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IDENTIFICATION OF THE CONTENTS FOR AN ADVANCED TRAINING COURSE FOR FISH INSPECTORS IN KENYA

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ABSTRACT

The objective of this project is to identify the contents for a training course for fish inspectors in Kenya. A summary of each topic and its relevance to Kenya was made and the relevant sub-topics indicated. The topics covered all the problems associated with seafood and how they are solved by processing technologies, regulations, implementation of HACCP systems and quality assurance inspections. Inspectors should have a risk based approach as they carry out inspections and check on the traceability systems in the fish processing establishments and the fish and fishery products compliance with the microbiological and chemical criteria. Topics covering these areas were identified as essential as well as that on sampling since they carry out different sampling for analysis in their inspection duties. Having knowledge of the fish products buyers' requirements is crucial to them since they do the certification for the safety of all fishery products exported and a topic covering these requirements was included. Training in these topics will lead to improved inspection skills and the ability to effectively train the fisher folks. A study of how the fish processing establishments are inspected in Iceland was also carried out by joining the inspectors both from the accredited inspection bodies and the Directorate of Fisheries. The experience was used to compare inspections in Iceland and Kenya and to recommend possible areas of improvements in the two countries.

Key words: Contents, training course, fish inspectors, fish processing establishments.

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1 INTRODUCTION

1.1 A brief overview of the fisheries sector in Kenya

The fisheries sector in Kenya is very important to the country as it contributes to the national economy through employment creation, foreign exchange earnings, poverty reduction and food security. It contributes about 0.5 % to the National GDP. There are slightly over 50,000 fishermen in the country and about 500,000 people have direct income from the sector as fishermen, traders, processors and employees. It supports other auxiliary industries such as net making, packaging material industries and boat building thereby supporting more than one million people.

The total annual fish production in the year 2006 was about 160,000 metric tonnes valued at about USD 115 million (Ksh 8 billion) (FDS 2006). There are around 400 fish landings sites and about 300 of these are found along Lake Victoria, which is a fresh water lake and contributed about 145,000 metric tonnes of the total landings. There are three main species which are of commercial importance in that lake. They are *Rastrineobola argentea* (small cyprinids), Nile perch and tilapia which contributed 40%, 38% and 13% to the total landings in 2006 respectively. Nile perch is the species that is processed for the export market and contributed about 40% of the around 40,000 metric tonnes total exports in the same year.

Kenya has a coastline of 536 km along the Indian Ocean and an Exclusive Economic Zone (EEZ) of 200 nautical miles. Landings from the marine fisheries in 2006 were only 7,000 metric tonnes but the estimated potential is around 150,000 metric tonnes if properly exploited (Fisheries Department, Kenya). Tuna is the main fish species for the export market, apart from other species like octopus and prawns.

The Kenyan coastline along the Indian Ocean is shown in Figure 1 below:

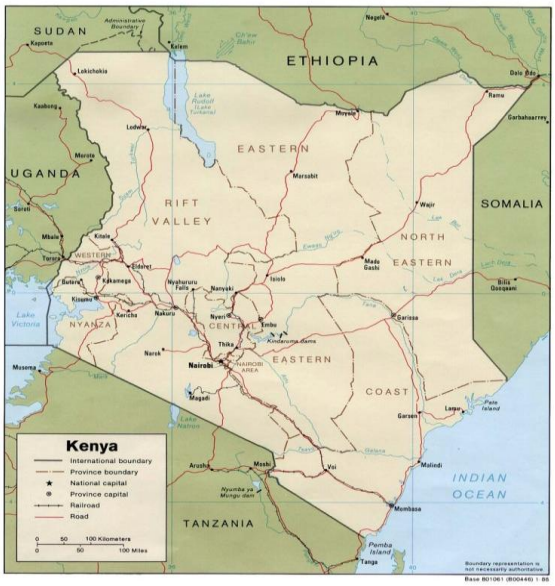

Figure 1: Map of Kenya showing the coastline along the Indian Ocean.

The fish produced in the country is expected to be safe for human consumption as safe food improves the health of the people and is a basic human right and the government plays a significant role to ensure this.

1.2 Role of governments in food safety control

Governments have an obligation to ensure that people have access to safe, reliable and nutritious food supplies. Production of a safe and good quality product is also a prerequisite for the successful development of domestic and international food trade.

In order to ensure food safety control, food legislation is put in place as an expression of the will of the government to carry out consumer protection from food borne hazards. The food legislation has the guidelines for food handling and processing.

A primary functional unit of the official control is an adequately staffed and trained inspectorate. The inspectorate has the role to inspect food manufacturing, processing and handling facilities for compliance with the national legal and regulatory requirements. With the introduction of HACCP systems in the food industry, governments should ensure the food inspectors have knowledge of the different processing technologies to be able to identify all the potential hazards associated with them and how they can be controlled (FAO/WHO 2004).

Some of the supportive functions of the national food safety control agencies are information dissemination and training services to sensitise the stakeholders on matters of food safety.

The Fisheries Department in Kenya is mandated to be the national food safety control agency for the fish and fishery products.

1.3 The Competent Authority in Kenya

The mandate of the Fisheries Department, which is under the Ministry of Livestock and Fisheries Development (MLFD), is to ensure the sustainable utilisation of the fisheries resource. The Fisheries (Fish quality Assurance) Regulations 2000, created MLFD as the Competent Authority (CA) which is mandated to ensure sustainable production, utilisation and marketing of safe and high quality fish and fishery products. The Fish Inspection and Quality Assurance (FIQA) section in the Fisheries Department is responsible for that activity.

The CA is composed of two committees, the Standing Committee and the Technical Committee. The Standing Committee comprises of the Permanent Secretary in the MLFD as the chairman, the Director of Fisheries and the Director of Veterinary services. The Technical Committee is responsible for the routine management of all technical operations of the CA and the Director of Fisheries is the chairman. It reports to the standing committee.

1.4 Past trainings for fish inspectors

The FIQA section is composed of fish inspectors who are appointed and gazetted by the CA and are substantive fisheries officers who are required to possess at least a first degree in biological sciences. Their roles are clearly defined by the Fisheries (Fish quality Assurance) regulations 2007 (FQA 2007) which replaced the regulations of the year 2000 with effect from July 2007.

The first gazettement of fish inspectors was done in 1993 when a total number of 30 were gazetted. The number has dropped to 22 in 2008 as a result of retirements and resignations without replacement due to a general ban on the recruitment of personnel in the public sector for the last 10 years.

The first training of the gazetted fish inspectors was done by FAO in 1993 and the following topics were covered (Georgsson and Gissurarsson 2007):

- Assurance of sea food quality
- Quality and quality changes in fish
- Fish processing and quality control
- Codex guidelines on food hygiene
- Recommended codes of practice for finfish and shellfish
- Good manufacturing practice
- European Union (EU) directives and their importance in fish processing
- HACCP systems
- Case studies of fish inspection services.

The government arranged for another course in 1999 and the following topics were covered:

- HACCP overview
- HACCP and sanitation
- Audit and verification of HACCP plans
- Fish standards and ISO-9000 series
- Seafood microbiology and safety
- Aquaculture and fish health

The third course was organised by the government in 2006 and covered the following topics:

- The new EU regulations
- Upstream control
- Traceability in food industry
- Quality system auditing

The current number of gazetted inspectors is inadequate for the inspection services in the country. There are already 15 trainee inspectors who require training to cover areas that have been covered in post-graduate courses by the gazetted fish inspectors. The gazetted fish inspectors also require further training to upgrade their skills, as was

confirmed by some of the findings and recommendations of a team from the UNU-FTP in Iceland which visited Kenya in June 2007 (Georgsson and Gissurarsson 2007).

1.5 Training of fish inspectors at Moi University

As indicated before, fish inspectors are recruited from the already serving fisheries officers who are required to possess at least a first degree in biological sciences. This is not adequate to make them perform inspection duties competently and further training is necessary. The resources within the Competent Authority are not always sufficient to carry out trainings for all the personnel it requires to perform its core functions. It would therefore be sustainable to recruit new fisheries officers who have undertaken a fish inspection course during their undergraduate training in the University.

The Fisheries Department in Kenya in collaboration with UNU-FTP in Iceland have identified Moi University in Kenya where a fish inspection course could be incorporated into the curriculum in the relevant faculty. This would require the development of a teaching manual for the University.

The Fisheries department Kenya, UNU-FTP Iceland and FAO have collaboratively planned for a training course for the fish inspectors in Kenya in May 2008 after which the training materials will be used to prepare a teaching manual that can be used by Moi University as indicated above.

In preparation of the anticipated May 2008 training course, the course content and relevance to Kenya must be developed.

1.6 Project objective

The objective of this project is to develop the course content for an advanced training course for fish inspectors in Kenya. Topics and sub-topics to be covered during the training will be identified together with their relevance to Kenya and how the knowledge will be imparted to the trainees.

A study of how the fish processing establishments are inspected in Iceland will be done and the experience used to compare with the inspection in Kenya for the purpose of identifying any possible improvements.

2 METHODOLOGY

Consultations were conducted with the Fisheries department Kenya, UNU-FTP Iceland and FAO which culminated in a one week meeting in Iceland in November 2007 attended by representatives of the three parties. The topics and sub-topics were agreed upon during that meeting.

After the meeting, the training objectives, teaching methods and the expected results for each topic were identified followed by a literature review for every topic and a summary including its relevance to Kenya. All the topics were then put together as the contents for the training course.

Two different fish processing establishments in Iceland were then visited during inspections by accredited inspection bodies in one of them, and the other by an inspector from the Directorate of Fisheries.

3 TOPICS IDENTIFIED TO BE COVERED DURING THE TRAINING

The following topics were identified during the one week meeting in November 2007 in Iceland as being relevant for the training:

- Outbreak data and epidemiology of food borne disease outbreaks investigation
- Emerging microbiological and chemical risks
- Main consumer safety issues concerning farmed fish.
- Fish spoilage
- Fish handling and processing
- National, regional and international regulatory framework
- Inspection, monitoring and surveillance
- Installation of a HACCP system and validation of the system
- Qualifications and responsibilities of fish inspectors
- Traceability
- Quality and safety management (risk analysis).
- Sampling techniques and evaluation of results
- Microbiological criteria and limits for hazardous chemicals in fish
- Buyers' requirements.

3.1 Summary of each topic including its objective and relevance to Kenya

3.1.1 Outbreak data and epidemiology of food borne disease outbreaks investigation

❖ Objective

To equip the inspectors with the outbreak data of seafood related diseases. The main causes and the preventive measures of the diseases will be emphasised, as well as the risks and benefits of fish consumption. This will be useful to the inspectors as they carry out inspections and when training fisher folks.

❖ Method of teaching

Lecture and discussions

❖ Results expected

At the end of the training in this topic the inspectors should:

- Have a good knowledge of the biological, chemical and physical hazards in seafood, their causes and prevention.
- Have knowledge of the outbreak data of food borne diseases.
- Know the risks and benefits of fish consumption.
- Know the surveillance and epidemiological methods used in the food borne diseases outbreak investigations.

3.1.1.1 Summary and relevance to Kenya

The epidemiological surveillance of food borne diseases is very necessary for the planning of food safety programmes and in the development of preventive and control measures (Bettcher *et al.* 1997). The strategy of reducing all the risks that are related to food requires knowledge of the current levels of food related diseases.

There has been increased international trade in food with time, thereby increasing the risk of cross-border transmission of infectious diseases. Kenya produces fish and fisheries products both for local consumption and for export to international markets. It is important for the inspectors to know the hazards associated with seafood, their causes and prevention for effective food safety control.

The majority of food diseases in developing countries like Kenya are caused by biological contaminants mainly bacteria, viruses and parasites (Kaferstein 2003). They are responsible for many diseases which include cholera, campylobacteriosis, *E. coli* gastroenteritis, typhoid, shigellosis, amoebiasis and poliomyelitis among others. Internationally, the diarrheal diseases from food borne diseases constitute about 70% of all diarrheal episodes (Kaferstein 2003) but there also cases of parasitic infection reported. It is therefore useful for the inspectors to have data on the incidences of food borne disease outbreaks and their causes to be able to know the areas that require more vigilance.

An example of a food borne disease outbreak in Kenya was in 1998 when there was a cholera outbreak around Lake Victoria and the EU slapped a ban on export of Nile perch from the lake. All government agencies with a stake in the fisheries industry and public health were involved in the interventions to solve the problem.

There has also been Rapid Alert System for Food and Feed (RASFF) notifications of the EU linked to fish and fishery products originating from Kenya for the period 2003-2007 as shown in Table 1 below (FVO 2006).

Table 1: Rapid Alert System for Food and Feed (RASFF) notifications linked with fish and fish products from Kenya (FVO 2006).

DATE	**PRODUCT**	**CONTAMINATION**
26/03/2003	Frozen fillets of Nile perch	Salmonella spp
06/08/2003	Frozen Nile perch fillets	Mesophiles
21/08/2003	Frozen fillets of Nile perch	Salmonella spp

Food borne diseases can be investigated by an epidemiological study. This study looks at the factors affecting the health and sickness of people making it a good tool for laying down the interventions. The studies can be either descriptive or analytic. Surveillance is the collection and use of epidemiological information to be able to plan, implement and assess the control of diseases (Venter 1999). The objectives of food borne disease surveillance is to determine which food acts as a route of the transmission of the pathogen, identify the level and trend of the problem and come up with interventions. The effectiveness of the food safety programme is also assessed with a view of making any improvements.

Fish inspectors in Kenya have a big role to play in epidemiological investigation and surveillance of food borne disease outbreaks since these activities are multi-sectoral involving them and other government agencies like the Ministry of Health and local authorities.

As professionals in the fisheries industry, it is imperative for the inspectors to be aware of the benefits and risks of fish consumption.

3.1.1.2 Summary of sub-topics

- Food borne diseases from consumption of seafood products.
- International data on reported outbreaks and cases of food borne diseases.
- Food borne diseases in developing countries.
- Epidemiological methods used in food borne disease outbreak investigations.
- Surveillance of food borne disease.
- Risk and benefits concerning fish consumption.

3.1.2 Emerging microbiological and chemical risks

- Objective
  To equip the inspector with the knowledge of emerging microbiological and chemical food borne problems and their causes. This is necessary during inspections and when carrying out training for fisher folks as they can advise on strategies to minimise the occurrences of these risks.

- Method of teaching
  Lecture and discussion

- Expected results
  At the end of the training in this topic, the inspectors should know the emerging microbiological and chemical hazards and why there is an increase in food borne diseases. They will also have knowledge of the intervention measures that can minimise the risks.

3.1.2.1 Summary and relevance to Kenya

The emerging or re-emerging food borne problems are those that have:

- appeared in a population recently
- extended new vehicles of transmission
- started to increase rapidly in number and new areas

They may have been there for a long time but were only recently identified due to new increased knowledge or methods of identification and analysis (Venter 1999). These are international problems including Kenya and all those involved in national food safety controls require knowledge in this area for effective control.

There are both microbiological and chemical risks. Some of the microbiological risks include bacteria like *Campylobacter, Salmonella typhi-murium DT 104, Salmonella enteritidis, Vibrio vulnificus, Listeria monocytogenes and E.coli 0157:H7* (EC 2005,

Venter 1999). The *Norwalk* and *Norwalk* like viruses (Noroviruses) and the *Rotaviruses* are other risks that have emerged (FDA 2006).

Food contamination by chemical hazards is a public health concern worldwide and is one of the causes of trade problems. Contamination may be caused through environmental pollution of the air, water and soil by heavy metals like mercury, arsenic, lead and cadmium.

In Kenya there is intensive inhabitation of the water catchment areas where a lot of agricultural activities are carried out. This poses a risk of the pesticides used in those areas ending up in the aquatic environment through storm water. Other potential sources of chemical contaminants include poor management of sewage water treatment plants, refuse disposal sites and urban run-off.

Though there has been reduced usage of leaded petrol in Kenya in the past few years, it is still being used in some parts of the country and this is a potential pollutant to the aquatic environment. However, national surveillance programmes for pesticides and heavy metals of the aquatic environment have never shown any non-conformity with the required national and international standards (FD 2006). The continued undertaking of that surveillance activity in view of the results could be discussed with the inspectors.

Some chemical contaminants that have been banned internationally include organic pollutants (POPs) such as DDT, PCBs, dioxins, furans and PBDEs (polybrominated diphenyl ether) which is a flame retardant. They were banned since some affect the nervous system, reproductive system and others are carcinogenic, and this is important information for food safety control personnel.

Sulphites are allowed in shrimp processing which is part of the fishery products exported from Kenya and a Maximum Allowable Limit (MAL) set in the Kenyan regulations as adopted from EU regulations. It would risk the consumers' health if the MAL is exceeded.

Several developments may be attributed to the increase in food borne diseases in the recent past. These include (Venter 1999):

- Emerging pathogens resistant to a wide range of antibiotics.
- The number of immunocompromised people has increased due to human demographics and behaviour.
- Consumer behaviour e.g. consumption of raw food and eating in public places like hotels.
- New production, processing and handling methods.
- Increased use of industrial and domestic chemicals.
- International travel and trade.

The reasons which can be attributed to the increase in food borne diseases could be discussed with the inspectors.

3.1.2.2 Summary of sub-topics

- Microbiological risks
- Chemical risks
- Reasons for increased problems with food borne diseases

3.1.3 Main consumer safety issues concerning farmed fish

- Objective
  To enlighten the inspectors with information on the hazards associated with farmed fish. This will make them have better knowledge and inspection skills as they deal with farmed fish.

- Method of teaching
  Lecture and discussions

- Expected output
  At the end of the training, the inspector should know:
  - The environmental contaminants, chemicals, antibiotics and drugs associated with farmed fish that are of public health importance.
  - The microbiological safety issues associated with farmed fish.
  - The safety of farmed fish as compared to wild fish.
  - The risk groups as a result of consumption of farmed fish.

3.1.3.1 Summary and relevance to Kenya

Fish farming has increased globally in the recent past due to increased demand for fish and the depletion of wild stocks due to overfishing and environmental degradation.

Though Kenya has underexploited its marine fisheries resources, the inland lakes have been overexploited and already intervention measures have been put in place to ensure there is sustainable utilisation of these resources. Fish farming which is still at a low scale is now being encouraged to offer an alternative source of fish apart from the natural water bodies.

Some of the fish farmed in Kenya include tilapia and *Clarias* and trout. Most of the small scale farmers specialise in tilapia monoculture and others on polyculture of tilapia and *Clarias*. The majority use locally formulated fish feeds.

Other fish farmers rely on the commercial fish feeds which contain fish oils and meal derived mainly from small pelagic fish such as anchovies, sardines and mackerel. These fish accumulate the chemical contaminants from the aquatic environment into their fats (Kimbrell and Letterman 2005), thereby passing the same to the farmed fish.

The Kenya fisheries regulations (FQA 2007) state that the Competent Authority shall provide for an annual monitoring programme for residues of veterinary drugs allowed to be used in aquaculture by the Kenyan Pharmacy and Poisons Act Cap. 444. Monitoring of the residues of substances whose use in aquaculture is banned under the same CAP. 444 is also provided for in the Kenya fisheries regulations. However, the monitoring programmes have not yet been practically put in place and will have to be implemented for the assurance of the safety of aquaculture products from the country with the development of the aquaculture industry.

The fisheries regulations in Kenya also states that fish culture operations have to be located in areas where the risk of contamination with hazardous chemical effluents is minimal and the risky areas are clearly defined.
Antibiotics are used in farmed fish to control diseases and are commonly used through fish feed. The consumers of fish ingest the residues of these substances from the meat of the fish and some are dangerous to human health.

The potential hazards associated with human pathogenic bacteria in farmed fish can be caused by the indigenous bacteria and also those resulting from the contamination of the aquatic environment. Hazards may also arise through the introduction of bacteria during post-harvest handling and processing with bacteria which include *Salmonella, E.coli, Shigella, Campylobacter, Vibrio spp*. and others.

It is imperative for food safety assurance personnel to understand the risks of the foods they are dealing with. Table 2 below shows the potential health effects from drugs and chemicals used in aquaculture.

Table 2: Potential health effects from drugs and chemicals used in aquaculture (Kimbrell and Letterman 2005).

Drug or chemical	**Examples**	**Some species affected**	**Potential risks**
Antibiotic	Oxytetracycline, Chloramphenical, Sulfadimethoxine-ornethroprim, Amoxycillin trihydrate, Nitrofurans	Catfish, Salmon, Shrimp	Development of resistant Bacteria, residues in food
Dye	Astaxanthin, Canthaxanthin	Salmon	Hyperactivity in young children, eye problems
Environmental contaminant	PCBs, PBDEs, dioxins	Salmon	Suspected carcinogen
Fungicide	Malachite green	Salmon, Catfish	Suspected carcinogen
Genetically modified fish	Growth hormones, antifreeze protein	Salmon, Tilapia, oysters	Allergenicity, toxicity, unintended effects.
Hormone	Bovine growth hormone (rBGH)	Tilapia	Links to cancer

3.1.3.2 Summary of sub-topics

- Environmental contaminants in farmed fish
- Antibiotics and drugs used in fish farming
- Chemical contaminants
- Genetically engineered fish
- Microbiological safety issues
- Safety of farmed fish as compared to wild fish
- Fish consumption and risk groups

3.1.4 Fish spoilage

- Objective
  To equip the inspectors with the knowledge of the different causes of fish spoilage and how they can be slowed down. This will improve their inspection skills and make them effective trainers of the fisher folks.

- Method of teaching
  Lecture and discussion

- Expected results
  At the end of the topic, the inspector should know about the microbiological, chemical physical spoilage of fish and how they can be slowed down.

3.1.4.1 Summary and relevance to Kenya

Spoilage of fish starts immediately after it dies and microbiological action is the main and fastest cause (FAO 1995) with the different microorganisms requiring specific conditions for optimum growth. Other factors that contribute to fish spoilage include oxidative rancidity, protein degradation and breakdown of chemicals with the subsequent formation of various products like ammonia and hypoxanthine.

Fish has a lot of bacteria naturally present on its skin, gills and in the intestines. These bacteria are normally not harmful to a living healthy fish, but shortly after death, they begin to multiply and ingest the flesh of the fish. The bacterial load carried by a fish depends on its health, its environment, the way it was caught and the eventual post harvest handling. Healthy fish from clean water will always keep better than fish exposed to dirty and unhygienic conditions in their natural environment.

Kenya has several types of fish and fish products. It is necessary to reduce post harvest losses of fish for maximum returns and for the safety and quality of the product despite the constraints in the country due to poor infrastructure and scarcity of financial resources.

The single most important factor affecting the rate of fish and shellfish deterioration and multiplication of microorganisms is temperature. Most of the fishing in Kenya is done by artisanal fishermen who use small wooden canoes that do not provide for the proper handling of fish and the majority of them do not carry ice on board during their fishing expeditions which compromises the quality of the fish landed.

Spoilage of fish for local consumption in Kenya is mainly caused by poor processing methods, handling and storage. These methods include sun drying, smoking and deep frying. The infrastructure in the retail outlets does not provide for proper fish storage and handling leading to fish spoilage including infestation by pests.

For the species prone to histamine (scombroid) poisoning, time and temperature control are the most effective methods of ensuring food safety (Codex 2003a). Histamine production in fish is related to the histidine content of the fish, the presence of the bacterial histidine decarboxylase and the environmental conditions. The

formation of histamine is significantly reduced at low temperatures and it is therefore necessary to hold all fish and fish products that are to be chilled at a temperature close to 0^{o}C. Tuna fish belongs to the scombroid family and is harvested and processed in Kenya.

Physical damage of fish accelerates the rate of decomposition both by autolysis and by exposing the flesh to bacterial spoilage. The physical damage includes puncture and mutilation which is brought about by fishing methods and poor handling.

Fish inspectors in Kenya play an advisory role to the fishermen and all fish handlers apart from enforcing the relevant regulations and should therefore have knowledge of the causes of fish spoilage and how they can be controlled.

3.1.4.2 Summary of sub-topics

- Microbiological spoilage
- Chemical spoilage
- Physical damage
- Control measures

3.1.5 Fish handling and processing

- Objective
  To equip the inspectors with fish handling methods and processing technologies. They will be made aware of the good manufacturing and hygienic practices (GMPs and GHPs) during the fish handling and processing activities to improve their inspection skills.

- Teaching method
  Lecture and discussions

- Expected results
  At the end of the training in this topic, the inspector is supposed to have proper knowledge of the following: fish handling, chilling, freezing, cold storage, smoking, drying, salting, fermentation, vacuum packing, Modified Atmospheric Packing (MAP), heating and food additives relevant to fish and fish products.

3.1.5.1 Summary and relevance to Kenya

Kenya has a diverse fishery resource base both for local consumption and the export market. Different markets require different types of products and also different fish species have their appropriate processing methods. Fish handling determines the safety and quality of the final product and the inspector should have knowledge of fish handling and the processing technologies for efficient inspection and training of the fisher folks.

The quality of fish begins to deteriorate immediately after catch and this cannot be stopped but can only be slowed down. The spoilage can be reduced by chilling the

fish to minimise bacterial, biochemical and chemical activity. It can also be slowed down by handling with care at all times to prevent and minimise physical damage like puncture and mutilation and by preventing contamination. The appropriate methods of preventing contamination are through good vessel design and construction, providing a hygienic working environment and by good handling practices.

The use of ice on board by fishermen in Kenya is not a common practice and is not mandatory in the current legislation. They also do not practice proper fish handling on board which would reduce the spoilage rate since the wooden canoes are not easy to clean and expose the fish to direct sun. They would require technical advice on fish handling and the inspectors have to be equipped with the appropriate knowledge for effective training and law enforcement.

Fish processing and trading at the artisanal level provides diversified employment to the fishing communities and other traders. Food safety control authorities have to ensure that fish and fishery products are safe and healthy to the consumers and the methods of processing, transporting and storing are environmentally sound. Post harvest losses should be minimal and where possible the production of higher-valued or processed products be encouraged since such products bring better returns to fishers (FAO 2001).

In Kenya the traditional fish processing methods like smoking, sun drying and salting fish are carried out and the products are mostly traded for local consumption. Poor processing, handling and storage of these products often lead to loss through spoilage and infestation by pests, and this poses a danger to the consumers as a result of contamination. Inspectors are required to enforce the law and to offer technical advice to address these problems.

Due to technological advancement globally and consumer demand for different types of products, modern methods of processing and preservation have been developed. The fish inspectors should have knowledge of these different processing technologies, the risks involved and the prevention measures for effective inspection and law enforcement.

3.1.5.2 Summary of sub-topics

- Handling
- Chilling
- Freezing
- Cold storage
- Smoking
- Drying salting
- Fermentation
- Vacuum packing
- Modified Atmospheric Packaging (MAP)
- Heating
- Additives

3.1.6 International, regional and national regulatory framework

- Objective
  To equip the inspector with the knowledge of national, regional and international regulatory framework on seafood safety. This will be useful to the inspector when carrying out inspections, advising and training the food handlers and other stakeholders in the fisheries industry.

- Methods of teaching
  Lecture and discussion

- Expected results
  At the end of the topic, the inspector should understand the sections of the Kenyan legislation relevant to fish and fishery products safety, the EU food law and fish hygiene controls which the Kenyan legislation has already harmonised with, and the WTO SPS/TBT agreements and their relevance in fisheries. They should also have a good knowledge of the Codex Alimentarius Commission and its outputs relevant to fisheries and some of the internationally recognised food safety laws like that of US Food and Drug Administration (FDA).

3.1.6.1 Summary and relevance to Kenya

All personnel involved in a national food control system should be conversant with the regulatory framework applicable. The Fisheries Act, Cap 378 (1991) (Fisheries Act, 1991) of the Laws of Kenya is an Act of Parliament that "provides for the development, management, exploitation, utilisation and conservation of fisheries and for connected purposes." Sections 23(2) (d) and (e) of the Act empower the Minister to make regulations, among other things, for regulating the handling, storage and processing of fish by prescribed methods. The Minister has made The Fisheries (Safety of Fish, Fishery Products and Fish Feed) Regulations 2007 (FQA 2007), which gives the Competent Authority powers to monitor and regulate all aspects of fish handling. The inspectors have to understand these provisions for effective inspection and enforcement.

The EU is a major market for fish products from Kenya and the country has suffered three fish export bans by the EU between 1996 and 2000. The first ban was in 1996 due to *Salmonella* contamination of fish that was exported to Spain while the second one which affected the three East African countries of Kenya, Uganda and Tanzania was in 1998 due to a cholera outbreak in the Lake Victoria region. The third was in 1999 for an alleged pesticide contamination of the Lake Victoria water and fish. These bans affected the fish industry and both institutional and legislative changes had to be made to win back market confidence in Kenyan exports (FD 2006). The EU demands that the legislation of any fish exporting country must be equivalent to their legislation and the Kenyan fish safety regulations (FQA 2007) are already harmonised with the relevant EU regulations. It is therefore imperative for the fish inspectors to understand the EU legislation relevant to the fish and fish products as well as those of the USA and Japan which are some of the markets for Kenyan fishery products.

Kenya, Uganda and Tanzania form the East Africa region and have got many things in common due to their geographical location. They share Lake Victoria which is the source of Nile perch which is mainly for the export market and several other fish species consumed locally. There is also a lot of cross border trade in fish and fishery products and the countries have found it necessary to have a common approach in regional matters and the formation of a full East African Community is at an advanced level. Some organs of the community are already in place like the Lake Victoria Fisheries Organization (LFVO) and a harmonised Code of practice for fish and fishery products (FIQA/EAC/001:2005) has been developed (EA 2005) whose provisions should be understood by all stakeholders including the fish inspectors.

Kenya is a member of the World Trade Organization (WTO) and is a trading partner with many nations and has an obligation to abide by the various relevant WTO agreements. In the fisheries industry, the WTO Agreement on the application of Sanitary and Phytosanitary measures (SPS) and the Agreement on Technical Barriers to Trade (TBT) are very relevant for ensuring food safety and fair trade. The precursor of WTO was the General Agreements on Tariffs and Trade (GATT).

At the end of the Tokyo Round of negotiations (1973-1979), the GATT contracting parties signed the agreement on Technical Barriers to Trade. This agreement was called the standards code and it laid down the rules for preparation, adoption and application of technical regulations, standards and conformity assessment procedures (Cho and Weiler 2004). The technical regulations and standards set out specific characteristics of a product such as shape, size, design, functions and performance, packaging and labelling. A new WTO TBT agreement (TBT, undated) became operational in 1995 and clarified the provisions of the Tokyo Round standards Code (WTO 2007a).

The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS, undated) also entered into force with the establishment of the WTO in 1995. It sets out the basic rules for food safety and animal and plant health standards. It covers all measures to protect:

- human or animal health from food-borne risks;
- human health from animal- or plant-carried diseases;
- animals and plants from pests or diseases.

The SPS measures are also of great necessity for the food safety for the local consumers in Kenya.

The SPS/TBT agreements require governments to harmonise their standards by basing them on the international standards and guidelines developed by WTO members in other international organisations. These organisations are the Codex Alimentarius Commission for food safety issues, the Office International des Epizooties (OIE) for animal health and the Food and Agriculture Organization (FAO) International Plant Protection Convention (IPPC) for plant health (WTO 2007b). There is therefore a need for the fish inspectors in Kenya to understand these organisations.

3.1.6.2 Summary of sub-topics

- Sanitary and Phytosanitary (SPS)/Technical Barriers to Trade (TBT) agreements
- Basic principals of SPS/TBT
- Implementation of SPS/TBT in the fish industry-special issues of developing countries.
- Dispute cases related to fisheries, SPS or TBT
- Codex/OIE, their missions, organisation and output relevant to fisheries
- EU regulatory framework on food safety, fish hygiene controls and directive on water quality
- The food safety regulatory framework of the United States Food and Drug Administration (FDA)
- Kenya food safety regulatory framework
- Precautionary principle
- Harmonised East Africa SPS requirements for fish and fishery products
- Other foreign countries' food safety regulatory frameworks, like that of Japan and Canada.

3.1.7 Inspection, monitoring and surveillance

- Objective
  To make the inspectors improve their skills in preparing and carrying out the different types of inspections and in compilation of reports. They will become aware of the rapid instruments and kits that are useful during inspection.

- Method of teaching
  Lecture, discussion and practicals.

- Expected results
  At the end of the training, the inspectors should know the required rapid instruments and kits for an inspection, how to prepare and carry out the different types of inspections and compilation of reports. They will also know some of the recommended surveillance programmes for contaminants in the water bodies and fish/fish products.

3.1.7.1 Summary and relevance to Kenya

The Kenya fisheries regulations (FQA 2007) creates the Competent Authority which is the national agency that controls the safety of fish, fish products and fish feed. The EU regulations make it mandatory for any exporting country like Kenya to have a Competent Authority in place for the official control of any food of animal origin (EU 2004b).

These regulations mandate the Competent Authority to appoint fish inspectors. One of the main duties of the inspector is to ensure that the owner of a fishery enterprise applies continuously and properly, measures provided in the same regulations with respect to (FQA 2007):

- HACCP system
- Good hygiene practices
- Traceability
- Training in hygiene and in work procedures
- Water quality
- Record keeping

The regulations also mandate the inspectors to enter any fishery enterprises and carry out inspections and they should therefore have skills to undertake the inspections.

There are several categories of inspections carried out in Kenya. There are the routine inspections that are done at least once a month by the inspectors in whose jurisdiction the particular fish processing establishment is found and are unannounced**.** Follow up inspections are carried out to verify the corrective actions that the establishment has undertaken to address non-conformities that were found during previous inspections.

Spot check inspections are undertaken without notice and can be triggered by, for example, a change in risk environment which may indicate the need for additional checks at certain periods, areas or type of process. Suspicion of establishment's non-compliance with certain requirements may also lead to the inspection.

National inspections are scheduled and are undertaken at least once a year and are normally carried out by a team of inspectors led by the head of the Fish Inspection and Quality Assurance (FIQA) section of the Competent Authority. The compliance certificates for the establishments with the national requirements are issued on the basis of these inspections and previously issued certificates may be suspended if the inspection reveals serious non-conformities.

If a newly constructed fish processing establishment applies for licensing by the Competent Authority, then there will be a pre-licensing inspection which comprises of the checks on the documents submitted with the application and the facilities in the establishment.

It is very essential for the already serving inspectors to refresh their knowledge on the inspection procedures for harmony and improvements of skills and the trainee inspectors require training in order to have skills of carrying out inspections.

Kenya has a national surveillance programme for both pesticides and heavy metals and the samples are collected by the inspectors who submit them to laboratories designated by the Competent Authority for analysis. There have not been any incidences of non-compliance with the Maximum Limits (MLs) or Maximum Residue Limits (MRLs) and the necessity for the continued sampling would be an issue that could be discussed with the inspectors.

3.1.7.2 Summary of sub-topics

- Rapid instruments and kits for inspection
- Preparation for inspections
- Procedures for inspection
- Final inspection report
- Follow-ups and conclusions
- Surveillance programmes

3.1.8 Installation of an HACCP system and validation of the system

- Objective of the topic
  To make sure the inspectors have practical knowledge of the HACCP system and are able to construct a HACCP plan for a given fish production. They will also be able to conduct the verification and auditing of a working HACCP plan which is an improvement in their inspection skills.

- Method of teaching
  Lecture, discussion and practicals

- Expected results
  At the end of training, the inspectors should know the prerequisites of HACCP, the principles of HACCP, how to construct a HACCP plan for a given food production and how to audit and verify a HACCP system. This will in effect improve their inspection skills. They should also be able to compare the HACCP system and the ISO 22000 standard.

3.1.8.1 Summary and relevance to Kenya

The HACCP system is a science-based systematic approach to the identification of specific hazards and measures for their control or prevention to ensure food safety (FAO 2003a). The system has been integrated into the Kenyan fisheries regulations (FQA 2007) and also into the regulations of most fish/fish products importing countries like the EU member states (EU 2004a).

In order to assure the proper execution of the various HACCP system activities, there has to be a proper description of those activities and the people responsible have to be trained. A record keeping system has to be developed to provide documentation for all the actions and measurements (FAO 2003a).

The already serving fish inspectors in Kenya have had HACCP system application training in food production but there is a need to develop a common understanding of the principals. This can be achieved during training by:

- Promotion of a common approach for the identification of hazards, critical control points and critical limits
- Agreement on the basic understanding of HACCP principals
- Sharing of knowledge and practical experience in applying the HACCP principals
- Making the inspectors understand that it requires study, investigation of each detail that may affect product safety, quality and economic integrity

The inspectors should understand the requirements of proper implementation of a HACCP system. According to the Codex guidelines, before the application of HACCP to any sector of the food chain, the sector is required to operate according to the Codex General principles of Food hygiene, the appropriate Codex Codes of practice (Codex 2003a), and the appropriate national food safety legislation, which is the Kenya fish quality assurance regulations (FQA 2007). Prerequisite programmes are steps or procedures that control the operational conditions within a food establishment allowing for environmental conditions that are favourable to the production of safe food. These are usually described as Good Hygienic Practices (GHP) or Good Manufacturing Practices (GMPs) (FAO 2003a).

The prerequisite programmes lay the foundation of HACCP plans and must be adequate and effective. If any part of the prerequisite programme is not well controlled, then additional critical control points may have to be identified, monitored and maintained under the HACCP plan (HACCP 2007). The inspectors should therefore understand the pre-requisites programme since they will be checking the implementation of HACCP systems in the fish processing establishments.

These prerequisite programmes cover:

1. Premises: outside property, building, sanitary facilities, and water/steam/ice quality programmes.
2. Transportation and storage: food carriers, temperature control storage of incoming materials, non-food chemicals and finished products.
3. Equipment: general equipment design, equipment installation, equipment maintenance, and calibration
4. Personnel: training, hygiene and health requirements
5. Sanitation and pest control: sanitation programme, pest control programme
6. Recalls: recall procedures, distribution records

The HACCP system has seven principles (FAO 2003a) which the inspectors should know. These are:

- Principle 1: conduct a hazard analysis
- Principle 2: determine the Critical Control Points (CCPs)
- Principle 3: establish critical limit(s)
- Principle 4: establish a system to monitor control of the CCPs
- Principle 5: establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control
- Principle 6: establish procedures for verification to confirm that the HACCP system is working effectively
- Principle 7: establish documentation concerning all procedures and records appropriate to these principles and their application

The introduction and application of the HACCP principles following a series of 12 steps in a logical sequence as described below (FAO 2003a):

1. Assemble HACCP team
2. Describe product
3. Identify intended use
4. Construct process flow diagram and plant schematic
5. On-site verification of flow diagram
6. List hazards associated with each step (principle 1)
7. Apply HACCP decision tree to determine CCP (principle 2)
8. Establish critical limits (principle 3)
9. Establish monitoring procedures (principle 4)
10. Establish deviation procedures (principle 5)
11. Establish verification procedures (principle 6)
12. Establish record keeping/documentation for principles one through to six (principle 7)

Most of the inspectors in Kenya have not had any training in HACCP auditing to effectively audit the system in the fish processing establishments. Auditing is a systematic and independent examination to determine whether activities and results comply with documented procedures, and also whether these procedures are implemented effectively and are suitable to achieve the objectives (FAO 2003). In HACCP, the objectives are the production and distribution of safe fish products through the use of an HACCP based approach.

The audit is to establish whether the processor has:

- Implemented a sound HACCP system
- The knowledge and experience needed to maintain it
- The prerequisite programmes in place to assess adherence to Good Hygienic and Good Manufacturing Practices (GHP/GMP).

During the audit, assessment will be done to assess the management commitment to support the system and assessment of the knowledge, competency and decision-making capabilities of the HACCP team members to apply the system and maintain it.

The ISO 22000 is a generic food safety management standard which requires an organisation like the fish processing factories to establish a Food Safety Management System (FSMS) to ensure food products do not cause adverse human health effects. It specifies the requirements for the food management that combines the following key elements to ensure food safety along the food chain (ISO 2005):

- Interactive communication
- System management
- Prerequisite programmes
- HACCP principles

Though compliance with ISO 22000 is not mandatory, the food safety regulators should have knowledge of the standards as the FSMS of the organisations being inspected may choose to comply with the requirements of the standards.

3.1.8.2 Summary of sub-topics

- Prerequisite programmes
- Revision of the HACCP principles
- Construction of an HACCP plan for a given fish production
- Auditing and verification
- Comparison of the HACCP system and the ISO 22000 standard

3.1.9 Qualifications and responsibilities of fish inspectors

❖ Objective
To make the inspectors understand their responsibilities and that of fishermen, processors and distributors in matters of food safety. They will also be made aware of the necessary qualifications and trainings for inspectors.

❖ Method of teaching
Lecture and discussion

❖ Expected results
At the end of the training, the inspectors should know their roles and responsibilities and the qualifications and trainings necessary for them to carry out inspections efficiently. They should also have knowledge of the roles of fishermen, fish processors and distributors in food safety.

3.1.9.1 Summary and relevance to Kenya

From the early 1980s, there has been an international drive towards reforming fish inspection systems to move from end-product sampling and inspection to HACCP based safety and quality systems (FAO 2005). The inspector's main role is to assess the food safety conditions during production based on the legal requirements, and to take action to prevent damage to consumer health when conditions don't meet the required standards.

Fish can never be 100% safe since it is a biological material and most fish are hunted from the wild environment which is not subject to human controls. The sources of supply, processing technology and distribution systems are always dynamic and it is not possible to control everything at all time. The inspector's task is therefore one of risk management to ensure that the limited resources available are applied in an efficient and effective manner so that the risk of a food safety hazard that can harm the consumer is minimised.

The responsibilities of fish inspectors in Kenya include (FQA 2007):

- Inspection and approval of intended and operating fishery enterprises like processing establishments, fishing vessels, canoes, distribution centres, landing sites and markets and means of transport
- Monitoring of approval conditions
- Audit and verification of GMPs and HACCP systems
- Ensuring the appropriate certification of fishery products

These responsibilities require certain qualifications and trainings for efficiency. The inspectors work together with other stakeholders along the food chain and all these have their distinct responsibilities.

Inadequate food temperature control is one of the most common causes of food borne illnesses or spoilage. Such controls would include time and temperature of cooling, processing and storage (Codex 2003b). It is important to have an integrated, multidisciplinary approach to food safety and quality throughout the entire food chain. FAO defines the food chain approach as that where the responsibility for the supply of safe, healthy and nutritious food is shared along the entire food chain by all those involved in the production, processing, trade and consumption of food (FAO 2003b). In the fisheries sector, stakeholders include fishermen, fish processors, transport operators, distributors (wholesale and retail) and consumers, as well as governments which are obliged to protect public health.

Fishermen are the ones involved in the primary production and this requires proper management to ensure that the fish is safe and suitable for its intended use. This would include (Codex 2003b):

- Avoiding areas where the environment poses a threat to the safety of food
- Controlling contamination from air soil and water
- Adopting practices and measures to ensure food is produced under appropriately hygienic conditions
- Taking care to prevent deterioration and spoilage through appropriate measures which may include controlling temperature, humidity, and other controls. The temperature of the fish should be kept as much as possible near $0^{o}C$.

According to the Kenya fish safety regulations (FQA 2007), which have been harmonised with the EU food hygiene rules, food producers are required to bear responsibility for food safety through the use of HACCP (EU 2004a). They are required to reduce risks of unsafe food by taking preventive measures to assure the safety and suitability of food at an appropriate stage in the operation by controlling food hazards. Products should bear appropriate information to ensure that the next person in the food chain is able to handle, store, process, prepare and display the product safely and correctly.

The distributors should take measures so as to protect food from potential sources of contamination and from damage likely to render it unsuitable for consumption. It requires that they also provide an environment which effectively controls the growth of pathogenic or spoilage microorganisms and the production of toxins in food (Codex 2003b).

The implementation of a food chain approach requires an enabling policy and regulatory environment and all those dealing with national food safety control are required to understand the responsibilities of the various stakeholders along the food chain.

3.1.9.2 Summary of sub-topics

- Roles and responsibilities of an inspector
- Qualifications of an inspector
- Responsibilities of fishermen, fish producers and distributors
- Law enforcement and harmonisation

3.1.10 Traceability

- Objective
  To make the inspectors understand traceability so that they can improve their inspection skills.

- Method of teaching
  Lecture and discussions

- Expected results
  At the end of the training, the inspector should understand the legal requirements of traceability, the different traceability methods and the roles of the Competent Authority in monitoring its implementation.

3.1.10.1 Summary and relevance to Kenya

There has been an increased interest in traceability in recent years, primarily because of the different crises in the food sector such as the mad cow's disease (BSE) in 1996 in the UK and the dioxin contamination in Belgium in 1999. National authorities have therefore focused on traceability to assure consumer safety to be able to recall defective or hazardous products and identify the source of the problem (FAO 2003b).

The Competent Authority in Kenya has included traceability in its fisheries regulations (FQA 2007) which is equivalent to Article 3 of Regulation (EC) No. 178/2002 (EU 2002). The Article defines traceability as "the possibility to find and follow the trace, throughout all the stages of production, processing and distribution of a foodstuff, feedstuff, an animal destined for food production or a substance destined to be incorporated in foodstuff or feedstuff or with a probability to be used as such". The requirements are in Articles 18, 19 and 20.

Regulation (EC) No. 2065/2001 (EU 2001) gives the requirements regarding informing consumers about fishery and aquaculture products through labelling. These EU legislations have to be well understood by the inspectors.

When considering a food product, traceability can relate to (FAO 2003):

- The origin of raw materials and other ingredients
- The processing history
- The distribution and location of the product after delivery

There are two types of systems that are used. These are (Lupin 2006):

- External traceability which refers to systems aimed to allow the traceability of a product or attributes of that product through the successive stages of the distribution chain.
- Internal traceability which refers to the traceability of raw materials, intermediate and final products within a productive or commercial unit.

Many fish processing companies in Kenya already have internal traceability systems as part of their HACCP based quality assurance systems.

External traceability, also called the chain traceability, is between individual entities throughout the food chain including fishers, buyers, processors, wholesalers, transporters and retailers and therefore is a bit more complex than the internal one (Thompson *et al.* 2005).

The Kenyan Fisheries regulations (FQA 2007) require fish processing establishments to acquire Local Health Certificates (LHC) from beach inspectors based at the fish landing sites where they purchase fish. This has, however, been difficult to implement since fish is landed in small quantities in several landing sites and not all of them have beach inspectors. The LHC is a traceability tool and the implementation could be discussed with the inspectors.

For a proper traceability system, the product information that is provided to customers must meet the minimum labelling requirements and provide sufficient information to ensure that the product can be traced back to the supplier, i.e. the suppliers name and batch identification number (BIN) (Derrick *et al.* 2005).

The effective management of the traceability system therefore would involve ensuring:

- The validity of the information related to the product
- The integrity of the transfer of information
- The efficiency of the procedures to ensure that the product can be removed from the supply chain, if required to protect the consumer from potential harm

The capturing, recording and transfer of the product information can be done in several ways. These may include (Derrick *et al.* 2005):

- Handwritten or printed paper labels
- Bar coded labels
- The final product packaging labels
- The Radio Frequency Identification (RFID) tags located on fish boxes, pallets etc. which is the newest development

In Kenya, the printed paper labels are the ones mostly used by the fish processing establishments.

The inspector should be able to verify the efficiency of a traceability system adopted by a fish processing establishment which should be clearly documented and followed. Some important requirements are:

- All products entering the processing plant should have a unique batch code.
- The products should have a batch code while inside the processing establishment.
- Products consigned to another point should be identified with a batch code.

Both the Kenya fisheries regulations 2007 (FQA 2007) and the EU Regulation (EC) No. 178/2002 (EU 2002) require the operator of a fishery establishment to withdraw food products from the market if they believe the food is not in compliance with the food safety requirements. These withdrawal and recall procedures should be documented.

3.1.10.2 Summary of sub-topics

- Legal requirement for traceability
- Developments and methods of traceability
- Monitoring of traceability and the role of the fish inspector

3.1.11 Quality and safety management (risk analysis)

- Objective
  To make the inspectors understand risk analysis as a food safety system and how they can use that approach during inspection.

- Method of teaching
  Lecture and discussion

- Expected results
  At the end of the training, the inspector should understand risk analysis and its three components of risk assessment, risk management and risk communication and how these can be applied in their inspection duties.

3.1.11.1 Summary and relevance to Kenya

Governments can significantly reduce diseases by taking the appropriate interventions after having the knowledge of the hazards that cause food borne diseases and the risks to the consumers. Risk analysis is a powerful tool for carrying out science-based analysis and coming up with solutions of food safety problems (FAO 2006). This would lead to the improvement of public health and can also be a basis for expanding international trade in foods.

It is the responsibility of the food producers to ensure food safety to the consumers and the national authorities to set the standards and legalise them based on risk analysis. The official control is mandated to enforce those laws governing food safety.

In Kenya, there has not been any risk analysis undertaken by the government on fish and fishery products. The safety standards requirements in the legislation in place

have been harmonised with the requirements of the market particularly the EU. Despite these measures, however, new challenges keep on developing and it is prudent for the fish inspectors in Kenya to understand risk analysis and its relation with standards and legislation.

Risk analysis is comprised of three components: risk assessment, risk management and risk communication. In risk analysis terminology, food safety officials working for national governments play the role of "risk managers". They have overall responsibility for ensuring that risk analysis is done, and for choosing and implementing food safety control measures.

The three components of risk analysis are essential and complementary to one another and are most effective when all are successfully integrated by the risk managers directing the process. The interaction of the components is shown in Figure 2 below (WHO 2008).

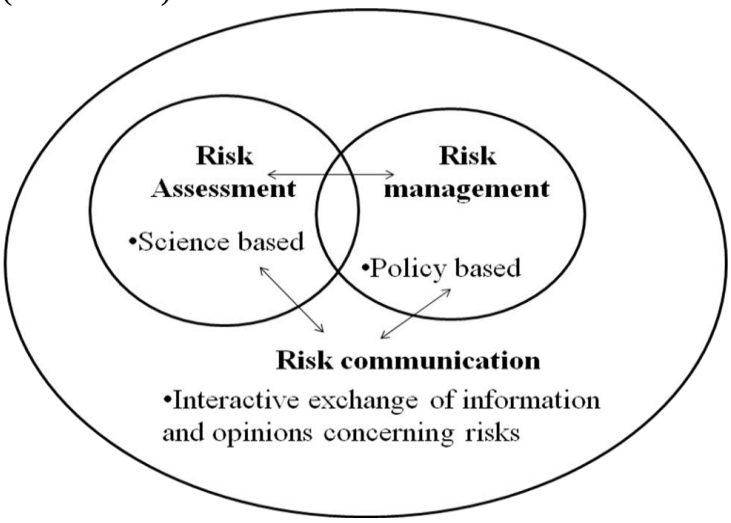

Figure 2: Components of risk analysis (WHO 2008).

Risk assessment is the scientific evaluation of known or potential adverse health effects brought about by human exposure to food borne hazards (WHO 2008) and is the scientific component of risk analysis. Risk managers decide whether a risk assessment is necessary and possible and then initiate scientific bodies or forums to undertake the assignment.

Risk management is the process by which policy alternatives are weighed and the most appropriate ones implemented by the risk managers (WHO 2008).

Risk communication is necessary for effective risk management and risk assessment since it contributes to transparency and broader understanding and acceptance of risk management decisions (FAO 2006).

Fish inspection is a risk management activity and inspectors should adopt a risk based approach as they perform inspection duties. Risk based approach improves efficiency in the allocation of resources allowing them to be focused on where they can have a major effect of food safety and public health.

Good manufacturing practices (GMP) and HACCP systems have been recommended along the food production chains to identify and implement targeted risk-reducing measures at relevant points. This is a risk management option which is to be implemented by the industry. The government then works with the industry to develop an agreed plan for putting food safety controls into effect, and monitors progress and compliance through the inspection, verification and audit process (FAO 2006).

3.1.11.2 Summary of sub-topics

- The risk analysis process
- Risk assessment
- Risk management
- Risk communication
- Consumer information and awareness
- Official inspection and risk analysis

3.1.12 Sampling techniques and evaluation of results

- Objectives
  To impart knowledge on sampling to the inspectors to improve their inspection and sampling skills.

- Methods of teaching.
  Lecture and discussion

- Results expected
  At the end of the training, the inspector should know how sampling for sensory, chemical and microbiological analysis should be carried out and how to evaluate the analytical results.

3.1.12.1 Summary and relevance to Kenya

The Kenya Fish quality regulations (FQA 2007) give the fish inspectors authority to collect samples for analysis, of anything that may have an effect in the preparation of any fish, fishery product or fish feed.

The following different sampling processes are currently undertaken by the inspectors in Kenya:

- Sampling of whole fish for freshness assessment organoleptically at the fish landing sites
- Sampling whole fish, water and sediments for heavy metals and pesticide residues analysis
- Collecting water samples from fish processing establishments for both microbiological and physico-chemical analysis
- Collecting ice samples from fish processing establishments for microbiological analysis
- Sampling finished products from the fish processing establishments for microbiological analysis

- Taking swabs for microbiological analysis from the fish contact surfaces in the processing establishments

The samples are taken by the inspectors for analysis at laboratories that have been identified and designated by the Competent Authority.
The fish processing establishments have their internal laboratories where they analyse samples from the final product, ice and swabs from fish contact surfaces. Though this is not an official requirement, the national fish safety control personnel should understand the sampling and interpretation of the results.

Sampling plans are required to ensure that fair and valid procedures are used when food is being controlled for compliance with particular standards and the people undertaking the activity require training in techniques of sample collection. Sampling may be done for a variety of purposes which may include:

- Providing assurance of compliance with phytosanitary requirements
- Verifying that a food quality management system is working
- Risk analysis

Sampling plans are planned procedures which enable one to choose, or draw separate samples from a lot, in order to get the information needed, such as a decision on compliance status of the lot. The sampling plan is thus a scheme defining the number of items to collect and the number of non-confirming items required in a sample to evaluate the compliance status of a lot by the responsible authority (CAC 2004).

A lot is a definite quantity of some commodity manufactured or produced under uniform conditions whereas a consignment is a quantity of some commodity delivered at one time. It may consist of either a portion of a lot or a set of several lots.

The sampling can be done for sensory, chemical or microbiological analysis and the results are evaluated against the set conformity level by the responsible authority which also stipulates enforcement actions and procedures in case of non-conformities.

3.1.12.2 Summary of sub-topics

- Sampling equipments and sampling techniques
- Number of samples
- Sealing and labelling of samples
- Sampling report
- Transport of samples
- Storage and handling of samples at the laboratory
- Sampling for chemical analysis
- Sampling for microbiological analysis
- Sampling for sensory examination
- Sampling plans and statistical approach
- Testing laboratories
- Evaluation of analytical results
- Enforcement actions

3.1.13 Microbiological criteria and limits for hazardous chemicals in fish

- Objective
  To make the inspector understand the microbiological criteria and limits for hazardous chemicals in fish and fish products, and their implications to both the local and export markets. This knowledge will improve the inspection skills and also be useful when sensitising the relevant stakeholders.

- Method of teaching
  Lecture and discussion

- Results expected
  At the end of the training the inspector should be able to understand how a microbiological criterion for fish products is set, the recommended analytical methods for the product and the health standards of the major markets for fishery products.

3.1.13.1 Summary and relevance to Kenya

A microbiological criterion for food defines the acceptability of a foodstuff based on the number of microorganisms including parasites, or their toxins or metabolites (CAC 1997). The criterion should be based on scientific analysis and advice and where scientific data is available, a risk analysis should be used for the foodstuff and its use.

The Kenya fish quality regulations (FQA 2007), which are enforced by the fish inspectors, have adopted the relevant provisions of the EU microbiological criteria for foodstuffs (EC 2005).

The inspectors are mandated to ensure compliance with the sanitary and phytosanitary measures covering the fish and fisheries products both for local consumption and the export market. These measures involve inspection, examination and certification procedures. The application of SPS standards vary in different fish importing countries and the microbiological criteria is one of those SPS requirements.

A microbiological criterion consists of (CAC 1997):

- The microorganisms of concern (and/or their toxins) and the reason for that concern
- The analytical methods for their detection
- A sampling plan and the size of the analytical units
- The microbiological limits (ML) considered appropriate to the food at the specified point (s) of the food chain
- The number and size of analytical units that should be tested and conform to these limits
- The food to which and where in the food chain the microbiological criteria applies
- Action to be taken when the criterion is not met

Microbiological criteria can be used in the following situations:

- To indicate the microbiological status of raw materials, ingredients and final products of unknown origin (e.g. at point of entry)
- As validation and verification of HACCP-based control systems, GMPs and GHPs
- To assess whether the prevalence of a pathogen in specific foods is increasing/decreasing relative to a target level
- For contractual purposes by food business

Thus regulatory authorities can use microbiological criteria to define and check compliance with the microbiological requirements (CAC 1997). The inspectors are the representatives of the national food control agencies and should understand the principles of the microbiological criteria and their implication in their inspection duties.

3.1.13.2 Summary of sub-topics

- Microbiological criteria for fish products
- Limits for hazardous chemicals in fish products
- Health standards of major markets for fishery products
- Criteria, limits and sampling plans
- Analytical methods

3.1.14 Buyers' requirements

- Objective of the topic
  To make the inspectors understand the private standards and requirements by the fish/fish products buyers since their duties involve certification for the safety of fish and fish products.

- Method of teaching
  Lecture and discussion

- Expected results
  At the end of the training the inspector should be able to understand the reasons why buyers set private standards and requirements for the fish products, examples of some private buyer organisations that have set their standards, eco-labelling of fish products, the ISO 22000 and 14000 standards.

3.1.14.1 Summary and relevance to Kenya

Food safety has become a major priority for governments and the private sector. The consumers have become more concerned about the safety of the food they consume and there have been emerging or re-emerging food borne risks like the *Campylobacter* and others. Food safety problems encountered for fish and fish products are parasites, microbiological contaminants due to lack of hygiene in the production process, residues from use of prohibited antibiotics and metal contaminants. This has led to the development of both public and private food safety standards. It is the obligation of every government to protect the health of its citizens and the national standards for food are set in cooperation with all stakeholders based on the consensus of the

interpretation of the scientific evidence after risk analysis either nationally or by internationally recognised bodies like Codex. Other standards are set as a result of the demand by the importing countries like the EU member states.

Official guarantee of the safety of the fishery product from Kenya is given by the Competent Authority since it undertakes surveillance activities in the living environment of the fish for chemical contaminants and also monitors the handling and processing of the fish after harvest. There is an EU regulation which lays down specific rules for the official controls on products of animal origin intended for human consumption (EU 2004b) and this has been adopted in the Kenyan fish quality regulations where the inspectors issue health certificates for all fish and fish products that are destined to the international market (FQA 2007).

Food safety incidences can compromise markets, market share and the reputation of the product. Private buyers have therefore been prompted by the increasing consumer demand for safe and quality products, as well as ethical and environmental issues to develop their private standards which normally exceed the national regulations. In order to guarantee safe products, traceability of the origin of the product is necessary and most buyers include it as they develop their own specifications (ARD 2005).

Some of the international standards used by buyers are the British Retail Consortium (BRC) global standards and good practices standards, the GLOBALGAP (formerly EUREPGAP) standards and the Global Food Safety Initiative (GFSI) standards.

The ISO standards are internationally recognised and the ISO 22000 is a generic food safety management system standard which has a set of general food requirements that apply to all organisations in a food chain. If an organisation is part of a particular food chain, ISO 22000 requires it to establish a food safety management system (FSMS) which can be certified by an auditor if it meets the food safety requirements of those ISO standards (Praxiom 2007).

Environmental pollution may lead to contaminated fish products and there has been a global encouragement of the use of eco-labels as a tool for achieving environmental objectives. Eco-labels are meant to increase consumer awareness of the environmental impacts of a product and encourage them to buy products with a lower negative environmental impact. Consumer purchasing decisions can provide a market signal to producers about product preferences (UNEP 2007). Fish inspectors should encourage the use of eco-labelling by processors for environmental conservation.

The ISO 14000 family addresses various aspects of environmental management. The standards help organisations minimise how their operations negatively affect the environment (air, water or land), and comply with applicable laws and regulations (Wikipedia 2008).

National food safety control agencies should be able to understand the private buyers' standards and requirements and how they relate to the national standards.

3.1.14.2 Summary of sub-topics

- Animal health
- Eco-labelling
- British Retail Consortium (BRC), GLOBALGAP, Global Food Safety Initiative (GFSI)
- ISO 22000, ISO 14000

4 DISCUSSION

An effective national food safety management system is essential for the protection of the health and safety of domestic consumers and also critical in enabling countries to assure the safety and quality of their foods entering international trade. Both importing and exporting countries have an obligation to strengthen their food control systems and to implement and enforce risk-based food control strategies.

Consumers are also having an increased interest in the way food is produced, processed and marketed and expect protection from hazards occurring along the entire food chain from the primary producer through to the consumer.

Some of the core responsibilities of an effective food control system include the establishment of regulatory measures, monitoring the performance of the system, facilitating continuous improvement and providing policy guidelines. The ultimate goal for all these endeavours is assuring a high quality, safe and nutritious food supply for the public for good health and for the economic benefits derived from trade.

The implementation and administration of the relevant food laws require a qualified, trained, and honest food inspection service. The fish inspector is the key functionary who determines the reputation and integrity of the fish inspection service and by extension, the Competent Authority.

Proper training of the fish inspectors is a pre-requisite for an efficient fish inspection service. They should be trained to understand all types of fish processing, identification of potential safety and quality problems, and to have the skills and experience to inspect premises. This is a basic necessity for effective and efficient inspection for food safety assurance.

The inspectors should also have the skills to collect samples and send them to a laboratory for analysis so that the samples are not interfered with and will therefore give the right results reflecting the objective of the sampling.

According to the fisheries regulations (FQA 2007) the application of an HACCP system in the fish industry is mandatory and therefore the inspectors require training on the HACCP system. This will make them have the ability to identify the potential hazards that may occur during processing and to assess the appropriateness of their specific controls during their inspection duties. They will also be able to audit the HACCP systems of the processing establishments.

In Kenya the resources that are available for the capacity building of the already serving government employees does not meet the requirements of all the sectors. The inspection services in Kenya which cover fish handling by fishermen, fish handling at the landing sites and retail outlets, processing at artisanal and industrial level require more than the 22 fish inspectors in place for official control. However, the food industry shares responsibilities with the government agencies in achieving the objectives of a national food control strategy. It is responsible for the production of a safe product through the implementation of a food quality management system. If they play their role as expected, then the government could reduce the magnitude of official inspections. The current situation in the inspection services however requires an increase in the number of fish inspectors and the already serving ones require upgrading of skills.

The Kenyan government has been encouraging the industry to live up to its responsibilities and there has been a positive development to that end in the last decade. Market requirements have also played a big role to that effect.

UNU-FTP Iceland, FAO and the Fisheries Department of Kenya have collaboratively planned for two courses in Kenya in May 2008 and September 2008 respectively and the contents for the first training course in May 2008 have been identified in this project. For sustainability, Moi University in Kenya has been identified where a course in fish inspection will be incorporated into its curriculum for the students studying for a degree in Fisheries. This will make the students graduate as qualified fish inspectors who can be engaged by the Kenyan government and even by the other East African countries.

Further to that, Moi University could possibly provide the specific training courses for fish inspectors working within the Competent Authorities of the neighbouring countries.

From the topics identified in this project, and after further consultations, a teaching manual for the University can be developed.

5 CONCLUSION

National food control systems require access to qualified and trained personnel in disciplines relevant to the food they control. The need for technical assistance in strengthening the food control systems in developing countries is well recognised internationally. Both the SPS Agreement (Article 9) and TBT Agreement (Article 11) specifically refer to the need to provide technical assistance to developing countries in, among other areas, the establishment of national regulatory bodies. It is, however, prudent for the developing country to make sure any assistance offered is self sustaining for maximum benefits.

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There are both microbiological and chemical risks. Some of the microbiological risks include bacteria like *Campylobacter, Salmonella typhi-murium DT 104, Salmonella enteritidis, Vibrio vulnificus, Listeria monocytogenes and E.coli 0157:H7* (EC 2005, Venter 1999). The *Norwalk* and *Norwalk* like viruses (Noroviruses) and the *Rotaviruses* are other risks that have emerged (FDA 2006).

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APPENDIX

A1.A study of how inspections are carried out in the fish processing establishments in Iceland as compared to Kenya.

Two fish processing establishments were visited separately to study how inspections are carried out by the inspectors in Iceland and compare with the way they are done in Kenya. *Bratun fish processing factory* was visited together with two inspectors from Frumharji HF ltd while *J.B.G Fish products* was visited together with an inspector from the Directorate of Fisheries.

A1.1 Factory inspection in Kenya

A1.1.1 Introduction

Kenya has got 12 land based fish processing establishments and 6 (Six) freezer vessels approved for exporting fish and fishery products. The bulk of the fish exports are frozen products although in recent years the demand for fresh products in the export market has increased leading to an increase in exports of the same products. In 2006 the frozen products constituted about 60% of the total exports. **Table 3** below shows the summary of the total exports of fisheries products in 2006.

Table 3: Summary of the exports of fishery products from Kenya in 2006 (FDS, 2006).

	Quantity (M. tons)	**Value ('000 Kshs)**
Nile perch Fillets	11,846	3,393,266
Nile perch Maws	537	142,311
Nile perch Skins	364	10,610
Tuna loins	22,117	1,100,992
Sword fish	192	26,523
Squids	11	1,506
Sharks	74	3,681
Lobsters	8	5,286
Octopus	665	140,433
Prawns	495	149,541
Cuttle fish	15	2,184
Crabs	44	6,863
TOTAL	**36,368**	**4,983,196**

As indicated before, there are about 22 fish inspectors in Kenya currently who are substantively fisheries officers. They perform other duties apart from inspection to achieve the mission of the department as may determined by the Director of Fisheries.

The inspection services cover fish handling by fishermen on-board, fish handling at the landing sites, transportation to the fish processing plants, all methods of processing fish both at artisanal and industrial levels and handling at all retail outlets in the country. The fish inspectors also perform advisory roles to all the fisheries industry stakeholders apart from enforcing the law.

The main importers of the Kenyan fish products in 2006 were the European Union (EU), Israel, Japan, Malaysia, Australia, USA, Japan and the United Arab Emirates (UAE) among other destinations.

All the tuna loins were exported to Spain and Italy and about 50% of the total Nile perch products exported to the EU (FDS, 2006). This shows that the EU is a major market for the fishery products from Kenya.

A1.1.2 Procedure for inspection

The inspectors define the objective of the inspection and go through the previous inspection reports from the file of the establishment at the office of the Competent Authority. Arrangements are then made of how to reach the establishment where they introduce themselves upon arrival if they are not known to the factory's representatives. They then indicate their mission and agree on the time frame for the inspection. A representative of the establishment, in most cases the quality controller is asked to join them during the inspection.

The inspectors normally observe the hygiene rules of the establishment being inspected which include filling a health declaration form and putting on protective clothing like clean boots and hats. Jewellery, watches and chewing gums and other prohibited items in the establishment as the GMPs provide are avoided.

Since the inspectors do not have rapid instruments and kits for inspection they use the probe thermometers and DPD kits found in the processing establishments for temperature and Free residue chlorine (FRC) checks respectively.

If the inspection covers both documentation and the processing, the practice is to start with the documentation and any non-conformity brought to the attention of the representative of the establishment. The inspection of the product processing commences from the microbiologically cleanest area and ends at the least clean area (raw material receiving area). Any non-compliance is pointed out to the factory's

representative and documented even if they are taken care of immediately, but it is noted that they have been corrected.

After the completion of the inspection, the inspection team hold a meeting with the appropriate member (s) of the establishment management team to review the inspection where the main findings, both positive and negative are highlighted. The non-conformities are discussed and a time period or a date of the correction is agreed upon. The urgency of corrective action is always measured by the degree of existing hazard related to health and safety issues. Each establishment has a notebook where the inspectors record the non-conformities and the agreed action plan is signed by the inspectors and the responsible party from the management of the establishment. The notebook is always left with the management of the establishment.

If there is a serious non-conformity, the inspectors are required to refer to the standing procedures and national legislation for guidance on the action to take. A serious non-conformity is one which might result in imminent risk to the health of consumers.

After the inspection a printed copy of the finalised inspection report is forwarded to the management and a signed copy kept in the file. The report contains the main findings, specific deficiencies noted, corrective actions required and sanctions if at all they are there. After the establishment has received the inspection report, they are required to write to the Competent Authority indicating the corrective actions they have taken on the non-conformities by the dates that were agreed on.

Follow up inspections are then carried out to verify the corrective actions taken and this forms a basis for the inspectors to conclude whether the deficiencies have been satisfactorily addressed or not.

There are checklists that have been developed for guidance and harmony as the inspectors carry out inspections and collect samples for analysis.

A1.1.3 Types of inspections.

Refer to **topic 3.7.1**.

The types of inspections carried out are:

- Pre-licensing inspections
- Routine inspections
- Follow up inspections
- Spot check inspections

- National inspections.

The inspectors also carry out sampling as indicated in **topic 3.12.1**

A1.2 Factory inspections in Iceland

A1.2.1 Introduction

A1.2.1.1 Icelandic Seafood processing and Markets (IMF, 2006)

The products of the Icelandic seafood industry include salted and cured products, the quick frozen and fresh products.

Quick frozen products have mostly constituted about 50% of the value of seafood exports. Most of the land based freezing plants are situated around the Icelandic coast and produce a wide variety of modern consumer products. A big number of them are modern and are technically well equipped. There are currently about 120 freezing plants holding processing permits which are supplied by fishing vessels ranging from large wet fish trawlers to small boats with hand lines.

The freezer trawlers are large, modern and properly equipped with highly automated processing technologies. There are currently about 61 freezer vessels with processing permits.

Markets for the frozen products are North America, Europe and the Far East, especially Japan and the largest shrimp market is the UK.

Fresh seafood has in the recent past been close to 20% of the value of seafood exports from Iceland, and are basically fresh fillets and whole fish on ice. The export of fresh fillets by air has increased in recent years and exceeds whole fish exports where the main species exported are cod, haddock, redfish, catfish, saithe and plaice. The markets for the whole fish on ice are mainly in Europe with cod fillets being exported to the United Kingdom (UK) and France, fresh haddock to the United states and UK, and redfish to Germany and France.

The salted fish products in the recent years have contributed to close to 20% of the value of exports. There are about 130 plants holding a salt fish processing licence and most of them situated along the Icelandic Coast. Nearly half of the Cod catch in Iceland has traditionally been salted and *bacalao* is very popular in the South European countries. Other species salted are *Saithe, ling, tusk* and *herring*. The markets for salt fish are Southern Europe and America, Portugal, Spain, Italy Greece and France.

Fishmeal and fish oil constituted around 10% of the value of seafood exports in 2005. *Capelin, herring* and *blue whiting* provide over 95% of the value of meal and oil

products. There are about 15 fishmeal and oil factories and most of them are very modern and highly automated. Fishmeal also provides an outlet to recycle trimmings from the food processing sector which could have been dumped to the environment. The markets for fish meal products are primarily in European countries such as the UK, Denmark, Norway and Ireland apart from North America. Fish oil markets are primarily Norway and other European countries.

Seafood which is farmed is just over 1% of the seafood exports. The exported fish are Atlantic salmon, Arctic charr and the Atlantic cod whereas Halibut fry are exported for further farming. The markets are in Europe and United States.

Fish drying mainly for Cod, Haddock and Saithe is also carried out and the main market is Nigeria.

A1.2.1.2 Fish processing establishments' inspection.

The Directorate of Fisheries (DOF) implements government policy on fisheries management and handling of seafood products. It is the Competent Authority responsible for enforcing laws and regulations regarding the handling, processing and distribution of marine products (IDOF, 2008).

In Iceland there are two approved private inspection bodies accredited to the Icelandic IS EN 45004 standards. They are *Frumherji hf* and *Syni skoounarstofa ehf* and are licensed by the DOF to inspect the seafood industries.

The *pre-licencing inspection* for every fish processing establishment is done by the DOF. After that each establishment is inspected at least *four* (4) times a year by the private inspection bodies and these are the *routine inspections.* These inspections are scheduled to make sure that the persons responsible for the HACCP plan in the establishments are available and for the planning purposes of the inspection bodies. The reports of the inspection are forwarded to the Directorate of Fisheries where they are entered in a database. **Figure 3** below shows the flow of information among the accredited inspection bodies, the Icelandic accreditation department, the Directorate of Fisheries and fish processing establishments.

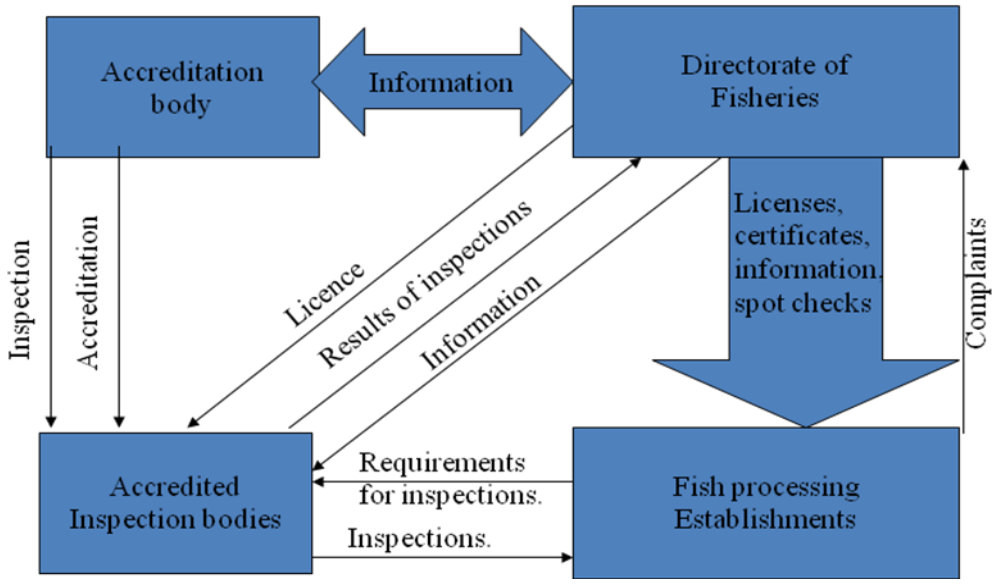

Figure 3: Flow of Information among the Directorate of Fisheries, Icelandic accreditation body, accredited inspection bodies and fish processing establishments (DOF, 2007).

Serious non-conformities are communicated to the DOF within 24 hours who in turn send their inspectors to the establishment for a spot check to take action as guided by the Competent Authorities' regulations depending on the nature of the non-conformity.

For the non-serious non-conformities, the DOF organizes for *follow up* inspections to check on the corrective actions taken by the establishment as recommended by the private inspection bodies during their routine inspections.

The DOF makes arrangements to join each inspector from the private inspection bodies for four times per year in the different processing establishments to assess the way they carry out inspections. When carrying out joint inspections, the inspectors agree on the ratings of the findings but it is the inspector from the private inspection body who submits the report.

As all the inspection reports are put in a database by the DOF, they are able to carry out statistical evaluation of the inspection bodies and the individual inspectors. The evaluation shows the weak points that require intervention which may include training or other appropriate administrative action as prescribed by the regulations.

The DOF organizes at least two meetings per year with the private inspection bodies to go through specific points of performance and to discuss issues regarding inspection as a whole.

To make sure that there is harmony in carrying out inspections, the DOF has put in place Inspection Manuals (IM) to be used by the inspectors. It is also a requirement

for accreditation of the private inspection bodies. The inspection manuals contain the following:

a) Interpretation of demands.

   Different people would have different interpretations of the same words and therefore the manual explains clearly what is required.

b) Method of inspection.

   The method to be used when checking a particular item is explained e.g *Visual observation, taking length measurement e.t.c*

c) Procedure

   The procedure to be used in the inspection is defined e.g *"All windows opening to the outside shall be inspected. If a fly screen that seems to have an opening that is more than 1 mm is observed it shall be measured by gauging"*

d) Limits

   The limits for each item to be inspected are defined. For example the size of the openings of the fly screens can be prescribed " *to have a gap of 1mm"*.

e) Rating

   This defines how the rating will be done. The rating by the inspector for a particular item is *YES/NO* for the requirement .

A1.2.1.3 Inspection process

The inspectors from the accredited inspection bodies were joined when carrying out *routine inspection* and the inspector from the Directorate of Fisheries was carrying out a *follow up* inspection. The approach on arrival at the establishment before they started the inspection was similar to what is done in Kenya as explained before. Inspection started with documentation and ended up with the product processing.

A1.3 Lessons learnt from the inspections in Iceland

- The developed *Inspection Manual* is very useful in making sure the interpretation of requirements is harmonised. There is no similar manual in Kenya and it can be developed and used to improve the inspection services.

- The use of checklists and keeping their records by all inspectors makes the inspection approach by all personnel similar. Though checklists have been developed in Kenya, their usage has not been harmonised. The inspectors mostly record their findings in a small note book during the inspection process and then record all the non-conformities after the final meeting at the end of the inspection in a notebook found at the establishment. The use of the checklists requires harmonisation.

- The inspection services can be privatised to accredited inspection bodies and reduce the need of having many inspectors in the Competent Authorities. This would be an option to be explored in Kenya where currently the number of inspectors is inadequate. It would require however a policy change from the current one and consultations with stakeholders would be necessary.

- There is no sampling for analysis by the Competent Authority carried out for the water used in the processing establishments. The guarantee of the safety of the water is the treatment done by the water suppliers through their quality management system. This is an option that Kenya can use, but the big question is whether the importing countries particularly the EU would accept that arrangement from a developing country.

- End product sampling for microbiological analysis in Kenya is only done when the inspector decides to use the method as a means of verifying that the HACCP system in a processing establishment is working. The inspectors in Iceland don't undertake the same activity since they have been convinced as a result of their inspections and HACCP audits that the quality management systems for the establishments are effective. Kenya can use the same approach to do away completely with the end product sampling.

- If the Competent Authority is convinced that the HACCP system in a fish processing establishment is effective, the number of inspections can be reduced significantly and save resources. The number in Iceland is at least 4 per year per establishment while in Kenya they are 12 (twelve).

A1.4 Recommendations to Iceland

- In a big number of the establishments visited even before these two inspections, the main door at the raw material receiving end was exposing the whole processing establishment to the outside when opened. This is not acceptable as a prerequisite to HACCP since fries and other pests can get their way to the inside of the establishment easily. This is recommended to be corrected.

- In some establishments that were visited, there was free movement of folk lifts from outside to the processing hall and in some cases just next to the processing line which can easily lead to cross contamination of the product. This is recommended to be corrected.
- In one of the establishment visited, the space in the processing hall was not adequate to reduce the chances of cross contamination along the processing line and some tubs that were to be used inside the processing hall were stored outside the processing hall which is not a Good Hygienic Practice (GHP). It is recommended that the factories with inadequate space be advised to address the issue.
- There was rampant use of wooden pallets in some establishments which are not easy to clean. It is recommended their use to be stopped since they can be a good medium for bacterial multiplication.
- Though the use of the accredited inspection bodies is good, the arrangement of them entering into contractual agreement and paid by the processing establishments might interfere with their objectivity. It is recommended they be engaged and paid for by the Competent Authority.

AI.5 Conclusion.

The inspection experience will be discussed with the Competent Authority in Kenya and recommendations given for possible improvement of the inspection system.