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Workshop on Quality and Hygiene Regulations in the Fisheries Industry*

Shetland, United Kingdom
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INSPECTION AND QUALITY ASSURANCE OF FISHERY PRODUCTS EXPORTED FROM DEVELOPING COUNTRIES**

Prepared by

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* Organized by UNIDO in cooperation with the Shetland Islands Council and the North Atlantic Fisheries College.

** The views expressed in this document are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO). This document has not been edited.

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SUMMARY OF MAIN CONCLUSIONS AND RECOMMENDATIONS

1 The most recent FAO compilation of fishery statistics is for 1988. In that year about 35%, by volume, of the total catch of fish and shellfish going for human consumption, and about 76% of the production of crustacea and molluscs entered the export trade.

2 The major importers of fishery products are the EEC as a trading block, Japan and the USA. Between them they accounted for about 80%, by value, of imports of fishery products in 1988.

3 Developing countries contribute about 47% of world exports of fishery products. Main commodities exported are frozen shrimp and molluscs, frozen fish, and canned fish. Very many developing counties export fishery products, but the main exporters are the Republic of Korea, Thailand and China who between them account for about 33% of exports from developing countries.

4 All countries exercise control over imported fishery products in order to ensure that they are wholesome and fit to eat, contain only permitted food additives, and are correctly labelled.

5 Fishery products are not major sources of food borne illnesses. Some types of food poisoning are specific to fish.

6 Food legislation is putting more emphasis on control over production, storage and marketing of foods rather than on product testing. The principle of 'equivalency' is being applied to imported fishery products - foods imported into the country must be manufactured in the exporting country under equivalent conditions and subjected to equivalent controls as prevail in the importing country.

7 In preparation for the unified market that comes into operation on 1 January 1993, the EEC has issued a directive on hygiene requirements for fishery products. The provisions of the Directive applies to imported fishery products.

8 The USA and Canada will apply the principle of equivalency to imported fishery products. They will negotiate Memoranda of Understanding on a government to government basis to provide some control over products exported to these countries.

9 A small proportion of exported fishery products are rejected in importing countries. Main reasons for rejection are decomposition and presence of food poisoning organisms.

10 Most developing countries have fish inspection services to exercise control over the safety and quality of exports of fishery products. Most of these bodies have insufficient resources to run an effective service at present and would not be able to meet the extra responsibilities required of the EEC Directive or of control agencies in other importing countries.

11 Primary responsibility for ensuring safe and high quality of products lies with the producers of the products. In general quality assurance systems in place in the fish processing industries in developing countries are not adequate to meet the requirements of importing countries.

12 Developing countries have adequate legal powers for effective control of the safety of exported fishery products. It is recommended that countries with any significant export trade in fishery products should have a specific fish inspection service. This service should be operated by a department of fisheries or a department of health, preferably the former.

13 It is recommended that in order to provide adequate resources, fish inspection services should be funded by fees and by levies on exported fishery products. It is estimated that less than 0.5% of the value of exports should be adequate to finance a service.

14 The main functions of a fish inspection service are to inspect and register approved establishments, and to inspect and approve consignments of fishery products intended for export. Other services could include provision of advice, laboratory services and training.

15 Fish inspection services must have adequate facilities for carrying out their responsibilities. Staff should have adequate training for the job, both by formal instruction and by learning on the job.

16 It is likely that a high proportion of fish processing establishments in developing countries would not at present meet the provisions of the EEC Directive or of the requirements of inspection agencies in other importing countries. There are deficiencies in the plants and in quality assurance. The resources, both physical and human, needed to remedy these deficiencies in the processing sector are likely to be greater than is needed to improve fish inspection services.

17 So far as physical resources are concerned there will need to be investment in design and construction of buildings, provision of main services - water, electricity and effluent disposal, equipment, facilities for staff, and provisions for sanitary and hygienic operations.

18 In general companies in developing countries have been successful in adopting the technologies needed for the manufacture of fishery products for export to developed countries. Freezing practices, particularly those involving air blast freezers, could be improved in many companies. Cold stores are often poorly designed and poorly operated so that product is above the minimum recommended temperatures.

19 Companies will have to introduce quality assurance programmes in their establishments. Quality control should be based on HACCP principles. All staff should be involved in the quality assurance programme. Process workers should receive training in sanitation and hygiene in fish processing.

I. INTRODUCTION

1. A high proportion of the world's catch of fish intended for direct human consumption, (as distinct for reduction to meal and oil), is traded on international markets. Many developing countries participate in these markets and in fact contribute a high proportion of the products imported into developed countries. This trade brings in valuable hard currency to the developing countries and there is a general desire on the part of these countries to develop their exports. There is a strong demand for fishery products throughout the world and, in the context of restricted supplies, good quality products find a ready, and high-priced, market in developed countries.

2. The emphasis is on good quality and exporters must meet the requirements of commercial quality standards, and of regulations in the importing countries for safe and wholesome food. Official requirements have always been strict, but they are becoming stricter. The European Community, as part of the process of harmonising regulations for the unified market in force from from 1 January 1993, has issued regulations for the hygienic control of imported fishery products which will apply uniformly at all ports of entry into the Community. Canada and the USA have over the last few years modified their approaches to the control of imported fishery products with the intention of better ensuring the safety of imported products. The main thrust of the EEC regulations, and of the Canadian and USA actions, is to put more emphasis on control at the time of preparation as the preferred means of ensuring the quality and safety of products. This puts a greater responsibility on food processors to establish effective quality assurance programmes in their premises. Official regulatory authorities in the importing countries are also requiring that inspection agencies in the exporting countries take a greater responsibility for ensuring the safety of exported fishery products.

3. Both commercial interests and official bodies in exporting countries have expressed concern that these new regulations and actions might present difficulties for exporters, particularly in developing countries. This might come about in two ways. Processors are concerned that regulatory authorities in the importing countries might not consider that a processor's quality assurance systems are effective and might ban products prepared by specific processors. Officials are concerned that the regulatory authorities in importing countries might not consider that official control in the exporting country does not ensure safety and wholesomeness of exported products, and will ban all fishery products from that country.

4. UNIDO (United Nations Industrial Development Organization) held a Regional Consultation on the Fisheries Industry for Asia and the Pacific Islands Countries in Vienna from 2 to 6 December, 1991, when some of these fears were expressed[1]. The Consultation identified a need for closer cooperation between importers and exporters for meeting the quality standards required by importing countries, and for information and training

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[1] Report of the Regional Consultation on the Fisheries Industry for Asia and the Pacific Island Countries. Vienna, 2-6 December, 1991. ID/379 (ID/WG.518/3) 16 January 1992.

on the new approaches to quality assurance and inspection, particularly the requirements of the EEC Directive on hygiene of fishery products.

5. Following the recommendations of this Consultation, UNIDO organised a workshop on Quality and Hygiene Regulations in the Fisheries Industry in the Shetland Islands, UK, from 6-10 July, 1992. Papers were presented at this workshop on the hygiene regulations applied to imports of fishery products into the main importing countries, including the EEC as a block, and on the facilities and expertise, both commercial and official, needed to meet these requirements on the part of the exporting countries. Again the need for information, advice and training was emphasised.

6. In order to meet, to some extent at least, the request for information and advice, UNIDO has commissioned this report on quality control and inspection systems for fishery products, particularly products exported from developing countries.

II. INTERNATIONAL TRADE IN FISHERY PRODUCTS

Amounts and natures of products traded

7. The total production of fish in 1988, the latest year for which comprehensive data are available[1], was 98.0 Mt (million metric tonnes). Of this, 69.6 Mt, 71%, was used directly for human consumption; the remainder being processed into fish meal and oils. The total catch is increasing by about 5% a year, and the proportion going for human consumption has remained more or less steady over the last 10 years

8. Of the total catches and landings, the equivalent of 35.7 Mt, 36%, was exported in various forms. Part of this trade is made up of fishery by-products like fish oils and fish meal. These are not relevant to this report on quality assurance and inspection of fishery products for direct human consumption and will not be considered in the following discussion on international trade in fishery products. The FAO statistics do not give directly the amount of the fish for direct human consumption which goes into the export trade, but it can be deduced from other data in the tables. It appears that 24.4 Mt 'live weight equivalent' of human food grade fish, 35% of the total, does so. The proportion exported has increased by about 3 percentage units over the last 10 years.

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[1] FAO Fishery Statistics 1988, vol 66: Catches and Landings; vol 67: Commodities. Food and Agriculture Organization, Rome, Italy, 1990.

9. The volumes of production and of exports of commodities as classified in the FAO statistics and going for direct human consumption are shown in Table 1. Note that the data are product weights, not live weight equivalents.

TABLE 1.

Production and exports of fishery commodities. Net product weights. Data from FAO Fishery Statistics for 1988.

	Fish			Crustacea and molluscs	
	fresh chilled frozen	dried salted smoked	canned	fresh frozen	canned
Production, Mt	14.14	5.63	5.44	2.10	0.48
Exported, Mt	5.09	0.51	1.15	1.58	0.27
Proportion exported, %	36.0	9.0	21.1	75.6	55.8

Mt = 1 million metric tonnes

10. It can be seen from this table that a surprisingly high proportion, three quarters, of the total world production of what is classed as fresh and frozen crustacea and molluscs enters world trade. It is predominately frozen shrimps, and much of this trade is accounted for by exports from developing countries. There is only a small production of canned crustacea and molluscs, but more than half enters international trade. Again developing countries account for much of the trade.

11. A little over a third of the world production of fresh and frozen fish enters international trade. This commodity group includes unfrozen fish distributed as whole fish, perhaps gutted, and as fillets, but most of the volume is frozen products in the form of whole fish, as blocks intended for sawn portions like fish fingers, or as fillets frozen in blocks or individually frozen. Much of this trade is between developed countries, though developing countries do contribute. In particular some developing countries have important trades in chilled whole fish to high value markets in North America, Europe and Japan. This is a market with potential for growth, but it does depend on there being good air freight facilities between the exporting and importing countries. Almost a quarter of the production of canned fish is exported, again the developing countries contributing a high proportion. Cured fish products - dried, salted and smoked or combinations of these treatments, make up a high proportion of of the utilisation of fish, about the same as goes for canning. These products, often made under artisanal conditions, are predominately intended for, and consumed in, domestic markets. The small amount traded internationally is mostly smoked fish produced, and consumed in, developed countries.

Main Importing countries

12. The value of imports of all fishery products in 1988 is given in the FAO statistics as $US 35 287 millions; that of products for direct human consumption is $US 33 120 millions. Table 2 lists those countries, and the EEC as a trading block, with imports valued more than SUS 90 000 a year in 1988. They account for 94% of imports.

13. The European Community appears to be the largest market for imported fishery products, just ahead of Japan, when imports are summed over the individual member countries, but this is not a true measure of imports into the EEC as a block because a part of the imports as listed in the FAO statistics represent trade between countries within the Community. Probably the EEC as a block comes between Japan and the USA in the ranking, but nevertheless individual countries within the EEC are important importers of fishery products. The three main importers, the EEC, Japan and the USA, between them accounted for about 80% of world imports in 1988. Some countries listed in Table 2 - Sweden, Norway, Austria, Finland - have signalled their wishes to join the EEC and when this comes about the EEC will be an even more important trading block for fishery products. The import regulations that prevail at present in the applicant countries will ultimately be harmonised with existing EEC regulations as these countries become full members. It would seem that perhaps in a decade or so the EEC requirements for safety and quality of imported fishery products will apply to about a third of imports of fishery products.

14. Some of the countries listed in Table 2 are classed as developing countries. A closer inspection of data in the FAO statistics suggest that fishery products imported into these countries are not consumed within the country; they are used as raw material for products, particularly canned products, which are later exported, or are re-exported because the country is a centre for entrepot trade.

Exports from Developing Countries

15. Developing countries account for about 47%, by value, of total exports of fishery products. Table 3 lists the developing countries with export trades of more than about $US 50 000 a year by value, and the commodities traded. Almost all developing countries exports some fishery products and the 29 countries listed in the table account for 79 % of the value of exports from all developing countries. The countries are ranked by value of the total trade in human food products. Chile is also an exporter of by-products and if all commodities were considered it would appear higher up the list. Peru, which does not feature in the table has a considerable export trade in fish meal.

TABLE 2.

Value, in $US millions, of imports of fishery products by major importing countries. Countries listed account for 94% of world imports. Data from FAO Fishery Statistics for 1988.

Country	Fish			Crustacea and molluscs		Total imports
	fresh chilled frozen	dried salted smoked	canned	fresh frozen	canned	
France	981	85	361	599	168	2 194
Italy	812	281	153	545	52	1 842
Spain	763	128	46	682	78	1 697
U K	596	9	373	191	201	1 370
Germany	723	102	184	123	97	1 230
Denmark	425	33	26	225	129	838
Belgium	213	21	89	159	72	554
Netherlands	246	15	72	80	56	469
Portugal	89	330	3	32	2	456
Greece	41	22	14	29	4	110
Ireland	16	3	32	8	1	60
E E C	4 895	1 039	1 321	2 682	859	10 797
Japan	4 331	366	580	4 846	379	10 502
USA	2 004	89	510	2 348	376	5 327
Hong Kong	205	133	20	604	52	1 014
Canada	158	9	119	218	80	584
Thailand	512	3	5	10	3	533
Sweden	156	26	74	76	57	389
Singapore	149	30	18	136	25	358
Switzerland	160	17	84	40	25	326
Australia	92	15	77	72	42	298
Korea	246	1	1	45	2	295
USSR	137	24	19	0	0	180
Côte d'Ivoire	144	0	5	0	0	149
Egypt	119	2	24	1	0	146
Malaysia	63	5	19	20	16	123
Brazil	72	40	9	0	0	121
Norway	25	14	19	44	4	106
Austria	43	5	40	5	5	98
Finland	32	6	39	3	14	94
Total	13 543	1 824	2 983	11 150	1 939	31 440
Proportion of total imports, %	43.1	5.8	9.5	35.5	6.2	

TABLE 3.

Value, in $US millions, of exports of fishery products from developing countries with large export trades. Data from FAO Fishery Statistics for 1988. Countries listed account for 79% of exports from developing countries.

Country	Fish			Crustacea and molluscs		Total exports
	fresh chilled frozen	dried salted smoked	canned	fresh frozen	canned	
Korea, Rep	844	34	175	537	190	1780
Thailand	127	17	593	631	233	1601
China	258	19	49	984	50	1360
Hong Kong	186	36	7	462	25	716
Indonesia	84	14	21	536	6	661
Mexico	105	2	10	306	16	439
India	20	7	0	402	0	429
Morocco	103	5	110	194	0	412
Philippines	34	2	93	271	7	407
Ecuador	32	1	23	342	0	398
Singapore	189	24	8	119	13	353
Chile	162	4	32	64	60	322
Argentina	164	11	5	88	0	268
Senegal	70	3	56	117	0	246
Mauritania	25	1	0	169	0	195
Malaysia	19	2	18	96	54	189
Brazil	32	2	3	147	0	184
Viet Nam	2	2	0	173	5	182
Bangladesh	14	6	0	140	0	160
Cuba	5	0	1	140	0	146
Cote d'Ivoire	34	1	90	3	0	128
Pakistan	14	17	0	91	0	122
Tunisia	11	0	1	91	0	103
Panama	13	0	0	61	0	74
Korea, Dem Rep.	16	5	5	40	4	70
Mozambique	0	0	0	65	0	65
Colombia	17	0	0	46	0	63
Uruguay	58	0	0	3	0	61
Honduras	0	0	0	56	0	56
Total	2 638	215	1 300	6 374	663	11 190
Proportion of total exports, %	23.6	1.9	11.6	57.0	5.9	

16. The Republic of Korea is seen to be the country with the largest trade, particularly of frozen products. Canned fish, mostly tuna, canned shellfish, mostly shrimps and crabmeat, and frozen shellfish, mostly shrimp and squids, make up the bulk of the Thai trade. China is the largest exporter of fresh and frozen crustacea and molluscs, and it also has a significant trade in frozen fish. These three countries between them account for 43% of the trade of the countries listed in the table and 33% of exports from all developing countries. Two countries - Hong Kong and Singapore - are shown as being significant exporters of fishery products, particularly of frozen products, but the trade should really be considered as re-exports as the countries are not themselves significant producers of fishery products.

17. The table reveals the importance of frozen crustacea and molluscs, (molluscs here are mostly squids), in the export trade of developing countries; they make up more than half the value of all exports. For some countries this commodity comprises all or almost all of the exports. Frozen crustacea and molluscs have high unit value so this commodity would not represent such a high proportion of the total by volume. Comparison of data in Tables 2 and 3 would suggest that exports of frozen crustacea and molluscs from developing countries make up about half of imports to developed countries. In fact the proportion is probably a little higher than this. Some of the imports of frozen crustacea and molluscs by countries listed in Table 2 are imports from other countries on the list and some of these re-exports are products that originally came from developing countries.

18. Frozen fish makes up almost a quarter of the value of exports. Most of this will be in the form of whole, perhaps gutted and headed, fish, but some countries, particularly some South American countries, have important trades in fillet blocks which are further processed in the importing countries into retail consumer products. The contribution of developing countries to international trade in frozen fish is not nearly as great as their contribution to the trade in frozen crustacea and molluscs.

19. Only about half the countries listed in Table 3 have significant export trades in canned fishery products, though for a few individual countries this trade is very important. Comparison of data in tables 2 and 3 suggest that exports of canned fish from developing countries is an appreciable proportion of total international trade.

20. Only a very small proportion of total production of cured fish produced in developing countries is exported. Almost all production, predominately dried or salted and dried, is consumed within the country, and even the export trade will be mostly to markets within the region of production.

III. OFFICIAL CONTROL OF THE SAFETY AND QUALITY OF FISHERY PRODUCTS

21. All countries exercise some control of imported foodstuffs as part of the country's overall food control system. Fishery products come within the scope of these general food laws, and additionally there might be specific regulations applying to fishery products or to particular fishery products. Around the world these basic food laws are very similar and typically have the following as their main objectives:

a) to protect the consumer against any food that might cause acute or chronic illness on consumption;

b) to ensure that foods are made from sound materials and will not be offensive to the consumer;

c) to ensure that only permitted additives have been used in the preparation of the food;

d) to ensure that the product is labelled correctly so as not to deceive or mislead the consumer.

Safety of fishery products

22. Food borne illnesses with severities ranging from mild to fatal occur in all countries and objective a) above is a major one for any food control agency. In most countries, (Japan is a noticeable exception), fishery products are only a minor source of food poisoning though outbreaks can be severe in their outcomes. A recent example is the cholera outbreak in some South American countries in which contaminated fish was a transmitter of infection. Incidents where deaths have occurred have involved canned fish, cooked shrimps, raw fish, and salted fermented fish. Fortunately such incidents are rare. A comprehensive review of food poisoning by seafoods has been published by the National Academy of Sciences of the USA[1].

23. There are a number of reasons for the relative safety of fish compared with other flesh foods. Fish do not generally harbour disease-causing organisms as do, say, poultry which are common carriers of Salmonella. An exception is the organism *Vibrio parahaemolyticus* which is present in marine waters and hence can be present of fish. Fish products though can be contaminated by handling after harvesting. Because fish is intrinsically so perishable it is commonly stored in the chilled or frozen states, conditions under which bacteria, whether initially present or introduced by contamination after harvesting will not grow or grow only slowly. Fish are usually purchased raw and cooked shortly before consumption, a process which kills potential food poisoning bacteria and inactivates toxins produced by them.

24. Some cause of food poisonings are specific to seafoods. One of the more frequent causes of poisoning from seafoods is the illness caused by scombrotoxin. This toxin is formed in fish mainly of the Scombroid family,

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[1] Ahmed, F. E., ed. (1991). Seafood Safety. Committee on evaluation of the safety of fishery products. National Academy Press, Washington, D.C., USA.

(hence the name), like mackerels and tunas, and less often in clupeids like herrings and sardines when the fish spoils at high temperatures, that is when not chilled. The toxin is not destroyed by heating and canned fish can remain poisonous if the toxin is present when the fish is canned. The nature of the toxin has not been identified, but poisoning is associated with the presence of high levels of histamine in the product. Many food control agencies specify maximum limits to histamine contents in fish products in which scombrotoxin poisoning is a hazard.

25. Some fish and shellfish can be intrinsically poisonous, that is they contain the toxin in the flesh when the fish is harvested. One of these toxins is tetraodontotoxin found in puffer fish and related species. Flesh from such fish is considered a delicacy in Japan where it is known to cause cases of poisoning each year, with fatalities, despite strict controls over preparation of dishes containing the fish. Many countries forbid the importation of puffer fishes. Ciguatera toxin is found sporadically in a number tropical fish species, particularly those associated with coral reefs. It is one of the most common causes of food poisoning from seafoods in the United States for example, and is a well recognised cause of food poisoning in other countries where tropical water fish are consumed. It is very difficult to control as not all specimens of a species even within a single batch are poisonous.

26. Bivalve shellfish - mussels, clams and such like - can become toxic following ingestion of certain species of phytoplankton. Planktonic organisms are natural foods of bivalves but several species, which can 'bloom' to large numbers under some conditions, contain toxins which are retained in the flesh of the mollusc and can cause illness when the meat is consumed. The toxins, more than one is known, are heat stable and are not inactivated on cooking. The most common is the toxin of Paralytic Shellfish Poisoning (PSP) which causes neurological disorders and can be fatal. Countries where PSP and other toxins are a risk usually have programmes for routine monitoring of shellfish for presence of toxins, and a fishery will be closed if significant concentrations of a toxin are found in the samples from the locality. Regulations in many importing countries specify maximum limits to the amount of shellfish toxins that may be in products offered for consumption, and imported bivalves might be inspected for the presence of these toxins.

27. The greatest risk of bacterial food poisoning by fishery products is posed by products like cooked and peeled shrimps which are served without any further heat treatment, or products eaten raw or only partially cooked like sashimi and cold smoked delicatessen products. Canned seafoods also pose a risk because these are usually consumed without further cooking, but food poisoning risks associated with canned foods are not specific to canned seafoods products. They arise from incorrect heat processing in the first place or subsequent contamination because of faults in the sealing of the cans.

28. Fish, in common with all animals, particularly those, like fish, caught in the wild, can harbour parasites. Some, related to liver flukes, are known to cause illness in man, but these are confined to tropical species of freshwater fish and some crustaceans, and do not feature as a problem for exported fish products. Another group of parasites, the nematodes, are common in temperate and arctic water fish and have caused considerable problems in marketing of these fish both nationally and

internationally. There are two main species. The cod worm, *Porrocaecum decipiens*, is found in cod and other related species. The parasite is clearly visible in the flesh being up to 2.5 cm long and 1-2 mm in diameter. It is not known to be pathogenic to man, or very rarely so, even when consumed alive and it is killed by cooking or by freezing. There is not a public health hazard associated with this species, but its presence is offensive and anything other than minor infestation might be considered by food inspectors as rendering the product unfit for consumption. Many commercial quality standards and some official guidelines will specify the maximum permitted number of nematodes for an acceptable product. The other nematode of concern is *Anisakis simplex* found in herring. Similar species are found in other seafoods. This parasite is known to cause illness in man if ingested. It is not as large as the cod worm and much less easy to see in the product. Again it is killed by cooking and the risk comes from eating raw products. It is also killed by freezing and the public health control measure is to require that herrings, or any other species that might be infested, be previously frozen if they are to be used for a product intended for consumption without cooking. This requirement applies to imported products equally as to production within the country.

29. Fish can take up pollutants present in the environment in which they are living. Some pollutants are considered hazardous to humans if consumed and most countries have regulations limiting the amounts of specific contaminants that may be present in fishery products. The contaminants are usually classed under three headings. Pesticides is one class and it is usual to specify the maximum limit for individual chemicals and an overall content. Pesticide contamination is of most concern in freshwater fish which makes up only a very small proportion of exports from developing countries. The difficulty for exporters is that importing countries differ as to the chemicals which are controlled and the maximum permitted concentrations. Another class is the organochlorines. This is a very wide class of pollutants, but the only group of chemicals that is controlled is the polychlorinated biphenyls (PCB's). Again not all countries have set limits and where they have been set differ somewhat. The third class of pollutants is the heavy metals - mercury, lead and cadmium are those of most concern. It is common for regulations to specify the maximum content of mercury in fishery products, usually within the range 0.5 to 1.0 mg/kg, and a few countries specify limits to contents of other heavy metals. Imported products must comply with the national regulations.

Fitness for consumption

30. Objective b) of paragraph 21 is the requirement that food be fit for consumption, as well as safe for consumption. It is more of an aesthetic than a safety requirement. Fitness for consumption covers such matters as the food not being spoiled or not being prepared from spoiled raw materials, not being made from diseased animals or from tissues not fit for consumption, and not being contaminated with foreign matter which of itself is not injurious to health, but might be offensive or an indication of careless processing. So far as fishery products are concerned, spoilage is the factor of most concern. Tests for spoilage are almost invariably carried out when imported fishery products are inspected at the port of entry. So far as whole fish are concerned they are inspected for extraneous matter by visual inspection, but canned products might be subjected to laboratory testing for presence of insect or rodent filth. Excessive

infestation by parasites would also be a reason for declaring a product unfit for consumption.

Additives

31. Objective c) of paragraph 21 controls the additives which may be used in food products. Countries differ both in their general philosophy towards permitted additives and in the list of chemicals which may be added. Some countries issue a list of additives which are considered safe and which may be used in any foodstuff, but most countries seem to favour listing specific chemicals which may be used in specific foods. So far as fishery products are concerned, only two additives are used to any extent. They are polyphosphates, which are quite commonly added to frozen fish preparations like shrimp meats and fillets and fillet blocks, and sulphites, which are added to shrimp to prevent discoloration. Polyphosphates are considered not to be toxic and food regulations do not usually set limits to the maximum permitted amounts - other than the general limit of what is used under good manufacturing practices. It is usual for food laws to specify maximum limits to sulphites. Because these are the only additives to be used to any significant extent in exported fishery products and the similarity of regulation of them among importing countries, meeting the requirements usually present no problems to exporters. Occasionally exporters have had problems because sulphite contents in imported products have exceeded maximum permitted levels. Just because an additive is permitted in an importing country does not mean that it should be added. The exporter must check with the customer that the customer wants or allows it.

Labelling

32. The concern of objective d) of paragraph 21 is that the consumer is adequately informed about what she or he is buying and is not misled. Labelling regulations for products going for retail sale can be quite detailed and extensive in importing countries, and quite strictly enforced. They differ in detail amongst countries, but at least the following should appear: the name of the product and its form, a list of ingredients and additives, the quantity, and the name of the manufacturer, packer or distributor. Some countries require a declaration of shelf life and any special conditions of storage, for example refrigerated or frozen, and the country of origin. Regulations will also state the position of labels and size of lettering. Any illustration must faithfully represent the product. The EEC is harmonising its labelling regulations, but there is allowance for national variations in minor matters. Otherwise the differences among countries in details of labelling requirements pose problems for exporters and it sometimes happens that consignments fishery products are rejected at the port of entry because they have not complied with the regulations.

33. An FAO publication summaries in tabular form the food safety regulations and labelling regulations of member states of the EEC, and of Canada, Japan and the USA[1].

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[1] FAO (1989). Food safety regulations applied to fish by the major importing countries. FAO Fisheries Circular no. 825, FAO, Rome.

IV. INSPECTION AND QUALITY ASSURANCE IN IMPORTING COUNTRIES

Official requirements, and control procedures

34. In developed countries official food control operates by a mixture of control over procedures for sale, production, storage and distribution, and by inspection and testing of food products at various parts of the manufacturing/distribution chain. It has long been realised by public health officials that testing of finished food products for harmful bacteria or for biotoxins in order to discover and remove from distribution those batches that might be harmful to health gives very poor protection of the public. The resources required in personnel and facilities and the costs involved, both for sampling and testing and in lost material, means that only a minute proportion of food on offer can be tested. The chances of finding an unsafe batch under these conditions is vanishingly small. The philosophy now is to prevent harmful raw material being used in the first place and to ensure the food does not become contaminated or otherwise rendered unsafe during processing, storage and distribution. Given these conditions the final product when it reaches the consumer should be safe to eat, and end product testing becomes more of a monitoring exercise to confirm that process control has been effective.

35. The thrust of food legislation over recent years has been to put more emphasis on control of food production and to require that the food industry does more to ensure the safety of the final product. Licensing of food premises has long been a feature of food control, but this aspect has tended to be reinforced in recent legislation in the UK and elsewhere in the EEC for example. The requirements for licenses to handle, store, process, and market food products, including fishery products, have become stricter over recent years. The stricter requirements apply not only to physical requirements like buildings and equipment, but also to processing methods and training and conduct of staff. Companies are being pressed to institute effective quality assurance programmes in their plants.

36. An important development in the implementation of quality assurance for safety in food production has been the introduction of formalised systems for reducing risks of food poisoning by the adoption of Hazard Analysis Critical Control Point (HACCP) procedures[*,**]. HACCP is an extension of the GMP (Good Manufacturing Practices) approach. GMP are those procedures which have been found in practice to ensure good quality and safe foods. They are documented as Codes of Practice which manufacturers should adopt in their premises. HACCP is a formalised way of establishing microbiological hazards and formulating procedures for reducing the risks of producing unsafe or low quality foods. The HACCP approach is being widely adopted in the food industry as an essential part of quality assurance systems. More than that it is being adopted in official food

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[*] Bryan, F. L. (1992). Hazard Analysis Critical Control Point Evaluations. A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage. WHO, Geneva.

[**] International Commission on Microbiological Specifications for Foods (ICMSF) (1988). Microorganisms in Foods. 4. Application of the Hazard Analysis Critical Control Point (HACCP) System to Ensure Microbiological Safety and Quality. Blackwell Scientific Publications, Oxford, England.

control as a way of evaluating a company for purposes of approval under food control legislation. In some countries, recent food legislation has explicitly referred to HACCP and even where its use is not explicit in regulations, official action makes it incumbent on companies to adopt its principles.

37. Official agencies have long had difficulties in controlling safety of imported foods. Since it was not thought possible to control production in the exporting country directly, control has been exercised by sampling and testing of consignments on arrival at the port of entry. This suffers from the problem already referred to that such inspections give poor assurance of the safety of foods. Inspectors are able to thoroughly inspect only a proportion of the consignments, and concentrate their efforts on products which pose a high risk, like cooked and peeled shrimps and canned fish, and on consignments from countries which have a poor record of previous consignments having been rejected. Even when a consignment is inspected only a very small sample, in proportion to the total amount, can be tested, For example an sea container of frozen shrimp might contain 20 000 cartons of product. Typically only 5 cartons will be taken for microbiological analysis. This inspection and sampling regime has only a low probability of detecting potentially unsafe consignments, but as will be discussed later, such consignments are detected which raises questions about the safety of other consignments.

38. Official agencies in many importing countries are now adopting the attitude towards imports as they have towards domestic production - it is the responsibility of the producer to ensure the safety of the product. The agencies are now expecting manufacturers of fishery products in exporting countries to institute effective quality assurance in their plants and are expecting official agencies in the exporting countries by legislation and action to ensure that fishery products are safe and are fit for consumption when they are exported. The principle here is that of 'equivalency' - foods imported into the country must be manufactured in the exporting country under equivalent conditions and subjected to equivalent controls as prevail in the importing country. Exactly how this principle translates into action differs a little among the importing countries.

Imports into the EEC

39. At the time of compiling this report, late 1992, imports of fishery products into member states of the European Comunity are subject to control according to the laws and procedures of the country of arrival of the consignment. If accepted there the goods could be subjected to further checks on crossing borders within the Community. On 1 January 1993, national legislation will be replaced by EEC legislation which provides for unified control over production and marketing of fishery products within the Community, and over imports. The legislation is EEC Directive 91/493/EEC[1].

[1] Council Directive of 22 July 1991 laying down the health conditions for the production and the placing on the market of fishery products (91/493/EEC). Official Journal of the European Community, L 268, vol 34, 24 September 1991, pp 15-34.

40. Though the primary objective of the legislation is harmonisation of practices within the Community, it is a principle of the Directive that its provisions should apply equally to imports - 'Provisions applied to imports of fishery products from third countries shall be equivalent to those governing the placing on the market of Community products' to quote the relevant section. This is the principle of equivalency laid down explicitly in legislation. The principle has considerable implication for both official agencies and the producers of fishery products in exporting countries. It has been pointed out earlier in discussion of Table 2 that the EEC is already a major importer of fishery products, but additionally several countries listed in that table will be joining the Community over the next decade and will be bound by the provisions of the directive when they do. Application of the provisions of the Directive will have an impact on both official agencies responsible for control of safety of exported products and on quality assurance in the fish processing industry in many exporting countries. Many exporting countries do not have official inspection systems in place that can meet the requirements, and current quality assurance procedures in much of the processing industry will not meet the provisions.

41. In many places the Directive refers to the 'competent authority'. This will be the official agency in the exporting country which has responsibility for applying the food control laws to fishery products, especially those destined for export. A central requirement of the Directive is that the competent authority in a country must draw up a list of approved establishments and only fish from approved establishments may be marketed in the Community. It is the responsibility of the competent authority in the exporting country to approve establishments in accordance with the provisions of the Directive, and to submit list to the Commission. Products exported to the EC must carry the licence number of the establishment of origin and consignments not carrying a number, or carrying a number not on the list of approved establishments, will not be admitted into the EC. There is a long technical annexe to the Directive which states the provisions which must be met by approved premises. Premises must be visited on a regular basis to ensure that standards are being maintained and approval can be withdrawn if they are not.

42. In order to apply the principle of equivalency the Commission reserves the right to carry out inspections of the situation concerning hygiene and inspection in the exporting country by experts from the Commission and the Member States. The experts will be appointed by, and be working for, the Commission and the Commission will bear all costs of the inspection. As a result of an inspection the Commission of the EC might set particular conditions for imports of fishery products into the Community. When fixing these conditions the Commission will take note of the organization of the competent authority of the exporting country and of its inspection services, the powers of such services and the supervision to which they are subject, and of the facilities they have for effectively verifying the implementation of their legislation.

43. It has already been mentioned that an approved establishment must meet the requirements specified in the general provisions of the Directive, among which is a requirement that persons responsible for establishments must have effective quality assurance systems in place in the plant. The Directive does not specifically refer to HACCP as such, but the principle is. Management are required explicitly to identify critical points in their

manufacturing processes and to establish and implement methods for monitoring and checking these critical points. Much publicity has been given to the application of HACCP principles in the fish processing industry in developing countries by international agencies and other organizations, and companies do seem to be aware of the need. Over the last few years training courses and assistance given by national and international agencies has included instruction and advice on application of HACCP, but in the main this training has gone to government officials.

44. Though the emphasis is on process control to ensure safety there are a few end product standards. The Directive contains specifications for acceptable histamine levels in fish of the Scombridae and Clupeidae families and limits will be specified for contaminants in fishery products. There is provision for specifying microbiological criteria if it is thought necessary to do so to protect public health. Products going for retail sale must comply with the general labelling regulations for foods, and on entry into the Community the cases, or accompanying documents, must state the country of origin and the registration number of the establishment where the product was prepared or packed.

Imports into the USA

45. In the USA the Food and Drug Administration (FDA) is responsible for food control. The law requires that the product must not be adulterated, that is not consisting wholly or in part of any filthy, putrid or decomposed substance, and must not have been prepared or held under insanitary conditions. The FDA is also responsible for ensuring compliance with other aspects of the food regulations such as those pertaining to additives, contaminants and labelling. In addition the National Marine Fisheries Service (NMFS) of the Department of Commerce operates a voluntary fish inspection service for compliance with commercial standards of quality. This service includes inspection of premises, continuous inspections of processes, and sampling and testing batches of products for compliance with grade standards. There is collaboration between the FDA and the NMFS so that some of the responsibilities of the former are delegated to officers of the latter. The requirements for a registerable premises under the regulations were based on considerations of GMP's which had force of law, but over the last few years HACCP has been implemented on a wide scale as the principle of ensuring safety of products. A comprehensive review of US regulations pertaining to fishery products, and their enforcement, has been published recently[4].

46. Imported fishery products must also comply with the food laws and are liable to inspection by the FDA at the port of entry to ensure compliance. More than half the fishery products consumed in the USA is imported and there is both consumer and legislative pressure to ensure that imported products are processed and monitored under conditions equivalent to those imposed on products prepared in the USA. Consequently the authorities in the USA are moving towards a system very similar in principle to that embodied in the EEC Directive. The basis of the system is that processing plants in the exporting countries wishing to export to the USA should be inspected and registered with an official agency. The basis of the

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[4] Martin, R. E. (1990) Regulations. In: The Seafood Industry, R. E. Martin & G.F. Flich, eds. Van Nostrand and Reinhold, New York.

registration should be equivalent to the requirements in the USA and the registering agency could be the national body, or it could be the FDA. The USA does not have comprehensive legislation equivalent to the EEC Directive and the US authorities will negotiate a Memorandum of Understanding (MOU) on a government to government basis to ensure this equivalency. The MOU could cover all fishery products, but is more likely to cover specific products or specific plants. The MOU will provide for inspection by US inspectors. Existence of a MOU does not mean that products covered by it are not liable to inspection; they are, but the frequency of inspections will be less than on products not so covered.

Imports into Canada

47. The Inspection Services Branch of the Department of Fisheries and Oceans (DFO) is responsible for enforcing the various regulations concerning fish inspection in Canada. This includes imported fish. Basically the law states that fish imported into Canada must not be 'unwholesome, tainted or decomposed'. Unwholesome is the safety aspect and means having on the product bacteria of public health significance or substances toxic to, or aesthetically offensive to humans. Tainted means having an abnormal odour or flavour, and decomposed means objectionably spoiled. There are further specific regulations concerning labelling, permitted additives, and acceptable levels of contaminants.

48. Consignments of imported fishery products are sampled and inspected at the point of entry into Canada by inspectors from the Inspection Services Branch. The frequency of inspection, and intensity of sampling and testing, of a particular type of product from a particular company depends on experience of previous inspections. Every consignment of a product new to the inspectorate will be usually be inspected until there is a history of successive compliances. The product will then be inspected at a relaxed rate until there is an instance of non compliance, when a stricter inspection regime will be applied. A fee is charged for inspection.

49. The DFO has instituted what it refers to as the Offshore Inspection Program. This is essentially the same as the US MOU scheme and equivalent to what the EEC Directive intends to achieve. Under this program, DFO inspectors inspect plants in the exporting countries for compliance with Canadian standards. These standards will based on HACCP principles. Where plants are found to comply a MOU will be agreed with the government of the exporting country for preferred inspection status. Like MOU's negotiated by the USA, the preferred status does not mean than products are not liable to inspection, only that they will accepted on a reduced inspection basis.

Imports into Japan

50. In Japan the Ministry of Health and Welfare is responsible for controlling the safety of imported fishery products. Consignments are inspected by officers of the Food Sanitation Inspection Office at the port of entry for compliance with a range of factors including microbiological and chemical criteria for safety and freshness and with levels of additives and contaminants. Consignments may also be inspected on a voluntary basis by the Japanese Frozen Foods or the Japan Canned Food Inspection Corporations for compliance with commercial quality standards.

51. There does not seem to be any move by the Japanese authorities to introduce any direct official control over processing conditions in the exporting countries. However there is often Japanese involvement in, if not ownership or control of, fish processing companies in exporting countries which has a considerable influence on processing conditions in the plants.

Commercial requirements

52. Official food control is intended to protect the health of the consumer and to protect against fraud and misrepresentation, but consumers expect more than this minimum - they want a product that is pleasing to them. Acceptability is a commercial consideration and, above the minimum safety and aesthetic levels required by law, is not usually considered a matter for official inspectors. Acceptability is of course crucially important to merchants. The sale of foods in economically advanced countries is dominated by large companies who put a high premium on consumer satisfaction. They are very concerned that their products are not responsible for outbreaks of food poisoning of course, but they also want consumers to enjoy eating them and come back for more. Such companies often buy directly from producers in exporting countries against strict quality standards equivalent to those they impose on their domestic suppliers. It is not uncommon for technologists from retailing companies in importing countries or from merchants importing fishery products to visit suppliers in exporting countries to ensure that effective quality assurance systems are in place in the processing plant. Again these quality assurance programmes are increasingly being based on the principles of HACCP. These commercial pressures often result in introduction of high standards in fish processing ahead of those imposed by the national authorities. There is no doubt that these pressures will be maintained and will extend to cover more companies and products.

Rejection of exported products in importing countries

53. A proportion of exported fishery products are rejected by officials at the ports of entry into the importing countries. The consultant is not aware of comprehensive, world-wide, summaries of the situation, but the FDA issues monthly lists of detentions of foods from which data relating to fishery products can be extracted. Data provided to the consultant by the Fish Utilization and Marketing Service of FAO show that in the month of October 1991, (there was no special reason for choosing that month; it was just taken as illustrative), there were 322 instances of detentions of imported fishery products in the USA. Some of these were small consignments of less than 1 tonne, but large consignments were also involved. The major reason for rejection, 28% of the cases, was decomposition, followed closely by presence of pathogenic microorganisms. Other significant causes were presence of foreign matter, incorrect labelling, non registration of processing conditions in the case of canned fish, and high levels of mercury content. A review of inspection systems for exported fishery products in countries in the Indo-Pacific region, reported that the main reason for detention in the USA of frozen shrimp or frogs legs from those countries in 1982 was presence of Salmonella with decomposition as another

frequent reason[*]. Papers presented at an INFOFISH technical consultation in 1987 also reported that presence of pathogenic microorganisms and decomposition were the most frequent reasons for rejection in other countries as well as the USA[**].

54. The FAO survey for October 1991 estimated that the detained consignments made up about 2.5% by value of imports of fishery products in that month. This is bad enough, but bearing in mind what was pointed out earlier that product sampling at the level undertaken by inspection agencies is inefficient in detecting substandard consignments, the actual proportion of potential detentions will be higher than that. It is considerations like this that lead public health officials to institute control over production as a means of ensuring safety.

55. This actual or possible amount of defective material arriving at ports in the importing countries indicates significant failures in quality assurance and inspection in the exporting countries. The processing industry must bear the primary responsibility for failures of in-plant quality control that allowed defective products to be manufactured in the first place, but a very high proportion of the detained consignments came from countries with official systems of inspection and certification of exported fishery products. The fact that the defective consignments were not stopped in the exporting countries indicates that the official inspection systems were not effective in detecting defective batches. Again, pre-shipment sampling and testing, at the level at which it is carried out in the exporting countries, or which it can be reasonably carried out, can not be 100% effective in detecting all faulty consignments even if it is carried out competently and with complete diligence.

V. THE SITUATION IN DEVELOPING COUNTRIES

56. It is a theme throughout this report that food control authorities in developed countries are moving away from the principle of control mainly by inspection of end products to more rigorous and extensive control over handling, processing and storage. The authorities wish to extend this control over imported fishery products through the inspection services in the exporting countries. At present control over the safety and quality of exported fishery products in the country of origin is predominately by inspection and certification of finished product just prior to export. Many countries include registration and licensing of processing plants in their control procedures, though the effectiveness of this aspect of control varies widely among countries. Following is a discussion of official inspection systems for controlling quality of exported fishery products, and of quality assurance in processing plants as a prelude to a discussion what is needed in exporting countries to meet the current requirements in

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[*] Howgate, P. (1984). Report on quality control and inspection systems for fish products in INFOFISH member countries. INFOFISH Report no. 13. INFOFISH, P.O. Box 10899, Kuala Lumpur, 01-02, Malaysia.

[**] INFOFISH (1987). Report on the FAO/INFOFISH technical consultation on fish inspection and quality assurance for Asia and Pacific, Cochin, India, 16-19 February 1987. INFOFISH, P.O. 10899, Kuala Lumpur, 01-02, Malaysia.

importing countries. The survey is based on written accounts, for example the INFOFISH report of 1984[1], verbal presentations at FAO courses in which the consultant has participated, and descriptions given to the consultant.

Food laws, and competent authorities

57. It seems to be the case that in all countries the consultant is aware of there are basic food laws which have the objectives discussed in paragraph 21 and following. In addition many developing countries with important trades in fishery exports have additional regulations covering the processing and sale of fishery products. Lack of adequate laws and regulations would not appear to be an impediment to effective control over exported fishery products.

58. The EEC Directive refers to the 'competent authority', that is the central authority of a state which has responsibility for carrying out health checks on fishery products. Where exporting countries differ is in which department of the state administration is responsible for enforcing laws and regulations concerning safety of fishery products and would be considered competent authorities in terms of the EEC Directive. Generally food control legislation, because it involves public safety, is enforced by departments of public health and this is the situation with regard to exported fishery products in a number of countries. For example, it was reported in the INFOFISH survey, that in 4 out of the 16 countries surveyed public health department had main responsibility for inspecting and certificating exported products, and in a further 2 countries it shared responsibility. However it is more frequently the case that inspection of fishery products, exported or not, and approval and certification of exported fishery products is the responsibility of a department of fisheries. If the fisheries department does not have the powers explicitly under the law and the department of public health has ultimate responsibility, the fisheries department undertakes the control and inspection as a delegated responsibility. In a very few countries - India is an important example - responsibility for control of exported fishery products lies with a department of commerce.

59. Sometimes a lack of clarity of responsibilities within a country and rivalries between departments, particularly in the allocation of resources, results in a weakening of the fish inspection services. There are many examples of this throughout the world. A department of fisheries might wish to promote exports as a means of developing the fishing industry, but a department of public health does not see inspection of exports and control of fish processing as a high priority among all its other duties, and is unwilling to devote resources to it. A department of fisheries might see its responsibilities as controlling the fish catching sector and conserving stocks, and might not have the skills or willingness to monitor the safety of fishery products which it considers is a function of a department of health. Officers of a department of public health might not have the technical knowledge and experience to adequately monitor fish handling, processing and storage. Officers of a department of fisheries might not have the legal powers to enforce good practices and to exert control of

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[1] Howgate, P. (1984). Report on quality control and inspection systems for fish products in INFOFISH member countries. INFOFISH Report no. 13. INFOFISH, P.O. Box 10899, Kuala Lumpur, 01-02, Malaysia.

processes and products. Where responsibilities are shared there could be duplication of effort and skills, or an absence of control at some points because each department believes certain functions should be the responsibility of the other.

Fish inspection services

60. Many developing countries with appreciable trades in exported fishery products have an institution whose sole, or main, function is control of the quality of exported fishery products. This control might extend nominally to all fishery products, including those for domestic consumption, but in practice resources are devoted in the main to control of exported products. There is a wide variation among countries in the way they go about their tasks, the resources available to the inspectorate, and the level of expertise of the inspectors. The operations range from excellent to rudimentary.

61. There are some common features. So far as the consultant is aware all countries with any appreciable export trade in fishery products require that processing plants for exported products be inspected and approved by officials. Where there is a fish inspection service this inspection and approval will be carried out by the inspectorate. Practices vary as to how frequently premises should be inspected, and what is required of an approved premises. Sometimes the requirements are laid down in codes of practice, or in standards which have some legal standing. However it is the consultant's experience that in most developing countries standards in practice are not very high and would not meet the requirements of the EEC Directive or of the standards expected in the USA or Canada. In fact in many cases they do not meet the requirements of codes of practice or standards issued by the inspectorate itself. There are noticeable and important exceptions to this generalisation. In some developing countries there are plants which compare very favourably with the generality of plants in developed countries and which would surpass many in standards of hygiene and sanitation.

62. There could be many reasons why practices of factory inspection do not meet requirements or even aspirations in so many cases. One could be a lack of knowledge and/or experience. The consultant's experience from meeting many fishery inspectors in developing countries, and from knowledge of the services and recruitment to the services, is that inspectors generally have adequate qualifications in public health, veterinary practice or food science all of which will include some training in food hygiene and sanitation. The basic knowledge is there but experience of applying it is often lacking. Some inspectorates do not have any, or sufficiently comprehensive, guidelines for inspecting factories. There is no excuse for this as there is no shortage of published material on this subject. Too often the inspectorate sets its standards by what is acceptable in the exporting countries rather than in the importing country. This will have to change because the principle of equivalency which has been adopted by, and will be applied by, most importing countries requires that standards of operation in the industry, and standards of control on the part of the inspection service, will have to comply with those prevailing in the importing countries.

63. Another feature common to fish inspection systems is that consignments of products intended for export must be inspected and approved

for export by the competent authority, usually the fish inspection service if such exists in the country. Such a system has a number of difficulties, both in principle and in practice. It is also open to abuse. The usual practice is for the would-be exporter to inform the inspection service that there is a consignment ready for export. Typically for frozen goods this would be a 20 tonne batch to make up a container load. Inspectors from the agency visit the factory and draw a sample from the cold stores for testing in their laboratories. The testing will include examination for weight, foreign matter and defects, a sensory evaluation for spoilage and for off flavours, and microbiological examination. It is the microbiological examination that is costly in resources and limits the number of samples that can be tested. Typically the sample size is between 5 and 10 samples, usually nearer the 5, from a consignment. This is a very small number from a consignment that might contain 10 000-20 000 units and on statistical grounds alone explains why sampling at this intensity is so inefficient in detecting batches that should not be approved. The analyses require skilled staff in order to carry them out correctly and failures in procedures give negative or low values which are interpreted as absence of the microorganism being sought or numbers being within limits. It is uncommon for inspection laboratories to have quality assurance systems in place to check on the performance of analytical procedures.

64. The system of sampling and certification is open to abuse through negligence or deceit. The samples are usually taken at the premises where they have been processed, not at the point of dispatch. There is often lax identification and marking of batches that have been sampled and often there is no guarantee that the batch dispatched is that which was sampled and approved. In some inspection systems, samples are selected by the exporter and handed to the inspector or delivered to the offices of the inspection service: clearly such a system is open to abuse.

65. Fish inspection agencies require various services to support their inspectors. In many developing countries services like provision of office facilities and transport are restricted by budgetary constraints thus restricting the work of the inspectors. Lack of adequate laboratory facilities is also a constraint in many developing countries. Some inspection services do not have their own laboratories and rely on testing facilities operated by other government departments, particularly public health laboratories. These are often overstretched as it is and do not welcome the added burden of servicing a fish inspection service.

66. Funding of fish inspection services differs among countries. In a few countries the service is more or less fully funded by fees charged for services. This is the case, for example, in India where the inspection service is an agency and to some extent separate from government budgeting. In some countries, Thailand is an example, the fish exporting industry collectively supports financially, or in kind, all or part of the costs. However in most developing countries fish inspection is a government service and is therefor subject to constraints on government spending. Fees may be charged for inspection and certification of consignments or for registration of premises, but these fees generally are small and do not recover the costs of the service. Also they most likely accrue to the treasury or to the department and are not directly available to the fish inspection service. It is the experience of the consultant, and of others who have ben involved with fish inspection services in developing countries, that generally they are underfunded for the tasks they are

required to perform at present, and certainly underfunded for what will be required of them as importing countries apply more and more the principle of equivalency.

Quality assurance in processing of fishery products

67. It has already been mentioned that primary responsibility for providing safe food of high quality lies with suppliers and manufacturers. No amount of inspection of end products can improve the quality of the product. Inspection and certification of premises is only confirmation that at the time of inspection premises, equipment and processes were adequate for providing wholesome products. Quality assurance requires continuous attention to selection of materials and surveillance of the process. This is under the control of the processing company and it is quite clear from the experience of the consultant and from reports of others that quality assurance in many plants does not meet current standards.

68. Quality assurance covers all operations in the company, technical and managerial, that affect the quality of the product. It starts with the premises in which the product is handled and stored. In some countries with large trades in exported fishery products there has been considerable investment in premises and equipment and the majority of plants there would meet the requirements of the EEC Directive or of inspection services in other importing countries. However, in the majority of exporting countries, by number rather than volume of trade, it is the other way round - very few, if any, plants would meet the requirements. Defects cover various aspects - siting, provision of basic services, design, materials of construction, facilities for achieving high standards of hygiene and sanitation, design and construction of fitted equipment.

69. Quality control systems in the plants might be lacking or rudimentary, or if present, not technically sound. It is not sufficient to have a test laboratory if the results of testing are suspect or the results are not effectively translated into control action. Too often there is overreliance on sampling and testing to the neglect of continuous monitoring and control of material and processes. Defects in quality control procedures result in the main from lack of knowledge of the subject, or of experience in the application of the knowledge. Though national and international aid agencies have, and have had over many years, programmes of training in fish inspection and quality assurance for developing countries, most of this training has been for staff in official inspection services. The intention is that the training should be transmitted to the industry, but it is likely that in many countries this has not happened.

70. As well as failures in quality control as a technology, there is often a lack of willingness on the part of management to invest either financial or managerial resources to quality asurance. Too often volume of production takes precedence over quality. Quality assurance requires a commitment to quality on the part of senior managements, and a willingness to set up the management structures required for achieving and maintaining high quality.

71. All too often unfortunately, processors in developing countries find that the infrastructure of fish catching and marketing in the country does not help their efforts to achieve safe and high quality products.

Processors have little control over the situation at landing sites and markets though conditions there have a marked effect on the quality of the raw material they have to work with. Often standards of hygiene and sanitation on fishing vessels and at markets are very poor indeed. Surveys of the microbiological quality of fish during catching and onshore marketing and distribution in several countries have shown that fish is often contaminated by food poisoning bacteria by the time it arrives at processing plants. Fish and shellfish are often not carefully handled, nor adequately chilled, during marketing and distribution resulting in damage to, and to spoilage of, raw material. The EEC Directive lays down requirements for the construction of market halls and for the handling of products during marketing and distribution. It also requires that the competent authority register auction and wholesale markets after verifying they meet the provisions of the Directive.

VI. REQUIREMENTS FOR OFFICIAL CONTROL AND INSPECTION

72. The EEC Directive is quite explicit that the Commission of the EC expects 'competent authorities' in the exporting countries to play a full role in monitoring the production of fishery products to ensure the safety of products being exported to the EEC. A central role for inspection agencies is also implicit in the principle of equivalency which has been adopted by the USA and Canada in their treatment of imports; imported fishery products should have been subjected to official surveillance in the exporting country equivalent to that prevailing in the importing country. Clearly the officials in these countries will expect the inspection service to be effective in its operations and not just a service which exists in name only. Again the EEC Directive is explicit on this point when it states that when fixing conditions of imports account will be taken of the 'legislation of the third country' and of the 'organization of the competent authority ... and of its inspection services, the powers of such services and the supervision to which they are subject, as well as their facilities for effectively verifying the implementation of their legislation in force'. Though the great majority of developing countries exporting fishery products have, at least nominally, inspection services the consultant believes only few of these will meet the requirements of the EEC and authorities in the USA and in Canada. Even those which have fully developed and effective services will need to check their powers and their operating procedures to ensure they comply with the requirements of the importing countries.

Powers and responsibilities of a competent authority

73. The consultant is of the opinion that existing legislation relating to food control in exporting countries will be acceptable the Commission. The primary legislation usually requires that food, which will include fishery products, offered for sale or consumption is wholesome, fit to eat and free from contaminants and non-permitted additive. The legislation gives responsibility to a specific government department, typically a department of health, to enforce the law, and officers of that department are granted specific powers of enforcement. These powers usually include the right to enter and inspect without notice premises where food is prepared stored or sold, and to seize and if necessary to destroy food which is unwholesome or unfit. The legislation usually provides for food

processing premises to be approved and registered. These powers are basically adequate for control over the safety of fishery products.

74. What might not be clear within a country's administration is how this legislation is to be applied in the case of exported fishery products. Much will depend on whether or not a fish inspection service is to be set up. If control over fishery exports is to be exercised by the department with general responsibility for food control then it is unlikely that extra legislation will be required for any special arrangements for fishery exports. Administrative action is all that is required to maintain a separate register of premises for submission to the EC Commission. It would be appropriate to designate this department as the competent authority for dealing with the EEC and as the body for negotiating with other countries in matters relating to the safety of exported fishery products, for example MOU's. If a fishery inspection service is to be set up then legislation might be required to establish the body and to give it certain powers. These would be powers like right to enter and inspect premises and to seize unwholesome or unsafe products, but only with regard to fishery products. The fishery inspection service would be charged with the duty of maintaining a register of approved premises, and perhaps for providing other services to the fishing and fish processing industries relevant to quality and quality assurance. It might also be designated the competent authority for dealing with the EEC and for similar matters.

The need for, and administration of a fish inspection service

75. It is not necessary to have a dedicated fish inspection service to control the safety of fishery products. For example, of the 12 member states of the EC only Denmark has a fish inspection service; in the other countries fish is just another food product, or, as is the case in many, another animal food product. Whether or not a national fish inspection service is warranted seems to depend on the importance of the country's export trade in fishery products. Within the EC, Denmark has an import export trade. Examples of other economically developed countries with specific fish inspection services are Canada, Norway and Iceland - all are among the top ten exporters of fishery products. Among developing countries it is quite common to have a fish inspection service of some kind if a country has a significant export trade in fishery products. Almost all the countries listed in Table 3 have dedicated fish inspection services; those that do not have regulations concerning control of exported fishery products and units within their food control agencies which deal with these exports.

76. Clearly governments appreciate the value of fish inspection in supporting the export trade. Consistent high quality provides reassurance to customers and supports high volumes of sales at high prices. Failures in quality assurance, particularly if it affects safety, not only has an immediate and direct economical loss to the company concerned, but reduces confidence in all exports of fishery products from the country. Though confidence can be lost immediately, it takes a long time for it to be restored.

77. It does not matter a great deal with regard to the effectiveness of a fish inspection service which government department takes responsibility for it. In almost all countries, developing or developed, with specific fisheries inspection services they are administered by departments of

health or of fisheries. There are good arguments for either department, but the consultant believes that on balance in the context of developing countries, departments of fisheries are to be preferred. Departments of health have many responsibilities of which food control is usually just a small part, and even within this responsibility, fish is not a major commodity. The needs of the fish processing industry, or at least of that sector making products for export, could well be neglected in such circumstances. A department of fisheries is usually charged with the responsibility of developing the fishing industry and for increasing the income of fishermen and others in the industry. Promoting exports, particularly of high value products, is seen as a means of achieving these aims. A fisheries department is likely to have staff with specialist knowledge of fish processing who can give scientific and technological advice and support to the industry.

Financing a fish inspection service

78. The administration of governmnet affairs differs among countries, but the consultant's opinion is that a fish inspection service should be controlled entirely by one government department. This department should be responsible for defining the aims of the services, for providing services, and for allocating resources. The service should preferably not have to look to other departments or bodies for services or personnel for carrying out its functions. There is always a problem of allocation of resources in any government machinery and resources for a fish inspection service is no exception. It is unfortunately the case, for quite understandable reasons, that fish inspection services in many developing countries have inadequate resources of skilled manpower, equipment and facilities.

79. The consultant's opinion is that fish inspection services, especially in developing countries where government budgets are very constrained, should be financed largely, if not entirely, from fees charged for services. There are good precedents for this approach in both developed and developing countries. Fees could be charged for registration of establishments, though perhaps not for individual inspections required for registration, but the bulk of income should come from fees for inspection and certification of exported consignments or a levy on exported fishery products. Fees could be charged for services like laboratory analyses and quality audits outside of what is statutorily required. Experience shows that an income of 0.5 per cent or less of the value of exported products is adequate to finance an effective fish inspection service. Judging from figures in the FAO statistics, the unit value of crustacean and mollusc products, the major product exported by developing countries, increased by 21% in the 5 years from 1983 to 1988 so extra costs of about 0.5% for effective inspection services could be absorbed by the industry. The FAO survey referred to earlier gave a the value of detentions by the US FDA in one month as US$ 11.5 millions. If effective fish inspection and quality assurance can prevent or even reduce this economic loss the cost of the services will represent value for money.

80. A body financed independently of a department's budget often sits uneasily in government administration. There is a temptation for the parent department or the finance ministry to view the operation as an extra source of revenue. There are good arguments in such cases for the service to be an agency, that is a body with responsibilities and powers devolved from a government department, but independent of the department so far as

budgeting and management of staff and resources are concerned. Again there are precedents for this approach - the Indian inspection service is an example.

Functions and operation of a fish inspection service

81. The detailed operations of a fish inspection service will obviously depend on the circumstances of the fish processing industry in the country, but certain functions are necessary in order to meet the requirements of the importing countries. Though the primary reason for a fishery inspection service is control of exported fishery products, the service should extend its interests ultimately to products for consumption within the country. The technical know-how generated within the exporting industry will spread to other sectors. The improvement in the infrastructure of marketing and distribution which will be necessary for supporting high quality of exported products will also benefit the domestic market. Domestic consumers should not be exposed to unwholesome or poor quality products, and overall improvement of the quality of fishery products for all markets should be an objective of a national fishery inspection service.

Inspection and approval of establishments

82. One of primary responsibilities of the service is the inspection of premises and approval of those that meet specified conditions. This is an explicit requirement of the EEC Directive and is implied by the principle of equivalency adopted by other importing countries. Most developing countries with an interest in exported fishery products already have a system for licensing processing plants, but what is required is that inspection and approval be carried out in a way that will satisfy inspectors from importing countries. Even inspection services in developed countries outside the EEC are reviewing their procedures to ensure they comply with the provisions of the EEC Directive.

83. The outlines of what is required of an approved establishment are laid down in the Annex to the EEC Directive, and guidelines are available from elsewhere, but these should be elaborated by the national fish inspection service for the conditions prevailing in the country and the products being made. The requirements should be issued as codes of practice and perhaps be given authority by being published by a standards authority. Approval should be given for premises and for specified processes within the premises. Products manufactured by processes not approved for the establishment should not be authorised for export, and carrying out an unapproved process could perhaps result in withdrawal of approval for the establishment as a whole. For example a plant approved for the preparation of frozen raw shrimps would not necessarily be approved for the manufacture of cooked and peeled shrimps. The latter is a high risk product and premises for its production must be designed and constructed to higher standards than those for processing raw products, and the process must be carried out to higher standards of hygiene and sanitation. Premises which are approved for manufacture of cooked products should not be used for handling raw products unless there is strict separation between the processes. In the case of canneries, approval is given for specific products. Any new product, or change in the processing conditions for an existing product, must have the new or revised processing conditions approved.

84. There are no hard and fast rules for how often premises should be inspected; the frequency should depend on the safety risks of the products and processes. Licenses to operate should last for a year and premises should be comprehensively inspected at least on an annual basis. Premises where low risk products like chilled or frozen raw fish and shellfish are produced could be visited at least once more during the year, but canneries and premises making cooked products should be inspected more often, and more intensively. Some food control authorities have issued guidelines for the frequency of inspections of food premises based on the potential hazards of the product and process, the size of the population at risk and an estimate of the effectiveness of the quality assurance systems in the plant[*].

Certification and inspection of exported products

85. Another basic function of the service is to inspect and certificate batches of fishery products destined for export. The EEC Directive requires that a 'health certificate' must accompanying consignments forwarded to the Community. The Directive does not specify what must declared on this certificate, but usually it should state that the products have been prepared from sound raw materials and have been processed under sanitary and hygienic conditions. This should be a formality if the inspection, licensing and control of premises is effective, but certification of exports should be more than this. The inspector should check that the products are what they claim to be, that they come from approved premises, and have been processed by an approved process. The inspector must also check that the consignment, or the accompanying documentation, carries the registration number of the establishment the products came from.

86. It has been pointed out more than once already in this report that end product inspection provides poor assurance of the safety and quality of a batch. This is true for pre-shipment inspection as it is for inspection at entry into the importing country, but it is the procedure generally adopted by inspectorates in exporting countries. There is a role for pre-shipment inspection, but only as confirmation that quality assurance during production has been effective. The tests carried out on the consignment should be appropriate to the nature of the product. Raw products should be subjected to an examination for weight and presentation, presence of defects and foreign matter and to a sensory examination in the raw and cooked states. It should be noted that Codex Alimentarius standards for fishery products are being revised to take out many criteria for what is regarded as commercial quality, and to emphasise sensory evaluation for fitness for consumption[**]. Microbiological tests provide confirmation, or not, that good hygiene and sanitation have prevailed during production, but they but should be considered as part of a monitoring programme, not as a the sole means of preventing unsafe products from being exported. The micobiological tests carried out should be appropriate to hazards and risks of the product being tested. There is little justification for testing for

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[*] Ministry of Agriculture, Fisheries and Food (1991). Food Safety Act 1990. Code of Practice No. 9. Food Hygiene Inspections. HMSO, London, U K.

[**] Codex Alimentarius Commission (1992). Report of the Twentieth Session of the Codex Committee on Fish and Fishery Products, Bergen, Norway, 1-5 June, 1992. ALINORM 93/18. FAO, Rome, Italy.

food poisoning organisms products which will be cooked before consumption; there is for cooked products.

Codes of practice, standards and operating manuals

87. It is necessary for the service to issue various documents to inform the processing industry what is required of it. The most important of these are codes of practice. Codes of practice are descriptions of good manufacturing practices for the manufacture of products. There should be basic codes for the design and construction of premises, including landing sites and markets, and for sanitation and hygiene in handling, processing and storage of fishery products. There could then be separate codes for the various operations and processes in place for the manufacture of products. Compliance with the codes would be a necessary requirement for registration of an establishment.

88. An important objective of a fish inspection service is to ensure that products comply with national regulations and, in the case of exported products, the import regulations of importing countries. The regulations are directed towards ensuring that the products are wholesome, fit to eat, and correctly labelled. They do not usually include requirements that products are otherwise acceptable to consumers; this is considered a matter for market forces. However it might be government policy to ensure that exported products meet certain commercial quality standards as part of a policy to ensure the good reputation of products from the country. In the case of fishery products this could cover aspects like freshness and freedom from off flavours above the minimum required by food control regulations, size grading, presentation, and freedom from blemishes and defects of workmanship. If a country wishes to wishes to adopt such a policy it would be natural for the fishery inspection service to draw up the standards, and enforce compliance with them. Examples of standards which have international recognition are those currently issued by Codex Alimentarius and the grade standards issued by the US Department of Commerce. A number of developing countries have also drawn up national standards for fishery products.

89. A fish inspection service should produce a manual of operating practices. This is a compilation of instructions and guidance for inspectors and other staff in the service, and of background reference material. It is intended for staff of the service and a major objective of the manual is to ensure consistent standards of inspection practices throughout the service. This is particularly important in a large service which might have units widely dispersed throughout the country. The manual should contain copies of the regulations and ordinances which govern the duties and powers of inspectors, codes of practice and standards, detailed instructions on how premises are to be inspected and the criteria for approval or not, and detailed instructions on the inspection, including sampling for analytical testing, and certification of consignments. The service should also have an analytical manual describing procedures for the testing of products.

Other activities

90. Apart from regulatory functions a fishery inspection service should undertake other activities concerned with quality assurance. It should undertake an advisory role and provide training. Companies should study

codes of practice and seek to comply with them before applying for approval, but aspects might have to be explained by the inspectorate. It is not sufficient to refuse approval of an establishment or process without giving the reasons why and advising the company on how to comply. The service could run training courses for personnel in the industry at various levels - basic hygiene and sanitation for processing workers, quality assurance for managers, analytical procedures for quality controllers, for example. Training courses for managers and technical staff should emphasise HACCP principles for the manufacture of safe products. This training function should not be limited to companies in the export trade.

Facilities

91. The main operating arm of the service will be the inspectorate, the group of men and women who inspect and approve or certificate premises, processes and products. They must have adequate resources to carry out their tasks efficiently and effectively. For a start they should have adequate secretarial and clerical assistance to cope with the inevitable paper work that is associated with any regulatory function. The service will have to respond efficiently to various requests and demands from outside as well as from within the country, and will need good communication facilities like telephones and facsimile machines. Even a small fishery inspection service should have computers to store all the information it will collect, and in a large service these computer systems might be linked so that information can be shared amongst regional offices.

92. The service will require laboratory facilities. The least it should have are facilities for physical and sensory testing of products. Where canned products are involved in the inspection programme it will be necessary to have equipment for seam inspection. The facilities need not be elaborate and it might cost in the order of a few thousand US dollars to set up a laboratory in an existing building. The FAO guidelines for a fishery products quality control laboratory[*] which gives advice on design, construction and equipment is both out of date and out of print, but a paper[**] presented to the 20th, 1992, session of the Codex Committee on Fish and Fishery Products has guidelines for facilities and procedures required for sensory analysis of fishery products in the context of fish inspection.

93. Facilities for microbiological and chemical analyses are more expensive than those for physical and sensory evaluation both to provide and to support. It will cost several tens of thousands if not hundreds of thousands of US dollars to provide analytical facilities for detection and measurement of bacteria of public health significance. In a large inspection service these facilities will have to be replicated on a regional basis. The consultant has recommended elsewhere in this report that a fishery inspection service should have its own laboratory

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[*] FAO (1971). A Model Fishery Products Quality Control Laboratory, FAO Fisheries Technical Paper No. 107. FAO, Rome, Italy.

[**] Codex Alimentarius Commission (1992). Review of Inspection Procedures (Sensoric Evaluation) for Fish and Shellfish. Paper presented to the Twentieth Session of the Codex Committee on Fish and Fishery Products, Bergen, 1-5 June 1992, CX/FFP 92/14. FAO, Rome, Italy.

facilities, but in a country with a small export trade the capital cost of establishing a microbiological laboratory might not be justified. The service will then have to come to some arrangement with another government institution or, as is the case in some countries, contract the work out to private laboratories. The service should negotiate some guarantees on ability to provide a service and on the reliability of the results.

94. There is little need for chemical analyses in quality control in fish processing, but there could be in official inspection. So far as safety is concerned there might be a need to measure histamine content in scombroids and clupeids - maximum limits are laid down in the EEC Directive and in regulations in force in many countries. Also there might be a need to check on some additives like sulphites which are often used in shrimp processing and for which maximum limits of residues are prescribed. These are fairly simple tests and do not need laboratory facilities or equipment which is not usually found in chemical laboratories. Testing for contaminants and residues like heavy metals and pesticides is a specialist branch of analytical chemistry and it is unlikely a fish inspection service would wish to set up a laboratory for these analyses. Regulations in importing countries specify maximum limits to contaminants in fishery products, but it is not usual for imported batches to be routinely tested. Officials in importing countries are usually satisfied with a certificate to the effect that fish from the waters from which the consignment originated were within the specified limits. Of course the assurance must be capable of being backed up with data if necessary, but this data will probably be available as a result of general monitoring of contaminants in the marine environment and need not be provided specifically by a fish inspection service.

Selection, training and management of staff

95. The majority of the staff of a fish inspection service will be inspectors. They must have a knowledge of fish processing and of public health as it applies to food, but this is not the sort of combination that is taught in schools and colleges. Food scientists are a group which will have had some tuition in these fields during their training, but not to a sufficient depth for fish inspection. Senior staff in the inspectorate should include a mix of people with professional qualifications in subjects like microbiology, particularly food microbiology, public health, and food science. They can learn from each other in order to develop the required expertise in fish inspection. Otherwise inspectors should be recruited from high school graduates with qualifications in science subjects. The inspectorate should try to recruit some people who have worked in the fish processing industry for both senior and junior posts. Inspectors should not be recruited only on the basis of their scientific qualifications - ability to get on with people and strength of character are important attributes. Inspectors must be able to meet people, perhaps in senior positions in companies, discuss technical matters with them, and make impartial decisions on approval and certification in the face of pressure or the promise of reward by the company concerned.

96. Most of the training, certainly the practical training, will have to be carried out 'in house'. It is a common practice among inspectorates for new staff to learn on the job in the company of experienced inspectors. There is no doubt that this is the only realistic way of learning the practicalities, but a service should try to bring new recruits together for formal tuition and training. There should be at least an induction course

for new entrants at which the objectives and responsibilities of the fish inspection service, and the duties and powers of inspectors are explained. Centralised instruction on procedures will ensure uniform application throughout the service. Some relevant background courses might be available in colleges, for example, basic food microbiology, hygiene and sanitation in food production.

97. Assistance from outside the country might be needed where an inspection service is being newly established or is being expanded or revised from a simple system. There are many textbooks on safety of foods and on hygiene and sanitation in food processing, and there are various publications and articles specifically on safety of fishery products. More recently several books on HACCP have been published, and articles on HACCP in fish processing have appeared. Codex Alimentarius have issued several codes of practice for the preparation of fishery products and FAO have published several texts on aspects of fish handling, processing and marketing. Staff in inspectorates could therefor learn a lot from publications. Theoretical knowledge like this is indispensable, (indeed 'keeping up with the literature' should not be neglected even by a well established inspectorate), but a newly formed inspectorate would benefit from guidance on application of this knowledge from staff of established inspectorates. This could be achieved by staff of established systems visiting countries setting up a system as consultants, or by staff of the new inspectorate visiting, and preferably working in, established inspectorates. This has already happened through bilateral and international aid, but given the recent pressures by importing countries for inspection services to be more effective in control of safety of fishery products, there is undoubtedly a need for expansion of this type of aid.

VII. REQUIREMENTS FOR QUALITY ASSURANCE IN THE PROCESSING INDUSTRY

98. It has already been stated to in this report, but there is no harm in repeating it, that primary responsibility for safety and quality of a product rests with the manufacturer. Quality assurance requires continuous surveillance and control over raw materials, and over the handling, processing and storage of the products. Officials can regulate the conditions under which products are handled, stored and processed, but they are not in continuous control. (Some official inspection systems, both in developed and developing countries, allow for inspectors to be present all the time in processing plants, but these systems are uncommon.) Public health officials realise this and are more and more requiring processors to take more responsibility for ensuring safety and quality of food products. This principle can be seen in the EEC Directive where it is required that 'persons responsible for establishments take all necessary measures so that at all stages of the production of fishery products, the specifications of this Directive are complied with.'.

99. It is quite clear from this requirement that the Commission puts the burden of making safe products on the management of the establishments, and this attitude has been, or is being, adopted by officials in many other countries including those which are major importers of fishery products. It has to be accepted that a large proportion of the processing industry in many developing country is unlikely at the present time to be able to comply with the requirements of the EEC Directive, or of the requirements

that other importing countries might apply under MOU's. It is the consultant's belief that overall more additional resources will be needed in the commercial sector in developing countries in order to improve handling, processing and storage practices to meet the standards required by importing countries than will be required to enhance and improve the services of official inspection services. Investment will be required in physical resources like buildings and equipment, and in human resources like management and technological skills.

Requirements for establishments

Siting and services

100. The first thing an inspector will consider when visiting a processing plant for purposes of approval is the siting of the plant. The buildings must not be cramped and it must be possible to keep the suroundings clean and tidy and free of rubbish. The premises must not be situated near any deposits of rubbish or offal that could attract insects or vermin. The site must be well drained and not liable to flooding during heavy rains. Fish processing plants are sometimes built on industrial sites, but this is not advisable because a food processing plant must not be liable to contamination by dust or fumes from industrial processes.

101. In the consultant's experience, processing plants in developing countries have been able to meet these requirements without too much difficulty. Where problems have arisen is when a plant has expanded to crowd the space; the business has started in a modest way, but success has necessitated expansion of the premises. Inspectors should not approve an establishment which is so crowded on the site that it is not possible to keep the surroundings in a sanitary manner. The company will have to limit its operations or more to a larger site.

102. A major factor in determining the location of an establishment, and one that will be taken into consideration by inspectors is the provision of public services - water, sewerage, and electricity. All of them, singly and in combination often pose problems for fish processing in developing countries. Their provision is usually not a problem if the plant is in an urban area, other than vagaries of public supplies generally, but fish processing plants are often sited in remote areas. There is often a dilemma in locating a processing plant. It is frequently the case in developing countries that the fish catching industry is extensive in nature, that is carried out by small vessels landing their catches at many small sites along a coastline. Catches can be collected and brought to a plant in a nearby town, but fish, particularly shrimps which make such an important contribution to exports form developing countries, are very perishable and are damaged by the transfers involved in collecting and distributing them, and by the journey over possibly rough roads.

103. Moving the plant to the fishing areas is more conducive to better quality raw materials, but that brings other problems. Electricity might not be too big a problem and even if there is not a reliable public supply, the company can install generators. Sewage and effluent can usually be disposed of without too much problem at a coastal site, though care has to be exercised with regard to the siting of the outfall pipe. The limiting factor for a fish processing site in a remote area is often the water supply. Fish processing is quite greedy in its demands for water and public

water supplies in a rural area might not be adequate for the needs of the local population, never might the demands of a fish processing plant. It is not uncommon to find that fish processing plant outside of urban areas have their own water supplies from boreholes or from surface water stored in simple dams. Food inspectors look on such water supplies with considerable suspicion; there is a long history of outbreaks of food borne illnesses which can be traced back to contaminated water supplies. An inspectorate would require that the water be treated to ensure its safety and would require that the effectiveness of treatment be frequently monitored by the company[*]. An establishment using raw water or with ineffective quality assurance of the water used in the plant would certainly not be approved by inspectors of the EEC Commission or by outside inspectors operating under an MOU agreement.

Design and construction

104. It is a requirement of fish processing plants that they be designed for hygienic processing of the fish. An important consideration is that handling and storage of raw material must be separated from handling and storage of processed or partially processed products. This is of prime importance in establishments making cooked products which are intended to be consumed without any further cooking. Separation of processes also means that foods other than fish must not be processed in the same plant as fishery products. Facilities for the staff such as toilets, changing rooms and rest areas also must be separated from processing areas.

105. Unfortunately many establishments in developing countries do not meet these design requirements. There is a variety of faults and of reasons for them. The buildings might not have been intended as a fish processing plant in the first place and the conversion, if any, has not been carried out properly. They might have been intended as a fish processing plant, but have been badly designed. The buildings might have been added to as the business expanded without sufficient thought going into the design. Sometimes poor design arises from an effort to reduce costs, but mostly it comes from lack of knowledge on the part of the management of the company when briefing the builders or architects. It is essentially a design problem; the extra costs of installing at the consruction stage the required walls and partitions needed to separate areas is not large. Facilities for staff are often skimped so there are inadequate toilets and washing facilities. It is a prime requirement in a food factory that workers must be scrupulously clean in their habits and the company must provide the facilities for them to be so. Staff must not consume food or drink in working areas or smoke there, but the company might not provide rest facilities elsewhere. The consultant has been in one shrimp processing plant where a corner of the processing area was partitioned off with flimsy cardboard screens to make living quarters.

106. Fish processing premises must be constructed so as to allow efficient cleaning and for keeping the premises in a sanitary condition. Surfaces - floors, walls, ceilings - must be smooth and easily cleaned. Floors must be hard wearing and sloped to allow water to run off to drains. Drains must be constructed so that they can easily be cleaned, and be fitted with traps to

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[*] Blackwood, C.M. (1978). Water in Fish Processing Plants. Fisheries Technical Paper No. 174. FAO, Rome, Italy.

collect solid debris. As far as possible walls should be free of projections so that they can be easily cleaned; pipework and cables should be chased into the walls or be boxed in.

107. A big problem in building factories in tropical countries is providing ventilation and it is common for buildings to have pierced walls and to have large vents. A food processing plant though should be enclosed to prevent access by flies and vermin. All too often fish processing plants in developing countries do not comply with this requirement either because of deficiencies of design and construction or of maintenance and use. Openings should be covered with fine mesh to prevent flies getting in, but too often these screens are missing or torn. Doors and vents are left open.

108. Incorporating these requirements in a new building is not too expensive and can be borne by a company in the export trade, but correcting deficiencies in design and construction of existing premises in order to obtain approved status for export of fishery products can be very costly. Walls might have to constructed or demolished, floors relaid, false ceiling put in, services re-routed and encased, existing walls lined with impervious materials, artificial ventilation and perhaps air conditioning installed, and washrooms and changing rooms constructed for the staff. The costs of converting existing buildings might well be more than the costs of buiding a new one. In a number of developing countries a high proportion of the present establishments will not comply with the requirements of the EEC directive as specified in its annex. These are minimum requirements and some inspectorates might expect higher standards. The EC Commission will allow a period for companies and inspectorates in exporting countries to adapt to the provisions of the Directive, but this period may be only 5 years or so at the most. This is not very long considering the time needed for planning, design, and construction or refurbishment of premises.

Equipment

109. All equipment and machinery used in fish processing must be capable of being maintained in a sanitary condition. Essentially what this means is that it must be constructed of stainless steel and plastics and must be designed so that it can be thoroughly cleaned. There should be no problem with major items of processing machine like filleting and skinning machines, size graders, shrimp peelers and cookers as these will be almost certainly be bought in from developed countries and the equipment will have been designed to comply with requirements in force there.

110. Smaller items like processing tables and storage containers must also be constructed from stainless steel and plastics. Wooden tables, so commonly used in plants in developing countries, even if topped with metal or plastic, are not allowed in approved fish processing plants. They are impossible to keep in a sanitary condition even if painted. Sometimes tables and supporting structures are constructed from mild steel. These corrode in the wet and slightly salty surroundings of a fish processing plant and again would not be permitted in approved premises. Stainless steel is costly and more difficult to work than aluminium and steel, but it seems to be available in developing countries as are the skills for working it. The consultant has seen in many developing countries excellent examples of stainless steel work tables and fittings manufactured locally. Though equipment and fittings constructed to the standards required for approved premises are more expensive than traditional products, their durability and

low maintenance costs means that when amortised over the life of the equipment, they may not be more, or much more, costly than the traditional products. Plastics baskets and containers are readily available, and not expensive, in all developing countries and there is no excuse for using wooden boxes and woven, natural fibre, baskets.

Facilities

111. The bulk supply of water to processing premises has been discussed earlier in this report. Within the plant there must be adequate supplies of water at sufficient pressure for hosing down equipment, floors and walls. Water in contact with products must be of potable quality, that is fit for drinking. The bulk supply to the premises should be of this quality, but even if it is mains supply it is recommended that it be further chlorinated in the factory - public water supplies are usually chlorinated, but to just a very slight excess of free chlorine otherwise there are complaints about its drinking quality. Hypochlorites are very cheap sources of chlorine and there is no excuse for not using them in processing plants. In-plant chlorination systems are strongly recommended and should be considered compulsory in approved premises where water comes from wells or surface run off or where there are any doubts at all about the public water supply.

112. There should be adequate hand washing facilities in all processing areas in addition to washing facilities provided in toilets. Hand washing stations must be situated just inside the doors of all processing area. Often fish processing plants in developing countries do not provide adequate hand washing facilities. Even if there are hand washing stations they might not be correctly placed, and not provided with soap, nailbrushes and single use towels; all compulsory in approved premises. Taps have to be of the type operated by knee or foot; uncommon, but not unknown, in plants in developing countries. Provision of hand wash facilities is considered a critical factor by inspectors in the approval of establishments, but suitable facilities are not expensive to provide.

113. The EEC Directive has no specific requirements for toilets and locker rooms; such requirements will almost certainly be covered by national food control laws. Adequate separation of toilet areas from processing areas would be considered a critical factor when considering an establishment for approval, but this is something to be considered in the design of the premises. Staff should have somewhere to relax, smoke, and consume food and drink. Smoking and consumption of food and drink is not permitted in processing areas and processing staff should leave processing areas at meal breaks.

Technology

114. The processing operations associated with the manufacture of fisheries products for export are not very sophisticated consisting mainly of gutting, filleting, skinning, and in the case of shellfish, beheading, peeling and possibly cooking. Often enough these are carried out by hand in developing countries; in developed countries with higher labour costs these operations are likely to be mechanised. Canning and freezing are the operations with more technological content. Surimi for the Japanese market is produced in a few developing countries, but otherwise added value products requiring more advanced technologies are not made. Developing countries have proved successful in adopting the technologies involved, and

do not have difficulties in making the products required by the importers. Generally an inspector is not concerned with the efficiencies, in the economic sense, of the practices in the company, but would take an interest if he, or she, felt that poor technological practices affected safety of the product.

Ice and icing

115. The cheapest type of ice in developing countries is block ice. It is made in large plants and distributed to the fish processing plants as blocks where it is crushed to small pieces before use, though some ice plants can supply ready crushed block ice. This type of ice is quite suitable for use as a cooling medium, but it does have disadvantages so far as quality control is concerned. The fish processing industry is usually not the only customer for ice and obtaining adequate supplies of ice is often a problem for companies when there are other high, and perhaps seasonal, demands for ice. The ice must be made from potable water, which preferably should have been further chlorinated. An inspector would want assurance on this. Ice might be distributed under unsanitary condition, often on an open lorry with at best only a well-used tarpaulin to cover it. Blocks are often slid along the floor during handling at the ice plant and during distribution.

116. Fish processing plants require plentiful supplies of clean ice. Fish can be kept cool in chill rooms, but fish merely placed in a chill room in a box will take long time to cool down. Contact with ice gives rapid cooling and and good manufacturing practices require that fish be mixed with ice even if it is to be held in a chill room. It is much better for a number of reasons for fish processing plants to make their own ice. Ice making plants can be supplied as compact stand alone units which just require connection to water and power supplies and are designed to be robust with little requirements for maintenance. They produce small particle ice which does not need further crushing and as the unit can be started and stopped as demand dictates there is no need of an ice store. The big advantage though so far as quality assurance is concerned is that the company has complete control over the hygiene and sanitation of ice supplies.

Freezing and frozen storage

117. An high proportion of exported fishery products are prepared in the frozen form. An inspector might not consider freezing and frozen storage to be critical steps so far as safety is concerned because by the time the product is ready for freezing it has usually been packaged and there would be little chance of further contamination during freezing and frozen storage. Poor freezing and storage practices can affect eating quality to the extent that the product will become unfit for consumption and importing countries in Directives or MOU's will lay down requirements for freezing and frozen storage.

118. It is common to see defects in freezing and frozen storage practices in companies in developing countries. The freezing equipment most commonly used are air blast freezers and plate freezers. The former work by blowing cold air over the products and can be supplied as units, but more often they are constructed on site. The consultant's experience is that those constructed on site are often poorly designed so that freezing times are

longer than recommended, and they are economically inefficient in terms of throughput and energy costs. The EEC Directive, which can be typical of what would be required by inspectors from importing countries, states that processing plants must have 'freezing equipment sufficiently powerful to achieve a rapid reduction in the temperature...'. This is not very precise, but the consultant believes that many air blast freezers he has seen would not meet a reasonable interpretation of this requirement. In many cases the performance of the air blast freezers could be improved by modifications to their design, and a closer attention to how they are used. Plate freezers work by freezing the product between hollow plates which are cooled by refrigerant flowing through them. Generally plate frezers are properly operated and maintained in the processing plants in developing countries and their operation will meet requirements of importing country regulations.

119. Official regulations of which the EEC Directive is an example require that frozen fishery products be stored below -18°C; fish technologists and many codes of practice recommend lower temperatures, nearer -30°C. Cold stores in developing countries often do not meet official requirements. Partly this is due to poor design - there are particular problems in designing cold stores for operation in the humid tropics for example - but more frequently the cause is poor standards of operation and maintenance. The EEC Directive requires that cold stores be fitted with a temperature recording device; few stores in developing countries are so equipped. Fish processing companies will probably not need to incur much capital cost in complying with the requirements of the EEC Directive and much can be done by adopting good manufacturing practices and by effective managerial control.

Canning

120. Canned products are considered a high risk product and official inspectors pay particular attention to the operations of canneries. There are well established and fully documented schemes for quality assurance of canned products which canneries in developing countries appear to follow completely. MOU's have already been negotiated with respect to canned products, and canneries are likely to be high on the list for inspection by EEC inspectors. The consultant does not see any significant problems in canneries' complying with regulations imposed by importing countries.

Management of quality assurance

A company quality assurance programme

121. There is increased pressure both from consumers and from officials for fish processors to establish effective quality assurance systems in their plants, and companies must devote both management and technical resources to meet this objective. Quality assurance is defined as all the activities and functions concerned with the attainment of quality. It is not just the technical aspects of quality control; it covers policy, administration and management as well. It means that many individuals in a company, and not just those in the QC department, make a contribution to a company's quality assurance programme. Quality assurance must be an integral part of company policy and management and there must be a systematic approach to quality assurance. There are international standards for quality assurance systems - ISO 9000 to 9004 - and though they were

developed in the engineering industry they are increasingly being adopted in the fish processing industry. It is possible for companies to get their quality assurance systems accredited as complying with an ISO standard, ISO 9002 is the appropriate one for fish processing, but accreditation does not automatically mean that products from a company are safe and of good quality. It means that the systems for this end are in place in the company; managers still have to operate the system.

122. Fish processing companies in both developed and developing countries are paying more and more attention to quality assurance programmes and introducing them into their management systems. Some companies, at least in developed countries, have achieved accreditation to ISO 9002 or its national equivalent. All companies in developing countries must take note of these developments and also move towards adopting this approach. Resources required for adopting a complete quality assurance programme are predominately managerial; little is required in the way of new physical resources.

123. A company should have a clearly defined and stated policy towards achieving and maintaining the quality of the products supplied by it, and towards the execution of this policy. The directors of the company must ensure that the proper administrative structures are in place to implement the policy, and that sufficient resources are provided. The overall responsibility for running a factory lies with the general manager who will have immediately below him, or her, other managers. It is important that the quality assurance manager should report directly to the general manager and not to the production manager. The production manager has to ensure volume of production within cost objectives and at times he will be tempted to achieve these at the expense of quality. The quality assurance manager might need to curtail production, for example if the raw material is not of the right quality, and if there is any conflict between the two managers it should be resolved at the general manager level; the production manager should not be able to overrule the QA manager.

124. It is an essential part of a quality assurance programme that details be written down so there is no doubt about what is intended. There will be a variety of documents. Some will concern administrative matters like chains of command and the responsibilities and duties of specific persons or posts. Others will be technical documents like results of HACCP exercises, codes of practice, specifications for end products and raw materials entering the processes, protocols for inspection, sampling and testing, schedules for maintenance of equipment and machinery and schedules for calibration of measuring instruments like thermometers and weighing scales. There should also be a policy for disposal of materials that does not meet specifications and for dealing for with consumer complaints.

125. Results of any tests or readings should be recorded in a systematic manner. This is a requirement of the ISO standards and it should be noted that the EEC Directive requires that results of any checks must be recorded and be available for inspection for a period of two years. This has long been a specific requirement for canned products.

Quality control

126. Quality control is defined as all the operational techniques and activities that sustain the product quality to specified requirements, and the use of such techniques and activities. Quality control is what quality

controllers do. It is an active process which monitors and if necessary modifies the production system so as to consistently achieve the required quality. Monitoring includes the measurement of properties of products entering and passing through the process to ensure that their qualities are appropriate for achieving the required quality of the end product. Quality control includes control over hygiene and sanitation of the plant and processes in order to achieve a wholesome product.

127. Effective quality control of a process requires a detailed survey of all the factors in the process that might affect the quality and the safety of the product, and of the actions required to achieve and maintain quality and safety. Detailed analysis of a process for these purpose always has been a feature of effective quality control under various headings such as quality audit, but Hazard Analysis Critical Control Point (HACCP) procedures have been developed over the last 20 years or so as a more formalised system for ensuring microbiological safety and quality of foods. The basis of the HACCP approach is the identification of the hazards associated with product and their severity, evaluation of the risks associated with the product, identification of critical points in the process where hazards can be controlled, specification of the procedures for exercising control over the hazard, and establishment of procedures for monitoring the effectiveness of the control. HACCP has been widely adopted in the food industry as an important component of quality assurance programmes and has also been taken up by regulatory authorities as basis for control of safety of processed foods.

128. The main thrust of HACCP is to reduce the risk of food poisoning, but it also has as an aim prevention of spoilage by reduction of overall bacterial contamination and growth. For a very perishable commodity like fish this is an important consideration. HACCP is not immediately concerned with consumer satisfaction in the sense of ensuring that the product is pleasant to eat, (other than ensuring it is not grossly spoiled), but the principles and practices of HACCP can be extended to other factors that are relevant to commercial quality.

129. All the conclusions and procedures resulting from HACCP exercises should be compiled into codes of practice and protocols for quality control. Codes of practice should be read not just by quality controllers and managers; relevant, and perhaps simplified, but accurate and adequate, extracts should be made available to process workers. Of particular importance should be a general code of practice for hygiene and sanitation for the factory as a whole.

130. The thrust of quality control should be towards selection of materials going into a process and control of the processing. The principle is that by starting with good quality raw materials and using good manufacturing processes the end product should be of good quality. Emphasis must be placed on inspection of raw materials and of products during processing rather than on inspection of end products. It is too late to find as the result of end product inspection that the product does not meet specifications. There is a role for end product testing, but merely as a final, overall check on the effectiveness of process control. Quality controllers must be seen on the processing floor, not just in the laboratory.

131. A company should have a laboratory in the factory, but again the emphasis should be on testing raw material and samples taken from the

processing line. On line inspection with perhaps the necessity to institute some action on the basis of the results does not permit of chemical or microbiological tests. Testing must be by sight, smell and taste, that is by sensory methods. These are fast, direct and, apart from evaluation of cooked samples, non destructive. Chemical and microbiological tests have a role in the inspection of finished products. Apart from their use already referred to in monitoring process control, they are used to check that specific standards are being met, for example sulphites in shrimp, and the presence of, or numbers of, specific bacteria. However the resources of a bacteriological laboratory are better directed towards monitoring the bacteriological status of the plant and equipment. Sources of bacterial contamination should be looked for and eliminated rather than looking for the consequences in the end product.

Selection, training and management of personnel

132. The company should have a policy of involving all staff in the quality assurance programme, from senior management to humblest worker. Managers and executives should be fully conversant with the company policy towards quality and of the customers' requirements for quality in products they buy from the company. They must support and cooperate fully in the execution of the company's policy.

133. The role of process workers in the quality control programme is of crucial importance. It must not be overlooked and must be given due recognition. Every process worker is responsible for the quality assurance of his or her own particular part in the process; the QC staff can only monitor that the job is being carried out according to specifications. It is very important then for the success of a QA programme that the staff are motivated to meet the standards required of them and are disciplined if they do not. Obviously staff must be given the facilities to achieve the standards required. They must be provided with appropriate protective clothing, and this report has already discussed the need to provide facilities for maintaining high standards of personal cleanliness.

134. When staff are recruited they should be made aware of the special responsibilities for hygiene demanded of workers in food factories and the seriousness of any breaches of hygienic and sanitary codes of practice. It is commonly required by law in developed countries, and common also in developing countries for that matter, for potential workers in food premises to produce a medical certificate to the effect that they are not suffering from any condition that should debar them for working with food. The requirement is referred to in the EEC Directive for example. Newly recruited staff should receive specific instruction on the tasks they are to carry out and particularly on any operations that affect quality. They must of course be instructed on the importance of hygiene and sanitation. The company should seek the assistance of local or national public health services on this matter as they might be able to provide teaching material and teachers. These authorities often have excellent posters and other display material concerning hygiene and sanitation. A fisheries inspection service could also help. Display material should be posted in wash rooms and rest areas.