BOBP/REP/84

REPORT OF THE EXPERT CONSULTATION ON CLEANER FISHERY HARBOURS AND FISH QUALITY ASSURANCE

25-28 October, 1999
Chennai, India

BOBP For Fisheries Management
BAY OF BENGAL PROGRAMME

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Preface

This document is the report of an expert consultation on Cleaner Fishery Harbours and Fish Quality Assurance held in Chennai, India, from October 25 to 28, 1999. It was attended by some 30 participants, most of whom were representatives from member-countries – fishery harbour managers and administrators, professionals in fish quality control, fish export, harbour design and construction. Resource persons were drawn from the FAO and the Bay of Bengal Programme (BOBP).

The consultation's development objective was to ensure the quality of seafood through rehabilitation of existing fishery harbours and appropriate designs for new fishing harbours. The immediate objectives were to build awareness among key stakeholders about techniques to develop and maintain cleaner fishery harbours, expose them to state-of-the-art design principles and technologies, and facilitate the sharing of experience, expertise and learning among member-countries.

This report contains the text of the "Chennai Declaration" passed by the Consultation, which grew out of discussions among member-delegates. It also contains the text of papers presented by the resource persons.

The consultation was part of a series of pilot activities implemented by the BOBP in co-operation with the International Maritime Organization (IMO) in India, Thailand, Maldives and Sri Lanka. Four publications resulted from these activities.

Cleaner Fishery Harbours in the Bay of Bengal	BOBP/WP/82
Dealing with Fishery Harbour Pollution – The Phuket Experience	BOBP/WP/93
Guidelines for Cleaner Fishery Harbours	BOBP/MAG/17
Fishery Harbour Manual on the Prevention of Pollution	BOBP/MAG/22

The Bay of Bengal Programme is a multi-agency regional fisheries programme that covers seven countries around the Bay of Bengal – Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka, Thailand. The Programme plays a catalytic and consultative role in developing coastal fisheries management in the Bay of Bengal, thereby helping improve the conditions of small-scale fisherfolk in the member-countries.

The BOBP is sponsored by the Governments of Denmark and Japan. The executing agency is the FAO (Food and Agriculture Organization of the United Nations).

Foreword

The BOBP has published several reports on cleaner fishery harbours based on its pilot activities in India, Thailand, Maldives and Sri Lanka. These focused on awareness-building among stakeholders about overcoming pollution in fishery harbours and landing sites. The pilot activities resulted from the BOBP's co-operation with the International Maritime Organization or IMO.

The four-day Expert Consultation on Cleaner Fishery Harbours and Seafood Quality Assurance, held in Chennai last October, built on the foundation of these activities and carried the work further. It brought together key decision-makers and action-takers on fishing harbours from the BOBP's member-countries. Two consultants presented five papers - three on fishing harbour infrastructure, two on post-harvest handling and quality assurance.

The papers discussed the design of fishing harbours and their infrastructure, fishery harbour management, seafood quality assurance and the handling and storing of fish. Some key points stressed were that the size of harbour facilities should match known fish resources; environmental compatibility should be borne in mind when the facilities were upgraded; and clean water supply should be available at any fish-landing facility. The papers were well received and generated keen discussion.

It was suggested that member-countries should put into practice the lessons from the consultation. Each country should select one facility to upgrade to high standards; this could serve as a living laboratory for everyone concerned with harbour design, construction and management.

I would urge all harbour managers and decision-makers to go through the Chennai Declaration passed by the consultation. It stressed the need for awareness-building and for wide stakeholder participation in the siting, planning and management of harbours, for factoring resources availability in the design of harbours, for better market intelligence and resource information on a continuing basis to help harbour managers. It recommended mechanisms to promote inter-departmental co-operation and coordination, rigorous enforcement of rules and regulations, and training for harbour managers in seafood quality assurance. It urged governments to make more funds available to rehabilitate harbours. It recommended rational tariffs for harbour facilities, a balanced approach to the privatisation of harbours and the development of a model fishery harbour. It asked countries to seek the support of the FAO in developing such a model harbour or landing site.

Together, these constitute a valuable package of recommendations. They deserve to be supported and implemented.

Kee-Chai CHONG
Programme Coordinator, BOBP

10 March 2000

CONTENTS

1. Consultation Summary (Reprinted from *Bay of Bengal News*, December 1999): Regional Expert Consultation on Cleaner Fisheries Harbours Urges Action by Governments — 1

2. Consultation Prospectus — 4

3. Programme — 7

4. List of Participants — 10

5. Needs Assessment in Fishing Ports Design *by Joseph Alan. Sciortino, Ports Consultant* — 13

6. Fish Quality Assurance in Small-Scale Fisheries and the Role of Cleaner Fisheries Harbours *by S. Subasinghe, INFOFISH* — 26

7. Infrastructural Design Specifications: Design Principles for the Development and Upgrading of Fisheries Ports *by Joseph Alan Sciortino, Ports Consultant* — 36

8. Fishery Harbour Management I: Handling and Storing Fish on-Board Fishing Crafts and in Fishery Harbours: Thoughts on Approaches and Methods for Fish Quality Assurance *by S Subasinghe, INFOFISH* — 46

9. Fishery Harbour Management II: The Port Management Body and Waste Collection and Disposal *by Joseph Alan Sciortino, Ports Consultant* — 55

10. Status and Development of Fishery Harbours in India *by Y.S. Yadava and K. Omprakash* — 63

11. The Chennai Declaration — 83

12. Field trip to Chennai fishing harbour and photo exhibition — 84

1. Consultation Summary

REGIONAL EXPERT CONSULTATION ON CLEANER FISHERIES HARBOURS URGES ACTION BY GOVERNMENTS

by J A Sciortino

(Reproduced from Bay of Bengal News, *December 1999)*

An FAO ports consultant summarises the presentations, discussions and recommendations of a four-day regional consultation on cleaner fisheries harbours organised in Chennai by BOBP and FAO.

The BOBP has since 1985 been promoting cleaner fishery harbours in the region with support from the IMO. It has conducted pilot activities in India, Thailand, the Maldives and Sri Lanka, focusing on awareness-building amongst stakeholders about overcoming pollution in fishery harbours and landing sites.

The key concerns in most fishing harbours and landing sites relate to supply of safe freshwater, sanitation, the collection and disposal of wastes, and the post-harvest handling of fish until it reaches local or export markets. The recent EU ban on fish and shrimp imports from at least three BOBP member countries, attributed specifically to lack of cleanliness and poor environmental conditions, has dealt a serious blow to trade in fish, and could affect the livelihood of millions of fisherfolk.

In the light of the above, the BOBP and the FAO organised a regional expert consultation on cleaner fishery harbours and seafood quality assurance in Chennai, India, from 25 to 28 October 1999. The meeting brought together fishery harbour managers and administrators, fish quality assurance professionals/administrators and harbour design engineers from the seven member-countries of BOBP (Bangladesh, India, Indonesia, Malaysia, the Maldives, Sri Lanka and Thailand).

Dr Kee-Chai Chong, Programme Coordinator of BOBP, inaugurated the consultation. He stressed that fish and seafood must be handled with great care, as food, not like any other commodity or raw material over which sanitation in handling is overlooked and compromised. Consultants J. Sciortino and S Subasinghe highlighted appropriate technologies and approaches and strove to facilitate exchange of know-how and expertise.

The meeting hinged around five major contributions by the consultants — three on fishing harbour infrastructure, two on post-harvest handling and quality assurance. The topics:

— Needs assessment in fishing port design;

— Infrastructural design specifications;

— Fishery harbour management, the port management body, sanitation and waste management;

— Seafood quality assurance in small-scale fisheries and the role of cleaner harbours;

— Handling and storing fish onboard fishing craft and in fishery harbours;

— Status and development of fishery harbours in India.

Mr Rathin Roy of BOBP gave a good presentation on communication skills and the need for a more decisive stakeholder approach to some of the problems afflicting the industry.

The first two days of the meeting were devoted to technical presentations and discussions. The third day saw a practical exercise in rehabilitation of an existing facility, consisting of a visit to Chennai fishing harbour, followed by a "design clinic". The fourth day was used to draw up a set of conclusions to be condensed into the Chennai Declaration (see page 83), which the delegations hoped to present to policy-makers back home. A set of recommendations was also adopted.

Technical Contributions

The technical papers presented at the meeting drew wide acceptance. The contribution on Needs Assessment typically raised the need to take the Code of Conduct for Responsible Fisheries and the technical annexes more seriously. In particular:

* The need to match the size of harbour facilities to the known resources;
* The importance of ensuring environmental compatibility when fisheries facilities are being planned or upgraded;
* The importance of supply of clean water at any fish landing facility;
* That sanitation without some type of water supply (clean fresh or sea water) is not possible.

The paper on Infrastructural Design Specifications highlighted the typical problems facing cash-strapped administrations who have to pay for much-needed maintenance. Those present agreed that unless life-cycle costing of infrastructure is taken into account at the construction and tendering stage, least-cost methods of procurement have the capacity to bring a fishing harbour to its knees. The typical items of infrastructure, which everybody agreed needed better specification, are:

* Water supply systems and plumbing in general;
* Auction hall floors and drainage.

The paper on Fishery Harbour Management laid bare current shortcomings in harbour management. Harbour management bodies, where they exist, must be manned by the right people who understand the fishermen's needs. Feedback from stakeholders, enforcement of regulations, waste management, good housekeeping and sanitation all depend on good management practices.

The paper on Fish Quality Assurance highlighted the plight of countries affected by the EU ban and the role that cleaner harbours can play in ensuring that fish landed in these countries does not get contaminated.

Fishing harbours, though not strictly classed as processing facilities, have a lot in common with food processing plants in that they produce food for consumers when fish is auctioned off for the local markets. The HACCP concept used in food processing plants can be emulated at the harbour facility to provide a management tool with which to combat contamination.

The paper on Post-Harvest Handling presented the delegates with an excellent little video clip produced in the South Pacific region, dealing particularly with the low-volume, high-value end of the artisanal sector.

The Indian paper on the current status of fishing ports in India presented an overview of the Indian fishing effort. However, as some delegates pointed out, there does not seem to be a connection between the proven resources and the entry of new vessels into the fishing effort (the construction of the new finger piers at Chennai appears to have strengthened the local fleet considerably, concentrating too much fishing effort in one area). This matter was discussed in great detail during the follow-up sessions on the third day.

BOBP and the Future

With the approach of the new millennium, BOBP enters a new and challenging era, partly because existing funding arrangements have ended, partly because of the growing need for more work in this field as soon as fish-importing countries start implementing the risk assessment approach to fisheries.

During the course of these discussions, the author said that the vast amount of information and goodwill BOBP has created cannot be let to gather dust on a shelf when so much still needs to be done, and when local consumer demand for good-quality fish is rising fast. The proposed Global Environment Facility (GEF) project that will succeed BOBP, and the prospect of turning BOBP into an Inter-Government Organization (IGO), was also discussed.

In conclusion, the author, together with the coordinating team, suggested that the Member-Countries themselves show the way forward by putting into practice the lessons learned at this meeting.

It was proposed that each country choose one facility to upgrade to the required standards and then use it as a living laboratory for Department of Fisheries staff, management bodies, consultants and designers.

The Consultation passed the Chennai Declaration (see page 83).

Consultation participants on a field trip to the Chennai fishing harbour.

2. CONSULTATION PROSPECTUS

Background and Justification

The European Union (EU) has recently imposed restrictions and bans on import of fish and shrimp from at least three BOBP Member-Countries. HACCP regulations imposed by the authorities in the USA and the ISO 9000 regulations imposed by the European Union to assure the quality of seafood imports are either in force or are expected to be in force by the end of the year. The recent EU ban on fish and shrimp imports from some BOBP Member-Countries, specifically citing the lack of cleanliness and poor environmental conditions in fishery harbours, is a serious blow to trade, and could affect earnings valued at several million dollars.

Seafood exports constitute a significant proportion of foreign exchange earnings. Seafood in warm and humid climates is very sensitive to the way it is handled and is prone to pathogen contamination and deterioration from poor water quality, lack of cold chain and storage facilities, lack of personal hygiene on the part of handlers, and unsanitary work areas.

Fishery harbours and landing sites in some BOBP Member-Countries have been found to be unhygienic and wanting in many aspects of design and provision of facilities. Many harbours need to be rehabilitated and new harbour designs need to be reviewed to meet the requirements of quality systems such as the HACCP and ISO 9000. The growing concern globally of seafood-related health hazards has resulted in stringent quality standards for water used in the processing of fish; hygiene in work areas, cooling and storing systems, fishing vessels and harbours; and of the fish and fish products. Inability to meet these standards would mean loss of trade and earnings, and direct negative impact on several thousands of fishers and fish workers.

The Bay of Bengal Programme of FAO (BOBP) with support from the International Maritime Organization (IMO) has been involved in promoting cleaner fishery harbours in the region, and has implemented pilot activities in India, Thailand, the Maldives and Sri Lanka. The focus of the activities was on awareness building amongst the stakeholders of fishery harbours **on the need for, the benefits of and methods of avoiding and overcoming pollution.** An important output of the effort **is a manual of guidelines for fishery harbour managers and administrators to help them cope with pollution and thus increase the quality of fish.**

The key concerns in fishery harbours seem to be ensuring safe and clean fresh water, collecting and safely disposing of solid and liquid waste, particularly bilge waste, rapid handling and transfer of fish from boats to harbours and on to markets, and adequate sanitation facilities. An important learning from BOBP's efforts has been that **cleaner fishery harbours are difficult to achieve without the participation and active involvement of all stakeholders.**

Fishery harbours, particularly in warm and humid climates, need special design approaches and construction materials, to cope with fish wastes and to facilitate cleaning and maintenance of hygienic conditions. Engineers who may not have the necessary knowledge and experience to take such factors into consideration often design fishery harbours. The FAO has considerable experience in the design of fishery harbours and in retrofitting fishery harbours to rehabilitate them to meet present standards.

The Member-Countries of BOBP have expressed keen interest in approaches and efforts to rehabilitate existing fishery harbours and design new ones, with a view to ensuring cleaner fishery harbours and assuring the quality of seafood. The Member-Countries are particularly interested in building awareness amongst key stakeholders about the need for cleaner fishery harbours, about their benefits, and about state-of-the-art approaches to rehabilitate existing fishery harbours and design new ideas keeping in mind appropriate and low-cost technology options. The Member-Countries have strongly endorsed the need for a technical consultation which will build awareness, expose the participants to state-of-the-art appropriate technologies and approaches and facilitate exchange of know-how and expertise.

Objectives

The overall development objective of the regional consultation is to assure the quality of seafood through rehabilitation of existing fishery harbours and appropriate design of new fishing harbours.

The immediate objectives of the regional consultation are to:

1. Build awareness amongst key stakeholders about the need for and the benefits from developing and maintaining cleaner fishery harbours; and about approaches and techniques to bring about cleaner fishery harbours.
2. Build awareness amongst key stakeholders about participative approaches to cleaner fishery harbours and their management.
3. Expose key stakeholders to state-of-the-art design principles and technologies to enable and facilitate low-cost and participative rehabilitation of existing fishery harbours and development of new fishery harbours.
4. Facilitate sharing of experience, expertise and learning amongst Member-Countries in their efforts towards cleaner fishery harbours and assuring quality seafood.

Venue

The regional consultation will be held in Chennai, India.

Duration and Dates

The Consultation will be a four-day meeting, including a field visit to a fishery harbour. The dates of the Consultation are 25-28 October 1999.

Participants

Each Member-Country will be represented by a team of two participants drawn from fishery harbour managers/administrators, fish quality control professionals, fish export professionals/administrators and harbour design/construction engineers. Resource persons with expertise and experience in state-of-the-art, low-cost approaches and technologies to rehabilitate existing fishery harbours and design new fishery harbours in hot, humid tropical conditions will be invited to make presentations and lead discussions with keynote papers. (The number of participants will be kept below 30 to enable good discussion.)

Organisation

BOBP-FAO and the Ministry of Agriculture, Government of India, in a cost-sharing mode, will jointly organise the regional consultation.

Programme Highlights

The following issues will be addressed through presentations by experts, contact sessions with experts, field visits, small-group discussions and a "design clinic" which will take a case study of the Chennai Fishing Harbour and come up with concrete recommendations for its rehabilitation:

- Seafood quality assurance and the critical role of cleaner fishery harbours and landing sites.
- Strategies and approaches to cleaner fishery harbours and seafood quality assurance in situations where unorganized, poor, small-scale and artisanal fisheries dominate the industry.
- Participative, self-financing, stakeholder approaches to developing and managing cleaner fishery harbours.
- Awareness-building as a tool for participative, stakeholder management of cleaner fishery harbours.
- Appropriate, low-cost, safe collection and disposal of liquid and solid waste in fishery harbours including appropriate sanitation measures for people working in harbours.
- Appropriate, efficient and low-cost methods and technologies for on-board fish quality assurance in small to medium fishing crafts.
- Appropriate, efficient, rapid and low-cost fish handling storage and transportation systems for fishery harbours.
- Appropriate, low-cost approaches and technologies for provision of clean freshwater for fishery harbours.
- Strategies and design principles for rehabilitation of existing and development of new fishery harbours for seafood quality assurance.

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3. CONSULTATION PROGRAMME

Monday, 25 October 1999

Registration of Participants		0900	hrs
Welcome Address :	Dr Kee-Chai Chong, BOBP	0930	hrs
Chairperson's Address :	Dr Y S Yadava, GOI	0945	hrs
Inaugural Address :	Dr. Kee Chai Chong, BOBP	1000	hrs

Session I

Presentation :Mr. Joseph Alan Sciortino, Consultant — 1030 hrs
Needs Assessment in Fishing Ports Design

Discussion in Small Groups — 1130 hrs

Presentations of Group Discussion — 1330 hrs

Session II

Presentation : Mr. S. Subasinghe, INFOFISH — 1430 hrs
Fish Quality Assurance in Small-Scale Fisheries &
the Role of Cleaner Fishery Harbours.
Discussion

Session III

Presentation : Mr. Joseph Alan Sciortino, Consultant — 1600 hrs
Infrastructural Design Specifications:
Design Principles for the Development and Upgrading of Fisheries Ports.
Discussion

End of Session — 1715 hrs

Tuesday, 26 October 1999

Session IV

Presentation : Mr. S. Subasinghe, INFOFISH	0900 hrs
Fishery Harbour Management I: Handling and Storing Fish on-Board Fishing Crafts and in Fishery Ports: Approaches and Methods for Fish Quality Assurance	
Discussion	

Session V

Presentation : Mr. Joseph Alan Sciortino, Consultant	1100 hrs
Fishery Harbour Management II : The Port Management Body & Waste Collection and Disposal	
Discussion	

Session VI

Presentation : Mr. Rathin Roy, BOBP	1330 hrs
Fishery Harbour Management III : Awareness-Building as a Tool for Participative Management – Learning from the BOBP Experience	
Discussion	

Session VII

Panel Discussion :	1530 hrs
Fishery Harbour Management IV : Participatory, Self-financing Stakeholder Approaches	
Moderator : Mr. Rathin Roy, BOBP	
End of Session	1730 hrs

Wednesday, 27, October 1999

Session VIII

Field Visit to Chennai Fishery Harbour 0800 hrs

Session IX 1330 hrs

Design Clinic
Approaches to Cleaner Fishery Harbours :
Case Study of Chennai Fishery Harbour
Discussions in Small Groups
Facilitators : Mr. Joseph Alan Sciortino,
Mr. S. Subasinghe & Mr. Rathin Roy

Session X 1530 hrs

Presentation of Recommendations by Groups 1630 hrs

End of Session 1730 hrs

** **Exhibition of Appropriate Technologies for Cleaner Fishery Harbours will run parallel to the discussions relating to the Design Clinic.**

Thursday, 28 October 1999

Session XI

Discussion on future directions leading up to 0930 hrs
The Chennai Declaration
Moderator : Dr. Kee-Chai Chong, BOBP

Concluding Remarks 1230 hrs
Dr. Y.S. Yadava, GOI
Vote of Thanks : Mr. S.R. Madhu, BOBP
Official End of Consultation

4. LIST OF PARTICIPANTS

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5. NEEDS ASSESSMENT IN FISHING PORTS DESIGN

J.A.Sciortino, Ports Consultant

1.0 Introduction

A fishing port serves as an interface between the netting of fish and its consumption. The type and size of the fishing port greatly influences the rate at which a country's fisheries resources will be exploited whereas the basic port infrastructure and its management set-up will dictate how well the resources will be utilised. This paper puts some very basic needs into perspective to enable designers of fisheries facilities to gain an insight into modern demands for environmental protection coupled with stringent health-awareness.

2.0 Type of Fishing Port

Generally speaking, fisheries operations are broadly divided into four major groups and accordingly, fishing ports may be graded according to the type of fishery that serve.

1. **Artisanal fisheries** usually involve subsistence or artisanal fishermen going out on daily trips a short distance from their village. Vessels typically consist of canoes (paddle, motorised or said-powered) beached in front of the village, *Figure 1.*

2. **Coastal fisheries** usually involve artisanal fishermen, making single-day or 2-day trips from home. Vessels typically consist of large motorised canoes and fishing vessels a maximum of 20 meters long. These vessels would either be beached or moored in calm spots, such as natural bays. In some cases, a proper harbour may be needed for high volume. *Figure 2.*

3. **Offshore fisheries** usually involve both fishermen and non fisheries-related business interests who invest in vessel fleets. Fishing trips extend several miles offshore and last anything up to four weeks. The vessel sizes are usually in the 20 to 40 meter range and the vessels generally need proper harbour facilities, *Figure 3.*

4. **Distant-water fisheries** involve large modern, factory-type trawlers roaming the oceans on very long trips, 6 to 12 months at a time. Their home port can be located at specially provided facilities in commercial ports but are considered more effective when specifically designed for the industry within a properly established fishery harbour, *Figure 4.*

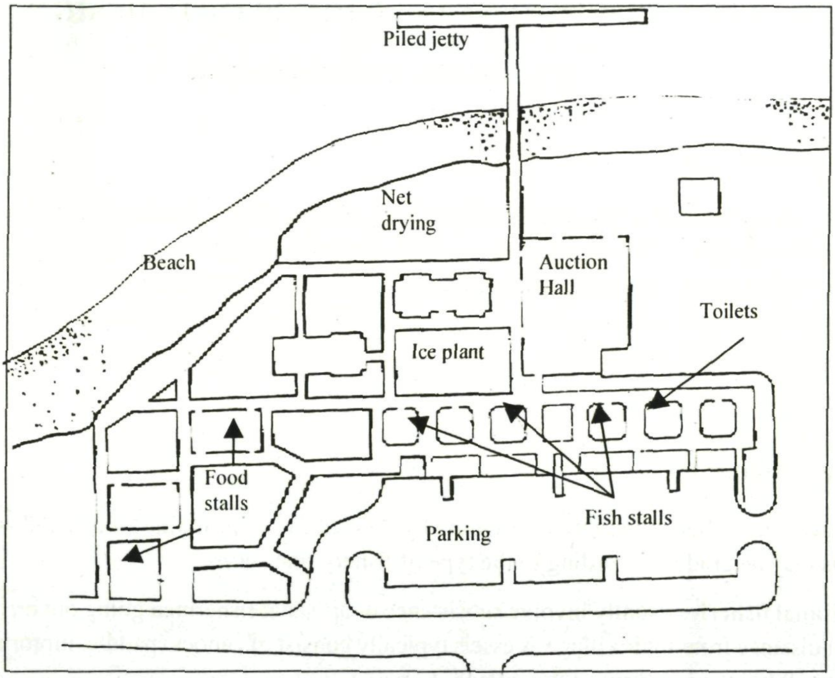

Figure 1 : Artisanal Landing

Location of fishing grounds	Inshore, steaming distance up to 3 hours.
Typical fishing trip	Anything from 6 to 24 hours.
Types of vessels handled	Canoes and small vessels (up to 5 tons), pole-and-line, hand lines, set nets etc.
Type of landed products	Low volume, high value and seasonal high-volume species
Typical shore processing	Gutting, icing and boxing for direct or onward retail, smoking and drying in certain countries.
Minimum depth required	Generally no depth limitations unless site handles other craft, such as sea buses, fuel delivery boats, etc.
Breakwater protection	Generally not required as beach landing equally suitable.
Auction hall	Required as fish is auctioned
Utilities	Mains power and water preferable, but generators, boreholes or seawater systems and septic tanks or soakaways acceptable.
Refuelling	Small-scale installation (up to 100 ton) or bauser service.
Ice production	Of primary importance due to high value of the products landed and possible delays in transportation links.
Cold storage	Generally required, whether by sea or road.
Transportation links	Good access required, whether by sea or road.
Dry docking	Beach slipways to handle large canoes usually sufficient.
Workshops	Outboard engine and hull repair shops required
Net repair areas	Required as nets are repaired inside landing area
Fishermen's/seamen's facilities	A proper fishermen's co-operative with full facilities is required and is highly desirable.
Open storage and parking	Large areas need to be set aside for parking during auctions
Ancillary services	Rarely used for other services unless sea buses operate.
Hinterland	A resident fishing village community nearby is desirable.

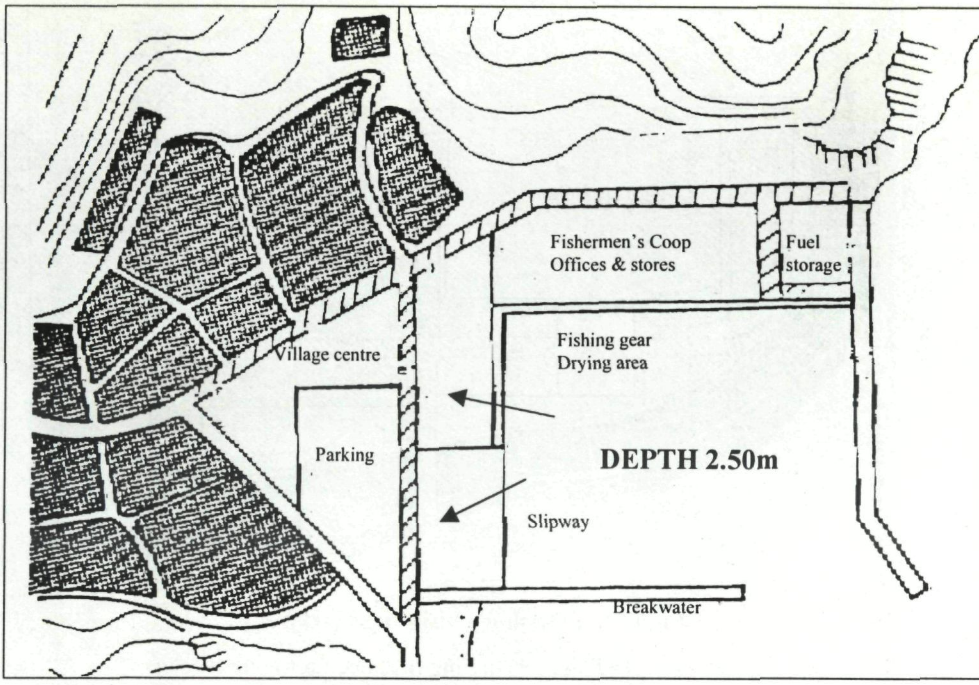

Figure 2 : Coastal Fisheries Harbour

Location of fishing grounds	Coastal, steaming distance up to 3 hours.
Typical fishing trip	Anything from 1 to 2 days
Types of vessels handled	Small vessels (up to 10 tons), mini seiners, pole-and-line, small trawl nets, small purse-seines, etc.
Type of landed products	Mainly fresh, low volume high value species or low value seasonal species.
Typical shore processing	Gutting, icing and boxing for onward retail,
Minimum depth required	2.50 meters below the lowest astronomical tide.
Breakwater protection	Generally required unless port located inside estuary.
Auction hall	Required as fish is auctioned
Utilities	Mains power and water and town sewage treatment preferred, otherwise locally generated (generators, boreholes and septic tanks)
Refuelling	Small-scale installation (up to 1000 tons)
Ice production	Of primary importance due to high value of the products landed.
Cold storage	Required, size depending on fleet landings and markets
Transportation links	Good road access required if village is not integral
Dry docking	Travelift or slipway to handle 50 ton vessels usually sufficient.
Workshops	Engine and hull repair shops required
Net repair areas	Required as nets are repaired inside port area
Fishermen's/seamen's Facilities	A proper fishermen's co-operative with full facilities is required (offices, stores, showers and toilets, etc).
Open storage and parking	Large areas need to be set aside for parking during auctions
Ancillary services	Coastguard, fisheries patrol and water buses.
Hinterland	A resident fishing village community is required.

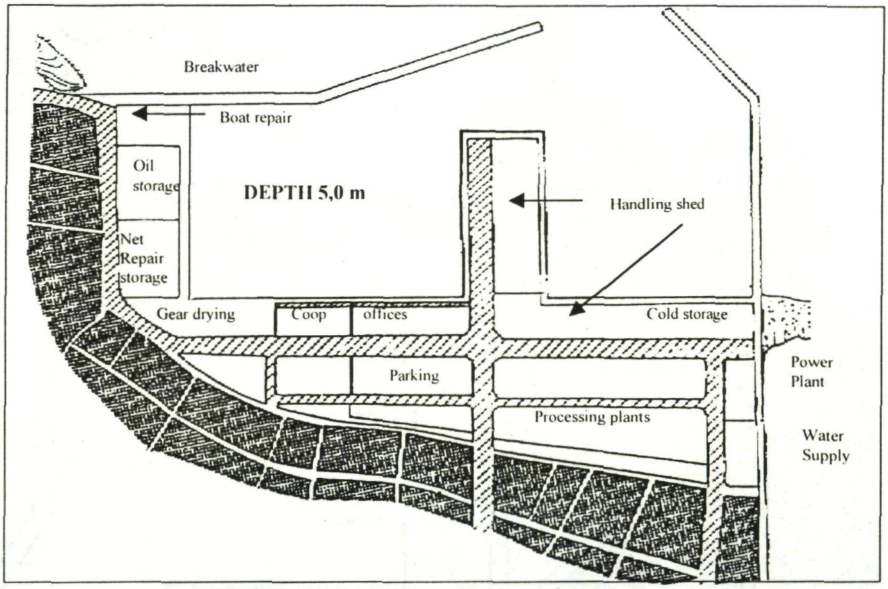

Figure 3 : Offshore Fisheries Harbour

Location of fishing grounds	Offshore, steaming distance up to one week
Typical fishing trip	Anything from 2 to 4 weeks
Types of vessels handled	Typically purse seiners and trawlers (10 to 100 GRT).
Type of landed products	Mainly iced but also frozen, low-value, high volume pelagics or high value, low volume shrimp.
Typical shore processing	Icing, boxing, fishmeal, drying, salting or canneries.
Minimum depth required	Five meters below the lowest astronomical tide.
Breakwater protection	Generally required unless port located inside estuary.
Auction hall	Required as some types of landed fish are auctioned
Utilities	Mains power and water and town sewage treatment preferred. Telecommunication services are required.
Refuelling	Medium scale installation required (1000 to 5,000 tons).
Ice production	Vitally important due to fresh-on-ice nature of some of the products landed.
Cold storage	Required for buffer stocks and depends on fleet landings.
Transportation links	At least road links to potential markets must be established for rapid movement of products to destination.
Dry docking	Synchrolift or slipway to handle 300-ton vessels generally sufficient.
Workshops	Engine and hull repair shops required
Net repair areas	Generally required
Fishermen's/seamen's	A proper fishermen's cooperative with full facilities (including banking) is required.
Open storage and parking	Large areas need to be set aside for parking during auctions and vessel crews.
Ancillary services	Typically, port acts as SAR centre, oil-spill combat facility, fisheries patrol and coastguard base.
Hinterland	Adjacent town required for complete commercial services i.e., banking, shipping, hospitals etc.

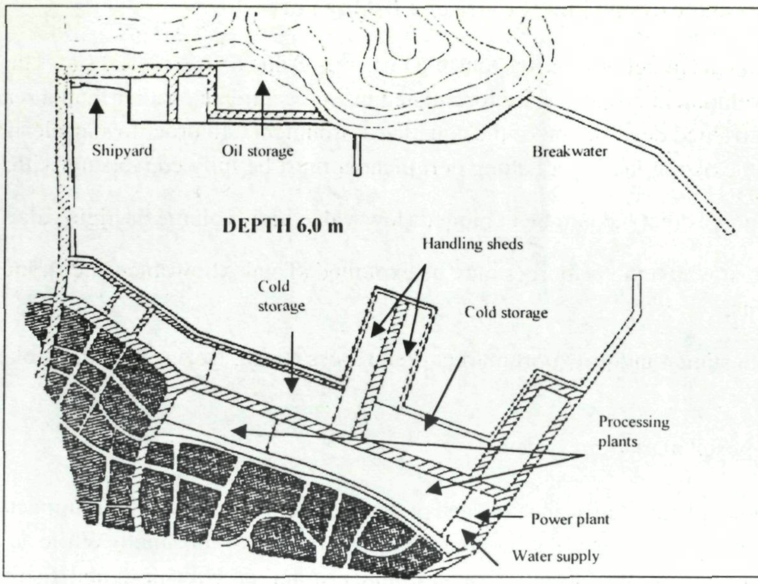

Figure 4 : Distant-Water Fisheries Harbour

Location of fishing grounds	Overseas, steaming distance up to 3 to 4 weeks
Typical fishing trip	Anything from 6 to 12 months
Types of vessels handled	Factory vessels (up to 5000 GRT) and large trawlers (500 to 1000 GRT).
Type of landed products	Mainly frozen, in bulk, individually packed or processed and ready for sale.
Typical shore processing	Value added processing,canneries, fishmeal etc.
Minimum depth required	6 metres below the lowest astronomical tide.
Breakwater protection	Generally required unless port located inside estuary.
Auction hall	Generally not required as fish is not auctioned
Utilities	Power, water, sewage treatment and telecommunications required to highest industry standards.
Refuelling	Large-scale installation required (5000 to 10,000 tons).
Ice production	Generally of secondary importance due to frozen nature of the products landed.
Cold storage	Generally dependent on shore processing facilities.
Transportation links	Sea, road/rail or air routes must be up and running to ensure rapid export of products.
Dry docking	May not be required, very common for vessels to dry dock overseas at established yards. Synchrolift or slipway to handle 500 to 1000-ton vessels may be an option.
Workshops	Engine repair shops generally required.
Net repair areas	Generally not required. Nets are repaired elsewhere.
Fishermen's/seamen's facilities	A proper seamen's union with full facilities (including lodging) is generally required.
Open storage and parking	Large areas need to be set aside for parking during auctions
Ancillary services	Typically, port acts as SAR centre, oil-spill combat facility, fisheries patrol and coastguard base.
Hinterland	Adjacent town required for complete commercial services i.e., banking shipping, hospitals etc.

3.0 Precautionary design and the size of a fishing port

The FAO Technical Guidelines for Responsible Fisheries, Annex VI, Article 4 states that "States should ensure that development proposals are formulated in a precautionary rather than a reactive manner to minimise unwarranted degradation of the aquatic environment". In order to start designing a new port or upgrading an existing facility a fishing port planner must be fully conversant with:

- The resources that have to be exploited (low-value high-volume or high-value low-volume);
- The rate at which the resources may be exploited (Total Allowable Catch), including seasonal variations;
- Local consumer and/or export market preferences (fresh, frozen, salted, smoked or canned fish);
- The proposed marketing systems.

Failure to understand the significance of each of the above conditions and their impact on the design of the facility generally results in a facility that is either too large or too small. While an under-designed fishing port may put the visible infrastructure under strain, an over-designed fishing port puts the relatively invisible resources under strain by enticing more fishing vessels to the port. Such design is called reactionary design and leads to the degradation of the aquatic environment through over fishing. Typical examples of past errors leading to reactionary design include:

- The extrapolation of the size of the fishing fleet from current fish landings by the port planners – the size of the fleet should be specified before hand by the Department of Fisheries;
- The upgrading of artisanal sites into deep draft harbours for artisanal fleets – this only leads to larger vessels moving in on artisanal fishing grounds;
- The design of fishing port facilities around a proposed fishing vessel's characteristics as in the case of imported, highly sophisticated, modern trawlers, leading to very complex and expensive designs – a country's exploitation of its resources may be better achieved by the proper management of existing, indigenous fleets using relatively cheaper port facilities.
- Last but not least is the building or siting of facilities based purely on political grounds with no regard to environmental or social realities – fishermen should not only be consulted but given more say in some decisions.

4.0 Fishing ports and incompatible environments

The difference between a conventional harbour engineer and a fishing harbour engineer is that whereas the former regards the harbour, i.e. the well-being of the vessels, as his objective, the latter considers the end to be a functional seafood producing operation running at the peak of its sanitary efficiency and sitting in an environment compatible with its end-use. In tropical climates, keeping fishing ports at their peak of sanitary efficiency is problematic by itself; it is far worse when such ports sit next to or inside heavy industrial sites. In many developing countries, especially those with fledgling environment protection agencies, the incompatibility of heavy or smoke-stack industries with the fisheries sector is never questioned. As a result, fishing harbours have been built next to or down-wind from:

- Large power stations burning coal or heavy oil;
- Cement plants;
- Fertilizer and petrochemical plants;
- Oil storage facilities.

Some fishing ports are also sited inside ports utilised primarily by these industries. The reverse may also be true, sometimes smoke-stack industries are allowed a foothold inside urban areas that are too close to the fishing port. Some of these industries even start utilising the fishing port for their needs. Such practices eventually lead to cross-contamination of the fish products through.

- Settlement of particulate matter on fish and fish products.
- Contamination of rainwater collection systems when these are required to supplement other supplies;
- Fouling of harbour basin water when this may be required to alleviate the use of fresh water;
- Contamination of the groundwater aquifers themselves.

It is hence of the utmost importance to site fishing ports as far away as possible from such activities. Once a decision has been reached regarding the siting of a fishing port, legislation should be enacted to ensure that all future development in the area is compatible with fisheries. With existing situations of incompatibility a decision must be reached at local or national level to priorities industrial needs and a decision taken as to what should be moved where. Unless this fundamental reasoning is accepted by all the parties involved, from local planners and engineers all the way up to local and national government, then problems of this nature are here to stay and will only lead to further fishing ports being condemned on pollution grounds.

5.0 The most basic of needs – Water

Every type of port has some basic infrastructural need without which a design is not considered feasible. For instance, container terminals need huge expanses of land for the stacking of containers. A wheat handling port must have silos adequate for grain storage. Fishing ports, on the other hand, are synonymous with water supply and without an adequate water supply there can be no sanitation.

5.1 Water

Water is used for fish washing operations, ice making, sanitation and processing – in other words, for every stage of the process after capture. In the interest of economy many harbour engineers tend to under-estimate the amount of water required for the daily operation of a fishing harbour. A fishing port, however, needs a properly designed supply system that is multi-redundant, whereby every drop of water available is employed for a specific function with the least amount of waste. In a bid to save potable water, even seawater may be utilised for certain functions. Typical components of a multi-redundant system may include:

(a) Extensive and secure borewell fields (very deep and away from sources of ground pollution),

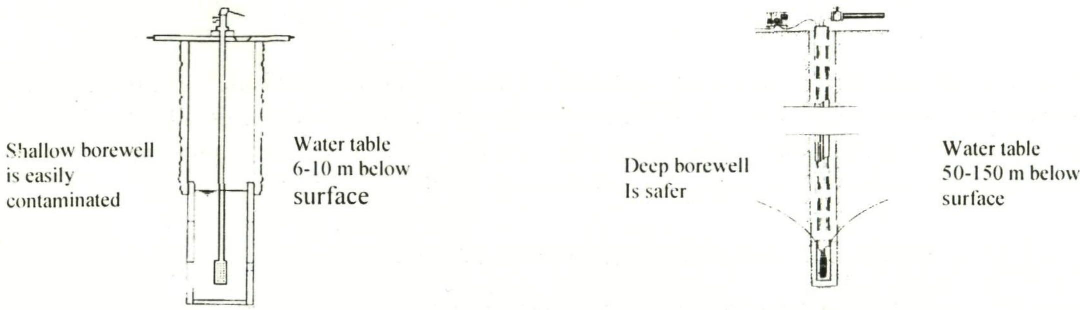

Figure 5 : Shallow village borewell (left), Deep borehole for a port facility (right)

(b) Reinforced concrete underground storage reservoirs (see Figure 6), or above-ground steel tanks, (see Figure 7), to alleviate extreme shortages of water.

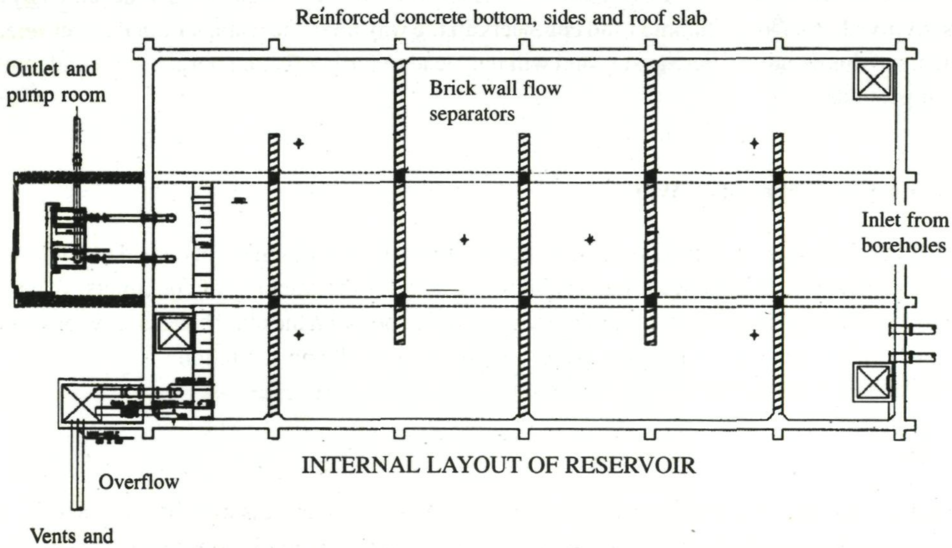

FIGURE 6 : TYPICAL REINFORCED CONCRETE RESERVOIR

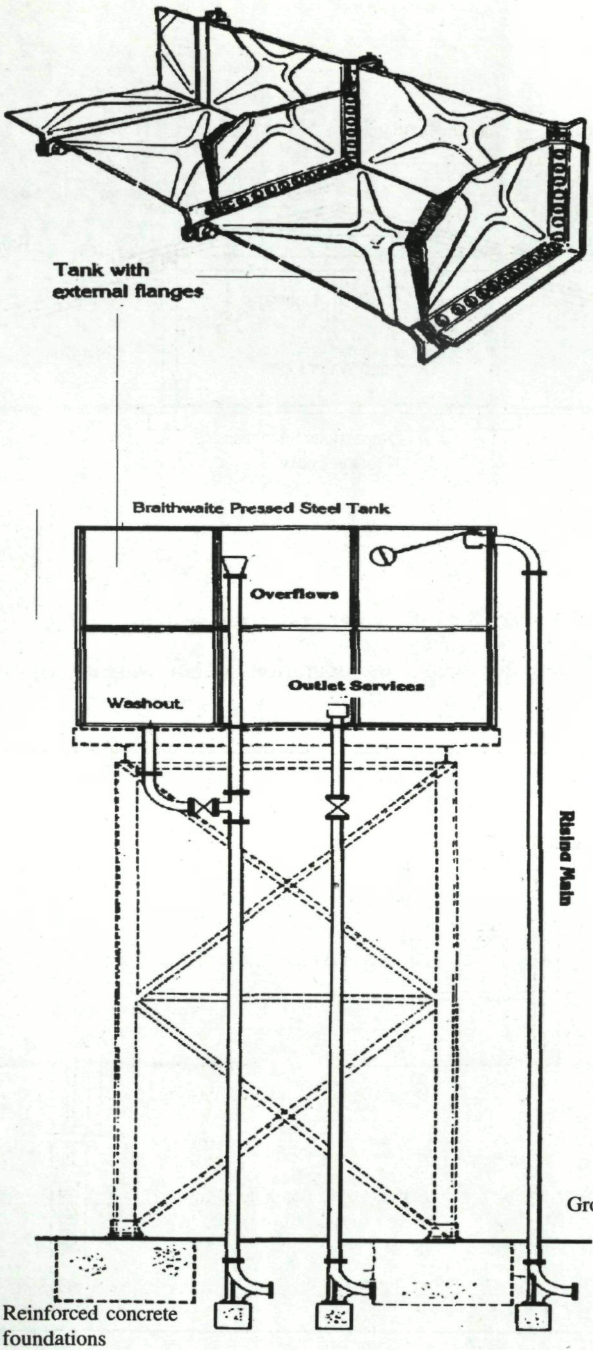

Figure 7 : Alternative Braithwaite overhead tank with gravity feed, including cover, internal partitions and supporting steel work.

(c) Rainwater collection systems linking all roof surfaces to storage, Figure 8.

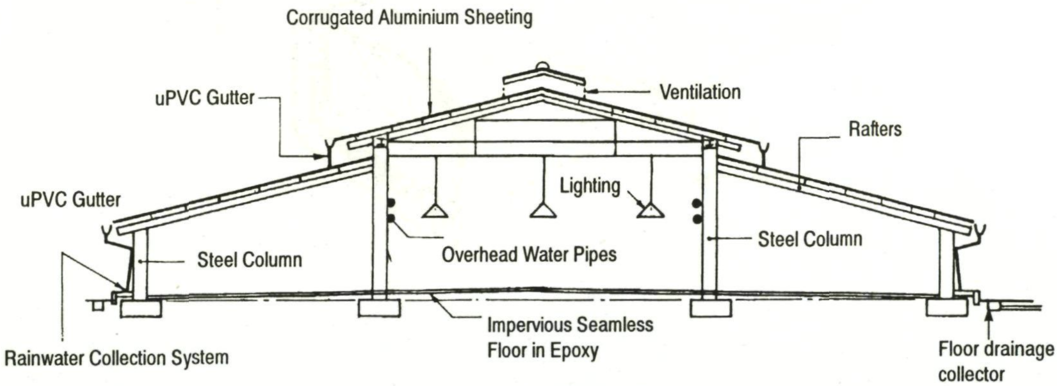

Figure 8 : Rainwater collection system

(d) Separate seawater system for secondary operations (floor washing or fish box cleaning), Figure 9.

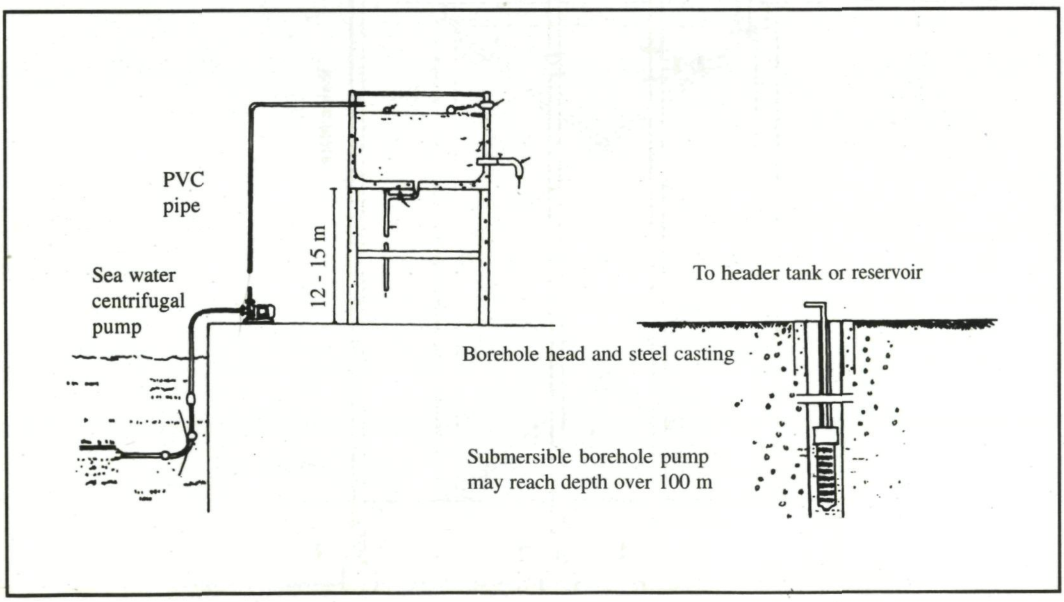

Figure 9 : An auxiliary seawater system

(e) Metered water hydrants to eliminate waste.

(f) Good quality (PVC, HDPE) pipes and fittings to eliminate leakage losses.

(g) Water saving measures, such as high pressure cleaners, Figure 10.

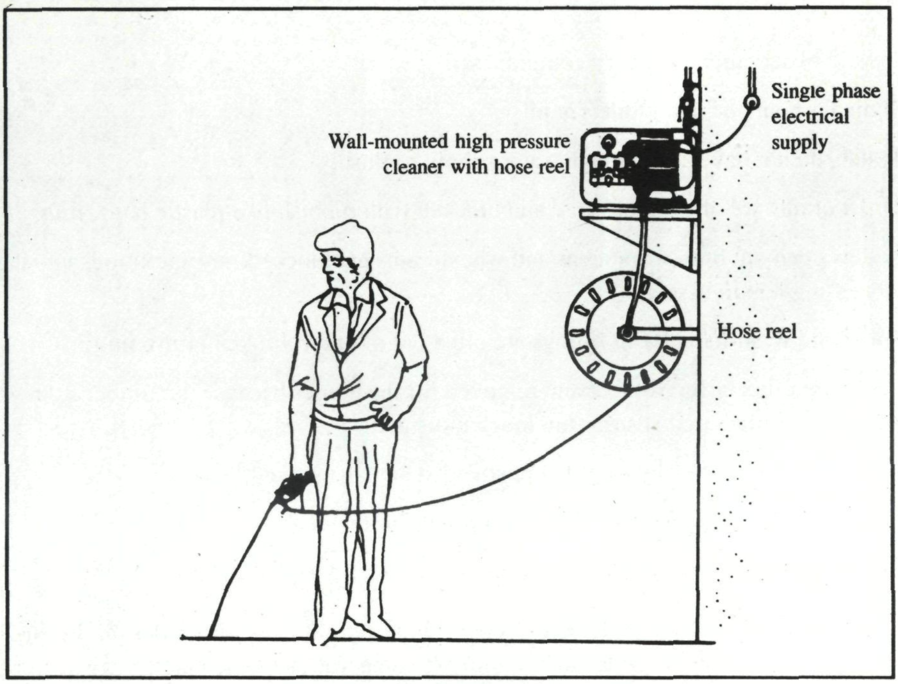

Figure 10 : Wall-mounted high pressure cleaner.

(h) Standby desalination equipment in extreme cases.

(i) Employment of outside contractors for the supply of ice.

Depending on the particular site and taken as a whole, the above generally yield very good results if integrated into the infrastructure at the design stage. However, failure to observe environmental compatibility at the design stage may lead to problems at a later stage.

For instance, if a harbour is planned in between other structures, with no opportunities for expansion, or if other structures such as housing are allowed to encroach on harbour land, retro-fitting an underground reservoir when the need arises may prove impractical at a latter stage.

Siting dirty smoke-stack industries in the vicinity of a fishing harbour or vice-versa may deprive a fishing port of valuable rainwater. Rain water polluted by industrial emissions is not suitable for use in a fishing harbour.

If a harbour basin is allowed to foul up with raw sewage or effluent from a chemical plant, then seawater for secondary purposes would have to be piped in from a greater distance or eliminated altogether, thereby increasing the load on the potable water supplies.

5.2 Sanitation

One of the major uses of water is in sanitation. Port administrators not conversant with the food industry requirements may underestimate its importance when budgetary cuts are in the pipeline. Closer examination of fishing harbours in many developing countries paints a very dismal picture to a would-be importer of seafood preoccupied with the personal hygiene of the workers handling the seafood products.

The following observations are very common:

a) Some harbours have no toilets at all;

b) Toilets do not have an adequate water supply to flush;

c) Toilet drains are often uncovered and blocked with rubbish like plastic bags, fruit;

d) Toilets open out onto work areas and when drains get blocked, sewage floods into the processing/handling area;

e) Toilet and wash-hand basin fittings are often out of order, broken or missing;

f) Doors are often unserviceable and removed off the hinges because the timber from which they are manufactured absorbs too much moisture;

g) Toilet and shower blocks are often unattended and abandoned;

h) Toilets are often flooded from leaking pipes or roofs;

i) Sewage disposal or treatment is either absent or totally inadequate.

All of the above generally lead to toilets of opportunity usually spread around the fishing harbour. Needless to say, this is a health inspector's nightmare come true as the potential hygiene trouble spots multiply and fester.

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6. FISH QUALITY ASSURANCE IN SMALL-SCALE FISHERIES AND THE ROLE OF CLEANER HARBOURS

by S Subasinghe *

Introduction

Coastal wasters are polluted to varying degrees from industrial and domestic wastes and agricultural run-off (Table 1). Shipping, ship building/breaking and port activities are other significant sources of coastal pollution in many countries. However, wave and wind action often help to disperse such pollutants and also help in their break down. In a sheltered locality like a harbout on the other hand there is a tendency for the pollutants to linger on. Various activities undertaken in the land areas adjacent to a harbour and within the harbour itself, very often further aggravate pollution of harbour waters.

On the other hand, fish landing complexes or harbours, regardless of their size, tend to be the focal point of any fishery industry, where catching vessels from different fishing grounds arrive to land their fish and obtain essential supplies and also where traders/processors get their fish supplies. In short, landing complexes serve as a meeting point for fishermen and their buyers. Looking at the nature and intensity of the activities undertaken at a harbour the importance of proper planning, maintenance and management of the facility cannot be over-emphasized. This is more so in a facility which is dedicated to handle fish, a highly perishable commodity, especially at ambient tropical temperatures.

Activities at a fish landing place may be basically categorized into three key groups – those relating to the fish, the vessels and the complex. Fish related activities at a landing site may include one or more of the following activities: landing, auction/sale, sorting/packing, icing/chilling.freezing, processing, packing, cold storage, sale/export, transportation. Vessel-related activities include berthing, servicing and maintenance. Complex-related taske include general administration and maintenance of the premises, machinery and equipment; collection of duties/revenue; and expansion and development activities. Management of the Complex plays an important role with respect to the quality assurance of fish landed and handled at the harbour, as the management's duty is to ensure proper sanitary supervision of all operations in the complex.

Fish Quality Assurance

Fish is a highly perishable commodity. Soon after death fish flesh starts decaying due to bacterial and enzymic action. Bacteria on the surface of the skin, gill cavities and inside the gut start invading the tissues and breaking them down. This is facilitated by changes in fish flesh due to enzymic action. Thus the decomposition is due to enzymic changes in the flesh as well as bacterial action.

Various handling.practices can reduce or minimize decomposition of fish landed.

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These include washing, removal of gut/gills and washing, chilling/freezing. The method of handling fish also has some bearing on the rapidity of decomposition. Care should be taken in unloading and transporting fish so as to avoid damage to fish flesh. Any damage to fish flesh will open up on the muscle mass thus speeding up bacterial invasion of the tissues. The quality of water used, cleanliness of surfaces/containers used in handling or processing fish, the state of hygiene of personnel etc. also determine the speed of decomposition and the quality and safety of the product.

Table 1: Pollutant Load in Coastal Waters of India

Input/Pollutant	*Quantum (Annual)*
Sediments	1,600 million tonnes
Industrial effluents	50 x $10^6 m^3$
Sewage (largely untreated)	0.41 x $10^9 m^3$
Garbage and other solids	34 x m^3 tonnes
Fertilizers (residue)	5 x 10^6
Synthetic detergents (residue)	1,300,000 tonnes
Pesticides (residue)	65,000 tonnes
Petroleum hydrocarbons (tall ball residue)	3,500 tonnes
Mining rejects, dred spoils and sand extractions	0.2 x 10^6 tonnes

Importance of cleanliness of fishery harbours in assuring fish quality

Apart from careful handling and temperature control, cleanliness of the premises, utensils and personnel are some of the primary factors determining the quality of fish. The contamination of fish after landing could thus be mainly through:

- premises/landing area
- utensils/containers
- water and ice
- personnel

Premises/landing area

Cleanliness of the landing area and premises is important to assure fish quality. Often, fish landing/fish handling areas in many developing countries are unable to control access by stray animals, pests (Table 2) and intruders. Proper control measures are essential:

- cordoning off the area by a fence or a wall to keep away stray animals and intruders
- vermin control by the use of traps or other methods
- methods to dispose of solid waste such as fish discards, packaging material, containers etc.

- adequate drainage to remove sewage, wash water, oil, detergents etc.
- proper storage area for paint, fuel/lube oil, detergents etc.

Table 2: Pests as a source of contamination

Pest	*Organic Contaminant*	*Route of Microbial Contamination*
Cockroach	Moult cases, faeces, dead bodies	Mechanical transfer from feet directly or indirectly from faeces.
Birds	Feathers, droppings, dead bodies	Mechanical transfer from feet directly or indirectly from faeces.
Flies	Droppings, dead bodies, regurgitation	Mechanical transfer from feet directly/ indirectly from faeces or reurgitation.
Rat/Mouse	Droppings, dead bodies, urine, saliva	Mechanical transfer from feet directly or indirectly from faeces or saliva

Source: How to Clean, Mike Dillion et al

Utensils and containers

Fish boxes and containers can be an important source of contamination. In some fish landing sites it is a common sight to see contaminated harbour water being used to wash fish boxes. Often water in most harbours is contaminated with pollutants such as bilge, lube oil, sewage, deck washing, toilet waste, fish hold wash water etc. Use of such harbour water can contaminate fish with pathogenic bacteria, viruses, toxic chemicals etc. The exterior of the boxes should be clean, as very often the exterior surfaces too come into contact with fish during storage and transportation. Fish boxes/containers should be stored in a clean, dust free area. Only clean potable water should be used to wash utensils/boxes.

Water and Ice

Water is another medium of fish contamination. As discussed earlier a fish landing complex should have an adequate supply of clean, potable water for cleaning/washing fish, working areas, utensils, machinery etc. If the municipal supply is inadequate, the use of treated sea water could be considered. The bacterial/chemical quality of the water should be closely monitored by subjecting samples of water to laboratory analysis. The water should be adequately chlorinated to satisfy free chlorine levels recommended for water used for various operations. Both under-chlorination and excessive chlorination should be avoided. Excessive chlorination can lead to tainting of the fish and corrosion of surfaces. It can be harmful to workers. On the other hand, low levels of chlorine will not have the desired effect. It is important to monitor the free chlorine level of water. The chlorinating agent used should be reliable. UV radiation too could be used, often to supplement chlorine, to reduce bacterial loads in water.

Ice is yet another source of contamination. Apart from usage of ice to chill the fish adequately, care must also be taken to ensure that the ice used for chilling is clean and is handled and stored to prevent contamination. Water used to produce ice should be of potable quality. The ice storage area should be properly secured to prevent employees walking into the area and contaminating the ice. In the case of flake ice, the ice storage area should ideally be above the floor level, or special bins should be used to store ice. In the case of block ice, the practice of dragging blocks of ice on the floor and crushing ice on the floor should be avoided. The complex should be equipped with ice crushers for the purpose.

Cleanliness, Hygiene and Sanitation

It is the duty of the complex management to supervise all sanitary works carried out within the landing complex. It is the responsibility of the complex management to ensure that proper hygiene and sanitary conditions are maintained all the time. It is not an easy task, but is not impossible! With a comprehensive sanitation and hygiene programme, competent/reliable and trained staff, and a little bit of common sense concerning cleanliness, a fish landing complex can be maintained clean and acceptable for fish handling.

In order for the complex sanitation programme to be effective, the complex must be located in a clean environment, provided with animal barriers, and so constructed that the floors and walls have smooth surfaces which minimize bacterial development and allow easy cleaning. The water supply must conform to microbiological specifications for potable water.

The complex must be provided with adequate sanitary toilet and hand-washing facilities. Good personal hygiene habits on the part of the employees must be insisted upon. Employees who are designated to carry out complex sanitation activities must be provided with suitable cleaning equipment and supplies. Storage bins and boxes used for holding raw materials should be cleaned immediately after use so that they will not become a source of contamination for new raw material.

Human beings are carriers of a wide range of pathogenic organisms. These pathogenic organisms can get transferred to fish directly during handling or via surfaces/areas polluted with spit or fecal matter. Hence it is important to ensure that proper personal hygiene is maintained in the work force. Most important from the harbour management angle is the prevention of open areas for urination and defecation. Its important to provide adequate toilet facilities for staff and harbour users. As far as the employees are concerned the following formula could be used in assessing the adequacy of toilet facilities in relation to the number of employees.

1 employees	–	1 toilet
10-24 - employees	–	2 toilets
25-49- employees	–	3 toilets
50-100- employees	–	5 toilets

Cleaning

Cleaning is the removal of unwanted soil from equipment and other areas of a food preparation/processing premises. Soil is 'matter-out-of-place'. Soil can be divided into two basic types based on its chemical nature: water-soluble and water-insoluble. Water-insoluble soil is normally hard to remove and requires a chemical detergent to effectively remove it. Thus cleaning needs water and a detergent. In addition, the removal of soil should be facilitated by rinsing/scrubbing the surfaces. Typical stages in a cleaning programme in a harbour complex (landing area, roads/walkways, fish preparation area, storage area, auction halls, box cleaning/washing area, boxes, weighing machines, utensils etc.) may involve one or more of the operations listed in Table 3.

Table 3: Stages in a harbour premises/utilites cleaning programme

Stage	*Function*	*Reason*
1. Pre-Clean	Remove loose food or dirt, scrape, vacuum, etc.	Improves efficiency of later stages, allows detergent access to firmly adhering residues.
2. Main clean	Removes more firmly adhering food residue, grease or dirt. Usually detergents used to emulsify food particles and reduce surface tension.	Improves efficiency of later stages. Presence of dirt/residue/grease reduces the efficiency of disinfectants.
3. Rinse	Removes detergent & emulsified/ dissolved dirt and grease.	Improves efficiency of disinfection, minimises any reactions between cleaning chemicals.
4. Disinfect	Further reduction in the number of micro-organisms	Minimises risk of cross contamination increases product shelf life and safety.
5. Final Rinse	Removes traces of disinfectant	Minimises risk of disinfectant contaminating the food.
6. Dry	Air dry or use disposable materials to minimise recontamination.	Residual moisture provides an opportunity for any remaining micro-organisms to grow and survive and increases the risk of cross contamination.

Responsibility

Whether it is harbour equipment or premises, cleaning must be planned for it to be economical and effective. Cleaning must be consistently performed and this requires clear written instructions to ensure that no matter who performs the cleaning it will safely be carried out and be effective.

Roles and authority should be defined within the cleaning plan (Table 4) and resources properly controlled and managed to ensure proper and efficient utilization of the resources. This involves defining roles and job descriptions in relation to the ports, sanitation programmes and sanitation requirements. Contract cleaning companies or chemical suppliers will also assist in documenting a system. Many variations will exist to the documentation – from a trained workforce and total absence of documentation to a fully documented cleaning manual .

Table 4: Factors to be consisered in the design of a cleaning schedule

Factors	*Management must consider*
Plant Description or Location	Intended product, whether high or low risk, size, temperature, humidity of area, surface finishes
Materials of Construction	Can affect level of water pressure, and detergent or disinfectant used.
Availability of (including waste disposal)	Electricity, steam etc. can dictate use of mobile or fixed utilities equipment
Time Available (including shift patterns)	Can dictate method of cleaning and choice of disinfectant e.g. use of ozone
Operative Working Conditions	Need for protective equipment, health and safety
Whether Disinfection Required or Not	Related to risk and any HACCP plans
Need For/Process of Validation	Proving that the cleaning is effective
Need for Monitoring	If CCP, or not, choice of method

Most advanced cleaning/sanitation programs require detailed documentation/record keeping. This written documentation, which could be required for the implementation of a satisfactory cleaning/sanitation programme, should be constantly examined to ensure that they satisfy the varying needs of the complex. It is also important to maintain records of cleaning schedules undertaken with details of process, personnel, time, observations, remedial action etc.

Harbour waste management

The standard recommended approach for waste management based on the 3Rs. (Reduction, Reuse and Recycling) may not be fully applicable in harbour waste management in developing countries. However, the approach based on the 3Rs should be considered whereever such applications are practical and have proven techno-economic feasibility. Source reduction focuses on careful management of raw materials rather than on managing waste as such. Reuse is putting the waste to some use such as fish offal in the production of fish meal, oil and fuel etc. Recycling on the other hand focuses on extracting recyclable material for recycling aluminium cans, bottles, recyclable plastics etc.

It is prudent, at least in the case of large harbours, to zone the harbour areas and conduct an audit to get both qualitative and quantitative information on harbour waste prior to developing a waste management plan.

Solid waste

Solid waste which often litters harbours, such as driftwood, paper/plastic bags, plastic/metal containers, netting, bottles etc, not only lowers the aesthetic quality of the harbour environment, but also tends to clog drains and water intakes. It can can damage propellers of boats and even cause death and destruction of marine fauna. Annually, large numbers of birds and marine mammals are killed by coastal water pollution, especially oil spills and drifting nets which entangle these animals.

Many of the solid waste items made of glass, aluminium, plastic etc are recyclable. Old tyres can be used as fish aggregation devices in suitable locations. Picking up recyclable objects not only cleans the harbour areas but also provides employment to many. However, collection of floating material may need the use of a scoop net or a floating net system.

In most harbours in developing countries eventual disposal of solid waste is done by the municipality even though in some harbours this function is assigned to private garbage collectors. Various types of collecting receptacles and compacting equipment are used in solid waste management. Open dumping, though commonly practised, is not a healthy practice. Uncompacted waste in open dump sites attracts flies, birds, rodents and even domestic animals such as cats, dogs and cattle. These animals feeding on dump sites can spread diseases to humans. The run off from such open dump sites can also contaminate wells and other inland water sources.

Solid waste may also include toxic components such as batteries/accumulators and paint and thinner used in boat repair and maintenance, industrial waste from tanneries and smelters (chromium, lead, zinc etc) located in the vicinity. Such wastes are difficult to collect and can cause considerable damage to the environment and also contaminate the fish. Dredging waste could also be considered as a form of solid waste in locations where regular dredging is undertaken as a result of siltation.

Oil waste and spills

Oil pollution may be due to accidental spills or leaks during supply of oil to vessels from shore facilities. Accidental grounding of vessels or damage to oil storage compartments can lead to catastrophic contamination of harbour water and miles of coastal water affecting fauna and flora as well as the tourism potential of beaches. Sometimes the contamination of harbour water could be due to deliberate pumping of bilge and discharge of used engine oil. Bilge water and waste oil from vessels can be collected and separated prior to recycling.

Effluent and sewage

Effluents may be primarily chemical or biological in nature. Effluent from wash areas may contain varying amounts of toxic components including detergents. The effluent from washing, cleaning and gutting of fish is rich in biological material such as fish blood and body fluids.

Untreated municipal sewage and industrial sewage from small or medium-scale operations are the most common causes of effluent pollution in coastal waters including harbour waters. Any discharge of raw sewage and effluent into sheltered harbour waters where, unlike open coastal waters, there is poor potential for dilution and dispersion, can often have very damaging effects on the harbour environment.

Sewage can introduce disease-causing organisms to harbour waters, thus creating a health hazard for those who come in contact with harbour water directly or indirectly. The water may be polluted with organisms such as faecal coliforms, salmonella, vibrio cholera etc.

Disease-causing (pathogenic) organisms

Fish landed at a complex may be contaminated with a number of disease-causing pathogenic bacteria. Such organisms include those causing bowel and intestinal diseases such as cholera and various forms of food poisoning (*V. parahaemolyticus,* various *Vibrio* sp, *L. monocytogenes, Aeromonas sp).* However, the presence of these animals alone does not cause any problem; it is the growth of these organisms that can be regarded as a problem. Often, if the temperature is not kept low they grow in large numbers, and some of them produce toxins. Thus if the fish is not properly handled, these organisms can multiply to levels high enough to cause disease or can produce enough toxins to cause illness.

Most of these bacteria enter water from diseased or bacteria-carrying humans or animals (Salmonella, *E.coli, Shigella, Saphylococcus aureus).* Fish and aquatic organisms caught in these contaminated coastal or harbour waters may carry and harbour the pathogenic organisms. Further contamination may take place during landing and processing. The diseases which these organisms can provoke are serious, but if the number of organisms in the fish is kept low by promptly chilling the fish the likelihood of serious disease is low. Cooking before consumption will eliminate the risk. However, an indirect hazard exists if contaminated products pollute the working areas (industry, kitchen) and thereby transport the pathogens to products which are not cooked before eating (cross contamination). This indirect hazard must also be prevented.

Fish caught in certain areas may also be infected with parasites dangerous to human health. The severity of the possible disease depends on the parasite involved. The likelihood of contracting parasites from fish is eliminated if the fish is cooked before consumption. The risk will be low if fish are consumed raw. The presence of biotoxins such as histamine and chemicals such as mercury in fish depends on fish species, fishing area and season. The biotoxins are heat-stable and the risk of intoxication after consumption (raw or cooked) is high.

Quality control, HACCP

Assurance of quality and safety of seafood is an important factor in increasing industry earnings and maintaining export growth. Step-by-step, more stringent inspection programmes are being implemented in the commercial seafood industries the world over. These programmes are based on the principles of the Hazard Analysis Critical Control Point (HACCP) system of regulation to ensure the safety of seafood products.

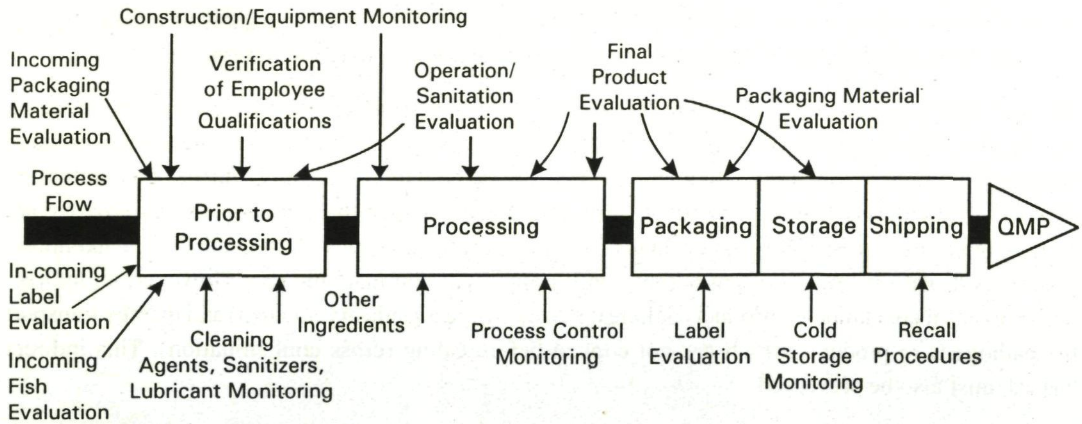
In the European Union a similar system, called Own Checks, is used to identify points along the seafood handling and processing chain where quality problems are most likely to develop, covering suppliers of products used along the production chain, and people involved in the production and distribution of seafood.

A typical process flow under the Critical Control Points programme is shown in Figure 1. The plan has to be set up to consistently monitor those critical points, in order to prevent related problems from seafood developing, and to take the necessary corrective action if they do occur. The main elements of a HACCP system are;

- Identify potential hazards
- Determine Critical Control Points (CCPs)
- Establish criteria to be met to ensure that CCPs are under control
- Establish a monitoring system

- Establish corrective action when CCP is not under control
- Establish procedures for verification
- Establish documentation and record-keeping

Figure 1: A Critical Control Points Programme for Fish Handling/Processing



The system ensures safety of the product by controlling hazards due to contamination with additives/ chemicals, presence of biotoxins, risk of contamination with/growth of pathogenic bacteria etc. Contamination with pathogenic bacteria from the human/animal reservoir can occur when the landing place is unhygienic or when the fish are washed with contaminated water. Most fish and crustaceans are cooked before eating although a few countries have a tradition of eating raw fish. Cooking the product before consumption usually eliminates the risk from contamination with pathogenic bacteria. However, an indirect hazard exists if contaminated products are polluting the working areas and thereby transporting the pathogens to products which are not cooked before eating (cross contamination). Cooking will not, however, eliminate the growth of heat-stable toxins (histamine).

Time and temperature conditions at all steps from capture of fish to distribution constitute an important critical point in preventing growth of pathogenic bacteria and spoilage bacteria. Below 1°C, no growth of pathogenic bacteria takes place. Therefore a maximum time at temperatures over 5°C must be specified in the criteria for this control point. Exposure for only a few hours of fatty fish to the sun, air and ambient temperature during fish handling on the vessel or at the harbour is sufficient to introduce severe quality loss and cause early spoilage.

A sensory assessment (appearance, odour) of the fish when landed is a control point for ensuring that until this point the material has been under control, and that spoiled fish or shrimp and potential toxic species can be discarded. Personal hygiene as well as fishery harbour sanitation are CCPs preventing contamination of products with micro-organisms and fish. The seriousness of the hazard varies, depending on the intended end-use of the product (cooking or no cooking). Occasionally a microbiological check of the cleanliness of working surfaces can be made. This control procedure must be carried out on a weekly basis. When the routines are well established, microbiological control of cleanliness can be carried out monthly. Water quality is a critical control point in preventing contamination from this source. Where in-plant chlorination is used, chlorine levels must be measured and recorded. Chlorine levels should be measured daily.

Table 5: Hazards in the production of fresh and frozen fish

Product flow	*Hazard*	*Preventative measure*
Live fish	Contaminated	Monitoring of Environment
Catch and Catch handling	Growth of bacteria	Temperature/time control
Chilling	Growth of bacteria	Temperature/time control
Landing	Excess contamination And/or growth of bacteria	Hygienic handling

Application of HACCP system in Fishery Harbours

Harbours vary a great deal in size and the quantities of fish they handle. Accordingly the hygienic requirements and the design of fish handling areas may vary considerably. Quite obviously the requirements of a small harbour or landing place where fish is landed, repacked in ice and distributed to the local market are different from the hygienic requirements of a large complex which includes fish processing of a variety of seafood and cold storage. In most fishery harbours where there is no seafood processing other than handling of fresh fish, all that is needed may be temperature and water quality controls besides encouraging a cleanliness ethic. Thus most food quality and safety aspects of fish handled by harbour operations can be taken care of by applying Good Manufacturing Practices (GIPs) and Standard Sanitation Operational Procedures (SSOPs).

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7. INFRASTRUCTURAL DESIGN SPECIFICATIONS

Design Guidelines for the Development and Upgrading of Fisheries Ports

J.A. Sciortino, Ports Consultant

1.0 Introduction

A cursory examination of most fish landed in many local markets, irrespective of its freshness, shows that in many cases the fish only becomes a health hazard when contaminants found in the work environment, the working medium (water) or the surrounding environments find their way onto the fish during the handling process. The common denominator for contaminants to jump across into the food chain may be traced back to faulty infrastructure.

2.0 Definition of "Faulty"

Faulty infrastructure is a generic phrase encompassing a wide variety of shortcomings. It may include any one or a combination of the following:

- **Poor design standards** (bad design and poor material specifications, outdated or geographically incorrect design criteria);
- **Sub-standard construction** (especially materials, methods of construction, lack of construction supervision etc.);
- **Lack of adequate harbour management** (lack of funding for a harbour management body, lack of funds for proper maintenance, absence of legislative tools for enforcement, etc.).

3.0 Poor Design Standards

Poor design standards are a common occurrence in fishing harbours and may be traced back to a lack of understanding or experience on the part of the designer. Poor design standards or incorrect specifications cover buildings, floors, surface drainage, walls, finishes, doors, lighting, sanitary facilities, fittings, piping and equipment.

3.1 Buildings: In designing new fish marketing premises, a smooth sequence of operations from the receipt of the fish to its loading and transportation should be achieved. All operations should be conducted off the floor, at a height convenient for workers to perform their tasks in a standing position. A single storey building, a short distance from the landing area, will enable fast handling of fish along the quay and marketing operations inside the market hall. It will also reduce costs for drainage and structural civil works. This type of design will also allow easy access to vehicles for loading purposes. Ample, natural air circulation should be provided for covered halls. In hot climates hollow-brick pattern walls or grills are often used and sometimes the entire building is without walls. Properly designed long leaves for protection against direct sunlight and rain are essential. An adequate pitch of the roof coupled to a rainwater collection system are also important factors in areas with a high rainfall. Orientation in relating to the prevalent direction of the elements (sunlight and wind) should also be taken into consideration to facilitate shaded loading operations.

3.2 Floor finishes: Engineers not conversant with fisheries operations traditionally specify the cheapest flooring system available, generally plain concrete. However, an exposed concrete finish is not always suitable as a floor finish inside wet-markets, especially in hot tropical climates, due to the fact that fish oils attack concrete and lead to pitting in the surface texture of the concrete floor. This, in turn, leads to blood soaking into the concrete and harbouring bacteria and giving rise to foul odours.

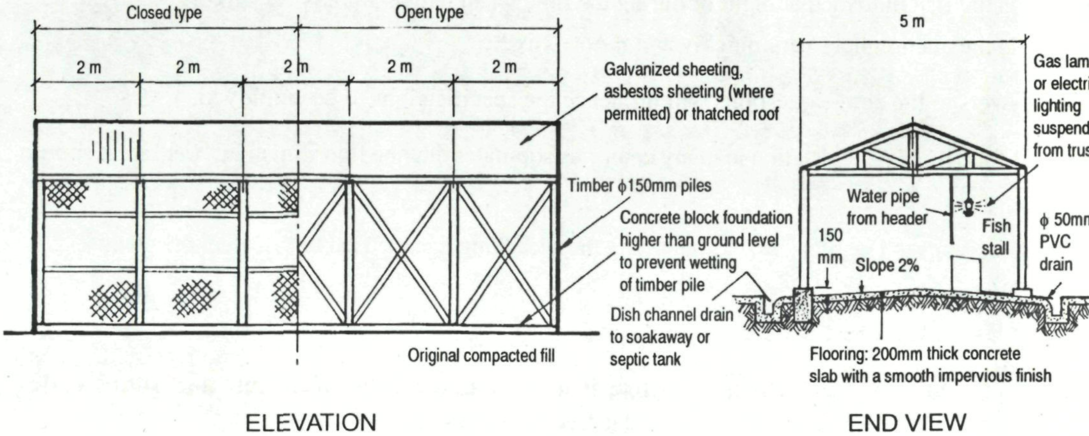

Figure 1 : A small artisanal auction/market hall

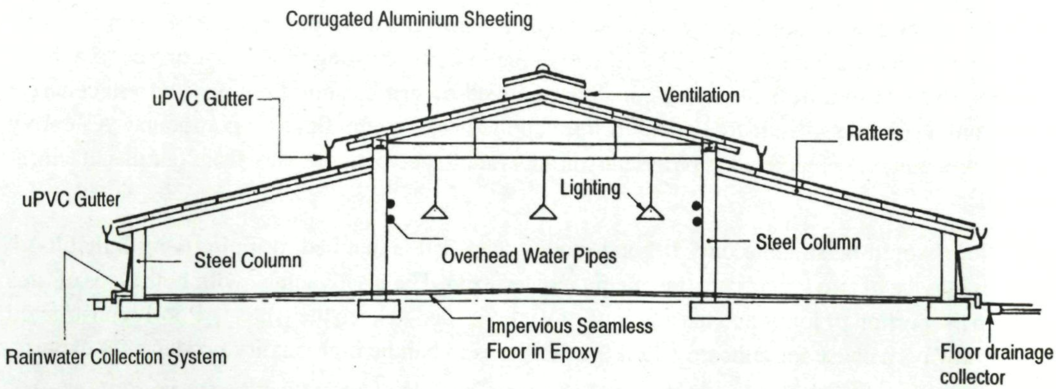

Figure 2 : A modern all-steel construction auction/market hall with no side walls

If costs are a problem, the following need to be assessed.

- What kind of fish is landed (oily fish, shrimps, white fish)?
- What state is the landed fish in?
- What is the water supply situation like?
- What is the ambient temperature and humidity?
- Is the fish unloaded at night or during daytime when temperature is very high?
- Is the auction held very quickly and if not, why?

The answers to the above questions will influence the specifications to be employed.

Current food hygiene legislation in many countries stipulates that the floor finish in "wet" areas should be:

- Resistant to chemical attack, including the bleaching agents used to disinfect the premises;
- Waterproof;
- Of seamless construction.

The only floor finish (the base is still concrete, in the form of a slab 200 to 250 mm thick) that satisfies the above requisites is that made from solvent-free epoxy resins.

Typically, epoxy-resin flooring compounds are self-levelling and available in two-pack or three-pack form and come in grey, green, red and yellow pigment.

Epoxy-resin flooring compounds are very strong and durable; after 14 days the compressive strength typically reaches values in the region of 800 Kg/cm2 (80 N/mm^2) and their bond to the underlying concrete is superior to that of concrete over concrete. The components are usually mixed just prior to use (the pot-life being in the region of 30 minutes depending on the ambient temperature) and applied by roller or trowel in a thickness not exceeding 3 to 4 mm. The finish may be rendered non-skid or non-slip by the application of a second roller just before the final setting takes place and has excellent resistance to abrasion. Ideally, epoxy-resin floor finishes should be applied to newly-laid concrete floor slabs. In the even that the epoxy floor needs to be retrofitted to a floor inside an existing market, and assuming that the concrete floor slab is still homogenous, the existing floor must first be "scabbed" (the upper 15 to 20 mm of the existing concrete removed by grit blasting to expose a fresh concrete surface) and a suitable solvent-free epoxy primer applied prior to the flooring compound. All epoxy flooring compounds are marketed as proprietary products and specifications vary from one manufacturer to the other.

A tiled floor would be suitable only if good quality iced fish is handled, dripping very little blood. Floor tiles may be of two types; ceramic or concrete terrazzo. The disadvantage with both types of tiles is the high proportion of joints and the amounts of water needed to keep them clean. Poorly constructed joints are always a cause for concern and if the facility is to handle high quality products for exports, even this type of flooring is not suitable.

In some countries it is also common to find concrete block paving in many port areas, sometimes even as part of the auction halls (loading bays). This type of paving is the least suitable and must never be specified in any area connected with the handling of wet fish. Even refrigerated trucks drain melt water overboard and if blood is present, this always creates problems with block-paved areas.

3.3 Surface drainage: All paved areas should be laid to cross-falls draining into appropriate channels. Typical falls are 1 to 2 percent (a 1% fall falls 1 metre in 100 metres) and it is common to break cross-falls at least every 10 metres, depending on the local intensity of rainfall (the longer the distance between the breaks the longer the rain water has to travel to drain away). Drainage channels should be appropriate and suitable for a particular location. Drainage channels may be of the open type, also known as dish channels, Figure 3, or of the covered type, Figures 4 and 5.

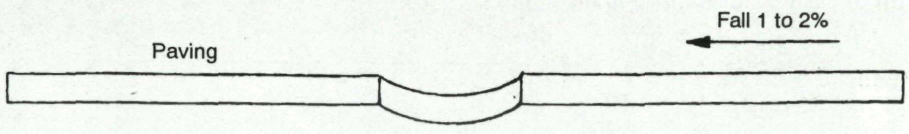

Figure 3 : Open dish channel drain

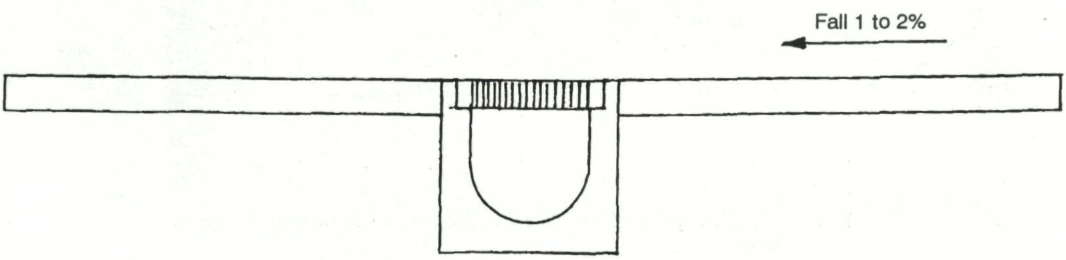

Figure 4 : Bar drain with light galvanised grill

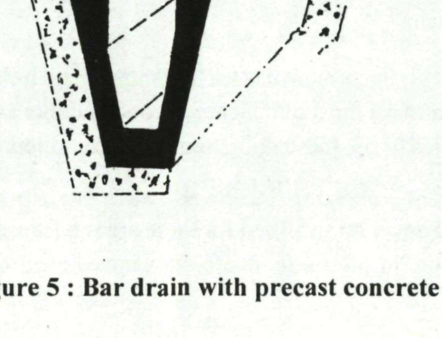

Figure 5 : Bar drain with precast concrete covers

Covered channels should not be used in areas where mobile sand or wet wastes are a problem, especially where wind occurrences are very frequent, around fish handling areas and at hawker stalls. In these cases, simple, uncovered dish channels should be used as these are easy to maintain. Covers over drains may consist of perforated concrete slabs, cast iron bar drains, galvanized steel grilles or glass reinforced polyester (GRP). Heavy precast concrete slabs or cast iron drains should be only installed around perimeter areas away from the handling areas as these are too heavy to lift for regular maintenance. Lightweight galvanised gratings or GRP grills should be installed instead as these are easy to lift to clear solids trapped in the gulleys.

3.4 Walls

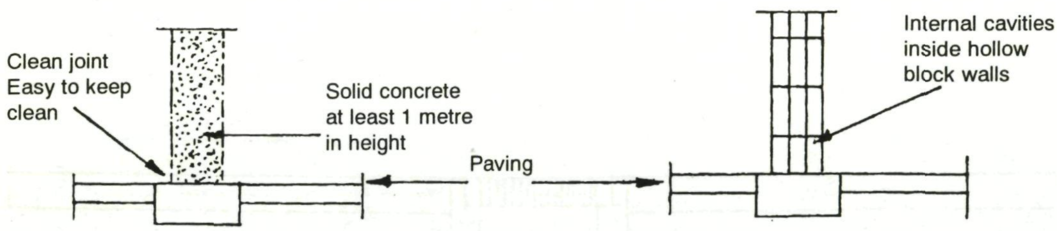

Figure 6 : Solid concrete wall (left) and hollow block wall (right)

The major reason for this is not vandalism but incorrect specification of the fittings followed by a total lack of management and maintenance. The three most common fittings likely to breakdown prematurely under current design practices are water taps, shower heads and toilet flush systems, leading either to losses, leakages or unserviceability of the facility.

It is not uncommon to enter a public toilet facility inside a fishing port and notice that water taps are either out of order, broken or missing altogether. In all probability the taps would have been the most economical variety of the common household tap.

3.5 Finishes: Traditional mortar finishes as used in normal buildings (plain sand cement or lime) are not suitable in areas of high saline humidity, especially where sea water is used for hose down or fish box rinsing. Nowadays, admixtures are available to improve the bonding properties of cement mortars for plastering, repair work and patching. These admixtures normally consist of reactive micro silica dispersed in an aqueous solution and added to the basic mortar mix. The resulting mortar also has better waterproofing characteristics.

3.6 Doors: In areas where water is in constant use such as shower and toilet facilities, basket washing areas, etc. the high humidity tends to rot most of the cheap wooden doors available on the market. It is not uncommon in tropical countries to see these doors removed from their hinges and stacked outside a building.

Plywood and veneer doors should never be specified for these areas because they tend to absorb water, swell and jam. In these areas doors in plastic laminate, galvanised steel or timber planks should be specified.

3.7 Lighting: Buildings should provide adequate natural light for most operations to be carried out. Adequate windows and skylights should be provided. Artificial overhead lighting should also be provided in order to allow personnel to work early in the morning before sunrise. Fluorescent lighting is particularly suitable (daylight type) for fish-market areas where a shadow-less light with very little glare is required continuously for a long time; even though the initial costs are relatively higher than other lighting systems, operational costs are lower. A light level of 220 lux as minimum is considered adequate. All lighting fixtures should be water-tight plastic. Metal fittings, conduits, etc. should be avoided. Cabling should be adequate for peak demands and suitable for the environment.

3.8 Sanitary facilities: The standard of personal hygiene of the workers employed inside a fishing port depends on the sanitary facilities provided and if the facilities provided break down quickly through wear and tear then *toilets of opportunity* usually spring up around the port.

Many types of toilet flush systems are available on the market and as with the other types of fittings, household varieties are not suitable for repeated use in a public facility. Most plastic cisterns are very fragile and often breakdown for the most minor of things. Dual-flush systems are preferable as these save water.

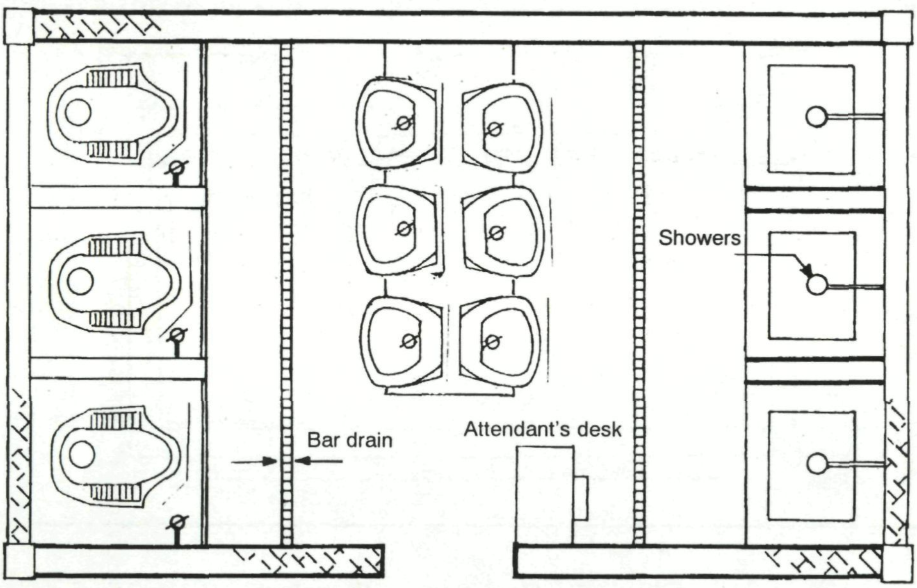

Figure 7 : Optimal layout of small toilet facility

All floor drains inside toilet facilities should be bar drains placed centrally across the room with water draining away from the walls to prevent flooding. (Figure 8).

All toilet facilities should be equipped with lighting to enable use during night time unloading and auctioning operations. Toilet facilities should be looked after the attendants, especially in artisanal harbours where the facility may also serve the village residents.

3.9 PVC Piping: Steel piping in sanitary facilities is gradually being replaced with PVC or HDPE (High Density Poly Ethylene) piping. The obvious advantages over steel are resistance to corrosion and ease of installation and maintenance. However, when installing external pipework care must be taken to employ a material that is UV stabilized against the sun's rays. Two methods of jointing plastic pipe are available : heat welding or glue. Heat welding involves heating the pipe ends by a small heater similar to a hairdryer and then applying force to weld the seams together. Gluing, however, is now the accepted industry standard because it involves little capital equipment, apart from the glue.

Similarly, repairing a leaking elbow joint or length of pipe is also very quick and needs no special tools.

Another basic piece of equipment that is required inside a fishing port not connected to a city's sewerage is the septic tank. In many cases only 2-stage septic tanks are installed and the volume of liquids passing through is too large because too many services are connected to a single tank. Septic tanks should be of the 3-stage type and only toilets connected to them. In many cases, wash hand basins, showers and floor run off do not need to pass through a septic tank but may be connected to a soakaway.

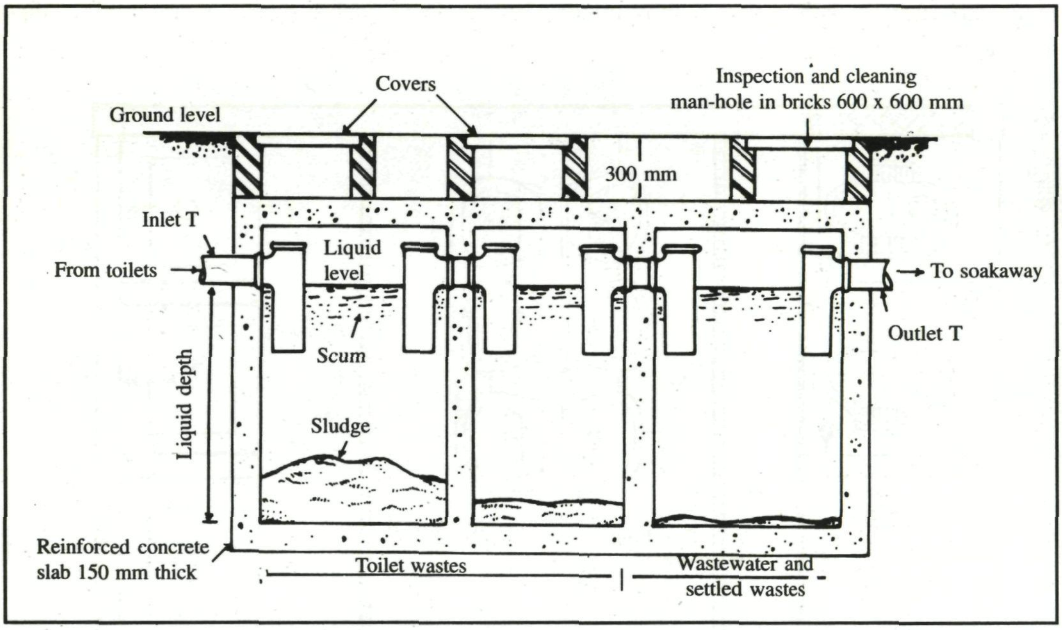

Figure 8 : The 3-stage septic tank

4.0 Sub-Standard Construction

Sub-standard construction is the result of improper site supervision during the construction phase of a project. The lack of proper site supervision is generally attributable to budgetary restraints at the design stage. However, any savings achieved through cost-cutting measures, such as cursory supervision as opposed to full-time supervision, only lead to increased maintenance costs in the long run. Good project supervision typically consists of two distinct components:

Quality assurance
and
Site inspection

4.1 Quality assurance: Quality assurance is the science of ensuring that all the components to be used in a project conform to the specification laid out by the consultant. The best way to ensure this is for the contractor to furnish samples of the products he intends to use on a project. Once the samples have been approved only material which complies in all respects with the approved samples should be allowed on site. In some cases, such as concrete, samples must be taken to a laboratory for proper analysis. Typical unsuitable items which may turn up on a site when no quality assurance is enforced may be:

- Unstabilised plastic pipes which decay when exposed to the sun;
- Household water and sanitary fittings which are not suitable for public use;
- Defective glazing tiles (factory rejects) which crack very easily;
- Untreated steel components which corrode quickly in a marine environment;
- Badly galvanised items that do nothing to prevent corrosion.

Generally speaking, once a consignment of any of the above items reaches the project site it is very difficult to send it back to the supplier and the end result is that the contractor will do his utmost to use it.

4.2 Site supervision: Site supervision is required to make sure that the components on site are assembled in the correct manner. Typical construction defects encountered on projects where supervision was inadequate or nonexistent are:

- Improperly fitted pipes and sanitary fittings leading to leakages and flooding;
- Improperly laid drains leading to blockages and flooding;
- Improperly screeded floors leading to pooling of run off water;
- Badly laid glazing tiles the joints of which are difficult to keep clean;
- Poor concrete work (too much water in the mix, not enough cement, no vibration) leading to a porous concrete finish;
- Incorrectly fixed reinforcing steel (not enough cover) leading to corrosion and then spalling of the concrete;
- Dissimilar metals in contact with each other leading to galvanic corrosion.

With good supervison most if not all of the above defects can be avoided. Once the facility comes on stream it becomes very difficult and onerous for the operator to fix things properly, especially corroded metal components.

Hence, no matter how tight a project's budgetary constraints are, proper project supervision should always form part of the design process.

5.0 Lack of Adequate Harbour Management

Harbour management may be considered as the "software" that runs the harbour "hardware". As in computers, the better the software the better the performance of the hardware. In order to be effective, a harbour's management must:

- Be commensurate with the size of the facility and the responsibilities expected of it (one person could be enough for a small village jetty but a group of persons would be necessary inside a harbour with a large fleet of canoes, plank boats and other types of vessels);
- Adequately funded to function as intended (landing fees and handling charges should reflect current maintenance and running costs);
- Represent the whole spectrum of users of the facility (if the jetty doubles as a passenger landing then the interests of the passengers must also be taken into account);
- Allow for consultation between the various users (if one of a multitude of users subjects the jetty to abnormal stresses, then this should be reflected in the maintenance charges).

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FISHERY HARBOUR MANAGEMENT I :

8. HANDLING AND STORING FISH ON-BOARD CRAFTS AND IN FISHERY HARBOURS – THOUGHTS ON APPROACHES AND METHODS FOR FISH QUALITY ASSURANCE

By S Subasinghe *

Solving the problem of fish handling at landing sites is complex and not easy to achieve, since different types of catch, fishing vessel, storage method, landing facility and market specification require different handling methods. Mechanization of fish handling methods is not simple, for it involves breaking away from traditionally established practices and, often, substantial investment in design and fabrication of new equipment. Also, some segments of the industry lend themselves more to mechanization than do others.

A vertically integrated establishment/complex owning fishing vessels, dock facilities and processing plants is in a better position to improve handling practices, all benefits being passed directly to the operating company. However, the case is not as straight forward where privately-owned vessels land fish at a public pier for subsequent auction and processing by others. Although many of the benefits are just as real as in the previous case, vessel owners are unlikely to invest in new methods for improving the quality of landed product unless they receive a higher price for these fish. Therefore, the investment must generally be made by those responsible for the pier operation, commonly the local government agency or fishermen's cooperative/association, which often have difficulty finding the necessary funds. Furthermore, introducing more efficient handling methods, particularly at public piers, is hampered by problems associated with reduction in the labour force.

At present, manual handling is widespread and generally combined with the use of baskets of various materials, sizes and shapes (Table 1). Improvised methods to help transfer the fish baskets ashore are evident in many places, such as the use of a simple, low cost lifter. Pitchforking is also still practised in a number of fish piers.

Table 1: Unloading systems based on the type of fish being landed:

Fresh fish	:	Boxes, baskets, derrick, mechanical elevators and conveyors
Frozen Fish	:	Derricks, baskets, nets, boxes, mechanical conveyors
Industrial Fish	:	Pumps.

Handling and unloading of iced bulk-stored fish

The most common method of storing fish onboard fishing vessels is to mix fish and ice in successive layers in the vessel hold. The current pegboard system is generally well accepted by fishermen all over the world because the job of loading the pens is reduced to icing and setting pegboards. With an adjustable chute, below the hatch, the loading itself is done by gravity.

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The methods used in unloading fish show wide variation (Table 2). Traditionally, iced bulk-stored fish are shovelled from the hold pens into baskets which are lifted up to deck by hand or a hoisting device such as a simple pulley and rope or an electric winch. The baskets are transferred manually from deck to land or with the help of a "swing". The weak point about a manual handling system is that it is extremely labour-intensive and detrimental to fish quality since it is rather slow, and the fish are often bruised and damaged in the fish room by the careless use of hooks and shovels.

Table 2: Factors determining the type of unloading system to be used

- Type of fish being landed, e.g fresh, frozen etc.
- use to which the fish are to be put (human consumption or industrial processing?)
- Type of vessel landing fish and the stowage methods used on the vessels themselves, e.g box, bulked, shelved.
- tidal rise and fall
- number of vessels being unloaded
- cost and availability of labour as opposed to the cost and availability of energy
- ambient temperatures

A faster unloading rate is possible if a larger container than baskets is used. The best alternative has been found to be flexible bag containers (net-bags) and large container units made to fit small vessels. Flexible bags may be more appropriate initially because they are cheap and can be made by fishermen. These bags are simple to use. The first bag (about two meters square) is placed in the bottom of the boat, and about half a ton of fish removed from the trap and placed in the bag. The process is repeated with a second bag and so on until all the fish are out of the trap. At the dock side, a small wire rope is used to hoist each of the bags out of the boat and onto the shore. An opening in the centre (bottom) of the bag enables the fish to be quickly discharged. Discharge rates of close to 20 tonnes per hour are achievable using this method in open boats.

Net-bags provide a reasonably efficient means of discharging small fishing vessels. They do have disadvantages, however, such as difficulty in cleaning and fish being damaged to some extent during discharge. For these reasons, they were always looked upon as a temporary solution.

Time and labour from deck to quay could be much reduced by using mechanical conveyors to replace the present system of either swinging, or swinging and then dragging the baskets ashore. When the plant or market hall is situated close to the landing site, conveyors may also be used to bring in the fish directly from the deck of the boat. Conveyor belts of different designs, sizes and lengths are available on the market and may facilitate unloading operations considerably.

Elevators or bucket conveyors may be satisfactorily used for unloading provided the size of the hatch is increased to accommodate the conveyor. The conveyor could be mounted at the dock and by a system of beams, be elevated over and then lowered into the fish hold. The fish are then shovelled into the buckets and lifted to the top of the conveyors. From the bucket conveyor, the fish can be transferred to a chute or another conveyor leading to the auction hall or processing plant.

Unloading of CSW or RSW tanks

Fish stored in chilled seawater (CSW) or refrigerated seawater (RSW) tanks have traditionally been unloaded by scoops. This method causes a minimum of damage to the fish. Most purse-seiners in Northern Europe, particularly in Scandinavian countries, landing herring and mackerel for the food industry, employ scoops for unloading. The hatches of these vessels are big and make scooping easy at a speed of 30 to 50 tonnes per hour. However, in many fisheries with no such tradition, hatches are too small for scooping.

Automatic unloading pumps make possible the rapid transfer of RSW/CSW stored fish onto the dock, virtually eliminating the physical labour involved. Pumps are commonly used to unload anchoveta, sardine and jack mackerel for the processing plants of Chile, Peru, Ecuador and Mexico. RSW-stored salmon is unloaded by pumps or scoops in British Columbia and Alaska.

Unloading of iced boxed fish

Boxing, according to many, offers the best solution to the problem of storage in ice, not only because of the slight improvement in quality at landing, but also because it offers greater opportunities for the catch to be carefully and speedily handled during and after discharge from the vessel, with consequently better fish for the consumer. Stowage of boxes on pallets in open storage could facilitate discharge by crane or slewing winch.

Containerization in box lots of 50 to 250 kg capacity lends itself to rapid and easy unloading from the vessel. With sized hatches, it is simply a question of lifting the boxed load out of the hold and depositing it on the dock. Specially designed elevators combined with conveyor belts may also facilitate boxed fish unloading operations.

Storage of fish on-board

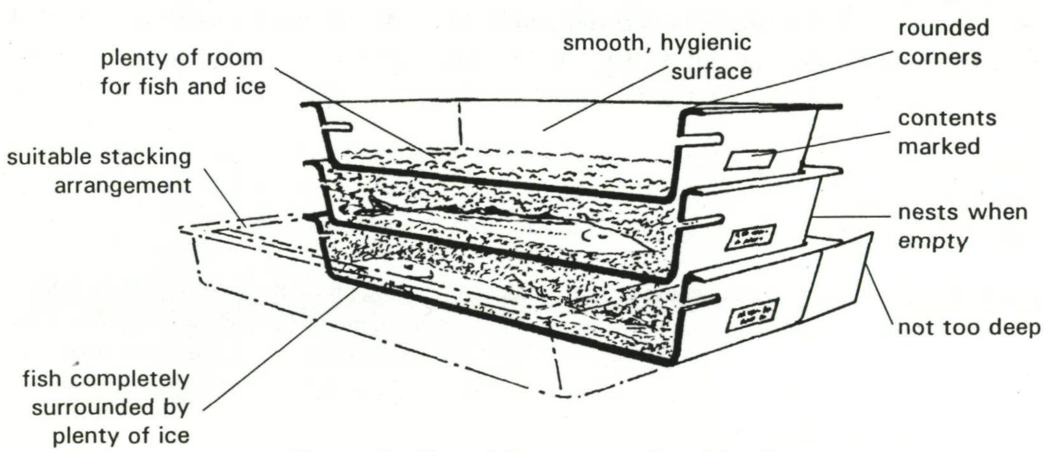

Figure 1 : Boxed Stowage – Good Design

There are three commonly used basic methods of storing fish on-board fishing vessels; bulking, shelfing and boxing. Bulk stowage requires about 2 cubic meters of fishroom space for a tonne of fish, which is much better than the stowage rate for shelfed fish, and usually somewhat better than for boxed fish. However, bulked fish may become marked and bleached by prolonged contact with pieces of ice, particularly if the ice contains large lumps; from this point of view the use of small ice flakes that have smooth, flat surfaces is to be preferred. Often bulked fish are subject to a considerable amount of rough handling during discharge, through the use of hooks and by transfer from pound to basket to kit.

Shelling is a refinement of the bulking method, whereby the fish are carefully laid out in a single layer on a bed of ice on each shelf; ideally the fish should be covered over with ice, but sometimes fish is laid on ice, with little or no ice on top of them.

Bulking

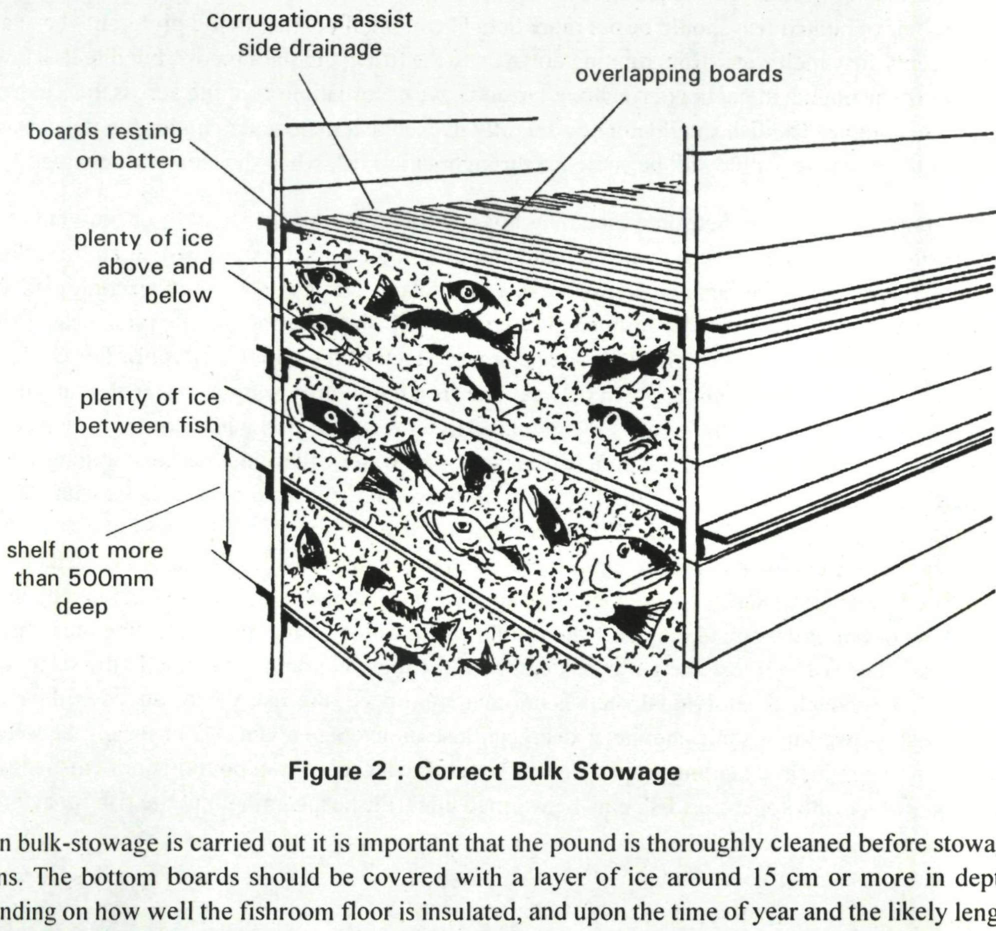

Figure 2 : Correct Bulk Stowage

When bulk-stowage is carried out it is important that the pound is thoroughly cleaned before stowage begins. The bottom boards should be covered with a layer of ice around 15 cm or more in depth, depending on how well the fishroom floor is insulated, and upon the time of year and the likely length of trip. There should be an air space of about 10cm between the bottom boards and the floor proper. If the bottom boards are of metal, or the fishroom floor is uninsulated, the thickness of the bottom ice layer should be increased accordingly. If no ice remains between fish and boards when the ship is discharged, then not enough ice has been used. The fish will have warmed up and will probably be spoiled. The first layer of fish should be placed on or slid on the bed of ice, and additional ice sprinkled over the fish to fill up the gaps between them; ideally every fish should be covered with ice.

Plenty of ice should be placed against the fishroom lining, particularly if the vessels side is uninsulated. Further layers of fish should then be added and each layer covered with a sprinkling of ice, until the bulk stowage is within about 50 cm of the top of the shelf. For distant water voyages, about one tonne of ice should be used for every two tonnes of fish; the proportion of ice should be even higher in warmer weather and in uninsulated vessels. A layer of ice 5-7cm thick should then be sprinkled over the top of the fish, and the boards for the next shelf laid down. Stowage should not be carried so high that the boards for the shelf above are supported by the bulked fish rather than by the rest angles or battens.

The second shelf is prepared by putting down a bed of ice 50 to 70 mm thick, and then adding successive layers of fish sprinkled with ice, topped with another layer of ice immediately beneath the next shelf. Successive shelves are added until the pound is full; the top of the topmost shelf should be covered by a layer of ice about 15cm thick to protect the fish exposed near the dockhead. For best results the depth of each shelf of bulked fish should be not more than 50cm. Shelf boards should preferably be of a type that prevents dirty melt water from running down on to the fish in the shelf below, but directs it towards the walls of the pound; metal boards that overlap and have occurgations running across the width of the pound are suitable. The fish should not be so tightly packed that melt water cannot run down between and over them. There should still be some ice throughout the fish when the ship is discharged.

Insufficient or incorrectly distributed ice may not cool the fish quickly enough, or may fail to keep them cool until they are landed. A dirty pound can contaminate the mixture of fish and ice; this can make the fish unsightly, and may increase the rate of spoilage, particularly if the fish comes into direct contact with the dirty surfaces, for instance by ice melting. Fish at the bottom of a pound can warm up considerably if they are not shielded by adequate ice. Much of the cooling effect of the ice depends upon ice-cold melt-water running down between the fish; the slightly warmer water should then meet more ice to produce more cold water. If there are large masses of fish with little or no ice between them, the fish will remain warm, and pools of stagnant melt-water will form, thus encouraging spoilage. If insufficient ice is placed against the lining of the fishroom, heat from outside can again affect the outer layers of fish, particularly if the fishroom is not insulated. If a shelf is filled so full that the boards of the shelf above continue to rest upon the contents of the shelf even after the cargo has settled down, the fish will be unnecessarily crushed and damaged; if this happens with every shelf in a pound, the fish at the bottom of the pound may bear the weight of the whole pound, thus defeating the purpose of the shelves. The fish can lose weight considerably under these conditions in exactly the same way as with too deep a shelf. If individual shelves are made too deep, the fish when landed will have lost weight; fish stowed in a shelf one meter deep can lose on average about 7% in weight between the times of stowage in, and landing from a distant water trawler. If the top pound is not covered with a thick layer of ice, the uppermost fish may be warmed up by the heat coming into the fish room through the deck.

Shelfing

In shelfing, fish are normally laid in shelves about 25-30 apart. It is advisable to fill the bottom shelf with ice only, especially if the fishroom floor is of metal and uninsulated. A 5cm layer of ice should be spread over the boards of the next shelf, and a single layer of fish placed belly down and head to tail on the bed of ice. The fish should occupy almost the whole width of the shelf, and be laid with their length along the width of the shelf, that is fore and aft in the vessel. The single layer of fish should then be completely covered with a layer of ice 5-7cm thick. The next layer of boards is then laid on battens or rest angles and the shelling process repeated. When the pound is full, the topmost layer of fish should be covered with a heavy layer of ice to protect it from heat coming in through the deck. The fish on each shelf should be protected by extra ice against the fishroom lining, particularly if the vessels side is uninsulated. Melt water should drain away to the ends of the shelf boards and not drip down on to the fish and ice on the shelf below.

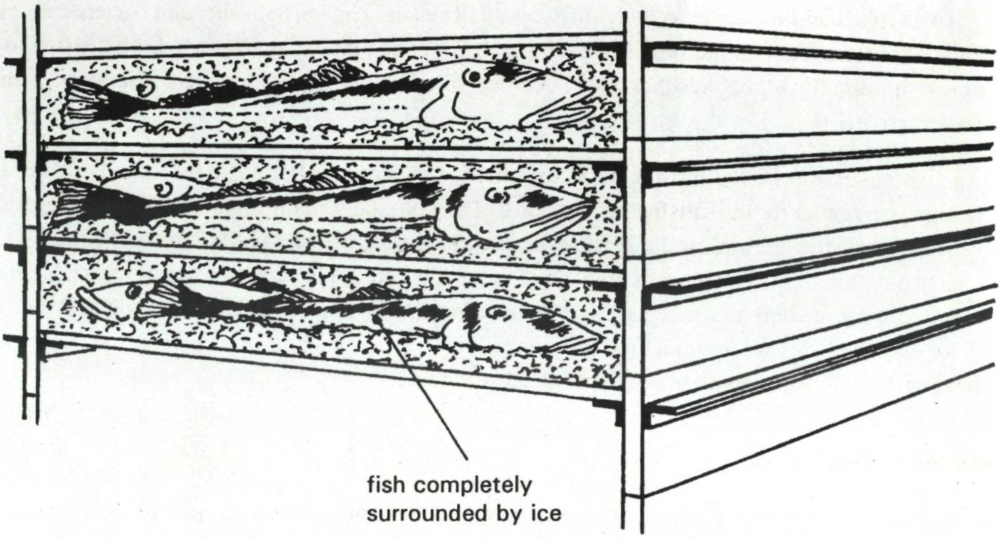

Figure 3 : Correct Shelf Stowage

If the fish are laid out other than with the bellies downwards, puddles of stagnant water and blood can lie in the belly cavities and hasten spoilage. Single-shelfed fish laid out on ice, but without ice on top or with a mere sprinkling of ice along the noses, are cooled from one side only and they therefore cool down less rapidly than fish that have ice all round them.

Single shelling with ice on top of the fish, is a satisfactory method of stowage for chilled fish; the stowage rate is about 4.5 cubic meters per tonne. However, it should be noted that the practice of shelling fish without ice on top of them introduces an element of risk of greater spoilage, in spite of the good appearance of the fish.

Boxing

Properly carried out, and using suitable boxes, this method of stowage can produce better quality fish at landing than either of the other two methods, and can help to ensure that the fish deteriorate as little as possible after landing. The box must be properly designed for the job. It must have sufficient room in it to ice the fish including enough ice to protect the fish until they are landed. It should not be so deep that fish at the bottom of the box are squashed, and must be long enough to accommodate fish without bending. It should be of food grade material that is easily cleaned and kept clean and that does not taint and should have drain holes. It should be robust enough to withstand working conditions on a trawler, and be suitable for use with mechanized equipment for rapid discharge and handling at the quayside, since one of the important advantages of boxing at sea is that the fish can be discharged and transported ashore in the same box without further rehandling from one container to another. The box should have provision for making on it the nature, quantity and date of capture of the contents. All boxes used at any one port, and preferably over a much wider area, should be of uniform design and size, so that central facilities can be provided for cleaning, maintaining and distributing the boxes.

The boxes must be clean before stowage begins. Boxes with awkward corners and ledges, or with fittings such as rope handles, are extremely difficult to clean, and can harbour dirt and bacteria; as can boxes made of porous, easily punctured materials; such boxes can defeat attempts to keep the fish in a wholesome condition. Fish in boxes that have been overfilled will become squashed, lose weight, and appear unattractive.

Boxing of fish at sea can be the most satisfactory method of stowing fish in ice. A standard box of correct design is essential for the satisfactory working of any boxing scheme; such a box could simplify the whole process of stowage and landing. The age, size and species of fish in boxes are easily recorded; accurate identification of the catch is possible while being marketed. The stowage rate for boxed fish is reasonably good, somewhere in the region of 2.7 cubic meters per tonne, which is considerably better than that for shelfed fish, and approaching that for bulked fish; with some improvement in design of box, stowage rate may well equal or surpass bulk stowage rate.

Common quality problems

The quality problems in the fishery industries in developing countries of Asia Pacific are mainly due to poor on-board handling compounded by bad practices in handling, transport and storage after landing. As a result most of the fish marketed in many developing countries are of poor quality. In fact, even the fish and fishery products exported from many Asian countries, which often get better care when compared to fish marketed locally during handling and processing, too often fail quality standards laid down by major buyers such as US, Japan and EU (Tables 3 and 4). The main reasons for such detention/ rejection are decomposition, presence of filth, and salmonella. Thus it is evident that the primary causes for poor quality are delay in icing, rough handling of fish and contamination.

Table 3: Detentions from ASEAN entered in the US FDA monthly detentions list (September-December 1992)

Reasons for detention	*No.*
Decomposition	65
Filth	44
Insect Filth/Damage	42
Unregistered LACF Procedures	29
Salmonella	27
Mandatory Labelling Omitted	11
Unusual Colouring	8
Poisonous Substances	3
Cat Filth	3
False Misleading Labelling	2
Rodent Filth	2
Animal Filth	2

Unusual Food Activities	1
Listeria/Other Pathogens	1
Mercury	1
Total	241

Source: US FDA Monthly Detention List

Table 4: Detention of frozen fish from selected ASEAN countries* entered in the US FDA monthly detentions list (September-December 1992)

Reason	*Number of Consignments*
Decomposition	20
Filth	14
Salmonella	11
Labeling	2
Additives	3
Procedural	3

*Indonesia, Malaysia, Philippines, Singapore and Thailand

Table 5: Sanitation Control Procedures

Objective: Production of safe, wholesome food fish & fishery products

Receiving the catch

"Prudent processor" concept - processor is responsible

Use of buying specifications to ensure

- Harvest from safe waters
- Proper sanitary handling and harvest vessels, dockside, auctions and trucking
- Safe storage temperatures

Planned system of product examination as product is received

Periodic audit of handling practices prior to receiving

Requirements under the US Regulation

1. Safety of the water and ice

Free from harmful chemicals and micro-organisms

Suitable source - public supply or private well

Protection from contamination, cross-connections, back siphonage

Treatment (i.e. chlorination)

Periodic Testing - at source and within plant's distribution system

Check pipelines within the plant - remove unneeded and dead-end pipes

Water reuse programmes

2. *Condition and cleanliness of food contact surfaces*

Sanitary construction of equipment, tools and utensils

Clean gloves and outer garments

Dismantling of equipment for cleaning

Use proper cleaning compounds and sanitizers

Use proper water temperature and effective cleaning techniques

3. *Prevention of cross-contamination*

Design product to prevent cross-contamination

Ensure proper product flow

Protect product from unsanitary objects

Use clean packaging materials

Ensure strict and adequate physical separation of cooked and raw product

Avoid workers handling both raw and cooked product

4. *Hand washing and sanitizing*

Adequate number and suitable location of hand washing and sanitizing facilities

Availability of hand soap and sanitizers at each facility

Worker training in and adherence to proper hand washing

Adequate number of properly maintained toilet facilities

5. *Protection of food and packaging materials*

Control of condensation

Protection from lubricants, fuels, pesticides, etc.

Use of edible lubricants

Use of coverings

6. *Potentially toxic compounds*

Clear and conspicuous labeling-color coding

Limit compounds to those essential for plant operations

Store separately from edible product and labeling/packaging material

Operators trained in proper use and handling

9. FISHERY HARBOUR MANAGEMENT II

The Port Management Body, Sanitation and Waste Management

J.A. Sciortino, Ports Consultant

1.0 Introduction

Irrespective of its size, a fishing port cannot be abandoned to itself. Experience and common sense show that somebody has to ensure that it is used and maintained correctly over the period of its useful life. The most effective way to run a fishing facility is to establish a fishing port management body. Waste collection and disposal together with sanitation are some of the most important tasks that face management bodies.

2.0 Port Management

Port management is required to ensure:

- Compliance with the laws, regulations and other legal rules governing the use of the facility *(landing fees, bulk handling charges, sale of potable water, etc.);*
- Compliance with environmental conservation and monitoring measures adopted by the planning authorities *(waste recycling, spent-oil recovery, wet wastes disposal, etc.);*
- Integration with other users as in the case of a non-exclusive facility for fishing vessels *(landing jetty may double as a passenger landing stage for coastal taxi boats);*
- Transparency in the decision-making process *(to prevent private interests from taking over a public facility through sheer bullying).*

In order for the port management body to be able to carry out its duties, it must:

- Be commensurate with the size of the facility and the responsibilities expected of it *(one person could be enough for a small village jetty but a group of persons would be necessary inside a harbour with a large fleet of canoes, plank boats and other types of vessels);*
- Adequately funded to function as intended *(landing fees and handling charges should reflect current maintenance and running costs);*
- Represent the whole spectrum of users of the facility *(if the jetty doubles as a passenger landing then the interests of the passengers must also be taken into account);*
- Allow for consultation between the various users *(if one of a multitude of users subjects the jetty to abnormal stresses, then this should be reflected in the maintenance charges).*

Because of the diversity of situations and circumstances in which small-scale fishermen operate, it is extremely difficult to present ready-made solutions for a port management body. However, at the village level, the management body could consist of the Community Fishery (CFC) or a similar organization of fisherfolk. Although the facilities and services within a small village area may be quite modest, there is still need for an organized form of management. Moving up the scale from a village landing to an artisanal harbour with a large fleet of vessels (any size), the management body should be clearly defined and should start to include local government (representatives from the departments of fisheries, hygiene, municipality etc). Further up the scale, industrial fishery harbours with trawler fleets may be run by autonomous, municipal, state or even private management bodies.

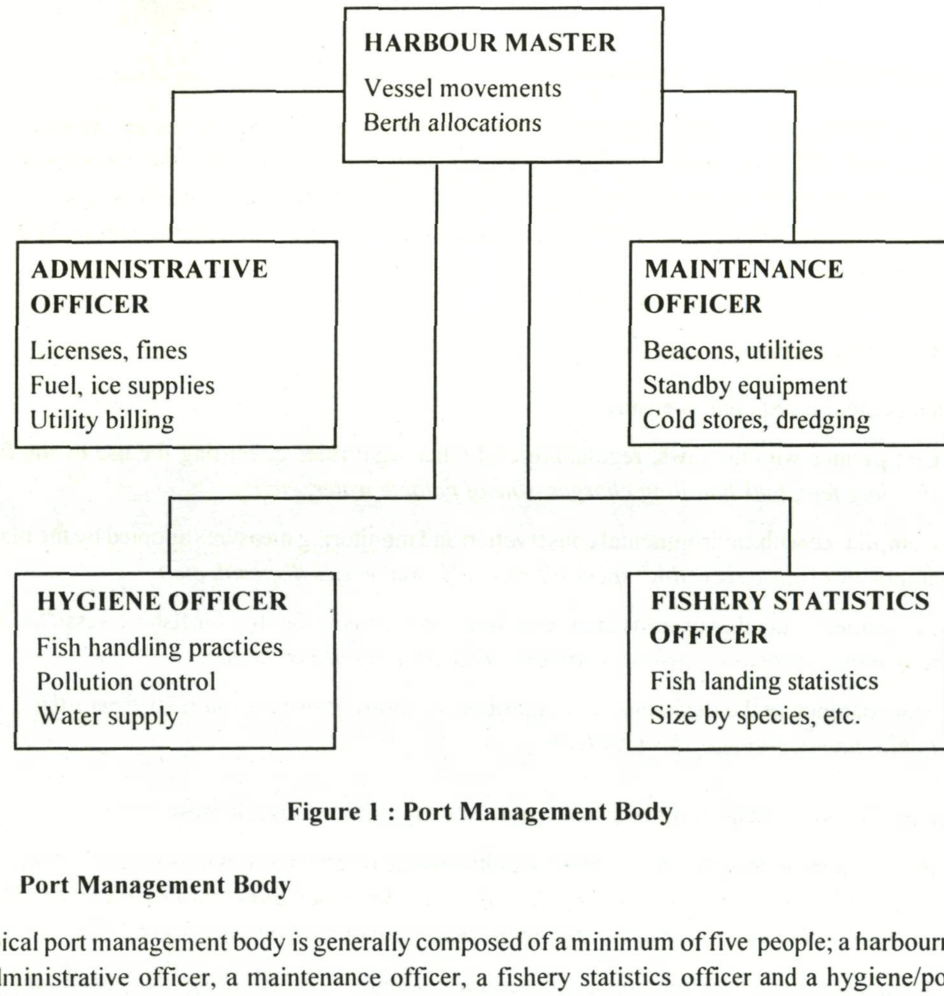

Figure 1 : Port Management Body

3.0 Port Management Body

A typical port management body is generally composed of a minimum of five people; a harbourmaster, an administrative officer, a maintenance officer, a fishery statistics officer and a hygiene/pollution controller (Figure 1). Whereas the harbourmaster's job is a full-time occupation, the other posts may be either full-time or part-time, depending on the throughput of fish at the fishing port. In some instances, especially if the fish landing is very small, the harbourmaster does all the work himself and hires workers only for specific jobs, such as repair work, dredging, etc. For large fishing ports even the five persons mentioned above would not suffice and additional personnel would be taken on to monitor port security, fishing practices, auctioning and cleansing operations. School teachers are often employed as part-time officers.

The harbourmaster is the single most important person inside a harbour as it is he who decides how a harbour facility is used. Ideally, harbour masters should be recruited from ex-captains of vessels, who are usually fully conversant with maritime regulations and the navigational and operational needs of fishing vessels. In addition, a good harbourmaster should also be knowledgeable in:

- National licensing arrangements

- Maintenance of infrastructure components (hydrography. dredging, beacons, fendering, public lighting, cold storage etc).
- Fishery statistics, methods of fishing, net regulations etc;
- Public hygiene and pollution prevention.

Generally speaking, the smaller the harbour or fishery landing, the more knowledgeable the harbourmaster has to be (to compensate for a smaller management body with fewer staff). In cases where a number of fish landing places exist a few kilometers apart, such as along big river estuaries, one good knowledgeable harbour master may be employed full time to look after more than one facility. In this case he may have to report to the local village chiefs as well as to his superiors at fisheries.

An administrative officer, whether full-time or part-time, has the task of keeping the harbour's books in order. His tasks generally include:

- Keeping a record of all the licensed craft, including their fishing gear, operating from the facility;
- Accounting for the cash receipts for harbour dues, and fish handling charges;
- Sale of potable water and fuel to vessels inside the port facility;
- Administering the fines imposed by the harbourmaster.

In busy ports, the administrative officer usually has his own staff to assist him in his duties. The administrative officer reports directly to the harbour master and his work generally decides the size of the harbour's operating budget.

The maintenance officer, whether full-time or part-time, is generally charged with keeping the harbour infrastructure in good working order. If the harbour is too small to support even a part-time maintenance officer, the duties fall on the harbourmaster himself. Typical duties of a maintenance officer include.

- Keeping a hydrographic chart of the immediate seabed up to date (siltation, sand bars, etc)
- Regular maintenance of the harbour beacons (batteries, cables, lamps, etc)
- Occasional maintenance of the harbour's water supply system (replacing corroded pipe work, leaking taps, unblocking water drains, replenishing the chlorinators with chlorine, ensuring that waste collection receptacles are in good working order, ensuring that the generator or pumping equipment is serviced regularly or that the right spares are available, etc).

The maintenance officer reports directly to the harbourmaster. In cases where a number of fish landings exist close to one another, a full-time maintenance officer may be employed to look after a number of facilities.

Generally speaking, the fisheries statistics officer, whether part-time or full-time, is usually a government employee (Fisheries Department) seconded to the port management body. His duty is to compile statistics on the resources being harvested. His observations usually include

- Species harvested
- Individual fish sizes and/or weights
- Amounts landed during each season
- Wholesale prices fetched at the local auction

The fisheries statistics officer usually fills in data-forms supplied by his department and these are sent to his headquarters for analysis. This work is of the utmost importance if fisheries are to be developed on a sustainable basis, because if the landed fish sizes suddenly drop, it is this officer who will sound the first alarm bells that the resources are being overfished.

The hygiene officer, whether part-time or full-time, may also be somebody from government (Health Ministry) seconded to the port management body. With the rising importance of fish as a primary source of healthy food, concern about the possibility of tainted fish entering the food market chain has been rising. The hygiene officer has to ensure that:

- Fish or fish products are not tainted by human faeces whilst being handled;
- Only potable standard water is used to wash fish for onward sale
- The port area and its immediate surroundings are not fouled up or invaded by sewage, rats and other vermin.
- Contaminants (diesel, oil, petrol, etc) do not come into contact with the fish

The hygiene officer usually reports to both the harbourmaster (who has to act on his observations) and to his department within the ministry. In many instances, the hygiene officer is based inside the Health Ministry and covers more than one facility, such as, for example, abattoirs, factories, cold stores, etc.

4.0 Sanitation

Assuming that the port infrastructure has been designed and built as per the specifications for fishing ports, the standard of sanitation and personal hygiene of the port workers employed depends on how well the port management body enforces certain directives. Port sanitation is best described by the following simple regulations:

1. All water supplies inside the port should comply with national drinking water standards if the port is not already connected to a town supply which is itself certified safe;
2. All ice, whether manufactured inside the port or brought in from outside suppliers, should also conform to the national drinking water standards;
3. All chlorination equipment should be functional, and adequate supplies of chlorination agent should be held in stock;
4. All sanitary sampling and testing carried out inside the port should be carried out by ISO-certified laboratories only.
5. All drainage systems (indoor and outdoor) and their filters should be kept in perfect working order;
6. Disinfection of required areas should be carried out on a regular basis;
7. No excessive trash and wet waste should be left to accumulate in work areas;
8. No rodent harbourage should exist in and around the port area (tall weeds, junk piles, vessel hulks, old netting and municipal rubbish);
9. No birds should be nesting inside the open areas of auction halls and fish handling sheds;
10. The entire fish handling area should be hosed down at the close of business and kept locked to prevent unauthorized entry;

11. Toilet facilities should be equipped with "Have you washed your hands?" signs at all exits;
12. Toilet facilities should be kept scrupulously clean and in perfect working order (fittings, soap, drainage, lights);
13. Toilet facilities should be manned during working hours and kept locked at all other times.
14. The entrance/exit to a fishing port should be manned at all times to keep out unauthorized people and domestic animals from the port area;
15. Port perimeter fences should be properly maintained and breaches repaired immediately;
16. Appropriate signs should be displayed at the entrance and within the port boundaries, listing the port hygiene regulations (dumping, spillage, use of seawater, spitting, etc).
17. Appropriate signs should be displayed at the entrance to the port area, listing the fines for contravention of port hygiene regulations;
18. Only electrically powered or manual machinery should be allowed inside the auction or handling sheds to prevent cross-contamination of the large fish which are often stockpiled on the floor.

5.0 Waste Management

Irrespective of the size of a fishing port, waste is generated. Unless managed properly, it has the potential to pollute the environment and contaminate the fish meant for human consumption. Waste management is a twofold exercise: It means having:

the physical infrastructure to collect it

and

an incentive to dispose of it in the right manner

The one does not work without the other: When dealing with new ports or the rehabilitation of existing ports, waste management must be factored into the infrastructure at the design stage. In addition, the port's management must also be well versed at recycling the waste thus stockpiled.

The typical wastes to be found inside a fishing port normally consist of sewage and toilet wastes, oily bilge water, spent engine oil and lubricants, workshop waste (paint cans, paint shavings, oil filters, oily rags, batteries, etc), wet wastes, trash fish and blood water. In order of importance to the port management, these wastes may be grouped as:

a. Sewage and grey waters
b. Toxic wastes
c. Oily wastes
d. Wet wastes

The health hazard potential of the groups is the strongest in (A) and the weakest in (D). Group (A) contaminants are not visible to the naked eye but the damage to health is quickest and may lead to fatalities. Group (B) contaminants need to accumulate over time to be a hazard and generally lead to tainted products which may fail close inspection. The contaminants in group (C) on the other hand, are nearly always visible and tainted products are immediately identified as such (the human threshold for oily taste is very low). Group (D) wastes are not contaminants in themselves but have the potential to attract pests from which diseases may jump across to contaminate the fish products.

5.1 Group (A) Sewage and grey water wastes

By their very nature, these wastes are the most common and the most likely to contaminate fish products directly.

Unless this effluent is piped away to a municipal sewer main, and assuming the municipal sea outfall does not affect the fishing port directly, then the port management body must devote the bulk of its energies to this problem.

The potential for re-cycling sewage waste exists but the treated water (through a septic tank) is only suitable for certain agricultural uses, such as non-leafy vegetables and landscaping. In areas of low rainfall this may prove beneficial.

To improve the biological quality of the effluent beyond this stage, however, is very expensive to attempt on a small scale. Sewage infrastructure is a relatively expensive item in a port and should always be handled by suitably qualified public health consultants. Outfalls from septic tanks should never discharge effluent into a port basin. Alternatives are:

- Slow rate treatment whereby effluent from the septic tank is sprayed or channelled over vegetated land;
- Constructed wetlands where effluent is fed into inundated areas that support growth of emergent plants such as cattail, bulrush, reeds, etc.;
- Constructed wetlands where the plants are of the floating species, such as water hyacinth and duckweed;
- Rapid infiltration, when effluent is applied intermittently to shallow spreading basins and lost into the ground.

Reference [XIX] gives more details on these methods of treatment. The port's management team should always be made aware of the potential and the limitations of the infrastructure they are given to manage in order that it may plan for its maintenance.

5.2 Group [B] Toxic Wastes

Most toxic wastes in fishing ports are solid wastes; Some may be re-cycled whilst others have to be disposed of in a safe manner to prevent pollution in other areas.

Lead starter batteries may be re-cycled for their lead content. Oily rags, oil filters, rechargeable batteries, button cells and some spare parts cannot be re-cycled and must be disposed of in appropriate landfills. Other solid waste, such as tyre fenders, old anchors, nets, packing; etc. may or may not be toxic and in many countries, plastics, glass and metal scrap are collected privately for onward processing.

Toxic wastes in the liquid form may also find their way into a port through other channels, such as for example the solvents from a workshop or effluent from a third party (cottage industry or chemical plants) dumping into the port basin or waterway.

The infrastructure for handling toxic wastes costs very little but the success rate for its operation depends largely on the port management team. The management body must be conversant with national legislation on waste handling and must practise good housekeeping and enforcement.

5.3 Group [C] Oily Wastes

The major source of oil pollution in fishing ports is the dumping of oily bilge water overboard. The re-cycling of this liquid through separation is well established and oil separation equipment exists to suit most pockets. Used engine oil is re-cycled directly by oil refineries and in some countries the oil is collected free of charge. Inside a port, this service may or may not be privatized. The infrastructure for handling oil waste must be designed to suit a particular fleet, especially the size of the oil storage facility (used oil is normally collected free of charge in large quantities only). Onshore, this may prove to be the weakest point in the system as most ports store the oil in used oil drums that invariably always seem to leak. As with the previous group, the port management body must practise good housekeeping and enforce MARPOL legislation.

5.4 Group (D) wet wastes

Wet wastes are the easiest to handle and are practically one hundred percent re-cyclable. These wastes normally consist of offal or trash fish, both of which may be converted to fish meal with little effort. The infrastructure for handling wet wastes costs very little and the whole process may be privatized even down to artisanal level. In hot climates this group of wastes tends to have a high nuisance value. Good house keeping is not observed at all times. Reference XIX gives all the details on how to re-cycle wet wastes.

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10. STATUS AND DEVELOPMENT OF FISHERY HARBOURS IN INDIA*

by Y.S.Yadava[1] and K.Omprakash[2]

1. Introduction

1.1 Importance of the fishery sector in the economy, employment generation, etc.

Fisheries play an important role in the economy of India in augmenting food supply, generating employment, raising nutritional levels and earning foreign exchange. In order to increase production and productivity in fisheries, the Fisheries Division of the Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India have been undertaking various production-oriented schemes, input supply programmes, infrastructure development projects, etc., either directly or through States/Union Territories. A number of institutions have been established for development of fisheries. According to estimates prepared by the Central Statistical Organization, the contribution of the fisheries sector to the Net Domestic Product has gone up more than six and a half times, from Rs.14,790 million in 1984-85 (base year for Seventh Plan) to Rs.98,260 million in 1994-95 at current prices.

India has a long coastline of 8,041 kms covering the east and west coasts of the peninsula as well as the Andamans, Nicobar and Lakshadweep group of islands with a continental shelf area of about 0.5 million sq.km. India's Exclusive Economic Zone (EEZ) covers an area of 2.02 million sq.km. The country has a long fishing tradition, with fish constituting the main supply of animal protein as well as an important source of foreign exchange earnings.

Fisheries is a very important sector with tremendous potential for income and employment generation, poverty alleviation and foreign exchange earnings. Continuous efforts have been made to increase fish production, both for domestic consumption and export. The total fish production from both inland and marine sectors has increased from 2.8 million tonnes in 1984-85 to 5.4 million tonnes during 1997-98, out of which about 2.95 million tonnes have been exploited from marine resources. India is now the sixth largest producer of fish in the world.

1.2 Fish production and exports

There are an estimated 3,726 fishing villages all along the Indian coastline, and fish are being landed at 2,337 landing centres. The country's total population of fishermen has been estimated at six million, which includes 2.4 million full-time fishermen, 1.5 million part-time fisherman and 2.1 million occasional fishermen. Of the total exploitable marine fishery resources of about 3.9 million tonnes, the country currently produces about 2.95 million tonnes, leaving a scope for additional exploitation of about one million tonnes of fish. The state-wise marine fish production during 1997-98 is given at Table 1.

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There has been tremendous growth in the export of marine products-from 86,187 tonnes valued at Rs.3,843 million in 1984-85 to 3,85,818 tonnes valued at Rs.46,975 million during 1997-98. There are about 47,000 mechanised fishing vessels (MFVs) and 1,91,200 traditional craft (including about 32,000 motorised craft) in operation in the country. A statement about the fishing crafts in the Maritime States/ UTs in 1994-95 is shown in Table 2.

2. Development of Fishery Harbours and Fish Landing Centres

2.1 Landing and berthing facilities - a historical perspective

The main thrust has been to harvest the available fishery potential through efficient and sustainable exploitation of the EEZ by promoting operation of fishing vessels. To meet this objective, landing and berthing facilities by way of fishery harbours with ice plants, chilled storage, workshop, repair facilities, auction hall, net mending sheds, etc., are the essential infrastructure facilities required by the marine fishing industry.

At the end of the First Five Year Plan, there were 863 mechanised fishing vessels operating along the Indian coast. By the end of the Sixth Plan, there were some 24,000 mechanised boats and at the end of Seventh Plan, the country had about 34,000 mechanised boats and 26,000 motorised craft. During the beginning of the Ninth Plan, there are some 47,000 mechanised boats and 32,000 motorised craft operating in the country, and more than 170 deep-sea fishing vessels with a length of 23 m. and above.

During the Second Five Year Plan, the Government of India began to give technical and financial assistance to State Governments for setting up fishery harbours, and sought assistance from the FAO for survey and preparation of feasibility reports for establishment of fishery harbours. Between 1955 and 1961, FAO experts identified some 40 sites for development of fishery harbours and fish landing centres and prepared feasibility reports. During the Fourth Plan, the Government of India, with the assistance of FAO/UNDP, established the erstwhile Pre-Investment Survey of Fishing Harbours at Bangalore for pre-investment surveys, preparation of techno-economic feasibility reports and related work in fishery harbour construction and development. During the Second, Third and Fourth Five-Year Plans, emphasis was laid mainly on the construction of minor fishery harbours and fish landing centres. During the Fifth Plan, the construction of major fishery harbours at Sassoon Dock, Chennai, Visakhapatnam (Vizag) and Roychowk was sanctioned. The development of fishery harbours and landing centres continued subsequently in the Sixth, Seventh, Eighth and Ninth Five Year Plans.

2.2 Government of India Scheme

The Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India, have been implementing a Central Sector Scheme (CS) and Centrally Sponsored Scheme (CSS) since 1964 to provide infrastructure facilities for landing and berthing of mechanised fishing vessels, traditional fishing craft and deep sea fishing vessels. Under CS, the Port Trusts are provided with 100% grant on the capital cost for the development of major fishery harbours at major ports. Besides construction, the management and operation of fishery harbours after their completion are also the responsibility of the respective Port Trusts.

Under CSS, the Maritime State Governments are provided with 50% grant on the capital cost for development of minor fishery harbours and fish landing centres. The construction and subsequent management and maintenance of such facilities created after completion are the responsibility of the respective State Governments. Union Territories are provided with a 100% grant under the scheme.

During the Seventh Five Year Plan, an allocation of Rs.170 million under the CS and Rs.180 million under the CSS totalling Rs.350 million, was made for the development of fishery harbours. The funds are utilised in full. In view of the increased demand from the State governments/UTs and the large number of fishery harbours under construction, the allocation of funds was increased sharply to Rs.540 million during the Eighth Five Year Plan in respect of CS and Rs.470 million for CSS. Out of the total allocation of Rs.1,010 million, Rs.950 million were utilised during the Plan period.

2.2 Total number of facilities sanctioned, completed and under construction under the Central Sector Scheme

Since the inception of the scheme in 1964, 100% financial assistance is provided as grant under the Central Sector Plan Scheme for the development of major fishery harbours at major ports by the Government of India. Till date, the Government have sanctioned six major fishery harbours at Cochin Stage I and II in Kerala, Sassoon Dock in Maharashtra, Chennai Stage I and II in Tamil Nadu, Vizag Stage I, II and III in Andhra Pradesh, Pradip in Orissa and Roychowk in West Bengal. All the five major fishery harbours except Sassoon Dock have been commissioned. The fishery harbour at Sassoon Dock is almost complete and expected to be put in operation very soon. The fishery harbour at Chennai Stage II is under construction.

2.3 Centrally Sponsored Scheme

The objective of the Centrally Sponsored Scheme is establishment of minor fishery harbours and fish land centres for landing, berthing, outfitting, repairs and operation of mechanised fishing vessels and traditional craft. Under the scheme, the Government of India have sanctioned 45 minor fishery harbours and 143 fish landing centres. Of these, 29 minor fishery harbours and 120 fish landing centres have been completed and the remaining are under various stages of construction. A statement on the present status of fishery harbours and landing centres commissioned/under construction under both the schemes is in Annexure I. The locations and names of minor and major fishery harbours commissioned/under construction under the schemes are shown in the drawings found in Annexures II and III respectively.

Landing and berthing facilities are presently available only for a quarter of the total fishing fleet. There is therefore an imperative need to develop more fishery harbours and landing centres to meet the requirements of the country's fishing fleet. The outlay for the Ninth Plan has therefore been increased to Rs.1,400 million against the allocation of Rs.1,010 million during the Eighth Plan period.

2.4 Outlays earmarked and actual expenditure for development of fishery harbours

The total Plan outlays and the expenditure incurred for the development of major and minor fishery harbours besides fish landing centres up to the end of the Eighth Five Year Plan are summarised in Annexure IV. It may be noted that the expenditure incurred has increased from Rs.1.7 million during the Third Plan to Rs.850 million during Eighth Plan. During the Ninth Five Year Plan, the two schemes are proposed to be combined as a Centrally Sponsored Scheme with a pattern of assistance of 50:50 share for State Government and 100% for Port Trusts and UTs. An outlay of Rs.1,400 million will be provided in the Ninth Five Year Plan for both the schemes. The break-up of total outlay and year-wise phasing is given in Annexure V.

2.6 Fishery Harbours Developed under Foreign Assistance

To achieve rapid progress and development of marine fisheries in Gujarat State, an Integrated Fisheries Project was formulated with World Bank and Central assistance in 1977 by the Gujarat Government Under this project, a provision was made for expanding and modernising two fishery harbours at Veraval and Mangrol with necessary infrastructure facilities to support the operation of a substantial fishing fleet. Thus, Veraval and Mangrol were developed as full-fledged modern fishery harbours and became fully operational.

Two fishery harbour projects – Karwar under Indo-Norwegian Assistance and Tadri under Indo-Danish Assistance – were implemented in Karnataka. The Indo-Norwegian project was taken up at Karwar for integrated development of fisheries in 1962 and completed in 1972 with all necessary infrastructure facilities.

The Norwegian Government had provided a number of experts to the project during its implementation. The Integrated Project, in collaboration with Danish International Development Agency (DANIDA) was taken up in May 1982 at Tadri, Uttara Kannada District. Phase I and II of the project were completed in July 1992 and July 1995 respectively. The Indo-Danish Fisheries Project, besides development of a fishery harbour, also brought in diversification of fishing and fish processing by introducing new technology, socio-economic uplift of the fishermen community, production of high-value exportable variety of fish, and manpower training. The project was also assisted by a number of Danish experts in civil engineering, marine engineering, fishing, fish processing, boatbuilding and socio-economic activities.

The Fish Landing Centre at Bahabalpur in Balasore District of Orissa was constructed under NORAD assistance during 1986-87. The facilities created under NORAD assistance were construction of a 65 m long jetty, auction and packing hall, overhead tank, tubewell, storage godowns, etc. Looking at the rapid development and increase in fishing vessels and landings, the Ministry of Agriculture sanctioned the expansion.

3.0 Updating of Master Plan for the Development of Fishery Harbours in India

The Central Institute of Coastal Engineering for Fishery (CICEF), Bangalore, prepared a Master Plan for the development of fishery harbours in the country during the period 1978-1981. A total number of 117 fishery harbour sites – 14 major, 7 medium and 96 minor sites – were identified at the time. This Master Plan was based on knowledge of fishery resources, and the size and draft requirement of fishing vessels operating then. State-wise details of sites identified between 1978 and 1981, and fishery harbour facilities available/under construction, are detailed in Annexure VI.

As a step forward in this direction, CICEF has reviewed and updated the above Master Plan by identifying fishery harbour sites in Maritime States/UTs. The Institute has prepared Master Plan reports for fishery harbour sites reconnoitred in various Maritime States/UTs. The potential sites identified by CICEF for development of fishery harbours and fish landing centres State-wise are listed in Annexure VII. The sites found suitable for development of fishery harbours/fish landing centers State-wise are listed in Annexure VIII. On the basis of the priorities of the Central and State Government, the potential sites identified by CICEF form the basis for detailed engineering and economic investigations by the Institute during the Ninth Five-Year Plan and beyond.

4.0 Procedure adopted for sanction of Harbour Projects

4.1 Pre-Investment Evaluation Studies

In a developing country like India, where resources available for undertaking developmental works are limited, the resources are tapped and used judiciously so as to ensure better returns for investment and better service facilities to the industries concerned. In order to develop a fishery harbour at a particular fishing centre, data about the existing status of the fishery industry at that centre is collected at micro and macro levels for detailed analysis. The micro-level information covers a number of mechanised fishing vessels operating at the centre, annual landings, species composition, vessel economics, infrastructure facilities, etc. At the macro level, information about the quantum of fishery resources available in the waters off the proposed site, potential markets, disposal of landings, and processing facilities available in the region etc., is covered.

After analysing data collected from the field, a detailed techno-economic feasibility report is prepared, covering engineering and economic aspects. While the engineering section provides details about surveys, sub-soil investigations, designs, layout and cost estimates of the fishery harbour, the economic evaluation portion discusses the projected fishing fleet, annual landings, vessel economics, disposal of landings, operational costs, investments, cash inflow and finally the Financial Internal Rate of Return (FIRR). The FIRR decides the feasibility of the project proposal from the investment viewpoint.

4.2 Investigations and preparation of Techno-Economic Feasibility Reports

The Central Institute of Coastal Engineering for Fishery (CICEF), Bangalore, a subordinate office of the Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India, is responsible for undertaking techno-economic feasibility studies for the development of fishery harbours in the country. Formerly known as Pre-Investment Survey of Fishing Harbours, CICEF was established in January 1968 by the Government of India in collaboration with the FAO. The primary objective: to carry out reconnaissance surveys/pre-feasibility studies to identify potential sites for development of fishery harbours and follow it up with engineering and economic investigations, besides preparation of techno-economic feasibility reports. The Institute has been entrusted with the task of monitoring the progress of construction of ongoing fishery harbours sanctioned under the schemes and provide technical advice on the engineering and economic aspects to the State Governments/ UTs. Till the end of September 1999, the Institute had carried out investigations at 63 sites and prepared project reports for 56 sites.

On the basis of a request from Maritime States/UTs and approval from the Government of India, CICEF carries out pre-feasibility studies and detailed engineering and economic investigations, and prepares techno-economic feasibility reports in consultation with the concerned State Governments. The project reports are sent to the Government of India for administrative approval and expenditure sanction. The Ministry of Agriculture, on receipt of the project reports from CICEF/States, scrutinises the reports. An appraisal note is prepared and sent to all concerned Ministries – finance, environment and forests, surface transport, Planning Commission, and other related Ministries – for their comments and approval.

On the basis of suggestions/comments received from the concerned Ministries, a final note is prepared and discussed in the meeting for project approval. Depending on the cost of the project, the Ministries/ Departments expedite investment decisions and approval. Once the project is sanctioned, the Ministry of Agriculture accords administrative approval and releases funds to the State Govts/UTs/ Port Trusts, depending on the progress achieved for taking up construction. Funds are released to the States on the basis of the physical and financial progress achieved during construction.

4.3 Environmental Clearance

Environmental clearance is a pre-requisite, and an important factor considered for sanction of the project. The proposal is referred to the Ministry of Environment and Forests for assessing environmental impact. The Pollution Control Board of the concerned State and the Ministry of Environment and Forests examine and assess the environmental impact analysis. All project proposals located in the Coastal Regulation Zone area require environmental clearance. A component on environmental protection has to be a part of the project proposal.

4.4 Construction, Management and Maintenance of Harbour Projects

A Central Monitoring•Committee has been constituted in each State for monitoring the progress of sanctioned projects. The Committee periodically monitors construction activities and resolves bottlenecks arising during construction. After completion of the project, the management and maintenance of fishery harbours is carried out by the respective State Governments/UTs and Port Trusts. The management of fishery harbours comprises four broad aspects - i. Water-side ii. Land-side iii. Engineering including dredging and iv. Collection of revenue. Details of the activities taken up in some of the better managed harbours in India are described below

4.4.1 Land-side Management

Control is exercised on landing of fish from the vessels and cleaning of the landed fish. Subsequently they are sorted, weighed, iced and kept in boxes for display in the auction hall. Once the fish is auctioned, it is cleared quickly to make way for the next batch of arrivals for auction. The vehicles and persons using the harbour are controlled at the entry point of the harbour complex by a security system. On completion of auction of fish, the auction hall is thoroughly washed and cleaned for hygienic handling of fish. Proper care is taken for the fish quality assurance during the entire process.

4.4.3 Engineering aspects

On the engineering side, the management ensures that safe navigable depths are available at the entrance, in the approach channel, the harbour basin, and alongside the quays and jetties for operation of fishing vessels at all stages of the tide. The management maintains and carries out necessary repairs to the waterfront structures, the land-based structures, roads and buildings in the harbour complex. The collection and safe disposal of waste material, sewerage, soilage, bilge waste, etc, are taken care of. The supply of safe and fresh water and good quality ice in adequate quantity is always ensured.

4.4.4 Revenue collection

The management makes arrangements to raise revenue by collecting necessary fees, dues, cess etc, from the vessels, vehicles, merchants and other users utilising the harbour the harbour facilities. Enough revenue is generated from these levies to maintain and manage and manage the activities of the fishery harbour in a sustainable manner.

4.5 Specific Cases of Management

With a view to bringing about hygienic handling of fish products and facilitate loading and unloading operations, it is essential that the harbours are maintained and managed in good condition. At present, most facilities created in the Coastal States/UTs/Port Trusts are not put to optimum use because of lack of maintenance of fishery harbours. International standards of hygiene and handling of fish products demand that these facilities be maintained strictly, and that contamination of fish and fish products is kept down to a minimum. With stringent imposition of international standards like Hazard Analysis Critical Control Point (HACCP) and ISO 9000 by most of the seafood importing countries, it is needless to emphasise that the fishery harbours be maintained in good condition.

Keeping the above points in view, a component on repair and renovation work is incorporated by the Government of India. Under this component, provision for waterproof flooring, construction of side walls for protection in the auctioning area and water supply etc., will be taken up. A provision of Rs.4 million for every completed fishery harbour and Rs.2 million for every fish landing centre is proposed under the component during the Ninth Five-Year Plan. Standards set for hygiene impose greater responsibilities for the orderly development, maintenance and management of fishery harbour facilities, which have already been created. There is also an urgent need to develop more fishery harbours and landing centres to provide better and more congenial facilities for the country's fishing fleet. The management and maintenance of minor fishery harbours and landing centres are the responsibility of the State Governments/Union Territories. In case of major fishery harbours, the concerned Port Trusts control the activity. To cite some of the examples in the States/Port Trusts, details are given below:

In Gujarat State, three fishery harbours at Veraval, Mangrol and Porbundar are managed and maintained by the Fishery Terminal Division (FTD) under the Department of Fisheries. The FTD operates as the interface between the harbour facilities and the primary market facilities which should ideally be in close proximity where large quantities of fish catch are landed. The FTD provides water supply, bunkering and ice. It enables repairs to vessels, and makes available market facilities such as auction hall, and shops for such users as boat operators, fishermen and traders. The landing statistics, revenue collection, etc. are carried out by the FTD.

The Gujarat Maritime Board looks after the harbour maintenance, traffic control and registration of vessels. The Karnataka State has five important fishery harbours at Mangalore, Malpe, Honnavar, Tadri and Karwar. All these harbours are managed by the Fisheries Department. A separate establishment of Project Co-ordinator was created to manage and maintain the fishery harbours at Malpe, Honnavar and Mangalore. The Karnataka Legislature has enacted the Karnataka Fishery Harbour Terminal Act, under which a provision has been made to create an authority to manage all fishery harbours.

In the State of Kerala, the Harbour Engineering Department carries out the management and maintenance of the fishery harbours with the assistance of the Fisheries Department.

4.6 Management of Major Fishery Harbours

The management and maintenance of the Chennai fishery harbour has been entrusted to the Chennai Fishing Harbour Management Committee by the Chennai Port Trust. The Cochin fishery harbour is managed and maintained by a separate division of the Cochin Port Trust headed by the Chief Engineer and Administrator. In Vizag, the management and maintenance of the fishery harbour are the responsibility of the Vizag Port Trust.

4.7 Issues in Construction Management and Maintenance

The fishery harbour projects sanctioned by the Government of India have a definite completion date. In order to complete the projects on time, State Governments and Port Trusts are required to plan the project's time schedule by utilising tools such as Programme Evaluation and Review Technique (PERT) and Critical Path Method (CPM). Projects are sometimes delayed due to reasons beyond the control of the Executing Agency. Some of the reasons attributed to these inordinate delays are land acquisition problems, environmental clearance, public litigation and the multiplicity of agencies concerned with project execution. Most projects have resulted in time and cost over-runs due to the above reasons.

Availability of the right type of equipment, labour and materials, selection of an experienced contractor to execute marine projects and the timely availability of funds are the basic requirements for completing the project on time. In many cases, a poor approach road, non-availability of electricity and water supply, and natural calamities like cyclones and storms delay construction of projects and lead to cost/ time over runs. The cost escalation arises due to

- Time over-run on account of natural calamities such as cyclones, monsoon, etc.,
- Disputes over the contractual work in the court of law,
- Revision of schedule of rates by the state governments/UTs/Port Trusts.
- Delays in land acquisition and award of contract, and delays in proper technical investigation by construction department
- Delay in conducting model studies and
- Delay in timely availability of State Budget funds.

Most fishery harbours are not properly maintained, because of lack of management and timely revenue collection. After the harbours are commissioned, the responsibility of maintenance and management vests with user agencies. Only in a few fishery harbours is revenue is being collected regularly. At some harbours the revenue has not been collected at all. Funds are essential to maintain these facilities, dredging in particular. This has a significant bearing on the availability of facilities for productive purposes.

Most State Governments and Port Trusts are approaching the Government of India for extending financial assistance to manage and maintain the fishery harbours. No arrangement for extending such financial assistance to State Governments for minor fishery harbours and landing centres exists. Harbours which are more than a decade old need to be rehabilitated. The approach to development of new fishery harbours requires specialised engineering designs. It must be reviewed to meet the requirements of the quality of systems such as HACCP and ISO 9000.

5.0 Post-Investment Evaluation

The responsibility of the Central and State Governments does not cease with the construction and commissioning of fishery harbours. They have to be properly managed and maintained to ensure that the facilities created are put to optimum use. The fish and prawn landings have to be handled under very hygienic conditions. The State Governments who are managing fishery harbours have to ensure that all the landings pass through the auction hall, are properly auctioned, the commission amount is collected, and correct fishery statistical records are maintained by species and landings from day to day. An accurate data base about the number of MFVs operating from the fishery harbour, individual vessel landings, and their incomes in respect of the fishing fleet, have to be maintained to make a comparative study of the situation that prevailed before and after harbour construction.

While preparing the techno-economic feasibility reports, certain projections would be made in respect of the number of MFVs which would be operating from the harbour, annual landings of prawn and fish, annual cash inflow for the project including export income components, revenue for harbour authorities etc. The present situation at any fishery harbour is deplorable; proper auctioning is conducted in none of the harbours. Result: the Government is losing a major portion of the revenue. Many fishery harbours are not properly maintained, and the facilities are in a state of disuse. It is, therefore, needless to emphasise that the State Government has to manage and maintain fishery harbours by collecting charges from different users of harbour facilities, so as to generate adequate funds for maintenance as well as returns for the investment made.

To sum up, the post-investment evaluation study of fishery harbour projects should cover the following

* Assess the degree of utilisation of facilities provided at the harbour
* Quantify the stream of benefits arising out of the facilities created
* Draw broad conclusions regarding the ultimate impact of such facilities over the standards of living of the fishermen community and
* Assess the need for future development/expansion

6.0 Conclusion and Recommendations

Some of the fishery harbours in India already in operation lack certain requisite facilities and need to be modernised to meet minimum international standards necessary for effective management and fish quality assurance.

Special design approaches covering layout formation need to be adopted by engineers and by organisations who formulate new harbour projects to meet the requirements of International Standards laid down by HACCP and ISO 9000, in order to ensure effective maintenance of harbours after construction. This would further help augment the trade and enhance the returns in the fishing industry. Some important factors that need an impetus for maintaining and managing fishery harbours to ensure fish quality assurance:

- Quick handling and transfer of fish catch from vessels to auction halls and then to potential marketing areas.
- Collection and safe disposal of solid and liquid waste from the auction hall and other land-based facilities.
- Ensuring adequate supply of fresh water free from contaminants for cleaning and handling the fish.
- Suitable design approaches for construction of modern auction halls and allied facilities for hygienic handling of fish at a faster rate.
- Economic and low-cost inputs required for providing efficient fish handling and transportation systems in fishery harbours.

- Adopting effective strategies for rehabilitation of existing fishery harbours and development of new fishery harbours at economic cost.
- Maintenance of facilities created in the harbour by periodical maintenance dredging of approach channels, the harbour basin and in front of water front structures, to ensure uninterrupted vessel traffic in and out of the harbour. This would enable speedy landing, handling and disposal of fish catch to markets.
- Awareness must be invoked among user groups and the harbour management to put in sincere and earnest efforts to maintain a cleaner fishery harbour, free from pollution and environmental degradation.

If all the points highlighted above are taken note of and implemented in fishery harbours, the quantity and quality of fish can be ensured. This will augment the earnings of the trade.

Table 1

STATE-WISE MARINE FISH PRODUCTION 1997-98

	STATES/UTs	(In Tonnes)
1.	Kerala	526,342
2.	Karnataka	189,859
3.	Goa	88,809
4.	Maharashtra	453,000
5.	Gujarat	745,706
6.	Tamil Nadu	355,100
7.	Andhra Pradesh	146,545
8.	Orissa	156,081
9.	West Bengal	164,000
10.	Pondicherry	38,420
11.	Daman & Diu	18,807
12.	Andaman & Nicobar	27,225
13.	Lakshadweep	10,550
14.	Deep Sea	30,000
	Total	**29,50,444**

TABLE 2 : FISHING CRAFTS IN MARITIME STATES/UTS AS IN 1994-95

States/UTs	*Traditional Crafts*	*Motorised Traditional Crafts out of Col.(2)*	*Mechanised Boats*	*Total*
(1)	*(2)*	*(3)*	*(4)*	*(5)=(2)+(4)*
Gujarat	12,653	4,283	8,365	21,018
Maharashtra	9,988	286	7,930	17,918
Karnataka	13,141	1,189	3,655	16,796
Kerala	40,786	12,913	4,206	44,992
Tamil Nadu	32,077	5,340	8,230	40,307
Andhra Pradesh	57,269	3,269	8,911	66,180
Orissa	10,249	2,453	1,665	11,914
West Bengal	4,361	270	1,880	6,241
Lakshadweep	1,078	298	443	1,521
A & N Islands	1,340	160	230	1,570
Pondicherry	6,265	365	553	6,818
Goa	2,000	900	850	2,850
Total	**1,91,207**	**31,726**	**46,918**	**2,38,125**

Annexure I

Present Status of Fishery Harbours and Landing Centres Commissioned/ Under Construction under Government of India Schemes

Sl.No.	State	Name of Fishing Harbour Commissioned	Under Construction
A.	**Major Fishing Harbours**		
1	*Kerala*	Cochin Stage I & II	
2	*Maharashtra*		
3	*Tamil Nadu*	Chennai Stage I	
4	*Andhra Pradesh*	Vizag- Stage I, II & III	Sasson Dock
5	*Orissa*	Paradip	Chennai Stage -II
6	*West Bengal*	Roychowk	
B.	**Minor Fishing Harbours**		
1	*Kerala*	Vizhinjam Stage I Puthjappa Munambam Vizhinjam Stage II Neendakara	Chombal Mopla Bay Kayamkulam Vizhinjam Stage II Thangassery
2	*Karnataka*	Karwar Honnavar Tadri Mangalore Malpe Stage -I	Malpe stage II Mangalore Stage II Karwar Stage II
3	*Gujarat*	Veraval Mangrol Porbandar	Jakhau Mangrol Stage - II
4	*Maharashtra*	Ratnagiri	Agrao
5	*Tamil Nadu*	Tuticorin Mallipatnam Kodiakarai Vallinokkam Tondi Pazhayar	Chinnamuttom
6	*Andhra Pradesh*	Kakinada Nizamapatnam Bavanapadu	Machilipatnam
7	*Orissa*	Gopalpur Dhamra Naugarh (Astrang)	Dhamra Stage II
8	*West Bengal*	Fraser Ganj Digha stage -I	Digha stage - II

9	*Pondicherry*			Pondicherry
10	*Andaman & Nicobar*	Phoenix Bay		

C Fish Landing Centres

1	*Kerala*	Kasaragod	Dharmadon	Punnappra
		Ponnani	New Mahe	Quilandy
		Cannanore	South Paravoor	Moylali
		Beliapatnam	Vellayil Beach	Kaddappuram
		Neeleswaram	Vallikunu	Kattoor Pollathai
		Thottappally	Vizhinjam South	
		Munakkadavu	Vizhinjam North	
		Cheruvathur	Chettuvai	
		Beypore	Arthugai	
		Palacode	Chalil Gopalpettah	
2	*Karnataka*	Coondapur	Gangolli	Kodibengre
		Bhatkal	Sadasivgad	Alvekodi
		Kagai Heni	Belikeri	Gangolli - II
		Mulki	Belambar	Hejmadikodi
			Keni	Belikeri Stage-II
3	*Goa*	Cortalim		Malim
4	*Maharashtra*	Karanja	Dakti-Dahanu	Sarjekote
		Navalgaon	Khardanda	Alibagh Koliwada
		Borli Mandla	Ekdara	Tarkarli
		Nandagaon	Mandavi	Achara Peerwada
		Nurad	Mulgaon	Taramumbri
		Thoorinda	Navapur	Rajpuri Koliwada
		Ajanala	Onne-Bhatti	Ekdara Koliwada
		Ade-Uttambar	Thurnvadi	
		Agrao	Thai	
		Borin	Uttoon	
		Burondi	Vashi	
		Bigmandla	Wadrai	
		Datiware	Rajpuri	
		Dahanu	Jeevne Bundar	
			Mahim Causeway	
5	*Gujarat*	Navapur	Sachana	Navabandar
		Jalliabad	Salaya	
		Umbergaon	Mandvi	
		Kolak	Madhwad	
		Jakhau	Surajbari	
		Hirakot	Jakhau I	
		Vansi Borsi	Umersadi	
		Chorwad	Dholai	
		Magod Dugari	Rajapara	
		Kosamba	Port Onjal	

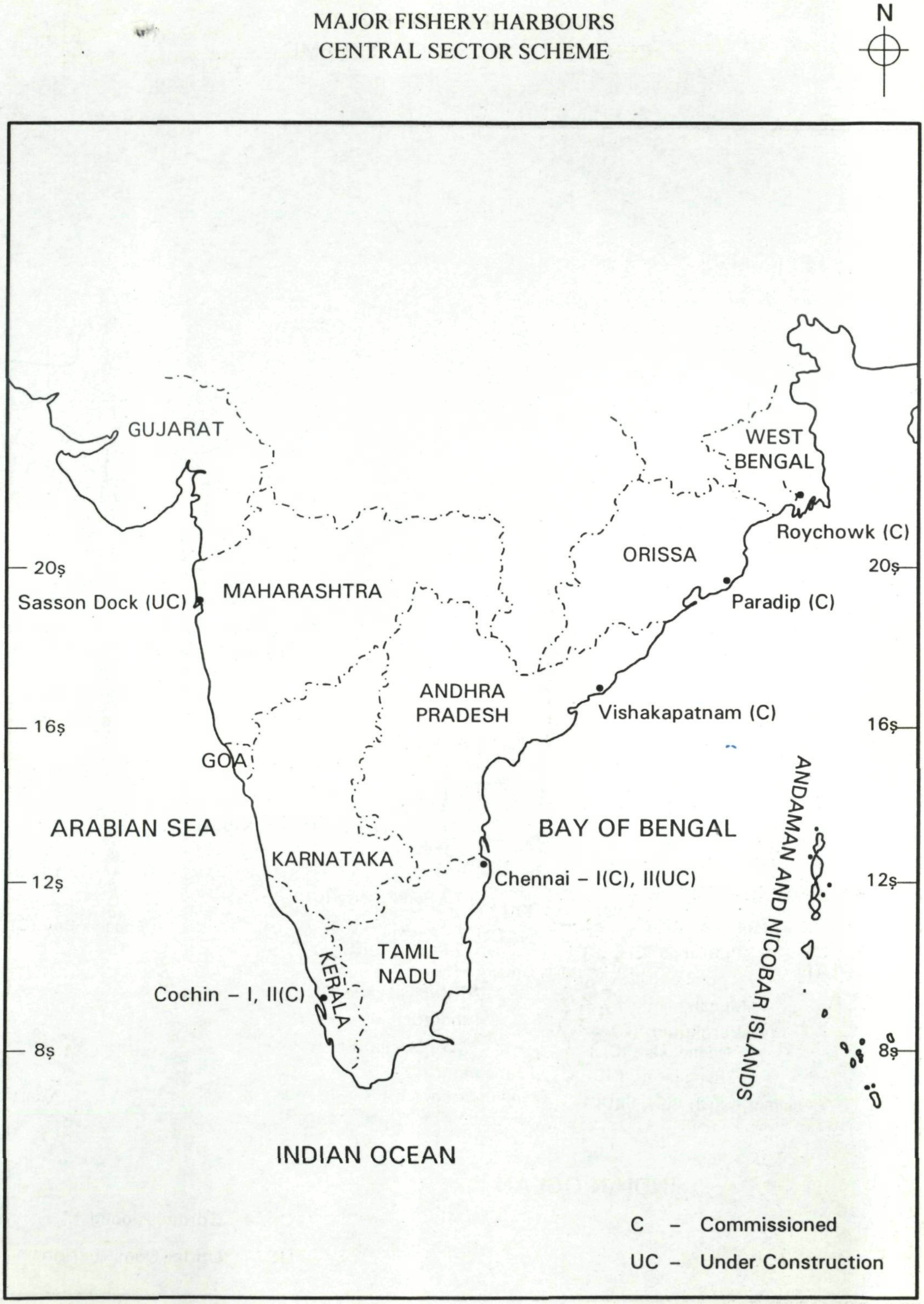
Sl.No.	*State*	*Name of Fishing Harbour*		
		Commissioned		*Under Construction*
6	*Tamil Nadu*	Cuddalore Nagapattinam Rameswaram Palk Bay Kottaipatanm Erawadi	Muttom Poompuhar Vallapallam Kodimunai Vallavillai	
7	*Andhra Pradesh*	Calingapatnam		Mangipudi
8	*Orissa*	Chandipur Sabelia Pathara Chudamani Nairi Panchubisa Nairi-II	Talchua Jamboo Kharansi Palaur Chandrabhaga Kansabans Rushikulya Soran	Tantiapal Sorala Bandara Khandiapatna Bhusandpur Baliapatpur Kirtania Talasari Ponthakata Gopalpur-on Sea Bahabalpur
9	*West Bengal*	Namkhana Jalda New Jalda Kalinagar Kharpai	Bamanagar Ganeshpur Akhoy nagar Junput Soula	Madanganj Brajobalavpur
10	*Pondicherry*	Mahe		
11	*Lakshadweep*	Karavatti Minicoy Agatti		
12	*Daman & Diu*			Ghogla Vanakbara

Summary

Category of Harbours	*Commissioned*	*Under Construction*	*Total*
Major Fishery Harbours	5	1	6
Minor Fishery Harbours	29	16	45
Fish Landing Centres	120	33	153

Annexure II

MAJOR FISHERY HARBOURS
CENTRAL SECTOR SCHEME



Annexure III

MINOR FISHERY HARBOURS
CENTRALLY SPONSORED SCHEME

Annexure IV

Outlays and Expenditure for Development of Major and Minor Harbours (Govt. of India)

	(Rs.in Million)			
Plan Period	*Major Harbours*		*Minor Harbours*	
	Outlay	*Expenditure*	*Outlay*	*Expenditure*
Third Plan	0.5	1.2	-	-
Three Annual Plans (1966-67 to 1968-69)	25.3	0.3	29.5	15.7
Fourth Plan	135	15.8	60	48.5
Fifth Plan	180	121	120	32.1
Annual Plans				
(i) 1978-79	50	30.8	60	39.4
(ii) 1979-80	55	20.6	-	0.1
Sixth Plan	170	132	190	179.5
Seventh Plan	170	168.4	190	216.9
Annual Plans				
(i) 1990-91	49.2	49.2	43.2	43.2
(ii) 1991-92	50	54.5	60	60
Eighth Plan				
(i) 1992-93	80	127.9	60	60.1
(ii) 1993-94	140	120	70	67.5
(iii) 1994-95	100	100	110	111
(iv) 1995-96	110	75.1	112.5	116.7
(v) 1996-97	91.3	34.5	115	135

Annexure V

Total outlay and year-wise phasing during Ninth Five Year Plan (Govt. of India)

Year	*Central Government Financial outlay (Rupees in Million)*
1997-1998	190.3
1998-1999	200.0
1999-2000	300.0
2000-2001	300.0
2001-2002	409.7
Total	**1,400.0**

Annexure VI

Master Plan for the Development of Fishery Harbours in India (As prepared during 1978 to 1981)

State/UT	*Fishery Harbour SItes*	*Facilities available/ Under Construction*			*Sites recommended for investigation*		
		Major	*Medium*	*Minor*	*Major*	*Medium*	*Minor*
Gujarat	19	1	1	4	1	-	12
Maharashtra	14	1	1	-	1	-	11
Goa	3	-	-	-	-	1	2
Karnataka	8	1	-	6	-	-	1
Kerala	14	1	-	6	-	-	7
Tamil Nadu	20	1	1	7	1	-	10
Andhra Pradesh	17	1	-	3		2	11
Orissa	12	-	1	1	1	-	9
West Bengal	3	1	-	-	-	-	2
Pondicherry	2	-	-	-	-	-	2
A&N Islands	3	1	-	-	2	-	-
Lakshadweep	2	-	-	-	-	-	2
Total	**117**	**8**	**4**	**27**	**6**	**3**	**69**

Annexure VII

Potential Sites Identified by CICEF for Development of Fishery Harbours and Fish Landing Centres

State/UT	*Proposed Harbour Facilities*	
	Minor FH	*Fish Landing Centre*
1. Gujarat	4	3
2. Maharashtra	4	-
3. Goa	2	-
4. Karnataka	7	4
5. Kerala	5	-
6. Tamil Nadu	11	4
7. Andhra Pradesh	1	-
8. Orissa	3	-
9. West Bengal	1	1
10. Daman & Diu	2	1
11. Pondicherry	1	-
12. Andaman & Nicobar Islands	-	12
Total	**41**	**25**

Annexure VIII

Sites found suitable for development of Fishery Harbours/ Fish Landing Centres under Master Plan

State *Union Territories*	*Proposed* *Fishery Harbours*	 *Fish Landing Centres*
1. Gujarat	Rupen Mangrol Bara Dholai * Umbergaon*	Madhavpur Sutrapada Dhamlej
2. Maharashtra	Deogad * Sakharinate Harnai Agardanda *	
3. Karnataka	Karwar ** Belambar Alvekodi Mangalore Stage II ** NMPT *Gangolli* * Amadalli*	Gangavali Belekeri** Koderi Shiroor
4. Goa	Chicalim Malim **	
5. Kerala	Ponnani Muthalapozhy Kasargode Neeleswaram Chettuvai	
6. Tamil Nadu	Cuddalore Stage II Pazhayar Stage II Mallipatnam Stage II Tuticorin Stage II Poompuhar * Arcotthurai Rameswaram* Veerapandiyanpattinam * Kulasekharapattinam Colachel* Thengapattinam	Portonovo Tirumullaivasal Periyatalai Ovari
7. Andhra Pradesh	Krishnapatnam *	
8. Orissa	Dhamra Stage II ** Bahabalpur Chudamani	

State *Union Territories*	*Proposed* *Fishery Harbours*	*Fish Landing Centres*
9. West Bengal	Harwood Point	Diamond Harbour
10. U.T. of Daman & Diu	Nani Daman Vanakabara *	Ghoghla *
11. U.T.of Pondicherry	Karaikal *	
12. A & N Islands		Junglighat Panighat Guptapara New Wandoor Havelock Island Neill Island Uttara jetty Yeratta Rangat Bay Betapur Maya bunder Durgapur

*** Sites investigated by CICEF**

*** * Projects Sanctioned by the Ministry of Agriculture**

Fishery Harbours

1.	Fishery Harbour sites proposed for development	:	41
2.	Fishery Harbour sites investigated by CICEF	:	13
3.	Fishery Harbour projects sanctioned by the Ministry	:	4
4.	Fishery Harbour project reports prepared; sanction awaited	:	4

Fish Landing Centres

1.	Fish Landing Centre sites proposed for development	:	25
2.	Fish Landing Centre sites investigated by CICEF	:	1
3.	Fish Landing Centre projects sanctioned by the Ministry	:	1
4.	Fish Landing Centre project reports prepared; sanction awaited	:	1

11. THE CHENNAI DECLARATION ON CLEANER FISHERY HARBOURS AND SEAFOOD QUALITY ASSURANCE

Conscious that the countries in Southeast Asia contribute more than half the world's marine fish trade, which is worth several billion US dollars;

Realizing the importance of fisheries as an essential sector of the development of nations in the region and underlining the high dependence of several million fishers and coastal peoples on fisheries for their food and livelihood security.

Recognizing the increasing global concern about seafood quality, which has resulted in imposition of quality standards by some countries

Concerned that the inability to meet quality standards may result in loss of trade and earnings and jeopardize the livelihood and food security of millions of fishers and coastal peopes.

Realizing that many fishery harbours and landing sites are a vital link in the chain of events from harvesting to consumption and the interface between harvesting and marketing of fish.

Concerned that many fishery harbours and landing sites in the region have been found to be wanting in some aspects of management, quality, design and provision of facilities and services and

Realizing that there already have been negative repercussions to the situation.

Reaffirming the Code of Conduct for Responsible Fisheries and, in particular, its sixth Annexure, which clearly gives direction to the management of fishery harbours and landing sites.

Emphasizing the immediate and urgent need for rehabilitation of fishery harbours and landing sites and giving direction to the design and development of new fishery harbours and landing sites to enable installations which are well managed, efficient, economically viable, address the needs of users and meet quality and environmental standards;

Realizing that the understanding, support and commitment of people's representatives and policy makers is vitally necessary to enable and facilitate the efforts of fishery harbour and fishery agencies;

We the representatives of fishery harbour and fishery agencies of the Governments of Bangladesh, India, Indonesia, Malaysia, Maldives, Sri lanka and Thailand, having participated in the BOBP-FAO/IMO/GOI regional expert consultation on Cleaner Fishery Harbours and Seafood Quality Assurance held in Chennai, India, 25-28 october 1999, Now Therefore.

1. *Emphasize* the need for awareness building amongst consumers, users and other stakeholders on the need for, the benefits and methods of achieving cleaner fishery harbours and landing sites, in order to assure the quality of seafood.
2. *Encourage* the participation of all stakeholders in the formulation, siting, planning, development, management and maintenance of fishery harbours and landing sites.
3. *Recommend* that fishery harbours and landing sites should be located and designed keeping in mind fisheries resources availability and market needs, and have facilities and infrastructure including laboratory facilities where necessary, means to ensure safety at sea of the users and natural disaster mitigation facilities, to enable total quality management.

(Continued on page 86)

12. FIELD TRIP TO CHENNAI FISHING HARBOUR AND PHOTO EXHIBITION

Participants to the consultation made a field trip to the Chennai fishing harbour. A small exhibition of photographs of the harbour, prepared earlier, facilitated discussion of problems at the Chennai harbour and other harbours during a "design clinic". Reproduced here are a few photographs from the exhibition.

Women fish vendors at the harbour.

Panaromic view of the fishing harbour

Hawkers in the harbour area.

The Chennai declaration *(Continued from page 83)*

4. *Recommend* that improved fisheries resources information and market intelligence be made available on a continuing basis to facilitate better decision-making regarding fishery harbours and landing sites and in order to ensure their long-term sustainability.

5. *Recommend* the evolution of mechanisms to promote inter-departmental cooperation and coordination for comprehensive and integrated management of fishery harbours and landing sites and to better conserve and protect the environment.

6. *Propose* formulation and rigorous enforcement of rules and regulations, including speedy removal of encroachments, adequate staffing and financial support, to promote and ensure compliance.

7. *Recommend* that fishery harbour and landing site managers should be adequately qualified and trained, especially in seafood quality assurance, handling and processing and general management and that managers be empowered adequately to take decisions, both financial and otherwise, to improve the management of fishery harbours and landing sites.

8. *Suggest* that governments make available funds for rehabilitation and maintenance of fishery harbours and landing sites, using among other sources a larger proportion of cess and duties on exports of seafood.

9. *Recommend* the charging of rational tariffs for services provided by fishery harbours and landing sites and incorporation of effective mechanisms for collection in order to generate revenue, which should be used in the management and maintenance of fishery harbours and landing sites.

10. *Suggest* a balanced approach to privatization of fishery harbours and landing sites (if necessary through the provision of incentives) to reduce the burden on governments and to improve efficiency and quality, without compromising the need to address the needs and concerns of poor fishers and stakeholders.

11. *Strongly* recommend the development of one model fishery harbour and one fish-landing site in each country to act as a working demonstration unit, assist in evaluation of methods/approaches/technologies and be used in the training of managers.

12. *Strongly* recommend that countries seek the support of the Food and Agriculture Organization of the UN and other countries for development of model fishery harbours and landing sites through TCP and TCDC arrangements.

Adopted on Thursday, the 28th of October 1999, in Chennai, India.

BOBP/RE