

**Assessment of the fisheries infrastructure and capacity
building needs in the fish supply chain and fish inspection
system in Barbados**

Final Report

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This report was prepared during the course of the project identified on the title page. The conclusions and recommendations given in this report were those considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project.

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SUMMARY

This project was carried out to make an assessment of the needs for improved fisheries infrastructure and the capacity building needs in the fish supply chain and fish inspection system in Barbados to meet international standards.

The assessment was done over two missions. The first mission reviewed the infrastructure of vessels, fish landing sites, markets and processing establishments and also the current fish handling practices in the fish supply chain in Barbados. The review of the fishing boats included observations of day boats or launches, ice boats and long liners. Observations were also made at Bridgetown Public Market and landing area, Oistins Berinda Cox Fish jetty and market and several rural small scale landing sites and public markets. The fish processing establishments visited included seven different operators dealing with a range of fish species important for Barbados. The observations indicated that these establishments were at different levels of compliance as regards meeting international market requirements. The fish inspection system in Barbados was also reviewed, including legislative provisions, institutional responsibilities and laboratory services available and actions required for harmonisation with international market requirements were identified. References to relevant sections of the Codex Code of Practice for Fish and Fishery products are provided as the basis for the improvements suggested.

The second mission built on the observations and areas of improvement identified during the first mission and discussed these issues in a stakeholder needs assessment workshop, which facilitated analysis of strengths, weaknesses, opportunities and threats (SWOT analysis) in different segments of the fish supply chain. The discussions during the workshop and, later, with the representatives of the relevant Ministries led to the development of the recommendations in this report, covering (a) policy and regulations regarding fish inspection and quality assurance, (b) fish inspection systems to meet international requirements, (c) government analytical services that perform analyses required by fish inspection services, and (d) improving the capacity of the fish supply chain actors to implement GHP, HACCP and traceability. The report includes suggested activities that could contribute to the required outcomes, presented in a simplified logical framework.

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ABBREVIATIONS

AHFC	Agricultural Health and Food Control
BNSI	Barbados National Standards Institution
CAC	Codex Alimentarius Commission
CVO	Chief Veterinary Officer
EHO	Environmental Health Officer
EC	European Commission
FAO	Food and Agriculture Organization of the United Nations
GHP	Good Hygiene Practice
GAS	Government Analytical Service
HACCP	Hazard Analysis and Critical Control Points
ISO	International Organisation for Standardisation
MCT	Ministry of Commerce and Trade
MoA	Ministry of Agriculture, Food, Fisheries, and Water Resource Management
MoH	Ministry of Health
NAHFCA	National Agricultural Health and Food Control Agency
OIE	World Organization for Animal Health (<i>Office International des Épizooties</i>)
SPS	Sanitary and Phytosanitary
SOP	Standard Operating Procedure
SSOP	Sanitation Standard Operating Procedure
SWOT	Strengths, Weaknesses, Opportunities and Threats (analysis)
WHO	World Health Organization

BACKGROUND

Barbados' Strategic Plan 2005-2025 refers to safeguarding Food and Nutrition Security by rationalizing and regulating the fishing fleet and market infrastructure to ensure Sanitary and Phyto-Sanitary (SPS) compliance and adherence to Hazard Analysis Critical Control Point (HACCP) principles as well as to enhance the agricultural health and food safety programme.

In addition, the Ministry of Agriculture's Medium Term Development Strategy 2008-2013 aims to protect and reduce the risk to agricultural health, and to facilitate food safety through the provision of the requisite infrastructure and services for inspection, monitoring and testing and the attainment of minimum (international) standards for fish and fishery products.

Barbadians consume 5 000 to 6 000 tonnes of fish annually, of which 3 000 tonnes are landed by Barbadian vessels. Fish is seen by Barbadians as a source of protein and it is a commodity which Barbadians in the United States and the United Kingdom demand. It is estimated that Barbados could export approximately 500 tonnes annually to the European Union. The industry provides work for 6 000 persons either as fishermen, fish retailers and/or fish processors.

In 2009, following a request by the Barbados Government to export fish and fishery products to the European Union, the Food and Veterinary Office of the European Commission conducted a mission to Barbados. The aim of the mission was to evaluate whether the system in place for fishery products was equivalent to those required by the European Union and hence would allow fish and fishery products to be exported to the European Union. The mission concluded that the system currently in place does not guarantee that fish and fishery products are produced with a standard that is equivalent to those required by the European Union. The mission cited the lack of the requisite legislation, the need for the implementation and maintenance of HACCP based programmes from fishing vessels, through landing sites, to markets and processing establishments, the requirement for the establishment of monitoring programmes for chemical and microbiological contaminants, the provision of adequate laboratory facilities and an adequate enforcement system including the need for training of all staff performing official controls.

The Ministry of Agriculture's Fisheries Division, the Markets Division as well as the Environmental Health Department of the Ministry of Health all play a role in the official control of fish and fishery products. There is little formal collaboration among the various entities and hence no comprehensive fish inspection programme detailing the role of each competent authority along the boat to throat continuum. As a result there are overlaps and gaps in the system.

The Ministry of Agriculture has embarked on a project which seeks to enhance the agricultural health and food control system in Barbados. The overall aim of the project is to contribute to Barbados' improved public health and increased quality of agricultural and fishery products by raising agricultural health and food safety standards to international level. Although the project has identified similar weaknesses with respect to fisheries sector as those identified by the European Union officials, there is a need to undertake a comprehensive assessment of the Fish and Fishery sector in Barbados with respect to (i) the fisheries infrastructure, namely the landing sites, fishing boats and markets; and (ii) the fish inspection system complete with a detailing of the weaknesses and gaps in the current system.

An assessment is required to assist the Government of Barbados in clearly defining the requirements necessary to effectively improve the fisheries infrastructure (boats, landing sites and markets) and fish inspection system (from boat to throat) to meet international standards.

At the request of the Government of Barbados, this TCP Facility was initiated to make this assessment to cover the areas requiring FAO support. Mr. Gerard Roessink, International Consultant, made field visits in early 2012 (Annex 1). A second mission by Dr Karunasagar Iddya, Senior Fishery Industry Officer and Dr John Ryder, Fishery Industry Officer, both with FAO Fisheries and Aquaculture Department in Rome was organized to follow up on this first mission and to undertake a needs assessment via a 3 day workshop (Annex 2) aimed at understanding the capacity building needs of the fish inspection system and the fish supply chain actors. This workshop was attended by 24 participants (Annex 3) from all relevant ministries and from the private sector.

This report details the combined outputs of both missions and provides recommendations resulting from the assessment.

REVIEW OF FISH SUPPLY CHAIN

The industry has the responsibility to produce foods that comply with national and, if they export, international regulations and should maintain or upgrade facilities, train personnel and implement GMP, GHP and HACCP at all stages of the supply chain. The role of the control agencies is to ensure that the producers do comply (see the next section on the Fish Inspection System)

The review of infrastructure of the supply chain and the fish handling practices along the chain was undertaken within the context of compliance with international codes of practice and guidelines as provided by the Codex Alimentarius¹. The main instruments of Codex Alimentarius as relates to this exercise are the Code of Practice for Fish and Fishery Products, CAC/RCP 52-2003 and the Code of Practice General Principles of Food Hygiene, CAC/RCP 1-1969. Reference will be made to these documents in the text.

Fishing vessels

From the perspective of compliance of fishing vessels with food hygiene guidelines and codes of practice, the Codex Code of Practice for Fish and Fishery Products² have detailed the main issues to be considered (Box 1). This review will describe the current situation with regard to the main categories of vessels used in Barbados, namely:

- Day boats or launches
- Ice boats
- Long liners

Box 1 Codex code of practice on fishing and harvesting vessel design and construction

CODE OF PRACTICE FOR FISH AND FISHERY PRODUCTS. CAC/RCP 52-2003.

3 PRE-REQUISITE PROGRAMMES

3.1 FISHING AND HARVESTING VESSEL DESIGN AND CONSTRUCTION

3.1.1 For ease of cleaning and disinfection

- Vessels should be designed and constructed to minimize sharp inside corners and projections in order to avoid dirt traps.
- Construction should facilitate ample drainage.
- A good supply of clean water or potable water at adequate pressure.

3.1.2 To minimize contamination

- All surfaces in handling areas should be non-toxic, smooth, impervious and in sound condition in order to minimize the build-up of fish slime, blood, scales and guts and to reduce the risk of physical and microbial contamination.
- Where appropriate, adequate facilities should be provided for the handling and washing of fish and shellfish and should have an adequate supply of cold potable water or clean water for that purpose.
- Adequate facilities should be provided for washing and disinfecting equipment, where appropriate.
- The intake for clean water should be located to avoid contamination.
- All plumbing and waste lines should be capable of coping with peak demand.
- Non-potable water lines should be clearly identified and separated from potable water to avoid contamination.
- Objectionable substances, which could include bilge water, smoke, fuel oil, grease, drainage and other solid or semi-solid wastes, should not contaminate the fish and shellfish.
- Where appropriate, containers for offal and waste material should be clearly identified, suitably constructed with a fitted lid and made of impervious material.
- Separate and adequate facilities should be provided to prevent the contamination of fish and shellfish and dry materials, such as packaging, by:
 - poisonous or harmful substances;
 - dry storage of materials, packaging, etc.;
 - offal and waste materials.
- Adequate hand washing and toilet facilities, isolated from the fish and shellfish handling areas, should be available where appropriate.
- Prevent the entry of birds, insects or other pests, animals and vermin, where appropriate.

3.1.3 To minimize damage to the fish, shellfish and other aquatic invertebrates

¹ www.codexalimentarius.net

² CAC/RCP 52-2003

- In handling areas, surfaces should have a minimum of sharp corners and projections.
- In boxing and shelving storage areas, the design should preclude excessive pressure being exerted on the fish and shellfish.
- Chutes and conveyors should be designed to prevent physical damage caused by long drops or crushing.
- The fishing gear and its usage should minimize damage and deterioration to the fish and shellfish.

Day boats or launches

Day boats or launches are small vessels operated by one fisherman only. They engage in day fishing which means that a limited number of hours are spent at sea and returning to the harbour after one fishing trip. Normally the fish, caught with gill-nets, is stored without ice in the back of the boat and in the open air. This type of fishing vessel does not have a shade at the rear of the vessel; only the steering wheel position has a small cover for the sun.

The design and construction is such that the fish has to be stored on the bottom of the boat. This does not facilitate the hygienic handling of the fish, since there will be cross contamination from the floor, from seabirds and from the fisherman and his equipment as he moves around on the boat.

A wooden bat is used to stun dolphinfish and other large species that have been caught with a line. This process will unavoidably cross-contaminate fish already onboard. Some fish species are gutted on board. This cannot be done in the space available without contaminating the area where fish are stored or will be stored. The fish holding facility is at the back of the boat; even if it is painted very well, this is difficult to clean and contamination from seabirds is unavoidable, as there is no cover. The absence of a cover also means that there is direct exposure to the sun, with obvious consequences for temperature issues. The cleaning materials and methods used are basic. The vessel that was visited looked clean, however, no records of cleaning exist. There are no sanitary facilities on board.

Ice boats

Ice boats are constructed of wood or fibreglass. They are managed with a crew of two and have the possibility to carry ice in a large container at the back of the vessel. On top of the ice container, which is constructed from fibreglass, is a lid through which a person can lower him/herself into the container. Ice and fish are packed in bins around the sides of the ice container; with wooden boards to create shelves so that the fish can be stacked from the bottom to the top of the container with reduced pressure on fish at the bottom.

Ice is taken on board before a fishing trip from the landing site at Bridgetown by using a hose directly from the ice machine. The middle of the ice container is left clear (called the pathway in Barbados) to allow easier handling of fish and ice into and out of the container. A bilge pump removes melt-water from the bottom of the container. The ice container and the sides of the deck are covered with a hood on many boats, though this practice is mainly seen on longliners.

Fishing trips take an average of 8 - 10 days. Fishing is carried out with two gillnets from which the fish is taken on board along the side of the boat. The crew make every attempt to avoid standing on the fish. The main target fish species is flying fish. As well as the gillnets, two handlines are used to catch dolphinfish, sharks and tuna. During fishing, the crew wears protective clothing and boots. The deck is cleaned before harvesting starts. When the catch is large (one gill net can catch up to 1 500 flying fish), it is rinsed with seawater during the packing of the fish into crates. The crates are carried to the ice container where the fish is emptied into the ice. Dolphinfish, sharks and tunas, caught with handlines, are slaughtered and gutted, one at a time at the back of the boat in a special compartment which prevents them from jumping over board. This compartment is not covered with a hood because the fishermen need the working space to handle the bigger fish. Dolphinfish are put on ice first in the pathway of the ice container and later put into the ice at the sides. After landing the fish, the ice box is cleaned by the crew or by workers hired to land the fish and clean the ice box.

The design and construction of these fishing vessels could allow for fishing and landing fish in a hygienic manner and could, in principle, meet international standards. However, at present there are some issues. Bare wood and plywood is present in many parts of the vessels - at the back boxing of the compartment where slaughtering goes on and in the ice box on the deck of some of the boats, as

examples. Bare wood and plywood is considered to be a material that cannot be easily cleaned and disinfected. If covered with non-toxic paint, wooden board can be used because then they can be cleaned easily, but it is vital that the paint layer remains intact and undamaged. However, many of the Barbadian ice boats have bare wood and plywood surfaces in evidence in the places where fish is handled or stored. The equipment used could be considered adequate to prevent contamination of the fish. However, some examples of poor practice were observed. Food for the fishermen (e.g. potatoes and drinks) was found in the ice used for the fish. In some instances, boots were dirty and clearly not cleaned. Rusty filleting knives were found and fish crates were found to be dirty just before a fishing trip. Sugar cane leaves (called cane trash or squeelers) that are used to attract flying fish were found inside the ice container. Indeed, almost every ice container that was inspected, some just cleaned, others filled with ice to go to sea, did not smell very fresh.

Cleaning materials were soap and chlorine, no cleaning documentation was evident, but the cleaning schedule was clear to the fishermen: cleaning the deck before and after fishing and cleaning and emptying the ice box after landing the fish. Some ice boats had toilet facilities on board but those who had toilets did not use them. Hand washing facilities using fresh water were present though.

Longliners

Longliners are larger than the ice boats but the design is the same, with the ice box/container that will hold the fish at the back of the vessel. Generally a crew of 3 or 4 people will operate the longliner. The fish is caught on hooks on lines hanging vertically from a horizontal line that is about 20 miles long. Frozen squid is used as bait and this is stored away from the fish holding area. The line is set in the day and pulled in at night. The fish can be up to a maximum of ten hours on the line. The best quality fish is naturally pulled in live on board. Fish hauled in dead on the line is put directly into ice; the others are pre-chilled in the pathway in the icebox. A carpet is used at the rear of the vessel to hold the fish while butchering. It remains to be seen if this carpet is easy to clean and disinfect, but it is unlikely to be an ideal surface for such a process.

The design and construction of the vessels, holding facilities, equipment and cleaning is the same as for the ice boats and the remarks to be made about the hygienic handling of the fish are also similar. The same can be said for the presence of the sanitary facilities; when they are there, they are not used.

Main landing sites with processing facilities

From the perspective of compliance of processing facilities with food hygiene guidelines and codes of practice, the Codex Code of Practice for Fish and Fishery Products³ have detailed the main issues to be considered (Box 2 and Box 3). Box 4 also provides details of the requirements for retail areas (see next section).

Box 2 Codex code of practice on facility design and construction

CODE OF PRACTICE FOR FISH AND FISHERY PRODUCTS. CAC/RCP 52-2003.

Facility Any premises where fish and fishery products are prepared, processed, chilled, frozen, packaged or stored. For the purposes of this Code, premises also include vessels.

3 PRE-REQUISITE PROGRAMMES (continued)

3.2 FACILITY DESIGN AND CONSTRUCTION

The facility should include a product flow-through pattern that is designed to prevent potential sources of contamination, minimize process delays (which could result in further reduction in essential quality), and prevent cross-contamination of finished product from raw materials. Fish, shellfish and other aquatic invertebrates are highly perishable foods and should be handled carefully and chilled without undue delay. Therefore, the facility should be designed to facilitate rapid processing and subsequent storage.

The design and construction of a facility should take into consideration the following:

³ CAC/RCP 52-2003

3.2.1 For ease of cleaning and disinfection

- The surfaces of walls, partitions and floors should be made of impervious, non-toxic materials.
- All surfaces with which fish, shellfish and their products might come into contact should be of corrosion resistant, impervious material that is light-coloured, smooth and easily cleanable.
- Walls and partitions should have a smooth surface up to a height appropriate to the operation.
- Floors should be constructed to allow adequate drainage.
- Ceilings and overhead fixtures should be constructed and finished to minimize the build-up of dirt and condensation, and the shedding of particles.
- Windows should be constructed to minimize the build-up of dirt and, where necessary, be fitted with removable and cleanable insect-proof screens. Where necessary, windows should be fixed.
- Doors should have smooth, non-absorbent surfaces.
- Joints between floors and walls should be constructed for ease of cleaning (round joints).

3.2.2 To minimize contamination

- Facility layout should be designed to minimize cross-contamination and may be accomplished by physical or time separation.
- All surfaces in handling areas should be non-toxic, smooth, impervious and in sound condition in order to minimize the build-up of fish slime, blood, scales and guts and to reduce the risk of physical contamination.
- Working surfaces that come into direct contact with fish, shellfish and their products should be in sound condition, durable and easy to maintain. They should be made of smooth, non-absorbent and non-toxic materials, and inert to fish, shellfish and their products, detergents and disinfectants under normal operating conditions.
- Adequate facilities should be provided for the handling and washing of products and should have an adequate supply of cold potable water for that purpose.
- Suitable and adequate facilities should be provided for storage and/or production of ice.
- Ceiling lights should be covered or otherwise suitably protected to prevent contamination by glass or other materials.
- Ventilation should be sufficient to remove excess steam, smoke and objectionable odours, and cross contamination through aerosols should be avoided.
- Adequate facilities should be provided for washing and disinfecting equipment, where appropriate.
- Non-potable water lines should be clearly identified and separated from potable water to avoid contamination.
- All plumbing and waste lines should be capable of coping with peak demands.
- Accumulation of solid, semi-solid or liquid wastes should be minimized to prevent contamination.
- Where appropriate, containers for offal and waste material should be clearly identified, suitably constructed with a fitted lid and made of impervious material.
- Separate and adequate facilities should be provided in order to prevent contamination by:
 - poisonous or harmful substances;
 - dry storage of materials, packaging, etc.;
 - offal and waste materials.
- Adequate hand washing and toilet facilities, isolated from handling area, should be available.
- Prevent the entry of birds, insects or other pests and animals.
- Water supply lines should be fitted with back-flow devices, where appropriate.

3.2.3 To provide adequate lighting

- Adequate lighting should be provided to all work surfaces.

Box 3 Codex code of practice on other prerequisite programmes and general considerations

CODE OF PRACTICE FOR FISH AND FISHERY PRODUCTS. CAC/RCP 52-2003

3 PRE-REQUISITE PROGRAMMES (continued)

3.3 DESIGN AND CONSTRUCTION OF EQUIPMENT AND UTENSILS

- For ease of cleaning and disinfection
- To minimize contamination
- To minimize damage

3.4 HYGIENE CONTROL PROGRAMME

- A permanent cleaning and disinfection schedule
- Designation of personnel for cleaning
- Maintenance of premises, equipment and utensils
- Pest control systems
- Supply of water, ice and steam
 - Water
 - Ice
 - Steam
- Waste Management

3.5 PERSONAL HYGIENE AND HEALTH

- Facilities and equipment
- Personnel hygiene

3.6 TRANSPORTATION

3.7 PRODUCT TRACING AND RECALL PROCEDURES

3.8 TRAINING

4 GENERAL CONSIDERATIONS

4.1 TIME AND TEMPERATURE CONTROL

- Minimize deterioration – time
- Minimize deterioration – temperature control

4.2 MINIMIZE DETERIORATION – HANDLING

Bridgetown Public Market

Bridgetown Public Market, owned by the Government and managed by the Markets Division of the Ministry of Agriculture, consists of a landing site for all types of fishing vessels, a processing area and a market open to the public.

The fish landed here is weighed and species and catch are registered by officers of the Markets Division. The landing site has ice production facilities and ice can be bought for a nominal fee. The processing area consists of processing rooms where individual fish processors can scale, gut, fillet and cut the fish. Changing rooms and toilet facilities are available. A cold store is also available. On the road side of the buildings, there are covered market stalls where vendors can display their fish in cabinets and cut and sell the fish to the general public. Facilities are available to selected Barbadians who have to pay a small fee of BBD 0.75 per day.

Landing fish at Bridgetown

The design and layout of the quayside (jetty) could allow for a rapid and hygienic movement of the fish. However, that is not the case at present. Firstly, fish is unloaded with many people standing both on the ship and the dock, with a resulting unnecessary risk of contaminating the fish. Although there is a small area available to unload under a roof (protection from the sun and preventing contamination from sea birds) this is not used in the majority of cases, as this covered area was designed specifically for unloading fish from longliners that was destined for export.

One landing was observed during the visit to the Bridgetown Public Market quays, and this was from ice boats which were constructed without a roof over the ice box. Landing was carried out in the late morning at high tropical temperatures. Fish was taken out of the ice box by a worker without protective clothing, although he wore clean gloves with which he handled the fish - small flying fish were in a basket and bigger fish, like dolphinfish were put on the rear of the deck (described in more detail below). No organoleptic or other checks from a fish or food inspector were taking place at the landing site at the time of observation. Temperatures measured immediately after unloading indicated that onboard the fish was kept well on ice. The holding temperature was at the temperature of melting ice, 0 °C.

Flying fish

Crates are filled with (smaller) flying fish from the ice box and handed to a fish unloader on the dock. Quite frequently the crates are put on the dirty floor. The flying fish are put in a large container without ice and after all the flying fish from catch are collected, the counting begins; flying fish is recorded in numbers, not in weight. Before the counting process is finished the temperature of the fish that has already been unloaded has risen to 15 °C. This is the first breach in the cold chain. Temperatures recorded immediately after unloading were very low, indicating that the fish prior to landing had the temperature of melting ice, 0°C. The flying fish destined to be sold at Bridgetown Public Market are transported to the processing area where they are scaled, gutted and filleted. At the processing stage potable water is available, although the temperature is around 28 °C. All the fish that were observed being processed had core temperatures of 21 °C and higher. After processing, the fish are placed in the market in display cabinets, put on ice (not in ice) allowing the temperatures to

remain high. Flying fish to be processed elsewhere is put in insulated containers with ice and transported in refrigerated trucks or open vehicles. The latter is an example of good practice.

Dolphinfish, sharks, tunas

The larger fish are taken out of the ice box and put on top of the ice box on the vessel. From there they are taken by another unloader and put in supermarket trolleys to be pushed to the weighing scales to be weighed and registered. This often takes such a long time that temperatures recorded were as high as 22 °C. At this temperature, histamine formation in dolphinfish and tunas can take place readily. Temperatures recorded immediately after unloading were very low, indicating that the fish prior to landing had the temperature of melting ice, 0 °C. The use of supermarket trolleys is not good practice as the fish are not covered, are not protected from damage by the trolley itself, cannot be kept in ice due to the design of the trolleys and are at risk from cross contamination from the trolley as they are difficult to keep clean and disinfected.

The weighing takes place with ordinary newspaper between the fish to prevent the fish from falling off the scale. This presents the hazard of ink entering into the fish. The scale is not cleaned between batches posing a cross contamination risk. After weighing the fish is taken to the market stalls for further processing in the same supermarket trolleys without ice (or for storage in insulated containers in ice, be it somewhat delayed). During filleting the temperature is not reduced quickly, therefore further histamine formation remains a risk.

Processing facility

At the Bridgetown Public Market there are two rooms where the processing of fish takes place. These are large rooms with processing tables provided. There were some problems noted in these processing areas, mostly of a procedural nature. There were no hand wash facilities upon entering the rooms and the changing rooms and toilets were in a poor state of maintenance and cleanliness. In the processing room, fish scales, intestines and bones were not always physically separated from the fillets, and there was fish offal present. Indeed, there was no special place for storing fish waste after collection from processing rooms. This will attract rats, birds and other pests and animals. Fish waste is collected to be taken to the landfill.

Wooden cutting boards were used as standard. No cleaning schedule or water testing scheme could be produced, suggesting that cleaning takes place irregularly and that the water in the processing facility is not tested there. However documents were produced indicating that samples of water and ice were tested. Most fish processors were wearing jewellery. An overcoat used as protective clothing was also kept on when they left the processing facility posing a cross contamination risk.

Ice production facility

The Government of Barbados provides the fish industry with ice. This ice is available to fishermen, fish processors and vendors at a very low price. The source of the ice is the water from the mains, which is supposed to be of drinking water quality. At this facility, ice is checked for faecal coliform and total coliforms. Once faecal coliforms were detected but this was attributed to the manner in which the sample was taken; the tap appeared to be contaminated; sampling now incorporates the sterilising of the taps before taking samples. In this respect, the Government Analytical Services Laboratory has a standard protocol for testing potable water in Barbados. Simple chemical tests, for instance residual chlorine, are not performed on the water at the facility. One point of concern is the use of plywood for a door at the side of the ice machine where the ice exits the machine (back wall of the screw conveyor). This cannot be cleaned and disinfected easily and is inappropriate.

Cold store

The cold store was in a poor state of maintenance with ice over the floor at the entrance and stalactites of ice coming from the condenser. The temperature is recorded manually and there were records in existence. It has two rooms providing a larger capacity than is being used at present. However, only one room is used and is mainly being used as a freezer to freeze small plastic bags of fillets of flying fish rather than being used as a cold store for already frozen fish, as its design intends. The temperature was -23.3 °C, which is below the required -18 °C stipulated in Codex and other

international regulations. Flying fish fillets are traditionally packed together in a plastic bag. This method of freezing is not recommended for producing good quality products, as it takes too long for the centre fillets to become fully frozen, and this is exacerbated by the improper use of a cold store rather than a freezer (blast, plate, tunnel, etc) to freeze the fish. A cold store is designed to keep the fish frozen, not to freeze it.

Oistins Berinda Cox Fish Market and Jetty

After Bridgetown Public Market, Oistins Jetty is the second largest landing site in Barbados. The facilities and set up are similar: government-owned and managed, landing fish facilities, fish processing facilities, ice production and market stalls. There were only a few boats at the jetty at the time of the visit: a wooden ice boat, which was preparing for a fishing trip the next day. The same remarks made about the Bridgetown inspected ice boat apply here, except that this boat was well-painted and the protective clothing of the fishermen looked very clean. However, the ice box did not smell pleasant, although it was empty and had been cleaned after the unloading.

The diesel supply is at the far end of the jetty and it was suggested to separate, time wise, the activities of fuelling the boats and off loading of fish, so that there would be overlap of these activities.

The jetty is not covered and a complete cover would be impractical and expensive and therefore, to protect the fish being contaminated from the air, it was suggested that the boxed fish should be protected with a lid. No organoleptic or other checks from a fish or food inspector were observed at the landing site.

Inside the Oistins building it is a different story to that in Bridgetown. The wooden rafters in the roof space are old and impossible to clean, the space used for fish processing, a outbuilding attachment, is too small for its purpose with too many fish processors processing flying fish in a small environment making it impossible to execute a hygienic flow of product and fish waste; indeed a bucket used for fish waste was standing just outside the processing room while piles of offal were still present in the processing room. This can attract vermin.

The windows of the processing room were open to the outside, which allowed for a fresh breeze but must be considered as a risk for contamination (airborne particles and flying insects). Here the same temperature problems as seen in Bridgetown were observed during processing and handling. The temperature of the water used for processing was recorded at 27 °C, processed fish was recorded at 26 °C and fish ready to be processed in a box with some ice present was at 21 °C. Wood was present in many places, cutting boards, seats and as a barrier in the ice machine. Coliform bacteria were detected in ice samples, indicative of poor hygienic practices.

The design of the ice maker, where ice falls from the top into the ice hold, is such that a worker physically has to enter the ice holding space to take ice from the rear. This should be not ideal with this design allowing the risk of cross contamination.

Inside the building paint was seen flaking from the ceiling. In the building, dolphinfish and tuna were being processed, but the excessive use of a powerful water hose resulted in the risk of cross contamination of the whole environment by spraying water. Even worse, the general public were allowed to pass through the processing area in the building to go to the jetty. This naturally constitutes a significant hazard for contamination. Changing rooms were outside (users of the market have to go out of the building to go to the toilet or change) and in a poor state of cleanliness and maintenance.

The cold store was mainly used for freezing, as noted at the Bridgetown facility, not for cold storage as it was designed. This results in poor quality product. Individual large fish (barracudas) were seen hanging with liquid dripping to the floor.

At the street side of the building is the retail market. This is an open, roofed area where fish can be processed and sold to the general public. The first thing that was noticed were bird droppings on the tiled benches, testimony of the fact that the birds that were present around the market did enter the market area where fish is being processed. A significant problem was that nobody took the effort to clean this before starting to cut and sell fish products.

Some imported frozen fish was handled as well as reef fish, but the majority of fish was flying fish and dolphinfish. The recorded temperatures of the fish being processed and sold were between 15 °C and 24°C. One market booth used a powerful water hose to wash the fish in a manner that

contaminated the whole area. Wooden cutting boards were used and fish was processed in stagnant water, contributing to cross contamination.

Tourists are ferried to Oistins as a regular outing to see the fish market. To comply with international market standards, the Oistins Market will have to be rebuilt. To bring the Oistins jetty area up to international standards, a complete restructuring will have to take place and this will include the infrastructure.

Rural small scale landing sites and public markets

From the perspective of compliance of retail market facilities with food hygiene guidelines and codes of practice, the Codex Code of Practice for Fish and Fishery Products⁴ have detailed the main issues to be considered (Box 4).

Box 4 Codex code of practice for fish and fishery products - for retail

CODE OF PRACTICE FOR FISH AND FISHERY PRODUCTS CAC/RCP 52-2003

SECTION 18 – RETAIL

Fish, shellfish and their products at retail should be received, handled, stored and displayed to consumers in a manner that minimizes potential food safety hazards and defects and maintains essential quality. Consistent with the HACCP¹ and DAP² approaches to food safety and quality, products should be purchased from known or approved sources under the control of competent health authorities that can verify HACCP controls. Retail operators should develop and use written purchase specifications designed to ensure food safety and desired quality levels. Retail operators should be responsible for maintaining quality and safety of products.

Proper storage temperature after receipt is critical to maintaining product safety and essential quality. Chilled products should be stored in a hygienic manner at temperatures less than or equal to 4 °C, MAP³ products at 3 °C or lower, while frozen products should be stored at temperatures less than or equal to –18 °C.

Preparation and packaging should be carried out in a manner consistent with the principles and recommendations found in Section 3 (NOTE: see above boxes). Products in an open full display should be protected from the environment, for example, by the use of display covers (sneeze guards). At all times, displayed seafood items should be held at temperatures and in conditions that minimize the development of potential bacterial growth, toxins and other hazards in addition to loss of essential quality.

Consumer information at the point of purchase, for example, placards or brochures that inform consumers about storage, preparation procedures and potential risks of seafood products if mishandled or improperly prepared, is important to ensuring that product safety and quality are maintained.

A system of tracking the origin and codes of fish, shellfish and their products should be established to facilitate product recall or public health investigations in the event of the failure of preventive health protection processes and measures. These systems exist for molluscan shellfish in some countries in the form of molluscan shellfish tagging requirements.

1. Hazard Analysis Critical Control Point
2. Defect Action Point
3. Modified atmosphere packaged

Throughout the rural areas, the Barbados Government, through the Fisheries Division and the Markets Division, offers facilities to unload, process and sell fish to the public. The philosophy behind this is that by providing these facilities, bad handling processes can be avoided and safe food can be sold. The Ministry of Agriculture employs staff at all of these facilities to manage the facilities. The Public Markets are divided into (a) primary sites with water and ice production facilities and processing and indoor market facilities, and (b) secondary sites with a simple building with running tap water and cutting facilities but without windows or doors and without ice production facilities.

Primary sites visited included: Paynes Bay, Millie Ifill Fish Market, Read's Bay, Speightstown Fish Market, Tent Bay, Consett Bay. Secondary sites visited included Pile Bay, Halfmoon Fort and Martins Bay. The Markets Division is the unit managing fish markets. The Fisheries Division is in charge of Fish Sheds at Pile Bay, Halfmoon Fort and Martin's Bay.

⁴ CAC/RCP 52-2003

Primary markets

Some rural primary markets could fulfil the requirements of the international markets. The processing area in Consett Bay looked very good, as was the set up in Speightstown Fish Market. But in all cases maintenance of the building and the equipment needs to be improved, taking into consideration that staffs from the Markets Division are always present. All the markets are in a poor state of cleanliness, even those where little fish was processed. When fish processing was ongoing, the temperatures of the water and the fish was as observed in Bridgetown and Oistins, that is, far too high. Cross contamination was not prevented in most steps of the production chain; stagnant water was used for rinsing; in one market birds were actually fed on the bench where the fish were being processed and wooden cutting boards were in common use. The design of the ice machine, where existing, was similar to that in Oistins market, in a way that a person had to physically go into the ice room to take ice from the back; sometimes wooden planks were used to stop the ice from flowing out of the chamber.

In Consett Bay a day boat was unloading its catch, but ice was not used. The fish were caught by speargun by divers and brought to shore hours after catching, including fast deteriorating lobsters.

Cleaning of facilities was not done always to schedule and sometimes there was no schedule. Bleach was found to be the primary disinfecting agent.

Secondary markets

The design and construction of the secondary sites does not meet international standards and export to international markets from these sites should not be allowed by the Competent Authority. The provision of these facilities is a significant and important improvement from processing in the open air and they provide an excellent service for the local market. With a few adjustments, as above, the safety and quality of the fish processed in these facilities could be significantly improved.

Fish processing establishments

From the perspective of compliance of processing establishments with food hygiene guidelines and codes of practice, the Codex Code of Practice for Fish and Fishery Products⁵ have detailed the main issues to be considered (Box 2 and Box 3) and for the application of the HACCP system (Box 5). The Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1969, Revised 2003) is also a valuable resource and also outlines the HACCP system and provides guidelines for its application.

The main EU regulations of relevance to seafood exports are contained in what is known as The Food Hygiene Regulations, which constitute a complementary set of rules to harmonise European Union food safety measures. They include Regulation EC/852/2004, which lays down the general hygiene requirements for all food business operators and Regulation EC/853/2004, which lays down additional specific requirements for food businesses dealing with foods of animal origin, including live bivalve molluscs and fishery products as Annexes.

⁵ CAC/RCP 52-2003

Box 5 The HACCP system

Hazard Analysis and Critical Control Point (HACCP) is a science-based system that aims to prevent food safety problems from occurring rather than having to react to non-compliance of the finished product. The HACCP system accomplishes this by the identification of specific hazards and the implementation of control measures. An effective HACCP system should reduce the reliance on traditional end-product testing. (Code of Practice for Fish And Fishery Products. CAC/RCP 52-2003)

The seven principles of HACCP are:

Principle 1: Conduct a hazard analysis	Identify the potential hazard(s) associated with each stage of production; assess the likelihood of occurrence of the hazard and identify the measures for their control.
Principle 2: Determine Critical Control Points (CCP)	Determine the points, procedures or operational steps that can be controlled to eliminate the hazard(s) or minimize its (their) likelihood of occurrence.
Principle 3: Establish critical limit(s)	Establish critical limit(s) which must be met to ensure that the CCP is under control.
Principle 4: Establish a system to monitor control of the CCP	Establish a system to monitor control of the CCP by scheduled testing or observations.
Principle 5: Establish corrective action (s)	Establish the corrective action(s) which must be taken when monitoring indicates that a particular CCP is not under control.
Principle 6: Establish procedures for verification	Establish procedures for verification including supplementary tests and procedures to confirm that the HACCP system is working effectively.
Principle 7: Establish records and record keeping	Establish documentation concerning all procedures and records appropriate to these principles and their application.

Visits to private sector processors

Seven processing establishments were visited to get an appreciation of the level of compliance of fish processing establishments to GMP/GHP and HACCP. The following provides brief descriptions of the individual operators.

Operator 1

This processor buys the fish from the Bridgetown Public Market and transports it on a flatbed truck in a closed container. No fish was present in the processing facility during the visit. Ice is made by putting buckets of water in the cold store on site. When the plant is active, frozen fish is cut with a band-saw and vacuum packed. Another product is seasoned fillets, whereby the frozen fillets are thawed, seasoned and then frozen again. The cold store was not working at the time of the visit. A wooden ladder led to the roof of the cold store which was used as a general store space. The general state of the premises was not up to (international) standards, the lighting was insufficient, the walls, doors and floors were not easy to clean, paint was peeling of the walls. Changing rooms were very small and not adequate. The premises were in a poor state of maintenance and a very poor state of cleanliness. Nevertheless, this plant was approved for fish processing and the inspector of the Ministry of Health, who accompanied the visit, stated that it still fulfilled the requirements for approval. No samples of water or fish have ever been tested from this establishment.

Operator 2

This operator imports fish from Guyana (red snapper) and also processes all types of local fish species. There was no ante room in front of the freezer and the temperature recording device for the freezer had not yet been installed. In one room, frozen fish is sawed with a band-saw into steaks. The floors, walls and ceiling were in good order of maintenance and of a material easy to clean and disinfect. Ice was made in-house by putting buckets of water in the freezer. The frozen ice is taken

from the bucket, put in a bag and smashed to pieces on the floor. This type of ice is likely to cause damage to the fish. No laboratory checks on the water had ever been performed in this establishment.

In the room where flying fish is processed (not operating during the visit), packing material was stacked and there was a microwave oven for food preparation after the fish had been processed.

Non hand-operated taps to wash hands were in good working order with soap and paper towels available. The changing rooms and toilets were small but in a good order of maintenance and cleanliness. There was a separate room full with packing material and it was dust-free, airy and the packing material was packed off the floor on pallets. Three different cleaning agents were used, one for the walls and the equipment, one for the floor and one for the drains.

However, no cleaning plan, hygiene plan or HACCP plan was present. Outside the building a large container is used as a store room for newly acquired carton boxes. Structurally this operation was of a good standard, however the operational procedures were not documented, there were no records and there was no HACCP plan.

Operator 3

At this establishment, several processing lines were operation - flying fish was being processed and frozen dolphinfish were being sawed into steaks, vacuum packed and boxed into cartons. Apart from the sawing operation, the operations were in one room. The cartons should not be in a processing room. The temperature of the flying fish fillets was recorded at 21 °C indicating a significant break in the cold chain.

The equipment, floors, walls, ceiling and doors were in excellent state of maintenance and cleaning was starting after the processing had finished. One cleaning agent is used and the premises are cleaned daily after processing; on Friday there is a total scrub down. Staff changing rooms looked clean, albeit small. There is a good system for staff changing in to and out of protective clothing when entering the processing area. Non hand-operated hand washing facilities were present and in excellent working order, with soap and paper towels available. Importantly, they were used by the staff before entering the processing area and this is monitored by the manager. He is also responsible for the cleaning operations.

However, no hygiene plan, cleaning plan or HACCP plan was present. Although dolphinfish and tuna are processed, the owner was not aware of possible risks with histamine poisoning and had never been informed of this risk from an inspector from the Ministry of Health. No sampling for any analysis has ever taken place. Because this company has an airline customer, there are plans to start with written hygiene manuals and HACCP.

Operator 4

The owner of this establishment worked his way up from being an individual processor at the Bridgetown Public Market 20 years ago to being the owner of this fish processing plant employing eight people. Presently the factory makes products for the domestic market. Previously, flying fish was exported to Canada. The owner has expansion plans to build a completely new purpose built processing facility; the drawings of this building were provided and comments were made on appropriate product and waste flows and on human movements into and out from the processing areas from staff changing facilities.

During the visit, frozen dolphinfish was being cut into steaks with the band-saw. The dolphinfish raw material is mainly imported fish from Trinidad and Tobago, Suriname and Guyana. Dolphinfish is also sourced from Peru, shrimp from Indonesia and lobster tails from Jamaica. The monthly production is around 10 – 20 tonnes.

Inside the establishment, the lighting was good and the floor, walls and ceiling were in good order and in a reasonable state of cleanliness, as was the equipment. The temperature gauges on the cold store were working; the cold store for finished product was recorded at -18 °C but the cold store for raw product was only at -10 °C and an ante room in front of the two cold stores was missing. However, having the two cold stores for raw material and finished products is good practice.

However, there was a door in the processing room that led directly to the outside and raw material enters and ready product leaves through that door. When closed it was certainly not rat proof. To visit

the bathroom, staff have to go outside the building; these facilities are shared with other businesses in the same block of housing and there are no changing rooms.

There are no written procedures, or HACCP system in place and no laboratory analyses have been performed. The premises have been approved by an inspector from the Ministry of Health, whereby the functioning of the cold store is checked to ensure it is below -18 °C.

The owner knows these shortcomings and is planning to build new purpose-built facilities on land that has already been acquired.

Operator 5

This is the largest operator in Barbados in terms of production. The building is from the late 1990s and in 2005 the company started to work towards HACCP accreditation. The raw material is frozen fish which is imported through their own buyer in Trinidad and Tobago. Billfish species (marlin and sailfish), tuna and shark are all imported frozen.

Flying fish, barracuda, black jack and lane snappers are bought from the local market fresh from selected fishermen who operate at the quality standards imposed by the company. To achieve this, sometimes higher prices are paid and sometimes other incentives are used, for instance, buying the whole catch instead of selected species. The selected fishermen have been trained by the company in hygienic operations and organoleptic testing. In this way, they are able to buy fish from the Moses boats, which operate without ice. In this case the company has sets standards for the time/temperature profiles which are accepted: flying fish less than 12 hours old since capture can have a temperature of 21 °C; fish which are dead more than 12 hours but less than 24 hours can be landed at minimum of 10 °C; and fish dead longer than 24 hours must not be over 4°C. Flake ice (the best type of ice from both the perspective of temperature transfer and minimal physical damage) is provided free to fishermen, where required.

The company exports tuna to Boston in the United States. In the company's HACCP plan, histamine is listed as a critical control point. The maximum limit for histamine is listed as 50 ppm and this is the contractual specification against which the fish is bought. An independent laboratory is used to test samples for histamine at irregular intervals (however, it was learnt from other sources that this laboratory is not capable of undertaking this test). Water and ice are tested for total plate count and coliforms on a monthly basis.

Visitors were given protective clothing, a hairnet and boots to wear before being allowed to enter the work floor. At the entrance the boots were washed by a machine and hand washing with non hand-operated taps was mandatory. Soap and paper towels were provided. Two processing rooms were being prepared for the flying fish season, whereby there was a clear separation between the scaling and filleting activities. Apart from some rust on the freezer and a dirty pallet machine, the equipment, floors, walls and ceilings were in good order with respect to maintenance and cleanliness. In another room frozen fish was cut into steaks on four band-saws. The floor in the receiving room needed attention and was not in a state where it could be easily cleaned. The Ministry of Health inspector issues the export certificates and inspects and audits the establishment from time to time. Attention is given to time and temperatures of products, personal hygiene and pest control. The inspector is by law not allowed to take any samples, except in a case of the outbreak of food poisoning. This is a food business operator that complies with international standards and indeed is exporting to the United States.

Operator 6

This company sources fresh fish from all the government run markets, but not from sites where fish is landed at the beach, for instance Six Men's Bay or from certain boats with a poor reputation for hygiene. The company has been in business for 11 years. In the plant, the company has different sections for fresh fish and frozen fish. In the processing facility, the product flow is good. Previously, tuna was exported to Canada. Fish is imported fresh from the United Kingdom and the United States, the species include cod, salmon, halibut, seabass, lemon sole, Dover sole, scallops and live mussels. The company pays great attention to controlling and documenting the cold chain and pays a premium for fish that is handled according to their specifications. However, Barbadian customers refused to

sign the forms in which they would state that they had received the fish and to record the temperature at reception. The company has a hygiene plan and a HACCP system in operation but the documentation is only available electronically. Structurally the plant did not comply with international standards. There were no changing rooms, the toilets were outside, the floor was not easily cleanable and doors and openings from one department to another were unfinished. Histamine tests are performed when the cold chain is broken, for instance in dolphinfish. Some microbiological testing to verify correct cleaning and disinfection procedures was ongoing. The manager was aware of the shortcomings of the establishment with regard to meeting international standards.

Operator 7

Previously this establishment has been audited for HACCP compliance by an institution from the United States. They passed, but are not in compliance presently. The structural problems of this plant include the floor, rusty equipment, changing rooms for staff and the layout of the factory. The cold stores for raw material and the cold store for finished products were not operating according to international standards of -18 °C, with the temperature recorded at -9 °C.

They currently produce a cold smoked product from Vietnamese catfish (*Pangasius*), marketed as a vacuum packed frozen product. Other products include value-added fish products, such as dolphinfish fish fingers, fish burgers, fish sausages, breaded fillets of fish, plus the basic fresh and frozen fish from the island: flying fish and dolphinfish. Fish is imported from Guyana, Trinidad and Tobago, Canada and Vietnam. Flying fish were scaled and filleted in a separate room. From this room, the waste was directly transported outside to give a good separation of the flow of product and waste. However, temperatures of the fillets were recorded to be between 9 °C and 18 °C.

Compliance with GMP/GHP and HACCP - summary

Compliance by fishing vessels

The ice boats and longliners could comply with international standards for supplying raw material to the national and international markets but current practice in many cases needs to be improved both from structural and procedural aspects. On board, the principles of GMP/GHP apply. For the day boats, the lack of a separate contained fish holding area or box that prevents cross contamination and the non-use of ice are problems that prevent these boats from meeting international standards.

From a structural point of view, the main issue is the presence of wood. All surfaces that come into contact with fish should be non-toxic, smooth, impervious and in sound condition and wood surfaces must be painted with a food-grade paint. Unfortunately, due to the nature of fishing operations, painted surfaces damage easily and thus maintenance is very important. The ideal solution is in the use of fibreglass but this is not commonly retrofitted to fishing vessels due to cost implications, however, it is sometimes seen and in the long term can be cost-effective due to the lower maintenance costs.

Toilet facilities, if present, should be maintained in working order and should be easy to clean, and should be used. If a water supply is available on the vessel, the system must be maintained in good working order and with no possibilities for cross contamination.

From a procedural point of view, the main issues on board any fishing vessel are hygiene, prevention of cross contamination and temperature control. There was evidence of poor practice from the inspections made (at dock side only). Improvements include:

- a) All food contact surfaces (decks and fish holds) need to be cleaned and disinfected thoroughly before fish is taken on board.
- b) The fishermen handling the catch should wear clean and disinfected protective clothing and boots when handling the fish.
- c) All efforts should be made to prevent cross contamination, for example from fuel, debris, dirty surfaces and birds.

It is important to note that some fishing vessels already comply and they deliver to selected fish processors and are paid a premium for the fish. It is also important to note that, where ice was used,

temperature control was good with the temperature of most fish that were tested being found to be close to 0 °C.

Compliance at main landing sites

The landing facilities visited at Bridgetown and Oistins do not currently comply with international standards. However, this could be changed with mostly procedural related improvements, though structural adjustments are also necessary.

The landing harbour/jetty at both Bridgetown and Oistins are well designed and allow off-loading for a variety of boats. There is a small permanent cover at Bridgetown to protect fish from direct sunlight during unloading, but it was not observed to be used. There is no cover at Oistins. This is easily and fairly cheaply fixed by use of moveable canopies on wheels. However, if unloading is undertaken rapidly into appropriate containers with the liberal use of flake ice, the lack of a cover ceases to be an issue. The proximity of the jetties to fish handling, processing and retailing areas follows good design principles.

There are structural (e.g. ceilings, windows) and size issues at Oistins processing area as elaborated in the earlier section and these would require significant investments to address. The processing halls at Bridgetown are in a better state and structurally are sound with some issues to address regarding hygiene facilities, for example, the availability of sinks in the processing areas and improved toilet facilities. But the main issues were procedural.

The availability of flake ice and cold storage facilities are positive aspects, though the use of the cold store as a freezer is not good manufacturing practice.

The market infrastructure for local sales at both markets provides a good facility though operationally there are areas for improvement.

The handling in the dock area does not prevent cross contamination. At unloading there are too many people around. Only those involved with unloading (including inspectors) should be present and appropriately clothed if handling fish.

The cold chain, which in many cases starts at a low temperature on board the vessels, breaks down after unloading and reaches temperatures in excess of 20 °C. This can be easily rectified given the presence of large insulated plastic container and flake ice on site. Temperature abuse must be prevented and the cold chain must stay intact.

During weighing, ordinary newspaper is used to prevent the fish from falling of the scales. This causes contamination with ink. The supermarket trolleys which are used are not appropriate for this purpose because they cannot be cleaned and disinfected properly and do not prevent temperature abuse. Fish handlers should wear protective clothing to prevent contamination of the fish from street clothes.

The elements of GMP/GHP need to be in place and documented throughout both facilities from the jetties to the public market areas. These areas include safety of water and ice, the condition and cleanliness of food contact surfaces and prevention of cross contamination, the maintenance of facilities for personal hygiene, the control of employee health and hygiene and pest control.

As an example, the ice produced and used must be free of contaminants like dirt or rust or splinters and must be produced from (documented) potable water. Therefore, no wood or plywood can be used in handling the ice. Shovels need to be rust free and preferably made from plastic or stainless steel. Regular laboratory tests to prove the sanitary quality of the ice need to be performed and action should be taken and documented if a problem is identified. Finding faecal contamination is proof that something is badly wrong with hygienic practices.

Temperatures should be recorded, as well as the weight of the fish. The fish inspector is responsible to ensure good practices are adhered to. Landings should not be unauthorised because of stock management purposes. Fish which are susceptible to histamine production (tuna, dolphinfish) must be monitored with this public health hazard in mind. When in doubt, a test for histamine should be carried out. Sales to the public at the market areas should be done without breaking the cold chain and undertaken in a hygienic environment.

The diesel supply at Oistins poses a cross contamination issue but this can be avoided if the activities of fuelling the boats and off loading of fish are done at different times, and that after any fuelling activities, the jetty is thoroughly cleaned to remove any diesel spillage.

Compliance at rural landing sites

For the local market, the Markets Division provides excellent facilities for small businesses to process fish. However, all marketing facilities of the Ministry of Agriculture could be managed more effectively; and even without major structural changes, these facilities could be significantly improved – they should be cleaner; the use of wood should be limited, or even better, eliminated; cutting boards and other equipment should be maintained in better condition; cleaning schedules should be developed and implemented; pest management (especially of birds) should be developed and implemented; and, ice usage to be improved.

Compliance at fish processing establishments

Presently, GMP/GHP (or prerequisite programmes) (see Boxes 2 and 3) are only executed in a small number of the establishments.

The use of protective clothing is not well understood: fish processors should enter the factory via changing rooms to change from their street clothes into protective clothing before entering the processing areas. They should not leave the building in their protective clothing as this is risks cross contamination with products when they re-enter. The protective clothing must be clean and must remain inside the factory.

Water sampling plans do not exist, hygiene practices for the staff, cleaning plans and pest control systems are not documented in most of the establishments. Furthermore, the physical infrastructure of most establishments does not comply with international standards. Floors, walls, ceilings and doors are often not made of a material that is easy to clean and disinfect. Many establishments operate too many different activities in small spaces, hindering the logical flow of people, product and waste. This can easily cause cross contamination. Maintenance of equipment is often not adequate and many establishments are not clean enough.

Refrigerated trucks are used by some companies as are flat bed trucks where the fish is put in ice in a closed plastic container or tub. This is good practice. However, fish is also transported in open trucks without protection or ice and frozen fish has been seen to be transported in bags in an open truck packed only in plastic bags. Transportation must be done in a way to prevent contamination and without breaking the cold chain.

A very important part of pre-requisite programmes is traceability. There was no evidence of traceability in the fish value chain. Traceability is mandatory if fish products are being exported to markets such as the European Union or the United States. It is vital that when a food businesses identifies a risk (or are informed of a risk with their product) that they can trace it back to its source in order to swiftly isolate the problems, identify the at-risk products and instigate a recall procedure in order to prevent contaminated products from reaching consumers. Thus, all processing companies (large and small) need to have a system for tracing all supplies of raw materials entering the factory, through processing and to the destinations of all finished products leaving the factory (traceability).

As mentioned above, the Hazard Analysis Critical Control Point (HACCP) is a system which identifies, evaluates and controls hazards which are significant for food safety. It is a science-based and systematic tool that assesses hazards and establishes control systems which focus on prevention rather than rely mainly on end product testing. It not only has the advantage of enhancing the safety of the product but, because of the means of documentation and control, it provides a way for demonstrating competence to customers and compliance with legislative requirements to the food control authorities.

TRACEABILITY Definitions

"The ability to follow the movement of a food through specified stage(s) of production, processing and distribution"

*Codex Alimentarius.
Report of the 27th Session Joint FAO/WHO
Food Standards Programme. Codex
Alimentarius Commission. Geneva,
Switzerland, 28 June- 3 July 2004. Paragraph
17-20. (Adopted)*

'Traceability' means the ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution"

*Regulation (EC) No 178/2002 of the
European Parliament and of the Council.
Article 3. Regulation on General Food Law.*

A HACCP system was in place in only one fish processing establishment. Other processors are thinking about the implementation of HACCP or are actually working towards implementation. It must be concluded that HACCP and verification procedures are not universally implemented in Barbados. It can also be concluded that the inspection systems are not geared towards meeting international food safety management systems.

Given these limitations, most of the processing establishments would not be approved for export to markets such as the European Union, as the EU food safety regulations are based on Codex and require effective and documented pre-requisite programmes to be in place for both GMP/GHP and HACCP.

Conclusions

These shortcomings in procedural aspects therefore strongly suggest that there is a lot of scope for training of operators throughout the whole food value chain from vessels to processing and distribution, in good manufacturing and hygiene practices and in undertaking and implementing HACCP systems to meet the requirements of international standards and regulations. With regard to HACCP training for operators in small businesses, it must be kept in mind that such training should be proportionate to the size and the nature of the business and should relate to the way that HACCP is applied in the food operation.

FISH INSPECTION SYSTEM IN BARBADOS

While there is growing evidence that the implementation of HACCP-based systems have contributed to improve fish safety and quality, there has been a growing awareness of the importance of an integrated, multidisciplinary approach to safety and quality, considering the entire fish food chain.

The implementation of the food chain approach requires a significant investment from national governments including an enabling policy and regulatory environment with clearly defined rules and standards, establishment of appropriate food control systems and programmes at national and local levels, and provision of appropriate training and capacity building. The development and implementation of Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP) and Hazard Analysis Critical Control Point (HACCP) are required throughout the food chain and have been described in the preceding section on the fish supply chain.

Government institutions should develop an enabling policy and a regulatory environment, organize the control services, train personnel, upgrade the control facilities and laboratories and develop national surveillance programs for relevant hazards. In European Union language, this is the role of the Competent Authority. The relevant regulation is EC/854/2004 which lays down specific rules for the organisation of official controls on products of animal origin intended for human consumption.

As mentioned in the previous section, the industry has the responsibility to produce foods that are safe to eat and meet national and, if they export, international regulations. The government has the responsibility to ensure that the industry does exactly that.

Legislation

The Ministry of Health has implemented the main basic legislation on food hygiene in relation to the production and sale of food products, the “Health Services Act 1969” and “Health Services (Food Hygiene) Regulations 1969”. These regulate basic Sanitation Standard Operating Procedures (SSOPs) in relation to food production.

Various statutory instruments have detailed the qualifications required for a variety of positions within control systems including laboratory staff, fisheries officers and fisheries biologists, veterinary officers and superintendents and quality officers at markets.

The Markets and Slaughterhouses Act (1958) allows for the registration of fish vendors, the operation of fish markets (including inspection from food safety, unfair practices and fraud perspectives) and the collection of fish tolls.

The Fisheries Act (1993, amended 2000) allows, as part of its remit, for the registration of all fishing vessels and an inspection on an annual basis, from a safety-at-sea perspective, not from a GMP/GHP point of view.

However, it is evident from the Food and Veterinary Office visit in 2008 that to achieve “equivalence” of Barbadian legislation with European Union legislation, from the perspective of food safety, there are many areas that need to be addressed. To quote the FVO report covering legislative issues:

“Barbadian legislation in place allows the CAs to approve processing establishments and to inspect LS, markets and establishments and to register and licence fishing vessels. However no specific legal requirements are in place to regulate the hygiene conditions of vessels concerning the handling of FP and/or ice. No specific legal requirements or other standards are in place to regulate the quality of FP concerning the organoleptic criteria and the possible contamination from biological or chemical agents (microbiology, parasites, histamine and toxins such as ciguatera, chemical contaminants). Furthermore no legal requirements are in place to implement HACCP system in establishment. Some general hygiene criteria are set in a code of practice but the application of these standards by the food business operators (FBOs) is not compulsory.

The CAs informed the MT that Codex Alimentarius codes of practices would be used as reference standards in some cases where Barbadian legislation does not cover particular items. Several legislative proposals are now being considered by the CAs, including the

proposal for the establishment of an agency (Agricultural Health and Food Control Agency) for the coordination of controls on food hygiene across all sectors; a "Seafood Quality Assurance" law is also at draft stage."

This situation does not appear to have changed much since this visit. The draft "Seafood Quality Assurance Regulation 2005" mentioned in the FVO report puts the Senior Veterinary Officer in charge as the head of a Competent Authority and mandates the Seafood Inspectorate to do the physical inspections. This draft legislation contains much that is necessary to inspect and control fish and fish production up to the international level, however significant aspects are lacking in this draft legislation, including the sampling and analysis and maximum allowable levels for a variety of hazards that are internationally recognised as relevant to fish and fish products (microbial criteria, heavy metals, dioxins, ciguatera, etc).

This seafood legislation has still not officially been approved and therefore has not been put into practice. However, the draft does exist and it provides a solid basis to move towards legislation that will pass the "equivalence" test for meeting international standards as long as shortcomings are addressed.

For an expert comment on food laws and regulations, a full examination by a legal expert experienced in these matters would be advisable.

Current organisation of the Competent Authority

Two Ministries, the Ministry of Agriculture, Food, Fisheries and Water Resource Management (MoA) and the Ministry of Health (MoH) are involved in performing the function of a Competent Authority in Barbados. The Government Analytical Services of the MoA provide laboratory support (see later section).

The Fisheries Division of MoA is responsible for registration of fishing vessels and issues vessel licence after looking into aspects like condition of the machines, seaworthiness of the vessels, and safety measures for the crew. The form used for licensing has reference to hygiene of the vessel and hygiene of operations related to handling and storage of fishery products. Since all fishing vessels have licences, all fish landed in Barbados would be legally caught and the Fisheries Division of MoA has Data Collectors to collect data on catches. Thus the issues related to illegal, unregulated unreported (IUU) fishing are not likely to be a major factor in Barbados, though the "catch certificate" is not issued by MoA.

The Markets Division of the MoA is involved in controls at the primary landing centre/markets, while the Environmental Health Officer (EHO) of the MoH is involved in controlling the landing centre and processing establishments. Though both the MoA and the MoH have controls over landing centres, there seems to be no formal agreement on sharing of responsibilities, but information exchange occurs based on specific requests. The MoA also has a Veterinary Services group and there are also discussions to assign the role of Competent Authority to the Chief Veterinary Officer (CVO) (see below).

The fish processing establishments need licences from the MoH and these are issued on an annual basis after the inspection of the premises by the EHO. Once the licence is granted, the establishments may be inspected every quarter by the EHO. Some processing establishments have permanent supervision in place with EHO inspectors completing a daily log book of inspection activities. These are then combined into monthly and quarterly reports. The MoH is currently signing certificates for fish processing establishments for export, but there is also discussion whether the Chief Veterinary Officer should be the designated authority. This thinking stems from the World Organization for Animal Health (OIE) recommendations related to animal health, but this may not be very applicable to Barbados, since fish production by aquaculture is almost non-existent.

The MoH is also responsible for controlling water used in processing establishments and the Barbados National Standards Institution Code of Practice sets standards in line with the WHO Guidelines for Drinking Water Quality. The Barbados Water Authority also has control over water.

As regards imports, frozen fish can enter the country through the main port in Bridgetown. It arrives by container and the temperature in the container is usually -18 °C. The cold store (Barbados

Ice Company) is privately operated and is approved by the Ministry of Health. Two days before a container of fish reaches the port, the shipping agent informs the Port Health Authority of the Ministry of Health, who have inspectors on site. Each shipment is physically inspected; the main focus is on the temperature inside the container and organoleptic assessment. Health inspectors have all had training in fish technology and organoleptic assessment - organoleptic testing is carried out in the inspectors' premises. It is very unusual for a consignment to be rejected. No other form of testing occurs in the harbour, nor are any samples taken for analyses elsewhere. On the documents accompanying shipments, only the local names of the fish species are mentioned, not the scientific names. At the port, a veterinary inspector from the Ministry of Agriculture is present, but this inspector is not involved in fish inspection. Fish was seen trucked from the harbour in a refrigerated truck but also was seen being transported in bags in an open pick-up with no protection from the sun.

The other route for importing fish is via the international airport. At the airport, the fish arrives in boxes and is maintained at low temperatures. Processors pick up their fish in refrigerated trucks. There is cold storage facility available at the airport. This supply chain is working to international standards.

The following table summarises the division of responsibilities between the various ministries.

Production Chain	Agency Controlling
Fishing vessels	Fisheries Division, MoA
Imports of fish	Environmental Health, MoH / Veterinary Services, MoA (animal origin)
Hygienic condition landing & first sale sites	Environmental Health, MoH
Wholesale Fish Markets	Markets Division, MoA
Other Landing sites	Environmental Health, MoH/ Fisheries and Markets Divisions, MoA
Processing establishments	Environmental Health, MoH
Storage and transport	Environmental Health, MoH

MoA = Ministry of Agriculture, Food, Fisheries and Water Resource Management; MoH = Ministry of Health

It is apparent from the table and the discussion that the organisation of the food safety control system for the fish value chain is a complex one involving four different units in two different Ministries. This split sometimes leads to problems such as duplication of regulatory activity, increased bureaucracy, fragmentation, and a lack of coordination between the different bodies involved in the control of food safety. This "multiple agency system" is common, especially when different sectoral controls are present (e.g. fish, vegetables, meat). However, not so common is a system where multiple agencies and divisions are used within a sector to control food safety in that sector.

While multiple food control agencies may be the norm, they suffer from serious drawbacks, (FAO/WHO, 2003⁶), including:

- Lack of overall coordination at national level;
- Frequent confusion over jurisdiction and resultant inefficiencies in performance;
- Differences in levels of expertise and resources and hence uneven implementation;
- Conflict between public health objectives and the facilitation of trade and industry development;
- Limited capacity for appropriate scientific inputs in decision-making processes;
- Lack of coherence leading to over-regulation or time gaps in adequate regulatory activity; and
- Reductions in the confidence of domestic consumers and foreign buyers in the credibility of the system.

There is evidence from this TCP-F study that the current system is not working optimally with some of the above issues noted.

⁶ FAO/WHO. 2003. Assuring food safety and quality: Guidelines for strengthening national food control systems. Food and Nutrition Paper 76. FAO/WHO, Rome. 73p.

Proposed new competent authority for fish

More recently, a significant study has been undertaken by international consulting group to develop a “Policy Paper on Agricultural Health and Food Control in Barbados”. The extensive document reviews the existing regulatory structure in Barbados for food control. This was completed in late 2010 and proposes a new integrated structure to create the National Agricultural Health and Food Control Agency. A draft bill exists entitled “An Act to modernise the national agricultural health and food control system in Barbados and to establish the National Agricultural Health and Food Control Agency and for related matters”.

The new National Agricultural Health and Food Control Agency, under the Minister of Agriculture, would be an “overarching, science based entity” which will provide a focal point and coordinating role for the food control system with improvements made in coordination of the existing structures in the three relevant ministries rather than total reorganisation into a central agency.

To quote the study:

“Most agricultural health and food control (AHFC) functions would not become part of the Agency but would remain elsewhere in the Ministry of Agriculture, Food, Industry and Small Business (MA) or in the Ministry of Health (MH) and the Ministry of Commerce and Trade (MCT). In the future System, the competent authorities for AHFC would be the NAHFCA, the National Plant Protection Organisation of the MA, the Veterinary Services Department of the MA, and Environmental Health Directorate of the MH, as well as the Fisheries Division of MA for fishery products. Other parts of the Barbados government, particularly the Barbados National Standards Institution (BNSI) of MCT, the Markets Division of MA and AHFC-related laboratories in the three key ministries, would be known as service authorities in the future System.”

This approach means the proposed food control system covering fish and fish products will be split between (adapted from the Policy Paper):

- Veterinary Services Department covering (amongst other things)
 - importation of animal products including food of animal origin
 - hatcheries
 - registration of veterinary drugs including veterinary biologicals
 - import risk analysis for animals and products of animal origin;
 - inspection at point of entry on imported products of animal origin
 - export certification, as competent authority, for exports of all animal products including food of animal origin (including supervision of the Fisheries Division);
- Fisheries Division
 - Licensing, monitoring, and enforcement for fishing vessels and licensing and training for fisher folk, covering both the commercial and the sport fishing sectors;
 - Inspection of vessels and ensuring observance on vessels of handling practices, such as icing or refrigeration, that maximise yields of safe and high quality products;
 - Promotion of HACCP within the Barbados fishing industry;
 - With oversight from the Senior or Chief Veterinary Officer, implementation of the sanitary handling and future HACCP regulation (for both wild-caught fish brought in by Barbados-based vessels and imported fish) from arrival of product onshore through primary processing, secondary processing (where applicable), including storage (including fishery products at private sector-owned cold storage facilities) and oversight of those markets that are approved for sale of fish and fish products in Barbados;
 - Animal health issues relating to fish and fishery products; and
 - Continued administration of present general fisheries management responsibilities including promotion of good fishing practices.
- Ministry of Health (amongst other things):
 - HACCP-based inspection for foods at the secondary production stage;
 - Risk-based inspection of all imported food products;

- Inspection, licensing and monitoring of all food establishment (secondary production) including processing plants, warehouses, retail stores, food stalls and restaurants;
- Food risk assessment;
- Food additives;
- Traceability of food products;
- Labelling regulations for food; and
- Overseeing the carrying out by food business owners of food product recalls.

The proposed responsibilities for fresh and frozen fish and seafood products are summarized in the following table, adapted from the Policy Paper⁷.

Location	Agency	MA	MH	Grey Area/ Overlap
Competent Authority				
Fishing port / Landing site	Fisheries Division with VS oversight	✓		
On farm/Sea Vessel	Fisheries Division with VS oversight	✓		
Fish Markets	Fisheries Division with VS oversight	✓	✓	
Primary processing plant	Fisheries Division with VS oversight	✓	✓	for fish plants doing both primary and secondary processing
Secondary processing plant	Fisheries Division with VS and EHD oversight		✓	
Retail	EHD/Fisheries Division		✓	
Sampling				
Ports-of-Entry	EHD		✓	
Exports	VS overseeing Fisheries Division	✓		
Fish Markets	EHD/ Fisheries Division	✓	✓	
Retail	EHD		✓	
Restaurant	EHD		✓	

** The line between primary processing and secondary processing for food products in general, and fishery products in particular, will need to be sorted out in legislation and implementing regulations.*

This approach is very similar to the existing setup and is still a more complex approach than that adopted in many competent authorities where a single Ministry takes overall responsibility for official control of all stages of the seafood sector's value chain.

During the Stakeholder Workshop held on March 14-16, there was considerable discussion on the organisation of a Competent Authority for the fish sector. The discussions during the workshop and also in separate meetings in with senior officials were focussed on the institutions involved in performing inspections and possible scenarios for organizing the Competent Authority, with no final conclusion. This is not surprising, as the issue is a very complex one with significant resources already devoted to developing a solution, but with delays in taking the proposals forward. Much will depend on factors outside of technical considerations. This focused on the advantages and disadvantages of multi-agency structure and the role of a Chief Veterinary Officer (CVO) in oversight of a competent authority for fish and fish products. This role of a veterinary officer arises from OIE regulations. It was pointed out that currently, Barbados does not have fish production by aquaculture and therefore, there are no animal health issues that would require support from a CVO. The participants thought that it will be useful to have some examples from other countries that have harmonized their regulations with the European Union. It was generally agreed that further and substantive technical assistance in drafting policy documents and regulations empowering a fish sector Competent Authority would be required and that appropriate legal expertise be part of that technical assistance.

⁷ Policy Paper on Agricultural Health and Food Control in Barbados. 2010.

Laboratories

Irrespective of the structure of a food control system, there is a requirement for laboratory services to be available to a competent authority. It is useful to note that there is no requirement for the competent authority to operate a testing laboratory. It is acceptable for a competent authority to purchase testing services from any laboratory, providing that the laboratory is technically competent to provide them. Evidence of technical competence is provided by accreditation to ISO/IEC 17025:2005 “General requirements for the competence of testing and calibration laboratories”. The testing services may be provided by any such laboratory, whether private or public sector.

In Barbados, there are three laboratories that have laboratory services relevant to fish inspection needs.

Government Analytical Services

The Government Analytical Services (GAS) laboratory of the MoA provides laboratory support for fish inspection and certification. The laboratory has chemical (organic and inorganic) and microbiological sections. The Chemical Section can perform most of the tests required for fishery products including residues of pesticides and heavy metals. But histamine testing was not being performed and this would be important for some of the fishery products. The Microbiology Section has capability to perform testing of water and fishery products for aerobic plate counts, coliforms, yeast/mould, *Salmonella* spp. *Staphylococcus aureus*, *Campylobacter jejuni* and *Bacillus cereus*. The services of GAS are utilised by Barbados Water Authority, Bridgetown fishing complex and Oistins fishing complex.

However, the laboratories were not accredited by any national or international accreditation body, but proficiency tests are performed regularly with the Food Analytical Proficiency Accreditation Scheme in the United Kingdom, the Canadian Association of Laboratory Accreditation and the GC Standard in the UK. Bivalves are not currently an important commodity in Barbados, hence the GAS is not focusing on biotoxins, but the importance of this was discussed during the Stakeholder Workshop, since bivalves are imported for the tourist market. Further, a capacity to perform ciguatera tests could be important since reef fish are landed in Barbados. It is expected that the method for histamine will be ready to be ring-tested later in 2012.

In summary the laboratory has the capability for:

- TVB-N in fish
- Heavy metals – lead, cadmium and mercury in fish
- Histamine (due this year) in fish
- *Salmonella* in fish
- *E.coli* in fish and water
- *Enterococcus* in water

Veterinary Laboratory

The Veterinary Laboratory of the Ministry of Agriculture is dedicated to serve the industrial production of animals. They concentrate therefore on animal diseases. Food products of animal origin are also tested. The samples are generally taken by veterinary inspectors and producers do not have to pay anything. The laboratory is not involved in testing of fish or fish products, although many years ago they researched a certain fish disease, and they experimented once with an Elisa test kit for ciguatera; the fish tested positive. However, apparently this test kit is no longer available. When the need would arise, the laboratory would be able to analyse for residues of veterinary drugs in fish products. With Elisa techniques the lab would be able to investigate histamine; this test cannot detect the low levels that are possible with the HPLC analysis. The laboratory is not accredited for any analysis but for all analyses, proficiency testing is ongoing.

In summary the laboratory has the capability for:

- *Listeria monocytogenes* in fish
- *Salmonella* in fish
- *E.coli* in fish

- *Staphylococcus* in fish
- *Vibrio cholerae* in fish

The Public Health Laboratory

The Public Health laboratory of the Ministry of Health concentrates its activities on human public health. They do analyse food products, but only in relation to food poisoning cases, which happens, on average, two to three times per year. During 2012 they will be applying for ISO 17025 accreditation. With support from an American HIV foundation this laboratory will merge with the leptospirosis laboratory and the present HIV laboratory.

In summary the laboratory has the capability for:

- *Vibrio cholerae* in fish
- *E.coli* in fish and water
- *Enterococcus* in water

Caribbean Public Health Agency

CARICOM have announced, in 2009, the establishment of a Caribbean Public Health Agency (CARPHA) which will integrate five existing regional laboratories under the CARPHA umbrella.

1. Caribbean Health Research Centre (CHRC) - Trinidad
2. Caribbean Epidemiology Centre (CAREC) - Trinidad
3. Caribbean Environmental Health Institute (CEHI) – St Lucia
4. Caribbean Food and Nutrition Institute (CFNI) - Jamaica
5. Caribbean Regional Drug Testing Laboratory (CRDTL) - Jamaica.

The Agency was legally established in 2011 and is scheduled to be launched in January 2013. It will be based in Trinidad and Tobago. Though focusing on public health, if it becomes accredited it could provide accredited laboratory services to Barbados that might have relevance to fish inspection, though an accredited GAS with expanded analytical capability would be of more value to the Barbados control agencies.

Markets based laboratories

Currently there are no facilities at the major landing centres for simple analyses. This needs to be addressed, but there is not a need for laboratories at these centres. However, inspectors should be properly equipped to perform their jobs. This includes transportation, protective clothing and equipment to record observations, as well as various tools and instruments to make measurements regarding important variables which impact on food safety. A typical inspection equipment kit may therefore contain (ACP-EU SFP Project Inspection Guide):

- Protective clothing (coat, rubber boots, hat)
- Voice recorded
- Camera
- Insulated sample box
- Sterile sample bottles and bags
- Digital thermometer
- Flashlight
- Knife
- Portable electric drill
- pH and chlorine colorimetric test kit for water quality
- test kits for qualitative assessment of ciguatera/histamine/sulphites – where relevant.
- micrometer

Inspectors will also need to carry out sensory tests, but this simply requires training in sensory assessment and does not require any equipment. However, this ability to undertake sensory assessment is important.

As regards sampling, inspectors should determine the need for sampling and testing according to the information required to assess safety or otherwise of a product or process. The inspector should take the samples and deliver them to the laboratory, identifiable only by a code. The laboratory should deliver test results to the inspector only, showing in a test certificate the value of the parameter tested. The certificate should not consider compliance or otherwise with a standard. Judgment regarding compliance and non-compliance should be made by the inspector based on the circumstance of the sampling. Laboratory staff should not perform as inspectors, and should never take samples, since this compromises their impartiality as analysts and is in direct contravention of accreditation standards. Analytical staff should not be aware of the provenance of the samples which they analyse.

RECOMMENDATIONS

The previous sections have provided significant detail on the current status and issues in the seafood value chain from fishing vessels to consumers and on the official controls along the chain.

The needs assessment workshop (Annex 2) had around 30 participants representing the Fisheries Division, Markets Division and Veterinary Services, Agricultural Health and Food Control Programme of Ministry of Agriculture, Environmental Health Division of Ministry of Health, Department of Commerce and Trade, Barbados National Standards Institute, Barbados Community College and the Barbados Union of Fisherfolk Organisation. There were widespread discussions on topics including inspections and possible scenarios for organizing the Competent Authority and on infrastructural and operational aspects of the value chain from fishing vessels to markets and conclusions drawn from a SWOT⁸ analysis (Annex 4).

The main outcome from the workshop was agreement by all participants on the needs of Barbados in terms of the capacity building needs of the fish supply chain and fish inspection systems. The main needs agreed were (phrased in terms of outcomes):

1. Policy and regulations regarding fish inspection and quality assurance drafted and harmonized with international market requirements
2. Fish inspection systems improved and meeting international requirements
3. Government analytical services strengthened to perform analysis required by fish inspection services
4. Capacity of fish supply chain actors to implement GHP, HACCP and traceability improved.

The following recommendations follow this needs assessment structure. Annex 5 provides the narrative part of a logical framework that covers these recommendations.

1. Policy and regulation regarding fish inspection and quality assurance drafted and harmonized with international market requirements

Recommendation 1: Review existing draft policy documents and regulations and provide advice on improvements required to develop a legislative framework for seafood inspection within a food control system. This will require legal expertise as well as specialties technical knowledge.

Recommendation 2: Examine the existing draft Seafood Quality Assurance Regulation 2005 and prepare a draft seafood regulation that includes all aspects so as to comply with international regulations with emphasis on equivalence with European Union and United States regulations. This will require legal expertise as well as specialties technical knowledge

Recommendation 3: Currently there is no single competent authority for fish and fish products with a clear mandate and a clear line of implementing GMP/GHP and HACCP on fish products throughout the value chain. Therefore, there is a need to provide case studies of organization of Competent Authority in similar fish exporting countries and conclude an ideal structure for fish and fishery product inspection and control in the Barbadian context. It is further recommended that a single authority for seafood is given primacy in these discussions. Once the structure is finalised, terms of reference for relevant staff should be developed.

2. Fish inspection system improved and meets international requirements

Recommendation 4: Currently there is no single fish inspection manual covering all aspects of control of seafood safety and quality along the entire value chain. It is recommended that a fish inspection manual appropriate for fish inspection practices in Barbados and that meets

⁸ Strengths, Weaknesses, Opportunities and Threats

international best practice is drafted and finalized in consultation with concerned staff. This would include sampling plans, inspection and audit schedules, checklists and forms and monitoring and surveillance requirements.

Recommendation 5: Many inspectors have experience but no formal training in inspection systems. It is recommended that training is provided for these inspectors. Training needs to cover inspection systems for all the steps in the fish supply chain involved in fish catching, landing, processing, distribution and markets and would include training in GMP and GHPs including traceability and in risk-based sampling. It is further recommended that pilot implementations of inspections are carried out after training at each of the stage of the value chain. Annex 6 provides a list of institutions globally where qualifications and training relevant to seafood inspection can be obtained.

Recommendation 6: It is recommended that minor field level inspection equipment is provided to allow each inspector access to a set of equipment for each inspection visit they undertake. This does not necessarily mean individual equipment for each inspector. It is further recommended that inspectors are trained in the use and maintenance of field equipment and are trained in sensory assessment of fresh fish to allow inspections at landing sites.

Recommendation 7: A crucial part of compliance with international regulations is adherence to the HACCP approach to ensuring food safety. It is recommended that all inspectors are trained in HACCP and to undertake HACCP audits of processing establishments.

3. Government analytical services strengthened to perform analysis required by fish inspection services

Recommendation 8: Given the existence of appropriate laboratories in Barbados, but that some minor equipment is absent that is relevant to fish inspections, it is recommended to undertake a survey of the GAS needs for minor equipment and consumables and to provide such support, funds permitting.

Recommendation 9: Histamine is an important hazard in fish and fishery products that needs to be controlled and, given the presence of histamine producing fish species in Barbados, training needs to be provided in both the rapid and HPLC testing for histamine and pilot testing undertaken for histamine in fishery products in Barbados to both gain an understanding of the prevalence (or otherwise) of this hazard and to raise awareness of the importance of preventative measures for the control of this hazard.

Recommendation 10: Given that reef fish are landed in Barbados and that previous tests indicated a presence of ciguatoxin in Barbados, it is recommended that a study visit to an international laboratory carrying out ciguatoxin (and other analysis of importance for Barbados) is undertaken and the capacity to test for this hazard is developed in Barbados.

Recommendation 11: In order to meet international requirements for laboratory testing, it is recommended that support is provided to perform proficiency testing for all hazards relevant to fish and fish products and that support is provided to develop systems and documents, such as standard operating procedures and laboratory manuals, to meet the requirements for accreditation to ISO 17025.

4. Capacity of fish supply chain actors to implement GHP, HACCP and traceability improved

The industry has the responsibility to produce foods that comply with national and, if they export, international regulations. It is evident that many actors in the supply chain are not following

GMP/GHP principles and that traceability and HACCP is not evident in most fish handling and processing facilities. It is recommended that training is provided in a two phase approach to ensure long term capability in Barbados.

Recommendation 12: It is recommended that training to future Barbadian trainers is provided in GMP/GHP/HACCP specific to seafood (a training of trainers approach). These future trainers should be qualified in a food safety relevant discipline to ensure a depth of knowledge in the trainers. This is essential for the provision of future training programmes.

Recommendation 13: It is recommended that support is subsequently provided for two to three training workshops on GMP/GHP/HACCP to be conducted by the Barbadian trainers and delivered to participants from various segments of the value chain. These would be delivered as practical oriented workshops and include pilot implementation in selected establishments.

Recommendation 14: It is recommended that a campaign of awareness raising among value chain actors and consumers for good hygienic practices and maintenance of quality of fish and fish products is undertaken. The aim of this is to change the behaviour of these actors and consumers. This could include the use of posters, leaflets, radio, social media and TV for the awareness raising.

Recommendation 15: The current market and processing infrastructure at the major landing centres does not meet international standards. It is recommended that expert advice is sought to advice on structural changes needed to bring these centres to international standards. This advice should be extended to private sector actors who are looking to comply with international requirements for their fish processing establishments.

ANNEXES

Annex 1 – Visits according to the program and people met

First mission – 16-27 January 2012

16 January	Courtesy Meeting with the Permanent Secretary Inception Meeting with representatives of relevant ministries Stakeholders Meeting with representatives of the private sector and relevant ministries
17 January	Inspections and tours of fishing vessels Visit to Bridgetown Public Market
18 January	Visit to Oistins - Berinda Cox Fish Market Meeting at FAO Office Tour of rural markets and landing sites - Pile Bay, Paynes Bay Fish Market, Weston
19 January	Millie Ifill Fish Market, Speightstown Fish Market, West Coast Fisheries
20 January	Courtesy Call to Permanent Secretary, Ministry of Commerce and Trade Tour of rural markets and landing sites - Tent Bay Market, Conset bay Fish Market
23 January	Visit to Barbados Ice Company Ltd - Harbour Cold Store Visit to Port Health Office Visits to fish processors - Monvern Fish processor, Ocean Bites, Sundale Trading,
24 January	Visits to fish processors - Atlantis Seafoods, Ocean Fisheries Fish Processor, Visit to Government Analytical Services Laboratory
25 January	Visit to Public health Laboratory Visits to fish processors - Shorelinez Fish Processor, Morgans fish House and to the - Seine boat fisherman Visit to Veterinary Services Laboratory
26 January	Presentation for Stakeholders - representatives of the private sector and relevant ministries
27 January	Project Findings Stage 1 Presentation to Ministries

Second mission – 12-20 March 2012

12 March	Meeting with Government Team Tour of Oistins, East and West Coast
13 March	Visit to Bridgetown Public Market Information gathering/Review on Inspection process and actors Preparation for Workshop
14 March	Workshop Day 1
15 March	Workshop Day 2
16 March	Workshop Day 3
17 March	Drafting of Workshop Report Presentation to government officials and stakeholders on draft report of second
19 March	mission
20 March	Debriefing meetings at FAO and Ministry of Agriculture

Annex 2 – Capacity Building Needs Assessment Workshop - Programme

14 - 16 March 2012

United Nations House, Marine Gardens, Hastings, Christ Church, Barbados

Workshop programme

March 14

- 08.30 – 09.00 Registration
09.00 – 10.00 Opening addresses, introductions
10.00 – 10.15 Coffee break
10.15 – 10.45 Objectives of the workshop and FAO format for assessment of capacity building needs (IK)
10.45 – 11.15 Overview of EU, US and Japanese requirements for export of fish and fishery products (JR)
11.15 – 11.30 Overview and identification of Codex Alimentarius standards relevant for Barbados (IK+ JR)
11.30 – 12.00 Discussion on requirements in terms of Codex standards implementation in Barbados
12.00 – 13.00 Lunch break
13.00 – 14.00 Discussion on fish supply chain in Barbados, identification of key players and current status of their capacities to meet international market requirements (Dr. Roessink report + inputs by RA)
14.00 – 14.45 Round table discussion on harmonisation of legislative requirements - institutions, policies, data requirement, training needs
14.45 – 15.00 Coffee break
15.00 – 16.00 Developing TORs, training modules on legislative aspects

March 15

- 09.00 – 10.30 Discussions on the elements of a fish inspection and certification system- IK to give brief overview and sum up observations from field visit (IK +JR).
Comments and inputs from Barbados fish inspectors
10.30 – 10.45 Coffee break
10.45 – 12.00 Competencies required by fish inspectors, official laboratories and identification of training needs in Barbados (in working groups)
12.00 – 13.00 Lunch break
13.00 – 13.30 Working groups report back to plenary on discussions held.
13.30 – 14.00 Inspection requirements for high risk products imported into and exported from Barbados (IK)
13.30 – 15.00 Revision of procedural Manual, Developing TORs, training modules for fish inspection and certification
15.00 – 15.15 Coffee break
15.15 – 16.00 Implementation of Codex standards, codes of practices in Barbados, identification of training needs.

March 16

- 09.00 – 10.30 Discussion on physical Infrastructural needs (current situation from Dr Roessink report) and competencies required for improving the situation considering future requirements
10.30 – 10.45 Coffee break
10.45 – 12.00 Training needs of key operators in the fish supply chain to implement GHP, HACCP
12.00 – 13.00 Lunch break
13.00 – 15.00 Developing TORs, training modules for fish supply chain actors
15.00 – 15.15 Coffee break
15.15 – 16.00 Discussions on the way forward.

Annex 3 – Capacity Building Needs Assessment Workshop – Participants

14 - 16 March 2012

United Nations House, Marine Gardens, Hastings, Christ Church, Barbados

List of Participants

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Annex 4 – SWOT Analysis

Boats - Fisheries Division

<p>Strengths</p> <p>Fisheries Divisions – good working relationship with its stakeholders. Advisory role- GHP, ice, design of boat, infrastructure, registration (good for traceability)- Provide training to fishers- class room and practical, written exam, annual training, medical examination, maintain documents on training, provide information to markets on trained personnel.</p> <p>Inspection of infrastructure of boats, have enforcement capacity with respect of infrastructure and annual inspection.</p> <p>Quick turnaround time, boat design good for this purpose ,</p> <p>Ice boats- have sanitary facilities, GPS (some) (Launch- day boat with no ice)</p> <p>Inspectors trained to inspect, have job experience of checking for sanitary facilities. Have policy and guidelines on inspection procedures of inspection of fish storage areas onboard.</p> <p>The necessary laboratory structure is present</p> <p>There is a structure of food inspection from the Ministry of Health</p> <p>Draft legislation is present</p>	<p>Weaknesses</p> <p>No role in implementation of hygienic practices- no checks performed on operational aspects- communication with Markets not formally organised.</p> <p>Very few fishers have insurance, health insurance</p> <p>Day boats do not have facility for storing ice (space would be a problem), though fishers know the importance of ice.</p> <p>Painting of wood- not there</p> <p>Maintenance is a problem</p> <p>Poor hygiene, not fitted with sanitary facilities</p> <p>No covering- fish exposed to high temperatures.</p> <p>No inspection onboard the vessel (day boat)</p> <p>Ice boats- design does not allow proper cleaning (draining of water)- could be an operational issue</p> <p>Inspectors have experience, but no formal training on sanitary structures and operational aspects.</p> <p>No legislation or penalties for poor maintenance of fish storage areas, fishers not all trained or certified, no requirement for medical certificate, no control on movement of personnel onboard, chances of contamination of fish with fuel</p> <p>Ice boats and long liners do not keep log book.</p>
<p>Opportunities</p> <p>Train fishers on good practices, to improve vessel design, phase out boats without ice boxes from commercial fishing,</p>	<p>Threats</p> <p>Could lead to loss of employment, some cultural practices may disappear.</p>

Landing sites and markets

<p>Strengths</p> <p>Markets: All landing sites are under Fisheries or Markets.</p> <p>For the local market, MoA provides excellent facilities for small businesses to process fish</p> <p>Have potable water and sanitary facilities, Ice (flake ice) provisions are available.</p> <p>Have records of boats.</p> <p>Random examination of vessels on landing, have records of disposal of condemned fish, ensure proper disposal.</p> <p>Provision of docking facilities, sales area, insulated</p>	<p>Weaknesses</p> <p>Markets: some are manned by markets or Fisheries. Fisheries staff not on site, but maintain facilities, Fisheries managed site is the third largest site</p> <p>No regular pre- and post- inspection of boats in all markets</p> <p>No records of fishing time (days of fishing)</p> <p>No regular monitoring of landings- fish may directly go to restaurants</p> <p>Lack of enforcement of rules and regulation, no written operational procedures, supply and demand issues with respect of cold storage and ice, lack of training, political interference, poor infrastructure</p>
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<p>bins for fish storage, transport of fish</p> <p>Technical quality control staff on site, refrigeration facility available.</p> <p>Well trained officers, existing facilities- ice at subsidised price</p> <p>Have cold stores,</p> <p>Facilities to haul boats for maintenance, and during disasters.</p>	<p>leading to cross contamination, open state (contamination opportunities), poor record keeping, stakeholder malpractices, use of non-covered trolleys, not enough technical staff resulting in inadequate performance, Lack of inspection protocols and stakeholder (fishers, handlers) resistance.</p> <p>Lack of adequate personnel</p> <p>Lack of blast freezers</p> <p>Movement of personnel –opportunities for contamination</p> <p>Insufficient funds for infrastructure improvement</p> <p>No risk based inspection</p>
<p>Opportunities</p> <p>Potential to upgrade facilities, training, provision of better legislation, implementation of correct procedures for off-loading, access for better markets to get better price.</p>	<p>Threat</p> <p>Public health issues and loss of markets</p>

Processing facilities

<p>Strengths</p> <p>Import facilities: ensure that the source is reliable</p> <p>Do inspection, temperature records checked during the transport, storage facilities well maintained.</p> <p>Processing plants: Proper documentation available, inspectors can prosecute if any problems found, one plant implements HACCP, one in process</p> <p>Can enforce factory design changes.</p> <p>Provision for ice and water quality checks, records and record keeping,</p> <p>Private plants have skilled staff, both private and government plants have to have medical certificates for staff</p>	<p>Weaknesses</p> <p>Import: Concern about quality of fish coming in</p> <p>Inadequate inspection personnel for following Codex procedures. Lack of space, concerns about country of origin, documentation unclear and confusing, no scientific testing, no histamine kits,</p> <p>No legislation for enforcing HACCP implementation</p> <p>More risk based inspection (hygiene) should be done- to reduce hazards</p> <p>Inadequate manpower for inspections.</p> <p>Poor layout of plants- makeshift facilities</p> <p>Implementation of traceability,</p> <p>Government facilities: interference by management in key health and sanitation, managers in key positions not qualified in specific areas</p>
<p>Opportunities</p> <p>Availability of training courses on fish handling (fishers also)</p> <p>Government facilities- improve access for export market, implement international standards, improve markets in region, and develop regional standards.</p>	<p>Threat</p> <p>Public health issues and loss of markets</p>

Annex 5 – Narrative part of a logical framework following the needs assessment

<p>Impact</p> <p>Consumers in Barbados have access to good quality and safe fish</p>
<p>Outcome</p> <p>Fishery products of Barbados meet international market requirements</p>
<p>Outputs</p> <ol style="list-style-type: none"> 1. Policy and regulation regarding fish inspection and quality assurance drafted and harmonized with international market requirements 2. Fish inspection system improved and meets international requirements 3. Government analytical services strengthened to perform analysis required by fish inspection services 4. Capacity of fish supply chain actors to implement GHP, HACCP and traceability improved.
<p>Activities</p> <ol style="list-style-type: none"> 1.1 Review existing draft Policy document and regulations and provide advice on improvements required. (FAO LEG + consultant) 1.2 Provide case studies of organization of Competent Authority in some fish exporting countries (FAO FIPM/consultant) 1.3 Prepare draft seafood regulations
<ol style="list-style-type: none"> 2.1. Fish Inspection Manual appropriate for fish handling practices in Barbados drafted (consultant) and finalized in consultation with concerned staff (including sampling plans)(Workshop) 2.2. Provide training for inspectors and pilot implementation in a couple of landing centers (with consultant support) 2.3 Provide minor field level minor inspection equipment 2.4. Provide training for inspectors to perform HACCP audit
<ol style="list-style-type: none"> 3.1. Provide minor equipment and consumable support to the analytical laboratories; 3.2. Pilot testing of fishery products for histamine and other essential parameters 3.3. Study visit to an international Laboratory carrying out ciguatoxin and other analysis of importance for Barbados 3.4. Provide support for performing proficiency testing and meeting other requirements for accreditation such as SOP, Lab Manual etc (consultant)
<ol style="list-style-type: none"> 4.1. Provide training for trainers on GHP, HACCP, traceability implementation (consultant+Workshop) 4.2. Provide support for two to three training workshops to be conducted by Barbados trainers (Practical oriented workshops) 4.3 Pilot implementation in two selected establishments (consultant) 4.4. Provide support for development of posters, leaflets for awareness among value chain actors and consumers 4.5. Provide advice on market infrastructure

Annex 6 – Main training service providers in fish inspection related courses

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1	French Research Institute for Exploitation of the Sea (IFREMER), France	French Research Institute for Exploitation of the Sea 155, rue Jean-Jacques Rousseau 92138 Issy-les-Moulineaux Cedex Tel.+330146482100 Fax+3301464821 21 http://www.ifremer.fr/anglais/	Alain Lagrange: Alain.Lagrange@ifremer.fr Patrick Berthou: patrick.berthou@ifremer.fr Jean Pierre Baud: Jean.Pierre.Baud@ifremer.fr Gilles Breuil: Gilles.Breuil@ifremer.fr
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4	HumberSide Seafood Institute, University of HumberSide, UK	The Grimsby Institute of Further and Higher Education HumberSide Seafood Institute Tel: +44800 315002 Fax: +441472 879924 http://www.grimsby.ac.uk/category/311.html	Matthew Thompson: thompsonm@grimsby.ac.uk +44 1472582400 Mike Dillon: dillonm@grimsby.ac.uk Simon Derrick: sederrick@googlemail.com
5	Marine Research Institute, Vigo, Spain	Instituto de Investigaciones Marinas de Vigo Eduardo Cabello, 6. Vigo. Pontevedra. Eduardo Cabello, 6. Vigo E-36208 (ESPAÑA) Tel:+34 986 231 930 FAX: +34 986 292 762 http://www.iim.csic.es	Director Aida Fernández Ríos aida@iim.csic.es
6	Natural Resources Institute, University of Greenwich, UK	Natural Resources Institute University of Greenwich at Medway Central Avenue Chatham Maritime Kent, ME4 4TB United Kingdom Tel:+441634880088 Fax+441634883386 / 880077 http://www.nri.org/	Linda Nicolaidis l.nicolaidis@gre.ac.uk
7	Fundación Cetmar, Regional Department of Fisheries and Maritime Affairs of Galicia, Spain	Centro Tecnológico del Mar - Fundación CETMAR C/ Eduardo Cabello s/n E-36208 Bouzas - Vigo Tel:+34986247047 Fax:+34986294587 www.cetmar.org	Coordinator: Yolanda Molares ymolares@cetmar.org Tel. +34 986 247 047 Ext. 208
8	Centre d'Etudes et de Valorization des Produits de la Mer (CEVPM), Boulogne s/Mer, France	Centre d'Etudes et de Valorization des Produits de la Mer (CEVPM) 15-17 Rue De Magenta 62200 Boulogne Sur Mer Tel. +33321839131 Fax: +33321874683 http://www.cevpm.com/index.htm	Bruno Lefur Bruno.lefur@cevpm.com labo@cevpm.com
9	National Fisheries College, Kavieng, Papua New Guinea	National Fisheries College P.O. Box 239, Kavieng New Ireland Province, Papua New Guinea Tel: +6759842187 and +675 9841248 http://www.fisheries.gov.pg/college_course_s.htm	Acting Principal: Hugh Walton hwalton@fisheries.gov.pg Ms. Catherine Natsek: cnatsek@fisheries.gov.pg
10	Mbegani Fisheries Development and Training	Mbegani Fisheries Development Centres, P.O. Box 83, Bagamoyo,	Principal: Y. Mgawe ymgawe@yahoo.com

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Source: Manual/Handbook for the Execution of Sanitary Inspection of Fish as Raw Material and Fish-Products as Food for Human Consumption. ACP/SFP Project Strengthening fishery products health conditions in ACP/OCT countries. 2010.