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GUIDELINE FOR

'SHAPHARI' - CERTIFICATION OF FARMS

for the production of antibiotic residue free shrimp

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Guideline for
'SHAPHARI'-CERTIFICATION OF FARMS
FOR THE PRODUCTION OF ANTIBIOTIC RESIDUE FREE SHRIMP

CONTENTS

1.0 DEFINITIONS

'SHAPHARI' *is a Sanskrit word meaning 'Superior quality fish suitable for consumption for even an Ascetic". Shaphari is a process certification applicable to an Aqua FARM that conforms to the basic guidelines for Good Aquaculture Practices (GAP) and meeting the standards of SHAPHARI.*

'SHAPHARI PLUS+' *is an add-on process certification. This certificate is to ensure the absence of banned antibiotic residues like Nitrofuran metabolites and Chloramphenicol in the farmed shrimp. Farmers are eligible for this certification when all the ponds are brought under Pre Harvest Test (PHT) schedule of MPEDA and tested negative for two consecutive crops.*

Export Oriented Species*: Shrimp Species having export potential including P.monodon, L.vannamei, P.indicus, P.merguiensis, Scampi, or any other species to be decided by the Competent Authority. The new species will be added to the list on fulfilling the following criteria:*

i. *Export Potential of the species*
ii. *Availability of suitable technology*
iii. *Suitability of the species for farming.*

Unit: *A Farm, involved in rearing of seeds/young ones to marketable size.*

Aqua Farm*: An aqua farm is a grow-out facility producing export oriented species.*

Good Aquaculture Practices*: sustainable aquaculture methods respecting the environment, assuring an adequate use of authorized inputs and ensuring that aquaculture products comply with relevant hygiene standards and requirements for contaminants and residues when harvested, before reaching processing establishments.*

Hatchery: *A hatchery is a place for artificial breeding, hatching, and rearing through the early life stages of aquatic animals - finfish and shellfish in particular. The term also includes the Nauplii Rearing hatcheries, which source nauplii from other sources and rear to Post Larval stages for supplying to farms.*

Antibiotics and Pharmacologically active substances*: Medicines used to prevent & treat infections for shrimp.*

Certification*: A process that assesses conformity of a product or process to the certification standards. It adopts a procedure by which accredited Certification Bodies, based on an audit, provide written or equivalent assurance that food safety management systems and their implementation conform to specified requirements of product or process*

Authorized Signatory of the application*: The person authorized to apply for certification under the scheme for certification of farms. Such authorization is valid only if all the partners/members of Executive Board of Society/Trust/Board of Directors unanimously approved by a special resolution (Certified by Managing Director in case of Private/ Public Ltd Companies).*

Competent Authority: *The Competent Authority for the scheme will be the Chairman, MPEDA or an officer duly authorized by a written office order from Chairman, MPEDA.*

Standards: *The standards mean the standards defined for the purpose of enabling the Aqua farm operators to match the farm infrastructure and farm GAPs in order to qualify for certification under the scheme.*

Compliance levels: *The level of compliance required to be met by the Aqua Farm for different standards prescribed are classified as Major, Minor and Recommendations. The Major compliance requirements are of mandatory in nature and have to be achieved by the farm for getting the certification. The minor compliance requirements are essential to maintain the quality of the Shrimp, comply environment protection and social responsibility, however, not mandatory requirement for Certification. As regards to the requirements of the recommendatory nature, the standards are advisories for maintaining shrimp quality and to meet the social and environmental responsibility.*

2.0. INTRODUCTION

India is the second largest fish producer in the world with a total production of13.7 million metric tonnes in 2018-19 showing a consistent growth in the total gross value added with one percent GDP contribution and providing meaningful employment to 14 million people across the value chain in harvesting, processing packaging, and distribution (Salim, 2020). During 2019-20, India exported 12.89 lakh MT of seafood worth US$6.68 Billion. The commodity basket of Indian fishery export is highly diversified and bulk of the exports is traded in the frozen form.

Frozen shrimp is the largest exported item, both in terms of quantity and value during the last decade. India exported 6.52 lakh MT of frozen shrimp worth US$4889.12 million during 2019-20. Frozen shrimp constitute 50.58% in quantity and 73.21% in terms of total USD earnings. Largest market for Indian frozen shrimp is USA followed by South East Asia, European Union, China, Japan and Middle East countries. Farmed *L.vannamei* shrimp is the single largest contributor for the seafood export basked by contributing 5.12 lakh MT.

Over the past few years, frequent recalls of import rejections by developing countries has increased consumer awareness on health hazards antibiotics residue and pharmacologically active substances present in the seafood, resulted in great deal of public concern particularly in the developed countries where food safety concerns are dealt at the Governmental level.

Rationale: When antibiotics like Chloramphenicol are unintentionally ingested as residues in food may cause direct health concerns, such as aplastic anaemia and Leukemia and pose significant risks to human health. Similarly, Nitrofurans, which is a class of synthetic antibiotics used for the treatment of bacterial and protozoan infections in animals, inhibit a number of microbial enzymes involved in carbohydrate metabolism. They are easily metabolized in the body of animals and are known to be carcinogenic and genotoxic.

The application of antimicrobials affects targeted pathogens as well as a wide variety of environmental bacteria, resulting in selection of AMR strains that increase the risk of horizontal gene transfer to potential human pathogens. The spread of antimicrobial resistance (AMR) has been classified by the World Health Organization (WHO) as one of the major threats facing the human population this century. The trans-boundary diffusion of AMR pathogens may occur at greater pace, it may seriously impacts the seafood trade in near future (Ravishankar, 2018).

Antibiotics are used in aquaculture either for disease prevention or prophylaxis. Although in India there is no approved list of veterinary drugs specifically for aquaculture and no agency for authorization of aquaculture drug exists, export rejection due to presence of antibiotic residues is reported. As it is not always possible to administer the antibacterial agent by injection or bath treatment, medicated feeds are used most of the times. Some of the major issues related antibiotic residues are Chloramphenicol and nitrofuran metabolites in cultured

shrimps and oxytetracycline at higher levels (>100 ppb) in culture fish and shrimp (Panda, 2019)

Regulations on Antibiotic use in Aquaculture: Ministry of Commerce and Industry (MOCI), Government of India has notified MRLs of antibiotics and heavy metals in the marine products exported (Notification SO 792 (E) dated Aug 17, 2001). As per the MOCI notification five antibiotics viz Chloramphenicol, Furazolidone, Neomycin, Nalidixic acid and Sulphamethaxazole are banned and no residues should be left in the animal body.

There are nine substances included of Regulation 2377/90/EEC that may not be used in food producing species because no safe level of residue can be determined: Chloramphenicol, Chloroform, Chlorpromazine, Colchicine, Dapsone, Dimetridazole, Metronidazole, Nitrofurans (including Furazolidone) and Ronidazole. The presence of such substance residues (including metabolites) is *prima facie* evidence of the use of prohibited substances in a food animal species.

3.0 BACKGROUND

European Union which is a 28 member guild of nation's accounts for 15.77 percent worth $7.08 billion of Indian seafood exports in 2017-18 has implemented stringent norms for accepting the consignments due to quality issues. Shrimp is the most critical species in high demand after Tuna and Cod in the EU market. Major portion (98%) of this demand is met by imports and more than half is contributed by the imports from Ecuador, India, China, Vietnam, Bangladesh, and Thailand. Sample size for testing Indian consignments have been increased from 10% to 50% and this has resulted in higher cost and risk for the exporter thus shying away from sending consignments to EU. Annual shrimp requirement of EU is estimated at about 0.8 million tones and if quality of the shrimp produced is improved, there is huge potential to tap the market.

Markets in EU have zero tolerance on antibiotic residue in seafood. There are instances where export consignments were rejected due to the presence of traces of residues in the products above the permitted limit prescribed by International standards. The demand for residue free shrimp by international markets has necessitated freeing aquaculture sector from the use of antibiotics and other pharmacologically active substances.

OIE listed pathogens and export: Till recent years, disease issues in farms were known to affect only the farmer, but now it began to affect the Indian shrimp exporter as well. Countries like Australia, Saudi Arabia, Kuwait, Canada and Thailand have banned import of uncooked shrimp from India due to presence of OIE listed shrimp pathogens in the frozen consignments. There are 7 OIE listed shrimp pathogens that are known to cause serious damage to crops. Recently, China also rejected consignments due to the detection of WSSV (White Spot Syndrome Virus) in the shrimp consignment and have banned import of seafood

from 10 processing units.

Importance of Certification: Certification of Aquaculture for production of antibiotic free shrimp has emerged as one of the main interventions to free Indian aquaculture from the use of antibiotics. This is also seen as a tool to improve the consumer confidence.

Quality Certifications issued by international bodies are expensive and beyond the reach of small and marginal producers. In this circumstance, MPEDA formulated a scheme for Certification of Aquaculture for production of antibiotic free products in consultation with Farmer representatives, Hatchery representatives, Fisheries research institutions, EIA and CAA.

Preparatory work for Certification of Aquaculture: Apart from National Residue Control Programme (NRCP) and Pre Harvest Test (PHT) initiatives implemented by MPEDA, development of Certification in Aquaculture which is named as 'SHAPHARI' meaning superior quality of fishery product suitable for human consumption is another milestone initiative to address the above issue on food security.

Stake holder meetings were conducted in association with Society of Aquaculture Professionals (SAP) in shrimp farming areas in Tamil Nadu and Andhra Pradesh during 2018-19 to find a lasting solution to issues related to food security aspects in aquaculture production. One of the decisions of the stakeholder consultations was to start a certification scheme for export oriented aquaculture production systems that include both hatcheries and farms. Farmers were also concerned on the quality of seeds supplied by the hatcheries.

Trial production on antibiotic free seed production protocol: A trial study was taken up by MPEDA-RD-Vijayawada during 2019 for the production of Antibiotic free and disease free shrimp PL production using application of bacteriophage and probiotics. RD-Vijayawada conducted a total of three trials by participating 5 hatcheries in different locations.

The study clearly demonstrated that the seed production with bacteriophage and probiotic protocol is possible and the survival rate can be increased substantially by standardizing the application rates and by gaining more experience in the antibiotic free operations.

Certification of Hatcheries for the production antibiotic free seeds: Based on the stakeholder meeting interactions, MPEDA decided to initiate certification of export oriented aquaculture production systems in India as a voluntary scheme. To this end, MPEDA constituted a committee comprising two representatives of All India Shrimp Hatcheries Association (AISHA), representatives of Prawn Farmers Federation of India (PFFI) and officials of MPEDA for formulating the scheme for certification of hatcheries for production of antibiotic free seeds. Draft guideline for certification prepared after a series of consultations were placed before various national and international institutions related to fisheries and Aquaculture for their comments and suggestions. Comments and suggestions were critically analysed by the committee and necessary amendments were made

in the scheme and prepared the final document. The scheme is under pilot phase of its implementation with the participation of 13 hatcheries.

Pilot phase of Shaphari certification of hatcheries: MPEDA pilot phase of hatchery certification scheme was initiated with the participation of 13 willing shrimp hatcheries engaged in seed production since May 2020.These hatcheries were willing to undergo audit by the designated auditors and agreed to be part of the surveillance program for shrimp seed quality. These hatcheries have also shared 50% of the estimate expenditure for the certification cost.

It is anticipated that by March 2021,the above hatcheries shall complete the essential audits viz. Preliminary audit, Committee audit and Surveillance audits (4 numbers) and will be eligible/non eligible for Certification based on the audit outcome. By April 2021, MPEDA will be ready for launching the scheme for about 350 shrimp hatcheries in the country.

Web portal for SHAPHARI: In order to improve the consistency, credibility and transparency of the Certification process, a webportal has been designed with an intention to streamline the auditing process. The online process passes through a series of steps before issuing the certificate. Processors & exporters who are desirous of buying quality shrimp for their farms can verify the claim of the farmer by visiting the SHAPHARI web portal. SHAPHARI webportal may be linked to E SANTA web site of NaCSA for realizing maximum value for their farm produce.

Figure I: Home page of the Shaphari WEB PORTAL for Certification of Aquaculture https://aquacert.mpeda.gov.in/

4. STANDARDS FOR 'SHAPHARI' CERTIFICATION OF FARMS

According to FAO, the minimum substantive criteria for developing aquaculture certification standards are

a) Animal health and welfare;
b) Food safety;
c) Environmental integrity; and
d) Socio-economic aspects.

The extent to which a certification scheme seeks to address the issues depends on the objectives of the scheme, which should be explicitly and transparently stated by the scheme. Development of certification schemes should consider the importance of being able to measure performance of aquaculture systems and practices, and the ability to assess conformity with certification standards.

The standards for certification of farms for production of antibiotic free shrimp are developed through a process of consultations with the experts in the field of farm/hatchery operation, government agencies involved in R&D, Regulatory agencies, and developmental bodies and general public. The standards proposed will be improved on a continuous basis in keeping with the modification in the scope of the scheme, improvements in the technology and scientific knowledge to ensure high quality, disease free and residue free shrimp production. The standard developed is as follows:

4.1 SHAPHARI: is a process certification applicable to an Aqua FARM that conforms to the basic guidelines for Good Aquaculture Practices (GAP) and meeting the standards of SHAPHARI. This certification encourages the farmer to adopt good aquaculture practices that improve the food safety of the aquaculture product.

S-1. Farm registration: Farm shall be registered with Coastal Aquaculture Authority or registered by the concerned State Govt. and Enrolled under MPEDA.
Compliance level: Major
Inspection method: Verification of documents.
S-2. Bio-security measures: Farms must establish adequate bio-security measures to prevent entry of bio-security threats.
Compliance level: Major
Inspection method: Visual inspection
S-3. Pond preparation: Any science based protocol to be followed for preparation of pond before stocking. Non-composted manures shall not be used.
Compliance level: Minor
Inspection method: Visual inspection and verification of records

S-4. Seed quality: The seeds shall be procured only from a CAA registered hatchery or SHAPHARI certified hatchery.
Compliance level: Major
Inspection method: Verification of record
S-5 Seed stocking and nursery rearing: Maximum stocking density is as per the limit prescribed by Coastal Aquaculture Authority from time to time for nursery and grow out operations. However, stocking density should be decided based on the availability of infrastructure facilities, quality and quantity of water source, operating management etc.
Compliance level: Minor
Inspection method: Verification of stocking record, assess from daily feed ration and pond sampling.

S-6. Soil and water management: The Guidelines prescribed by CAA for regulation of Coastal Aquaculture to be followed. CAA registered Probiotics only to be used as soil and water conditioner.
Compliance level: Minor
Inspection method: Visual inspection and verification of record.
S-7. Feed management: Feed management should be science based and directed towards reducing feed wastage and improving the Feed Conversion Ratio. Quality feed with adequate water stability and nutritional profile and registered by CAA shall be used.
Compliance level: Major
Inspection method: Verification of feed stock registers and seed stocking record. Field monitoring of check trays and pond sampling data.
S-8. Health management: Health management is an important aspect contributing to the success of farming activity. Health Management should be oriented towards prevention of deterioration of shrimp health by providing optimal soil & water quality conditions, daily monitoring of shrimp behavior and periodic health check.
Information on disease outbreak shall be communicated to the authorised officer/designated fishery officer and follow the directions as per the rules & regulations.
Compliance level: Major
Inspection method: physical inspection and verification of records.
S-9. Use of Antibiotics: banned antibiotics & pharmacologically active substances as per CAA list / FSSAI list should not be used.
Compliance level: Major
Inspection method: Verification of records.

S-10. Effluent management: Discharge of effluents must be done through a sedimentation pond/drain/canal, which will prevent re-suspension of sediment. The effluent parameters should meet the standards set by the Coastal Aquaculture Authority. Minimize release of water to the surroundings. Saline effluent pond water should not be discharged into freshwater canals.
Compliance level: Minor
Inspection method: Verification of records.
S-11. Harvest: Shrimp harvest and transportation must be planned in advance wherever possible. The farm should have an emergency harvest plan in case of natural calamities, diseases and challenges in the market.
Harvest and transportation should be carried out to ensure freshness of the produce when it reaches the processing plants.
Compliance level: Minor
Inspection method: Verification of records
S-12. Traceability & recall/withdrawal :
Farm shall have records for all the activities viz
POND PREPARATION: Record on soil conditions: Major
Treatments used for soil/water during pond preparation: Minor
BIO SECURITY: data of entry of vehicles & men: Minor
Data on filtration system & disinfection system at intake point: Major
SEED : Record of source and number of seeds, test reports, procurement & stocking, hapa survival etc. Minor
FEED: CAA registered feed/manufacturer certified feed for not having antibiotic residues, feed consumption data, data on feed supplements used: Major
POND MANAGEMENT: records on Physico-chemical parameters, microbiological data, details of probiotics and chemicals applied.: Minor
HEALTH MANAGEMENT: Pond-wise health observation during periodic samplings, PCR test reports, drug application if any.: Minor
HARVEST: Pond-wise harvest details, – count / size at time of harvest, quantity in kg, name & contact details of the person who has purchased the raw material- Major
Time of harvest, ambient temperature, quantity of ice used, duration of transportation to the processing unit, report from the processor on the quality of the product-Minor
DATABASE and Identification of harvested stock shall be maintained for traceability and recall/withdrawal, if needed: Minor
Inspection method: Verification of records and SOP's.
S-13 Food safety in the farms:
Shrimp farming facilities should be designed and operated in ways that prevent contamination of shrimp by workers, sewage toilets, domestic animals, machinery, oil/fuel and other possible sources.
Compliance level: Major
Inspection method: Visual inspection and lay out available with the farmer

S-14 Safety and welfare of farm workers:
Shrimp farm workers should not be exposed to hazards which may pose danger to their health and safety. Working conditions, wages, benefits and working conditions in the shrimp farm should be in compliance with local and national legislation Safety equipment should be provided to workers Children shall not be engaged for labour.
Compliance level: Minor
Inspection method: Verification of records and SOP's.
S-15 Technical competency of technical manpower:
The technician/Manager should be trained on good aquatic animal health and husbandry practices to ensure they are aware of their roles and responsibilities in maintaining shrimp health.
Compliance level: Major
Inspection method: documents regarding the qualification & trainings.

4.2 SHAPHARI Plus+ : This is an add-on Process certification. This certificate is to ensure the absence of banned antibiotic residues like Nitrofuran metabolites and Chloramphenicol in the farmed product used as raw material for export.
S+-1. Shaphari Plus+ certification is issued only to a 'Shaphari' Certified farm.
Compliance level: Major
Inspection method: Verification of records
S+-2. Farm brought under Pre Harvest Tests for all the ponds and with NO positive results for two consecutive crops. Further to Certification, testing all the ponds in the farm is mandatory for every crop to maintain the Shaphari Plus+ Certification status.
Compliance level: Major
Inspection method: Verification of records with the farmer and monitoring through the MPEDA – 'Shaphari' web portal

5.0 FARM CERTIFICATION PROCESS

Application:

SHAPHARI, Certification of farms for the production of antibiotic free shrimp production is purely a voluntary one. Farms having basic infrastructure facilities and willing to operate their farms with a clear intention of producing healthy and antibiotic residue free shrimp should apply through the online platform https://aquacert.mpeda.gov.in to get certified. Upon entry of the MPEDA-Farm enrollment number, all the details of the farmer shall be auto populated from the enrollment database. There is a provision to update the communication details auto-populated from the empanelment webportal, if desired. Only remaining details pertaining to the farm need to be entered by the farmer. If the farm is not

yet enrolled, the SHAPHARI webportal will redirect the farmer to the farm empanelment web portal to complete the process and apply for the Farm Certification.

If the application is complete in all respects and the unit meets the eligibility conditions, the farm will have to pass through two levels of audit viz. Gap audit and Certification audit to qualify for the issue of certificate.

Gap Audit:

Gap audit is meant to assess the gaps in the farm vis-à-vis the standards for Shaphari Certification and help the farmer to prepare for the Certification audit. The online application submitted by the farmer first reaches the field office. Field office conduct a preliminary evaluation based on the past information and farm enrollment details of the farm and confirms its suitability for Certification and forward the application to Certification Cell. Certification cell (CC) accepts the application and nominate an empanelled auditor to conduct the Gap audit. The Auditor visits the farm and carries out the Gap audit as per the procedure and records the details in the webportal. Non conformity (NC) to the SHAPHARI standards if any will be intimated to the farmer online/sms/WA and the farmer has to close the NC's within 365 days.

The farm with Gap Audit NC's will be placed under Aquaculture Improvement Programme wherein all possible avenues for assistance will be extended to the farmer to clear NC's recorded during the Gap audit. Failure to close the NC's within the stipulated period will lead to the rejection of the application. If everything is as per the standards, CC recommends the farm for Certification audit. The farmers may avail the assistance of the field office of MPEDA for clearing the NCs.

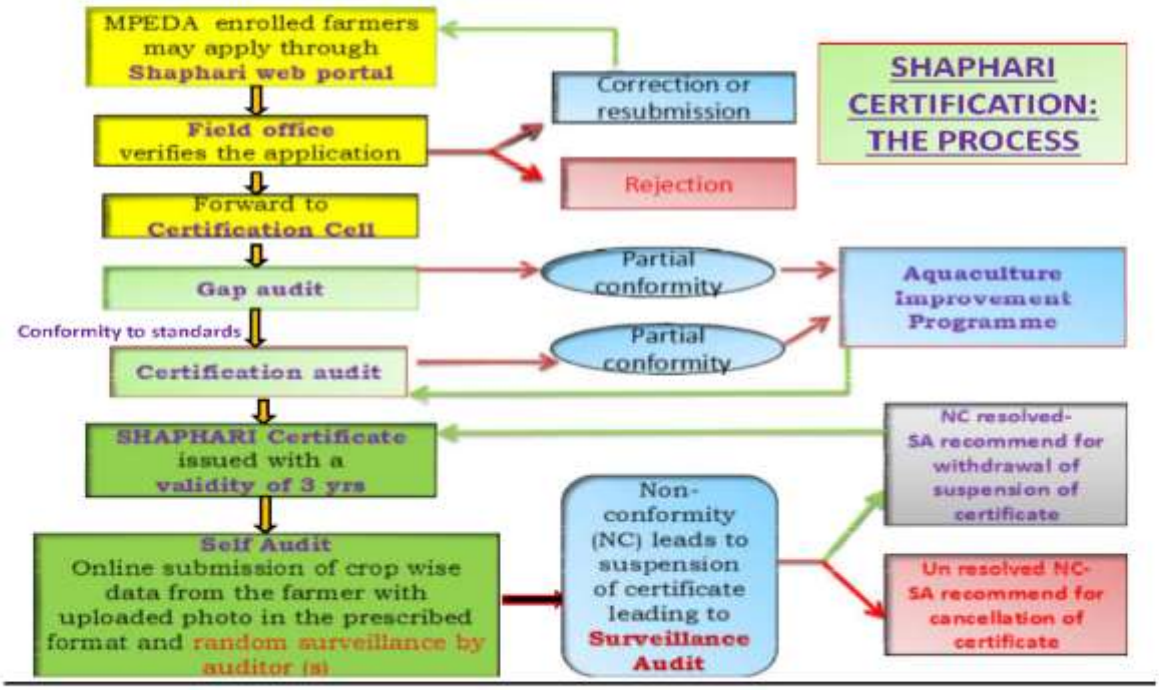

Fig.II: Shaphari Farm Certification process

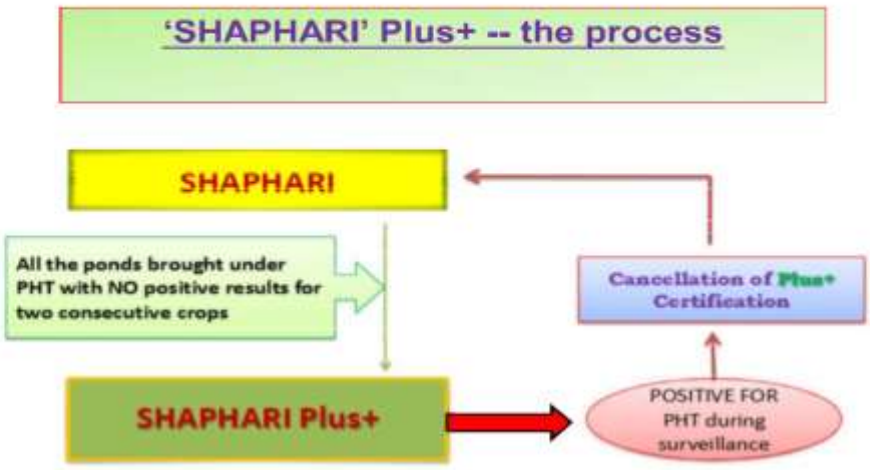

Fig. III: Shaphari Plus+ Farm Certification process

Certification Audit:

The CC assigns the Audit to a committee of auditors consisting of three members with a minimum quorum of two members by visiting the farm and submitting the details in the web portal. Field office shall intimate the farmer in advance through sms/WA/phone/email for uploading essential documents in the webportal for the perusal of the Auditors. The Auditors may peruse the documents prior to the visit to the farm and ask for more information if required. Further, auditors conduct the audit wherein the original documents may be presented by the farmer for verification of the records to confirm whether the farm follows the standards for Shaphari Certification and as per CAA guidelines for the production of good quality shrimp free from residues of banned antibiotics/pharmacologically active substances. Farms with NC's recorded during Certification audit will be placed in Aquaculture Improvement Programme (AIP) for a maximum period of 365 days from date of Certification audit during which all possible avenues for assistance will be extended to the farmer to clear NC's recorded during the certification audit. Failure to close the NC's within the stipulated period will lead to the rejection of the application.

Issue of Certificate

Farms that successfully pass Certification audit will qualify for issue of SHAPHARI certificate for production under Good Aquaculture Practices.

Validity of Certificate

The Certificate issued is valid for a period of two (2) years from the date of issuing the Certificate.

Surveillance Audit:

Post Certification of the farm, the farmer is responsible to furnish the crop details (once in 6 months) in the SHAPHARI webportal in a prescribed format which is a pre- requisite to retain the validity of the Certification. Non – Conformity to the above will lead to Suspension of the Certificate and trigger surveillance audit. The surveillance audit shall

i. recommend for withdrawal of suspension of the Certificate upon clearance of NC's
ii. recommend cancellation of Certification, upon confirming breach of standards/terms & conditions,

Surveillance audit shall be conducted by a three member committee with a minimum quorum of two members. Surveillance audit shall also be conducted on a random basis to confirm that the farms are conforming to the standards and the information uploaded by the farmer during the self audit is genuine.

Grievance redressal body:

Farmers may post their grievance with regard to Shaphari Certification in the Shaphari webportal. Certification cell (CC) will resolve the grievance within 30 days of posting the grievance. Serious issues that CC cannot resolve will be placed before the Grievance redressal body for consideration and resolution.

6.0 SCHEME GOVERNANCE:

The Marine Products Export Development Authority (MPEDA) is the custodian of the Scheme. The governance of the scheme will be as given below.

Competent Authority: The Competent Authority for the scheme will be the Chairman, MPEDA.

Standard setting, Steering and Ethics Committee

Standard setting, Steering and Ethics committee is an advisory body that is made up of senior stakeholders and experts to ensure that certification process align with the set objectives, to monitor progress, approving changes related to scope or budgets, conflict resolution, provide guidance on different issues that will help the certification scheme to produce deliverables eventually. The committee ensure that the entire certification process progress in an atmosphere of transparency and accountability. Feedback collected from the stakeholders shall also be included in standard development. The committee will review those standards at least once in a year. Recent scientific studies as well other relevant international norms or sector- specific standards will be considered for inclusion by the committee as and when required.

The committee shall be headed by the Chairman, MPEDA with members as follows:

1. Director, MPEDA, or an officer nominated by Chairman, MPEDA.
2. Representative of CAA
3. Representative of CIBA
4. Representative of CIFT
5. Representative of EIC
6. Representative of Farmer's Association
7. Representative of Hatchery Association
8. Representative of Seafood Exporters Association
9. Nominated subject expert
10. Nominated subject expert

Certification Cell:

Certification cell will be responsible for implementation of the scheme and day to day operational monitoring of the scheme. Certification cell shall be responsible for

a. Identification and empanelment of Auditors.
b. Organising training for Auditors and field officers.
c. Allotment of auditors for Gap audit and certification audit of the farm applied for the registration.
d. Database maintenance with regard to received applications for

certification, audit reports, surveillance reports, Non Compliance reports, compliance reports, sample collection and lab analysis reports pertaining to each farm applicant.

e. Issuing certificate for the eligible farms based on the approved guidelines.
f. Uploading real-time information in MPEDA website.
g. Initiate compliance resolution process as per the guidelines with regard to certification from the farms.
h. Convening Standard, Steering and Ethics committee meeting, Grievance redressal committee meeting, as and when required for the smooth conduct of the certification scheme.
i. Co-ordination of the activities of various committees.
j. Maintenance/modification & upkeep of the webportal

The Certification cell consists of the following members:

1. Deputy Director (Aqua), MPEDA.
2. Asst. Director (Aqua), MPEDA.
3. Jr.Technical Officer or equivalent.

Additional staff if required may be engaged on contract basis.

Grievance Redressal body:

This body is responsible for resolving conflicts, complaints and eligibility issues, with regard to the Certification application which could not be resolved by the Certification cell.

This appellate body is a three member committee of experts with the following members.

1. Director, MPEDA or an officer nominated by Chairman, MPEDA.
2. Representative of the Farmer's Association.
3. Representative from CIBA

This body will be constituted by inviting nominations from the said organizations/departments for acting as members of the committee.

7.0 AUDIT AND AUDITORS

The certification procedures involve audit of the farm and surveillance of the implementation of the GAPs in farm operation. Audit will be conducted during the farm operations period. Auditors are selected and empaneled by a designated auditor selection committee that will follow prescribed norms for selection of auditors. Auditors may be chosen from different fields such as farming, quality control and environmental protection. Independent third party audit institutions will also be considered for conducting the audit.

The auditors will be empanelled based on the stipulated qualification and experience. Empanelled auditors will be provided with necessary training on Auditing with the help of professional trainers.

Auditors will be assigned to audit farms on a random basis by the Certification cell based on the availability. All the audits shall be conducted with prior notice and in consultation with the farmer.

The auditors will have to follow the farm audit format and guidelines provided to them and enter their observations/findings in the respective columns in the web portal within 10 days of the audit.

8.0 GUIDELINES FOR GOOD AQUACULTURE PRACTICES (GAP)

For producing residue free and pathogen free shrimp, it is imperative to ensure good bio-security as well as responsible use of chemicals, while adopting CAA guidelines for farm operation. Good Aquaculture Practice is sustainable aquaculture methods respecting the environment, assuring an adequate use of authorized inputs and ensuring that aquaculture products comply with relevant hygiene standards and requirements for contaminants and residues when harvested, before reaching processing establishments. CAA guideline for regulating coastal aquaculture as annexed (An-I) will be the benchmark for verification/auditing.

9.0 CONCLUSION

Benefits to the farmer is as follows:

1) Farmer is benefitted by receiving training on recent advances in shrimp farm operations through workshop conducted as part of the Certification scheme. Farmers will be provided with necessary amenities required for maintaining farm records.

2) MPEDA propose to provide publicity to the farms brought under Certification among the processors/exporters for better market access and pricing.

3) Certified products shall help the farmer to get better price for the shrimp produced in the farm.

4) Processors and exporters may source the shrimp at a premium for exports to markets like EU/Japan etc. without the risk of rejections due to antibiotic residues.

Outcome of the pilot project on Certification will be evident from the second year of operation itself. Accordingly, an independent committee may assess the impact of Certification on the quality of shrimp produced and take a decision to extend the Certification to more farmers. Unlike the traditional certification processes, utilisation of webportal will considerably reduce the cost of Certification and improve the efficiency and transaparency.

In a world in which the demand for fishery products are increasing certification appears to be a possible way to bring about a greater degree of control and sanity in the system and supply of safe seafood with better quality. The role of certification programs will not only provide consumers with a safe product but it will also ensure better returns to farmers, reduction in rejections of export consignments and will lead to increased export earnings.

Appendix: I

SHAPHARI- CERTIFICATION OF FARMS
for the production of antibiotic residue free shrimp

I. Guideline formulating Committee

1. Dr.M. Karthikeyan, Director, MPEDA.
2. Shri.A.Antony Xavier, Director (Tech), CAA.
3. Shri.Balasubramaniam V, Gen. Secretary, PFFI.
4. Shri.D.Ramraj, President, AISHA.
5. Shri.G.Pawan Kumar, SEAI representative.
6. Dr.P.K.Patil, Principal Scientist, CIBA.
7. Dr. Satyen Kumar Panda, P.S, CIFT.
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Guidelines for Regulating Coastal Aquaculture

Annexure-I

(see rule 3)

Guidelines for Regulating Coastal Aquaculture

Contents

Guidelines for Regulating Coastal Aquaculture

1.0 Introduction

1.1 Coastal aquaculture entails managed farming or culture of organisms in saline or brackishwater areas for the purpose of enhancing production, both for domestic and export markets. Coastal aquaculture in the broader sense includes culturing of crustaceans like shrimp, prawn, lobsters, crabs and finfishes like groupers, sea bream, mullets and molluscs like clams, mussels and oysters.

1.2 These guidelines are to ensure orderly and sustainable development of shrimp aquaculture in the country. The guidelines are intended to lead to environmentally responsible and socially acceptable coastal aquaculture and also enhance the positive contributions that shrimp farming and other forms of aquaculture can make to socio-economic benefits, livelihood security and poverty alleviation in the coastal areas.

1.3 The present guidelines are to cover the entire gamut of shrimp farm management and measures to reduce the environmental impact of the wastewater discharged from shrimp farms, treatment of such wastes and mitigation of the adverse impact of such wastes on the environment as well as resolution of social conflicts, which could lead to sustainable development of shrimp aquaculture. The guidelines are intended to assist the farmers in adopting good management practices (GMP).

1.4 These guidelines are for the use of all stakeholders involved, including shrimp farmers, the coastal community, State Fisheries Departments, Pollution Control Boards and the Ministries and Departments of the Governments of India and the States.

2.0 Shrimp aquaculture

2.1 Shrimp aquaculture is one of the most common and popular farming practices in the coastal areas. By the end of 2004 out of an estimated 12 lakh ha amenable for coastal area only about 1 50 000 ha is under shrimp farming producing about 1 20 000 tonnes of shrimp every year. *Peneaus monodon* is the most commonly farmed species for which the technology is also well established. Presently, about 80 per cent of the shrimp culture activities in the country are under traditional/ extensive systems.

2.2 Shrimp aquaculture also resulted in development of several ancillary/ associated activities such as seed production, feed production and processing units as well as aquaculture machinery/ equipment production. Together, these activities have contributed to the generation of livelihood options and employment opportunities in the coastal areas.

3.0 Shrimp aquaculture practices

3.1 The technology, scale and intensity of shrimp aquaculture determine the production and productivity as well as the environmental and socio cultural impacts on the coastal environment. Presently, traditional/ improved traditional and scientific extensive shrimp farming practices are most common and adopted by the farmers in the coastal areas of the country. Traditional/ improved traditional systems are characterized by low stocking densities and limited application of supplementary feeding or fertilizers. In scientific extensive farming, supplementary seed and feed are encouraged as a means of integrating more effectively the use of land and water resources in the coastal areas.

3.2 The other technologies of shrimp farming such as semi-intensive and intensive are not recommended as they involve the use of higher stocking density of seed and larger quantities of feed and fertilizers. Such practices generally place larger demands on the natural resources and result in higher organic load leading to pollution and social impacts in the coastal areas. Therefore, only traditional/ improved traditional and scientific extensive systems of shrimp farming shall be permitted in the coastal areas.

4.0 Site selection

4.1 Site selection is an important process in aquaculture as this can often decide the success or failure of the shrimp farm, small or large. Besides technological (biological, physical and chemical) aspects of aquaculture, the environmental and socio-economic aspects covering social, economic and legal issues are important parameters to be considered while finalizing the site for setting up a shrimp farm. It is also essential to look into the previous use(s) and topography of the site to determine the adequacy of the site and cost of farm construction.

4.2 The following guidelines on site selection are to ensure that shrimp farms are harmoniously integrated into the local environment and social settings. By identifying the limitations that influence the suitability of a site, it is possible to incorporate corrective measures in the farm design and also formulate remedial measures for the negative impacts likely to arise out of these limitations.

4.3 Large-scale shrimp aquaculture may bring in excessive demand on land resources, resulting in multi-user conflicts. Construction of shrimp farms may make inroads into agricultural land. The States must undertake detailed surveys to identify lands/ areas, which are fit for different purposes and allocate suitable area for shrimp farming. They should discourage conversion of agriculture land for aquaculture. Construction of shrimp ponds on marginal land not fit for cultivation alone should be permitted. However, the competitive and cooperative activities of the different sectors concerned should also be considered while giving approval to setting up of shrimp farms.

4.4 Generally clayey loam soils are preferred. High capital and operational cost will be involved in maintaining a farm in sandy area, which is also to be avoided owing to the high water percolation through the sandy soils, and possible environmental damage which could arise from it. Further, the topography of the soil and its contour should be ascertained in relation to the water intake and drainage points as well as construction costs. A better site is the one, which involves lesser capital investment for constructing fully drainable ponds.

4.5 The quality of soil should be ascertained for soil pH, permeability, bearing capacity and heavy metal content. Soil with low pH of below 5 (example acid sulphate soils) should be avoided. Similarly, soils with high concentrations of heavy metals also should be avoided. The suitable soil characteristics ideal for construction of a shrimp farm are as follows:

pH	Organic carbon	Calcium carbonate	Available nitrogen	Available phosphorus	Electrical conductivity
7-8	1.5 – 2.5%	> 5%	50–75 mg/100 g soil	4–6 mg/100 g soil	> 4 µmhos

4.6 The hydro-meteorological data of the proposed area is very important to develop the design of the farm and to ensure the availability of acceptable water quality in the farm. The most important data required in this regard are rainfall, tidal fluctuation, wind direction and velocity, flood levels, frequency and time of occurrence of natural calamities such as storm, cyclone, hailstorm, etc. Construction of farms in cyclone prone areas and places where natural calamities such as floods occur should be avoided.

4.7 Mangroves play an important role in soil binding, as a source of nutrient cycling, as a buffer and a natural biological filter of several pollutants and as a breeding ground and

nursery area for many important fin and shellfishes. There is evidence that removal of mangroves leads to a decline in fin and shellfish recruitment to the open waters through reduced availability of post-larvae. Mangroves are now legally protected under the environment law of the country.

Large concentration of shrimp farms in mangrove areas has not proved sustainable elsewhere in the world. Mangrove soils are potential acid sulphate soils and not conducive for setting up of shrimp farms. The States should not permit shrimp farm construction within natural mangrove areas, or ecologically sensitive wetlands, swamps, etc.

4.8 The infrastructure facilities like roads, electricity, proximity to hatcheries, feed manufacturing units/ feed retailers, ice plants, processing plants should be considered while choosing the site for a shrimp farm since these play an important role in the economics of culture operations.

4.9 The following guidelines, which are mandatory, should be adopted for site selection and also to avoid subsequent social and environmental impacts.

- Mangroves, agricultural lands, saltpan lands, ecologically sensitive areas like sanctuaries, marine parks, etc, should not be used for shrimp farming.
- Shrimp farms should be located at least 100 m away from any human settlement in a village/ hamlet of less than 500 population and beyond 300 m from any village/ hamlet of over 500 population. For major towns and heritage areas it should be around 2 km.
- All shrimp farms should maintain 100 m distance from the nearest drinking water sources.
- The shrimp farms should not be located across natural drainage canals/ flood drain.
- While using common property resources like creeks, canals, sea, etc, care should be taken that the farming activity does not interfere with any other traditional activity such as fishing, etc.
- Spacing between adjacent shrimp farms may be location specific. In smaller farms, at least 20 m distance between two adjacent farms should be maintained, particularly for allowing easy public access to the fish landing centers and other common facilities. Depending upon the size of the farms, a maximum of 100 – 150 m between two farms could be fixed. In case of better soil texture, the buffer zone for the estuarine-based farms could be 20 –25 m. A gap having a width of 20 m for every 500 m distance in the case of sea based farms and a gap of 5 m width for every 300 m distance in the case of estuarine-based farms could be provided for easy access.
- Larger farms should be set up in clusters with free access provided in between clusters.
- A minimum distance of 50 – 100 metres shall be maintained between the nearest agricultural land (depending upon the soil condition), canal or any other water discharge/ drainage source and the shrimp farm.
- Water spread area of a farm shall not exceed 60 per cent of the total area of the land. The rest 40 per cent could be used appropriately for other purposes. Plantation could be done wherever possible.
- Areas where already a large number of shrimp farms are located should be avoided. Fresh farms in such areas can be permitted only after studying the carrying/ assimilation capacity of the receiving water body.

5.0 Construction and preparation of shrimp farms

5.1 Farm Design and Construction: Proper designing and construction of shrimp farm is essential for their efficient management and for promoting environmental protection. Good site selection and incorporation of mitigatory features in the farm design are the best ways to avoid problems related to flood levels, storms, erosion, seepage, water intake and discharge points. A site-specific approach to design and construction of shrimp farms is necessary, as site characteristics vary greatly from place to place. The following checklist should be considered while designing and constructing shrimp farms:

Checklist for farm design and construction
• Embankments should be designed to prevent flooding and erosion, after taking into consideration the tidal amplitude, water current, wind direction, wave action and the past histories of flooding in the area during cyclones/ storms. • In soils, which are seepage prone, design should include an inner clay core in the dykes with greater compaction and trench around the farm to reduce saline water intrusion into the neighbouring lands. • The elevation of the pond bottom, drainage canal and the outlet should be designed in such a way that the water in the farm can be drained fully and easily through gravity. • Ponds should have separate intake and outlet structures to permit control of filling and draining. • A minimum water depth of 80-100 cm should be maintained in the ponds. • Inlet and discharge canals should be separate so that water supply and wastewater are not mixed. In areas where such a provision cannot be made, it is advisable that waste treatment pond should be included in the design. • The farm design should not alter natural water flows, or impound floodwater. • The sluice gates should be watertight and provided with net filters. • Where possible, vegetative buffer zones, riparian vegetation and habitat corridors should be maintained and vegetative cover provided on exposed earthwork. • Pump intakes should be screened, vegetative buffers provided around pump stations, and containments installed to prevent fuel spills.

5.2 Construction of Intake Reservoirs and Effluent Treatment Ponds: In areas where the source water is turbid with suspended particles, an intake reservoir for settling the silt is very essential. Similarly, in areas where there is overcrowding of shrimp farms and the intake and outfall are from the same source (*i.e.* creek, estuary, backwater) the intake reservoir with provision for treatment of water is essential. In areas where the tidal current is swift and tidal amplitude is high, the wastewater from the farm can be directly let out during the low tide. But in areas where the tidal current is very low, it is essential that the wastewater be treated in an Effluent Treatment Pond (ETP) before it is released into the natural system. An ETP, as a reservoir for holding and regenerating wastewater, is mandatory for farms larger than 5 ha. A minimum of 10 percent of the total farm area should be reserved for this purpose. It is also necessary that smaller farms that are located in close proximity to each other (farm clusters) should consider setting up of common ETP to avoid self-pollution and also release of excess nutrients and suspended solids, which could lead to eutrophication of the receiving water body.

For better water management, individual culture units should be within 5 ha areas and suitable feeder channel system should be provided within the farm so that the water intake can be effectively managed in all the individual units.

5.3 Pond Preparation: Pond preparation is an essential part of culture practices during which the metabolite load and contaminants (chemical and biological) in the soil from the previous culture cycle is removed through tilling, ploughing and drying. During pond preparation, the pests and predators are removed and pH and nutrient levels in the water and soil are brought to optimal concentrations through application of lime, organic manures and inorganic fertilisers. The following checklist would assist in pond preparation and reduction of the possible environmental impacts:

- Pond sediments from the previous culture, which are likely to have accumulation of nutrient loads and other contaminants, should not be disposed off in the natural environment. In case it is necessary to remove the sediments it should be disposed off within the farm site itself, by putting such sediments in trenches made in the wide dykes. However, it should be ensured that these sediments do not leach out.
- Application of lime is useful in correcting the pH of the soil and water, as a disinfectant and for increasing the mineralisation process. If the soil pH is not below 7.5, a basal dose of 300-500 kg/ ha can be applied. However, in acid soils, where the pH is low, the quantity of lime to be applied should be calculated based on the pH and type of lime used.
- Unwanted /pest organisms should be killed and removed from the pond by drying of the pond bottom. In cases, where complete drying is not possible, organic, biodegradable piscicides such as *Mahua* oil cake (100-150 ppm), tea seed cake (15-20 ppm) and also lime *(Calcium oxide preferred)* can be used. No chemical piscicide should be used.
- After the application of the organic piscicide at least a period of 10 days should be given for its toxic effect to be removed. Chlorination can be done to remove the pests and pathogens in ponds where drying of pond bottom is not possible.
- Fertilizers and manures should be used judiciously as per the requirement, according to recommended doses (Table 1 below). Over fertilization should be avoided. Fertilizer schedule should be decided based on the phytoplankton growth in the ponds. The colour and transparency of the water can be taken as indicators of plankton growth. Optimal density of phytoplankton should be maintained throughout the culture period.
- Heavy algal bloom should never be allowed to develop since crash of algal bloom may lead to anoxic conditions in the pond thereby affecting the survival and growth of the shrimps.

Table 1. Recommended dosages of organic manures and inorganic fertilizers for improving production from traditional and extensive systems of farming

Dosage of manures in relation to organic carbon content of soil		
	Prescribed basal dose	
Organic Carbon in soil (%)	Raw cow dung (kg/ha)	Dry chicken manure (kg/ha)
1	500	175
0.5	1000	350
0.25	2000	700

Application of Urea in relation to available Nitrogen	
Available N in soil (mg/100g soil)	Urea to be applied (kg/ha)
12.5	100
25.0	50
50.0	25

Application of super phosphate in relation to available Phosphorus	
Available P in soil (mg/100g soil)	Super phosphate to be applied (kg/ha)
1.5	100
3.0	50
6.0	25

(Source: Aquaculture Authority, 1999)

6.0 Water quality and its management

6.1 Brackishwater/ seawater in adequate quantities should be available throughout the year. The water source could be from backwaters, canals/creeks, lagoons or sea. The quality of the water available in the site has a strong influence on the success of the shrimp farm. Water quality parameters like pH, salinity, dissolved oxygen (DO) and the presence of toxicants/ pollutants should be ascertained. Low pH water will pose serious problems and similarly wide fluctuation in salinity will also be detrimental to the cultured species. The water source should be free from any industrial/ agricultural pollution. The presence of contaminants and their levels should be considered in the light of the tolerance and also sub-lethal effects on the species to be cultured. The optimal levels of various water quality parameters for better survival and growth of shrimps are listed in the Table 2 below:

Table 2. Optimal levels of water quality parameters for shrimp farms

Sl. No.	Water Quality Parameters	Optimal Level
1.0	Temperature (^{o}C)	28–33
2.0	Transparency (cm)	25-45
3.0	pH	7.5 - 8.5
4.0	Dissolved oxygen (ppm)	5 – 7 (above 50% air saturation)
5.0	Salinity (ppt)	15-25
6.0	Total alkalinity (ppm)	200
7.0	Dissolved inorganic phosphate (ppm)	0.1 - 0.2
8.0	Nitrate - N (ppm)	< 0.03
9.0	Nitrite - N (ppm)	< 0.01
10.0	Ammonia - N (ppm)	< 0.01
11.0	Cadmium (ppm)	< 0.01
12.0	Chromium (ppm)	< 0.1
13.0	Copper (ppm)	< 0.025
14.0	Lead (ppm)	< 0.1
15.0	Mercury (ppm)	< 0.0001
16.0	Zinc (ppm)	< 0.1

6.2 Nutrients and organic wastes produced in shrimp culture ponds consist of solid matter (mainly uneaten feed, faecal matter and dead plankton) and dissolved metabolites (mainly ammonia, phosphate, carbon dioxide, nitrite and nitrate). Various management methods are followed to maintain these within the tolerable limits. Among these, the most economical is water exchange. A water exchange of 5 – 30 percent per day is usually done depending on the availability of water and the quality of pond water. A variety of chemicals and probiotics are used in improving the water and soil quality.

6.3 The following guidelines are to ensure that the harmful effects of these practices are reduced.

- Good water quality should be maintained by using water stable feed with minimal wastage.
- Water quality parameters should be monitored regularly and periodical water exchange is necessary to maintain optimal water quality conditions. While exchanging water, care should be taken to avoid wide fluctuations in water quality, so as to avoid stress to the shrimps and proper screens should be used to prevent the entry of pests and predators. Dissolved oxygen concentrations should be measured during early morning hours.
- Fertilisers and lime should be used in a responsible manner only when it is actually required.
- Use of freshwater to reduce the *salinity* of the culture water should be avoided for sustainability reasons; even though the shrimps can adapt and grow in a wide range of salinity, it is better to avoid salinity fluxes so as to avoid stress to the shrimps, which could make them more prone to diseases.
- In low density cultures, high level of water exchange is not required. In view of the complaints of nutrient loading in the open environment and the fear of viral contamination in the source water, the water exchange should be need-based. If water quality remains within optimal limits no water exchange is required for the first two months of rearing.
- Indiscriminate use of chemicals, bacteriological and enzyme preparations that supposedly enhance nutrient removal, organic matter, oxidation and removal of ammonia from water and soil should be avoided.

7.0 Seed production

7.1 All shrimp hatcheries need to be registered by MPEDA as per their norms which may be reported to the Authority at its subsequent meeting. The Authority will have the power to review the registration of hatcheries and to take appropriate decisions in tune with the requirements of the Coastl Aquaculture Sector.

7.2 Production of healthy and disease free shrimp seed is the first step towards sustainable shrimp farming. About 300 shrimp hatcheries were set up in the country by the end of 2004 with a total production capacity of 12 billion post-larvae. These hatcheries are mostly located on the East coast of the country.

7.3 Hatchery operations can be broadly classified into broodstock, larval/ post larval rearing and live feed management. Since production of healthy seed is a primary step towards disease free farming, shrimp hatcheries are required to maintain strict sanitation, quarantine and quality control management to ensure bio-security and health management. These following guidelines should be adopted by the shrimp hatchery to ensure production of standard and homogeneous quality seed, which are pathogen free.

7.4 Water quality: Hatcheries should ensure good supply of oceanic quality seawater with the following optimal water quality characteristics in its rearing systems so as to avoid any stress to the larvae. This can be achieved by selecting a good site with the required water quality.

Table 3. Recommended water quality parameters for shrimp hatcheries

Parameters	Tolerable Limit	Optimal Levels
Temperature (^{o}C)	18-36	28-32
Salinity (ppt)	26-34	30-34
pH	7.0 - 9.0	8.0 - 8.4
Dissolved oxygen (ppm)	Above 3	Above 4
Ammonia - N (ppm)	Up to 0.1	Less than 0.01
Nitrite - N (ppm)	Up to 0.1	Less than 0.01

Further, the water should be treated to remove all the suspended solids, dissolved nutrients and bacterial and viral pathogens. This could be achieved by following a good water treatment protocol, which includes:

- Sedimentation
- Water chlorination and dechlorination
- Filtration with sand filters
- Filtration with activated carbon filter
- Cartridge filtration up to 1 micron size
- UV filtration/ Ozonation

7.5 Spawner/ broodstock quality: Vertical transmission of viral pathogens from mother shrimps to larvae through the ovarian tissue is one of the sources of introduction of viral pathogens into the hatchery system. In addition to that any stress caused to the spawners will result in spawning of poor quality eggs. The following measures should be strictly followed to obtain good quality eggs.

- Spawners/ broodstock collected from commercial trawling operations will be stressed after being caught in the trawl nets. They should be immediately transported to the hatcheries without further stress/ injuries.
- The spawners collected should be placed individually in disinfected water and immediately transported individually under oxygen packing. Maintaining the spawners individually from the time of their capture is more important to avoid cross contamination with viral pathogens.
- The broodstock should be quarantined on arrival at the hatchery to prevent the entry of pathogens.
- Spawners/ broodstock, which do not have lesions, damage to gills, loss of appendages and red colouration, should only be selected.
- Prophylactic treatment of spawners/ broodstock with formalin at 50 ppm for 1 hour under strong aeration should be done before introducing the stock into the hatchery/ maturation system.
- Spawners/ broodstock should be kept individually for acclimatization and screened for the presence of WSSV using a terminal portion of pleopods and for monodon baculo virus (MBV) from the faecal matter. Only spawners free from these pathogens should be taken into the hatchery/ maturation system.

7.6 Induced maturation under captive conditions: Healthy, pathogen free, immature, broodstock, collected from wild, after the prophylactic treatment and acclimatization

should be taken into the maturation tanks and allowed to recover from the stress of capture and transportation for 4-5 days. Then they are induced to mature through eyestalk ablation following the guidelines given below:

- Hard shelled, intermoult healthy female shrimps free from disease or injury having spermatophore in the thelycum should be selected for eyestalk ablation.
- The females should be above 100 g in size for ensuring good quality eggs.
- Eyestalk ablation is to be avoided for newly moulted and ready to moult female shrimps.
- Electrocauterisation is the best way of ablating eyestalk since it causes minimum stress.
- The ablated female shrimps are stocked in the maturation tanks along with unablated males @ 4 nos/ m^2. Stocking of females and males in the ratio of 2: 1 ensures best mating success.
- Fresh feeds such as clam (*Meritrix sp.*), mussel (*Perna viridis*) and squid (*Loligo* sp.) having similar amino acid profile as shrimps, polychaete worms, Artemia biomass rich in long chain poly-unsaturated fatty acids are used as maturation feeds. Feed should be provided in sufficient quantities by visual observation. Feeds like crabmeat, which are carriers of pathogens, should be avoided.
- In addition to live feed items, pelleted feed fortified with polyunsaturated fatty acids (PUFA) such as arachidonic acid, eicosopentaenoic acid and decasohexaenoic acid should be used to ensure good egg quality.
- Water quality should be maintained under optimal conditions with 100 percent to 200 percent water exchange per day.
- Light intensity should be maintained low and the movement of personnel near the maturation tanks should not disturb the ablated shrimps.

7.7 Spawning and hatching:

- Wild spawners/ induced matured stock should be disinfected with formalin treatment before placing them individually in spawning tanks.
- Feed should not be provided in the spawning tanks.
- Spawned eggs should be collected, washed thoroughly and disinfected by formalin dip treatment and re-suspended in fresh seawater for hatching.
- The quality of the eggs should be assessed within 2 hours after spawning when it will be easier to identify the fertilized and unfertilized eggs.
- If the quality of eggs is very poor, it is advisable to discard the eggs.
- Only active positively photo tactic nauplii should be collected for transfer to larval rearing tank.
- Nauplii should be tested for WSSV before transfer to larval rearing tank.

7.8 Larval rearing/ nursery rearing:

- Nauplii from a single spawner should be reared separately to avoid cross contamination.
- Stocking density of nauplii should be maintained at 50 no./l in larval rearing tanks.
- Algal feed should be initiated before nauplii moult to zoea 1.

- Algal feed should be given in required quantity from cultures that are in exponential stage of growth.
- Algal feed should be concentrated to avoid introduction of large quantities of algal culture water with its nutrient load.
- Water quality in the larval rearing should be monitored for ammonia, nitrite and bacterial load.
- Uniform aeration in all parts of the tanks should be provided through air diffuser stones placed @ 1 no/ sq. ft. This will keep the larvae and the algal feed uniformly distributed in the tank.
- During water exchange, appropriate mesh size nets should be used for draining the water so as to facilitate the removal of faecal matter without stressing the larvae.
- Artemia nauplii/ flake diets should essentially be used from Mysis II stage onwards along with the algal diet.
- Prophylactic use of antibiotics or other drugs should be avoided and only permitted antibiotics, chemicals, etc should be used. Probiotics should be used to the maximum extent possible.
- At PL5, the larvae should be collected from the larval rearing tanks, disinfected with formalin dip treatment and distributed in outdoor nursery tanks @ 15-20 nos/ litre.
- During later stages of nursery rearing, along with artemia nauplii, other live feed items like clam meat or balanced compounded feed can be used.
- Acclimatization to required salinity levels should be done gradually in the nursery stage of rearing.
- Only PL20 should be sold to the farmers after testing its quality with reference to presence of Monodon Baculo Virus (MBV) and White Spot Syndrome Virus (WSSV). At any stage of rearing, if WSSV is detected, the larvae from the whole tank should be discarded.
- For long distance transportation, the seed should be packed in thermocol boxes at reduced temperature.
- Supplementary feeds and raw materials should be properly handled and stored to avoid spoilage.

7.9 Algal culture:

- Algal culture should be maintained in pure form in indoor; temperature controlled rooms and used as started culture for outdoor mass culture.
- It is advisable to use UV treated water for the pure culture of the algae, to prevent contamination.
- The quality of the mass culture should be tested before feeding in larval rearing tanks.

7.10 Artemia hatching:

- Artemia cysts should be disinfected before keeping them for hatching.
- Hatched artemia nauplii should be segregated from the cyst wall and un-hatched cysts before being used as feed in larval rearing tanks.
- Only the nutritionally superior instar I nauplii should be used as feed.

7.11 General bio-security procedures:

- The quality of intake water is very important for healthy operation of a shrimp hatchery. The pollution free water drawn from natural sources should be filtered and possibly, sterilized before usage.
- Movement of men, materials and paraphernalia between different sections of the hatchery should be controlled to avoid contamination.
- Foot pits, washbasins, toilets, etc. should be provided to ensure adequate sanitation and hygiene in the hatchery premises.
- The effluent water should be properly treated in a effluent treatment system before discharge. Regular monitoring of effluents to ensure environment standards, stipulated.
- Hatchery should have adequate facilities for pathology lab like microbiology/PCR facilities to check the health condition of brooders/seeds at different stages.
- Diseased or moribund shrimps should be disposed off safely to prevent contamination of the stock.
- Bio-filters, tanks, buckets, nets, etc. should be thoroughly washed and cleaned using sanitizers and dried thereafter. Regular disinfections should be carried out to ensure bio safety.
- The hatcheries are required to monitor their effluents frequently so that the water quality standards remain within the limit stipulated in Table 5. Considering the need for maintaining effluent discharge standards, effluent treatment system shall be mandatory for all hatcheries.
- It is essential that hatcheries maintain proper records of their activities in various sections, for verification by the supervising agencies and also to ensure traceability and easy market access.

7.12 Shrimp hatcheries require large quantity of seawater for their day-to-day operations. The water used in the hatchery and let out is likely to be contaminated with dissolved or suspended organic matter, nutrients, chemicals, antibiotics, etc. When contaminated water is discharged into open, it is likely to result in environmental pollution that could be detrimental to the hatchery operation itself, since intake and discharge points are nearby. Therefore, it is necessary to properly treat the effluents so that the discharged water conforms to environmental standards.

8.0 Seed selection and stocking

8.1 Seed quality has a direct relationship with the survival and growth of the cultured shrimps and the stocking density has a strong bearing on the level of waste generated in the pond. The higher the stocking density the larger the quantity of feed that has to be used. Higher stocking densities also stress the animals leading to greater incidence of disease. In ponds with excessive stocking and feeding rates, the wastewater is generally of low quality and has a greater potential to cause water pollution than wastewater from ponds stocked at more reasonable densities. Hence, it is essential that the following guidelines be observed:

- Only healthy and pathogen-free seed from registered hatcheries should be used for stocking.

- The health status of the shrimp seed should be checked through standard testing procedures, including PCR.
- Seed collection from the natural resources should be banned by the State Governments with a view to protecting a large spectrum of fin and shellfish species from being destroyed.
- Before stocking the seed should be acclimatised to the prevailing temperature, salinity and pH in the pond conditions by gradual mixing. In areas with very low salinity, salinity adjustments are to be made over a period of 4 –5 days and hence should be done at the hatchery itself.

8.2 In view of the strong impact of stocking densities on sustainability of farming practices, low stocking densities would only be permitted in shrimp aquaculture. However, such stocking densities for different types of practices shall be as per the regulation of the Coastal Aquaculture Authority.

9.0 Feed and feed management

9.1 All shrimp feed manufacturing units need to be registered by MPEDA as per their norms which may be reported to the Authority at its subsequent meetings. The Authority will have the powers to review the registration of feed mills and to take appropriate decisions in tune with the requirements of the coastal aquaculture sector.

9.2 Feed is the basis for optimum yield levels in shrimp farming. About 33 shrimp feed mills with a production capacity of 1 50 000 metric tonnes of feed were set up in the country by the end of 2004. Besides, there are a large number of small feed manufacturing units, meeting local requirements.

9.3 However, shrimp do not eat all of the feed provided to them, and only a portion of the feed consumed is converted to shrimp flesh. Uneaten feed, feces and metabolic wastes add to the nutrient load in the wastewaters. As feeding rates increase, water quality and soil quality in ponds usually deteriorate.

9.4 Fresh diets increase nitrogen loads in shrimp ponds. Considerable amount of detritus and wastes often accumulate on the pond bottom, in areas where water circulation is slow, leading to increased BOD and release of harmful gases, which could cause stress on bottom living shrimps. On the contrary, regular feeding with pelletised diets is known to maximize the growth of shrimps and minimize the nutrient enrichment of the wastewater.

9.5 Feed quality and conversion ratio/ efficiency have considerable influence on waste levels. Reduction of phosphorus content in feed, control of dietary nitrogen in relation to metabolism and improvement in physical characteristics such as attractability, water stability, texture and appropriate size of the feed will help to reduce the nutrient loading to a large extent.

9.6 Careful feed management is essential for successful shrimp farming. By using good quality feed in reasonable quantities, water and soil quality in ponds remains in optimum conditions. This reduces stress on shrimp, there is less likelihood of disease, and they convert feed more efficiently to improve the feed conversion ratio and minimize feed costs. Better water quality in ponds allows minimum load of nutrients in wastewater and reduces the possibility of environmental impacts in receiving water bodies.

9.7 Monitoring of feed input is required to keep feed wastage to the minimum. Similarly, careful monitoring of standing stock in the ponds will also help to ensure that correct feeding levels are observed. The feeding rate prescribed by the manufacturer varies depending on the quality of the feed. The feeding rates given in Table 4 below are recommended. However, it should be regulated based on the check tray observations.

Table 4. Recommended feeding rates for different sizes of the shrimp

Shrimp size (g)	Daily Feed as Percentage of Body Weight
2 - 5	4.0 - 3.0
5-10	3.0
10 - 15	3.0 - 2.5
15 - 20	2.5 - 2.0
20 - 35	2.0

9.8 The following guidelines should be adopted for feed and feed management in shrimp farming:

- Feed ingredients should not contain contaminants, anti-nutritional factors, microbial toxins, banned antibiotics or other adulterating substances.
- Farm-made wet diets should not be used. However, when wet feeds are used crustaceans should be avoided as an ingredient.
- Only dry, nutritionally balanced pelleted feed with optimal water stability should be used.
- Freshly obtained feed should be used to the extent possible. In any case feed stored for more than two months should not be used. Feed should be stored in cool, dry areas to prevent mould and other contamination.
- Feeding rates should be determined from standard feed curves/charts (Table 3 above) and adjusted for shrimp biomass on a weekly basis.
- Feed check trays should be used to regulate feeding rates. Feed trays should be widely distributed in the pond.
- Both overfeeding and underfeeding should be avoided. Efforts should be directed to ensure that the shrimps consume the maximum amount of supplementary feed given, since excess feed lying uneaten would decompose and lead to poor water quality, stress to the shrimps and consequently increased vulnerability to diseases.
- Since the shrimps require about 4 hours for digestion of feed, feeding frequency should be 4 – 6 times in a day. Since shrimps are nocturnal, more than 60 percent of the feed should be fed during night.
- Feed Conversion Ratio (FCR) should be monitored. Reductions in FCR through careful feeding schedule will improve production efficiency and reduce waste loads.
- Feeds with high acceptability, high digestibility and assimilation efficiency will reduce waste generation and nutrient loading. Further this will reduce the cost of production since feed accounts for more than 50 percent of the recurring cost.

- Shrimp farmers should keep full records of daily feed schedules to enable assessment of FCR, which should be used to increase feeding efficiency and reduction in feed waste.

10.0 Health management of shrimps

10.1 Viruses, bacteria and protozoa cause the major shrimp diseases. The " White Spot Disease", caused by the White Spot Syndrome Virus (WSSV), which led to devastations in shrimp farming in India as elsewhere is the most known virus disease; the other well known virus disease is the "Yellow Head Disease", which has not been reported from India but is frequent in Thailand and other parts of Asia. Bacteria cause vibriosis. Protozoan diseases such as gill and external fouling caused by *Zoothamnium* also cause problems in shrimp farming.

10.2 Outbreak of disease in shrimp culture systems is related to the environmental factors such as deterioration of water quality, sedimentation and self-pollution. Treatment should be undertaken only when a specific disease has been diagnosed and it is known that this disease is treatable. Also, effective measures must be taken to minimize the spread of disease between farm stocks and natural stocks.

10.3 The following guidelines envisage health management as a holistic activity with disease prevention as the main objective. The approach includes reduced stocking of disease free seed, better handling, maintenance of good pond environment, and optimal feed management to reduce the stress and prevent most infectious and non-infectious diseases.

- The health of the shrimps should be monitored continuously and those with any one or more of the following conditions are diagnosed to have some disease: inactive and sluggish, empty gut, bluish/blackish coloration, body blisters, flared up gills, broken appendages, black / white spots, coloured gills and opaque muscles.
- Any disease should be diagnosed immediately with the help of trained pathologists/ microbiologists.
- Chemical treatments that can stress the animals should not be employed.
- Disease problems arising in aquaculture can be attributed primarily to the environmental degradation and most of the pathogens are facultative pathogenic in nature. Hence, management of pond environment is of utmost importance for disease prevention and control.
- For non-infectious diseases related to pond conditions, treatment of animals should be carried out or pond conditions corrected.
- For mild infectious diseases with potential to spread, the pond should be quarantined and the best options for disease treatment should be carried out.
- For serious infectious diseases that may spread widely, the pond should be isolated, remaining shrimp should be net harvested and the pond should be disinfected without discharging any water.
- Dead and diseased shrimp should be disposed off in a sanitary manner that will discourage the spread of disease.
- When disease occurs in a pond, transfer of shrimp, equipment, or water to other ponds should be avoided.

- Drug, antibiotic, and other chemical treatments should be done in accordance with recommended practices and all national and international regulations should be complied with.

11.0 Use of chemicals and drugs

11.1 Chemicals and drugs used in aquaculture include those associated with structural material, soil and water treatment, antibacterial agents, therapeutants, pesticides, feed additives, anesthetics, immuno-stimulants and hormones. Chemicals and drugs presently in use are mostly derived from agriculture/ veterinary field and have never been tested/ evaluated specifically with regard to their effects on the aquatic environment.

11.2 Some of the chemicals and antibiotics can accumulate in the flesh of shrimp and represent a potential health hazard to the consumer and also affect trade prospects. Some chemicals may also exist in effluents as residues and be harmful to natural aquatic ecosystems. Reducing the use of these agents and chemicals will improve environment performance but also reduce cost of operating shrimp farms. Shrimp health management should focus on disease prevention through good nutrition, sound pond management, and overall stress reduction rather than disease treatment.

11.3 *Use of chemicals:* Chemicals should be avoided in shrimp ponds for prevention or treatment of disease, as feed additives, disinfectants, for removal of other fish or for treatment of soil or water. However, chemicals may be required in hatcheries. The hatchery operators should carefully monitor entry of such chemicals into the natural waters from the hatcheries and they should take steps to remove such materials from the wastewaters.

11.4 *Use of fertilizers:* Both organic and inorganic fertilizers are used widely in shrimp culture for promoting the growth of fish food organisms, particularly for the early post-larval stages. This may contribute to the nutrient load in waters receiving the effluents. Therefore, as far as possible only organic manure/ fertilizers and other plant products should be used for such purposes.

11.5 *Use of piscicides:* Similarly, piscicides and molluscicides are widely used for removing predators and competitors from shrimp ponds. It would be advisable for aquaculturists to use only the biodegradable organic plant extracts for this purpose, as they are less harmful than the chemical agents. Use of chemical piscicides should be avoided.

11.6 *Use of chemotherapeutants:* Some of the chemotherapeutants such as formalin and malachite green which are commonly used as disinfectants are toxic and may affect adversely the pond ecosystem, the external waters, etc. and hence their usage in culture system should be avoided.

11.7 *Use of antibiotics/ drugs:* The use of antibiotics in shrimp culture is strictly prohibited as their use may result in development of pathogens resistant to such drugs and the transfer of these pathogens into human beings might result in development of resistance in human pathogens. The list of 20 antibiotics/ pharmacologically active substances presently banned for use in shrimp culture is given in Table 5. This ban will also apply to other substances so notified by the Government from time to time.

Table 5. List of Antibiotics and other pharmacologically active substances banned for using in shrimp aquaculture

Sl. No.	Antibiotics and other Pharmacologically Active Substances
1	Chloramphenicol
2	Nitrofurans including: Furaltadone, Furazolidone, Furylfuramide, Nifuratel, Nifuroxime, Nifurprazine, Nitrofurantoin, Nitrofurazone
3	Neomycin
4	Nalidixic acid
5	Sulphamethoxazole
6	Aristolochia spp and preparations thereof
7	Chloroform
8	Chlorpromazine
9	Colchicine
10	Dapsone
11	Dimetridazole
12	Metronidazole
13	Ronidazole
14	Ipronidazole
15	Other nitroimidazoles
16	Clenbuterol
17	Diethylstilbestrol (DES)
18	Sulfonamide drugs (except approved Sulfadimethoxine, Sulfabromomethazine and Sulfaethoxypyridazine)
19	Fluroquinolones
20	Glycopeptides

11.8 The Maximum Permissible Residual levels for various antibiotics and other pharmacologically active substances stipulated by the Government for fish and fishery products is as per appendix attached to these guidelines. Shrimp farmers and input providers should strictly follow these stipulations, which may be revised by the Government from time to time.

12.0 Harvest and post-harvest

12.1 During the harvesting maximum suspended particles are likely to be released into the open waters. Hence great care should be taken to prevent such a release. The farmers are advised to adopt the following norms while harvesting the crop:

- Harvesting can be done by completely draining the pond either by gravity or through pumping and hand picking or trapping.
- The water drained out for harvesting should be pumped into the waste stabilization ponds and kept for a few days for settlement before releasing into the open water.
- Icing should be done immediately after harvest.
- Generally, the processors/ buyers collect the harvest from farm site and transport in refrigerated vans. When such a facility is not available and the produce has to be transported over a long distance, the shrimps should be beheaded and stored in ice to prevent spoilage.

13.0 Wastewater management

13.1 The waste from shrimp ponds contain mainly suspended solids, comprising unconsumed feed, faecal matter and plankton, and dissolved nutrients such as ammonia, nitrite, phosphorus, carbon-dioxide, hydrogen sulphide. The former component is the result of physical qualities of feed and fertilizers while the nutrients are influenced by the chemical composition of the feed ingredients and the fertilisers. The nutrients and organic matter in shrimp pond wastes have potential for the following impacts:

- reduce dissolved oxygen in receiving waters, due to discharge of waste water low in dissolved oxygen and breakdown of dissolved and particulate organic matter and other waste materials (BOD and COD).
- hyper-nitrification and eutrophication of receiving waters, resulting in increased primary productivity (with potential risks of phytoplankton blooms), alteration of biological community structure and secondary productivity; and
- increased sedimentation due to organic matter, leading to changes in productivity and benthic community structure, plus possible siltation.

13.2 Such impacts depend on the quantum of wastewater outflow and the capacity of the environment to assimilate the waste materials. It is, therefore, desirable to match loads with the capacity of the environment to accept the waste materials. The following checklist will guide the shrimp farmer in responsible waste management and for protection of the water and land resources.

Checklist for wastewater management
• Proper designing of the farm with independent intake and outfall will reduce the nutrient loading. • Proper compaction of bunds with vegetative cover should be provided which will reduce erosion. • Proper pond preparation methods will reduce nutrient loads. • Proper water and soil quality management in the culture ponds will reduce the nutrient loading of wastewater • Responsible feed management will reduce feed wastage. • During harvest, water should be drained carefully avoiding re-suspension of sediment. • Shrimp pond wastewater should not be discharged into freshwater areas or onto agricultural land. • Removing of sediments from the pond bottom should be avoided. It should be corrected *in situ.*

13.3 Direct output of waste from shrimp farms and hatcheries can alter the water quality along the coastline. The dissolved and particulate nutrients and organic matters including small quantities of chemicals, micro-organisms and detritus can alter the water quality to a great extent and hence have to be properly treated before such wastes are discharged into the open waters or in the drainage canal. Such wastewater could also be used for undertaking secondary aquaculture projects, particularly for culture of mussels, oysters, seaweed, other finfishes, etc. Such integrated projects would also offer scope for

improving the wastewater quality, reducing the organic and nutrient loss and producing an additional cash crop. In addition to this biological amelioration of wastewater, settlement/ sedimentation ponds may be constructed along the drainage canals. The drainage canals may be designed in such a way that they are wide enough to slow down the flow of water from ponds, so as to allow the settlement of these suspended solids.

13.4 Effluent Treatment System (ETS) is mandatory for farms above 5 ha. At least 10 per cent of the total pond area should be earmarked for the ETS which may be used for secondary aquaculture projects, particularly for culture of mussels, oysters, seaweed, other fin fishes, etc. Such integrated projects would help improving the wastewater quality, reducing the organic and nutrient loads and producing an additional cash crop.

13.5 The standards shown in Table 6 are laid down for the wastewater discharged from the aquaculture systems, hatcheries, feed mills and processing plants. The same may, however, be modified by the Authority from time to time.

Table 6. Standards for treatment of wastewater discharged from the aquaculture farms, hatcheries, feed mills and processing units

S No	Parameters	Final Discharge Point	
		Coastal Marine Waters	Creek or estuarine courses when the same inland water courses are used as water source & disposal point
1	pH	6.0 – 8.5	6.0 – 8.5
2	Suspended solids mg/1	100	100
3	Dissolved oxygen mg/1	Not less than 3	Not less than 3
4	Free Ammonia (as NH3-N) mg/1	1.0	0.5
5	Biochemical Oxygen Demand-BOD (5 days @ 20 c) Max mg/1	50	20
6	Chemical Oxygen Demand-COD mg/1 Max	100	75
7	Dissolved Phosphate (as P) mg/1 Max	0.4	0.2
8	Total Nitrogen (as N) mg/1	2.0	2.0

13.6 It is advisable to let ponds dry between harvests rather than removing sediment accumulations from the pond bottom. This method is probably less environmentally damaging than indiscriminate discharge of bottom sediment. If shrimp stocking densities are kept low (below 15 Pl per m^2), then sediments can be kept in good condition by simply drying the pond bottom between harvests. The solid waste of the farms, including sludge and scrapped soil from the ponds should not be disposed off into the waterways. The waste shall be disposed off within the premises of the farm after adequate treatment without allowing it to get into waterways.

14.0 Farm hygiene and management

14.1 The objectives of shrimp farming practices should be to produce contaminant-free products for consumers through responsible pond operations and good management practices that prevent, eliminate, or appropriately reduce levels of chemicals, drugs and pathogens that pose human health concerns. The following guidelines should be used to achieve this goal:

- All waste materials should be disposed of in a sanitary way.
- In evaluating the suitability of a site for aquaculture, include testing for any chemicals, drugs and pathogens that might pose a human health risk and are likely to occur at the site.
- Avoid the potential for septic runoff from humans or other animals, as well as any indication of frequent use of pesticides, herbicides, and drugs; and past contamination with fuel oil or any other chemical contaminants.
- Feed should not contain chemical or microbial contaminants. Feeding of uncooked organisms or any nutrient source derived from uncooked organisms is discouraged.
- The shrimp industry and individual producers should work with the government to prepare lists of pathogens, drugs and chemical contaminants that pose existing or potential human health concerns and takes effective measures to control these risks.
- When using any chemical products at or near shrimp-farming sites, shrimp farmers should be attentive to the information on product labels that regards human health concerns.
- Approved drugs, or other chemicals should be used only when necessary to control identified disease problems.

15.0 Environment impact assessment

15.1 An Environment Impact Assessment (EIA) should be made even at the planning stage by all the aquaculture units above 40 ha size. For 10 ha and above a statement will be required to be given in the detailed plans. The District/ State Level Committees set up by the Coastal Aquaculture Authority should ensure that such an EIA has been carried out by the aquaculture units before their proposal is recommended to the Coastal Aquaculture Authority for approval.

16.0 Environment monitoring and management plans

16.1 The shrimp culture units with a net water area of 40 ha or more shall incorporate an Environment Monitoring Plan and Environment Management Plan (EMMP) covering the areas mentioned below:

- Impact on the water courses in the vicinity;
- Impact on ground water quality;
- Impact on drinking water sources;
- Impact on agricultural activity;
- Impact on soil and soil salinisation;
- Waste water treatment;
- Green belt development (as per specifications of the local authorities) and
- All farms of 10 ha and more but less than 40 ha shall furnish detailed information on the aforesaid aspects.

17.0 Cluster management, record maintenance and networking

17.1 There should be an awareness of avoiding social conflicts and the stakeholders together should discuss common problems and adopt appropriate management measures to avoid conflicts and increase sustainability of the farming systems.

17.2 Farmers' Associations and Self-Help Groups: Shrimp farmers should form co-operatives, associations or self-help groups in order to exchange technology and to achieve co-operation in water use and waste management. Shrimp culture techniques are also constantly improving, and it is important that shrimp farmers continue to increase their knowledge of sustainable farming techniques.

Small farmers should gain benefit by forming such co-operatives or self-help groups/ associations for facilitating supply of inputs, synchronised farming operations, common necessities for monitoring seed and feed quality, shrimp health management and water quality, sale of product and also in organising credit and crop insurance. Formation of an Apex body of Shrimp Farmers associations in the State/ District would be helpful, especially in negotiations with credit agencies and other major organisational activities.

17.3 Facilities for regular extension work and different aspects of training should be made available to the farmers. Individual farmers and self-help groups/ Associations should arrange to interact with the extension staff in the State Department of Fisheries, MPEDA, ICAR institutions, Agricultural Universities, and NGOs, as the case may be to assist the small farmers.

Appropriate awareness programmes through extension work and training of shrimp farmers and officials should be initiated for enhancing the technical knowledge and environmental awareness among the fisheries personnel, extension workers, aquaculturists and all those involved in related activities for planning and operation of sustainable aquaculture.

17.4 For facilitating data collection on the practices and farm accounts shrimp farmers/self-help groups should co-operate with the State Department of Fisheries to collect, organize, and evaluate data to demonstrate the adoption of the guidelines and document the benefits of their use and also for other statistical purposes.

17.5 Farmers should be encouraged to join shrimp farmers information network at the local, national and regional levels. The shrimp farmers should also see the various developments in shrimp farming in the country and elsewhere. The aquaculture networks available should be made use by shrimp farmers/Groups for improving their knowledge and skills and also for obtaining latest developments and market trends.

18.0 Integrated coastal zone management

18.1 Integrated coastal zone management plans should be prepared for each coastal State by the States concerned with zoning for different activities and with buffer zones. This could at best be only a rolling plan (dynamic) in the initial stages so that improvements can be effected annually or biannually, with improved databases and knowledge on site-specific interactions of aquaculture with other sectors.

18.2 Detailed master plans for development of aquaculture through macro and micro-level surveys of the potential areas and zonation of coastal area delineating the land suitable and unsuitable for aquaculture using the remote sensing data, ground truth verification, Geographical Information System (GIS) and socio-economic aspects should be considered. In areas where pond density or water surface area (WSA) of shrimp ponds are in excess of the carrying capacity (CC) of the eco-system, which can also be defined as the assimilation capacity of the receiving waters, a reduction in pond density and thus a reduction in the overall WSA should be effected.

19.0 Protecting the livelihood of various coastal communities

19.1 Coastal aquaculture, which is now confined mainly to shrimp farming, is one among the several activities in the coastal area involving the coastal communities. Much of the social conflicts in coastal areas are due to the larger demands on the limited resources, resulting in competition amongst the various stakeholders. There are also instances where through harmonious use of resources coastal communities have set up excellent examples of integrated coastal development.

19.2 Badly planned and unregulated operation of shrimp farms, as already indicated can cause considerable level of avoidable conflicts with the community and other sectoral activities in the vicinity of the farms. Conflicts could arise between shrimp farmers and others who either live in the coastal zone or depend on coastal zone resources for their livelihood, as also between shrimp farm owners/ managers and employees, especially in the case of larger farms. Some of the more serious inter-sectoral problems would be addressed in the overall governance and regulation by adopting the following guidelines.

- Shrimp farm owners/managers should respect the community rights and needs and in case of any conflicts arising always attempt to solve the problems in amicable ways for ensuring harmony in the community and sustainability of the shrimp farms. They should cooperate with the community and other sectoral users of the coastal resources, in common efforts for improving environmental conditions and community welfare.
- Farmers, especially with larger holdings should employ local workers as far as possible.
- Workers should be provided with good working conditions and should also be trained for their skill upgradation.
- Access to the sea front and other common resources to the coastal communities by the aquaculture units should be ensured. The interests of the communities and organisations in the area should be safeguarded.
- Care should be taken to see that the natural drainage canals which are used as water source for aquaculture units are not blocked so as to avoid flooding of low lying areas and villages.
- Salinisation of land and drinking water should be avoided by providing suitable buffer zones between agricultural land, villages and shrimp farms.
- Use of common property resources like the creeks, canals, etc should be carried out in a harmonious manner and the traditional rights of the coastal communities should not be affected in any way.
- To avoid problems of ground water salinisation, drawal of ground water is strictly prohibited for shrimp aquaculture. It must be ensured that piezometers/groundwater monitoring bore wells preferably 4/ha (along the periphery of the pond) are installed to monitor salinity ingress. In case of salinity ingress the Coastal Aquaculture Authority should ensure immediate closure of the farms.

Appendix

Maximum Permissible Residual Levels for Fish and Fishery Products

	Substance	Maximum Permissible Residual Levels (in ppm)
A	**Antibiotics and other Pharmacologically Active Substances**	
	1. Chloramphenicol	Nil
	2. Nitrofurans including: Furaltadone, Furazolidone, Furylfuramide, Nifuratel, Nifuroxime, Nifurprazine, Nitrofurantoin, Nitrofurazone	Nil
	3. Neomycin	Nil
	4. Nalidixic acid	Nil
	5. Sulphamethoxazole	Nil
	6. Aristolochia spp. and preparations thereof	Nil
	7. Chloroform	Nil
	8. Chlorpromazine	Nil
	9. Colchicine	Nil
	10. Dapsone	Nil
	11. Dimetridazole	Nil
	12. Metronidazole	Nil
	13. Ronidazole	Nil
	14. Ipronidazole	Nil
	15. Other nitroimidazoles	Nil
	16. Clenbuterol	Nil
	17. Diethylstilbestrol (DES)	Nil
	18. Sulfonamide drugs (except approved Sulfadimethoxine, Sulfabromomethazine and Sulfaethoxypyridazine)	Nil
	19. Fluroquinolones	Nil
	20. Glycopeptides	Nil
	21. Tetracycline	0.1
	22. Oxytetracycline	0.1
	23. Trimethoprim	0.05
	24. Oxolinic acid	0.3

B.	**Substances having anabolic effect and unauthorised substances**	
1.	Stilbenes, stilbene derivatives and their salts and esters.	Nil
2.	Steroids	Nil
C.	**Veterinary drugs**	
1.	Antibacterial substances, including quinolones	Nil
2.	Ante helminitic	Nil
D.	**Other substances and environmental contaminants**	
1.	Organochlorone compounds including PcBs	Nil
2.	Mycotoxins	Nil
3.	Dyes	Nil
4.	Dioxins	4 picogram per gram, fresh weight
E.	**Pesticides**	
1.	BHC	0.3
2.	Aldrin	0.3
3.	Dieldrin	0.3
4.	Endrin	0.3
5.	DDT	5.0
F.	**Heavy Metals**	
1.	Mercury	1.0
2.	Cadmium	3.0
3.	Arsenic	75
4.	Lead	1.5
5.	Tin	250
6.	Nickel	80
7.	Chromium	12

ANNEXURE: II

MPEDA-THE PROJECT IMPLEMENTING AGENCY

The Marine Products Export Development Authority (MPEDA) was set up by an act of Parliament during 1972. The erstwhile Marine Products Export Promotion Council established by the Government of India in September 1961 was converged in to MPEDA on 24th August 1972. MPEDA is given the mandate to promote the marine products industry with special reference to exports from the country. It is envisaged that this organisation would take all actions to develop and augment the resources required for promoting the exports of "all varieties of fishery products known commercially as shrimp, prawn, lobster, crab, fish, shell-fish, other aquatic animals or plants or part thereof and any other products which the authority may, by notification in the Gazette of India, declare to be marine products for the purposes of (the) Act". The Act empowers MPEDA to regulate exports of marine products and take all measures required for ensuring sustained, quality seafood exports from the country. MPEDA is given the authority to prescribe for itself any matters which the future might require for protecting and augmenting the seafood exports from the country. It is also empowered to carry out inspection of marine products, its raw material, fixing standards, specifications, and training as well as take all necessary steps for marketing the seafood overseas.

MPEDA is the nodal agency for the holistic development of seafood industry in India to realize its full export potential as a nodal agency. Based on the recommendations of MPEDA, Government of India notified new standards for fishing vessels, storage premises, processing plants and conveyances. MPEDA's focus is mainly on Market Promotion, Capture Fisheries, Culture Fisheries, Processing Infrastructure & Value addition, Quality Control, Research and Development.

Functions of MPEDA in brief:

- ✓ Registration of infrastructural facilities for seafood export trade.
- ✓ Collection and dissemination of trade information.
- ✓ Promotion of Indian marine products in overseas markets.
- ✓ Implementation of schemes vital to the industry by extending assistance for infrastructure development for better preservation and modernised processing following quality regime.
- ✓ Promotion of aquaculture for augmenting export production through hatchery development, new farm development, diversification of species and up gradation of technology
- ✓ Promotion of deep-sea fishing projects through test fishing, joint ventures and up gradation & installation of equipments to increase the efficiency of fishing.
- ✓ Market promotional activities and publicity.
- ✓ To carry out inspection of marine products, its raw material, fixing standards and specifications, training, regulating as well as to take all necessary steps for maintaining the quality of seafood that are marketed overseas.

- ✓ Impart trainings to fishermen, fish processing workers, aquaculture farmers and other stake holders in the respective fields related to fisheries.
- ✓ Conduct research and development for the aquaculture of aquatic species having export potential through Rajiv Gandhi Centre for Aquaculture (RGCA).
- ✓ Conduct extension and awareness activities, trainings etc through Network for Fish Quality Management and Sustainable Fishing (NETFISH) & National Centre for Sustainable Aquaculture (NaCSA).
- ✓ To prescribe for itself any matters required for protecting and augmenting the seafood exports from the country in the future.
- ✓

Role of MPEDA for promotion of export oriented Aquaculture

Aquaculture has been consistently contributing to ever increasing seafood export in the country. Considering the importance of Aquaculture in increasing export from the country, MPEDA has adopted a three pronged strategy for export oriented aquaculture development through the following thrust areas:

- ✓ Expansion of area under Aquaculture
- ✓ Increasing the productivity through adoption of Better Management Practices (BMPs) and introduction of advanced technologies wherever possible.
- ✓ Diversification in aquaculture production by introducing commercially important species for Aquaculture and targeted programmes for the inclusive development of hinterland areas.

Some of the schemes implemented by MPEDA for Export oriented aquaculture production is as follows:

Financial assistance: MPEDA is providing financial assistance to encourage aqua farmers to adopt Better Manufacturing Practices in Aquaculture. The assistance includes installation of bio-security infrastructures like bird fencing, crab fencing, aerators, motors, blowers, pumps etc.

Promotion of cluster farming: MPEDA also encourages cluster farming by formation of Aqua farmers Welfare Societies through its Society called the National Center for Sustainable Aquaculture (**NaCSA**). Cluster farming will enable the farmers for the collective procurement of seed, feed and other inputs and for better marketing of the produce. Assistance is given for the installation of common infrastructure like electrification, common roads, culverts, generators, tractors etc.

Enrollment for traceability: MPEDA is carrying out enrolment of the export oriented aqua farms for traceability. Traceability is very important for the seafood exports for its marketing and sustainability. GIS mapping and enrolment is useful for the identification of the product exported upto the farm level.

Lab Infrastructure and testing facilities: MPEDA – NacSA is in the process of establishing 10 mini labs called Aqua One Centres near to the farming areas. These facilities will provide testing facilities close to the doorsteps of aquafarmers. Disease diagnostic infrastructure will aid farmers for the diagnosis of shrimp

diseases and for better management of farms

Capacity building exercises: MPEDA is also providing capacity building & skill development assistance to Aqua farmers by rendering Training, Awareness Campaigns, Farmers meet, Workshops etc. Capacity building exercises will help the farmers to acquire additional skill and this will contribute to better farm management and production.

Demonstration farming: MPEDA has been conducting demonstration of farming practices for promoting diverse species of export potential and for the introduction of new technologies. Demonstration will draw more farmers and entrepreneurs to aquaculture thus increasing the production base also. MPEDA has carried out demonstration in farming of diversified species like Mud crab, Seabass, GIFT, Cobia in cages and Pompano. Demonstration is also being done for nursery rearing for better survival and growth

Technical support: Regional offices of MPEDA established across maritime States in the country are providing aquaculture development services to the aqua farmers in the country. Demonstration farm projects are run by these unit offices involving farmers.

Research and Development: Rajiv Gandhi Centre for Aquaculture (RGCA), the Research and Development wing of MPEDA has established 11 projects for diversifying export oriented aquaculture. RGCA is actively involved in the development of various sustainable aquaculture technologies for various aquatic species having export potential. These projects are facilitating aquaculture by sale of seeds and providing technical assistance. MPEDA has set up Multispecies Aquaculture Complex (MAC) at Vallarpadom, Cochin for the supply of quality seeds to the farmers. RGCA provides technical support for the promotion of new technologies and establishment of hatcheries. RGCA has set up a facility for the first time in India at Chennai to quarantine the imported SPF *vannamei* shrimp broodstock. RGCA has also set up the first Aquaculture Genetics laboratory in India which is accredited by the NABL

The Central Aquaculture Pathology Laboratory (CPL) is a state of the art Laboratory designed and facilitated for screening of aquatic Pathogens and diagnosis of diseases encountered in Aquaculture. The laboratory develops and performs molecular diagnostic tests for nucleic acid targets for economically significant crustacean and fish pathogens. The focus of the laboratory is to diagnose disease using Molecular, Histopathological and Microbiological methods.

The Pathology laboratory has three component units.

- Molecular Pathology
- Histopathology
- Microbiology

The Molecular pathology laboratory of CPL is the only lab in India providing Molecular Diagnostics/Screening facility for all the OIE listed and major pathogens of Shrimp, Prawn and Crabs. The Lab is equipped with Quantitative Real Time PCR system, conventional thermal cyclers, Automatic Spectrophotometer, Gel documentation system etc and screens for economically significant fish pathogens such as: Viral Nervous Necrosis (VNN), Iridoviruses and Photobacterium damselae subsp.pisicida. The molecular pathology laboratory has

separate dedicated cubicles as per the international standards.

The histopathology laboratory of CPL is equipped with Automated Tissue Processor, Automated instruments for Embedding, Microtomes, Cryostat, Fume Exhaust Hood, Fixation area, Staining and mounting facilities. The lab also has a dedicated slide

observation and documentation facility. The Microbiology unit of the CPL is well-equipped for carrying out routine bacteriology and molecular pathology studies

MPEDA quality control Laboratories:

MPEDA has set up 4 Quality Control Laboratories in Kochi (Kerala), Bhimavaram, Nellore (Andhra Pradesh) and in Bhubaneswar (Odisha). MPEDA QC Laboratories (Kochi, Nellore and Bhimavaram) are accredited as per the ISO/IEC 17025: 2005 standard, by the National Accreditation Board for Testing and Calibration Laboratories (NABL), a member of the International Laboratory Accreditation Co-operation (ILAC).The scope of accreditations cover testing of fish and fishery products for Chemical residues. The laboratories are also approved by the Export Inspection Council of India for testing of fish and fishery products intended for export (commercial samples).The Labs are also ISO 9001: 2008 certified.

The MPEDA QC Laboratories are equipped with high precision sophisticated equipments such as Liquid Chromatography Tandem Mass Spectrometers (UPLC-MS MS /HPLC-MSMS),Inductively Coupled Plasma-Optical Emission Spectroscope/Mass

Spectrometer (ICP-OES / ICP-MS),Atomic Absorption Spectrometers (AAS), High Performance Liquid Chromatographs (HPLC), Gas Chromatographs (GC-ECD), Gas Chromatograph- Mass Spectrometer (GC-MS & GC-MSMS), Automated ELISA Reader etc, and all necessary supporting equipments/instruments.

The laboratories at Kochi, Nellore and Bhimavaram undertake the National Residue Control Plan (NRCP) for aquaculture products as per EU requirement under directive 96/23/EC.

National Residue Control Plan (NRCP) is operated by MPEDA for aquaculture on behalf of the Export Inspection Council (EIC) to monitor the residue levels in aquacultured fish & fishery products exported from India. The NRCP is a statutory requirement to be implemented by the countries intending to export products of animal origin to EU. NRCP is formulated and implemented based on the Council Directive 96/23/EC of 29 April 1996, which is applicable to EU member countries and Non-EU Countries which are exporting to the EU.

Under NRCP, the samples are tested for substances like Antibiotics/ Antibacterial substances/ Veterinary Medicinal Products like chloramphenicol, nitrofuran metabolites, nitroimidazoles, tetracyclines, sulphonamides, quinolones, steroids, stilbenes, anthelmentics, dyes, aflatoxins and environmental contaminants like Organo Chlorine Pesticides, PCBs, Chemical Elements (Heavy Metals).

Pre-harvest Testing (PHT) was introduced from April 2009 to ensure the absence of banned antibiotic residues like Nitrofuran metabolites and Chloramphenicol in Aquaculture products used as raw material meant for export. Currently, Pre-harvest testing was restricted to raw material meant for export to EU countries

only. The above tests are being conducted at 12 ELISA (Enzyme-Linked Immuno Sorbent Assay) Labs established by MPEDA. MPEDA issues Unique ID to aqua farms after physical verification with GPS. The farm ID's are the most effective tool for Traceability of the aquaculture produce meant for export.

Enrolment of Aquaculture farms and hatcheries with GIS Mapping under PHT System

MPEDA has a voluntary scheme for enrolment of aquaculture farms and hatcheries, which produce export oriented species in India. MPEDA has generated a database of nearly 72,796 aquaculture farms across the coastal states of India which is maintained in an online system. Each farm is tagged with a unique system generated farm identification number. The farms are enrolled after verification of documents and field verification of farms including the process of recording geographical coordinates of the farm using a highly accurate handheld GPS (Global Positioning System) device and a further verification at the head office level and generation of kml files. Out of the total 460 shrimp hatcheries in India, MPEDA has enrolled 357 shrimp hatcheries with an annual production capacity of 25 billion.