Annex 1

FAO Technical Guidelines for Responsible Fisheries – Fishing Operations – 1 (Annex VI)

Annex VI. Procedures for the Development and Management of Harbours and Landing Places for Fishing Vessels

A. INTRODUCTION

1. The increasing problems associated with the construction of new harbours and landing places for fishing vessels and, in particular, their operation and maintenance, reached critical levels in some parts of the world. In many instances, the adverse effects of harbour pollution from the activities of fishing vessels as well as those of vendors and processors was exacerbated by the almost total lack of reception facilities. Matters became more serious in the late 1980s with an ever-increasing demand for assistance from developing countries to solve specific problems with existing harbours as well as for help in designing new installations.
2. In the Bay of Bengal subregion, the matter gave great cause for concern and, with the cooperation of the International Maritime Organization (within its cleaner seas programme), the Bay of Bengal Programme (BOBP) commissioned a series of important studies. At the same time, FAO also embarked on the preparation of a manual in relation to harbours and landing places to give guidance on design, construction and maintenance of harbours and landing places. An important component of this manual dealt with the reduction of pollution.
3. In connection with the activities of the BOBP, the Government of Malaysia hosted a subregional workshop at Penang, 9-11 December 1991, at which the results of the studies carried out by the BOBP project were presented. The FAO secretariat reported on its activities in other regions and IMO highlighted developments with regard to MARPOL.[1]
4. At the United Nations Conference on Environment and Development (UNCED), June 1992, in relation to the protection of the marine environment, the need for a precautionary and anticipatory approach rather than a reactive approach was seen to be necessary to prevent degradation of the marine environment. UNCED recommended, *inter alia*, the adoption of environmental impact assessment procedures.
5. In recent years, environmental auditing has become an accepted norm for development within coastal areas. It ensures that a State, in consultation with the promoter of a project proposal, can jointly make an assessment of a project and the effect of the planned activities with regard to any significant adverse impact upon the environment. The auditing mechanism also provides for a preliminary assessment or partial audit, on the basis of which a government can decide whether or not to go ahead with a proposal. It also provides the basis

[1] International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

for a decision with regard to a full environmental audit. In addition, taking into consideration the size and cost of the project, as well as the practicality of the exercise, it can provide the terms of reference for the full audit.

6. Although it was apparent from the studies undertaken by the BOBP and FAO, that impact assessments with respect to coastal development seemed to be a matter of common sense, the reality of the matter indicated otherwise. Similarly, the level of cooperation between users of the coastal area often fell far short of what was needed.
7. Therefore, in the preparation of this Annex, account has been taken of the requirement for better systems of management identified by the BOBP workshop in Penang, recent developments in the implementation of MARPOL with regard to cleaner harbours (port reception facilities), Agenda 21 of UNCED and Articles 8 and 10 of the Code of Conduct for Responsible Fisheries (the Code).

B. STANDARD PROCEDURES

1. General Provisions

1.1 Within the concepts of responsible fishing operations and the integration of fisheries into coastal area management, this Annex provides a technical framework for the implementation of procedures as an aid to the management and development of harbours and landing places for fishing vessels.

1.2 Provisions are made for the formulation and implementation of environmental audits for future fisheries related infrastructure projects.

1.3 Although forming a part of the Code of Conduct for Responsible Fisheries, that is voluntary, some provisions of this Annex may be or have already been given binding effect by means of legal instruments, such as UNCLOS 82[2], the Montreal protocol[3] and MARPOL 73/78.

2. Scope And Objectives

2.1 The proposed procedures are global in scope, and directed towards all persons, whether in government or the private sector, involved in the planning, design, construction, maintenance and management of harbours, harbour infrastructure and landing places for fishing vessels.

2.2 The objective is to enhance the capacity of States to ensure the adoption of environmentally sound development, management and conservation practices through:

a) better standards of management in harbours and landing places for existing and future facilities;

b) the establishment of environmental auditing procedures and design criteria related to future fisheries infrastructure projects; and,

c) appropriate training and education in environmental awareness.

3. Management

3.1 States should ensure that an appropriate legal and institutional framework is adopted to manage coastal zone development.

3.2 The fisheries sector should be an integral part of the coastal zone management arrangements in order to ensure that:

a) due account is taken of the rights of coastal fishing communities and their customary practices to the extent compatible with sustainable development; and,

---

[2] United Nations Convention on the Law of the Sea of 10 December 1982.

[3] Montreal Protocol to the Vienna Convention.

b) that the fisheries sector, together with fishing communities are consulted in the decision making process regarding fisheries related projects as well as providing for their inputs in non-fisheries activities related to coastal area management.

3.3 States should take measures to establish effective management bodies at the fish landing or harbour levels to ensure:
a) compliance with the laws, regulations and other legal rules governing the duties of a port State in relation to a fishing harbour or a fish landing facility;
b) compliance with environmental conservation and monitoring measures adopted by the competent authorities at the national level as well as measures adopted on a regional or subregional basis;[4]
c) integration with other users (as in the case of a non-exclusive facility for fishing vessels); and,
d) transparency in the decision making process.

3.4 In establishing a management body, the competent authorities should ensure that such bodies:
a) are adequately funded to function as intended;
b) represent the whole spectrum of users of the facility;
c) allow for consultation between the various users;
d) are commensurate with the size of the facility and the duties of the body and the responsibilities assigned to it.

3.5 At the village level, the management could be entrusted to a Community Fishery Centre (CFC) or similar organization of fisherfolk. Although the facilities and services within a particular village or area may be quite modest, there is still a need for an organized form of management.[5]

3.6 At the industrial level, the management should be implemented by a well defined body (Private, Autonomous, Municipal or State), with the members drawn from the various constituent users of the port as well as the community at large. An exception to the rule would be where the facilities are owned by a single company. Nevertheless, the company would remain accountable, within the overall management structure, for its operations.

4. Environmental Auditing Procedures

4.1 States should ensure that development proposals are formulated in a precautionary rather than a reactive manner to minimize unwarranted degradation of the aquatic environment.

4.2 States should also establish procedures for the inclusion of future development proposals for harbours and landing places for fishing vessels into national development plans, and where applicable, fisheries or coastal zone management plans. These procedures should be sufficiently flexible to accommodate requests for proposals within a programming period which may arise, for instance, as a consequence of unforeseen changes in the fisheries sector, including natural disasters.

4.3 States should also ensure that all such proposals are supported by clearly defined justifications.

4.4 States should adopt environmental audits in support of all applications for construction or improvement of harbours or landing places for fishing vessels, whether in coastal zones or inland waters.[6]

---

[4] The provisions or regional or subregional agreements to which the coastal State is a party would normally be incorporated in national legislation.

[5] See FAO guidelines for the establishment and operation of Community Fishery Centres.

4.5 The auditing procedures required for carrying out a full environmental audit in compliance with commonly accepted standards, should:
   a) assess the existing environment, including the land-use characteristics and socio-cultural activities at the proposed site;
   b) list the planned changes to be made to the environment by the proposed project;
   c) estimate the anticipated impact of the planned project on the existing environment[7];
   d) propose mitigation measures to prevent (or mitigate) the anticipated impact on the existing environment; and,
   e) establish a system of environmental monitoring in the vicinity of the project site.

4.6 In order to commence an auditing process, States should ensure that all applications submitted in respect of new constructions are accompanied by a detailed outline design of the proposal.

4.7 A detailed outline design of the proposal should be a stand-alone document. It should consist of a detailed description and layout of the project proposal in relation to its surroundings, the anticipated demand on the resources of the area both during construction and operation, together with mitigation and environmental monitoring proposals. The detail in the detailed outline design should be commensurate with the size of the proposed project; the larger the project the more detail required. This document should form part of the environmental audit up and until full planning or building permission has been issued by the competent authorities.

5. Environmental Assessments

5.1 The existing environment around a project site should be assessed through:
   a) onshore topographic and offshore bathymetric maps (down to the 20 metre contour) of the site, covering at least 1 km in each direction along the coast;
   b) aerial imagery of the above-mentioned area with a resolution not smaller than 1:2000 together with any satellite imagery available[8];
   c) details of existing or planned coastal structures within 5 km of the proposed site;
   d) a morphological description of the coastal zone of the site, backed up by a geological description of important local features such as cliffs, sand dunes, beaches, reefs, terraces, rivers, dams on nearby rivers, river mouths;
   e) wave, tide or lake level statistical characteristics including probability tables for extreme conditions;
   f) seasonal variations in rainfall, river flows, water density, water temperature, nutrients concentration and microbial pollution levels;
   g) geological, petrographic and sedimentological characteristics of the coastline and seabed, including source, volume and seasonal changes in littoral transport;
   h) maps of onshore and offshore habitats in and around the project site (coral reefs, lagoon systems, mangroves, estuaries, etc.);
   i) maps of types of habitat in and around the project site (areas of refuge, feeding grounds, nursery and spawning);

---

[6] Institutional bodies or private sector organizations with the capacity to carry out such audits should be identified.

[7] See FAO paper on fishery harbour planning, reference 1.

[8] Satellite images are available for many parts of the world. The FAO remote sensing unit and its network of regional stations could provide appropriate reference points.

j) lists of the species to be harvested, lists of protected or rare species and biological indicators as well as the methods of fishing;
k) layouts, size and capacity of resource networks, such as for water supplies, power supply and distribution, road and other communications and sewerage networks, etc.; and,
l) location maps of any type of activity discharging directly or indirectly effluent into the aquatic environment, including distant but connected watercourses, such as sewer outfalls, onshore fish farms, slaughterhouses, logging/saw mill concessions, wood pulp factories, mines and ore reduction plants and other industries.

6. Planned Changes

6.1 Assessments should address the planned changes to the environment and should include:
a) a general description of the entire project, including location, type, size and typical cross-sections of the various components that together make up the project together with a description of the proposed stages of construction;
b) the additional demands which would be placed on the locally available resources, both during construction and operation of the project;
c) details of all the effluents and emissions arising from the project; and,
d) the changes in the landscape, including land use characteristics and socio-cultural activities envisaged in the project.

7. Anticipated Impact

7.1 The estimation of the anticipated impact of the planned project on the existing environment should include:
a) topographic, bathymetric and oceanographic changes, including dredging and reclamation, during and after construction until stable conditions are resumed, together with their effect on habitats, flora, fauna and land use;
b) changes in water quality (temperature, salinity, turbidity, dissolved oxygen, nutrients concentration and microbial pollution levels) during and after construction and their effect on habitats, flora, fauna and land use;
c) sources of pollution discharging effluent, emissions or solid wastes during and after construction until stable conditions are resumed and their effect on habitats, flora, fauna and land use; and,
d) the visual impact on the seascape and the landscape and general quality of life around the proposed project site.

7.2 In the valuation of the coastal resources, the competent authorities should take into account all elements of value, not just those elements for which markets happen to exist. The fact that a resource is not traded in a market does not mean it is of no value (consider for instance the social benefits of a clean beach, the tourist potential of a coral reef, or the health implications of clean air).

8. Mitigating Measures

8.1 The detailed outline design should list the proposed measures to prevent or reduce (mitigate) the negative effects upon the environment. The mitigation measures should be:
a) technical, i.e oil reception facilities, waste recycling schemes, sewage treatment systems, CFC-free refrigeration equipment and by-pass dredging where applicable;
b) managerial, i.e. a clearly defined harbour board, commensurate with the size of the proposed project and the responsibilities expected of it; and,

c) legal and administrative, i.e. frameworks formulated in conformity with national laws to provide for sanctions in respect of violations.

8.2 The detailed outline design should also list the proposed monitoring measures to identify environmental degradation as early as possible.

8.3 In the first instance, such proposals should identify the appropriate indicators and secondly the institutional bodies with the capacity to carry out the monitoring process. These indicators could be:

a) physical parameters (i.e. changes in coastal morphology such as erosion or siltation);
b) biological parameters (i.e. edibility of certain shellfish);
c) chemical parameters (water quality); and,
d) socio-economic parameters (such as population density and income levels).

9. Design Criteria

9.1 In general, States should adopt acceptable design criteria for the design and construction of harbours and landing places for fishing vessels to ensure against unwarranted degradation of the aquatic environment. Design criteria for both the detailed outline design and the final design should ensure, *inter alia*:

a) compliance with basic engineering principles regarding the morphological degradation of the coastal zone in respect of erosion and siltation (UNCED 92)[9];
b) compliance with all relevant conventions concerning pollution of the aquatic environment (MARPOL 73/78); and,
c) the provision of adequate monitoring of the effects of operations on the environment (UNCED 92).

9.2 The detailed outline design should enable the competent authorities to make a preliminary assessment of the project and the effect of the planned activities with regard to any significant adverse impact upon the existing environment.

9.3 The detailed outline design of a project proposal should be based on the following minimum technical requirements:

a) detailed current topographic and bathymetric maps, resolution not smaller than 1:1000;
b) wave, tide or lake level statistical hindcast studies, including probability tables for extreme conditions;
c) geological, petrographic and sedimentological characteristics of the coastline and seabed; and,
d) mathematical and/or physical hydraulic modelling of the anticipated changes in the shoreline (including erosion, and siltation) and conditions at sea (including wave reflections and circulation).

9.4 The competent authorities should ensure that:

a) the resolution and accuracy of the maps are adequate and verifiable;
b) the wave statistical and hindcast studies are reliable;
c) the geological studies are adequate in extent and detail; and,
d) the hydraulic models are adequate in extent and calibration and the results reliable.

9.5 Final design should only be submitted after the environmental audit has been approved by the competent authorities.

9.6 States should ensure that final design adheres strictly to the detailed outline design (and approved modifications) as approved by the competent authorities in the final version of the environmental audit.

---

[9] The United Nations Conference on Environment and Development, 1992.

9.7 The final design should comply with the relevant provisions of International Conventions to which the State is a party, such as:

a) UNCLOS 1982 – which establishes rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment;

b) MONTREAL PROTOCOL 1987 – which protects the ozone layer by taking measures to control equitably total global emissions of substances that deplete it;

c) MARPOL 73/78 – which protects the marine environment by eliminating completely pollution due to oil and other harmful substances; and,

d) LONDON CONVENTION 1972 – which controls pollution of the sea by dumping.

10. Education and Training

10.1 States should promote awareness of environmental issues related to fishing harbours and landing places. The target audience should include:

a) direct users;

b) other user groups;

c) those responsible for the management and operation of such facilities; and,

d) the general public.

10.2 States should ensure that the provisions of the Code in relation to harbour and landing places are brought to the attention of those responsible for the training and certification of fishermen. Awareness programmes should ensure that these provisions are brought to the attention of all those employed directly in the fisheries industry, and their families.

10.3 Such training and awareness programmes should incorporate guidelines on personal hygiene, public health (sanitation) and on how to maintain harbours and landing places in a clean condition.

10.4 Other user groups may be served through community based arrangements supported by government extension services, such as:

a) Community Fishing Centres (CFCs)[10]

b) Fishery Development Units[11] (FDUs); and,

c) Vocational training programmes, which could include the general public.

10.5 States should ensure that their awareness programmes are supported by requiring those responsible for the management and operation of fishing harbours and landing places, to prominently display by-laws and regulations (billboards, posters and newspapers) for the benefit of all users.

10.6 The general public, and as appropriate, those still at school, could also be targeted by community wide awareness programmes or association of these issues with environmental studies.

11. References

Fishery Harbour Planning – FAO Fisheries Technical Paper No. 123, Food and Agriculture Organization of the United Nations, Rome 1973.

Community Fishery Centres: Guidelines for Establishment and Operation – FAO Fisheries Technical Paper No. 264. Ben-Yami M, Anderson A.M., Food and Agriculture Organization of the United Nations, Rome 1985.

Construction and Maintenance of Artisanal Fishing Harbours and Village Landings – FAO Training Series No. 25. Sciortino J.A., Food and Agriculture Organization of the United Nations, Rome 1995.

[10] FAO/IMO Guidelines Ref. 3 and 5.

[11] Fisheries Technical Paper No. 264 on Guidelines for the establishment and operation on FDUs.

Linking Government Agents and Local Users: Participatory Urban Appraisal for Artisanal Port Development – Reusen R., Johnson J. International Institute for Environment and Development, Issue No. 21. Nov. 1994.
Guidelines for Cleaner Fishery Harbours, BOBP (Madras 1993).

Annex 2

Port hygiene checklist

INTRODUCTION

The standard of personal hygiene of the workers employed inside a fishing harbour depends on both the sanitary infrastructure available and the harbour management in enforcing certain directives. The following principles are based on actual cases.

TOILETS

Toilets should be constructed to the highest standards possible to ensure the maximum lifetime. Poorly built facilities break down very quickly and in hot climates they give rise to "toilets of opportunity" elsewhere. Toilet facilities should always be properly maintained and full-time manning by attendants is desirable. Toilets should never open on to a work area where fish is being handled due to the risk of flooding from blocked drains.

WASH-HAND BASINS

An adequate number of wash-hand basins should be provided within each toilet block. These should be equipped with arm or foot-operated faucets and soap should be available at all times. Household-type fittings should not be specified as these do not withstand the rigours of constant use. Water saving spring loaded faucets should be provided in areas where water is scarce.

SHOWERS

The importance of showers in hot climates should not be underestimated; fishermen returning from long journeys always welcome a shower with proper running water. As with toilets, showers should be built to the highest standard possible and manned by attendants. When the harbour is not offloading fish, showers should be cleaned and locked up.

SIGNS AND BILLBOARDS

Appropriate signs and billboards listing food hygiene regulations should form part of the harbour's sanitary awareness infrastructure. These signs should be displayed at all the strategic locations within the port boundary, for example:

- "*NO SMOKING, NO SPITTING, NO EATING*" signs should be posted wherever fish is being handled; and
- "*HAVE YOU WASHED YOUR HANDS* ?" signs should be posted at all toilet exits.

Adequate signs should also be posted in prominent locations indicating the direction to the toilets. Proper and frequent training of the port workers in personal hygiene should form part of the harbour master's management brief. Port sanitation is to the port what personal hygiene is to the workers employed by the port.

Port sanitation is best explained by the following simple regulations:

1. All water supplies inside the port should comply with the national drinking water standards;
2. All ice, including that brought in from outside suppliers, should also comply with the above drinking water standards;

3. All chlorination equipment should be functional and adequate supplies of the chlorination agent should be held in stock;
4. All sampling and testing carried out inside the port should be carried out by International Organization for Standardization (ISO) certified laboratories only;
5. Appropriate signs should be displayed within the port area covering the prohibition of dumping, spillage, use of seawater from inside harbour basin, spitting, eating areas, access for domestic animals, etc.;
6. Appropriate billboards should be displayed at strategic locations listing fines for the contravention of port hygiene rules;
7. All drainage systems (*indoor and outdoor*) should be kept in perfect working order;
8. Port perimeter fences should be properly maintained to keep unauthorized people and domestic animals from entering the port area at any time;
9. The entrance and exit to a fishing port area should be manned during business hours to prevent unauthorized people from gaining entry to the fish handling areas;
10. Disinfection of required areas should be carried out on a regular basis;
11. No excessive trash and wet wastes should be left to accumulate in work areas;
12. No rodent harbourage should exist in and around the port area (tall weeds, junk piles and municipal rubbish);
13. No birds should be nesting inside open-sided auction halls and fish handling sheds;
14. Only employees and officially recognized fish traders should be allowed access to work areas during fish handling operations and auctions;
15. Toilet and shower facilities should be kept scrupulously clean and in perfect working order;
16. Only electrically powered machinery should be allowed inside the auction or handling sheds to prevent oil, petrol and diesel from leaking onto the floors which are sometimes used as auction surfaces for large fish;
17. All equipment inside the fish handling areas, from block ice crushers to platform trolleys, should be in stainless steel; and
18. The entire fish handling area should be hosed down properly at the end of business and locked up to prevent unauthorized entry until the next auction.

Annex 3

Port hygiene deficiencies checklist

INTRODUCTION

The sanitary infrastructure inside many fishing harbours always gives cause for concern, especially when health or food hygiene inspectors are expected for an official visit. The following infrastructure deficiencies are among the most common infractions which the inspectors look for and are based on actual cases:

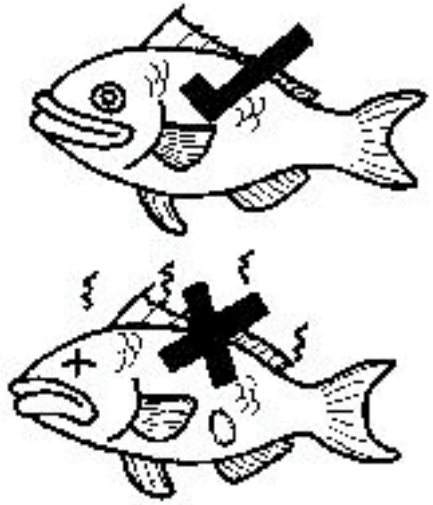
A. WC Facilities

1. Toilets are sometimes totally absent from the harbour infrastructure;
2. Toilets open out onto work areas where sewage can flood directly into the processing/handling area;
3. Toilet drains are often uncovered and full of rubbish like plastic bags, fruit, etc., causing blockages;
4. Toilets do not have an adequate water supply to flush;
5. Toilet and wash-hand basin fittings are often out of order, broken or missing;
6. Toilet wash-hand basins are often left without soap or wipe towels/blowers;
7. No "**HAVE YOU WASHED YOUR HANDS**" signs posted inside toilets;
8. Doors are often unserviceable and removed off the hinges because the timber from which they are manufactured absorbs too much moisture and renders them inoperable ;
9. Toilets are often flooded from leaking pipes or roofs; and
10. Sewage disposal or treatment is either absent or totally inadequate.

B. Auction Hall

1. No fish sorting tables in sorting hall and fish is handled on the floor;
2. No sanitary water is available inside the harbour to rinse fish; and
3. No sanitary water is available inside the harbour to wash floors.

TRAINING MANUAL
on
Seafood handling



Francisco Blaha
Fishery Industry Officer
Food and Agriculture Organization of the United Nations

Clean Ports Initiative
Capacity building in support of cleaner fishing harbours

Index

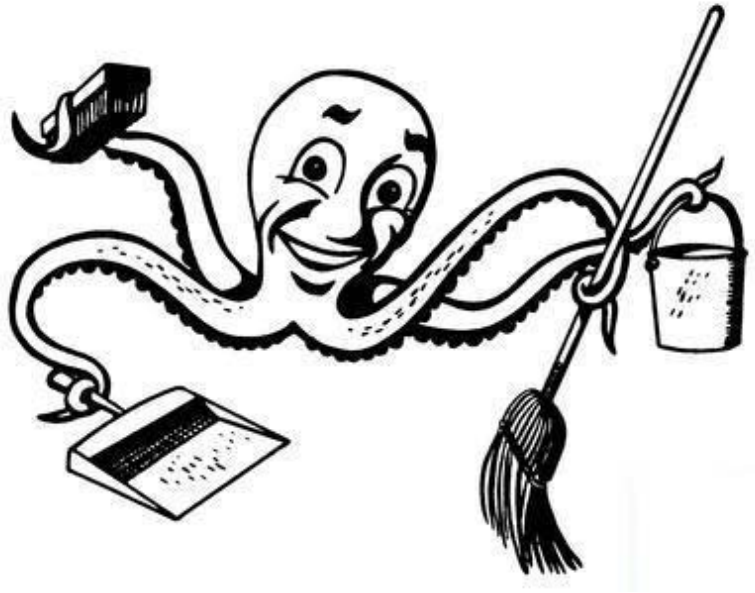
Section 1: Problems

Section 2: Solutions

Prepared by:

Francisco Blaha
Fishery Industry Officer
Fish Marketing and Utilization Service
Fish Products and Industry Division
Fisheries and Aquaculture Department
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla
00153 Rome, Italy
E-mail: Francisco.Blaha@fao.org

Illustrations reprinted from training resources by the
New Zealand Seafood Industry Training Organization (www.sito.co.nz)



1. Spoilage

After a fish dies, its flesh begins to break down (rot).
This is called spoilage; this process cannot be avoided. It can be slowed, but not stopped. After some time, the fish gets softer, smellier, loses its bright colours, and begins to produce harmful substances that can make people sick.

Seafood spoils quickly; when it does:

- it goes to waste;
- it is not healthy because there are fewer nutrients;
- it can make you, your family or other people sick;

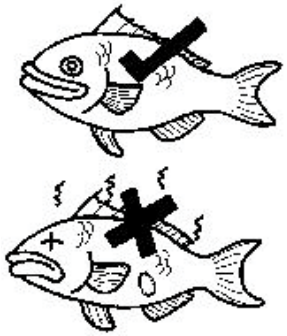
and

- those selling lose money as people do not want to buy it.

Activity

1. Where have you found bad fish?

2. What made these fish go bad?



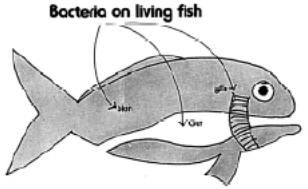
Agents of spoilage

Fish go bad, or spoil, when agents of spoilage attack the flesh after the fish is dead.
The two main agents of spoilage are:

- bacteria
- enzymes

Bacteria and enzymes are the enemies in the battle to preserve food products.
Bacteria are simple - and very tiny - organisms.
They live almost everywhere, including:

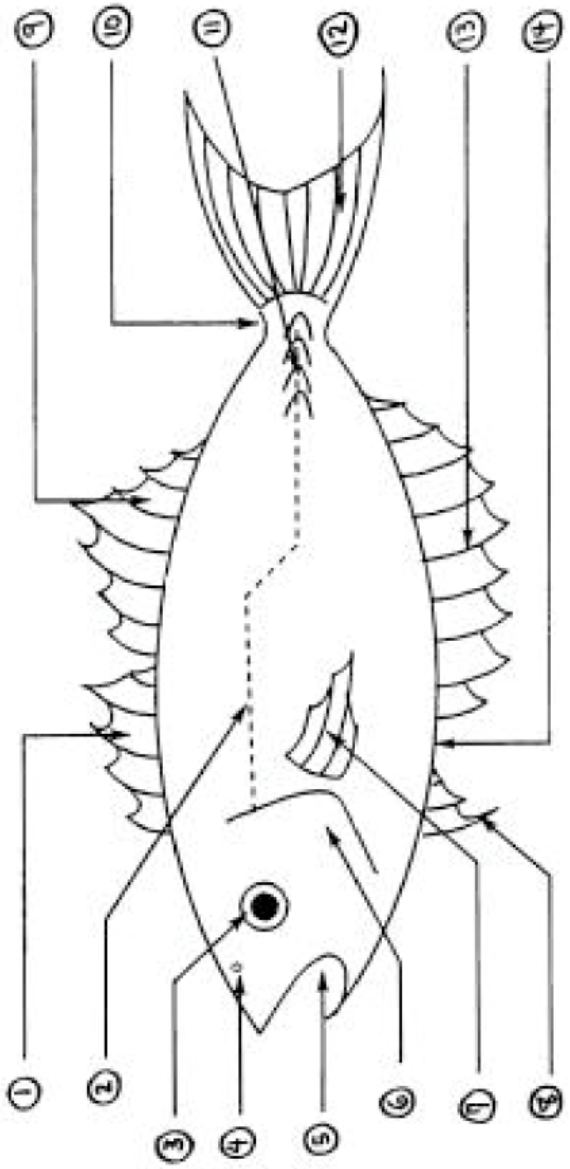
in the air
on land
in the sea (and on the ocean floor)
on plants and animals
on the skin, gills and guts of fish.



One place bacteria do NOT normally grow is in the flesh of a live, healthy fish. Bacteria are found only on exposed surfaces such as the skin (and body slime), gills and gut.

Activity

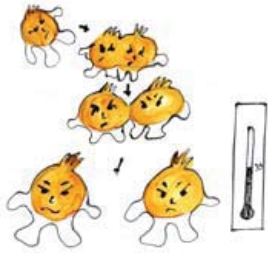
1. Label parts of a fish using local names



Which parts of the fish have the most bacteria?

Bacteria on the skin, the guts and the gills cause no harm to a living fish. However, when the fish dies, these bacteria grow quickly in number, especially in warm conditions. If there is a tear or a hole in the skin, the bacteria can enter the flesh - an ideal place for bacteria to grow - and make the flesh smell and taste bad, look awful and possibly make those eating it sick.

When are there more bacteria?



Bacteria are greater in number if the seafood:
is washed with polluted waters (harbour waters);
touches dirty hands, boats, boxes, etc;
is handled or gutted without care;
is stored at high temperatures; or
has fed just before capture (more bacteria in the gut).

When does fish go bad?

Fish goes bad when bacteria numbers grow.
In tropical countries, fish can go bad within 12 to 20 hours, depending on the species and method of capture.

Some types of fish go bad more quickly than others. For example, white reef fish meat keeps longer in ice than red tuna meat. This is because tuna have a higher body temperature compared to reef fish, making it easier for bacteria to grow. Their thicker body shape also makes them slower to chill.

If fish are dead a long time before being taken out of the water, bacteria may start to attack the flesh.

Enzymes

Enzymes are proteins that are present in the muscles, organs and gut of fish (and all animals). Metabolic enzymes are the "workers" in the body and help to speed up processes such as digestion. Digestive enzymes break down food until the gut can absorb the nutrients in the food. The body can then use the nutrients for growth and energy.

When a fish dies, enzymes keep working in the body, causing changes in the flesh. The digestive enzymes continue to break down the food in the fish's gut. If the fish is not gutted, the enzymes begin to eat holes through the gut lining, allowing bacteria to enter the flesh and break it down.

Sometimes the gut cavity swells up with gas and eventually bursts, making it even easier for bacteria to enter the flesh. This is known as 'belly burst'.

'Belly burst' is more likely to occur:
in well-fed fish
(because there are more digestive enzymes in their guts); or
if the fish is warm
(because enzymes work better in warmer temperatures).

Enzymes cause changes in the flesh and can assist the spread of bacteria from the gut.
The enzymes cause:
- **loss of flavour** or an **increase in bad flavour**;
- loss of texture; and
- loss of colour.

Activity

Answer these questions :

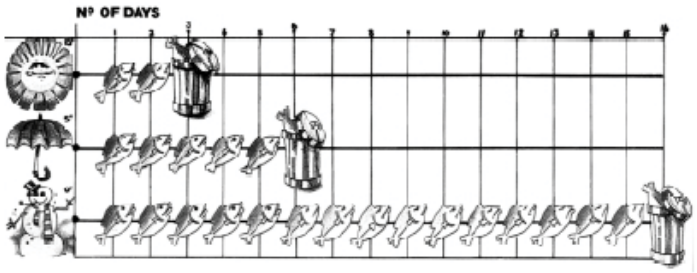
1. Which parts of the fish are likely to have high amounts of bacteria?

2. Enzymes are not a problem when the fish is living. Why are they a problem when the fish is dead?

3. What causes 'belly burst'?

4. How can you stop 'belly burst'?

How long before fish goes bad?



The fresh fish test

If a fish is kept in conditions allowing bacteria or enzymes to attack the flesh, it will quickly lose its freshness and quality. However, a person who buys or eats fish would like it to be fresh.

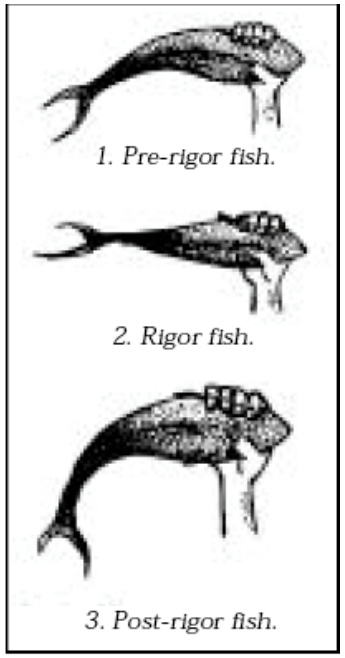
A fresh fish:
has bright colours;
has clear, bright eyes;
has bright red gills;
smells likes fresh seaweed;
feels firm and springy;
does not have overly slimy skin or gills;
tastes good.

A fresh fish is more nutritious and is less likely to make you sick.

Stiff fish and spoilage

Just after a fish is caught, it quickly dies. A dead fish goes through three stages, known as the stages of rigor.

Stage 1 The fish is soft immediately after it dies.
Stage 2 The fish becomes stiff within several minutes to several hours after death, depending on the temperature it is kept at - the quicker it is chilled the longer it will take to reach this stage. The fish will also be stiff longer if it is bigger and is kept cool.
Stage 3 The fish becomes soft again after some time. If you push your finger into the side of the fish, it is not as springy as it was in the first stage.



Stages of rigor

Bacteria and enzymes are more active in Stage 3 and fish will then go bad very quickly. **Fishers should try to keep fish in Stage 1 and Stage 2 for as** long as possible.

The cooler a fish, the longer it will take to reach Stage 3.
Cover it, and/or even better, **put the fish on ice.**

2. Contamination

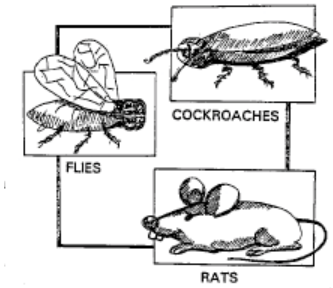
Contamination can be classed as anything on or in **fish that is not supposed to be there.**

Contamination can originate from different sources.

For example, in the case of poor personal hygiene, contamination can be any pathogenic organisms transferred to the fish from people handling it or through unhygienic work practices.

In the case of poor cleaning and sanitation, contamination can be any matter (biological, chemical or physical) which is transferred to the fish as it is handled and stored on the vessel, at the port or the factory.

Sometimes contamination can come from pollution of the environment, for example, bacteria from sewerage, heavy metals from industry, pesticides from agriculture, etc.



Poor personal and environmental hygiene.

Examples of types of contamination

Source	Contamination	Transfer to fish/product
Personnel	Pathogens	From handling product without proper hand washing. Coughing. Sneezing over product. Eating over product. Incorrect clothing.
Unloading area and equipment	Physical contaminants	Jewellery. Sticking plasters (could contain pathogens). Hair.
	Pathogens	From unclean surfaces, droppings of animals, dead insects.
	Chemicals	Cleaning chemicals not rinsed, machine oils/grease.
Storage areas	Physical contaminants	Metal, paint flakes, glass, vermin, etc.
	Pathogens	From condensation drip, use of hose (splash), area not cleaned.
	Chemicals	Excessive use of chemical cleaners and sanitisers. Not rinsing. Machine oils/ grease.
Product containers and contact surfaces	Physical contaminants	Metal, paint flakes, glass, vermin, etc.
	Pathogens	From unclean surfaces, build up of bacteria in conveyors and other difficult to clean equipment.
	Chemicals	Cleaning chemicals not rinsed, machine oils/grease.
Water and ice	Physical contaminants	Metal, plastic, vermin, etc.
	Pathogens	From contaminated or non potable sources, or stored and transported in a non hygienic way.
	Chemicals	Excessive use of chemicals (i.e. chlorine), or enviromental contaminants.

3. Sickness

Introduction

Seafood is normally a healthy food choice. Unfortunately, food from the sea sometimes contains germs or toxins that make people sick.
You probably know somebody who has been sick after eating seafood. You may have even been sick yourself.

People get sick from eating fish that is not safe. Too many of some bacteria on fish can create substances on fish that are bad for people. This fish can be contaminated. Contamination means that there is something on the fish that is not supposed to be there, for example, bacteria from faeces or flies or petrol or chemicals.
Bacteria that cause sickness are called pathogenic bacteria.

Activity

1. Can you remember someone you know getting sick from eating spoiled or rotten or poisonous fish? Who? When?

People can get sick from seafood:

if the fish was contaminated
if too many pathogenic bacteria have grown on the fish
if the fish has been kept for too long
if the fish has been kept at a temperature that allows bacteria to grow

When someone gets sick, they not only feel bad, but they need costly medicine, cannot go to work, cannot cook, cannot look after the baby.
If people get sick, they don't buy seafood from the same place again.

This means that local people will not eat as much fresh seafood and may buy more tinned foods, which are more expensive and not as healthy as fresh unspoiled seafood.

Overseas customers do not want to buy seafood that may make them sick.

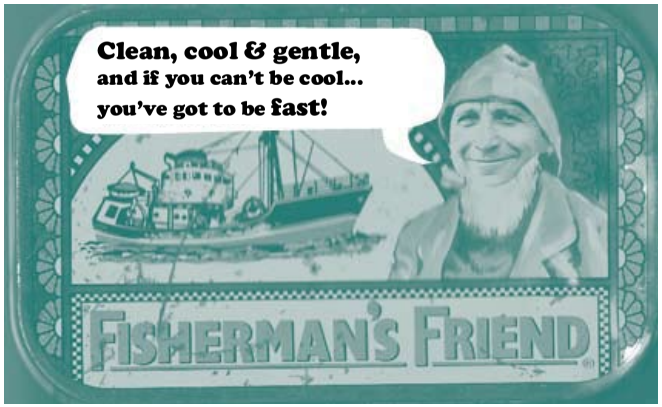
If an area becomes known for its disease causing seafood, then overseas customers will refuse to buy from that area, or they will want the seafood tested to see if it is safe. Tests cost money and the exporter may have to pay fishers less for their fish in order to stay in business.

This is not to scare you from eating seafood but to help you understand what things can cause sickness and ways to avoid it.

How to avoid fish going bad and people getting sick

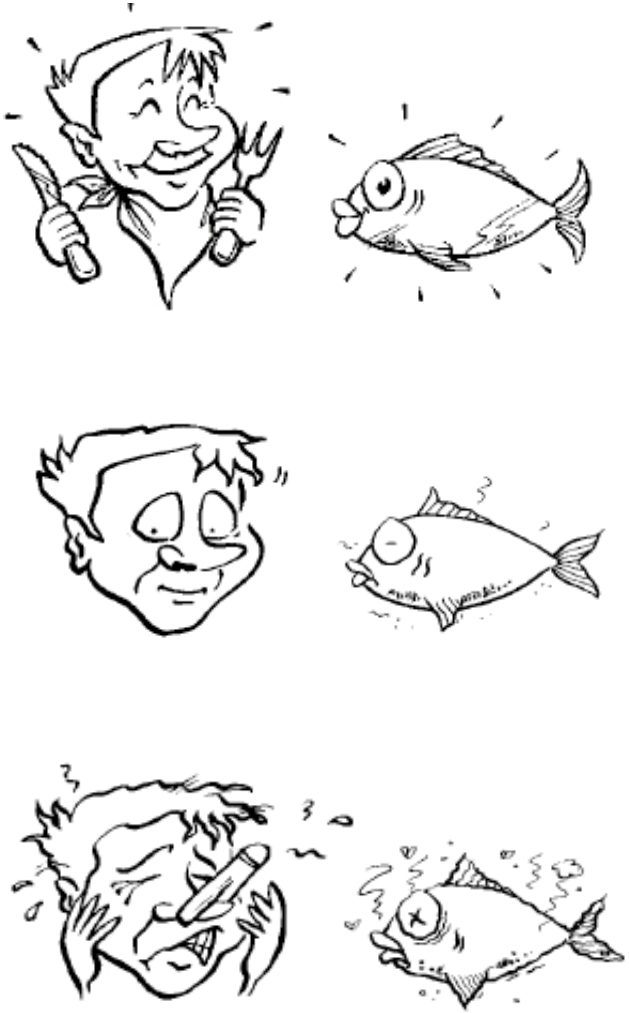
The most important ways to fight spoilage of fish and to prevent people getting sick from eating seafood are:

- keeping the fish and everything the fish touches clean
- avoiding cross contamination
- keeping the temperature of the fish down (cool)
- treating the fish as gently as possible to minimise tears
- gutting the fish if possible



In the next section we will talk about the ways we have to manage the problems of spoilage and sickness.

One of the most important things when you're handling fish is the practice of cleaning and sanitising the place where fish is being handled and the personal hygiene of the people doing this work.



4. Personal Hygiene

Introduction

The main objective of personal hygiene and hygienic work practices is to minimise cross contamination.
Cross contamination includes any pathogenic or food poisoning organisms which may be transferred to product from people (or their equipment) during their handling of the fish or fish product.
Many people harbour pathogenic organisms that could lead to food poisoning if they are able to contaminate seafood products. They are not always a problem for the person carrying the organism, but can be transferred to product if good personal hygiene and hygienic work practices are not followed.

Common pathogenic organisms you may know:

- Staphylococcus aureus (or staph)
- Salmonella
- Shigella
- Eschericia Coli (or E coli)

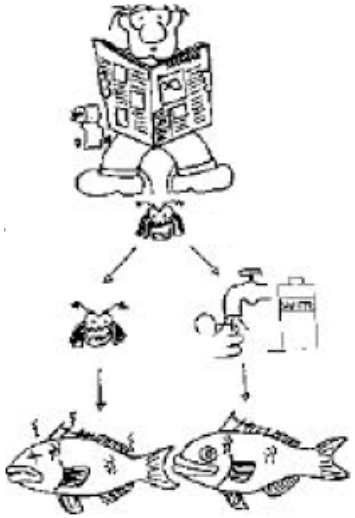
Personal Hygiene includes:

- The wearing of clean protective clothing
- The washing of hands

Hygienic Work Practices include:

- Personal conduct (eg not eating, drinking, sneezing, coughing, etc. over the product)
- Keeping your work areas clean
- Handling dropped product and contaminated product appropriately
- Using equipment, tools, protective clothing, etc. in a sanitary manner

Good personal hygiene and hygienic work practices prevent you from contaminating the product with pathogenic organisms, which cause food poisoning, illness or infection.



Wash hands after toilet.

Good personal hygiene and hygienic work practices, minimise the risk of contamination.

Cuts and Sores

Infected cuts and sores must be treated, for the benefit of both the worker and product safety.
Once treated, cuts must be well covered with waterproof dressings and gloves for hands, before the worker is allowed to handle product.

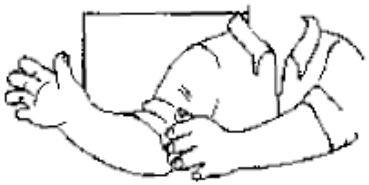
Illness

For people who are ill or feeling ill, a judgement is required as to whether work can be carried out in areas away from direct product handling, or whether the person should be sent home.
Those who are suffering from vomiting or diarrhoea should be sent home.
Personnel may often come to work when they are not feeling well or if they have infected cuts. This can be a significant risk for product safety if it is not managed.

Summary

The main objective of personal hygiene and hygienic work practices is to minimise cross contamination.
The reasons for good personal hygiene and hygienic work practices are to produce safe food and meet legislative requirements.
Cuts and sores must be treated and completely covered with a waterproof dressing.
People who are ill or feeling ill should not be at work, if there is a risk of contamination to the product.

Correct Handwashing Procedure



1. Roll up sleeves to the elbow

2. Rinse up to the elbow

3. Apply soap carefully

4. Brush hands and nails

5. Rinse to eliminate soap
6. Rinse with clean water

7. Dry hands with a clean personal towel or, better still, with a paper towel.

5. Cleaning and Sanitising

After completing this section you will be able to:

- Describe the difference between cleaning and sanitising.
- Describe why cleaning and sanitation are important.
- Describe what happens if we don't clean and sanitise.

Cleaning and sanitising are activities that occur quite regularly in seafood processing premises. The main purpose of cleaning and sanitising is to minimise the risk of cross contamination. Contamination can lead to spoilage of the product or cause someone to become ill when they eat the product.

The types of activities used as part of cleaning and sanitising will vary, depending on the product being processed, what is being 'cleaned or sanitised', and the time available. Each processing plant is likely to have something different in their cleaning and sanitation procedures.

Cleaning

Cleaning is the process of removing the visible 'dirt'. Cleaning is helped with the use of detergents, which soften the "dirt" and allow water to get in. Cleaning is also helped by the use of friction and elbow grease – in other words, scrubbing. Even foam cleaners, which can create their own friction as the millions of tiny bubbles burst, need the additional application of the scrubbing brush in difficult areas.

Sanitising

Sanitising is the process of killing the bacteria. This relies on the action of a chemical which will only work once cleaning has been completed. Sanitising chemicals won't work if there is still a lot of dirt present.

Importance of Cleaning and Sanitation

There are a number of reasons why good cleaning and sanitation procedures are important for ports seafood processing premises.
The main reason, as discussed above, is to produce a product that is safe to eat and one that is good quality (not spoiled). The other reasons include helping to maintain the plant and equipment in good condition and to help prevent the 'fishy' smell that is caused by the breakdown of seafood flesh, gut and slime, by bacteria. The presence of a 'fishy' smell indicates that both seafood matter and bacteria are still present at the end of the cleaning and sanitation process.

The reasons why cleaning and sanitizing is important are:

To ensure the food we produce is safe to eat
To ensure the food we produce is good quality
To help provide a pleasant place to work
To meet legislative requirements

The Consequences of Not Cleaning and Sanitising

If cleaning and sanitizing is not carried our correctly then the chances of meeting any of the above things are not very high.

The product may be contaminated and unsafe to eat
The product may not be good quality
The plant and equipment will not last
The place you work in won't be very pleasant at all
Meeting legislative requirements will be very hard

First clean then sanitise

Good cleaning will remove over 90% of the bacteria as the dirt is washed away.
Sanitisers act once cleaning has been completed. They won't work if there is still a lot of dirt present.

Different sanitisers act in different ways to kill bacteria.
For example, Chorine acts by invading the bacterial cell and interfering with its life functions. Another common sanitiser, Quat, (or QAC – quaternary ammonium compound) acts more quickly, by breaking down the bacterial cell wall. Whichever type is used, the correct amount of time in contact with the equipment surface must be allowed for the sanitiser to complete the job.

Current practice of chemical companies has been to combine both detergents and sanitisers into one material. This means that the cleaning and sanitation process can be carried out much more quickly and easily.

Activity

1. Give some examples of products you have access to to clean and sanitise.

General routine for cleaning and sanitising

In all premises the general routine for the main clean down of processing areas is as follows:

1. Tidy the area.

2. Hose all surfaces with cold water to remove most of the fish waste.

3. Dismantle equipment if required.

4. Apply detergent or detergent/sanitiser that has been made up to the correct concentration.

5. Scrub surfaces to loosen dried on dirt - fish, scales and slime. For combined detergent/sanitisers, ensure that the chemical is left in contact with surfaces for the required time (for sanitiser to work).

6. Rinse off using low pressure water.

7. Apply sanitiser at the correct concentration and temperature. Leave for the required time (this may be overnight).

Note: Sanitiser may be applied after a combined detergent/sanitiser in problem areas or for additional assurance of sanitising effect.

6. Managing Food Safety

Food safety aspects of fish products are considered to be part of the overall quality of those products.

In the modern world, however, food safety has become one of the most important factors in food quality. In fact, the concern about food poisoning and food contamination by consumers the world over, means that food safety is now non-negotiable.

Food must first be safe to eat. Then, it can be good to eat.

The implications of any producer releasing unsafe food onto the market are wide ranging and in recent years there have been many examples of this occurring throughout the world.

These implications include:

- harm, illness or even death of consumers
- widespread media involvement
- loss of customer
- loss of market for the companies involved
- companies out of business
- reduced market access for the industry as a whole

Seafood, as a product category, contributes on a regular basis to incidences of food poisoning. Closer examination of the data, however, will show that some seafood products are more likely to be involved in these incidences than others are.

Why are some seafood product more likely to be "unsafe" than another?

This has to do with the causes of unsafe food, or the food safety "hazards", which may be associated with a food. Foods which have a high number of food safety hazards associated with them will have a high risk of causing food poisoning, or harm to consumers, if those hazards are not controlled.

Hazards are categorised in the following way:

Biological hazards include, most commonly, bacteria and other micro-organisms which cause food poisoning, illness or infection. They are called food pathogens or pathogenic micro-organisms. They may occur on the food naturally or through contamination, but due to some lack of control, they grow to high numbers on the food product. It is either the organisms themselves, or toxins produced by them, which make people ill.

Chemical hazards include any form of chemical compound which may contaminate food products and which result in illness or harm to consumers. These may include fuel or oil from the catching vessel, cleaning chemicals, contamination from industrial activities (heavy metals, poisons, etc.).

Physical hazards can include a wide variety of contaminants such as glass, metal, bone, shell, etc, which may cause harm to the consumer while they are eating the food product. In many cases, objects that are called physical hazards are in fact the source of biological hazards. These would include sticking plasters, insects, rodent droppings, etc., which are themselves contaminated with pathogenic organisms.

In order to manage food safety, producers must have a good knowledge of how to control the food safety hazards that may be expected on their products. They then need a system in place that ensures that the specific controls are carried out when required.

7. HACCP

The system used internationally today is called HACCP (Hazard Analysis Critical Control Point).

This is a system that identifies the hazards that may occur with the processing of each product, and then establishes a set of controls that are based on preventing the hazard from developing into a food safety problem. The controls may completely remove the hazard or they may only reduce it or prevent it from reaching significant levels.
HACCP is a system that is designed for each product and process. It takes account of the severity of the hazards associated with each product (that is, the seriousness of the hazards), the risk of the hazard (the likelihood that the hazard will occur) and also the expected way in which the product will be consumed. All of these factors will combine to determine the level of control required.

The HACCP system consists of the following seven principles:

1. Conduct a hazard analysis.
2. Determine the Critical Control Points (CCPs).
3. Establish Critical Limits
4. Establish a system to monitor control of the CCP.
5. Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.
6. **Establish procedures for verification to confirm that the HACCP** system is working effectively.
7. Establish documentation concerning all procedures and records appropriate to these principles and their application.

It is outside the scope of this book to fully detail the HACCP system, its design and implementation. Further information is available from many other documents.

However this publication can introduce the concept of prerequisite programmes in relation to HACCP.

Prerequisite programmes

Prerequisite programmes may also be referred to as Good Hygienic Practices, Good Manufacturing Practices, Standard Operating Procedures, umbrella programmes or satellite programmes.

They relate to HACCP by providing the foundation of food safety controls from which HACCP systems can be developed.

In a food handling environment, there are many other things which can influence the safety of products that are not directly part of the process.

These include:

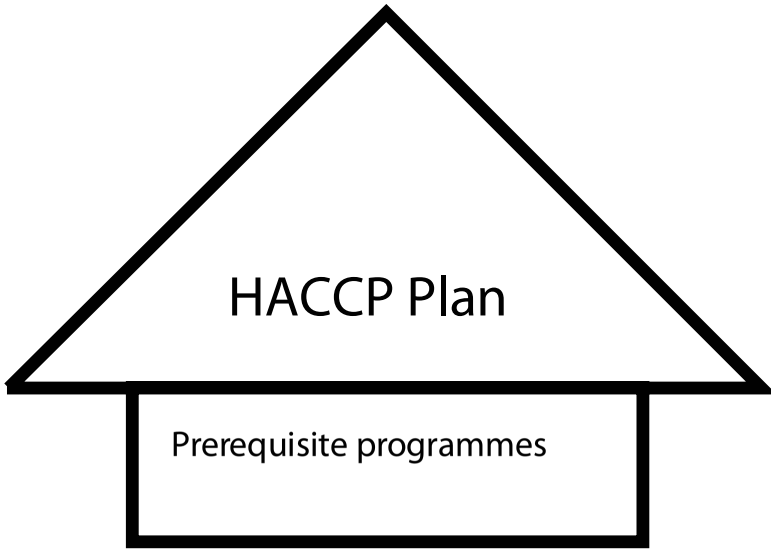
quality (potability) of the water and ice supply
quality (safety) of the incoming fish
construction of buildings and equipment
cleaning and maintenance of the buildings and equipment
behaviour and hygiene standards of the staff (level of training)
correct storage of product
transport of product prior to reception and after dispatch
presence of vermin waste disposal

Within fishing port, the management of these activities is carried out through documented systems as required by legislation.

As part of the management of food safety management, all these activities are still expected to be controlled in some way.

Like a HACCP plan, these programmes themselves are controlling food safety hazards and it is very important that they are effectively managed. Without this effective management, the HACCP plan has no foundation of food safety control from which to work.

Problems with, or lack of control of, the prerequisites will result in the failure of the HACCP plan.



Annex 5

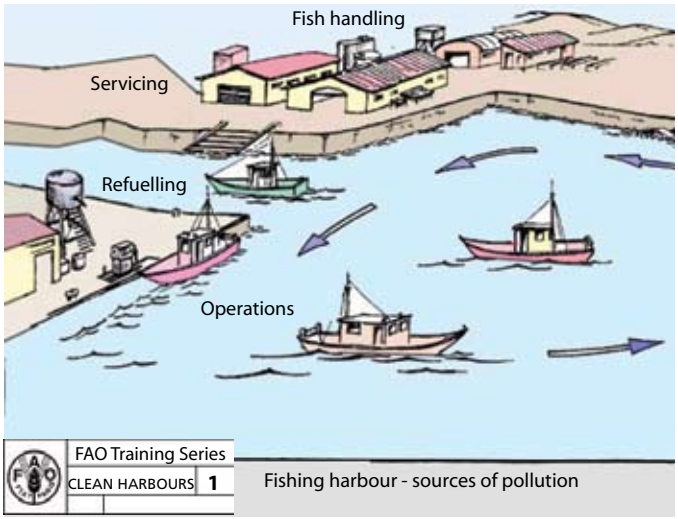
Prevention of pollution

INTRODUCTION

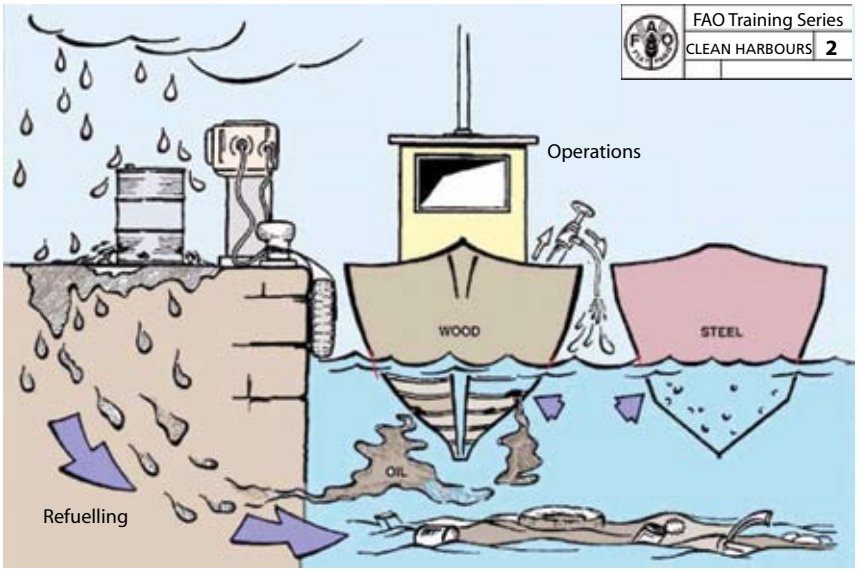
The following is a series of cartoons taken from the Cleaner Harbours publication in the FAO Training Series. They may be adapted to make them compatible with the different regions of the world.

Who should use them?

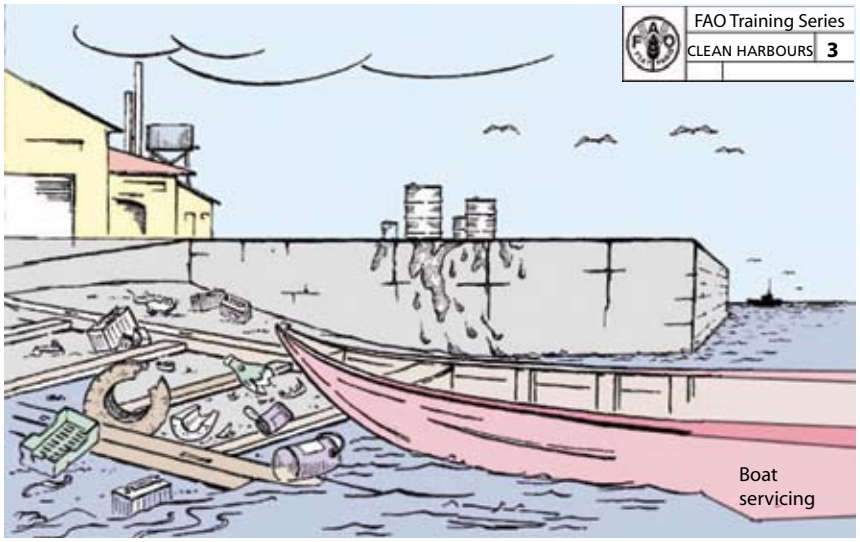
The drawings are for use by extension workers in the field, fisheries training colleges, fisheries enforcement officers and harbour-masters. The drawings may also be used as part of an elementary public awareness programme within a larger educational framework. Some of the drawings are also suitable as posters.



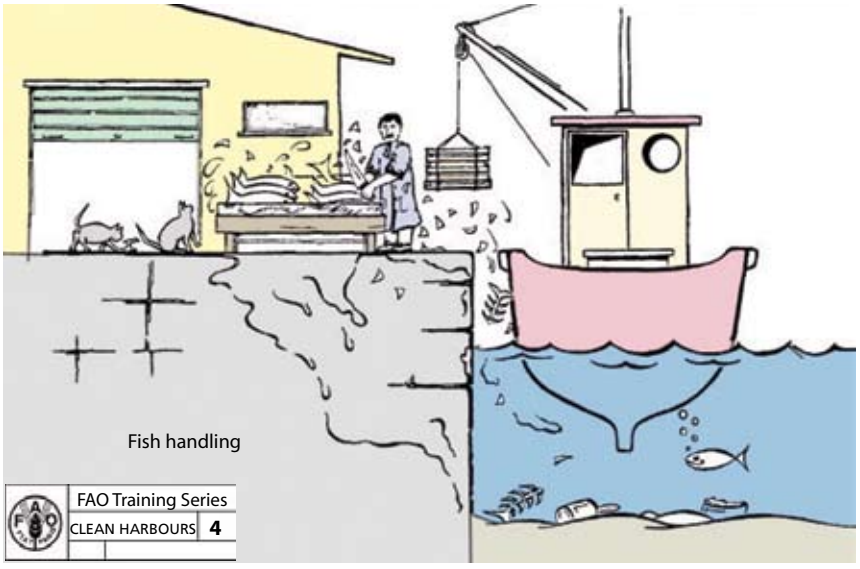
Drawing No. 1 outlines the four major sources of pollution in a typical fisheries harbour; operations; handling; servicing; and refuelling.



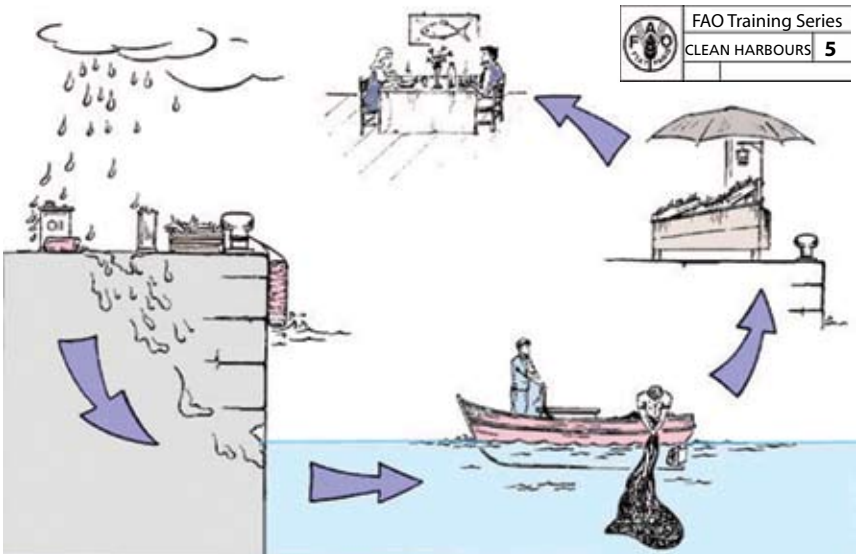
Drawing No. 2 shows how split fuel oil attacks the caulking on timber vessels. Metal cans on the sea-bed attack metal hulls and fittings, such as the propeller and the shaft.



Drawing No. 3 shows the discarded waste that is typical when vessels are serviced carelessly.

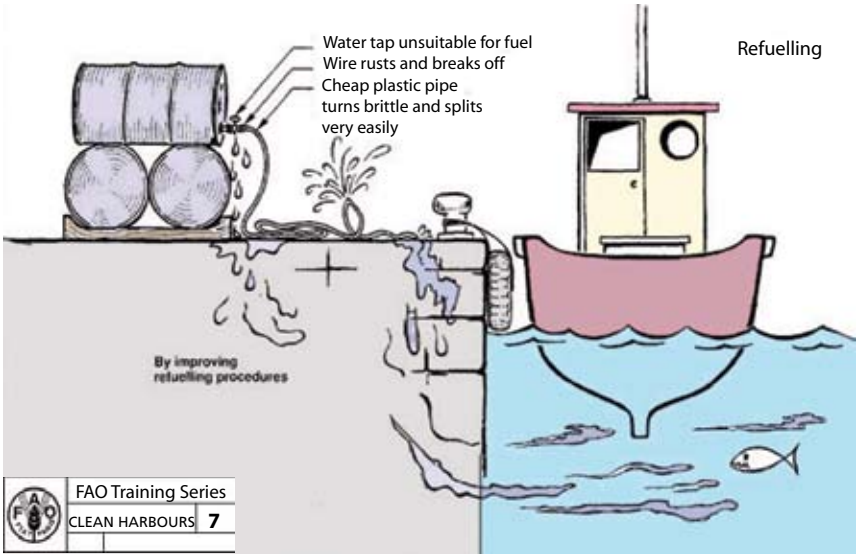


Drawing No. 4 emphasizes the health hazard of gutting fish inside the harbour – pests are invariably drawn to the area.

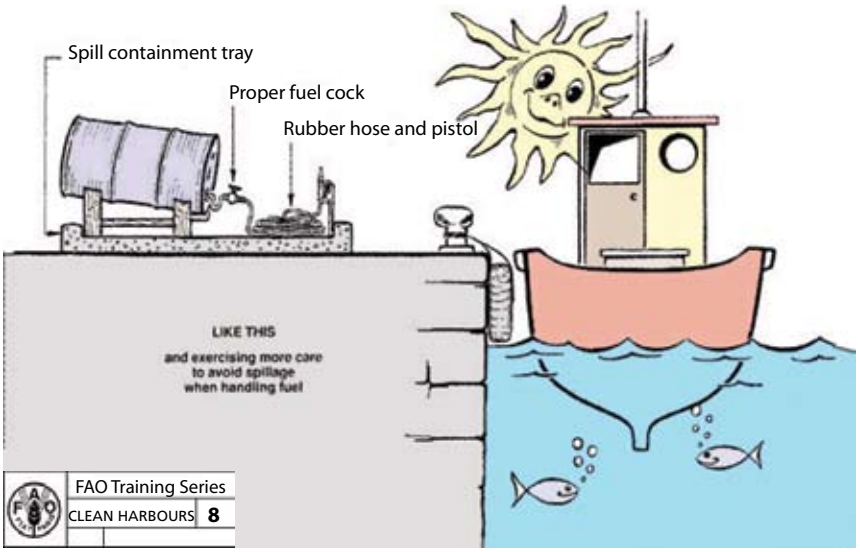


Drawing No. 5 shows how dangerous chemicals find their way into the food-chain.

Drawing No. 6 asks the important question without laying blame on any one particular sector of the fisheries industry.

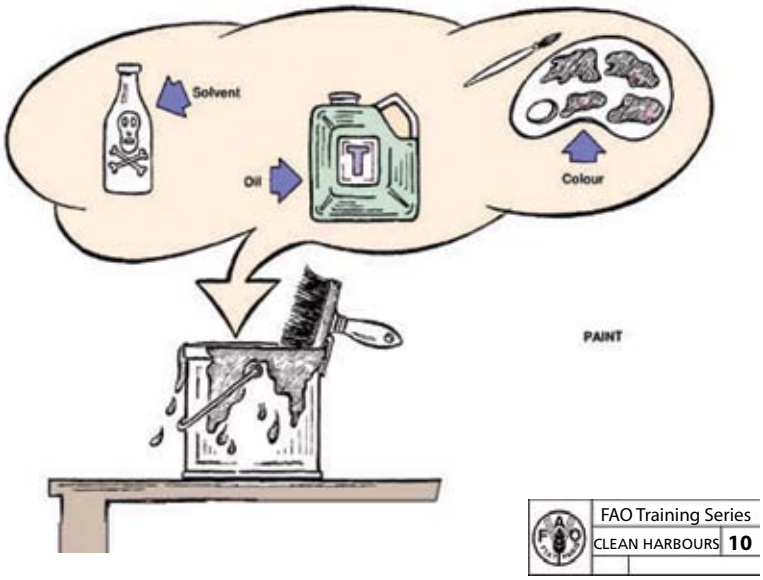


Drawing No. 7 shows the typical mistakes made by people who are not aware of the consequences of spilling fuel. Case history slides should be inserted in-between slides of drawings No. 8 onwards.



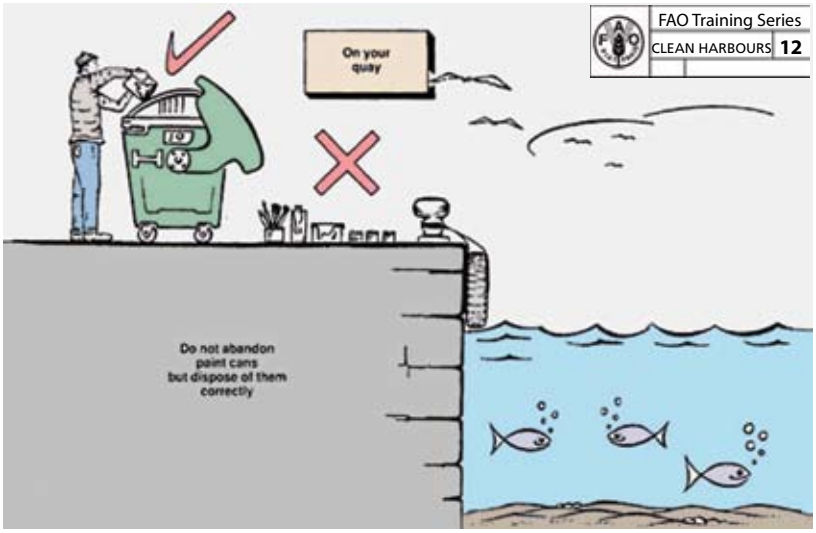
Drawing No. 8 shows the correct way to store and dispense fuel at the quayside.

Drawing No. 9 shows a careless boat owner servicing his boat with little attention to the mess around him.

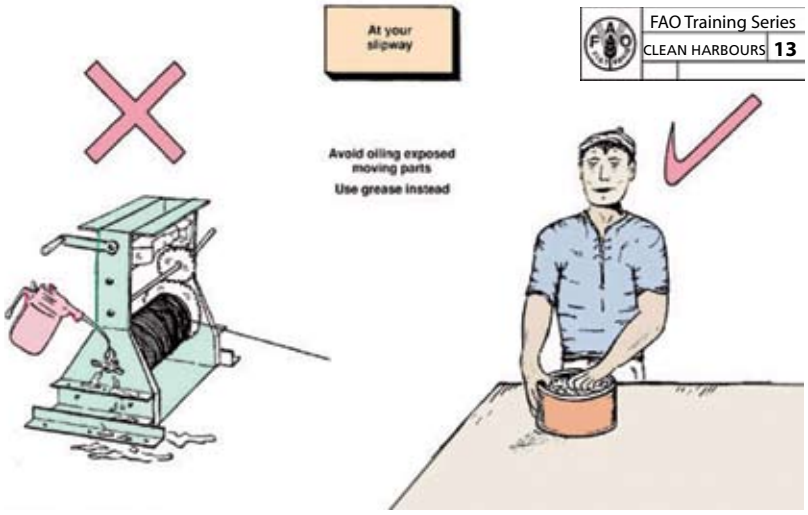


Drawing No. 10 explains in very simple terms the various chemicals that make up paint and their toxicity to humans.

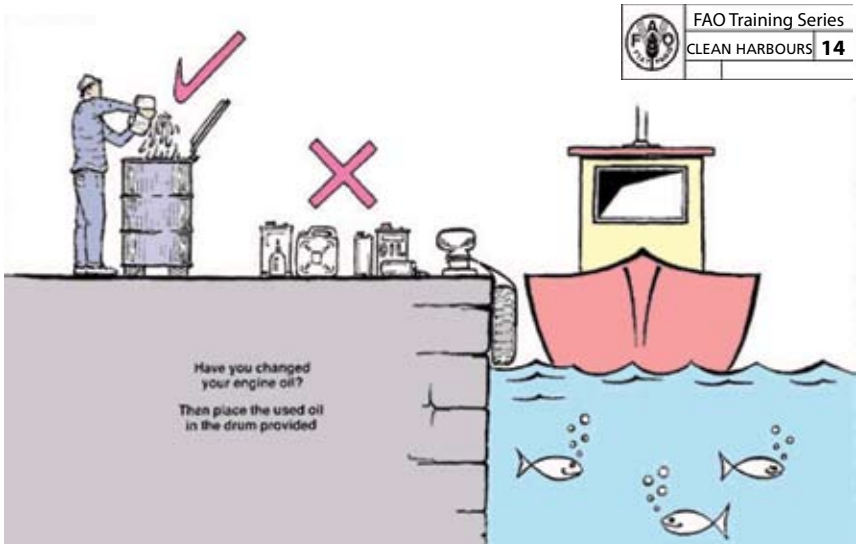
Drawing No.11 stresses the point that any material abandoned near the water's edge invariably ends up in the water. For example, wind blows some empty cans and children kick the rest in.



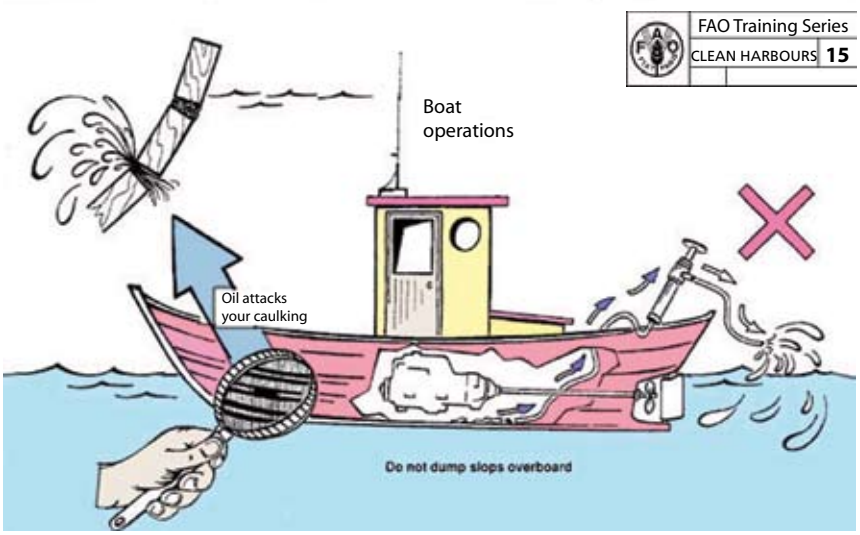
Drawing No.12 shows the correct method of can disposal. The container shown should look like the one intended for use at the particular landing.



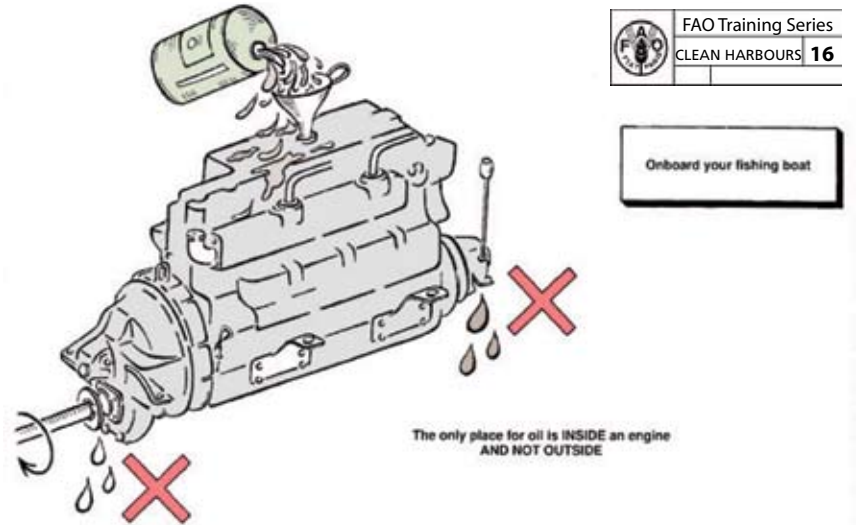
Drawing No.13 explains the importance of greasing moving parts rather than oiling them.



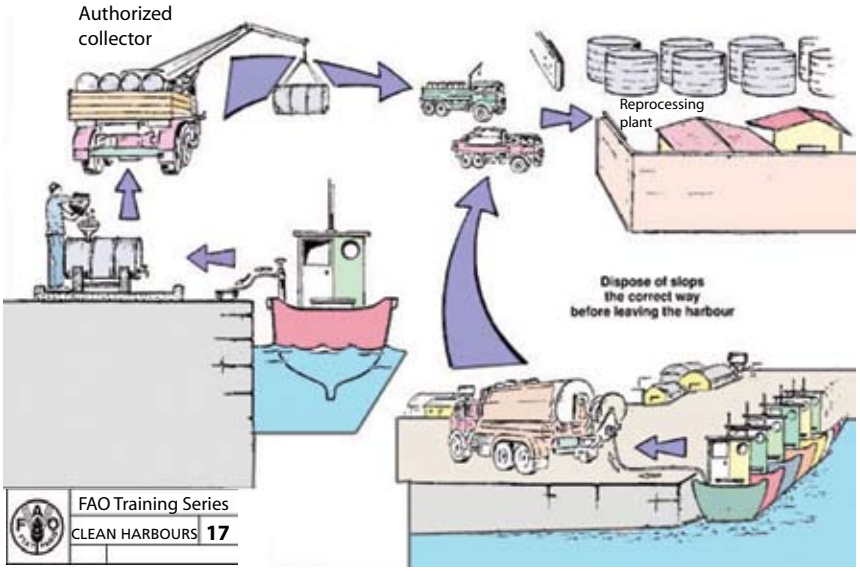
Drawing No.14 shows the correct method of oil disposal. The container shown should look like the one intended for use.



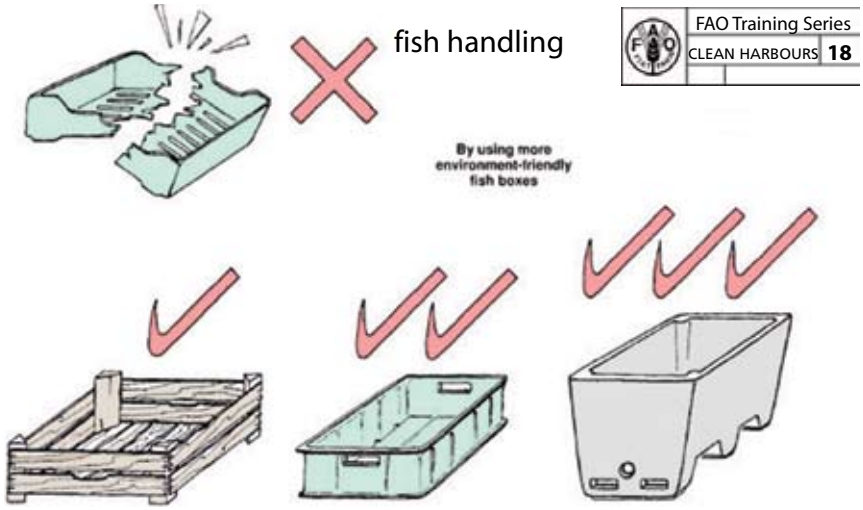
Drawing No.15 shows the effect that oil has on a vessel's caulking.



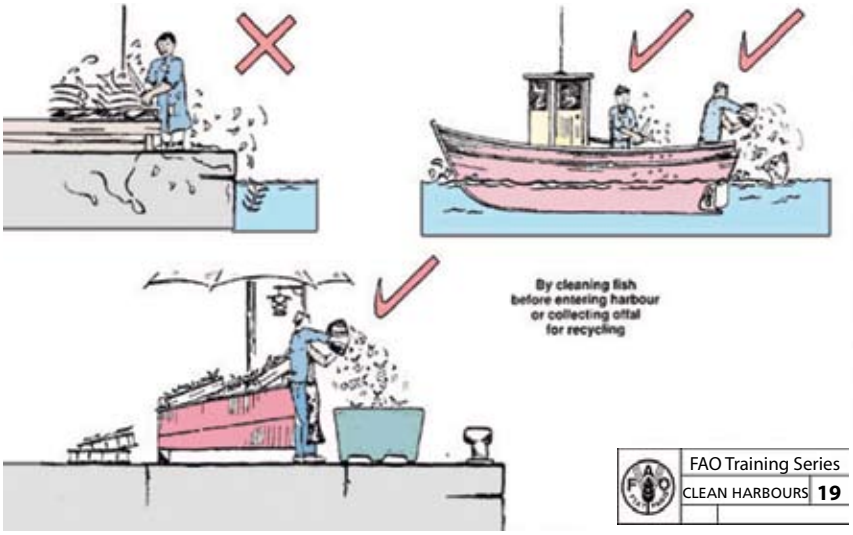
Drawing No.16 emphasizes the need to maintain engines properly (oil seals) and avoid oil spillage. If outboards are very popular in a specific country, an outboard engine should be added to this drawing.



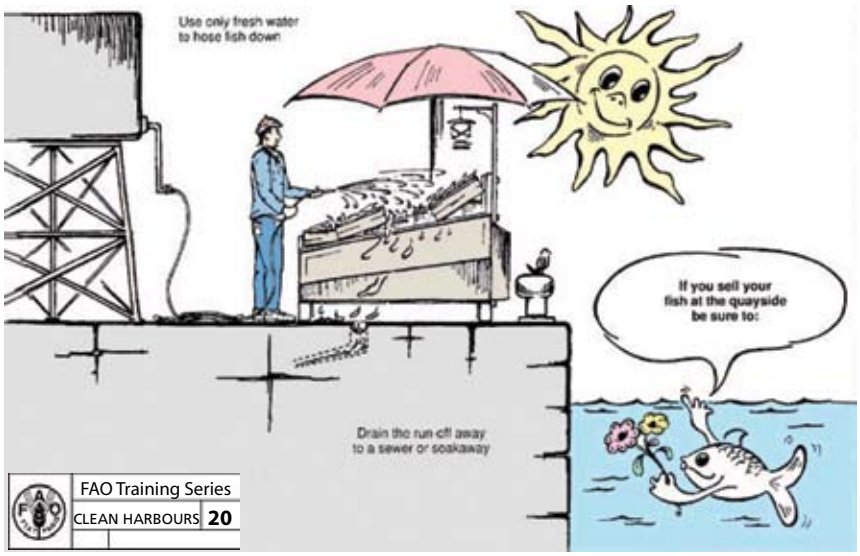
Drawing No.17 shows collection and treatment of slops at both the artisanal and industrial levels.



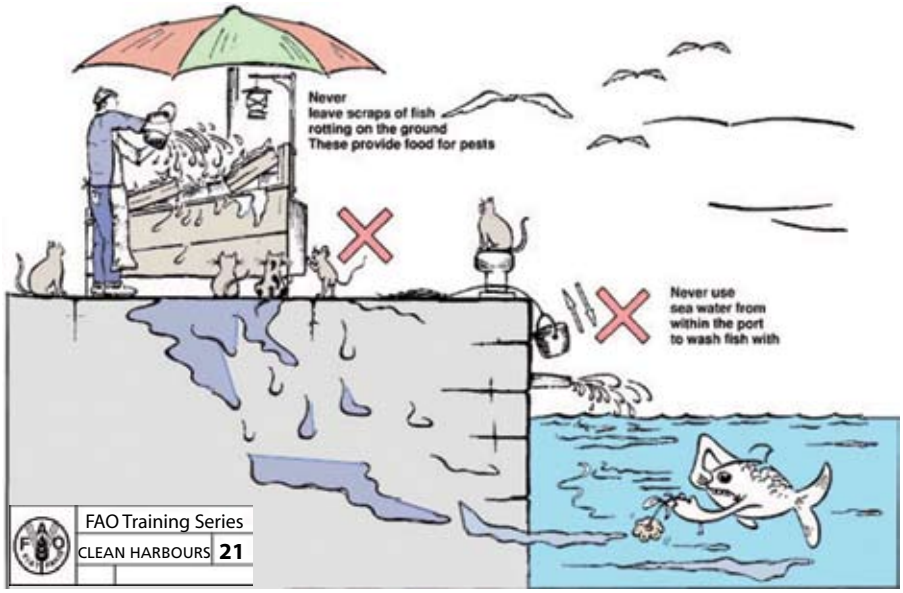
Drawing No.18 suggests more environment-friendly methods of storing fish. Foam and timber boxes accumulate bacteria and are not suitable for continuous use. However, timber boxes are made locally and can be used as fuel when they break.



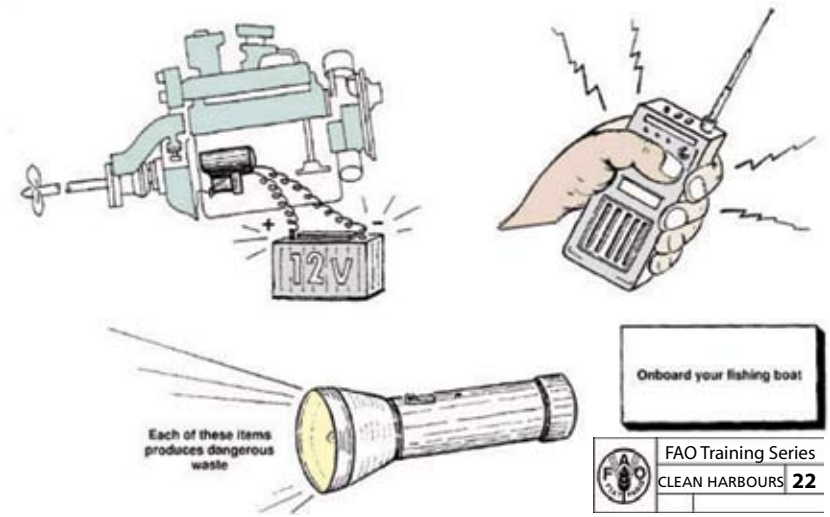
Drawing No.19 shows how to keep the problems associated with offal to a minimum.



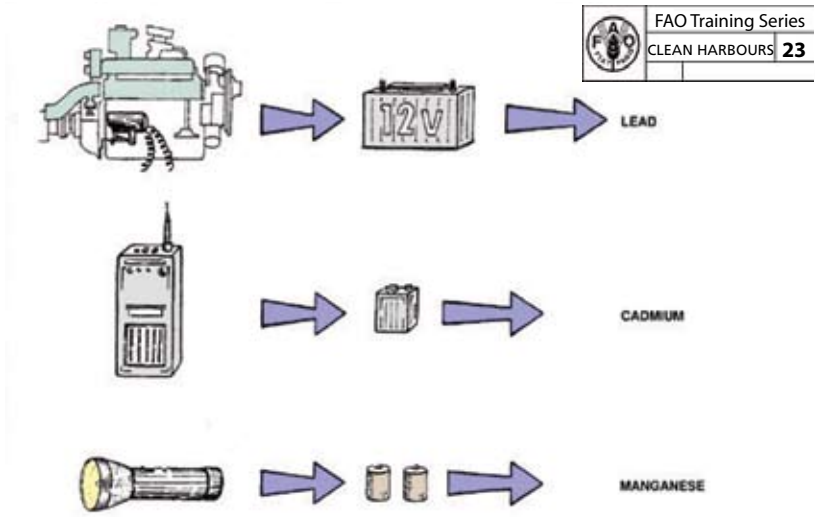
Drawing No. 20 explains the importance of using clean fresh water to rinse fish. Note also that the run-off containing blood is drained into a soakaway and not into the harbour.



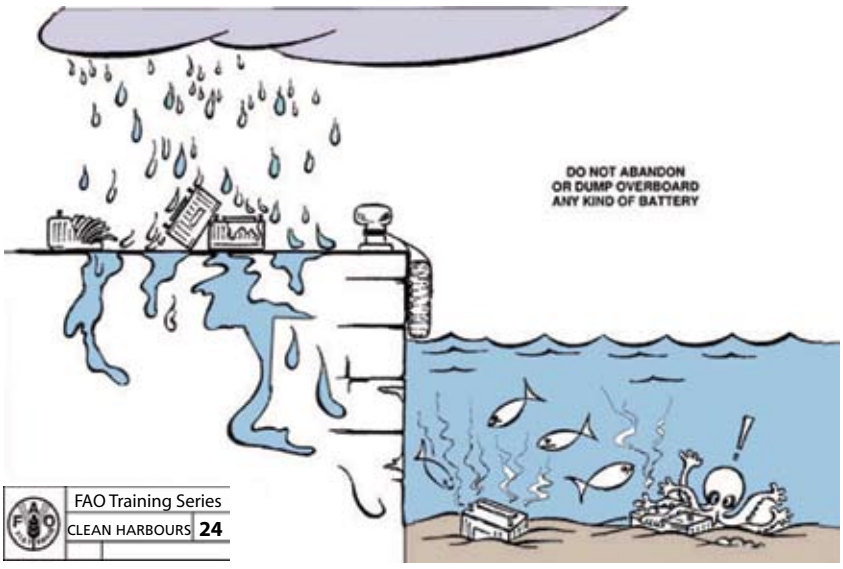
Drawing No. 21 shows bad fish-cleaning techniques. The fishmonger is using dirty water from the harbor, where raw sewage might be present, and dumping scraps of fish which attract pests and disease. Note the absence of soakaway.



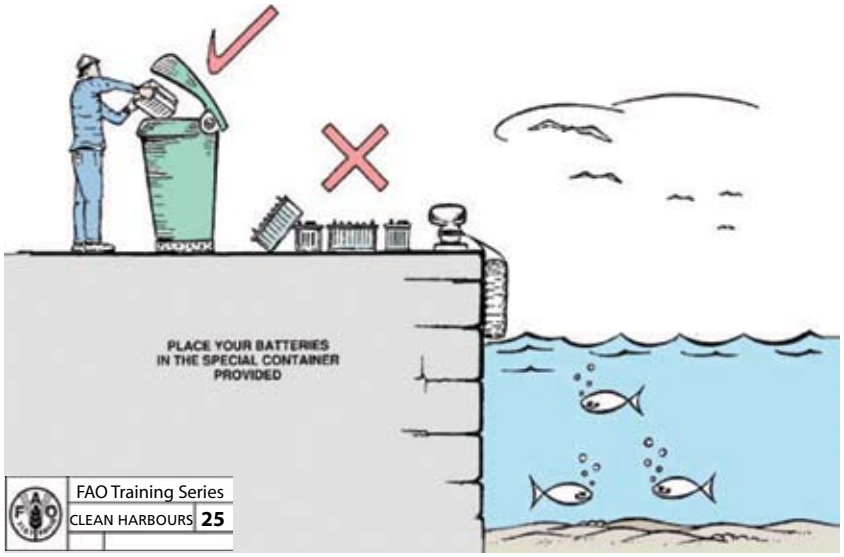
Drawing No. 22 illustrates the sources of highly toxic heavy metal pollution.



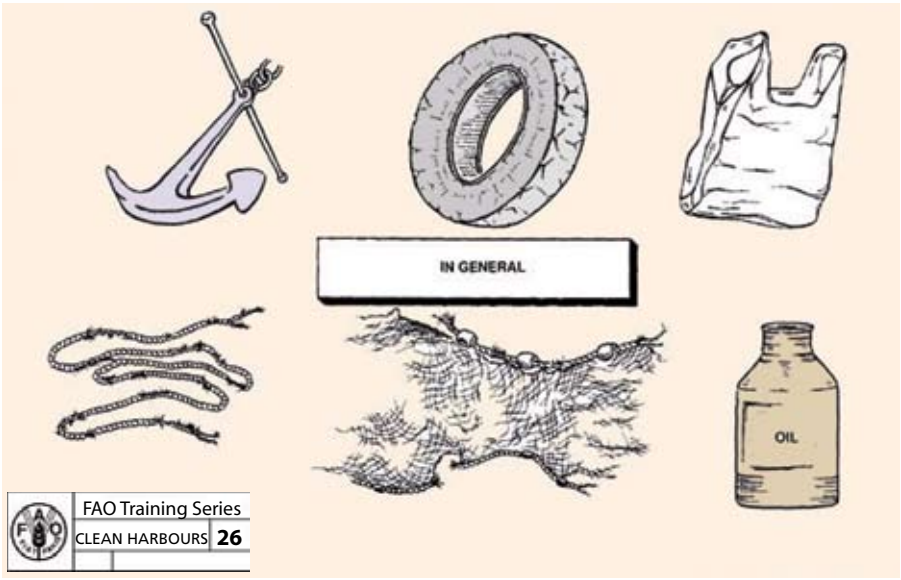
Drawing No. 23 shows which toxins the items shown in Drawing No. 22 contain. Although the manganese powder filling of the torch battery is not considered toxic, it always contains traces of mercury which is highly toxic.



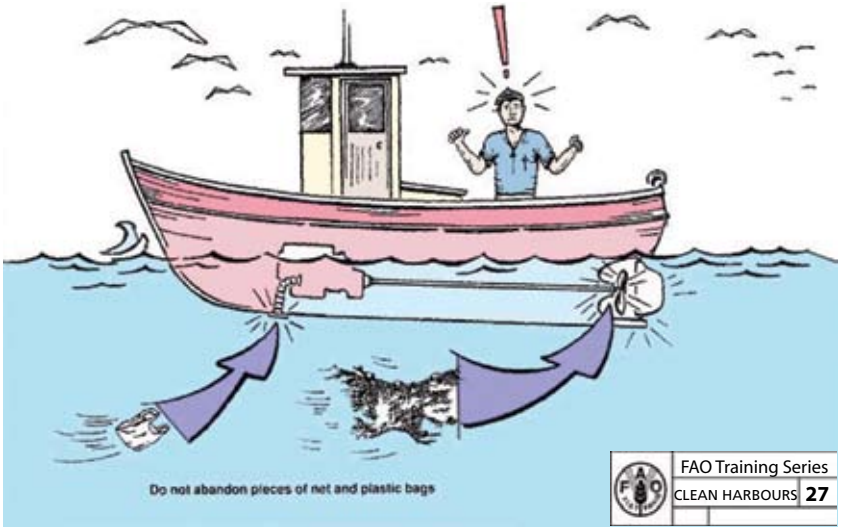
Drawing No. 24 illustrates how batteries break up and release toxic lead into the environment.



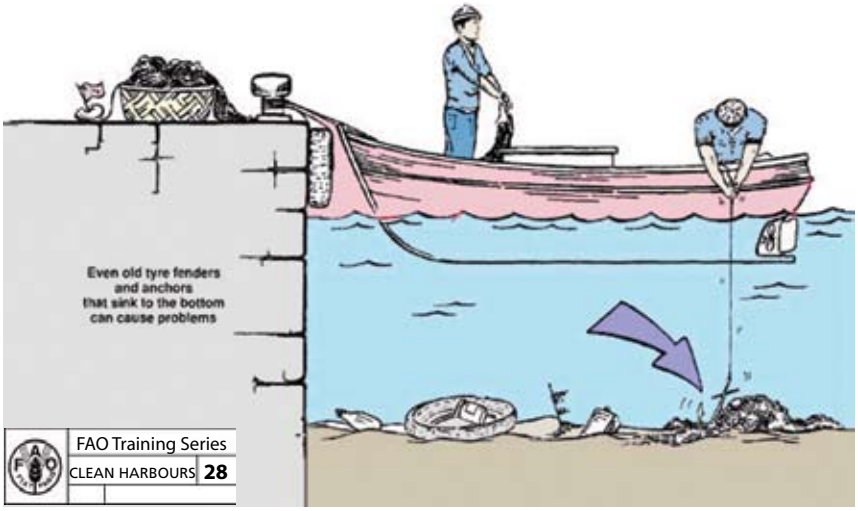
Drawing No. 25 illustrates a recommended collection method. The size and shape of containers illustrated should match local market conditions.



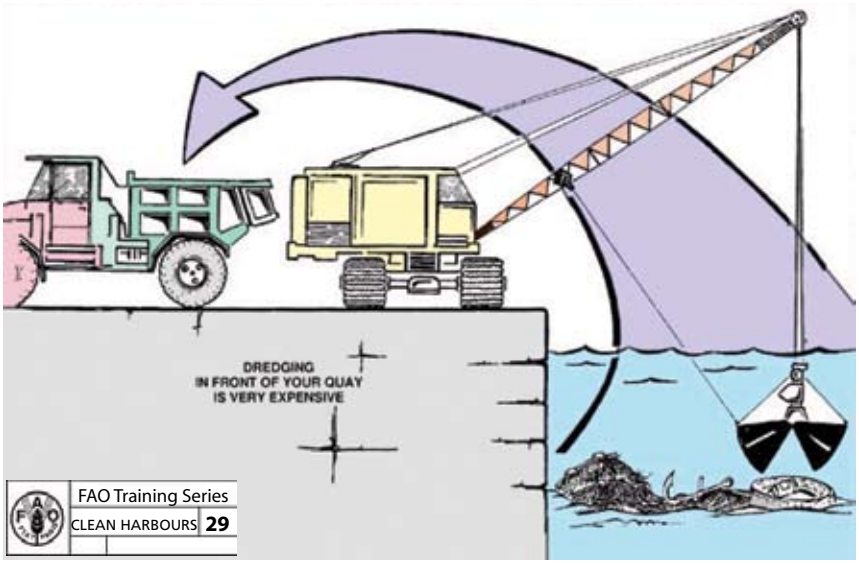
Drawing No. 26 Illustrates items which are sometimes "lost" over the side of boats.



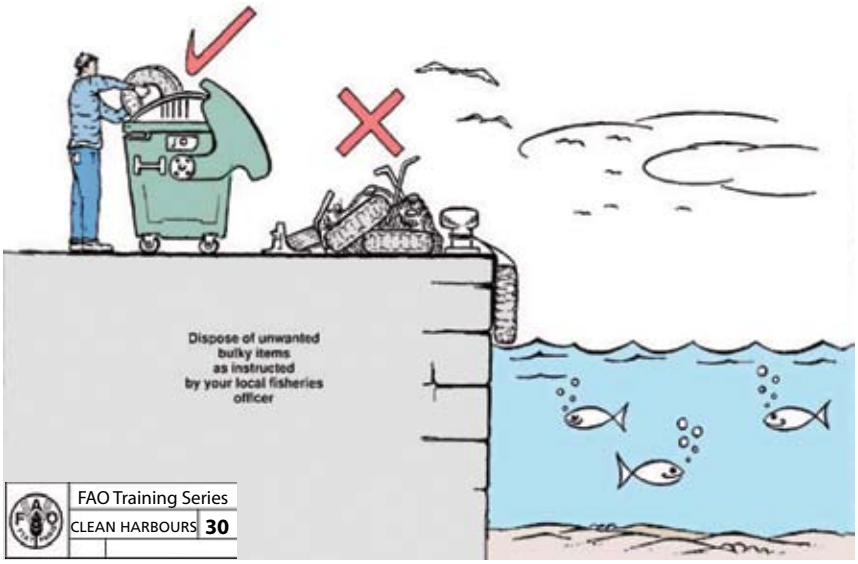
Drawing No. 27 illustrates two cases where such items cause inconvenience to other vessels.



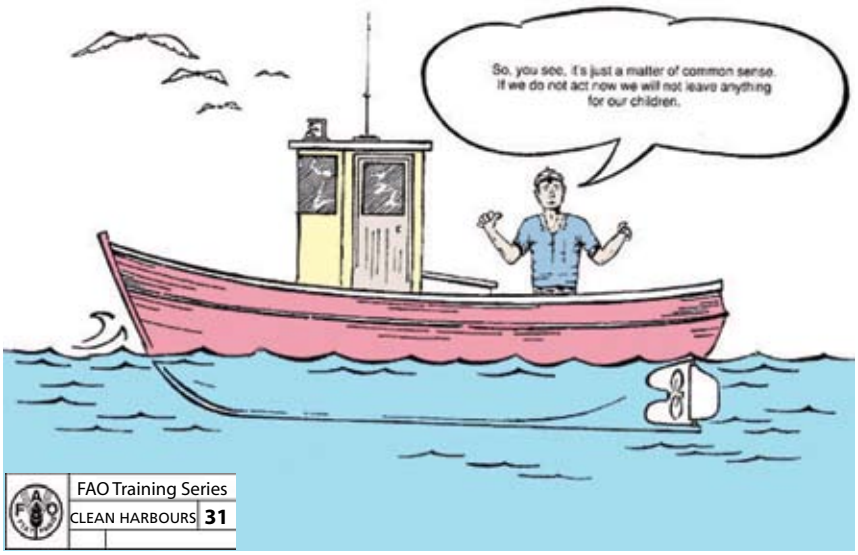
Drawing No. 28 illustrates another such inconvenience.



Drawing No. 29 focuses on the cost of removing this sort of rubbish.

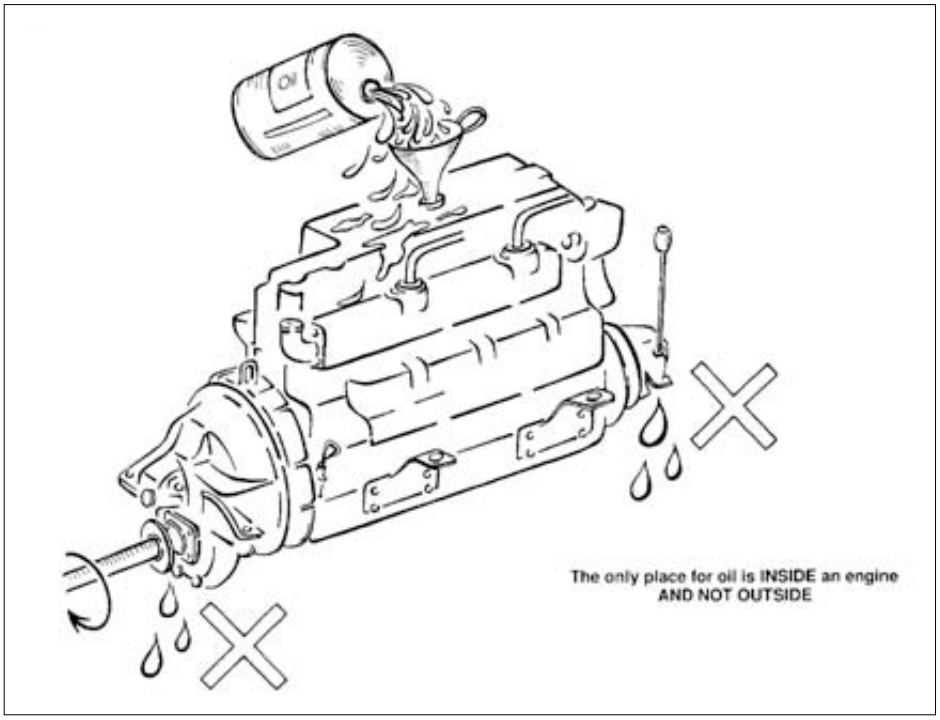


Drawing No. 30 illustrates the correct method of rubbish disposal. The container should resemble the one intended for use.



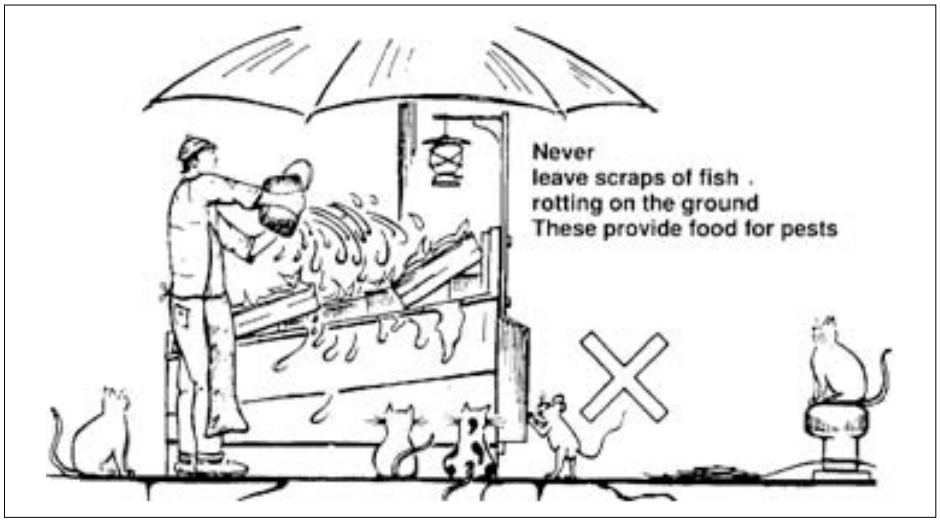
Drawing No. 31 can be used to illustrate the commentator's summing-up remarks.

PRACTICAL POSTERS
Based on FAO POSTER TRAINING SERIES



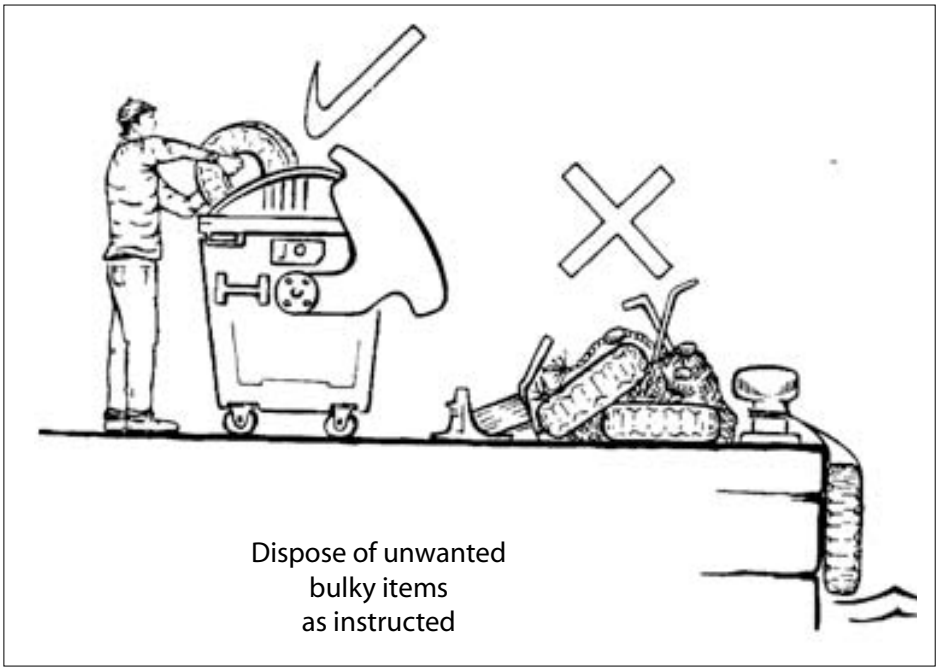
Drawing for a poster to be affixed in fishing harbours to remind fishermen to replace leaking oil seals and to exercise care when replacing engine oil.

Leaking oil seals and oil spillage contribute to create oily bilge water which must then be treated before being returned to the sea. Although it is an offence under MARPOL to dump oily bilge water at sea, very few fishermen seem to understand the process. Invariably, most bilge water ends up in the sea.



A poster to be affixed inside the port area where fish hawkers congregate to sell fish.

Although fish gutting and cleaning should be forbidden inside the harbour area, sometimes this practize cannot be helped. In order to avoid the spread of diseases which accompanies the presence of household pests, hawkers should be instructed on the proper disposal of unwanted wastes. Wet waste bins should be provided in ample quantities and placed in strategic locations. They should be shaded from sunlight to prevent higher rates of decomposition and foul smells.



The figure shows a drawing for a poster instructing harbour users to utilise the harbour waste receptacles for their bulky inorganic wastes.

Posters indicating the different types of wastes catered for and the respective bins to use should be placed at the entrance to the harbour as well as in strategic locations around the port. The bins for the different wastes (non-toxic, toxic and wet wastes) should be colour coded and suitable for the kind of waste.

Fines levied by the management for non-observance of the port regulations should be listed and placed in a prominent location inside the port boundary.

The role of the fishing port may be considered as the interface between the netting of fish and its consumption. In today's world of increased environmental awareness, a fishing port must be planned, designed and managed in harmony with both the physical and biological coastal environments. At each stage of the process, whether it is planning, design or management, both technical and non-technical persons become involved in the process. This manual was produced in order to tackle fishing harbours in a holistic approach. It should be of use to both technical and non-technical planners, both at government level and at departmental level. It provides non-engineering staff within such departments with enough technical knowledge to better understand certain basic design requirements, which could otherwise be interpreted as superfluous and not cost effective.

ISBN 978-92-5-106696-6 ISSN 2070-7010

9 789251 066966

I1883E/1/11.10