

Fish and fishery product quality and safety of aquaculture products in Bosnia and Herzegovina

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ABSTRACT

The overall aim of the FAO Technical Cooperation Programme (TCP) Project TCP/BiH/3101 “Strengthening Aquaculture Health Management in Bosnia and Herzegovina” is to strengthen the capacity of Bosnia and Herzegovina’s aquaculture sector for aquatic animal health management. The ultimate goal is the harmonization of Bosnia and Herzegovina’s aquaculture legislation and its food processing businesses with the European Community (EC) legislation in order to be able export aquaculture products to the European Union (EU) and other countries with similar requirements. The aquaculture sector is seen being able to meet EU requirements more quickly than other agricultural sectors in Bosnia and Herzegovina. This technical paper provides an overview of the measures specified by Bosnia and Herzegovina legislation and the extent of their implementation by the aquatic food production sector with regard to the new European food safety approach. The implementation of Hazard Analysis Critical Control Point (HACCP) based systems, good manufacturing practice (GMP)/good hygiene practice (GHP) and quality management systems (QMS) by fish growers and fish processing businesses hoping to export to EU was briefly checked and the organization of the official veterinary services briefly evaluated. For the implementation of official and self-controlled monitoring programmes, laboratories capable of investigating the relevant health hazards must be at hand; thus, some of the laboratories were visited and their capacities to comply with some specific requirements examined.

INTRODUCTION

The overall objective of this component of the Food and Agriculture Organization of the United Nations (FAO) Technical Cooperation Programme (TCP) Project TCP/BiH/3101 “Strengthening Aquaculture Health Management in Bosnia and Herzegovina” is to identify gaps in legislation and short-comings in the veterinary inspection system related to aquatic food safety, inspect the implementation of hazard analysis critical control point (HACCP) systems in fish processing enterprises and confirm the possibility of registration for export or provide recommendations to further strengthen the sector.

This part of the project dealing with food quality and safety will produce the following:

- recommendations for motivating and training all participants in the fish production and trading chain (e.g. fish producers and processors, veterinary inspection services and laboratories);
- recommendations for improving organizational structures;
- recommendations for improving the institutional framework, and
- identification of requirements for further cooperation.

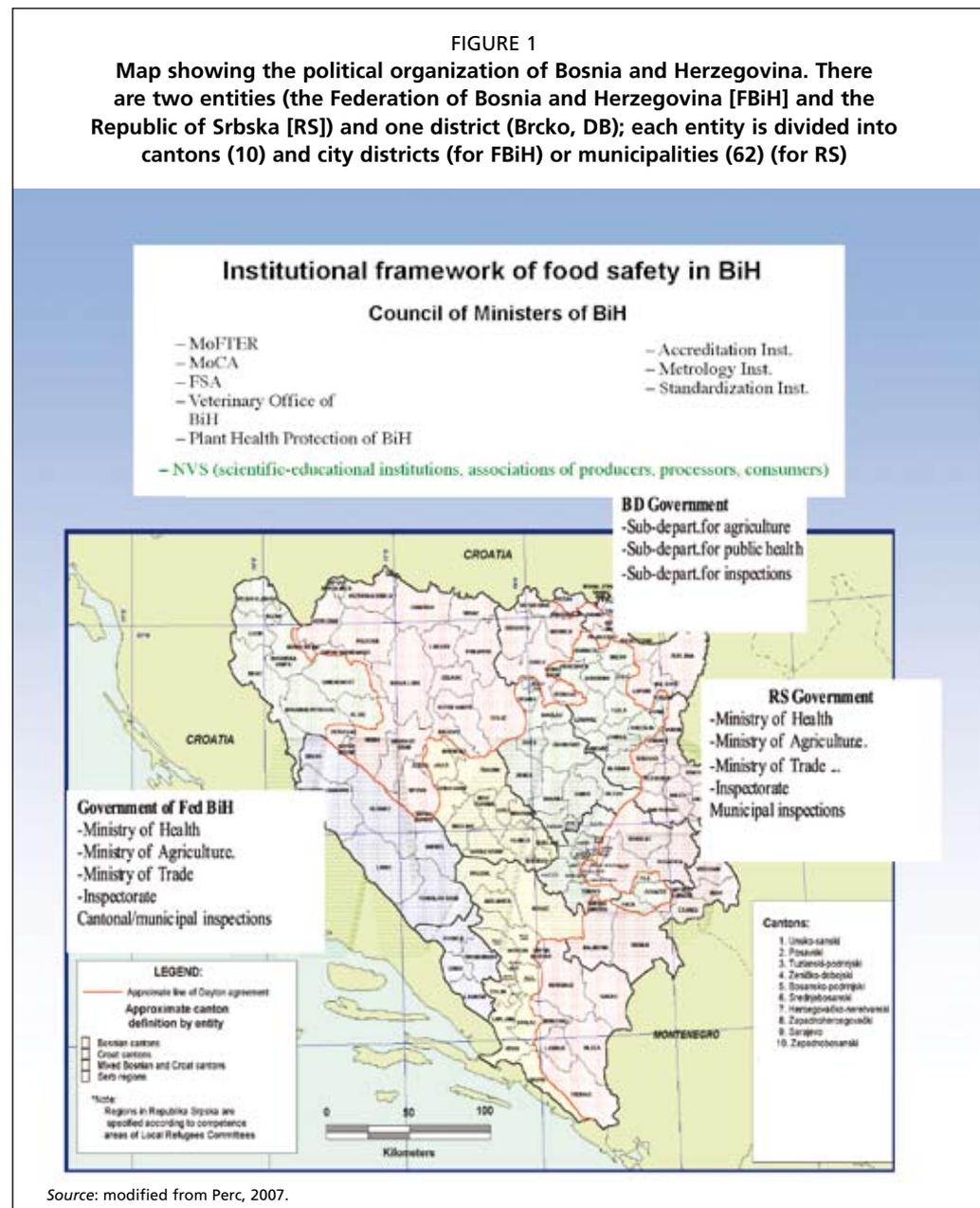
This project’s ultimate goal is the compliance of Bosnia and Herzegovina’s fish producing and processing operators with all requirements that must be met in order for them to be approved for export to the European Union (EU) and other countries. The project’s outputs were to be implemented in 2008, and by this date technical support was expected from countries having long-term experience with the food safety measures specified by European food safety legislation. This technical assistance must be coordinated through close cooperation among the authorities involved in food safety, namely the responsible ministries at the State and Entity/District level, as well as other authorities such as the State Veterinary Office (SVO), the Entity Veterinary Inspectorates, the Food Safety Agency (FSA), etc. European-style legislation must be officially implemented down to the municipality level and be integrated into businesses seeking to access international markets. Additionally, the fish production and processing sectors must start to understand their own roles in the future processes. Market-directed thinking by laboratories and all others in the food production chain must be encouraged through extensive training. Finally, a network of officials from the Institute of Public Health (IPH) and the FSA should help strengthen the national capacity to backtrack foodborne outbreaks of infectious diseases.

ADMINISTRATIVE AGENCIES INVOLVED IN FOOD QUALITY AND SAFETY OF AQUATIC PRODUCTS

The official parties involved in food safety are at different administrative levels according to the political structure of Bosnia and Herzegovina. The administrative structures shown in Figures 1 and 2 makes clear that there are official authorities at the State, Entity or District, Canton and City or Municipality levels.

The following authorities are engaged in food safety inspections or legislation at the State Level:

- *Ministry for Foreign Trade and Economic Relations (MoFTER)*: MoFTER is responsible for the development of basic legislation in the areas of veterinary, phytosanitary, quality control and food safety, along with the establishment of institutions that are directly responsible for its implementation. The adoption of the entity-level Inspection Laws now seems to have eliminated most of MoFTER’s food safety inspection activities.
- *State Veterinary Office (SVO)*: The SVO is responsible for preparing draft regulations regarding food hygiene and food safety requirements for fish-producing and processing businesses and all other legislative acts concerning food of animal origin (e.g. veterinary border inspection, coordination of activities

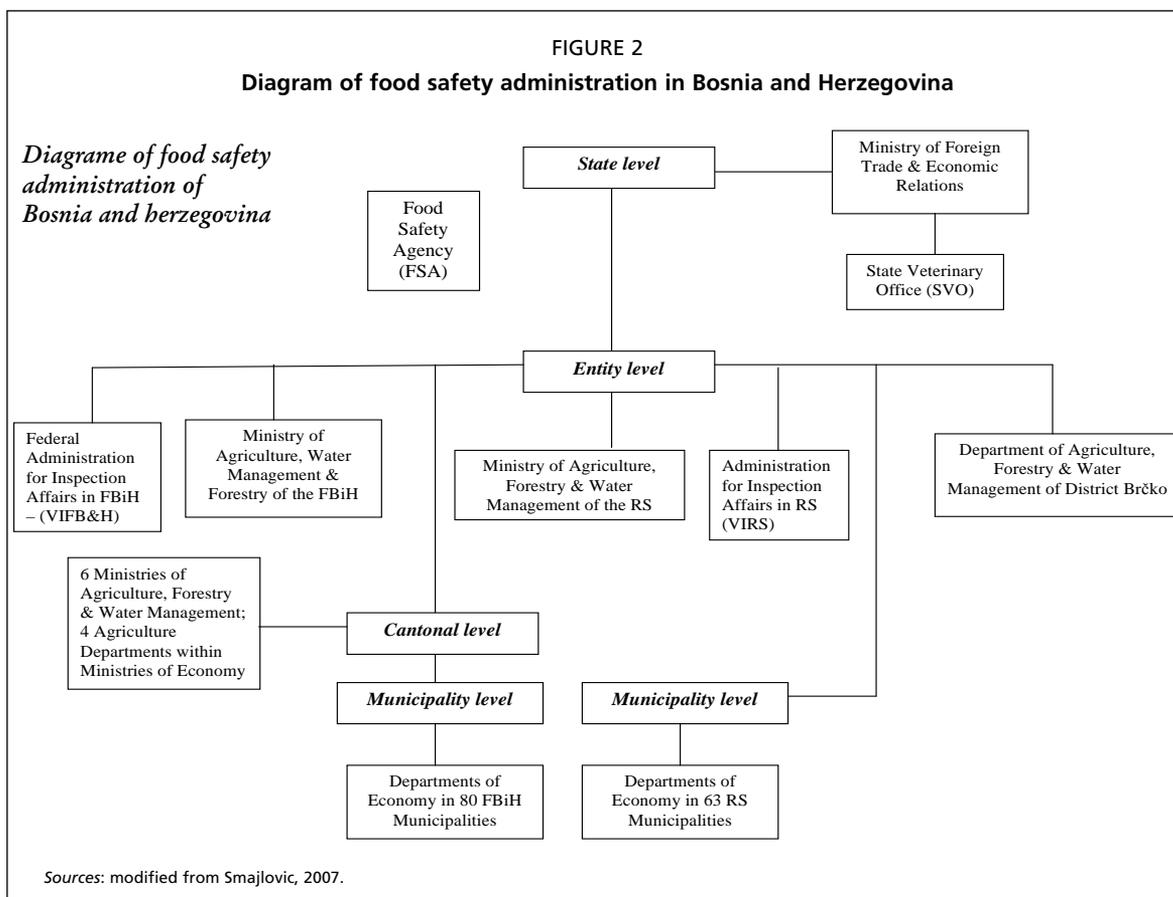


between the entity authorities and international cooperation). The proposals then go to the MoFTER and the Council of Ministries of Bosnia and Herzegovina. The SVO also gathers surveillance data and publishes it in the Official Gazette of Bosnia and Herzegovina.

- **Food Safety Agency (FSA):** The FSA is an independent administrative organization whose duties and tasks are defined by Articles 53 and 54 of the *Law on Food* (OJ 50/04). In addition to all types of scientific activities linked with the food and animal feed risk analyses, the FSA initiates, prepares and organizes the development of implementing regulations based on the *Law on Food* (OJ 50/04) and represents a point of contact for the activities of Bosnia and Herzegovina in the Codex Alimentarius Commission. It is obligated to perform these activities in cooperation with the competent authorities (CAs).

The following authorities are engaged in food safety inspection or the development of legislation at the Federation of Bosnia and Herzegovina (FBiH) Level:

- **Federal Administration for Inspection Affairs in FBiH (FAfIA) – Veterinary Inspectorate of the FBiH (VIFBiH):** The VIFBiH cooperates closely with



veterinary inspection bodies at the cantonal level. In 2006, inspection supervision at the entity level was established within the administrations for inspection affairs (by the *Law on Inspections in the Federation of B&H* (OJ FB&H, 69/05), and the *RS Law on Inspections* (OJ RS 113/05) as independent administrative organizations. Border-post inspection supervision falls within the responsibility of the above inspections, except in the case of veterinary inspection organized at the State level. Supervision over the operation of these inspections is performed by the entity-level governments and therefore, the entity-level ministries may not perform a direct supervision over their operations. They follow-up registered companies, do daily up-dates if alerts are notified, conduct on-site inspections, etc.

- *The Federal Ministry of Agriculture, Water Management and Forestry (FMoAWF)*: The FMoAWF, through its Veterinary Department, is mainly involved in initial registration of food businesses and in conducting audits.
- *Cantonal level*: Cantonal-level veterinary inspections/departments, which are supervised by the cantonal governments, conduct Cantonal audits, inspections and monitoring.

The following authorities are engaged in food safety inspection or development of legislation at the Republic of Srpska (RS) Level:

- *The Veterinary Inspectorate of Republic Administration for Inspection Affairs (RAfIA – VIRS)*: The RAfIA-VIRS has similar author and functions to those performed by the FAfIA-VIFBiH.
- *The Ministry of Agriculture, Forestry and Water Management Republic Srpska (MoAFWRS)*: The Veterinary Department of MoAFWRS has mandates similar to those of the FMoAWF-Veterinary Department.
- *Municipality level*: Municipality-level veterinary inspectors have authority similar to that of the Cantonal-level veterinary inspectors; their inspections are supervised by the municipality governments.

AQUACULTURE IN BOSNIA AND HERZEGOVINA

As stated in official reports, Bosnia and Herzegovina has a long tradition of producing fish through aquaculture. The species cultured are mainly cyprinids and salmonids, of which rainbow trout has major importance. Although most establishments were destroyed during the war, aquaculture now is seen as a major part of the agricultural sector with good future possibilities.

Fish aquaculture production and registration

According to data provided by the FMoAWF, in 2006 there were seven main fish-producing facilities with a total production output of 1 778 tonnes per year. Altogether approximately 2 800 tonnes of cultured fish were produced. Food business enterprises intending to export their products must be registered by the FMoAWF in accordance with the provisions laid down in the *Decision on conditions which have to be fulfilled by the establishments intended for slaughter of the animals, processing, refining and storing of the products of animal origin* (OJ 27/05), while establishments producing food intended for the domestic market must be registered by the local CAs, following the same decision.

According to information provided by the Federal Chief Veterinary Officer of VBiH and by the FMoAWF, in the FBiH there are:

- 14 fish-producing or processing enterprises registered at the cantonal level for regional trade of their products, and
- five fish-producing or processing enterprises registered at the federal level for exporting their products.

The registration code used for these fish-producing or processing businesses is "RI-2-" followed by an ongoing registration number. Export permission for the five federally registered businesses was given for one (two enterprises) or two (three enterprises) years.

Within the short time of the authors' visit, data were only requested from authorities from the FBiH. Thus, it is not known if there are similar data available from RS.

In total, 3 975 853.65 kg of fish, crustaceans, molluscs and other marine invertebrates were exported (mainly) to nearby non-European Union countries in 2006, whereas importations of these products totaled 6 421 356.22 kg in the same year (Perc, 2007). However, export possibilities will probably decrease, as some of the countries now importing products from Bosnia and Herzegovina (especially Croatia) may become EU Member States in 2009/2010. If this occurs, these countries will no longer be able import fish products from Bosnia and Herzegovina unless the country's fish-producing and processing enterprises obtain approval to export products to the EU market.

Aquaculture businesses

In Bosnia and Herzegovina, most aquaculture businesses are small or medium-sized units. Most of the fish produced go to local markets or shops. Because of difficulties with transportation facilities and hygienic measures, the fish is mainly traded (exported) as live fish. Animal welfare concerns related to longer distance transportation in comparison to killing and processing on-site and transportation of ice-chilled/frozen produce is noted here as an area that should be considered more strongly in the future.

FOOD SAFETY AND QUALITY OF FISH AND FISH PRODUCTS

With respect to its biochemical composition, wild marine fish is one of the food products for which man has little direct control. The environmental conditions of the live fish, important for its health and contamination status, are often unknown for wild catches. In comparison, fish grown in aquaculture systems can be well monitored in regard to the quality of their immediate environment, physical condition, feed, growth, diseases, meat quality, etc.

Health hazards associated with aquaculture products

General aspects

Fish and its products are highly perishable food products. Firstly, due to the high amount of polyunsaturated fatty acids (PUFAs) fish fat is exposed to oxidation processes. Secondly, due to the fish muscle structure and composition (tri methylamine oxide, sulfuric amino acids, non-protein-nitrogen-substances, etc.), bacterial and enzymatic spoilage results in high amounts of TVB-N (total volatile basic nitrogen). These are made of TMA, ketone ester, aldehydes and others. Besides a proper organoleptic investigation, the TVB-N results are used for a final food quality diagnosis. Limit values for some marine fish are given in *Reg. EC 2074/2005*; most cultured fish, however, keep low amounts of TMA and TVB-N for a long while. In consequence, these chemical tests have only limited significance for these fish species. Organoleptic testing plays the major role in these fish. For example, *Salmo salar*, as a fish species often traded, has a limit value of 35 mg/100 gm of flesh. Reference methods for these tests are also named in the above-mentioned Regulation.

High histamine levels in fish are likewise caused by the bacterial reduction of histidin. Thus, only fish species with high amounts of histidin in their meat have to be considered (according to *Reg. EC 2073/2005 on Microbiological Criteria in Food*). The fish mainly raised in aquaculture systems in Bosnia and Herzegovina do not belong to those fish species rich in histidin. Bosnian and Herzegovinian legislation considers TVB-N testing and histamine levels in fish in the *Decision on veterinary health conditions which have to be fulfilled by the establishments intended for breeding, processing and placing on the market fish and fishery products and crustaceans and products* (OJ 5/04).

Chemical residues and contaminants

The load of residues and contaminants found in fish products highly depends on the water and surrounding soil quality of the culture system, the use of drugs and the quality of the feed. In order to determine any chemical health hazards, samples from fish and water must be tested for the presence of these chemicals. This is mainly done through official programmes on residue and contaminant control (e.g. *Decision on monitoring residues of certain substances there of in animals and their products* [OJ]; *Decision on establishing reference laboratories in Bosnia and Herzegovina* [OJ 68/05 and OJ 90/05, consolidated text]).

Biological agents – Bacteria, viruses, parasites

Biological hazards include all bacterial, mycological or viral contaminations, as well as parasites found in fish. Tables 1 and 2 present data on infections recorded by FSA for Bosnia and Herzegovina (the origin of infection is not considered). No similar data were at hand from the Republic of Srbska (RS) or the District of Brcko (DB). A differentiation into origin of the food (fish, poultry, etc.) was not given. As known from other countries, the actual number of cases is likely to be considerably higher. This will be the case for Bosnia and Herzegovina too, because the notification system has yet to be established and adopted by all persons having notification and surveillance responsibilities. The IPH and the FSA are not yet fully operational, as all manpower and especially cooperation is not at hand.

Bacterial pathogens or spoilage bacteria often found on fish and fish products are *Shewanella putrefaciens*, *Pseudomonas* spp. and *Aeromonas* spp., as well as *Salmonella*, *Shigella*, *Escherichia coli* and *Listeria monocytogenes*. Contamination also highly depends on the quality of the surrounding water.

The laboratory results seen in some fish enterprises during our on-site visits were all negative for *Salmonella* testing and were below the limits for other bacteria set by Bosnia and Herzegovina's relevant legislation, *Regulation on conditions in terms of microbiological fitness for food on the market* (OJ SFRJ 45/83). However only

TABLE 1
World Health Organization (WHO) statistics for Bosnia and Herzegovina, 2000–2005

Infective agent	2000	2001	2002	2003	2004	2005
<i>Coxiella burnetii</i> (Q-fever)	153	7	43	20	41	31
Salmonellosis	366	240	351	419	574	437
Trichinelosis	6	31	2			
Leptospirosis	21	17	31	8	5	51
Hepatitis A	1579	731	83	53	22	
Campylobacteriosis						
Amoebiasis						74
Anthrax	2		3		1	
Brucellosis	6	4	14	47	89	137
Yersiniosis						
Leptospirosis	21	17	31	8	5	51
<i>Staphylococcus aureus</i> – poisoning						
EHEC –Enterohaemorrhagic <i>Escherichia coli</i>	3 703	3 590	4 195	4 199	3 826	
Botulism						
Rabies						

Source: Decision on veterinary health conditions which must be fulfilled by establishments which are carrying out processing of fish and fishery products (Food Safety Agency, 2006).

TABLE 2
Number of registered cases of food poisoning in Federation of Bosnia and Herzegovina during the period 2002–2006

Foodborne infections	2002	2003	2004	2005	2006
Incidence	1 021	1 024	807	797	862

Source: Decision on veterinary health conditions which must be fulfilled by establishments which are carrying out processing of fish and fishery products (Food Safety Agency, 2006).

qualitative results are given in this kind of investigation; no exact counts are available for any bacterial species. Also, no investigations on *L. monocytogenes* were seen.

Fish viral diseases are said to be well monitored, and as fish diseases are not part of this investigation, no data was sought.

Data on parasitic diseases in fish or humans were not given. From personal information given by a laboratory member, problems are mainly seen in imported marine fish. This presumably involves infections by the nematode *Anisakis simplex*; x-ray of fish filets does not seem to be done properly and visibly contaminated fish parts do not always seem to be removed during processing.

Physical hazards

In fish processing, the main physical hazards are fish bones and in canned products, metal or glass pieces. As most of the fish produced in Bosnia and Herzegovina are traded as whole fish, fish bones are therefore a natural part of the produce. Also, in fish caught with a metal hook, the hook can be a considerable health threat if not removed.

FOOD SAFETY LEGISLATION

Legislation concerning food and food products is one of the widest fields in law. In this report, only legislation of importance for regulating fish quality and safety will be discussed.

Legislation concerning the general meaning for fish and fish products

The development of the *Law on Food* (OJ 50/04) in 2004 aimed to follow the requirements of the *Agreement on the application of sanitary and phytosanitary measures* (the SPS Agreement) of the World Trade Organization (WTO, 1994) and the *Agreement on Technical Barriers to Trade* (TBT Agreement), as well as of *Reg. EC*

178/2002. In major accordance with these agreements, the named basics and principles of the new approach in food law are:

- The highest aim is to assure a high level of consumer protection and with it, food quality and safety.
- Preventive consumer protection means process control (instead of end product control), and traceability and transparency.

In order to reach these major aims, the following measures or actions are needed:

- inclusion of primary production and feed;
- responsibility for food safety lies with the food producer (= enforcement of product liability);
- implementation of hazard analysis critical control point (HACCP)-based systems;
- self-controls – neutral controls (audits) – State controls of self-controls;
- enforcement of risk assessment, risk management and risk communication;
- implementation by the Food Safety Authority (FSA);
- implementation of Early Warning Systems (according to the Rapid Alert System for Food and Feed, RASFF); and
- establishment of a Central Data Collection System.

In major accordance with hygienic practices mentioned in *Reg. EC 853/2004* and *854/2004*, the *Veterinary law in Bosnia and Herzegovina* (OJ 34/02) is supposed to build the legal basis for veterinary control and hygienic requirements for food businesses in BiH. In cooperation, the FMoAWF and the MoAWFRS together with SVO prepared the *Decision on conditions which must be fulfilled in slaughterhouses, facilities for processing, production and warehousing products of animal origin* (OJ 27/05) in order to specify the hygienic requirements for food production businesses.

In order to ensure transparency and traceability through all production steps in a food chain that will result in a clearly traceable food at the consumer stage, documentation of all incoming and outgoing materials and goods coming in contact with or being part of the food, as well as a correct labeling, are of importance.

Reg. EC 104/2000 dealing with providing information to the consumer concerning fishery and aquaculture products and *Reg. EC 2065/2001* dealing with procedures for implementation of the named measures are tools to fulfill this aim. In short, the proper scientific species name, the trade name and the production method (“from aquaculture”) must be given and for aquaculture products, the country of origin must also be given as information to each consumer. Finally the name and address of the food business must be shown. This labelling information must be ensured at each step of trading in order to have complete traceability of product.

A complete list with trade names and nationally accepted specifications for food products reflecting the expectations of the consumer has not yet been published. A national commission to specify the food and food products as well as associate scientific names with national trade names must be established. Based on available information, there is currently no official list or book containing all specifications.

Product specification must contain: the name of the product, the name and place of the producer, the type and quantity of raw materials and additives added (given in distinctive measurement units or percentages), and a short description of the technological procedures used during production. As prescribed in the *Rule on quality of meat production* (OJ SFRJ 29/74), only products that are accompanied by a product specification can be placed on the market.

In order to fulfill the demand for a safe and traceable food, the following order describes the commitment to the need for documentation at each step of the production process, which is also part of each proper QMS and GMP: *Decision on veterinary health conditions which have to be fulfilled by the establishments intended for breeding, processing and placing on the market fish and fishery products and crustaceans and products* (OJ 5/04).

To accomplish the main aim of *Law on food* (OJ 50/04), which is the (preventive) protection of the consumer's health, HACCP-based principles must be implemented at all stages of the food business. To ensure the production of a safe food at all steps in the food chain, this commitment to the HACCP principle is precisely named in the *Decision on conditions which must be fulfilled in slaughterhouses, facilities for processing, production and warehousing products of animal origin* (OJ 27/05); the *Decision concerning the implementation of compulsory measures in recognized establishments in order to reduce microbial and other contaminants of meat, meat products and their products of animal origin intended for human consumption* (OJ 08/05); and the *Decision on the manner of completing veterinary and health examination of animals before slaughtering and products of animal origin* (OJ 82/06). Veterinary inspections of these HACCP systems are recommended in the above decisions.

General hygienic measures specifically for fish and fish products are given at the EU level in *Fish Hygiene Decision 91/493/EC* and in BiH legislation in the *Decision on veterinary health conditions which have to be fulfilled by the establishments intended for breeding, processing and placing on the market fish and fishery products and crustaceans and products* (OJ 5/04).

Legislation dealing with chemical hazards

Monitoring programmes for chemical contamination and residues in food are laid down in the *Decision on monitoring of residues of certain substances in animals and their products* (OJ) and the *Decision on establishing reference laboratories in Bosnia and Herzegovina* (OJ BH No. 68/05, last amended in OJ 90/05, consolidated text) as well as, especially concerning treatment and residues in fish: *Decision banning administering of certain substances in medical treatment of fish* (OJ 33/07).

At the entity level, this is followed by the *RS Rulebook on pesticides and fertilizers* (2001), a *Rulebook on the conditions of the production, marketing and sampling of pesticides and fertilizers* (1998) and the *FBiH Rulebook on the allowed levels of pesticides and other harmful substances, hormones, and mycotoxins in food and feed* (1992). Limit values for unwanted substances in food and feed were adopted from former Yugoslavian orders and do not always correspond to European limits.

Decision 2005/34/EC gives norms for the investigation of certain residues in food of animal origin from non-EU Member States. These should also be considered for investigations of products originating in BiH that are intended for export to the EU.

The residual monitoring of products of animal origin is working well due to the long-term and intensive training of veterinarians via workshops on sampling and other matters important for meaningful results. The results for fish from aquaculture are shown in Table 3. Investigations were carried out in laboratories named by SVO as reference laboratories. Investigations were mainly performed with serological (enzyme-linked immunosorbent assay, ELISA) methods. One of the laboratories (the Veterinary Faculty of the University of Sarajevo) performs gas chromatography (GC), high performance liquid chromatography (HPLC) and atomic absorption spectroscopy (AAS). Some of analyses (e.g. for mycotoxins and dyes) are also being carried out at the National Veterinary Institute in Ljubljana (Slovenia), a laboratory contracted by SVO.

Legislation dealing with control of biological hazards

Complete control of biological hazards requires a good and detailed risk assessment, a properly working HACCP programme and appropriate hygienic management. In general, biological hazards (particularly bacteria and molds) are identified through the use of time-consuming classical microbiological methods. Serological and molecular biological methods are faster but more expensive. Instructions for the investigation of fish products for relevant bacteria as well as their hygienic production is included in

TABLE 3
Results of the regulatory programme for control of residues in food

COUNTRY	Bosnia and Herzegovina		DATE		26.3.2007	
YEAR OF IMPLEMENTATION OF THE RESIDUE PLAN	2006					
ANIMAL SPECIE/PRODUCT	AQUACULTURE					
GROUP OF SUBSTANCES TO BE MONITORED	COMPOUND OR MARKER RESIDUE	MATRIX ANALYSED	NUMBER OF SAMPLES		DECISION LIMIT [$\mu\text{g}/\text{Kg}$]	NUMBER OF NON COMPLIANT RESULTS (ABOVE DECISION LIMIT)
			PLANNED	TESTED		
A1. STILBENES	DES	MUSCLE WITH SKIN	15	15	pos.result	0
A3. SYNTHETIC STEROIDS (WITH ANDROGENIC, GESTAGENIC OR ESTROGENIC ACTIVITY)	Trembolone	MUSCLE WITH SKIN	15	15	pos.result	0
A6. CHLORAMPHENICOL	Chloramphenicol	MUSCLE WITH SKIN	12	21	pos.result	0
A6. NITROFURANS	ELISA	MUSCLE WITH SKIN	1	1	pos.result	0
Nitrofurantoin metabolite	GC-ECD					
Furaltadone metabolite						
Furazolidone metabolite	ELISA	MUSCLE WITH SKIN	2	2	pos.result	0
Nitrofurazone metabolite	ELISA					
A6. OTHERS						
B1. ANTIBACTERIAL SUBSTANCES	all antibiotics mentioned in plan for 2006	MUSCLE WITH SKIN	19	32	pos.result	0
Screening test	all sulfonamides mentioned in plan for 2006	MUSCLE WITH SKIN	19	30	pos.result	0
Confirmatory test	we did not have confirmatory method					
B2a. ANTHELMINTICS	Avermectine	MUSCLE WITH SKIN	16	16	2377/90 (EEC)	0
B2f. OTHER PHARMACOLOGICALLY ACTIVE SUBSTANCES						
B3a. ORGANOCHLORINE COMPOUNDS INCLUDING PCBS	Aldrin + Dieldrin	MUSCLE WITH SKIN	6	9	0,01 mg/kg	0
	Chlordane	MUSCLE WITH SKIN			0,05 mg/kg	
	DDT	MUSCLE WITH SKIN			1 mg/kg	
	Endrin	MUSCLE WITH SKIN			0,001 mg/kg	
	Alpha HCH	MUSCLE WITH SKIN			0,01 mg/kg	
	Lindane	MUSCLE WITH SKIN			0,5 mg/kg	
	PCB Isomeres (28, 52, 101, 138, 153, 180)	MUSCLE WITH SKIN			3 mg/kg	
B3c. CHEMICAL ELEMENTS	Lead (Pb)	MUSCLE WITH SKIN	6	10	1 mg/kg	0
	Cadmium (Cd)	MUSCLE WITH SKIN			0,1 mg/kg	
	Mercury (Hg)	MUSCLE WITH SKIN			0,5 mg/kg	
	Arsenic (As)	MUSCLE WITH SKIN			2 mg/kg	
B3d. MYCOTOXINS	Ohratoxin A	MUSCLE WITH SKIN	3	3	pos.result	0
	Aflatoxin B1	MUSCLE WITH SKIN	3	3	pos.result	0
B3e. DYES	Malachite green	MUSCLE WITH SKIN	3	3	pos.result	0
	Leukomalachite green	MUSCLE WITH SKIN	3	3	pos.result	0

Source: Provided by S. Tankovic, SVO.

legislation such as the *Decision concerning implementation of compulsory measures in recognized establishments in order to reduce microbial and other contamination of meat, meat products and other products of animal origin intended for human consumption* (OJ 08/05) and the *Decision on veterinary health conditions which must be fulfilled by establishments which are carrying out processing of fish and fishery products* (Food Safety Agency, 2006).

Fish businesses with a registration number and permission to export their produce must have implemented HACCP systems according to the *Decision on conditions which have to be fulfilled by the establishments intended for slaughter of the animals, processing, refining and storing of the products of animal origin* (OJ 27/05). However, based on available information, these conditions are not being verified or audited by international authorities. In any case, the Veterinary State Law is followed, such that no food business whatsoever can place its products on the market without being registered by official authorities.

According to the *Veterinary law in Bosnia and Herzegovina* (OJ 34/02), a veterinary inspector can close a food business if food is produced in non-hygienic premises. These conditions are reported to the SVO. No information was available as to how many food businesses, if any, have received any punishments. Even though implementation of HACCP is mandatory for food businesses, no data are available on the number of establishments having HACCP systems and their status. Also, the extent of training for people in charge of QMS, GHP etc. in each business is unclear.

European Reg. EC 2073/2005 on *microbiological criteria in food* divides the investigation and regulations into two areas of production: the process hygiene criteria and the food safety criteria. Such a division has not yet been made in national microbiological or hygiene legislation.

Also, for the investigation of certain kinds of bacteria, the allowable limits and the (international) methods to be used are precisely named in the Reg. EC 2073/2005. The methods named and to be used in BiH according to the national legislation are for the most part not in accordance with the methods specified for EU countries. Also, according to EC 2037/2005, most ready-to-eat foods must be tested for *Listeria monocytogenes*. However, in BiH relevant legislation does not prescribe similar compulsory control of *L. monocytogenes*.

Requirements for visible inspections of fish for parasites are named in EU legislation in Reg. EC 853/2004 and (in more detail) in Reg. EC 2074/2005. For Bosnia and Herzegovina, these controls must be done according to the *Decision on conditions which must be fulfilled in slaughterhouses, facilities for processing, production and warehousing products of animal origin* (OJ 27/05) and the *Decision on the manner of completing veterinary and health examination of animals before slaughtering and products of animal origin* (OJ 82/06). Meat that contains larval tapeworms (*Diphyllobothrium latum*), trematodes (*Opisthorchis felineus*), nematodes (*Anisakis*) or other parasites or their adult forms pathogenic to humans is not fit for human consumption.

CONTROL AND INVESTIGATION OF AQUACULTURE BUSINESSES

Self-controls and official Controls

According to the *Law on food* (OJ 50/04), all food businesses have the responsibility to produce only safe food. Therefore, they are also responsible for reasonable testing (self-controls) in order to demonstrate that they undertake all actions needed to protect the consumer from any harm that could be induced by their food. The official authorities, however, have the responsibility to implement a legal framework through which they are also responsible for protecting consumer health, while also allowing fair trade and the same possibilities for all food-business operators involved in market trade. To fulfil their mandate of protecting consumers and ensuring high-quality and safe food, official veterinarians must verify that all persons involved in the food chain

comply with the relevant legislation. They must inspect and assess all documentation and GHP/HACCP plans, control the sectors' self-controls, conduct their own official monitoring and hygienic sampling programmes, and enforce the relevant laws. If these activities are not completed, the demand for equality for all food business operators is not fulfilled. This division into (i) the self-controls done by the food-business operators and (ii) the control of self-controls and the official sampling undertaken by state authorities (veterinary inspectors) is clearly stated in the *Decision on monitoring residues of certain substances thereof in animals and their products (2002)* (OJ).

However, during our visits to food-business enterprises and through discussions with the responsible officials it was not quite clear which controls were the responsibility of the establishments and which sampling (especially microbiological testing) was to be done by the official services. Additionally, the national methods, which are described in legislation but are not tested (validated) against International Organization for Standardization (ISO) methods, were used by the laboratories, which makes their comparison to other non-Bosnian and Herzegovinian results difficult. A regular control of cleaning and disinfection in the food businesses seems not to be done regularly; as well, some veterinary inspectors also do not seem to do these controls either, and no restrictions against food operators were seen.

Laboratories

The *Decision on monitoring residues of certain substances thereof in animals and their products (2002)* (OJ) defines an *authorised laboratory* as "a laboratory that meets the requirements laid down by the Office and approved by the competent authorities of entities and Brcko District for the purposes of examining official samples in order to detect the presence of residues". At least one reference laboratory shall be named. The reference laboratories shall be responsible for:

- coordinating the work of the other authorized laboratories responsible for residue analysis and coordinating the standards and methods of analysis for each residue or group of residues;
- expertise in making of the Plan;
- conducting periodical comparative tests for each residue or group of residues analysed in the laboratory of concern;
- informing the Office and the competent authorities of the Entities and Brcko District regarding the results of analysis, at least once per month;
- carrying out training courses for laboratory personnel in other reference laboratories and in reference laboratories of other countries;
- observing the laws that establish standards and methods of analysis; and
- exchanging information with other reference laboratories.

To detect residues and fish-specific infectious diseases like infectious pancreatic necrosis (IPN), the *Decision on establishing reference laboratories in Bosnia and Herzegovina* (OJ 68/05 and OJ 90/05, consolidated text) defines the duties of a reference laboratory with regard to investigation of residues and infectious diseases as follows:

- undertake super-analysis for all investigations for which it is the reference laboratory;
- provide expertise and give final opinions regarding the results of the other laboratories at the request of the Office, courts of law, inspections and other legal subjects;
- process and interpret all results of the investigations that are undertaken within the framework of the international cooperation;
- undertake domestic and international inter-laboratory investigations;
- evaluate work of the authorized laboratories at the request of the Office;
- provide professional assistance for the application of modern equipment and methods of work for the effective accomplishing of the laboratory tasks;

- improve investigation and working methods in laboratories;
- coordinate and supervise trainings and train experts for work in the laboratory;
- initiate creation of the standards for investigation of certain parameters and give proposals for their adoption; and
- undertake control of diagnostic and immunobiological substances within its field of reference.

This is a very wide field and it is not clear to what extent the reference laboratories fulfill these duties. Techniques such as GC, HPLC, AAS and polymerase chain reaction (PCR) are available only at the Veterinary Faculty of the University of Sarajevo, whose Food Hygiene Department can serve as a qualitative and quantitative laboratory for residue analysis and also for the quality control of animal products and feed. The Veterinary Institute at Banja Luka has acquired modern analytical equipment for milk control. All other laboratories work mainly with the ELISA technique in residue testing.

According to the *Decision on conditions which must be fulfilled authorized veterinary diagnostic laboratories* (OJ 16/05) and considering the *Law on food* (OJ 50/04), there are different laboratories defined as:

- testing laboratories authorized to carry out basic analyses;
- testing laboratories authorized to carry out specialized analyses;
- testing laboratories specialized to carry out analyses, with the possibility of issuing international certificates; and
- reference laboratories.

Laboratories authorized by procedures set up by the Council of Ministers upon the Agency's proposal and with prior opinion of the Institute for Accreditation of Bosnia and Herzegovina to carry out specific types of microbiological or chemical analyses are as following (Perc, 2007):

1. Public Health Institute of FBiH – Mostar
2. Public Health Institute of FBiH – Sarajevo
3. Public Health Institute of Una-Sana Canton
4. Public Health Institute of Tuzla Canton
5. Public Health Institute of Zenica-Doboj Canton
6. Public Health Institute of Bosnian-Podrinje Canton
7. Public Health Institute of Central-Bosnia Canton
8. Public Health Institute of West Bosnia Canton (Canton 10)
9. Public Health Institute of Herzegovina-Neretva Canton
10. Public Health Institute of West Herzegovina Canton
11. Public Health Institute of Sarajevo Canton
12. RS Health Care Institute – Banja Luka
13. RS Health Care Institute – Zvornik
14. RS Health Care Institute – East Sarajevo
15. RS Health Care Institute – Foča
16. RS Health Care Institute – Trebinje
17. Veterinary Institute of the Veterinary Faculty – Sarajevo
18. Veterinary Institute “Vaso Butozan” – Banja Luka
19. Veterinary Laboratory – Mostar
20. Veterinary Laboratory – Tuzla
21. Veterinary Laboratory – Bihać
22. Cantonal Veterinary Station – Sarajevo
23. Veterinary Laboratory – Bijeljina
24. Veterinary Laboratory – Zenica
25. Institute of Agriculture – Sarajevo
26. Faculty of Agriculture – Sarajevo
27. Institute of Agronomy – Mostar

28. Institute of Agriculture – Banja Luka

29. Institute of Agriculture – Bijeljina

The laboratories seen during our visits were quite different, some showing considerable effort in fulfilling the major Good Laboratory Practice and accreditation concerns, while others were very far away from the possibility of being accredited by an international accreditation body. Some laboratories seem to have major internal structural deficiencies, whereas others have to cope mainly with external deficiencies (e.g. dealing with waste disposal, obtaining high-quality materials, etc.). Based on the information given, no ring trials, proficiency tests, etc. are being performed by any institute. Given the availability of equipment and the structure of some laboratories, the reproducibility, comparability and correctness of results must seriously be questioned.

The methods applied in the laboratories are generally based on entity legislation that was mainly adopted from former Yugoslavian orders. These methods are not internationally accredited like ISO methods (e.g. named in EU Reg. 2073/2005 on *microbiological criteria for food*). Also, not all bacteria named as basic micro-organisms that should be investigated in food are also mentioned in the national law (e.g. *Listeria monocytogenes*).

There is only one accredited laboratory (Veterinary Laboratory of Cantonal Veterinary Station Sarajevo) that is also a reference laboratory. The accreditation was performed by the national accreditation body, which is not a part of an EU accreditation body. However, in *Decision on establishing reference laboratories in Bosnia and Herzegovina* (OJ 68/05 and OJ 90/05, consolidated text), no reference laboratory for microbiological testing is named, only those for residual and viral fish diseases being specified (see above).

The microbiological results obtained by testing following the national regulations are mainly qualitative results. However, for future policy in preventing health hazards and to ensure high-quality food and the planning of further hygiene strategies, it is of major importance to a company if quantitative results are available (for example, in the case where a food contains less than 1 000 *E. coli* per gram, it is of great importance to know if the number was 999 bacteria per gm or less than 10 *E. coli* per gram).

CONCLUSIONS

The problems identified during this study can be divided mainly into:

- structural problems (politics, ministries, competences, infrastructure, RASFF),
- educational/motivational problems, and
- laboratory problems (e.g. certified agars, ISO methods and accreditation).

Structural problems

One main problem is the lack of implementation and enforcement of State and Entity/District Level legislation at the municipality and local levels (e.g. by the companies). Either there are old laws at hand at these lower levels or officials (veterinarians) do not enforce the relevant laws. The reasons for this may include lack of motivation due to uneducation or low salary. Many persons may not understand the importance of implementing the modern food legislation, particularly in structurally low-developed areas. In particular, food businesses wanting to export need enforcement of legislation in order to address the requirements and concerns of other countries. Even if export to the EU is not the major aim of the food production sector or politics, by meeting the requirements specified by the EU legislation, exportation to other countries will be easily possible.

A phenomenon called “social peace” sometimes seems to be too generally accepted. It may be acceptable that, for example, a poor elderly woman is permitted sell her two self-caught fish on the street without officials troubling her; however, the impression is that at times this concept of “social peace” is extended to larger fish-business operators. An assessment of the risk associated with each type of food business should be done by

each inspectorate. Testing procedures and enforcement of laws should be implemented according to the risk posed by each food business. Companies with a high amount of fresh fish production are surely a greater risk than a “one-person-one-product” seller. Food businesses must be law-abiding; else fair trade is not possible.

It also seems that differentiation of competencies between different official authorities is not always clear. Some persons involved in the food production chain complained about unclear definition of responsibilities between ministries and other authorities on different levels (state, entities, cantons, districts and municipalities), as well as insufficient cooperation between the responsible ministries and the involved food businesses.

For a small country like Bosnia and Herzegovina to have State ministries and offices, followed by the same structures at the Entity Level, the Cantonal Level and the Municipality Level would seem to require too much money and can result in having too many people responsible for one thing. The existence of one major Ministry would make things easier.

According to the *Law on food* (OJ 50/04) the following structures must also be fulfilled:

- *RASFF*: A national early warning system is mandated by the *Food Safety Law* and is supposed to be operated by the FSA; however, it has yet to be established.
- *Central Data System*: Until now there is no central information and data collection system implemented at the State level.

There are only monthly reports submitted by the SVO to the World Organisation for Animal Health (OIE) concerning the occurrence of infectious diseases in animals in Bosnia and Herzegovina. The reliability of data due to notification reliability from some districts is not clear; there is no overall notification from the human sector on food-borne diseases, the identified source, etc., only fragmentary data are available.

There is an urgent need for coordination of data collection encompassing the human and veterinary sectors on matters related to food-borne diseases; again, reliable working reference laboratories applying ISO/Association of Analytical Communities (AOAC) methods are needed.

If there is a central contact point for other countries, results from investigations of food exported from BiH could also be collected in one point.

Food Safety Agency

The FSA, as currently handled, is not independent from the state authorities (namely the Ministry), but at the moment fulfils matters lying within the scope of the Ministry. FSA should be responsible for risk assessment and risk communication, but not mainly for risk management. At present it seems that FSA mainly fulfils risk management duties (e.g. drafting Decisions and Regulations).

When most legislative work has been accomplished, this relationship between the Ministry and FSA should change. The mandate of FSA lies primarily in its scientific work supporting consumer protection and in its role as a contact point for other countries for questions regarding the safety of food produced in Bosnia and Herzegovina; it may also advise the Ministry in food legislation matters. Risk communication should be accomplished by providing information on health risks (and on issues identified as not being risks) to the consumer via newsletters, Internet, TV and others.

Further needs

These include:

- *National Book on Food Codes*: to specify what a consumer can expect in Bosnia and Herzegovina from a certain kind of food; for this, trade names must also be specified.
- *Institute of Public Health* (IPH): a close cooperation between human (IPH) and veterinary medicine (FSA, SVO) offices can result in synergies and a faster backtracking of outbreaks.

Education and motivation

The education of most persons involved on the official side is very good at the higher levels. The question is how to improve the understanding of matters concerning new food legislation and the importance of its enforcement to officials at the “lower” levels. Recommendations include that trainings be done mainly by regional and national veterinarians (e.g. veterinarians from the university assisted by a cantonal veterinarian who speaks the “same language” and knows more about structural difficulties. Trainings that include modern concepts (e.g. HACCP, QMS, etc.) should explain these programmes on-site or at least with relevant examples. Also, veterinarians should be pushed to enforce the legislation on all food businesses and understand the importance of doing so.

Food-business operators and especially the responsible persons in these businesses who are in charge of HACCP plans, hygiene, etc. should be trained on the importance of implementing these measures and be educated to “live” an HACCP system and not only have a document on paper. Food-business operators must understand their own responsibilities for the production of safe food, as well as the power they have in the food chain. Their goals must be given a higher priority than is currently given by official legislation, if BiH is to meet international trade standards (e.g. International Food Standard) and have a chance on the international market. If laboratory investigations do not meet the standards demanded by trading partners, the companies must ask for the implementation of internationally recognized laboratory methods. Surely they must understand that although there will be initial costs without any assurance of selling their food on the international market, if they do not take this step, they will not have a chance for exporting in the future anyway.

Laboratory staff must be trained regularly on modern techniques but also in Good Laboratory Practice and internationally accepted (validated) methods.

Laboratories

Laboratories that are not performing to an internationally acceptable standard still seem to receive samples from officials. Pressure on these laboratories to adopt reliable working techniques should be intensified by both authorities and food businesses. International (ISO, AOAC, etc.) methods should be implemented, at least in those laboratories testing samples for companies trading internationally. The comparability of test results obtained by local laboratories with those achieved by laboratories in other countries is an important aim. While this will require investments by laboratory owners, it is essential if samples for businesses seeking access to international markets are going to be tested. Laboratories can specialize on some methods and cooperate with other laboratories when other methods are needed. Otherwise, the laboratories may only investigate samples for the national market. Laboratory owners should define their major aims and competencies and then strengthen these competencies with modern equipment and methods. For residue testing, besides ELISA testing some very expensive equipment and materials are needed (HPLC, etc.). Again, the laboratory system should be organized to investigate the major residues using internationally accepted methods (the international limit for the residue being tested is important; e.g. if HPLC is recommended and a limit of 1 ng/kg is given for acceptability of the food but the food is tested using ELISA with a detection limit of 1 µg/kg, the results are not valid for international trade).

It may be possible to clarify the intentions of food businesses to test certain foods according to international standards in order to see if investments in new equipment can be covered by income generated by processing the food samples sent in by the businesses. There is an inter-relationship between the food businesses and the laboratories; the goals should be specified by both parties. The final aim must be to

achieve accreditation by the accreditation office; however, capability must also be certified by the international accreditation councils.

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This publication, one of the main documentation outputs of the FAO Technical Cooperation Programme (TCP) Project TCP/BIH/3101 "Strengthening Aquaculture Health Management in Bosnia and Herzegovina" contains, a series of seven contributed papers with useful information on the development and current status of aquaculture and aquatic animal health in Bosnia and Herzegovina. These papers were presented by national and international consultants during the various training/workshops that were undertaken during project implementation. The topics include: project overview and highlights of implementation, development of national policy and strategy for aquaculture, European Union animal health requirements for aquacultured animals and their products, status of national aquaculture development, aquatic animal health surveillance and disease control system in Bosnia and Herzegovina and national health status of aquatic animals and aquacultured fish and fishery product quality and safety in Bosnia and Herzegovina.

