Aquaculture is developing, expanding and intensifying in almost all regions of the world. Although the sector appears to be capable of meeting the gaps the past trends in aquaculture development and describes its current status globally.
Cover photo:
*Penaeus monodon* hatchery in Vizag, India. Courtesy Dr. G. Subbarao
Improving *Penaeus monodon* hatchery practices
Manual based on experience in India

Aquaculture Management and Conservation Service
Fisheries and Aquaculture Management Division
FAO Fisheries and Aquaculture Department

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Preparation of this document

Responding to a request made by the Government of India, a Technical Cooperation Programme (TCP) project was structured, with the view to improve the capacity of the State of Andhra Pradesh to better manage the shrimp aquaculture sector, with special reference to controlling diseases and managing health. The TCP, besides assisting the Department of Fisheries (DOF) of the State Government of Andhra Pradesh in managing shrimp health, also assisted in creating national capacity for emergency preparedness, empowering rural farmers by providing tools for the self-management of farming systems, improving the quality of hatchery-produced postlarvae and establishing overall better management practices for the shrimp aquaculture sector. It was felt that this multidisciplinary approach is required to obtain positive and permanent results.

This publication, “Improving *Penaeus monodon* hatchery practices. Manual based on experience in India” is one of several outputs of the TCP. It reviews the status of broodstock, hatcheries, postlarval production, health and opportunities for improving hatchery biosecurity and larval quality of tiger shrimp (*Penaeus monodon*). The publication also provides technical protocols and guidelines for improving hatchery biosecurity and larval and postlarval quality.

In preparing Section 3.6 (Broodstock quarantine), we have drawn extensively on material previously published in FAO Fisheries Technical Paper No. 450, *Health management and biosecurity maintenance in white shrimp (Penaeus vannamei) hatcheries in Latin America* (FAO, 2003).
Abstract

The successful farming of tiger shrimp (*Penaeus monodon*) in India is mainly due to the existence of some 300 hatcheries whose capacity to produce 12,000 million postlarvae (PL) annually has provided an assured supply of seed. However, the sustainability of the sector is still hampered by many problems, foremost among these being a reliance on wild-caught broodstock whose supply is limited both in quantity and in seasonal availability and that are often infected with pathogens. The current low quality of hatchery produced PL due to infection with white spot syndrome virus (WSSV) and other pathogens entering the hatcheries via infected broodstock, contaminated intake water or other sources due to poor hatchery management practices, including inadequate biosecurity, is a major obstacle to achieving sustainable shrimp aquaculture in India and the Asia-Pacific region. Considering the major contribution of the tiger shrimp to global shrimp production and the economic losses resulting from disease outbreaks, it is essential that the shrimp-farming sector invest in good management practices for the production of healthy and quality seed.

This document reviews the current state of the Indian shrimp hatchery industry and provides detailed guidance and protocols for improving the productivity, health management, biosecurity and sustainability of the sector. Following a brief review of shrimp hatchery development in India, the major requirements for hatchery production are discussed under the headings: infrastructure, facility maintenance, inlet water quality and treatment, wastewater treatment, biosecurity, standard operating procedures (SOPS), the Hazard Analysis Critical Control Point (HACCP) approach, chemical use during the hatchery production process and health assessment. Pre-spawning procedures covered include the use of wild, domesticated and specific pathogen free/specific pathogen resistant (SPF/SPR) broodstock; broodstock landing centres and holding techniques; broodstock selection, transport, utilization, quarantine, health screening, maturation, nutrition and spawning; egg hatching; nauplius selection; egg/nauplius disinfection and washing and holding, disease testing and transportation of nauplii. Post-spawning procedures covered include: larval-rearing unit preparation, larval rearing/health management, larval nutrition and feed management, important larval diseases, general assessment of larval condition, quality testing/selection of PL for stocking, PL harvest and transportation, nursery rearing, timing of PL stocking, use of multiple species in shrimp hatcheries, and documentation and record keeping. Information on the use of chemicals in shrimp hatcheries and examples of various forms for hatchery record keeping are included as Annexes.

FAO.
Foreword

The rapid development of shrimp farming in India is largely due to the setting up of a large number of hatcheries and the resulting availability of an assured supply of seed. Presently about 300 hatcheries are in operation with an annual capacity to produce about 12,000 million postlarvae (PL). In India wild-caught broodstock is the only source of shrimp seed. Studies indicate that about a quarter of wild-caught shrimp spawners are infected with white spot syndrome virus (WSSV). Furthermore the continuous exploitation of shrimp resources has brought about a scarcity of brooders, and their availability is also not uniform throughout the year. Viral-disease monitoring is an area of growing importance and biosecurity is also a serious concern for hatcheries, and thus protocols to address these concerns are urgently needed. Considering the major contribution of the tiger shrimp (Penaeus monodon) to global shrimp production and the economic losses resulting from disease outbreaks, it is essential that the Indian shrimp-farming sector invest in good management practices for the production of healthy and quality seed.

The FAO TCP/IND/2902 (A) project entitled “Health Management of Shrimp Aquaculture in Andhra Pradesh” is a result of a request made by the Government of India for assistance in building capacity to improve health management capabilities in shrimp farming in Andhra Pradesh. The TCP inter alia was aimed at providing tools to improve the quality of hatchery-produced PL through better health management and adoption of biosecurity measures at the farm and hatchery levels. The current low quality of hatchery-produced PL is considered a major obstacle to achieving sustainable shrimp aquaculture in the region.

The TCP benefited from close collaboration with other national and regional development agencies active in the field of aquaculture such as the Network of Aquaculture Centres in Asia-Pacific (NACA), the Aquaculture Authority (now Coastal Aquaculture Authority) and the Marine Product Export Development Authority (MPEDA). The TCP activities were conducted in collaboration with members of the private sector involved in hatchery production and the grow out of shrimp in Andhra Pradesh. This collaboration and cooperation between state agencies, regional and international agencies and the private sector not only improved the efficiency of implementation of project activities but also increased and expanded the size of the target groups and beneficiaries of the project.

This publication “Improving Penaeus monodon hatchery practices. Manual based on experience in India” is a major output of the TCP, based on strong consultation and collaboration between farmers, hatchery operators, scientists, state extensionists and several key experts in the field of shrimp hatchery production. We believe that this publication will be a milestone reference for shrimp hatchery operators and shrimp farmers in India and anyone interested in tiger shrimp farming globally. We commend and congratulate everyone involved in producing this document.

Ichiro Nomura
Assistant Director-General
Fisheries and Aquaculture Department
FAO

Yugraj Yadava
Member Secretary
Coastal Aquaculture Authority
India
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Abbreviations and acronyms

ACC  Aquaculture Certification Council Inc.
BAP  Best Aquaculture Practices
BIOTEC  National Centre for Genetic Engineering and Biotechnology (Thailand)
BKC  benzalkonium chloride
BMNV  baculovirus midgut gland necrosis virus
BMP  Better Management Practice
BP  baculovirus penaei
BSCC  Broodstock Collection Centre
CAA  Coastal Aquaculture Authority
CCP  Critical Control Point
CIBA  Central Institute of Brackishwater Aquaculture
CMFRI  Central Marine Fishery Research Institute
COC  Code of Conduct
COP  Code of Practice
CSIRO  Commonwealth Scientific and Industrial Research Organization (Australia)
DOF  Department of Fisheries
EDTA  ethylene diamine tetraacetic acid
FAO  Food and Agriculture Organization of the United Nations
FCR  feed conversion ratio
FRDC  Fisheries Research Development Centre
HACCP  Hazard Analysis Critical Control Point
HH  high health
HPV  Hepatopancreatic parvo-like virus
HUFA  highly unsaturated fatty acid
IHHNV  infectious hypodermal and haematopoietic necrosis virus
LR  laboratory grade reagent
LRT  larval rearing tank
MAF  Ministry of Agriculture and Forestry
MBV  Monodon baculovirus
MPEDA  Marine Product Export Development Authority
NACA  Network of Aquaculture Centres in Asia-Pacific
NSTDA  National Science and Technology Development Agency (Thailand)
OIE  World Organisation for Animal Health
OSSPARC  Orissa Shrimp Seed Production Supply and Research Centre
PCR  polymerase chain reaction
PL  postlarva, postlarvae (plural form) or postlarval
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<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>PUFA</td>
<td>polyunsaturated fatty acid</td>
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<tr>
<td>PVC</td>
<td>polyvinyl chloride</td>
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<tr>
<td>SIFT</td>
<td>State Institute of Fishery Technology</td>
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<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
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<tr>
<td>SPF</td>
<td>specific pathogen free</td>
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<tr>
<td>SPR</td>
<td>specific pathogen resistant</td>
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<tr>
<td>SPT</td>
<td>specific pathogen tolerant</td>
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<tr>
<td>TASPARC</td>
<td>Andhra Pradesh Shrimp Seed Production and Research Centre</td>
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<tr>
<td>TCBS</td>
<td>thiosulphate citrate bile salts</td>
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<td>TSA</td>
<td>trypticase soy agar</td>
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<tr>
<td>TSV</td>
<td>Taura syndrome virus</td>
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<tr>
<td>UV</td>
<td>ultra violet</td>
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<tr>
<td>WSSV</td>
<td>white spot syndrome virus</td>
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<tr>
<td>YHV</td>
<td>yellow head virus</td>
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