause injury to human beings (possess venomous spines/ poisonous flesh/ toxins/ special defense mechanism).
   (b) has possibilities of attacking human beings and animals (e.g. Piranha).
   (c) known vector or carrier of pathogens

   Probiotics containing microorganisms harmful to non-target aquatic organisms are also to be included in this list.

ii) Import of the species is prohibited if it is listed under Convention on International Trade in Endangered Species (CITES) or in the threatened list of International Union for Conservation of Nature (IUCN) or that of the exporting country's threatened list.. However, if the source of the endangered aquatic organism is cultured and it is certified by the exporting country's competent authority, that it can be permitted

iii) Species under any other ban imposed on the export/ import due to national legislation or international treaties/conventions

iv) Invasive species exhibiting well documented deleterious impacts in India or other countries having environmental conditions similar to India.

Import of live aquatic organisms will only be through Chennai and Mumbai. The whole process will be facilitated by CIBA and CIFE. In spite of training custom officials, capabilities of officials in screening variety of live aquatic imports would be inadequate. There is a need for having a panel of experts/taxonomists attached to ports designated for entry of exotic aquatic organisms that would be called upon to give technical input to custom officials with regard to items listed under prohibited category or for checking that only items cleared for imports are allowed for introduction and there is no mislabeling.

3. CRITERIA FOR FINALIZING DISEASES OF CONCERN

In attempting to finalize the criteria for drawing a national list of diseases of concern the following general points need to be considered.

1. FAO-NACA guidelines mention that countries should design a 'decision matrix' model to prepare a list of diseases of concern and the criteria have to be addressed individually. This decision process should be transparent so as to enable the country to explain its decisions to potential exporting countries.

2. The diseases to be listed as those of concern must be exotic to the country or restricted to part of the country and exert significant adverse socioeconomic and ecological impacts.

3. There are many pathogens of aquatic animals that would be exotic to our country. All these will not be primary pathogens. Therefore, ubiquitous organisms are not to be categorized as pathogens of concern. However, many may exert pathogenicity under adverse environmental conditions. The majority of pathogens are of little significance because of their low pathogenicity, restricted distribution or infrequent occurrence. It will be a big impediment to trade if all the exotic pathogens are included in National List of Diseases of Concern.

4. On the other hand, the disease may be less pathogenic in aquatic animals of the exporting country but may have hosts of higher pathogenicity in the importing country. Until some experimental studies are carried out, it would be difficult to draw conclusions in this regard. The potential for such risks must also be considered. Such diseases merit inclusion in the national list of diseases of concern, provided they are absent in India.

5. Generally the groups to be considered while drawing up the national list of diseases of concern are viruses, bacteria, protozoa and fungi. This is evident from analysis of OIE and NACA listed diseases.

OIE has prepared a list of diseases (Annexure II) important in international trade of aquatic animals,categorised as notifiable and other significant diseases. FAO-NACA has prepared a list of diseases (Annexure III) important to Asia-Pacific Region. The lists have three categories of diseases *i.e.*

a) Diseases prevalent in some parts of the region.
b) Diseases presumed exotic to the region, but reportable to OIE.
c) Other diseases of importance: In particular, these include the following diseases so far presumed, but not proven, to be exotic to this region.

i) Finfish: All the five OIE notifiable and six out of eleven other significant diseases are caused by viruses, two significant diseases are caused by bacteria and one each by rickettsia, fungus and monogenean. Out of 14 finfish diseases listed by NACA, nine are viral, two bacterial and one each rickettsial, fungal and monogenean.

ii) Molluscs: All five notifiable OIE listed diseases are caused by protista. Of the six molluscan diseases listed by NACA, five are caused by protista and one by virus.

iii) Crustaceans: All the three OIE notifiable diseases and four out of five other significant diseases are caused by viruses while another significant disease of crustacean is caused by fungus. Similarly, out of the 10 crustacean diseases listed by NACA, nine are viral and one is fungal.

Criteria

1. New infectious disease: The diseases coming under national list of concern should be infectious *i.e.*, capable of being transmitted from one individual to another. Any new infectious disease reported from other countries should be considered for inclusion in the national list of diseases of concern.
2. The diseases of concern to other countries : During initial screening, all the diseases of concern to other countries can be included in the initial list.
3. Possibilities of international spread. Based on available literature, pattern of sudden international spread during past 50 years need to be considered. Those infectious diseases are to be eliminated, which are presently widely distributed but no further spread has been observed in past 50 years or those with limited geographic distribution or isolated reports.
4. Exotic to India : The list prepared from steps 1, 2 and 3 to be screened to identify diseases exotic to India. In the absence of active surveillance, only those reported in secondary literature is the guide. This would include strains of pathogens exotic to India.

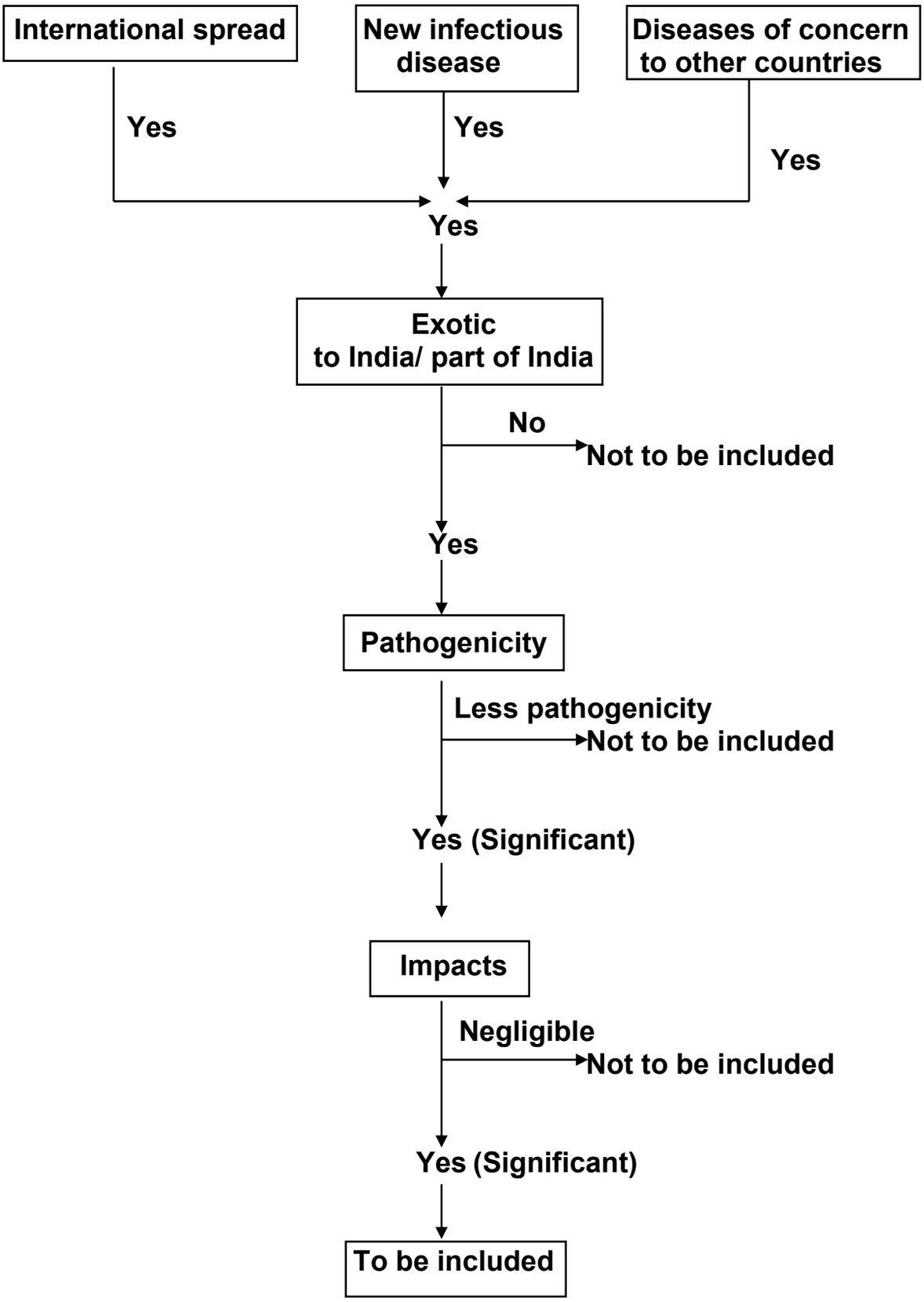
Exotic diseases identified from above 4 steps to be included into the diseases of concern list if they meet the following two criteria

5. Pathogenicity: Pathogenicity is an important criterion. The disease must be capable of (i) inducing acute/ subacute to chronic systemic, viscerotrophic and/ or dermatotrophic disease with high mortality and/ or morbidity, and/ or (ii) having capacity for establishment of latent infections in nature or under experimental conditions. Mortality of 25% and above under culture conditions and/ or changes in population dynamics of any species attributable to the pathogen under consideration can be taken as high. Specific analysis should be made to rule out opportunistic pathogens which may express mortality of 25% or higher under certain conditions which are not uniformly found in Indian farming conditions. If morbidity leads to 25% and above reduction in economic returns over the normal level, it can be considered as high morbidity.
   Diseases inducing (i) low grade chronic systemic, viscerotrophic and/ or dermatotrophic disease with (ii) and low to minimal mortality and/ or morbidity, and/or (iii) not known to cause latent infection or clinical disease in natural or experimental infections are to be eliminated.
6. Impacts: For inclusion under the national list of diseases of concern the disease must have potential to cause moderate to major adverse socioeconomic and ecological impact. All OIE and NACA listed diseases are considered to have significant ecological and/ or socioeconomic impacts.

If it is very difficult to establish major and moderate adverse impacts in terms of ecological/ socioeconomic impacts. The reviewer may fix a base level and 25% reduction is treated as moderate and 50% reduction as major. If the reviewer feels that less than 25% reduction should be considered irreversible, it may also be termed as major impact. The 25% level fixed is arbitrary, but generally it can be used to separate out impacts due to other causes. This would include strains of pathogens exotic to India.

Flow chart for finalizing diseases of concern is given in Figure 1.

Figure 1. FLOW CHART FOR FINALISING DISEASES OF CONCERN



4. EVALUATION OF INTRODUCTION PROPOSALS

The importation of any live aquatic animals involves a degree of ecological and disease risks to the importing country.The aim of import risk analysis (IRA) is to provide importing countries with an objective and defensible method of assessing ecological and disease risks associated with importation of live aquatic animals. This analysis has to be transparent so that the exporting country is provided with clear and documented conditions for import or refusal .

The four major components of IRA are -

- Hazard identification
- Risk assessment
- Risk management
- Risk communication

Hazard identification is the process of identifying biological agents that can be introduced through the live aquatic animals considered for imports. The risk assessment is the process of estimating the risk presented by an identified hazard. Risk management encompasses the use of quarantine measures to reduce the risk of entry and establishment of exotic organisms and diseases of quarantine importance in an aquatic animal population. Risk communication is interactive exchange of information among risk assessors, risk managers and other interested partners.

As already mentioned in the Draft National Strategic Plan for Aquatic Exotics and Quarantine, member countries can adopt higher standards than those recommended by OIE, but these must be based on scientific risk analysis.

In the present guidelines, only hazard identification and risk assessment are covered. Risk management and communication have already been covered under quarantine and evaluation of introduction proposals in the National Strategic Plan, to some extent.

All proposals for introduction must undergo the following two pre-import procedures:

1. Ecological risk assessment.
2. Disease risk assessment.

For evaluating introduction proposals, information is critical and it is to be supplied by the person proposing to introduce the species or strain (see 4.3)

4.1. Ecological risk assessment

1. General points

The following general points have been considered in trying to work out an ecological evaluation procedure.

1.1 Initially it must be ascertained if the introduction of exotic species is must and if the same objectives can be met with native species

1.2 In spite of the all precautions, the possibility of escape from aquaculture or ornamental fish establishments cannot be ruled out.

1.3 The key elements to be considered in ecological evaluation of proposals of aquatic exotics introduction are –

i) The probability of escape of exotics into natural environment.
ii) Capacity of escaped exotic species to reproduce and establish self-sustaining population and spread.
iii) The likely impact if the species spreads and becomes invasive.

1.4 It is difficult to determine beforehand establishment for the following reasons :

i) For many exotic species it takes a long period before population expands to a level where it is detected.
ii) In India, most of fish biodiversity survey is based on gear used in normal fishery, which is not appropriate to capture exotics especially those used in ornamental trade. This is mainly due to the fact that the size or behavioral characteristics of exotics do not match with gear type or mesh size used.
iii) Many species are at low density initially and later due to changes in environmental conditions or species spectrum, their population expands at a rapid rate.
iv) Absence of specific studies and non availability of quality data.

1.5 It is difficult to establish the likely impacts before hand for the following reasons.

i) Many impacts are measurable only after a long time, some even after a span of 100 years.
ii) It is difficult to separate the impact due to exotics from that caused by other factors like fishing and environmental degradation.

1.6 The critical physical parameters that determine the survival, growth, maturity, spawning and establishment of exotics are temperature, pH, salinity and dissolved oxygen. Of these, temperature is the most important parameter. While trying to match habitat requirements of exotic with that available in the area where the species is to be introduced, one must be aware that average temperature measurements may not reflect a true picture. Within a water body (static or flowing) there will be variations due to edge effects, presence of aquatic weeds or overhanging vegetation. In deeper water bodies like lakes or reservoirs, thermal stratification or underlying flow of cold water can provide ideal conditions for

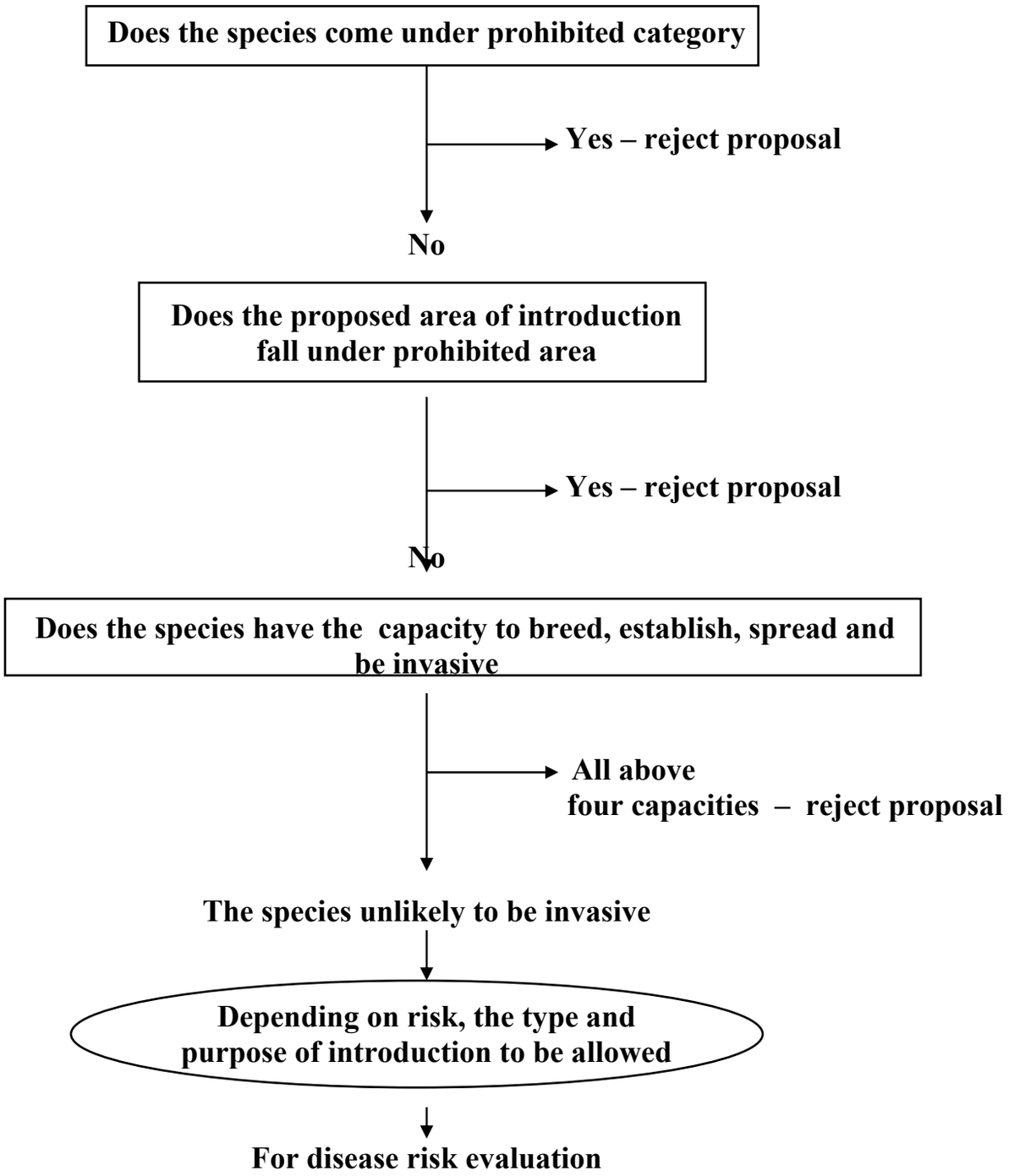
survival of exotic fishes. Some fishes with preference to browse on the bottom and/ or ability to burrow into bottom may be able to overcome adverse hot or cold temperature and reproduces under favourable temperature regimes.

1.7 India has different agro-climatic zones and coastal regimes. Therefore, environmental conditions of recipient region, where exotic aquatic organism is proposed to be introduced, has to be taken into consideration for evaluating ecological risks. Simultaneously an evaluation is done for ecological risks for other agro climatic zones and coastal regimes. In case, there is potential risk of establishment in other parts of the country, the introduction is permitted subject to condition that it would not be introduced to geographic areas other than originally intended. A system of monitoring such introduction has also to be introduced. This should be backed by state level legal mechanisms to settle the issues relating to inter-state introduction

1.8 Import of exotic strains having native counterparts will be subject to risk evaluation only to find out if the exotic strain is a distinct genetic unit different from that available in the country. The ecological risks of exotic strains of native species are expected to be less as compared to exotic species

The evaluation of ecological risk is based on sequential steps outlined in the flow chart (Figure 2).

Figure 2. FLOW CHART FOR ECOLOGICAL EVALUATION OF EXOTICS



2. Geographic areas where introduction is prohibited

Presently the request for introduction is for whole of India. In future, proposals have to indicate the exact location (*i.e.* farm and watershed) where the species will be introduced and where the progeny from this broodstock will be distributed and clearance will be given for this specified area. Any transfer to other parts of India will again require approval unless in the initial ecological evaluation it has been cleared for other parts of India.

In evaluating the proposal, one has to determine if the area selected falls under the prohibited areas for introduction of aquatic exotics. In the following areas, exotics are not to be introduced:

i) Island ecosystems
ii) Fragile ecosystems like mangroves, wetlands, sea grass and coral reefs with clearly demarcated geographic areas
iii) National heritage sites
iv) Biodiversity reserves or hot spots of biodiversity
v) Aquatic sanctuaries

Since areas under ii, iii and iv identified above can be very large and some of these have no clear boundaries, the exact geographic boundaries for such type of areas for the present purpose have to be defined, taking into consideration the following points:

(i) Presence of threatened species.
(ii) Presence of rare endemic species
(iii) Any other ecological or economic value(s).
(iv) A buffer zone to prevent spread of exotic to these restricted areas.

3. Major data and analytical input for determining ecological risk

Though there is a high degree of uncertainty about the capacity outlined in 5, ecological risks can be determined using following data and analysis. The reviewer proforma for evaluating the introduction proposals (item 4) includes all the aspects covered below under 4, 5 and 6.

Data input

i) All information on the biology of the *exotic species* under natural and farm conditions in its original range of distribution and in other regions, if it has spread.
ii) Performance and impact of the *exotic species* in other countries following introduction.
iii) Environmental requirements of the *exotic species*.
iv) Environmental conditions in the geographic areas where the *exotic species* is to be introduced.
v) Any native species exhibiting diets, feeding and breeding habitat similar to that of the *exotic species*; its conservation status, distribution and abundance.

In the absence or uncertainty about data on the species being proposed to be introduced, data from other species from the same genera and to some extent from the same family will be used . Whether they are the candidate species and/ or from same

genera and from same family, they are collectively termed as *exotic species* with regard to the above five points.

Analytical input

vi) Match between the environmental requirements of the species with that found in regions of India where the imported aquatic organism is to be introduced.
vii) Overlap between natural diets, feeding habitats, breeding habitats and other life history traits with native species.
viii) 'Possible' role in causing ecological imbalances.
ix) 'Possible' deleterious environmental effects.

Efforts will be made to collect case histories of introduction of candidate species in other countries under similar environmental conditions.

4. Assessment of capacity of exotics

The ecological risk is based on the **capacity** of the aquatic organisms with respect to **Indian conditions to**.

i) Breed in nature on its own,
ii) Establish feral populations,
iii) Spread beyond its point of establishment, and
iv) Be categorized as invasive due to 'possible' deleterious (a) genetic and (b) environmental impacts.

5. Purposes and areas to allow or refuse

The purpose of introduction is also taken into consideration while assessing the risk in view of the establishment, spread and invasive character of the exotics.

i) *Natural stocking*

For stocking in natural waters to increase fish production, for sport fishery or for biological control.

- Isolated water bodies like high altitude lakes

ii) *Aquaculture* (food and ornamental fishes)

The aquaculture sites have been categorized into the following, based on inbuilt measures and probability of escape of exotics into natural ecosystems (Table 1).

- Open aquaculture system
- Low secure closed system
- Medium secure closed system
- High secure closed system

Table 1. Characterisation of different types of aquaculture systems

	Requirement	Types of Aquaculture system			
		High secure	**Medium secure**	**Low secure**	**Open**
1.	'Sufficient' land barrier to natural water system.	✓	✓	✓	**x**
2.	Farm not likely to be flooded under 'normal' condition.	✓	✓	✓	**x**
3.	Water source 'independent'	✓	**x**	**x**	**x**
4.	Protected against unauthorized intrusion by man and from animals and birds.	✓	✓	**x**	**x**
5.	Farm or 'area of farm' meeting above criteria to be exclusively used for only exotic species.	✓	✓	**x**	**x**
6.	Facility (material, infrastructure and staff) to destroy stocks in case of flood or other calamities, on warning .	✓	✓	**x**	**x**
7.	No 'direct' connection with natural water bodies but water is drawn from canals and/ or is drained into canal connected to natural water bodies.	**NA**	✓	✓	**x**
8.	Above, but with a system of filters to prevent escape of animals to feeder canal.	**NA**	✓	✓	**x**
9.	Government system to monitor the presence of above requirements and certify the farm.	✓	✓	✓	**x**

✓ - Should have; x – Need not have
NA – Not applicable, since they rely on independent ground water.

a) High secure system

In view of the higher cost involved in establishing and operating these systems these can be justified only on the basis of objectives/ economic return. These can be in:

- Research Organizations for carrying out (i) further research/evaluation due to inadequacy of data before the exotics are moved to a lower risk category (ii for any other research work like studies on reproductive containment (genetic or otherwise) or genetic upgradation.
- Private industry, willing to invest in view of economic returns.

In high secure systems, the probability of escape of exotics into natural waters is negligible and may happen only in case of natural calamities, which strike without warning like earthquake.

b) Medium secure system

These are general aquaculture farms, which are willing to invest in requirements 4, 5, 6, 7 and 8 listed in table 1. These are similar to high secure systems except that they draw and drain water into canal that are connected to natural water bodies and to prevent escape, a system of filters is built in, at the outlets of the farm.

However, since they do not have an independent water source and are dependent on canal water, there is increased risk of escape of exotic to natural water system, through crevices and breaches found on the peripheral dykes of the farm.

c) Low secure system

Though they may have a system of filters to prevent escape of the exotics compared to medium secure systems, there is higher probability of escape . In view of this, during 1st phase of the national strategic plan on exotics, culture of exotics is not to be allowed in this system.

d) Open culture system

All farms 'near' rivers and other water bodies that can be flooded under normal conditions are to be categorized as open culture systems. No culture of exotic is to be allowed during 1st phase of the strategic plan in this system.

The above system will work only if the competent authority has a mechanism for inspection and registration of each of these farms. In view of the immediate practical difficulties, in 1st phase, culture of exotics is to be allowed in high and medium secure aquaculture establishments. This decision is to be reviewed after 2 to 3 years when 1st phase of plan is likely to end.

Research

All systems under research institutes having similar characteristics as in private aquaculture sector should have the same precautions.

If work is to be carried out on invasive species for any reason, it may be allowed after building additional safeguards to provide maximum secure system.

6. Capacity determination

6.1 Capacity, which may help the exotics to breed in new environment, can be:

- Maturity under pond environment.
- Ease of breeding under captivity with inducing agents
- Natural breeding in pond environment.
- Continuous spawning.
- Live brooders.
- Nest building and brood caring.
- Schooling and territorial behaviour.
- Low age at maturity.
- Age at maturity is flexible and even if environmental conditions do not permit the fish to grow, it can mature at an early age/ smaller body size.

6.2 Conditions favoring establishment of exotic species in the recipient water:

- Matching climate and habitat of the recipient environment in relation to the habitat requirements of the exotic species with special emphasis on temperature and salinity
- Low species diversity
- Abundant food supply
- Disturbed environment

6.3 Capacity for exotics to spread can be:

- Plasticity in environmental requirements with respect to temperature, oxygen, salinity and pH.
- Plasticity in feeding habit and capacity to switch diets.
- Ability to survive out of water (air breathing, resistance to desiccation, aestivation).
- Absence of predators, parasites and pathogens in recipient water.

6.4 Capacity of the exotic organisms to be invasive can be:

- General predatory feeding habit
- Tendency to selectively feed on eggs and larval stages
- Inhibiting reproduction of native species.
- Capacity to alter food web or energy transfer in a major way to cause ecosystem imbalance.
- Complete elimination of particular category of diet, thereby destroying an ecological niche.
- Causing environmental damage due to general or feeding behaviour.

All the characteristics listed above need not be necessarily fulfilled for the organism to breed, establish, spread or be invasive. While the capacity to breed under Indian conditions may be relatively easy to assess, assessment of capacity to establish and spread will be difficult. It will mostly be a judgment value in the absence of earlier case history of the species and will be based on the reviewer's expertise. Wherever information is not available, the judgment will be based on information from other species within the same genera or family.

7. Risk categorization

The ecological risks can be categorized into Risk I, II, III and IV.

Risk I: Species or strains unlikely to establish in recipient waters. It will be based on inability of the organism to breed without any inducing agent and hence unlikely to breed if it escapes into nature (See 6.1).

Risk II: Species that can breed without inducing agent and have the capacity to establish in the recipient waters. The species or strains will have the probability of establishment if they can maintain self-sustaining population through local breeding and recruitment. The probability of establishment will be based on capacity and conditions as listed under 6.1 and 6.2. Establishment should not be confused with invasion until the species or strains are suspected to have detrimental effects on the native species or strains of the recipient environment.

Risk III: Species or strains having the capacity to spread to other regions from original point of establishment. This capacity will be based on the characteristics of the species or strains as mentioned under 6.1, 6.2 and 6.3.

Risk IV: Species or strains suspected to be invasive in recipient environment will be categorized as high-risk category. The term invasion has three distinct phases *viz.*,

- Establishment
- Spread *i.e.* spatial distribution of individuals

- Persistence *i.e.* forging ecological links with other species or strains in the recipient region and effecting a changed selective regime in the recipient community.

The probability of invasiveness will be based on the species or strainsattributes of the species or strains as listed under 6.1, 6.2, 6.3 and 6.4.

(**Note**: Risk I is equivalent to low risk category, Risks II and III are medium risk category and Risk IV is high risk category from ecological point of view as given on page 23 in *National Strategic Plan for Aquatic Exotics and Quarantine*)

Decision matrix to allow or refuse imports

Depending on the assessed capacity of exotics to breed in natural waters, establish feral population, spread and be invasive in relation to the type and area where the species or strains is to be introduced, the decision to allow or refuse import can be made (Table 2).

Table 2. Decision matrix to determine the types and areas to allow introduction of exotic aquatic organisms based on assessed capacity

Types and areas to be introduced	**Capacity of exotic species to**				**Decision**
	Breed (equi-valent to Risk I)	**Establish (equival-ent to Risk II)**	**Spread (equ-ivalent to Risk III)**	**Invasive (equiva-lent to Risk IV)**	
- *Natural stocking*					
a) Isolated water bodies	✓ ✓	✓ ✓	**x** ✓	**-** **x**	**Allow** **Refuse**
- Aquaculture					
a) Open system	**x**	**-**	**-**	**-**	**Allow**
b) Low secure closed system	✓ ✓	**x** ✓	**-**	**-**	**Allow** **Refuse**
c) Medium secure closed system	✓ ✓	✓ ✓	**x** ✓	**x** ✓	**Allow** **Refuse**
d) Highly secure closed system	✓ ✓	✓ ✓	✓ ✓	**x** ✓	**Allow** **Refuse**
- *Research*					

✓ - Capability; x – No capability

- Not taken into consideration since capacity at the earlier level was judged nil.

4.2 Disease risk assessment

The four key elements for higher disease risk are:

1. If the source is from wild.
2. Adult life stage of the animal.
3. Larger number of individuals imported in the consignment.
4. Absence of pre border quarantine.

Criteria for allowing import

Taking into consideration the four key elements for higher disease risk, the following conditions may be imposed:

1. Adults are allowed only to be used as brood stocks.
2. For a single consignment consisting of adults, the actual number allowed for importation will be finalized on basis of capacity of quarantine unit to handle the number.
3. For eggs and larval stages, higher number may be allowed, only for purpose of building brood stock.
4. For eggs and larval stages, higher number may be allowed but only for purpose of building brood stock.
5. All consignments must be accompanied by pre-border certificate from competent authority.

Based on the above criteria, risk category and purpose, the decision to allow or refuse imports can be made. Thereafter these need to undergo quarantine.

Based on the above, it will be possible to import specific pathogen-free brood stock of species like *Penaeus monodon* for production of seed provided brood stocks have undergone quarantine. It would also facilitate import of valuable aquarium fishes to be maintained under high secure aquaculture system and resulting progeny to be used for export market.

Categorization of exotic imports on basis of requirement and risks.

There are many items, which may come regularly in the country in bulk quantities and are required for sustaining the industry. However, in view of inherent risks involved in items coming in bulk, those coming directly as seed material for aquaculture industry particularly prawn/shrimp seed or items sold as aquarium species to public are not to be allowed. For these, only brood-stocks will be allowed which will undergo disease risk evaluation.

Items can be categorized on the basis of frequency and quantity.

i) Items coming regularly in bulk:

Items, which are required in larger quantities for hatchery operations in the country, are to be allowed, provided an initial risk ecological and disease risk assessment is carried out and if required, safeguards are built up. In the case of uncertainty (e.g. Artemia) more information is to be collected and/ or it is taken as an item of research to assess potential ecological/ disease risks.

ii) Items coming regularly in low quantities:

There will be requirement of brood stocks of already introduced aquarium species, which need to be imported regularly, since they lose colour (ornamental value) after many generations of breeding.

These will need to meet the following conditions:

a) Material is not from wild.
b) Material is from recognized hatcheries, which have facilities for quality control in terms of disease.
c) Certification from the competent authority indicating that it is free of pathogens known to cause OIE-listed/ NACA-listed and diseases of concern.

The consignments need to undergo a disease risk analysis, before they are cleared for import in bulk.

iii) Items coming for the first time in low quantities:

These will be new species for building of brood stock for aquaculture and aquarium trade.

Low, medium and high disease risk categorization of consignment

The disease risks of each consignment of aquatic organisms will be dependent on:

- Country of the origin
- Candidate species to be imported

The following factors need to be considered by evaluating the disease risks associated with introduction of exotic aquatic organisms.

1. The absence of a pathogen causing disease of concern can be confirmed by active surveillance only. If any disease of concern has been reported, the country must undertake active surveillance to know infected and disease-free zones. The movement of aquatic organisms between these zones must be restricted. The consignments originating from disease free zones have minimum disease risks.
2. We also have to consider if the pathogen causing disease of concern has been reported from candidate species from any part of the world. This would include reports of pathogen in the candidate species in the form of natural or experimental infections or as vectors. It might be that disease is present in the exporting country but has not been reported in the recipient country in the absence of active surveillance.
3. If the disease of concern is reported from other species from the exporting country and particular candidate species has a proven susceptibility to the disease, there is a possibility that the consignment can carry the pathogen.

Taking the above factors into consideration, we can categorise the disease risks into low, medium and high.

- In the absence of active surveillance for aquatic animals in exporting country, all the imports will have **high disease risk** unless no disease of

concern has been reported for the candidate species from anywhere in the world. In the latter case the disease risks will be **medium**.

- Any imports originating from disease free zones will have **low disease risks**.
- The disease risks will be high if disease of concern has been reported from candidate species and/ or other susceptible species in the exporting country.
- The disease risks will be **medium** if some diseases have been reported from other countries in the world, though the same have not been encountered during active surveillance in the exporting country. However, there is no officially recognized disease free zone in the exporting country.

The first step in disease risk analysis is to gather information on the diseases reported from candidate species. Thereafter the OIE/ NACA / national diseases of concern can be shortlisted. The list can be screened to identify diseases exotic to India. Once exotic diseases have been identified, risk analysis for each disease has to be taken up. The various steps are shown in Figure 3. Based on risk categorization, the quarantine duration has been indicated in Table 3 and decision matrix for allowing release depending upon disease risks is shown in Table 4.

A conservative approach should be adopted in case where insufficient knowledge exists in relation to disease risks posed by a particular import; a higher stringency of quarantine may be adopted when insufficient knowledge exists.

Figure 3. DISEASE RISK ASSESSMENT FLOW CHART

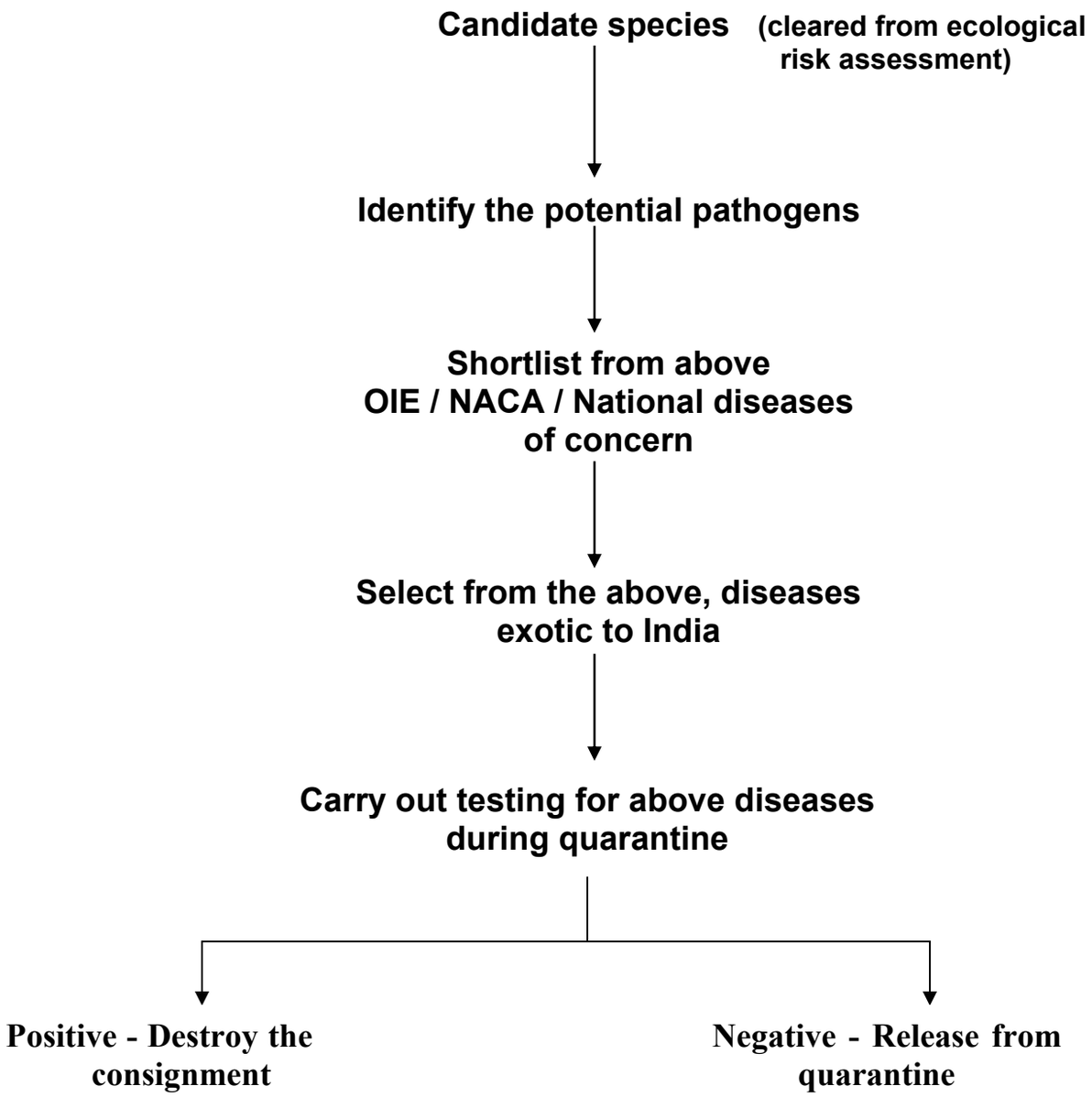


Table 3. Decision matrix on quarantine requirement for live aquatic organisms*

Sl. No.	Condition	Diseases risk categorization		
		Low	Medium	High
1.	Period spent in quarantine facility and stage of release if the species is being imported for the first time as			
	a) Brood stock	7 days7 days	21 days; after initial quarantine of 21 days, cohabitation trials for 21 days, if needed	Only F1 progeny is released
	b) Eggs/ larvae		After 21 days	3 months with last 21 days under cohabitation trial, if needed

(NA- Not applicable)

Disease risk analysis is to be done on a batch-to-batch basis. If no disease of concern has been detected during quarantine of aquatic organisms and there is no change in disease status of the exporting farm within particular period (only for early life cycle stages) and there has been no introduction of aquatic organisms of the exporting farm during that period, then the disease risk can be moved to one category below for subsequent imports i.e. from high to medium and medium to low. Under these conditions, the low risk and medium risk category would have to undergo quarantine for 7 and 42 days respectively during which testing for diseases is to be completed (if required). With increased availability of diagnostic tests, the holding time will only be for disease testing.

* Since it is not possible to hold *Penaeus monodon* brood stock for long duration under quarantine, brood stock free of pathogens causing diseases of concern should be held for a maximum of 3 days under quarantine to complete screening tests. Screening tests should be carried out by non-lethal sampling and only by PCR tests.

Table 4: Decision matrix for allowing release

Post quarantine cleared for release to	Diseases risk categorization		
	Low	Medium	High
:			
• Natural stocking	Yes	No	No
• For open culture system	Yes	No	No
• For low secure system	Yes	No	No
• For medium secure system	Yes	Yes	No
• For high secure system	Yes	Yes	Yes

4.3 Proforma for submitting proposals for introduction of live aquatic organisms *

1	**Name of the applicant**	:
2	**Status of the applicant**	:
2.1	Central Govt. Department/ State Govt./ Private	:
2.2	Govt. Research Institute/ Academic Institution/ private research laboratory	:
2.3	Designation	:
2.4	Full Address	:
	Telephone Fax E-mail	
3.1	**Brief field experience of the applicant with activities related to species being introduced**	:
4.1	**Name of the aquatic organism proposed to be introduced in Indian waters**	:
4.2	Type of organism Plant/ mollusc/ crustacean/ fish/ others (please specify)	:
4.3	Scientific name (s)	:
4.4	Common names used in the country from where it is imported	:
4.5	Source of origin (Wild/cultured)	:
5	**Purpose of introduction**	:
5.1	Research/Aquaculture/Aquarium trade	:
5.2	Any additional or specific information on scope and extent of activities with the organism proposed to be imported	:
5.3	Any technical knowhow that will be transferred from the importing country along with the organism	:
6	**Import details**	:
6.1	Life stages Unfertilized eggs/ cryopreserved milt developing eggs/ larvae/ juveniles/ immature adult/brood stocks	:
6.2	Quantity/ size of import	:
6.2.1	Number	:
6.2.2	Average weight (g)	:

6.2.3	Average length (cm)	:
7	**Biological profile of original species as recorded from wild**	:
7.1	Maximum size (cm) with likely age	:
7.2	Maximum weight (g) with likely age	:
7.3	Adult habitat	:
7.3.1	Freshwater/ brackish water/ marine	:
7.3.2	Anadromous/ Catadromous	:
7.3.3	Flowing/ stagnant	:
7.3.4	Usually found in bottom/ column/ surface of water	:
7.3.5	Littoral/ deeper waters	:
7.4	Temperature requirement for different stages	:
7.4.1	Yolk sac larvae	:
7.4.2	Post larvae	:
7.4.3	Fry	:
7.4.4	Fingerlings	:
7.4.5	Adults	:
7.5	If migratory in nature	:
7.5.1	Feeding/ breeding migration	:
7.5.2	Life stages undergoing migration (broodstock/ juvenile/ larval).	:
7.6	Breeding	:
7.6.1	Bisexual/ hermaphrodite/ clonal	:
7.6.2	Oviparous/ viviparous	:
7.6.3	Age at maturity	:
7.6.4	Period/ time of breeding	:
7.6.5	Fecundity	:
7.6.6	Temperature requirements	:
7.6.7	Salinity requirements	:
7.6.8	Other requirements	:
7.6.9	Feeding habits (herbivorous/ carnivorous/ omnivorous	:
7.6.10	Natural food item of - Larval stages - Juvenile - Adult	:
8	In its natural habitat with which species it is known to compete for	:
8.1	Food	:
8.2	Breeding grounds	:
8.3	Same ecological niche	:

9	**Genetic profile**	:
9.1	Wild/ captive/ domesticated/ developed	:
9.1.1	If wild, area of collection	:
9.1.2	If captive - Number of generation held in hatchery	:
9.1.3	If domesticated - Number of generations undergone domestication	:
9.1.4	If developed - Originals/ stocks used for development	:
9.1.5	Genetic mechanism used for developing (Selection/ hybridization/ chromosome engineering/ genetic engineering/ combined (please specify)	:
9.1.6	Strain No./ Name	:
9.1.7	Genetic stability of characters developed	:
10	**Quarantine profile**	:
10.1	Parasites and other diseases recorded, if any, in wild	:
10.2	Parasites and other disease, recorded in farmed stocks	:
10.3	a). Has any OIE/ NACA or list of diseases of concern to India been reported from exporting country.	:
	b). If yes, from which species.	:
10.4	Has it been reported frrm candidate species from exporting country.	:
10.5	a). Has there been any disease outbreak in the farm from where import is proposed.	:
	b). If yes so, give details.	:
10.6	a). Is there any active surveillance in the exporting country.	:
	b). Does the particular hatchery/ farm from where the species is imported is covered by a national aquatic health surveillance system.	:
	c). Has this particular hatchery or farm been declared free of any disease (if yes, specify disease(s)	:
10.7	Name and designation of the officer who would sign pre movement certificate	:

11	**Details of earlier export of the same species from the farm/ hatchery from where import is planned**	:
11.1	The date and details (listed in item 5, 6) with address of organization to which earlier exports have been sent	:
11.2	Any evaluation done in the importing countries on ecological and quarantine angle before import. If so, address of agency and copy of report	:
11.3	Is pre-shipment quarantine possible from exporting country? If so, type of quarantine and certification	:
11.4	Route, packaging and shipment details	:
11.5	Any facility with the importer for maintaining imported stock in isolation for a minimum of 30 days.	:
12	**Recommendations of the State Government in case of Private Company**	:
13	**Other relevant information concerning the proposed project**	:
13.1	Proposed period of import	:
13.2	Experimental area - Hatchery/ farm location where brood stock developed from import will be maintained - Address - Names of nearby stream, canals, rivers, lakes and distance from the farm	:
13.3	Operational areas	:
	Progeny produced from brood stock will be sold as live/ killed	:
	For export/ only within India	:
	If within India which States	:
13.4	Liaison with State/ Central Govt.	:
13.5	Liaison with any research organization which could oversee import	:
14	**Information regarding farm where imported aquatic organisms will be maintained**	:
14.1	What is the distance in kilometers from the nearest water body?	:

14.2	What is the height of the farm from sea level?	:
14.3	Has the farm been flooded over the last 10 years? If yes, state the year of flooding.	:
14.4	Whether the water supply is independent?	:
14.5	Whether there is a provision for preventing backflow?	:
14.6	Whether the discharge is going to the natural water bodies or not? If yes does it have a system of filters?	:
14.7	Whether the farm is fenced?	:
14.8	Whether nets cover the pond?	:
14.9	Whether the farm will be used only for exotic aquatic organisms or other aquatic organisms as well?	:
14.10	Whether the capacity for emergency harvest or destroying the whole stock is there?	:
14.11	Experience in aquaculture sector (in years)	:
14.12	Other related activities in aquaculture sector	:

Date

Signature

Seal

- **Format of items 6 and 7 to be suitably modified for aquatic organisms other than finfishes and shell fishes**

Essential enclosures :

1. Photos of organisms to be imported
2. Layout of hatchery/ farm (item 13.2)
3. Scientific literature/ documents for items 7, 8, 9, 10 (except those marked in boxes *)
4. Documents/ letter for items 11 and 12.4, 12.5

Instructions for filling proforma

1. For each species separate proforma may be used.

2. No column should be left blank. If information is not available, indicate by N.A. and if item is not relevant by N.R.

3. Effort may be made to supply relevant information supported by scientific literature/ documents. This would facilitate rapid evaluation from exotic and quarantine angles. Due to inadequate information on items other than enclosed in boxes request for import can be rejected since evaluation of risks will not be possible.

4. Some of the items (*) have been enclosed in a box. It is not mandatory for the importer to fill these details. However information on these items along with scientific literature supplied, would result in faster processing of their proposals.

4.4 Proforma for evaluating ecological risks of fresh introductions of ornamental fish, which have already been introduced in India

1.1 **Name of the ornamental fish introduced in Indian waters** :

1.2 Scientific name (s) :

1.3.1 Name of countries where the specieshas beenintroduced earlier :

1.3.2 Name of country from which the species is proposed to be introduced :

1.3.3 Source of origin (wild /cultured) :

1.4 Common names used in the country from where it is imported, and in India, (if any) :

2. Will the species be used for any purpose other than aquarium trade :

3. **Import details** :

3.1 Life stages
Juveniles/ immature adult/ brood stocks :

3.2 Quantity/ size of import :

3.2.1 Number :

3.2.2 Average weight (g) :

3.2.3 Average length (cm) :

4. **Biological profile of original species as recorded from wild** :

4.1 Maximum size (cm) with likely age :

4.2 Maximum weight (g) with likely age :

4.3	Adult habitat	:	
4.3.1	Freshwater/ brackish water/ marine	:	
4.3.2	Anadromous/ catadromous	:	*
4.3.3	Flowing/ stagnant	:	
4.3.4	Usually found in bottom/ column/ surface of water	: :	
4.3.5	Littoral/ deeper waters	:	
4.4	Temperature requirement for different stages	:	
4.4.1	Yolk sac larvae -	:	
4.4.2	Post larval	:	
4.4.3	Fry	:	
4.4.4	Fingerling/ juvenile	:	
4.4.5	Adult	:	
4.5	If migratory in nature	:	
4.5.1	Feeding/ breeding migration	:	
4.5.2	Life stages undergoing migration (/ juvenile/larvae/ broodstock /).	: : :	
4.6	Breeding	: :	
4.6.1	Bisexual/ hermaphrodite/ clonal	:	
4.6.2	Oviparous/ viviparous	:	
4.6.3	Age at maturity	:	
4.6.4	Period/ time of breeding	:	
4.6.5	Fecundity	:	
4.6.6	Temperature requirements	:	
4.6.7	Salinity requirements	:	
4.6.8	Other requirements		
4.6.9	Generation interval		
4.7	Feeding habits (herbivorous/ carnivorous/ omnivorous)	:	
4.7.1	Natural food items of		
	- Larvae	:	
	- Juvenile	:	*
	- Adult	:	
4.7.2	Artificial feeds accepted/ not accepted (If accepted, what are the feeds?)	:	
		:	
5.	**In its natural habitat with which species it is known to compete for**	:	
5.1	Food	:	
5.2	Breeding grounds	:	
5.3	The same ecological niche	:	

6. Genetic profile

6.1 If developed - Originals/ stocks used for development :

6.2 Genetic mechanism used for developing (selection/ hybridization/ chromosome engineering/ genetic engineering/ combined (please specify). :

6.3 Genetic stability of characters developed :

6.4 Morphological characters of parent strains in terms of body shape, colour and fin shape :

6.5 Morphological changes in body shape, colour and fin shape in the present strain : *

Strain	No./Name	Body shape	Coloration	Fin shape
1				
2				
3				
4				
5				

* A separate photograph for each strain to be enclosed

7 Earlier import

7.1 Year of first import and total number imported, if available :

7.2 Documentary evidence for Ist import :

7.3 Name and address of the firm which imported it for the first time :

7.4 Area where introduced for the first time

7.5 Were the imported ornamental fish :
a) Confined to large secure farms :
b) Distributed to backyard hatcheries or hatcheries without secure facilities

8 New introductions

8.1 a) Will the ornamental fish be confined to large secure farm :

b) Will the ornamental fish be distributed to backyard hatcheries or hatcheries without secure facilities :

8.2 Are the ornamental fish meant for

a) Export :
b) Internal market :

8.3 Whether the new introduction of ornamental fish will be maintained by

a) One hatchery* :
b) Many hatcheries* :

Date Signature

Seal

*Secure Systems (*see 4.1 item 5)

Essential enclosures:

1. Photos of organisms imported
2. *Address of Hatchery/ Farm

Instructions for filling proforma

1. For each species use a separate proforma.
2. No column should be left blank. If information is not available fill N.A. and if item is not relevant, N.R.

4.5 Proforma for ecological risk evaluation (Part 1-4) and disease risk evaluation (Part 5)

[Answer Yes (Y)/ No (N) with details; if no data indicate unknown (U)]

Part – 1 : Justification for import

Sl. No.	Parameters	Y/N/U	Details	Ref. Code No.	Data Quality code
1.	Purpose of the introduction				
2.	Whether the proposed objective can be met by native species				
3.	If not, kindly indicate; a). Native species don't have capability b). Technology is not available for its culture				

Part – 2 : Species Summery (taxonomic and general habitat)

Sl. No.	Parameters	Y/N/U	Details	Ref. Code No.	Data Quality code
1.	Scientific name				
2.	Common name(s)				
3. 3.a)	Classification: Family Order Taxonomic reference				
4.	Is the species difficult to distinguish from any other species? If yes, what species.				
5	In the species to be introduced, a developed strain of the original species or domesticated farm stock. If it is a strain a) Indicate strain development method (selection, hybridization, cross breeding chromosome manipulation). b) Give details of founder stocks and number of generation from founder stock. c) Can the species to be introduced produce all male/ female/ sterile population? (If so specify details).				
6	Natural distribution [country of origin]				
7	Climate of source region. (e.g. tropical, subtropical, temperate, etc.)				
8 8.a)	The specie's main ecosystem marine, estuarine, warm freshwater, cold freshwater. Other ecosystems found				
9 9.a)	Main habitat type – River, lake/ reservoir, estuary, wetlands, reef, inter tidal, mangroves Other habitats				

Part - 3 : Species assessment to judge if it is under prohibited category or for prohibited area

Sl. No.	Parameters	Y/N/U	Details	Ref. Code No.	Data Quality code
1.	Is the species already present in India? 1.a) If yes, specify where available. 1.b) Can it meet present demand? 1.c) If no to 1.b, the reason.				
2.	If not available in India, what is the source of the fish to be introduced? Wild/ hatchery stock Country and fish farm address				
3.	What is the population status of the species in its native range as classified by IUCN or the threatened list of the country.				
4.	Would approval of this application further endanger the species in its native range?				
5.	Does the species have potentially harmful characteristics? If yes, provide details on venomous spines, poisonous flesh/ toxins, special defence mechanisms, etc.				
6.	Is the species known to be a host of any parasite or pathogen of public health significance? Specify the parasites or pathogens that have been identified.				
7.	Do these pathogens already exist in India? If yes, specify.				
8.	Would the present introduction have potential to introduce disease harmful to human beings in India?				
9.	Can the species play a role in the spread or transmission of diseases or parasites that affect aquatic or terrestrial domestic, native or feral animals? Specify which parasite or disease.				
10.	Does the geographic area where introduction is proposed come under prohibited area?				

Part – 4: Ecological assessment

4.1

Sl. No.	Parameters	Y/N/U	Details	Ref. Code No.	Data Quality code
1.	What are the main predators of the species throughout the life cycle in its country of origin?				
2.	Do similar predators occur in India?				
3.	What are the ranges of the following physical parameters in the natural habitat of the species? Temperature - Upper / lower pH - Upper / lower Salinity - Upper / lower Oxygen - Upper / lower				

4.	Does this combination or range of parameter characteristics exist in the areas of India where the organism is likely to be introduced? Specify.				
5.	Does the species possess any accessory breathing organs? If yes, specify.				
6.	Does the species possess any other characteristics or behaviour that would enhance its ability to survive drought, *e.g.* aestivation, hibernation?If yes specify.				
7.	Does the species have any unusual habitat requirements? If yes, specify.				

4.2

Sl. No.	**Parameters**	**Y/N/U**	**Details**	**Ref. Code No.**	**Data Quality code**
1.	Are the sexes of the species readily distinguishable?				
2.	If yes, at what size are they first distinguishable? Male Female				
3.	What is the size of maturity? Does the species exhibit plasticity with this character. If so details.				
4.	What is the maximum length and weight the species attains? Male Female				
5.	Has the species been bred in captivity? Specify condition/ situation- pool/ pond aquarium others (specify)				
6.	Does the species breed readily in captivity without any inducing agent? Specify conditions-				
7.	What type of breeder is the species? Live bearer, pelagic spawner, mouth brooder, carrier of attached eggs, layer of adhesive eggs, substrate spawner which guards the site, substrate spawner which abandons the site, parasitic (cuckoo) breeder. Others (specify)				
8.	Does the species have particular requirements for breeding sites? If so which of these: Bedrock, boulders, gravel, sand, unknown, fine sediments, aquatic plants (specify species), timber-snags. Others (specify)/ unknown				
9.	Does the habitat condition in the area where the species is to be introduced meet the species requirements for nest/breeding sites? Specify.				

10.	Does the species utilize nest or shelter sites similar to those used by Indian native species?				
11.	What breeding characteristics does the species possess? Obligate, opportunistic, serial (batch/ complete) Other (Specify)				
12.	What is the fecundity of the species?				
13.	What are the triggers for breeding? Day length, feed availability, water level (increase/ decrease), temperature rise/ fall, first rainfall,. change in water conductivity, social factors Other (specify)/ unknown				
14.	Does the species exhibit a) Schooling b) Territoriality				

4.3

Sl. No.	Parameters	Y/N/U	Details	Ref. Code No.	Data Quality code
1. a) b) c)	Is the species known to hybridize? In its' natural habitat. In aquaria/hatchery without inducing agent. Only after inducement.				
2.	If the species has hybridized, what crosses are known?				
3.	Are the F1 progeny fertile?				
4.	With which Indian species there is a possibility to hybridize and the reason.				

4.4

Sl. No.	Parameters	Y/N/U	Details	Ref. Code No.	Data Quality code
1.	How do you characterize the species with regard to its feeding habit? Carnivore/ piscivore, omnivore, herbivore, detritus feeder Specialist (scale, blood, slime, eggs, larval stage, etc.) specify				
2.	Describe the range of food types of the species. Does it show plasticity/ capacity to switch diet.				
3.	Name the Indian native species having similar diet to the exotic species. Give details.				
4.	With which Indian species there is possibility of competition for food. Give reasons.				
5.	Is the species aggressive in its behaviour to own kind? Specify.				
6.	Is the species aggressive in its behaviour to other species? Specify.				
7.	Does the species cause any physical disturbance to the aquatic environment such as disturbance of the bottom, uprooting of flora, increasing turbidity, etc.				

8.	If yes, what would be the expected nature and degree of such disturbance?				
9.	Is the species able to utilize/adapt to disturbed habitats? Specify.				

4.5

Sl. No.	Parameters	Y/N/U	Details	Ref. Code No.	Data Quality code
1.	List all introductions (country, year, purpose)				
2.	Has the species established/ failed to establish feral populations in areas where introduced? Specify countries.				
3. a) b) c)	In the country (ies) it has established feral population What is its present distribution? widespread/ limited? Ecosystem and habitats feral population found (see part: 6, 7) Rate of spreadrapid/ slow but steadily expanding/ not expanding				
4.	What are the impacts (genetic, environmental, economic and social in countries where feral population have established.)				
5.	Please provide any other information you feel is relevant to the report.				

Part – 5 : Disease risk assessment

Sl. No.	Parameters	Y/N/U	Details	Ref. Code No.	Data Quality code
1.	The parasites/ pathogens the exotic species is known to harbour. List species name, taxonomic position, country and year of report.				
2.	Which of the above cause disease and the morbidity and mortality rate reported.				
3.	Which of the above is listed under OIE, NACA or national list of diseases of concern.				
4.	Which of the items under 3 are exotic to India or so far not reported from India.				
5.	What is the mode of transmission of disease vertical, horizontal or both.				
6.	Does each of the disease under 4 exhibit difference in pathogenicity depending on a) Life stage b) Season c) Particular culture conditions.				
7.	What is the documented spread of diseases in other countries identified under item 4.				
8.	Which are the natural hosts of this pathogen.				

9.	Has experimental infection been proven.				
10.	In which species the pathogen exists as d) Latent infection e) Vector				
11.	Are any of the hosts (other than candidate species to be imported) listed in 8, 9, and 10 found in the country from where import is proposed?				

Data quality

Reviewer has to indicate data quality as per details given below.

Code	Conditions
1.	Definite documented evidence from particular species.
2.	Definite documented evidence from species belonging to same genera.
3.	Definite documented evidence from species belonging to same family.
4.	Studies to indicate that potential exists but are not conclusive.
5.	In the absence of studies, based on overall assessment reviewer to indicate yes or no.

Reviewer's Judgement:

- Can the species breed in Indian conditions? If yes, list such agro climatic zones/ coastal regimes and what are the criteria for making judgement?
- Whether the candidate species can establish and spread?
- State the risk category based on risks?
- Under which secure system (high, medium, low secure or open system as defined in Guidelines**)** does the farm fall?

Reference

- All references to be listed separately and the code for reference to be indicated for each item.

5. MANAGEMENT OF EXOTICS ALREADY PRESENT IN INDIA

A large number of exotic aquatic organisms have been introduced in the country both legally as well as illegally. However, the legal status is not clearly known for many species. It is important to fix the status of exotic species already introduced into India as legal or illegal and to suggest a course of action about banning or allowing further culture on this basis. The knowledge of illegal introductions will help in identifying pathways of illegal entry and thereby assist in undertaking preventive measures for checking these introductions. Moreover there is a need for region-wise evaluation of impacts of already introduced exotic species. This will also help in further propagation of culture of beneficial exotic species in selected regions and taking mitigative measures for minimizing the impacts of invasive exotic species. Under management of exotics already present in India, the following three items are to be evaluated:

5.1 Criteria to decide whether the introduction is legal or illegal

The criteria will be based on year of introduction vis-à-vis setting up of National Committee

- All the aquatic organisms introduced before setting up of 'National Committee' i.e. 4th April, 1984 vide ICAR circular No. 21(6)/68-AS(F) may be considered as **legal** since there was no mechanism in place to regulate the introduction of exotic aquatic species.
- Aquatic organisms introduced after obtaining approval of 'National Committee on introduction of exotic aquatic species in Indian waters' will be termed as **legal.**
- The aquatic organisms introduced after 4th April 1984 without approval of the National Committee will be termed **illegal.**
- Aquatic organisms which might have been introduced as part of Research Institute's programme but have not been formally cleared by the *National Committee* would **need to be evaluated** by the *National Committee* before release for aquaculture.

5.2 Evaluation of species introduced legally or illegally

There is a need to evaluate the impact of exotics introduced legally and illegally to manage the exotics present in the country. Examples of species introduced legally are *Cyprinus carpio, Oreochromis mossambicus, Hypophthalmichthys molitrix, Ctenopharyngodon idella, Artemia sanfranciscana* and illegally are *Clarias gariepinus* or *Pangasius sutchi*. Some species introduced for culture have established in certain parts of the country like *Hypophthalmichthys molitrix* in Himachal Pradesh, indicating the need for region wise evaluation of exotics. All exotic species must be evaluated in the light of

- Economic benefits over species already being cultured
- Spread under culture to locales not originally intended
- Establishment in wild and variation in establishment of these species in different agroclimatic regions

Based on the above evaluation, species and location-specific recommendations should be drawn. After evaluation, the exotics can be divided into three categories *i.e.*

1. can be cultured in all parts of the country
2. culture should not be allowed in certain regions of the country and
3. culture and sale should not be allowed in any part of the country

For category 2, measures have to be taken to control spread of exotics beyond the areas intended for culture.

5.3 Measures to control spread of exotics

- Seed production and movement must not be allowed beyond the defined geographic areas (category 2)
- Ban sale and culture of the species in prohibited areas (category 2)
- Ban sale and culture of the species in whole of India (category 3)
- Create awareness about negative impacts of exotics after evaluation (category 2 and 3)

Legal and policy directives for regulating movement and culture of exotic aquatic organisms (category 2 and 3)

6. QUARANTINE

Though FAO/ NACA guidelines have extensively dealt with quarantine, some of the items were not covered in detail. These have been identified and information available from Australian Quarantine Inspection Service has been presented below with some modifications covering.

1) Standards for transporting aquatic animal to India.
2) Guidelines for quarantine facilities for live aquatic animal.
3) Quarantine procedures to be adopted on arrival
4) Quarantine procedures to be adopted on arrival into India and at the quarantine facility.
5) Approved disinfection procedure.

6.1 Standards for transporting aquatic animals to India

1. All aquatic animals in the consignment must be packaged in leak-proof bags, each bag containing only one species. The bag must be colourless and sufficiently transparent to enable proper inspection and identification of the aquatic animals and must not contain any extraneous matter, unapproved plant material, pests or unauthorized species. The use of outer bags of opaque materials or half-black bags to provide a dark shipping environment is acceptable, provided the contents can be inspected to the satisfaction of competent authority.

2. The inclusion of inert material such as zeolite, activated carbon, shredded plastic or dried terrestrial plants is permitted provided the contents of the bag can be properly inspected to the satisfaction of competent authority and the material is disinfected or destroyed as directed by competent authority.

3. Each bag must be of a size and weight which will allow inspection to the satisfaction of competent authority.

4. Each bag must be placed within polystyrene boxes or cartons fitted with a plastic lining. Each box or carton must be clearly identified as part of a shipment/ consignment and be individually identified.

5. The consignment must be accompanied by documents which include the identification number of each box or carton, and the scientific name and number of the contained aquatic animals. It is recommended that the common names of the aquatic animals also be included in the papers.

6. The aquatic animals in each bag must be stocked at a density that will facilitate inspection and hence must not be overcrowded. When packed for export, aquatic animals must be placed in clean water. The use of pH indicator in the water is permissible, provided it does not interfere with inspection.

7. Each consignment of aquatic animals must be accompanied by a health certificate issued by the Competent Authority of the exporting country, signed by an official with appropriate knowledge of the health of the animals and the export premises.

6.2 Guidelines for quarantine facilities for live aquatic animals

It is the responsibility of the person setting up quarantine facilities to be aware of and to ensure compliance with the requirements of all State and local government regulatory organizations**.**

The requirements for quarantine premises to hold live aquatic animals are:

Criteria for selecting location:

i) The location of the approved quarantine premises must be such that designated officers can make arrangements for inspection to the satisfaction of competent authority.

ii) The quarantine premises should not be located in an area classified by the appropriate State or local authority
   (a) as a flood prone area,
   (b) area adjacent to a aquatic farming/ hatchery operation.

iii) The facility is not used for any purpose other than as a place for the performance of quarantine. The facility may share a building with other areas which are used for purposes other than any activity connected with live aquatic organisms like storage of feed but must not be used as an access-way to other parts of the building.

iv) The quarantine facility must have a quarantine sign prominently displayed on the entrance to the satisfaction of competent authority. The sign must be on pattern of the internationally accepted quarantine sign.

v) Approval of quarantine premises will be for a period of 12 months after which approval will have to be renewed. The premises must be inspected by competent authority prior to approval to ensure that standards stipulated are met. Approved quarantine premises may be inspected at other times to determine whether standards are being maintained. In addition to those requirements identified above, competent authority may stipulate other measures for the effective running of approved quarantine premises. Approval may be cancelled or suspended if the standards are not maintained.

Setting up Quarantine Facility:

i. The quarantine facility shall be in a walled or fenced area. The facility must be away from other aquaculture establishments and natural water bodies. The distance will be decided by AQIU. The wall or fence must be a minimum of 2 meters in height. There shall be no water used in common by quarantined aquatic animals and any other operation involving eggs or aquatic animals.

ii. The quarantine facility must be fully enclosed and the walls and floor must be impervious and sufficiently smooth to enable adequate cleaning and disinfection. Windows may be installed in the facility, but must be either sealed or, if capable of opening, must be adequately screened to prevent entry of insects. The door must have a self-closer to ensure that it remains shut after entry.

iii. The facility must be secured with locked access and only authorized persons will be allowed entry.

iv. The floor must be able to retain all spill water, and should have sufficient slope to allow good drainage into an approved septic tank system as followed by Australian Quarantine Authority. The drainage outlet should be supplied

with a plug or other means of closing the outlet. Overseas water (water brought with consignment) and other wastewater must be disinfected prior to discharge, provided this does not provide direct entry to natural waterways.

v. Lighting in the facility must be of sufficient intensity to permit adequate inspection of all aquatic animals.
vi. The quarantine facility should have a covered enclosed area that can be used as a laboratory for preparing samples and undertaking microscopic examination. Sterilized containers and reagents should be available to collect samples for despatch to other laboratories for further examination, if required.
vii. Intake water should be disinfected/ sterilized. Spring, ground, artesian and well waters, which have no flora or fauna in them prior to entry into quarantine facility, are best and require no further treatment. If surface waters are used, there is a risk that native pathogens and pests may cause disease outbreaks in the unit causing consequent difficulties in deciding whether the pathogen is native to the water supply or was imported with the introduction.
viii. The facility should have tanks, ponds, pools and other containers of appropriate size and volume as appropriate. They must provide good visibility of contained aquatic organisms.
ix. The premises should have a designated refrigerator used solely for the storage of clinical materials before sending the same to laboratory. It should be located within the quarantine facility.
x. **There should be footbaths at the entrance of the quarantine facility for the disinfection of the footwear.**

Disinfection facilities:

i. Facilities must be available for proper disinfection of
    a. Water brought with consignment
    b. Equipment that come into contact with water or aquatic animals under quarantine.
ii. Provision must be made for staff and inspectors to wash their hands prior to leaving quarantine facility
iii. There should be provision for disinfection of all effluents from the quarantine facility in an approved manner.
iv. The quarantine facility must have a chlorination system to chlorinate all effluents. The chlorination system except the stock chlorine solution tank shall be enclosed within a walled and roofed building. The stock chlorine solution tank shall be separately enclosed to prevent solution leakage. The chlorination system shall include an alarm, which is activated when the amount of residual chlorine falls below 5 ppm. At that stage, discharge of effluents from the facility will not be permitted.

6.3 Quarantine procedures to be adopted on arrival

i. Each consignment of aquatic animals entering India (including packaging) will be examined on entry by inspectors of the competent authority who will evaluate their health , check that all documentation is in order, that only approved species are included and that no material of quarantine concern is present. Any prohibited species or materials of must be re-exported, destroyed or treated to the satisfaction of competent authority, all at the importer's expense. After inspection, all the animals will be ordered into quarantine at a place approved by the competent authority as aquatic animals quarantine facility (AAQF). On arrival at the premises, the aquatic animals will be transferred using a net to new water in the facility.

ii. All bags, polystyrene boxes and cartons used for importing exotic aquatic organisms must be either incinerated or effectively disinfected by methods approved by competent authority prior to disposal

iii. All water imported with the consignment must be disinfected to the standards of competent authority prior to disposal.

6.4 Operation of Quarantine Facilities

i) All aquatic animals must be kept in units *i.e.* tanks or other approved containers. Units must be kept clean at all times. They must be free of gravel, sand, plants, soil or shell grit and only sterilisable materials (*e.g.* polypropylene) may be contained in the unit. Tanks must be fitted with covers (or approved equivalent) to prevent the aquatic animals from jumping out of the tanks and to minimize splash contamination. Each unit must contain only a single species of aquatic animals.

ii) Where separate consignment of animals share a water recirculation system, the animals may only be approved for release from quarantine when the last consignment to enter the system has satisfactorily completed its quarantine requirements. All aquatic animals sharing the system may be subject to quarantine risk management measures (*e.g.* destruction, treatment or detention beyond the normal quarantine period) if any aquatic animals in the system is suspected to carry disease agents or pests of quarantine concern. In deciding on the need for measures to be applied to all aquatic animals sharing a recirculation system, competent authority will take into account the presence of water sterilization systems (*e.g.* ozonation or ultraviolet irradiation).

iii) The quality of water used in the quarantine unit should be monitored at regular intervals to ensure that any mortality in the quarantine population is not due to environmental conditions but to disease agents.

iv) Only authorized persons should be allowed entry in the quarantine facility. Entrance to the quarantine facility is restricted to the importer, his nominated employees and officials of the competent authority, or other persons approved by the competent authority. Once a person has entered a quarantine facility, such person will not on the same day enter any other place where live aquatic organisms are kept.

v) Any unusual levels of mortality or unusual signs of disease/ pests (levels of mortality or illness above that normally observed in imported aquatic animals) must be reported to the competent authority immediately. If the quarantine unit suffers a disease outbreak that cannot be controlled, the diseased stocks must be destroyed and disposed off after sterilization in an approved manner, but not before notification to the appropriate government authority. The quarantine unit or the particular module and associated items must be disinfected prior to its reuse

vi) The importer must ensure that no aquatic animals leave the quarantine facility under any circumstances without the approval of the competent authority, excepting dead aquatic animals moved to a nearby refrigerator or freezer. Aquatic animals may not be released from quarantine until completion of the following quarantine detention periods and fulfillment of all the requirements to the satisfaction of the competent authority:

vii) Approval of requests for prophylactic or therapeutic treatments will be considered by the competent authority, taking into account the need to ensure that exotic disease agents are not inadvertently released from quarantine. Any treatment may result in the extension of quarantine detention period or other measures as deemed necessary by the competent authority.

viii) Where the competent authority has reason to believe at the end of the quarantine detention period that the aquatic animals still present an unacceptable risk of introduction of disease or pest, they may be kept in quarantine detention for further investigation, observation, treatment, testing or for any other purpose appropriate to the circumstances. If the risk cannot be effectively managed, destruction of the aquatic animals will be ordered. The costs associated with these measures will be borne by the importer.

ix) Permission may be granted by competent authority for healthy aquatic animals to be held in the quarantine facility after release from quarantine provided that all the requirements are met during the time that the aquatic animals remain in the quarantine facility. On completion of quarantine, aquatic animals are to be transferred by a suitable net into clean water prior to removal from the facility.

Records:

i) A standard record sheet of the competent authority must be maintained for each unit. A template of a unit record sheet may be obtained from competent authority. Unit record sheets must be legible and available for inspection by the officials of the competent authority during the quarantine period and for 12 months thereafter.

ii) A record should be maintained for all water treatments.

iii) All drug/ chemical treatment of aquatic animals must have approval of the competent authority and be recorded on unit record sheets.

Disinfection:

i) All nets and equipment shared between units must be disinfected in the quarantine facility by a method approved by competent authority before

being used for other consignments of aquatic animals or prior to removal from the quarantine facility.

ii) All equipment must be disinfected prior to their removal from the quarantine facility. All material for filtering water must be disinfected prior to removal of water from the quarantine facility or disposed off by incineration.

iii) Staff and visitors must leave their street footwear outside the quarantine facility, and use separate waterproof footwear within the facility. The footwear used in the quarantine facility must remain inside the facility. Alternately, footwear may be removed from be quarantine facility after being cleaned and disinfected to the standards of the competent authority.

iv) Staff and visitors who make contact with aquatic animals or water within the quarantine facility must wash their hands with soap and water prior to exiting the facility.

v) All the effluents from the quarantine facility should be regarded as potentially infectious and must be disinfected in an approved manner before releasing to the wastewater.

6.5 Disinfection procedures

Water sterilization and disinfection of equipment should be effective against the more resistant aquatic animals disease agents or pests. Disinfect ion/ sterilization protocols should reduce pathogen titres to levels below that likely to cause infection when exposed to a susceptible host. The following disinfection/ sterilization protocols provide an indication of the level of disinfection and/ or sterilization required . Alternate methods which provide equal or greater level of quarantine security may also be used. But it needs the advance approval of competent authority.

Sterilization of wastewater (including overseas water)

Chlorine is very toxic. Hence hypo chlorite powders and concentrated hypochlorite solutions should be kept in sealed containers in well-ventilated area outside the quarantine facility. This is to prevent volatilization of chlorine gas into the air with risk to staff, and to reduce the possibility of chlorine dissolving in aquarium water, with risk of toxicity to aquatic animals.

ii. All the water to be treated must pass though a filter capable of removing suspended organic material prior to hypochlorite treatment.

iii. The water to be treated must pass to a retention vessel where sufficient hypochlorite must be added to achieve a final concentration of 200 ppm. Sodium hypochlorite (bleach) should be used at 1.6 milliliters of hypochlorite solution (12.5% available chlorine) per litre of water, while calcium hypochlorite powder (65-70% available chlorine) should be used at 0.3 g of powder per litre of water.

iv. Following addition of hypochlorite, wastewater must be agitated for a period not less than 10 minutes to ensure thorough mixing of hypochlorite and retained for a period not less than 1 hour.

v. After the one-hour retention period, the chlorine in the wastewater may be neutralized by adding sodium thiosulphate (hypo) at a rate of 1.25 g (2.5 ml of 50% sodium thiosulphate solution) per litre of treated wastewater, then agitated for not less than 10 minutes before discharge.

Disinfection of equipment, hands, footwear and dead aquatic organisms:

i. Units and unit equipment to be disinfected must be thoroughly cleaned and treated with hypochlorite solution at 200ppm concentration for 5 minutes or with an iodophore solution containing 0.5% available iodine for 5 minutes or by other approved disinfection methods.

ii. Hands of the personnel should be thoroughly washed with soap and water to remove any contaminant material, prior to exiting the quarantine facility.

iii. If footwear is to be removed from the quarantine facility, it should be clean and the soles and lower portion of the footwear must be disinfected by immersion of the exterior surface in an approved disinfectant such as a 5% solution of Betadine.

iv. All dead aquatic animals or eggs can be kept in a solution of 10% formalin for a minimum of 5 days before disposing off . The ratio of dead fish or fish eggs volume to solution volume shall not be less than 1:5.

7. SURVEILLANCE AND REPORTING

Surveillance means a systematic series of investigations of a given population of aquatic animals to detect the occurrence of disease for control purposes, and which may involve testing samples of the population (OIE code, 2000). It helps in early detection of exotic pathogens, thereby preventing spread of the same to the aquatic organisms in the country. Surveillance will assist in evolving zoning concept for diseases of concern and also in contingency planning.

The existing disease reporting system has to be strengthened with clear understanding of flow of information through different channels. This has been schematically expressed in the flow chart (Figure 4). To bring uniformity in the diagnosis report, aquatic disease diagnosis laboratory form is enclosed.

For surveillance, the active participation of State Fisheries Departments is essential. Measures need to be developed for linking State Fisheries Departments with Network of Diagnostic Laboratories to strengthen surveillance and reporting.

Outbreak Report Form

Date reported: / /	Date problem first noticed: / /

Reported by:

Name: _____ Phone/
Fax/Email:_____
Address: _____

Location of problem:

Contact name: _____ Phone/ Fax/Email:_____
_____
Address: _____

Tick one box only for each affected species:

Species affected	+ + + +	+ + +	+	**Appearance of affected and dead animals**

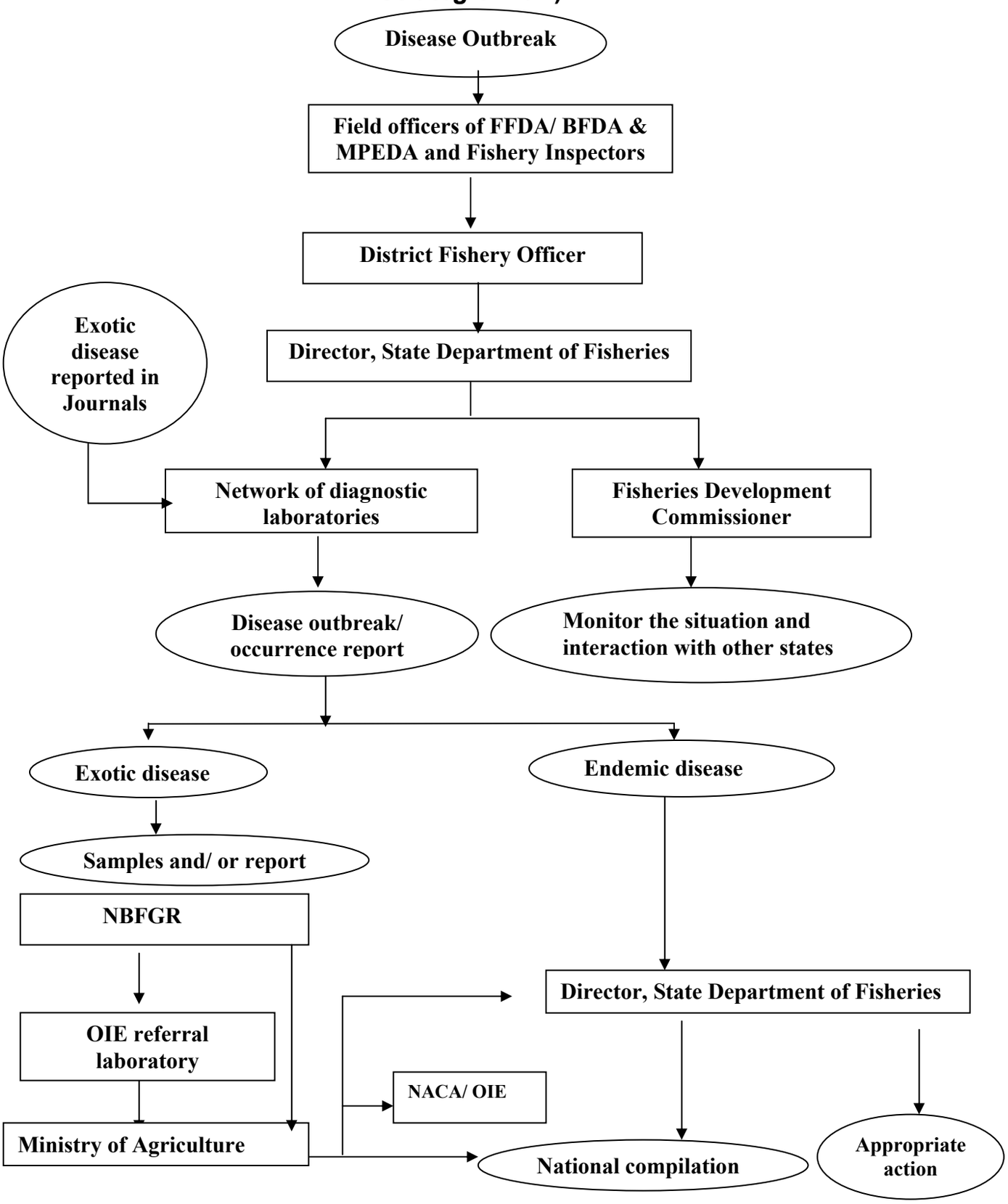
++++: Mass mortalities; +++: moderate numbers of deaths; + few deaths

Current situation (Tick one or more boxes):	**Suspected cause (s):**
Problem now over	
Problem is continuing	
Problem occurring elsewhere	

Signature: _____

Place: _____
Date: _____

Figure 4. Disease Reporting System (Taken from *National Strategic Plan*)



DISEASE DIAGNOSIS LABORATORY REPORT

Inspection date						
Investigator/ Institute						
Laboratory						
A. Location data						
1. Name and address of Facility						
2. Type of farm						
3. Natural water body (specify)						
4. District & State						
B. Aquatic Animal Data						
Aquatic animal	Scientific name	Age/ stage	Number held in farm	Sample number	Clinical signs and symptoms	**Postmortem lesions**

C. Water Data			
1. □ River	2. □ Lake	3. □ Stream	4. □ Well
5. □ Brackish water	6. □ Marine		
Where does effluent water drain into?		Name of watershed	

D. Diagnosis *			
□ Isolation of etiological agent	□ Histopathology	□ Molecular technique	□ Serological technique

D. Water quality parameters	
Dissolved oxygen	Salinity
Free CO_2	Alkalinity
Temperature	pH
Hardness	

E. Disease data
1. OIE listed pathogens detected (see annexure II)
2. Other pathogens detected (specify)
3. No pathogen detected
Additional comments (*e.g.* facility disinfection and chemicals used **:** Disinfection of eggs and chemicals used : drugs/ vaccines used) _____ _____ _____ _____ Date of issue Signature of Investigator

* Details of confirmatory test for disease to be separately enclosed

8. NETWORK OF DIAGNOSTIC LABORATORIES

India ranks 7th in world in terms of land area and has rich aquatic diversity. Therefore it may not be possible for single organization to reach the different locations for diagnosing diseases of aquatic organisms, which are already occurring and are introduced from time to time. Similarly, one organization cannot have expertise for such diverse range of aquatic organisms. Hence there is the need for different organizations to come together for surveillance and quarantine by making a network of different institutions working on similar lines.

The mandate of the proposed network will be to diagnose diseases of aquatic organisms in the country and to detect pathogens of concern in addition to OIE listed pathogens in imported consignments of live aquatic organisms. It may include existing laboratories from ICAR Fisheries Institutes and Colleges of Fisheries working on aquatic animal health. It may also include laboratories from Colleges of Veterinary Sciences.

Identification of Laboratories for Diagnostic Network

To carry out the surveillance of aquatic organisms through out the country, a network of laboratories needs to be established. Already a number ICAR institutes and SAU's have disease diagnosis laboratories. The laboratories proposed to be included in the diagnostic network will have to be identified from the already existing ones.

Criteria for Identification of Laboratories for Diagnostic Network

A. In terms of Facilities already existing with the laboratories

The proposed laboratories to be included in the diagnostic Network will have facilities equivalent to international standards. As identification of indigenous and exotic pathogens involves use of sophisticated equipments in the whole area of microbiology including bacteriology, virology, mycology, pathology etc for, the existing diagnostic laboratories should be already equipped to carry out at least the isolation and identification of bacteria and fungi and histopathology as a basic requirement for its inclusion in the diagnostic Network.

Basic requirements of the laboratory: For this, the laboratory should have laminar air flow cabinet placed in a sterile room for isolation. In addition to this autoclave, hot air oven, incubator, refrigerator, microtome, paraffin-embedding oven, tissue floatation bath, hot plate, magnetic stirrer, vortex mixer, electronic weighing balance, water distillation plant, and a good compound microscope preferably with photography attachment are must. These capabilities are essential, which every centre should have at present.

Preferably a wet lab facility for maintenance of live fish for pathogenicity trial should also be present with the centre.

In addition to the above basic capabilities the laboratory should also have any one capability also, out of the three listed below:

1. The centre should have a virology laboratory for the isolation of the viral pathogens. The virology laboratory should have a separate sterile room along with laminar airflow for cell culture work to avoid external contamination during working. The laboratory must have the experience of successfully maintaining cell lines or primary cell cultures. The laboratory should have fish cell lines,

inverted microscope, ultra freezer (-80^{0}C), CO_2 incubator and a refrigerated centrifuge for carrying out the virology work.

2. The centre should have the facility for the detection of the antigen or the antibody by Enzyme linked Immunosorbent assay (ELISA). The laboratory must also have the experience to carry out simple serological techniques like Indirect Haemagglutination test (IHA), Agar gel precipitation test (AGPT), and bacterial agglutination tests etc. For this the centre should have an ELISA reader, multichannel micropipettes, refrigerated centrifuge, and an animal house facility for raising of the antisera.
3. The centre should have to facility to detect the presence of the pathogens by DNA- based diagnostic tools such as Polymerase chain reaction (PCR), DNA probe etc. All the facilities related to the isolation of the DNA/RNA from viral as well as bacterial DNA including plasmid should be available at the centre. The centre should possess at least a thermal cycler, transilluminator, refrigerated micro centrifuge, submarine gel electrophoresis apparatus along with power pack for carrying out the diagnostic testing.

B. In terms of Trained Manpower existing with the laboratories

As identification of indigenous and exotic pathogens involves a high degree of expertise in the whole area of microbiology including bacteriology, virology, mycology, parasitology, pathology etc for, the existing diagnostic laboratories should have trained manpower experienced in diagnostic testing of pathogens using molecular diagnostic techniques. The laboratory should have at least one person with the following qualification and experience:

1.Post graduate degree in the field of fisheries science or veterinary science with specialization in the field of microbiology / biotechnology / pathology.

2. Minimum two years of experience in the area of fish disease diagnosis using isolation of fish pathogens and molecular diagnostic tools.

C. In terms of Area of specialization

The existing laboratories already working in the particular field of specialization can be given due weightage for their inclusion into the network of diagnostic laboratories. For example, a laboratory already undertaking the work on the diagnosis of crustacean disease can be given priority over other labs for its claim, to be the centre of expertise on crustacean diseases.

Mechanism of selection of laboratories

The laboratories, which have the above requirements in terms of facilities trained manpower and area of specialization, are to be considered for inclusion in the Diagnostic network. Scientific sub committee can screen the above requirements of the applicant laboratories and select the laboratories, which are best, suited for the network of diagnostic laboratories.

Selection of Surveillance centre for each Centre of expertise: Surveillance centres will be mainly responsible for collection of sample from approved farms and the fish-landing centre (Figure 5). The centre should have knowledge in the field of aquatic organism health in reference to the sample collection from diseased fish. Presently the centres can

be located in Fisheries colleges, Agriculture Universities and Veterinary colleges. Later the State fisheries can undertake the work. The Centre of Expertise in consultation with other centres of Network of Diagnostic laboratories can select surveillance centres for covering a region.

Functions of Centre for Exotic Diseases of Aquatic organisms (CEDA):
This centre is proposed at NBFGR, which will be the nodal centre for the implementation and coordination of Network of diagnostic laboratories

- To provide health certification of imported aquatic organisms for exotic diseases in Phase-II.
- To provide virology, serology, pathology and microbiology testing services for exotic diseases of aquatic organisms being reported from India
- Serve as reference laboratory for exotic pathogens at National level.
- Conduct technology development and research projects to develop better testing and control methods for exotic diseases.
- Provide service of identifying and typing exotic pathogens isolated by others.
- Provide consultancy, information and advise on epidemiology, detection and prevention of exotic diseases.
- Compilation of all the disease information obtained through National Disease reporting system and updation of the disease database.
- Feed back to OIE and NACA on disease status of the country through Ministry.
- Maintain emergency response capabilities and a state of readiness for laboratory confirmation of exotic diseases.
- Training to the Fish health officials on exotic disease diagnosis, control and prevention.
- Prepare field identification guides on aquatic animal diseases for creating awareness at farmer level

Functions of Centre of Expertise in their field of specialization

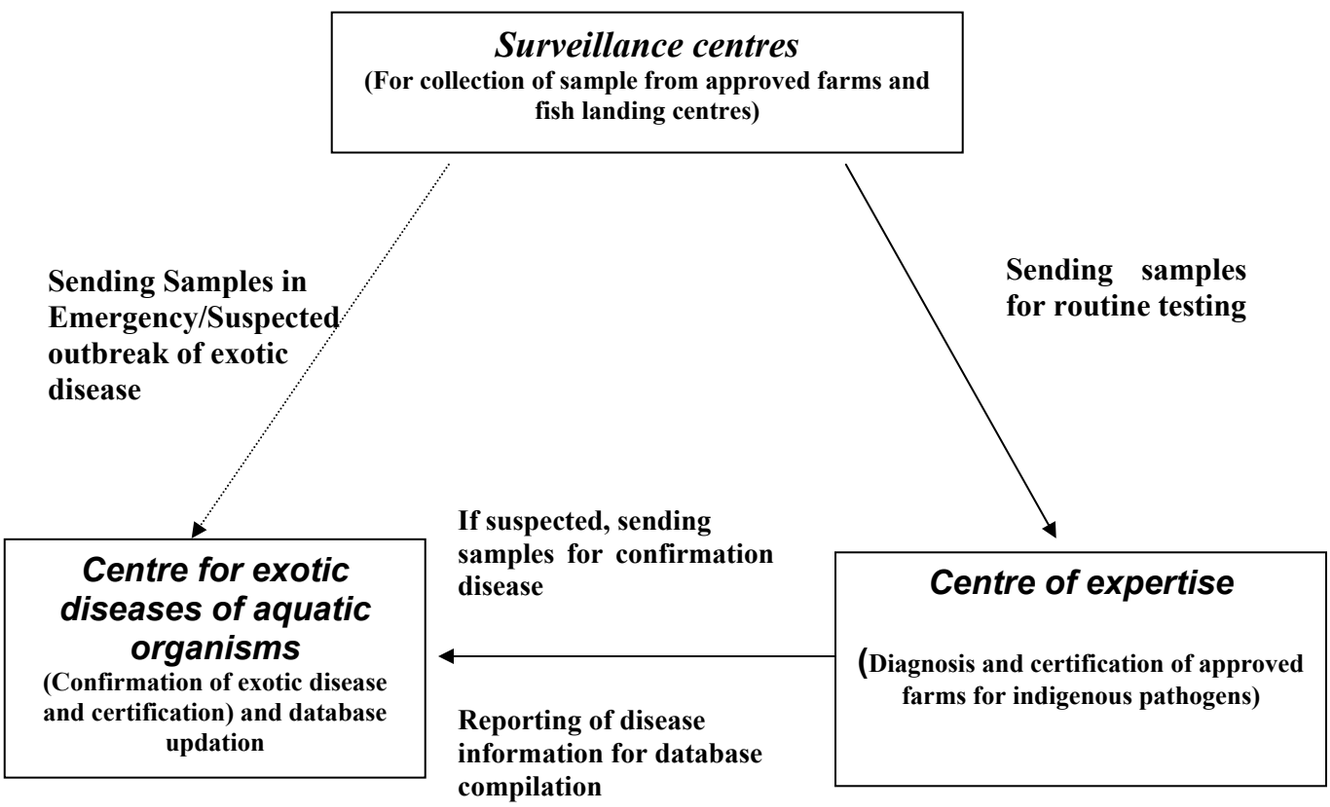
- Laboratory testing of the native fish population for indigenous pathogens as part of surveillance and disease control programmes in Phase-II.
- Monitoring and Health certification of the approved farms.
- Conduct technology development and research projects to develop better testing and control methods.
- Serve as reference laboratory for indigenous pathogens at National level in their field of specialization in Phase-II.
- Provide service of identifying and typing pathogens isolated by others in their field of specialization.
- Provide consultancy, information and advise on epidemiology, detection and prevention of disease.
- Part of National reporting system wherein all disease information is to be passed to a central facility located at NBFGR for updation of disease database and its subsequent reporting to the OIE and NACA.
- Training to the Fish health officials on disease diagnosis, control and prevention.
- Laboratories should be service and information centres on aquatic diseases.

- Prepare field identification guides on aquatic animal diseases for creating awareness at farmer level

Functions of Surveillance centre: The surveillance centre will undertake the following works:

- Collecting the samples from the approved farms and the fish landing centres in collaboration with the centre of expertise periodically.
- Recording the gross observation/clinical signs in the prescribed format to be developed by the centre of expertise.
- Packaging and shipping the collected samples to the centres of expertise or to CEDA

Figure 5. Working of Network of Diagnostic Laboratories for active surveillance



Annexure 1

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Annexure II

OIE LISTED DISEASES

Notifiable Diseases

Diseases of finfish
Epizootic haematopoietic necrosis
Infectious haematopoietic necrosis
Oncorhynchus masou virus disease
Spring viraemia of carps
Viral haemorrhagic septicaemia

Diseases of molluscs
Bonamiosis
Haplosporidiosis
Marteiliosis
Mikrocytosis
Perkinsosis

Diseases of crustaceans
Taura syndrome
White spot disease
Yellowhead disease

Other Significant Diseases

Diseases of finfish
Channel catfish virus disease
Viral encephalopathy and retinopathy
Infectious pancreatic necrosis
Infectious salmon anaemia
Epizootic ulcerative disease
Bacterial kidney disease
Enteric septicaemia of catfish
Piscirickettsiosis
Gyrodactylosis
Red sea bream iridoviral disease
White sturgeon iridoviral disease

Diseases of molluscs
No other significant diseases

Diseases of crustaceans
Baculoviral midgut gland necrosis
Nuclear polyhedrosis baculoviroses
Infectious hypodermal and
haematopoietic necrosis virus
Crayfish plague
Spawner-isolated mortality virus disease

Annexure III

NACA LIST OF DISEASES IN ASIA-PACIFIC

Diseases prevalent in some parts of the region	
Finfish diseases :	Epizootic heamatopoietic necrosis* Infectious heamatopoietic necrosis* Oncorhynchus masou virus disease* Infectious pancreatic necrosis** Viral encephalopathy and retinopathy** Epizootic ulcerative syndrome (EUS)** Bacterial kidney disease**
Mollusc diseases:	Bonamiosis (*Bonamia* sp., *B. ostreae*)* Marteiliosis (*Marteilia refringens, M. sydneyi*)* Microcytosis (*Mikrocytos mackini, M. roughleyi*)* Perkinsosis (*Perkinsus marinus, P. olseni*)*
Crustacean disease:	Yellow head disease* Infectious hypodermal and heamatopoietic necrosis (IHHN)** White spot disease* Baculoviral midgut gland necrosis** Gill associated virus (GAV)*** Spawner mortality syndrome (‘Midcrop mortality syndrome’)**
Diseases presumed exotic to the region, but reportable to OIE	
Finfish diseases:	Spring viremia of carp* Viral heamorrhagic septicaemia*
Mollusc diseases:	Haplosporidiosis (*Haplosporidium costale, H. nelsoni*)*
Other diseases of importance: These include the following diseases so far presumed, but not proven, to be exotic to this region:	
Finfish diseases:	Channel catfish virus disease** Infectious salmon anaemia** Piscirickettsiosis** Gyrodactylosis (*Gyrodactylus salaris*)** Enteric septicaemia of catfish**
Mollusc diseases:	Iridovirus (Oyster velar disease)
Crustacean disease:	Nuclear polyhedrosis baculovirosis (*Baculovirus penaei*)** Crayfish plague (*Aphanomyces astaci*)** Taura syndrome* Necrotising hepatopancreatitis***

- OIE notifiable diseases

** OIE other significant diseases

*** Diseases other than OIE-listed diseases