

Strengthening aquaculture health management in Bosnia and Herzegovina



Cover photo:

Modern trout cages of Norfish Blagaj in Mostar, Bosnia and Herzegovina, courtesy of M.B. Reantas (FAO).

Strengthening aquaculture health management in Bosnia and Herzegovina

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Preparation of this document

This document is an output of the FAO Technical Cooperation Programme (TCP) Project TCP/BiH/3101 “Strengthening Aquaculture Health Management in Bosnia and Herzegovina”. The document consists of several papers: the first paper presents an overview of the project and implementation highlights, followed by a series of six papers that form part of the work of national consultants and international experts who participated in the project. These papers contain useful information on the development and current status of aquaculture and aquatic animal health in Bosnia and Herzegovina.

The Aquaculture Management and Conservation Service (FIMA), Fisheries and Aquaculture Management Division (FIM) of the FAO Fisheries and Aquaculture Department was the Lead Technical Unit (LTU) of this TCP; Dr Melba B. Reantaso, Fishery Resources Officer of FIMA and Lead Technical Officer of the TCP, supervised the preparation of this publication and the overall implementation of the TCP.

Abstract

The FAO Technical Cooperation Programme (TCP) Project TCP/BiH/3101 “Strengthening Aquaculture Health Management”, implemented between late 2006 and mid-2009, was aimed at increasing the effectiveness and efficiency of the State Veterinary Office of Bosnia and Herzegovina on aquatic animal health management to support sustainable and healthy aquaculture production of the country. In this way, Bosnia and Herzegovina will improve the value and efficiency of aquaculture production through the implementation of international aquatic animal health and food safety standards, especially those of its trading partners in Europe. The project developed national policies on aquatic animal health and strengthened the capacity of veterinary administration, inspectors, laboratories and producers in improving compliance with international health and food safety and quality requirements and practices. The project also assisted in disseminating the lessons learned to neighbouring trading partners in order to promote future regional cooperation in aquaculture and aquatic animal health management.

This publication, one of the major documentation outputs of the above TCP, contains a series of seven contributed papers that were presented by national consultants and international experts to participants attending the series of workshops organized by the project. These papers contain information on: (i) project overview and highlights of implementation; (ii) development of national policy and strategy for aquaculture; (iii) European Union animal health requirements for aquacultured animals and their products; (iv) status of national aquaculture development; (v) aquatic animal health surveillance and disease control system in Bosnia and Herzegovina; (vi) national health status of aquatic animals and (vii) aquacultured fish and fishery product quality and safety in Bosnia and Herzegovina.

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Strengthening aquaculture health management in Bosnia and Herzegovina.

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Abbreviations and acronyms

AAS	atomic absorption spectroscopy
ALOP	appropriate level of protection
AOAC	Association of Analytical Communities
AVIS	Advanced Veterinary Information System
BD	Brcko District
BiH	Bosnia and Herzegovina
BKD	bacterial kidney disease
BMPs	better management practices
BVI	Border Veterinary Inspection
CA	competent authority
CCA	central competent authority
CCRF	Code of Conduct for Responsible Fisheries
CEFTA	Central European Free Trade Agreement
CRL	Central Research Laboratory
CRL	Community Reference Laboratory
CVI	Cantonal Veterinary Inspection
DAWF	Department of Agriculture, Forestry and Water Management, District of Brcko
DB	District of Brcko
DL	Designated Laboratories
EC	European Community or European Commission
ELISA	enzyme-linked immunosorbent assay
EHN	epizootic haematopoietic necrosis
EPA	Expert Panel for Aquaculture
ERD	enteric redmouth disease
EU	European Union
EUS	epizootic ulcerative syndrome
EVI	Entity Veterinary Inspection
FAfIA	Federal Administration for Inspection Affairs in FBiH
FAO	Food and Agriculture Organization of the United Nations
FBiH	Federation of Bosnia and Herzegovina
FIEP	Development and Planning Service
FIMA	Aquaculture Management and Conservation Service
FIIU	Fish Utilization and Marketing Service
FMoAWF	Federal Ministry of Agriculture, Water Management and Forestry of the Federation of Bosnia and Herzegovina
FSA	Food Safety Agency
GC	gas chromatography
GHP	good hygiene practices
GMP	good management practice
HACCP	Hazard Analysis and Critical Control Point
HH	high health
HPCL	high performance liquid chromatography
IFAT	indirect fluorescent antibody test
IHN	infectious haematopoietic necrosis
IPH	Institute of Public Health

IPN	infectious pancreatic necrosis
ISA	infectious salmon anemia
ISO	International Organization for Standardization
LEGN	FAO Development Law Service
MoA	Ministry of Agriculture
MoAFWRS	Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska
MoFTER	Ministry of Foreign Trade and Economic Relations
MVS	Municipality Veterinary Services
NAAHS	National Aquatic Animal Health Strategy
NPC	National Project Coordinator
NRL	National Reference Laboratory
OIE	World Organisation for Animal Health
OJ	Official Journal of Bosnia and Herzegovina
OMVD	<i>Oncorhynchus masou</i> virus disease
PCR	polymerase chain reaction
PUFAs	polyunsaturated fatty acids
QMS	Quality Management Systems
RAfIA	Republic Administration for Inspection Affairs
RASFF	Rapid Alert System for Food and Feed
RS	Republic of Srpska
SAA	Stabilization and Association Agreement
SPF	specific pathogen free
SPS	WTO Agreement on the Application of Sanitary and Phytosanitary Measures
SVC	spring viraemia of carp
SVO	State Veterinary Office
SWOT	strengths, weaknesses, opportunities and threats
TBT	WTO Agreement on Technical Barriers to Trade
TCP	Technical Cooperation Programme (of FAO)
TRACES	TRAdE Control and Expert System
TVB-N	total volatile basic nitrogen
VHS	viral haemorrhagic septicaemia
VIFBiH	Veterinary Inspectorate of FBiH
VIRS	Veterinary Inspectorate of the RS
WAHIS	World Animal Health Information System
WTO	World Trade Organization

Strengthening aquaculture health management in Bosnia and Herzegovina: highlights of project implementation

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ABSTRACT

This paper provides a background to the FAO Technical Cooperation Programme (TCP) Project TCP/BiH/3101 Strengthening aquaculture health management in Bosnia and Herzegovina and a brief narrative of the major accomplishments of the project. The project, implemented from late 2006 to mid-2009, was successfully concluded with a regional seminar/workshop on aquatic animal health which provided the venue to disseminate the outcomes of the TCP and which generated support for the development of a regional proposal. In addition to the many capacity building activities and documentation outputs, the TCP had assisted Bosnia and Herzegovina in being included in the list of third countries and territories from which imports of fishery products in any form for human consumption are permitted. Four Bosnia and Herzegovina fish processing facilities and establishments were included in the list in December 2008. A second major outcome was the development of a regional technical programme, taking the lessons learned from the Bosnia TCP, which will give another opportunity to Bosnia and four other countries in the western Balkan to improve capacity on aquatic animal health that will support the sustainable development of aquaculture for food security, nutritional well-being, poverty reduction and socio-economic development.

BACKGROUND TO TCP/BiH/3101 (A): STRENGTHENING CAPACITY ON AQUACULTURE HEALTH MANAGEMENT

Bosnia and Herzegovina has a long history of aquaculture production but this was interrupted during the 1991-1995 war destroying a large part of the production infrastructure. Since then, modern fish production and processing facilities have been established and trade in fish and fish products has resumed.

The Government of Bosnia and Herzegovina strongly supports the further expansion of the aquaculture sector as a means to increase access to animal protein, particularly by the poorer segments of the population, as an important tool for development and income generation in rural areas and as source of foreign exchange earnings through trade, especially with the European Union (EU).

While in the process of negotiating an export licence to the EU, the competent authorities, in particular the State Veterinary Office (SVO) of the Ministry of Foreign Trade and Economic Relations and other stakeholders recognized the lack of capacity in fulfilling some of the EU requirements on issues related to aquatic animal health management and food safety.

In order to fill this gap, the Government of BiH has therefore requested FAO's assistance through a Technical Cooperation Programme (TCP). An official visit of BiH officials to FAO headquarters on 27–28 April 2005 and subsequently an official request from the State Veterinary Office (SVO) dated 6 May 2005 lead to an Inception Mission undertaken by FAO Fishery Resources Officer, Dr M.B. Reantaso from 10 to 17 July 2005 to assist in the preparation of a TCP proposal on “National Surveillance Program in Aquaculture Farms in Bosnia and Herzegovina (BiH), Training and Equipping Veterinary Inspectors and Upgrading a National Fish Disease Laboratory”. The proposal was developed and submitted following the usual protocol and the project “Strengthening capacity on aquaculture health management” was officially approved on 14 June 2006. The National Project Coordinator (NPC) was appointed in September 2006, followed by preparatory work for the Inception Planning Workshop.

The development objective of the project was to increase the effectiveness and efficiency of the SVO Bosnia and Herzegovina in aquatic animal health management to support sustainable and healthy aquaculture production in Bosnia and Herzegovina that will enable the country to improve the value and efficiency of aquaculture production through the implementation of international animal health and food safety standards, especially those of its trading partners in Europe.

The specific objectives of the project were to:

- develop and assist in implementing national policies in the area of aquatic animal health management and disease control and aquaculture development in general, in accordance with those of the EU through the development of an appropriate national biosecurity framework;
- improve the management of aquatic animal health practices that will support sustainable and healthy aquatic production through the development of a National Aquatic Animal Health (NAAH) Strategy;
- improve and strengthen the institutional capacity of the veterinary administration, veterinary inspection, laboratories and producers on aquatic animal health management to support the growing aquaculture industry and for better compliance with aquatic animal health and food safety and quality requirements for international trade, with both the EU and non-EU trading partners;
- prepare extension materials and technical guides (e.g. uniform inspection procedures, hatchery technical standards, good seed quality production, better management practices, etc.) to support good health management practices at extension and farm/producer levels; and
- assist in disseminating the outcome of the project to neighbouring trading partners in order to promote future cooperation in aquaculture and aquatic animal health management.

This TCP was expected to increase the capacity of the SVO and other stakeholders to support sustainable and healthy aquaculture production, both for domestic consumption and for trade, through the implementation of the same international animal health and food safety requirements that apply to its trading partners. Specifically, the project

will develop national policies in the areas of biosecurity, aquatic health management and disease control and would strengthen the capacity of veterinary administration, inspectors, laboratories and producers to ensure compliance with international health and food safety and quality requirements and practices. The project was to disseminate the lessons learned to neighbouring trading partners in order to promote future regional cooperation in aquaculture and aquatic animal health management.

PROJECT HIGHLIGHTS

A number of training/workshops were held in various places in the country; overseas training opportunities were provided to key staff of the project and laboratory personnel; SVO was equipped with basic office equipments; virology laboratory at the Faculty of Veterinary Medicine was provided with additional equipments and a regional seminar/workshop on aquatic animal health was organized back to back with the Project Terminal Workshop. More details on these are provided below.

1. Training/workshops

A total of 6 training/workshops were conducted between 2006 and 2008 on a wide range of topics and issues such as policy and strategy development in aquaculture, EU trading and aquatic animal health requirements, risk analysis for aquatic animal movement, food safety, diagnostics, surveillance and reporting of aquatic animal diseases. A brief narrative is provided below.

1.1 Inception Planning Workshop (Mostar, 30–31 October 2006)

The Inception Planning Workshop laid down the detailed implementation plan for the TCP. It was participated by 30 representing the various stakeholder groups from government and industry. A number of presentations were provided to the participants before breaking them into three working groups to tackle on the following topics: national biosecurity framework, national aquatic animal health strategy and capacity building, extension materials and technical guides. During the workshop, the participants also prepared a logical framework (logframe) for these three topics.

1.2 Training workshop on Policy and Strategy Development in Aquaculture (Mostar, 1 November 2006)

The one-day training session was provided with a number of presentations on: (i) policy and strategy development in the aquaculture sector in BiH; (ii) current state of the world aquaculture; (iii) concepts of SWOT (strengths, weaknesses, opportunities and threats); (iv) possible structure for a National Aquatic Animal Health Strategy (NAAHS); and (v) FAO Code of Conduct for Responsible Fisheries. The fourth presentation became the basis for the working group discussions to start the NAAHS policy formulation process with specific emphasis given to the formulation of a long-term vision on aquatic animal health and related principles.

1.3 Training/Workshop No. 2 on Aquatic Animal Health Strategy Development, Preparation of Extension Materials (Mrakovica, 16–19 April 2007)

The objectives of this training/workshop No. 2 were to: (a) initiate the development of the National Strategy framework (i.e. agree on the elements of the National Strategy); (b) elaborate on the legislative framework; (c) elaborate on the extension manual; and (d) update on other thematic issues.

Seven plenary presentations were provided on the following topics: (i) current status and future trends in aquaculture and trade in live aquatic animals and their products in BiH; (ii) role of fish disease laboratories in NAAHS; (iii) general principles of biosecurity; (iv) international experiences in NAAHS development; and (v) a proposed framework for a NAAHS for Bosnia and Herzegovina.

Training/workshop No. 2 was successfully implemented by 34 representatives from State Veterinary Office, Ministries of Agriculture and Management, Canton/Municipality Veterinary Inspectors, private sector representatives, translators and FAO officers contributed and participated to a productive training/workshop.

The Workshop achieved the following: (i) development of the National Strategy framework with agreed elements; (ii) elaborated programme/element on legislative framework; (iii) elaborated programme/element on information and communication where two types of materials were proposed: an extension manual and a brochure for politicians and the general public; (iv) updated information on aquaculture, aquatic animal health, food safety aspects in Bosnia and Herzegovina; and (v) increased awareness on aspects of biosecurity.

1.4 Training/Workshop No. 3 on EU Trading and Aquatic Animal Health Requirements and Risk Analysis for Aquatic Animal Movement (2–5 October 2007, Bejašnica, Sarajevo, Bosnia and Herzegovina)

The workshop was attended by some 20 participants, including staff of the SVO, state representatives, government officers, private-sector aquaculturists, two FAO backstopping officers (FIMA and LEGN) and two FAO consultants. The workshop reviewed the EU trading and aquatic animal health requirements and conducted a brief course on application of risk analysis in aquaculture.

1.5 Training/Workshop No. 4 on Product Safety and Quality Assurance (4–7 December 2007, Neum, Bosnia and Herzegovina)

The workshop was attended by 46 participants from various organizations such as SVO, food safety agencies, veterinary laboratories, veterinary inspectors and officials from fish farms, fish hatcheries and fish processing facilities. The topics covered during this workshop included Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) agreements, causes of detentions and rejections in international trade, responsible use of antibiotics and residue monitoring, application of risk analysis in food safety, principles of risk management, Codex standards and codes of practice.

1.6 Training/Workshop No. 5 on Diagnostics, Surveillance and Reporting of Aquatic Animal Diseases, 18–21 March 2008, Fojnica

The workshop was attended by some 25 participants, including staff of the SVO, state representatives, government officers, private-sector aquaculturists, international consultant, and one FAO backstopping officer. The presentation of the National Consultant on epidemiology provided an exhaustive status of diagnostics and surveillance of aquatic animal diseases in Bosnia and Herzegovina. Identified constraints include issues related to: (i) organizational and structural problems; (ii) legislation; (iii) management of animal movement; (iv) diagnostic laboratories; (v) education/motivation related problems. A number of recommendations addressing these issues were also provided.

2. Overseas training

Three staff of the SVO (Drs Nihad Fejzic, Sanin Tankovic and Zorana Mehmedbasic) participated in the FAO Expert Workshop on Understanding and Applying Risk Analysis in Aquaculture held from 7 to 11 June 2007 in Rayong, Thailand. This expert workshop gave the SVO staff opportunity to better understand the seven risk sectors in aquaculture production, i.e. pathogen, food safety, genetics, environmental, ecological, financial and social risks and for them to contribute their own experience in dealing with these risks, particularly pathogen and food safety risks which were important components of FAO Project TCP/BiH/3101.

The recipients of the overseas training on diagnosis of viral fish diseases, Drs Nermina Vejzagic and Dejan Stojanovic, attended an on-the-job training conducted by the European Community Reference Laboratory for Fish Diseases at the National Veterinary Institute at Aarhus, Denmark, from 28 January to 15 February, 2008. The training consisted of lectures and hand-on practice on several techniques for viral disease examination (e.g. sampling procedures; handling and preparation of fish tissue for virological examination; preparation of cell culture growth media; introduction to fish cell lines used for diagnostics; cell cultivation and maintenance; preparation of cell culture plates for diagnostic use; inoculation of samples on cell culture and subcultivation; identification of virus-mediated CPE; cell sensitivity tests; freezing and thawing of cells; Mycoplasma testing; ELISA test for identification of VHS, IHN, and IPN virus; neutralization test; virus titration; purification of viral RNA; RT-PCR and gel electrophoresis; handling of proficiency tests and introduction to quality assurance schemes according to ISO 17025 accreditation.

3. Purchase of laboratory equipment

The purchase and delivery of laboratory equipment were completed in early 2009. The equipments include incubators, laminar flow, inverted microscopes, deep freezer, refrigerated centrifuge and laboratory consumables. These equipments are now being productively used by the Faculty in monitoring fish viral diseases. The laboratory is now able to maintain two cell lines, i.e. EPC and BF-2 cell lines which can potentially be used for diagnosis of a number of OIE-listed diseases such as EHN, IHN, VHS, IPN and SVC. BF-2 and EPC cell lines would cover the culture of all fish viruses of interest within a similar growth temperature that will reduce the need for more incubators. One of the staff who received training at the EU Community Reference Laboratory at Aarhus University in Denmark has since been doing maintenance and preservation of the cell lines, preparation of samples for diagnosis, quantifying viral particles and performing diagnosis based on cell line culture and serological identification of each of the OIE-listed fish viral diseases.

4. Regional Seminar/Workshop on Aquatic Animal Health and Project Terminal Workshop (20–23 May 2008, Sarajevo)

The Western Balkan Regional Seminar/Workshop on Aquatic Animal Health was held from 20–22 May 2008 in Sarajevo. The regional seminar/workshop was successful as demonstrated by the presence of high-level officials from Bosnia and Herzegovina (i.e. Minister of Foreign Trade and Economic Relations, the Director and Chief Veterinary Officer (CVO) of the SVO) and representatives from OIE and FAO/SEUR (FAO Subregional Office for Central and Eastern Europe), and participation of 2 or 3 representatives (CVOs and/or Veterinary Officers) from Croatia, The former Yugoslav Republic of Macedonia, Montenegro and Serbia. Although Albania was not able to participate, they prepared a statement of support and a powerpoint presentation. A major outcome was the finalization of TCP Facility Concept Note “Assistance to Western Balkan Countries for Improving Compliance with International Standards for Aquatic Animal Health”.

The Project Terminal Workshop held on 23 May 2008 recognized that the overall implementation of the TCP was in good order, although there were some delays in the completion of remaining tasks. The major objectives of the project were achieved, particularly noting that the project had greatly assisted the country in getting an export licence to the EU. Other achievements include: (i) five training/workshops (inception workshop, aquatic animal health strategy and policy workshops, EU trading requirements, risk analysis, surveillance and diagnostics and food safety aspects), one internal stakeholder consultation and a regional workshop successfully carried out; (ii) two overseas capacity building activities (i.e. three SVO officers participated in the

FAO Expert Workshop on Understanding and Applying Risk Analysis in Aquaculture, Rayong, Thailand, June 2006; two staff from the Faculty of Veterinary Medicine were trained on virology at the EU Community Reference Laboratory in Denmark); (iii) provision of miscellaneous office equipment to SVO and laboratory equipments to the University of Sarajevo, Faculty of Veterinary Medicine as National Reference Laboratory for Fish Disease; and (iv) expected five major documentations outputs (national strategy, veterinary inspector's checklist, disease diagnostic manual, seminar/workshop report and an FAO Fisheries and Aquaculture Technical Paper).

5. TCP/RER/3206 Assistance to Western Balkan Countries for Improving Compliance with International Standards for Aquatic Animal Health

One of the major outcomes of FAO Project TCP/BiH/3101 was a follow-up TCP facility – TCP/RER/3206 “Assistance to Western Balkan Countries for Improving Compliance with International Standards for Aquatic Animal Health”, submitted in December 2008 and subsequently approved in February 2009.

The overall objective of this TCP facility was to prepare a future regional TCP proposal for submission to FAO later this year. The processes involved in the development of a regional TCP include the following: (i) regional survey of aquatic animal health capacity and performance (May to August 2009); (ii) regional field assessment (May to August 2009) by two teams (i.e. Reantaso/Tankovic – first mission to Serbia, Croatia and Bosnia and Herzegovina; Arthur/Fejzic – second mission to The former Yugoslav Republic of Macedonia and Montenegro); (iii) regional proposal preparation (August 2009); and (iv) regional workshop to build consensus and finalize the regional TCP proposal (September 2009 in Croatia).

The regional proposal development workshop was successfully implemented from 8 to 9 September 2009 and participated by 34 delegates from five countries (Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Serbia) and FAO. The regional workshop agreed that the Regional Technical Cooperation Programme on Assistance to Western Balkan Countries for Improving Compliance with International Standards for Aquatic Animal Health will have the overall objective of improving participating country compliance with international health standards for aquatic animals. The specific objectives include: (i) building capacity on specific themes (legislation, risk analysis, surveillance (aquatic epidemiology), diagnostics, emergency preparedness/contingency planning, aquaculture development and promotion); (ii) review of national legislation to harmonize with respect to compliance with international standards of aquatic animal health (WTO-SPS, OIE, EU); (iii) design a regional disease surveillance programme for aquatic animal diseases (regional in scope, e.g. five Western Balkan countries, surveillance design based on international standards); and (iv) promote communication mechanisms and networking systems for aquaculture development. The workshop was concluded with a note on the following: (i) active participation and strong interest and support in the development of the proposal; (ii) strong support (four of five Chief Veterinary Officers of participating countries, competent authorities, laboratories, research institutes and universities); (iii) systematic, logical and transparent process (two regional workshops, regional survey, country level field assessment/stakeholder consultation); and (iv) strong consensus on the scope and elements of regional proposal through regional cooperation.

6. Documentation output of the project

In addition to the above, the project had accomplished a number of documentation outputs. These include the following:

1. FAO. 2008. Report of FAO Western Balkan Regional Seminar/Workshop on Aquatic Animal Health. Sarajevo, Bosnia and Herzegovina, 19–21 May 2008. *FAO Fisheries and Aquaculture Report*. No. 879. Rome, FAO. 2009. 25p.

2. Draft national aquatic animal health strategy for Bosnia and Herzegovina (bilingual, in English and Bosnian languages)
3. Veterinary inspector's checklist for aquaculture farms and fish processing establishments in Bosnia and Herzegovina (bilingual, in English and Bosnian languages)
4. Manual on health management of animals in aquaculture in Bosnia and Herzegovina (in Bosnian language)
5. Strengthening aquaculture health management in Bosnia and Herzegovina. FAO Fisheries and Aquaculture Technical Paper No. 524.

CONCLUSIONS

The project was successfully implemented with outputs much more than originally anticipated. The project provided the services of three international consultants, four national consultants and technical backstopping support from the FAO Fisheries and Aquaculture Department Services (FIMA, FIEP and FIU) and the FAO Development Law Service (LEGN). In addition, the project provided laboratory equipment and supplies, official international and in-country travel, several training courses and workshops, a study tour, and general as well as direct operating expenses. The project concluded with a Regional Workshop/Seminar on aquatic animal health and a Project Terminal Workshop held in May 2008.

In addition to the many capacity building activities and documentation outputs, the TCP had assisted Bosnia and Herzegovina in being included in the list of third countries and territories from which imports of fishery products in any form for human consumption are permitted. Four Bosnia and Herzegovina fish processing facilities and establishments were included in the list of December 2008. A second major outcome was the development of a regional technical programme, taking the lessons learned from the Bosnia TCP, which will give another opportunity to Bosnia and four other countries in the Western Balkan to improve capacity on aquatic animal health that will support the sustainable development of aquaculture for food security, nutritional well-being, poverty reduction and socio-economic development.

PLATE 1

Left column (top to bottom): M. Reantaso (FAO, second from left) meeting with officials of Sarajevo University Veterinary Faculty during an inception mission in July 2005; modern trout cages of Norfish Blagaj in Mostar; processed fish products from Tropic Rivarstvo, Banja Luka. Right column (top to bottom): M. Reantaso (FAO, second from left seated) meeting with officials of State Veterinary Office (SVO) and Entity Ministry of Agriculture during an inception mission in July 2005; carp farm of Sanicani Farm, Priedor, Banja Luka; processed fish products from Tropic Rivarstvo, Banja Luka



PLATE 2

Left column (top to bottom): processing facility of Tropic Rivarstvo, Banja Luka; Participants to the Training/Workshop on Diagnostics, Surveillance and Reporting of Aquatic Animal Diseases held in March 2008 in Fojnica; compound microscope provided by the project. Right column (top to bottom): processing facility of Tropic Rivarstvo, Banja Luka; tissue cell culture facility; clean bench provided by the project; cell culture incubators provided by the project. Bottom photo: 40 participants (fisheries and veterinary authorities and private sector representatives from Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia; representatives from OIE and FAO) to the Western Balkan Regional Seminar/Workshop on Aquatic Animal Health held in Sarajevo from 19–22 May 2008

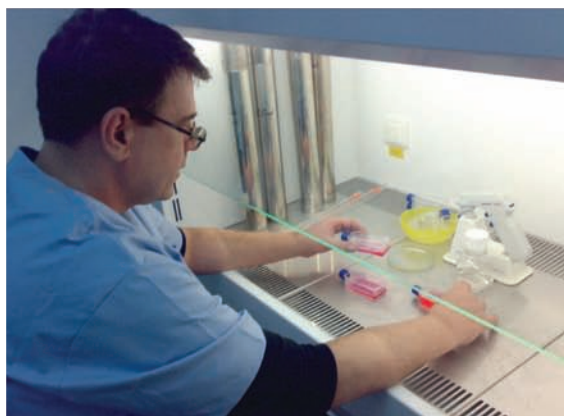


PHOTO: M.B. REANTASO (FAO)

Policy and strategy development in aquaculture in Bosnia and Herzegovina

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ABSTRACT

This paper briefly reviews the activities conducted during a one-day Training Workshop on Policy and Strategy Development in Aquaculture that was held on 1 November 2006 under the FAO Technical Cooperation Programme (TCP) Project TCP/BiH/3101 “Strengthening Aquaculture Health Management in Bosnia and Herzegovina”. The workshop was convened to train participants on policy and strategy development in aquaculture to support the development of a National Aquatic Animal Health Strategy (NAAHS). A SWOT (strengths, weaknesses, opportunities, threats) analysis was used to assist participants in developing their thoughts, then a “vision” for a NAAHS was formulated and an outline of the contents for the NAAHS developed and agreed upon. The final activity was the preparation of a set of “Guiding Principles” that would be used in future development of the NAAHS. It was decided that the policy and strategy formulation process would be continued via an internal stakeholder workshop at which a further identification of the key principles would take place and the logical framework approach in support of the development of the policy and strategy would be followed.

INTRODUCTION

On 1 November 2006, a one-day Training Workshop on Policy and Strategy Development in Aquaculture was organized under the FAO Project TCP/BiH/3101 “Strengthening Aquaculture Health Management in Bosnia and Herzegovina.” The workshop was convened to train participants on policy and strategy development in aquaculture to support the development of the National Aquatic Animal Health Strategy (NAAHS). At the time when the workshop was organized, the policy and legal framework for aquaculture in Bosnia and Herzegovina (BiH) was weak. The workshop thus tried to support capacity-building efforts of the State Veterinary Office (SVO) in terms of planning and policy development.

The training session started with a presentation on Policy and Strategy Development in the Aquaculture Sector in Bosnia and Herzegovina. A short introduction was

provided on the current state of aquaculture in the world, referring to the image of aquaculture outside the sector, then the way forward was discussed, as well as constraints to aquaculture development in the country. It was explained why a NAAHS was requested by the Government, and the steps in a strategic planning process that should be taken by the project were outlined.

The steps to be taken in the NAAHS planning process were the following:

- identify what Bosnia and Herzegovina needs in terms of planning (e.g. policy, strategy, plan);
- decide if the NAAHS is for Government purposes only or if it will be directed to the aquaculture sector as a whole;
- determine if the information required for the planning process is available and if not, how it will be obtained; and
- decide who should participate in the planning process.

SWOT ANALYSIS

It was suggested to start with a situational analysis. Some tools were presented for this purpose and it was decided that a so called “SWOT” (strengths, weaknesses, opportunities and threats) listing would suit the purpose best, as it was known to a number of the participants and as some presented examples clearly demonstrated what the listing could bring in support of the planning and policy development process. A preliminary SWOT listing of the aquatic animal health situation in Bosnia and Herzegovina that was undertaken by the working groups resulted in the following outcomes:

Strengths

- Water resources (rivers, lakes, sea) offer a large potential to increase production.
- Bosnia and Herzegovina has a very good health status with regard to the infectious fish diseases listed by the World Organization for Animal Health (OIE).
- The human resources involved in aquatic animal health are of high quality, and thus quick adoption of all technological achievements is possible.
- Bosnia and Herzegovina has a long tradition in aquaculture, dating to 1892.
- There is a relatively good relationship between fish breeders and processors.
- Bosnia and Herzegovina has a great diversity of fish species that can be cultured.
- The competent authorities (CA) have recognized that aquaculture is an important branch of the agriculture/rural sector.
- Bosnia and Herzegovina has competent institutions dealing with infectious disease control in aquaculture.
- There is a readiness to invest by the private sector.

Weaknesses

- A Ministry of Agriculture (MoA) does not exist at the state level (however, legislation is under review).
- Bosnia and Herzegovina does not have a National Aquaculture Development Strategy.
- The majority of the farmers are not familiar with the health risks and means of aquatic animal health control.
- Aquatic animal health laboratories in Bosnia and Herzegovina are not internationally accredited.
- Aquatic animal health laboratories in Bosnia and Herzegovina are poorly equipped.

Opportunities

- The establishment of the relevant CAs on a state level (MoA) is possible.
- The establishment of uniform databases through international projects can be accomplished.

- Access to international information exchange systems (e.g. AVIS, RASFF, TRACES, WAHIS) is available.¹
- Education in aquatic animal health issues can be supported through international projects such as those funded by the Food and Agriculture Organization of the United Nations (FAO) and the European Union (EU).
- The current FAO TCP project is supporting the development of a NAAHS, as well as the improvement of the National Reference Laboratory (NRL) for viral fish diseases.
- The signing of the the Stabilisation and Association Agreement (SAA) with Bosnia and Herzegovina by the EU Member States, which would bring the country closer to EU accession.²
- The joining of Bosnia and Herzegovina to the Central European Free Trade Agreement (CEFTA), which is a trade agreement between Non-EU countries in Central and South-Eastern Europe; joining CEFTA would harmonize trade standards that are important to animal import and export (including aquatic animals).
- The inclusion of Bosnia and Herzegovina in the list of the European Community (EC) third countries approved for export of fish and fish products to the EU market is possible.

Threats

- The aquaculture sector in Bosnia and Herzegovina lacks market competitiveness.
- There may be insufficient interest by international markets in Bosnia and Herzegovina aquaculture products.
- Construction of hydroelectrical power dams on rivers and lakes used by fish farms may constrain the expansion of aquaculture.
- Lack of coordination between services that jointly deal with the process of construction of the fish farms and processing plants may hinder development of the sector.
- National standards may be developed more quickly by neighboring countries than by Bosnia and Herzegovina, giving them a competitive advantage.
- Sustainable development of the sector could be constrained by an absence of all relevant competent authorities at the state level.

While it was recognized that the above lists are incomplete, at the same time participants felt that they could provide a good basis for continuing the policy development and planning process. The next steps in the process addressed policy and strategy formulation, making use of a logical framework approach.

DEVELOPMENT OF A NATIONAL AQUATIC ANIMAL HEALTH STRATEGY (NAAHS)

A presentation on the possible contents of a National Aquatic Animal Health Strategy (NAAHS) was given and a structure was proposed for discussion. It was agreed that the document should contain the following sections:

1. Introduction
2. Background
3. Justification
4. Long-term vision

¹ AVIS – Advanced Veterinary Information System; RASFF – Rapid Alert System for Food and Feed; TRACES – TRAdE Control and Expert System, WAHIS – World Animal Health Information System.

² On 3 May 2007, the EU Member States approved the text of the Stabilisation and Association Agreement with Bosnia and Herzegovina. The conclusion of this Agreement could bring Bosnia and Herzegovina a step closer to the EU. For more information see: www.eu2007.de/en/News/CFSP_Statements/May/0510Bosnian.html (accessed 19 January 2009).

5. Principles
 6. Timeframe
 7. Monitoring mechanism
 8. Overall goals
 9. Specific objectives
- Annexes
- Indicators for monitoring/risks and assumptions

Vision

The participants were asked to start the NAAHS policy formulation process through a working group discussion session whereby specific emphasis was given to the formulation of a long-term vision for aquatic animal health in Bosnia and Herzegovina.

The workshop decided that the following draft long-term vision best reflects their views: *“To develop and maintain up-to-date an aquatic animal health management strategy in BiH that will be able to support the sustainable development and management of the aquaculture sector and meet growing consumer demands for aquatic foods and products that are of high quality, safe, competitively priced and are produced in an environmentally responsible manner with maximum opportunity for profitability in all stages of the aquaculture product chain”*. This draft long-term vision was used for the development of policy at a later stage.

Guiding principles

The workshop made an effort to discuss and agree upon the guiding principles for the NAAHS. The participants decided that the principles should be largely based on those listed below, adding a principle referring to the fact that the State Veterinary Office (SVO) would be the main authority supporting the implementation of the policy and strategy and stressing that all processes should be transparent.

Principles purely focused on aquatic animal health that were modified from *Health Management for the Responsible Movement of Live Aquatic Animals* (FAO, 2007) include:

- 1) Aquatic animal health is important for economic, social, development and public resource purposes. Collaboration among all stakeholders including governments, public institutions, the private sector and existing aquaculture and fishing industries is important to achieve effective health management.
- 2) The role of aquatic animal health management is to reduce the risks arising from the culture, reproduction, potential entry, establishment or spread of pathogens and the diseases they cause. This is necessary to protect living aquatic resources, the natural aquatic environment and the aquatic biodiversity in Bosnia and Herzegovina and neighbouring regions, countries or territories.
- 3) Bosnia and Herzegovina may introduce or maintain sanitary measures resulting in a higher level of protection than would be achieved by measures based on the relevant international standards, guidelines or recommendations (e.g. the OIE *Aquatic Animal Health Code* – OIE, 2007); however, such measures must be justifiable based on science (i.e. risk analysis) and be consistent with the country's acceptable level of protection (ALOP). Control measures applied to movements of aquatic animals within the country must also be consistent with this ALOP.
- 4) The aquatic animal health strategy of Bosnia and Herzegovina and related procedures will adhere to international and regional standards and be harmonized on as wide a basis as possible.
- 5) SVO encourages the Bosnia and Herzegovina aquaculture sector to use preventative measures to limit their exposure to pathogens and disease. Such measures include but are not limited to the use of better management practices (BMP), health certification, specific pathogen free (SPF) and high health (HH) stocks, biosecurity and vaccination protocols.

- 6) Health management measures will be effective, practical, cost-effective and utilize readily available resources. These resources will allow the development of appropriate national and regional policies and regulatory frameworks as required to reduce the aquatic animal health risks incorporated in the culture, reproduction and movement of aquatic animals.
- 7) Access to relevant national aquatic animal health capacity (infrastructure and specialized expertise) is crucial for health management of aquatic animals. Collaboration with international organizations and countries in the European region will be sought wherever possible to further increase Bosnia and Herzegovina's capacity in aquatic animal health issues.

Guiding principles of a more generic nature focusing on the socio-economic, environmental and stewardship aspects of the NAAHS include:

- 8) The economic principle: aquatic animal health management should enable aquaculture to make a positive contribution to the economy through being internationally competitive in the marketplace and economically viable at a national level.
- 9) The environmental principle: the aquatic animal health management measures should facilitate aquaculture to develop in harmony with nature, managing and minimizing transient environmental impacts and avoiding significant, cumulative, long-term or irreversible changes to ecosystems, to cultural remains or to valued landscape and scenery.
- 10) The social principle: Aquatic animal health measures should foster strong aquaculturists' links, recognizing and supporting the needs of private-sector aquaculturists and working with community initiatives to manage local environments for mutual benefit.
- 11) The principle of stewardship as applied to the situation in Bosnia and Herzegovina. While the first three principles relate to outcomes, the principle of stewardship relates to the ways in which these principles will be observed. It is about delivering outcomes sustainably. The principle of stewardship embraces the precepts of transparency, integration, coordinated government and fit-for purpose regulation, partnership and stakeholder participation, accountability, ethics and regard for animal welfare, and a culture of best practice and continuous improvement.

THE WAY FORWARD

It was decided that an internal stakeholder workshop would be held in which the policy and strategy formulation process would be continued. At that workshop a further identification of the key principles would take place and the logical framework approach (which was outlined through a presentation in the training workshop) in support of the development of the policy and strategy would be followed.

The training workshop concluded with a presentation on the FAO *Code of Conduct for Responsible Fisheries* (CCRF) (FAO, 1995) to provide the necessary background for the next steps in the development process of the NAAHS. Specific emphasis was placed on the participatory stakeholder process that resulted in the widely endorsed Code and on Article 9 of the Code on aquaculture development.

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Directive 88/2006: European Union animal health requirements for aquaculture animals and products thereof

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ABSTRACT

The European Union animal health legislation concerning aquaculture animals and products has been updated. Directives 91/67/EEC, 93/53/EEC and 95/70/EC have been replaced by Directive 88/2006, which came into effect on 1 July 2008. This new directive establishes the animal health requirements for the placing on the market, importation and transit of aquaculture animals and their products; the minimum measures to prevent diseases in aquaculture animals; and the minimum measures to be taken in response to suspected or established cases of certain diseases in these animals. The animals concerned are fish, molluscs and crustaceans and their products, not including ornamental animals bred in an aquarium not intended for sale, wild animals introduced directly into the food chain and animals intended for the production of fishmeal, fish oils and similar products. This directive states the need to designate Community Reference Laboratories for each of the listed diseases and National Reference Laboratories for each member country and establishes the functions and responsibilities of these laboratories.

INTRODUCTION

Aquaculture has been recognized as an important economic activity in the European Union (EU) and an alternative to capture fisheries. Diseases have become one of the most important constraints to growth of the aquaculture sector and at the same time they represent a significant threat to wild populations. For this reason, the EU has adopted specific legislation on aquatic animal health in order to control and reduce the impact of diseases in farmed and wild populations and to prevent and effectively respond to new diseases that threaten animal health. Such measures are expected to reduce the constraints that diseases impose on the sustainability of animal production and improve the preservation of natural ecosystems.

The Community animal health legislation concerning aquaculture animals and their products has been updated. Directives 91/67/EEC, 93/53/EEC and 95/70/EC have been replaced by Directive 88/2006, which was implemented on 1 July 2008.¹ This new directive merges the three previous directives into a single one. The previous directives mainly took into account the farming of salmon, trout and oysters. Since they were enacted, the aquaculture industry has developed significantly, with additional species being cultured and new types of farming practices coming into use. Since the adoption of the first directive on this subject in 1991, the EU has ratified the Agreement on Sanitary and Phytosanitary Measures (the SPS Agreement) of the World Trade Organization (WTO). Therefore, this new directive takes into account the *Aquatic Animal Health Code* (OIE, 2008) and the *Manual of Diagnostic Tests for Aquatic Animals* (OIE, 2006) of the World Organisation for Animal Health (OIE). But the most significant changes in the new directive are related to a new strategy for animal health surveillance based on risk analysis, with emphasis on the traceability of all animal movements and considering especially the role of wild aquatic populations in spreading diseases. There is also a change in the way that diseases are listed, the new directive dividing them into exotic and non-exotic diseases depending on whether or not the diseases of interest have been reported as occurring within the EU. This paper summarizes the main issues raised in Directive 88/2006 of the EU.

DEFINITIONS

There are a number of technical definitions that apply to this directive:

- *Aquaculture animal*: any aquatic animal at all its life stages, including eggs and sperm (gametes).
- *Ornamental aquatic animal*: any aquatic animal, which is kept, reared or placed on the market for ornamental purposes only.
- *“Placing on the market”*: the sale, including offering for sale or any other form of transfer, whether free of charge or not, and any form of movement of aquaculture animals.
- *Compartment*: one or more farms under a common biosecurity system containing an aquatic animal population with a distinct health status with respect to a specific disease.
- *Zone*: a precise geographical area where the water body is naturally or artificially isolated, preventing the migration of wild animals.
- *Disease*: a clinical or non-clinical infection with one or more aetiological agents.
- *Infection*: the presence of a multiplying or developing or latent disease agent in or on a host.
- *Emerging diseases*: newly identified serious diseases or listed diseases in a new host species.
- *Susceptible species*: any species in which infection has been demonstrated by natural cases or by experimental infection that mimics the natural pathways.
- *Vector*: a species that is not susceptible to a disease but which is capable of spreading infection by conveying pathogens from one host to another (living mechanical vector).

AQUACULTURE PRODUCTION BUSINESS AND AUTHORIZED PROCESSING ESTABLISHMENTS

All farms rearing or keeping fish or molluscs susceptible to listed diseases must be registered by the official service and keep records of mortality and movement of animals into and out of the farm. In case of suspicion of outbreak, the farm must be

¹ Council Directive 2006/88/EC on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals.

investigated in order to confirm the presence of a pathogen and movements must be forbidden until the disease is ruled out or eradicated. An early detection system can reduce the spread of disease if strict restriction of animal movements is applied in order to reduce the transfer of pathogens and emergence of disease in other territories.

INTRODUCTION OF AQUACULTURE ANIMALS AND PRODUCTS THEREOF INTO THE COMMUNITY FROM THIRD COUNTRIES

Only the countries listed or approved by the EU are allowed to export into the Community. To obtain that approval, the third country needs to demonstrate to the EU that the competent authority (CA) provides appropriate guarantees as regards compliance with the EU legislation. An inspection by EU may be required to confirm this.

The different issues that are taken into account are:

- The legislation of the third country.
- The organization of the CA and its inspection services, the powers of these services, the supervision to which they are subjected and the means at their disposal, including staff capacity to apply their legislation effectively.
- Health requirements in force that are applied to the production, manufacture, handling, storage and dispatch of live aquaculture animals intended for the EU.
- The experience of marketing from the third country and the results of any import controls carried out.
- The results of any EU assessment or the report submitted by the CAs of the third country on any inspections carried out.
- The health status of the farmed and wild aquatic animals in the third country, especially with regard to exotic diseases, and any aspect of general health that may pose a risk to the aquatic animal health in the Community.
- The regularity, speed and accuracy with which the third country supplies information on the existence of infectious diseases in its territory, particularly diseases listed by the OIE.
- The rules on the prevention and control of aquatic animal diseases in force in the third country and their implementation, including rules on imports from other countries.

DISEASE STATUS

The health status of a country, aquaculture zones or compartments will be determined by the presence or absence of the listed pathogen in its aquaculture stocks and wild animals. The listed pathogens in Directive 88/2006 are given in Table 1. These have been divided as exotic or non-exotic diseases depending on whether or not they have been previously reported as occurring within the EU.

DISEASE-FREE STATUS

A country shall be directly declared disease-free of one of more diseases if:

- none of the species susceptible to the disease in question is present in the territory, or
- the pathogen is not able to survive in the country and its water source.

If the susceptible species is present and the pathogen may survive in the country environment, the disease-free status may be achieved by two ways: (1) on historical grounds or (2) targeted surveillance.

- On historical grounds: a country with susceptible species, with no outbreak for at least 10 years from the time of application of disease status despite the existence of conditions that may lead to clinical expression where:
 - basic biosecurity has been in place for at least 10 years (disease is compulsorily notifiable, and there is an early detection system [recognition and communication]);

- infection is not known to be established in wild animals; and
- implementation of trade and import conditions.
- By targeted surveillance: a country where the last clinical outbreak was within 10 years before applying for disease-free status or where the infection status prior to targeted surveillance was unknown (for example because of the absence of conditions that may lead to clinical expression), may be considered disease-free if:
 - basic biosecurity is place (compulsory notification and availability of detection system); and
 - the appropriate targeted surveillance has been implemented for at least two years without detection of the agent.

When a neighbouring country or water area is not declared a disease-free zone, the country needs to establish within its territory a buffer zone. The limits of the buffer zone need to be such that they prevent the passive introduction of the disease.

TABLE 1
European Union listed diseases, Directive 88/2006

		Exotic diseases
	Disease	Susceptible species
Fish	Epizootic hematopoietic necrosis (EHN)	Perch (<i>Perca fluviatilis</i>), rainbow trout (<i>Oncorhynchus mykiss</i>)
	Epizootic ulcerative syndrome (EUS)	Members of the genera <i>Channa</i> , <i>Mastacembelus</i> , <i>Puntius</i> , <i>Trichogaster</i> , <i>Catla</i> , <i>Mugil</i> and <i>Labeo</i> .
Molluscs	Infection with <i>Bonamia exitiosa</i>	Chilean flat oyster (<i>Ostrea chilensis</i>), Australian mud oyster (<i>O. angasi</i>)
	Infection with <i>Perkinsus marinus</i>	Pacific oyster (<i>Crassostrea gigas</i>), Eastern oyster (<i>C. virginica</i>)
	Infection with <i>Microcytos mackini</i>	Pacific oyster (<i>C. gigas</i>), Eastern oyster (<i>C. virginica</i>), Olympia oyster (<i>Ostrea conchaphila</i>), European flat oyster (<i>O. edulis</i>)
Crustaceans	Taura syndrome	Gulf white shrimp (<i>Penaeus setiferus</i>), Pacific blue shrimp (<i>P. stylirostris</i>), Pacific white shrimp (<i>P. vannamei</i>)
	Yellowhead disease	Gulf brown shrimp (<i>P. aztecus</i>), Gulf pink shrimp (<i>P. duorarum</i>), Kuruma prawn (<i>P. japonicus</i>), black tiger shrimp (<i>P. monodon</i>), Gulf white shrimp (<i>P. setiferus</i>), Pacific blue shrimp (<i>P. stylirostris</i>), Pacific white shrimp (<i>P. vannamei</i>)
		Non-exotic diseases
	Disease	Susceptible species
Fish	Spring viremia of carp (SVC)	Bighead carp (<i>Aristichthys nobilis</i>), goldfish (<i>Carassius auratus</i>), Crucian carp (<i>C. carassius</i>), grass carp (<i>Ctenopharyngodon idellus</i>), common carp and koi carp (<i>Cyprinus carpio</i>), silver carp (<i>Hypophthalmichthys molitrix</i>), sheatfish (<i>Silurus glanis</i>), tench (<i>Tinca tinca</i>)
	Viral hemorrhagic septicemia (VHS)	Herring (<i>Clupea</i> spp.), whitefish (<i>Coregonus</i> sp.), pike (<i>Esox lucius</i>), haddock (<i>Gadus aeglefinus</i>), Pacific cod (<i>G. macrocephalus</i>), Atlantic cod (<i>G. morhua</i>), Pacific salmon (<i>Oncorhynchus</i> spp.) rainbow trout (<i>O. mykiss</i>), rockling (<i>Onos mustelus</i>), brown trout (<i>Salmo trutta</i>), turbot (<i>Scophthalmus maximus</i>), sprat (<i>Sprattus sprattus</i>), grayling (<i>Thymallus thymallus</i>)
	Infectious hematopoietic necrosis (IHN)	Chum salmon (<i>O. keta</i>), coho salmon (<i>O. kisutch</i>), Masou salmon (<i>O. masou</i>), rainbow or steelhead trout (<i>O. mykiss</i>), sockeye salmon (<i>O. nerka</i>), pink salmon (<i>O. rhodurus</i>), chinook salmon (<i>O. tshawytscha</i>), Atlantic salmon (<i>Salmo salar</i>)
	Koi herpes virus (KHV)	Common carp and koi carp (<i>Cyprinus carpio</i>).
	Infectious salmon anemia (ISA)	Rainbow trout (<i>O. mykiss</i>), Atlantic salmon (<i>S. salar</i>), brown and sea trout (<i>S. trutta</i>)
Molluscs	Infection with <i>Martelia refringens</i>	Australian mud oyster (<i>O. angasi</i>), Chilean flat oyster (<i>O. chilensis</i>), European flat oyster (<i>O. edulis</i>), Argentinian oyster (<i>O. puelchana</i>), blue mussel (<i>Mytilus edulis</i>), Mediterranean mussel (<i>M. galloprovincialis</i>)
	Infection with <i>Bonamia ostrea</i>	Australian mud oyster (<i>O. angasi</i>), Chilean flat oyster (<i>O. chilensis</i>), Olympia flat oyster (<i>O. conchaphila</i>), Asiatic oyster (<i>O. denselamellosa</i>), European flat oyster (<i>O. edulis</i>), Argentinian oyster (<i>O. puelchana</i>)
Crustaceans	White spot disease	All decapod crustaceans (Order Decapoda)

Maintenance of disease-free status

A declared disease-free country may stop surveillance as long as the conditions conducive to clinical expression exist and the other provisions are implemented. If the conditions conducive to clinical expression do not exist, surveillance must continue to confirm the absence of the pathogen.

Suspension of disease-free status

When there is suspicion of loss of disease-free status, trade with susceptible species and vectors needs to be suspended with countries of higher health status. If the infection is confirmed, the disease-free status will be withdrawn. In order to restore the disease-free status, targeted surveillance needs to be carried out to confirm the absence of the pathogen.

The disease status of a country will determine the possibility of trade with the EU (see Table 2). Countries are classified into categories depending whether they are disease-free (Category I), under a surveillance programme (Category II), undetermined (Category III), under an eradication programme (Category IV) or infected (Category V). As a general rule, countries (zones or compartments) can introduce animals from countries with a higher sanitary status than themselves and can dispatch animals to countries with lower sanitary status.

NOTIFICATION AND MINIMUM MEASURES FOR CONTROL OF DISEASES OF AQUATIC ANIMALS

Any suspicion or confirmation of the presence of a listed disease or an increase in mortality needs to be notified at the national level. The obligation to notify is applied to any professional that is aware of the situation (such as the owner or manager), any person to accompany the animals during transportation, veterinary practitioners or aquatic animal health professionals, official veterinarians and private laboratories.

In case of suspicion of a listed disease, appropriate sample collection and submission to a designated laboratory has to be carried out. While waiting for the results, the farm/area is placed under official surveillance and no aquatic animals are allowed in or out of the facilities/area. At this point, an epizootic investigation is performed with the aims of finding out the possible origin and means of contamination, the animal movement prior to notification, the health status of other farms and the establishment of a containment area appropriate to the disease in question, including a protection zone and a surveillance zone around the area.

TABLE 2
Health status of aquaculture zones or compartments to be considered

Category	Health status	May introduce animals from	Health certification		May dispatch animals to
			Introduction	Dispatching	
I	Disease-free	Only Category I	Yes	No when dispatched to category III or V Yes when dispatched to categories I, II or IV	All categories
II	Surveillance programme	Only Category I	Yes	No	Categories III and V
III	Undetermined (not known to be infected but not subject to a programme for achieving disease-free status)	Categories I, II or III	No	No	Categories III and V
IV	Eradication programme	Only Category I	Yes	Yes	Only Category V
V	Infected	All Categories	No	Yes	Only Category V

If a listed disease is confirmed, international notification is due to the OIE, trading partners and neighboring countries potentially at risk.

The control measures that need to be established will depend on whether the disease is an exotic or non-exotic disease, whether it is established in wild animals, and whether it is an emerging disease or a non-listed disease. These measures should be maintained until eradication has been carried out and the appropriate sampling and surveillance for the disease has been carried out with negative results.

Control measures in case of an outbreak of an exotic disease

In the case of an outbreak of an exotic disease, the farm/area is declared infected and a containment area, including a protection and surveillance zone around the area is established. No movement of aquatic animals into, outside or within the area should be allowed. Harvesting is possible if the animals have reached commercial size, but minimizing the risk of spread of the pathogen. The removal and disposal of dead animals and animals that show no clinical signs should be done in a safe way. Following after emptying and cleaning and disinfection, if appropriate, should follow.

Control measures in case of a non-exotic disease

The control measures for a non-exotic disease are similar to those for an exotic disease but with the particularity that clinically healthy animals are allowed to continue growing till harvest size if no disease outbreak appears.

Control measures in case of a listed disease in wild aquatic animals

When wild aquatic animals are infected or suspected of being infected with an exotic or non-exotic disease, the country needs to monitor the situation and take measures to reduce and prevent further spread of the disease.

Control measures in case of emerging diseases

The country needs to take the appropriate control measures and prevent the spread of an emerging disease and inform the Commission, trading partners, OIE and neighbouring countries. Within four weeks of reporting, it should be brought to the attention of the Standing Committee on the Food Chain and Animal Health, who will decide if the measures taken need to be extended, amended or repealed.

Control measures in case of non-listed diseases

If a non-listed disease has a significant risk for the animal health situation of aquaculture or wild aquatic animals, a country may take measures to prevent its introduction or to control the disease as long as these do not exceed the necessary requirements.

CONTROL PROGRAMMES: SURVEILLANCE, ERADICATION AND CONTINGENCY PLANS

Depending on the disease status, countries need to have a surveillance or an eradication programme. In any case, the country should have a contingency plan in place.

Surveillance and eradication programmes

Countries not known to be infected but not declared disease-free need to draw up a surveillance programme for achieving disease-free status. Countries known to be infected need to draw up an eradication programme for that particular disease. Both programmes need to contain at least:

- a description of the epidemiological situation of the disease before starting the programme,
- an analysis of the estimated cost and anticipated benefits of the programme,

- the duration of the programme and the objective at the time of its completion, and
- the description of the geographical and administrative area.

Vaccination is not allowed for exotic diseases as a control measure, unless for certain exceptions or as part of an eradication plan.

Contingency plans

Every country needs to have a contingency plan to maintain a high level of disease awareness and preparedness and to ensure environmental protection. The contingency plan should ensure:

- legal powers to implement contingency plans and put into effect successful eradication campaigns;
- access to emergency funds and financial resources in order to cover all aspects to fight diseases;
- cooperation between veterinary and environmental authorities so that they are properly coordinated. Also communication with potentially affected neighbouring areas and trade partners;
- provision of adequate resources for a rapid and effective campaign, including personnel, equipment and laboratory capacity;
- establishment of a chain of command that guarantees a rapid and effective decision-making process, including a central decision-making unit charged with the overall direction of control strategies;
- availability of an up-to-date manual with a detailed and practical description of all actions, procedures, instructions and control measures to be employed in handling exotic or emergency diseases (it is recommended that the contingency plan is updated every five years);
- availability of detailed plans for emergency vaccination if necessary;
- regular training of staff in clinical signs, epidemiological enquiry and disease control;
- identification of a place for the disposal of carcasses and animal waste in the event of disease outbreak, taking into account that it causes the minimum risk to soil, air, surface and ground waters and minimizes noise, odours and adverse effects on nature.

COMPETENT AUTHORITIES AND LABORATORIES

There is a series of general obligations for Member States:

- Each Member State shall designate its competent authorities (CAs) and notify the Commission.
- Each Member State shall ensure effective and continuous cooperation based on the free exchange of information between CAs and any of its other authorities involved in regulating aquaculture, aquatic animals and food or feed of aquaculture origin and between CAs of the different Member States.
- Each Member State shall ensure that the CAs have access to adequate laboratory services and state-of-the-art know-how in risk analysis and epidemiology.

The requirements, standards and functions of the three types of laboratories are described: the Community Reference Laboratory (CRL), National Reference Laboratory (NRL) and Designated Laboratories (DL).

Community Reference Laboratory

The CRL needs to comply with some requirements and follow some standards and is responsible for certain functions. CRLs are required to:

- have suitably qualified staff (i.e. properly trained personnel) available for emergency situations occurring within the Community;

- possess the equipment and products needed to carry out the tasks assigned to it;
- have an appropriate administrative infrastructure;
- ensure that the staff respect confidentiality;
- have sufficient knowledge of international standards and practices;
- have available an updated list of substances and reagents and a list of manufacturers and suppliers; and
- take into account research activities at national and community levels.

The CRL needs to operate, be assessed and accredited in accordance with the following standards:

- EN ISO/IEC 17025 on “General requirements for the competence of testing and calibration laboratories” ;
- EN 45002 on “General criteria for the assessment of testing laboratories” ; and
- EN 45003 on “Calibration and testing laboratory accreditation system-General requirements for operation and recognition”.

The functions of the CRL are to:

- coordinate the diagnostic methods employed:
 - typing, storing, supplying strains of pathogens; and
 - supplying standard sera and other reference reagents to the NRL in order to standardize the tests and reagents.
- organize periodic ring test with national laboratories;
- retain pertinent expertise on the relevant pathogens and others for a quick differential diagnosis;
- assist in the diagnosis of outbreak by providing confirmatory diagnosis;
- facilitate the training or retraining of experts in diagnosis with a view to harmonizing diagnostic techniques;
- collaborate with the CAs from third countries where listed diseases are prevalent;
- collaborate with OIE reference laboratories with regard to exotic diseases; and
- collate and forward information on exotic and endemic diseases that are potentially emerging in Community aquaculture.

National Reference Laboratory

Each Member State needs to designate a NRL. It may be situated in another Member State and a single laboratory may be the NRL of more than one Member State.

- The NRL shall collaborate with any laboratory in the Member State.
- Member States shall ensure that any NRL is adequately equipped and staffed with the appropriate number of trained personnel.

The NRL shall be responsible for coordinating the diagnostic standards and methods within their field of responsibility in the Member State. The functions of the NRL are to:

- notify without delay the CA whenever the laboratory is aware of suspicion of any of the listed diseases;
- coordinate with the CRL the methods employed for diagnosing; and
- cooperate with the CRL and participate in the ring tests organized.

In addition, it performs functions similar to those undertaken by the CRL but at national level, and needs to be accredited by European standards.

Designated Laboratories

The CA shall designate diagnostic laboratories within their territory that will fulfil the following requirements:

- notify without delay the CA whenever a laboratory is aware of a suspicion of any of the listed diseases;
- participate in the ring tests organized by the national laboratories ; and

- operate and be assessed and accredited in accordance with the European Standards referred to in the CRL.

The CA shall cancel the designation where the conditions are not fulfilled.

CONCLUSIONS

The new EU Directive 88/2006 provides the requirements and specifications to establish a higher control on aquatic animal health and preserve the health status of aquaculture and wild populations. It also addresses the requirements for third countries to export into the EU, providing them with a framework to develop their own aquatic animal health strategies.

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Aquaculture development in Bosnia and Herzegovina

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ABSTRACT

Bosnia and Herzegovina has a very long and rich tradition in aquaculture. Important advantages that the country possesses for the development of aquaculture include abundant clean water, high-quality, educated and cheap labour, high capability of fish processing factories, and the high quality of its hatcheries. Thanks to these and other factors, Bosnia and Herzegovina has a great potential for increasing national aquaculture production. During the war period of 1991–1995, the majority of the fish farms were destroyed along with their entire infrastructure. After the war, the process of privatization started, leading to an increase in fish production. The privatization of the fish farms, which since 1995 were in the possession of the State, has broadened the possibilities for aquaculture development in the country, including the use of new technologies, the expansion of capacity and the production of high-quality feeds. The export of fish and fish products from Bosnia and Herzegovina to European Union markets as officially permitted by EU Decision 2008/156/EC is the most important success of Bosnia and Herzegovina's agriculture sector in the post-war period.

INTRODUCTION

Bosnia and Herzegovina is located in the Western Balkans region and has a total surface area of 51 209.2 km², of which land accounts for 51 197 km² and sea accounts for 12.2 km². Air distance by latitude and longitude is 314 km north to south (2°43'30'') and 309 km from east to west (3°53'41''). The national border is 1 538 km long, of which 774 km is land border, 751 km is river border and 13 km is sea border. The longest river is the Drina, being 346 km long, and the largest lake is Buško Blato, with an area of 55.8 km², an elevation of 716.6 m above sea level and a maximum depth of 17.3 m.

The first written data on organized fishing in Bosnia and Herzegovina dates back to the late nineteenth century. During that time, fishing was under the control of the Forestry Directorate and taxes were imposed on professional fishermen as a so-called "fishing fee" (e.g. in the nature park Hutovo Blato). The organized protection of water bodies and legal regulations were introduced by Decree in 1886. Founded in 1892, "Fischerei-Verein fur Bosnien-Herzegovina" was the first fishermen's association in

Bosnia and Herzegovina. The “Fishermen Association” was the first sport fishermen’s association, and was established in Sarajevo in 1906.

The introduction of fish culture to Bosnia and Herzegovina is associated with the establishment of the fish farm “Vrelo Bosne” near Ilidža in 1894. A new hatchery, the largest and the most modern hatchery in the region at the time, was built in 1898 with a capacity of 600 000 pieces of fry. It played an essential role in the development of salmonid fish culture and associated stocking programmes. Development of cyprinid fish culture in the country began in 1902 when a Polish citizen, Viktor Burda, purchased 300 acres of barren land near Prijedor and 600 acres near Bosanska Gradiška from the Government and constructed fish farms producing 300–400 and 100–150 kg/acre, respectively (Hamzić, 2003).

During the Yugoslavia Kingdom (1919–1941), development in the area of aquaculture in Bosnia and Herzegovina was in stagnation; however, during the period of the Federal Yugoslavia (1946–1991) significant development occurred. During 1946–1982, a new and more intensive model for the culture of fish and other aquatic organisms developed rapidly. A system using floating cages in lakes and reservoirs using high stocking densities and highly nutritious pelleted feeds was developed, leading to significantly higher production.

During the same period, cyprinid fish species (grass carp, silver carp and bighead carp) were introduced and produced. At the same time, the production of salmonid species achieved full expansion. In 1952, the Institute for Fishery was established. It subsequently merged with the Sarajevo University Institute of Biology, which conducted extensive scientific activities and played an important role in the development of ichthyology and fisheries, in particular salmonid and cyprinid fish production, in Bosnia and Herzegovina.

The Center for Fishery was established in 1959 as a part of the School for Scientific and Technological Cooperation of the Veterinary Faculty of the University of Sarajevo. This center had a huge impact in the field of disease diagnostics, prevention and management in controlled salmonid and cyprinid culture.

In 1964, BiH had 13 salmonid farms with a total surface area of 38 000 m². In 1982 salmonid farms produced 1 086 tonnes per year, and by 1990 the country had a production of approximately 3 000 tonnes of fish for consumption (Hamzić, 2003; Arthur and Reantaso, 2007).

During the war of 1991–1995, the majority of fish farms were destroyed along with their entire infrastructure (Arthur and Reantaso, 2007; FAO, 2007). After the war, a process of privatization was started, leading to an increase in fish production. The privatization of fish farms, which in 1995 were in possession of the State, has broadened the opportunities for aquaculture development in Bosnia and Herzegovina through the adoption of new technologies, expansion of production capacity and the use of high-quality feeds.

According to the survey conducted by Hamzić (2003), during the period 1999–2003 there were production increases in the various subsectors as follows:

- total production of fish and shells for consumption: 55 percent
- production of salmonid eggs: 98 percent
- production of salmonid fry: 69 percent
- production of salmonids for consumption: 82 percent
- production of cyprinid fry: 19 percent
- production of cyprinids for consumption: 11 percent
- production of marine fish and shells: 650 percent
- production per employee: 37 percent
- production capacities: 12 percent
- employment: 12 percent



Photo of Lake Buško Blato

HYDROGRAPHY OF BOSNIA AND HERZEGOVINA

The hydrological resources of Bosnia and Herzegovina belong to the river basins of the Black and Adriatic seas. Bosnia and Herzegovina has following aquatic resources:

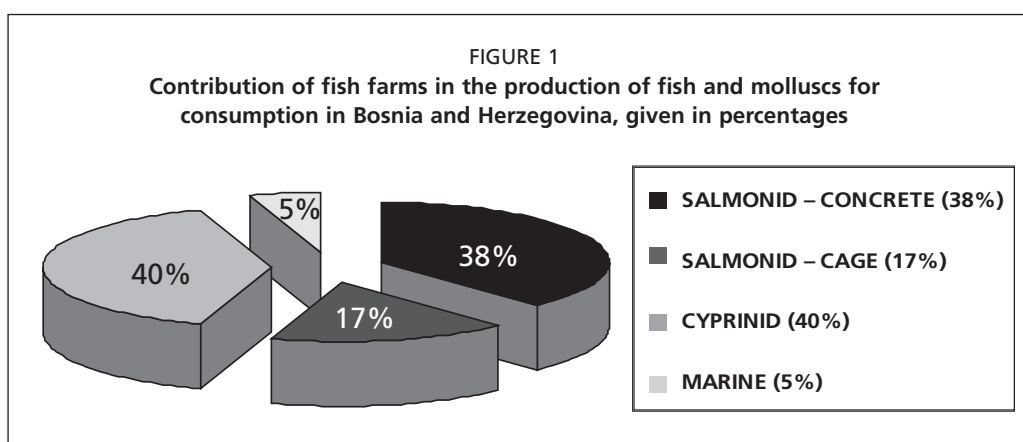
- 20 000 km of rivers and brooks (including the Sava, 355 km; Drina, 346 km; Bosna, 308 km, Vrbas, 240 km; and Una, 207 km);
- 400 ha of lakes (including Buško Blato, Višegradsko, Jablaničko, and Modrac). Buško Blato Lake (shown in Figure 1) is the largest lake in Bosnia and Herzegovina with a surface area of 55.8 km² and a water volume of 782 million m³. Currently fish production on the lake is not organized; and
- 1 400 ha of seacoast (12.2 km long).

DISTRIBUTION OF FARMING SYSTEMS AND THEIR CHARACTERISTICS

Fish farms in BiH are generally distributed in three main regions. In northern Bosnia, there are salmonid and cyprinid farms in the Neretva and Una rivers and in the Vrbas River there are salmonid farms. Additionally, marine aquaculture has developed in the Adriatic Sea at Neum.

According to data provided by the Center of Aquaculture of the Veterinary Faculty in Sarajevo, there are 30 registered fish farms in Bosnia and Herzegovina (i.e. “Martin Brod”, Martin Brod; “Klokot”, Bihać; “Tropic Ribarstvo-Ribnik”, Ribnik; “Tropic Ribarstvo-Bočac”, Crna Rijeka; “Tropic Ribarstvo-Krupa na Vrbasu”, Krupa na Vrbasu; “Tropic Ribarstvo-Jezero”, Jezero; “Ribogojilište” d.o.o., Bugojno; “Norfish”, Blagaj; “Norfish”, Salakovac; “Salmon d.o.o.”, Ljubuški; “Pastrmka”, Drežnica; “Bijela”, Salakovac; “Forele”, Salakovac; “Laks” d.o.o., Salakovac; “Drežanjka d.o.o.”, Drežnica; “Eko-Fish”, Jablanica; “Šanica”, Jablanica; “Prenj”, Jablanica; “Zeriko”, Drežnica; “Krupić”, Prozor; SPD “Kavezni uzgoj ribe”, Prozor; “Ljuta”, Konjic; PJ “Gunjani” Kreševo; “Salmon d.o.o.”, Salakovac; “Žunovnica”, “Hadžići; d.o.o.” “Ribamerc”, Krupa na Vrbasu; d.o.o. “Slapovi”, Krupa na Vrbasu; “Restoran Pečina”, Čelebići; “Butrex Ribarstvo”, Trebinje; “Jazine”, Trebinje).

In addition, there are five registered cyprinid fish farms (i.e. doo “Ribarstvo”, Sijekovac; doo “Kušljic Commerce”, Sijekovac; AD “Saničani”, Prijedor; AD “Ribnjak Prnjavor”, Prnjavor; “Ribnjak Bardača”, Srbac) and two marine fish farms in Neum, Ancora. It is assumed that there are many of unregistered fish farms, mostly of small capacity.



Salmonid farms mainly use concrete tanks with optimal flow and high-quality water. Aeration has not been used, and a large number of these fish farms do not have filters for purification of used water. After the war, there was an expansion of cage culture in the rivers Neretva, Una and Vrbas. Today, with the help of new technology from Norway, cages with dimensions 10 x 10 x 10 m are in use in Salakovac Lake (previously their dimensions were 5 x 5 x 5 m).

Cyprinid farms using earthen ponds have a long tradition in production. Unfortunately, there are no hatcheries for cyprinid species in Bosnia and Herzegovina, and as a result, fingerlings are imported from other countries, such as Croatia and Hungary. The quality and quantity of water is satisfactory, except during periods of extreme drought.

Marine aquaculture is carried out in only two fish farms using cages located in the Adriatic Sea at Neum. Molluscs are cultivated in the traditional way.

In Bosnia and Herzegovina there are two factories for fish processing, one located in Salakovac and the other in Banja Luka. They use modern technology, produce a wide range of products and have an annual capacity of approximately 3 000 tonnes. The contribution of fish farms to the production of fish and molluscs for consumption in BiH is shown in Figure 1 (Hamzić, 2003; Hamzić and Ecimovic, 2004).

FISH AND MOLLUSCS OF BOSNIA AND HERZEGOVINA

The ichthyofauna of the country comprises approximately 120 species. The most important fish and molluscan species used in the aquaculture sector in the country are:

- Salmonids: rainbow trout (*Onchorhynchus mykiss*), brown trout (*Salmo trutta fario*) and brook char (*Salvelinus fontinalis*).
- Cyprinids: common carp (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*) and wels catfish (*Silurus glanis*).
- Marine fishes: European seabass (*Dicentrarchus labrax*), gilthead seabream (*Sparus aurata*) and common dentex (*Dentex dentex*).
- Molluscs: Mediterranean mussel (*Mytilus galloprovincialis*) and European flat oyster (*Ostrea edulis*) (Aganović, 1979; Hadžiselimović and Hamzić, 1999).

AQUACULTURE PRODUCTION, MARKETS AND TRADING PATTERNS

Data on aquaculture production have been obtained from the private sector, since there is no institution at the state level that collects and distributes data on production and type of products (see Tables 1 and 2). Because available data on the production of fish and fry in 2006 and 2007 are contradictory, they have not been included.

Traditionally, consumers in Bosnia and Herzegovina buy live freshwater fish for consumption from fish shops. Of the total production of foodfish, approximately 65 percent is from the domestic markets of the larger cities such as Sarajevo, Banja

TABLE 1
Production of foodfish by aquaculture in Bosnia and Herzegovina, 1999–2005 (tonnes)

Year	Salmonids	Cyprinids	Marine species	Total
1999	1 389	1 807	40	3 236
2000	1 785	1 602	60	3 447
2001	2 241	1 818	70	4 129
2002	2 737	2 009	190	4 936
2003	2 794	2 422	172	5 388
2004	3 085	2 811	174	6 070
2005	3 410	2 968	163	6 541

TABLE 2
Production of salmonid fry in Bosnia and Herzegovina, 1999–2005 (tonnes)

YEAR	1999	2000	2001	2002	2005
SALMONID FRY	890	830	781	1 057	1 570

TABLE 3
Summary of trade in fish and fish products in Bosnia and Herzegovina in 2005 and 2006 (kg)

	Import		Export		Transport	
	2005	2006	2005	2006	2005	2006
Fish fry	36 824	21 795	25 460	–	–	–
Fish/fish products	8 506 986	12 652 146	959 839	248 123	92 831	784 589
Live fish	150 040	368 016	227 482	2 034 779	–	–
Feed for fish	5 611 205	3 207 557	165	–	116 000	223 395

Luka, Mostar, Tuzla, Bihać and Zenica. Approximately 35 percent of the production is exported to Serbia and Montenegro and a smaller quantity to Croatia. Table 3 provides a summary of trade in fish and fish products in the country in 2005 and 2006. Data for 2007 is not given because it could not be obtained for all border crossings where transportation of fish and fish products is conducted.

The main exported species are common carp, grass carp and rainbow trout. These species are exported mainly as fresh products and iced. A smaller amount (approximately 15 tonnes) is exported as smoked fish. Rainbow trout is the most important species in aquaculture.

ANALYSIS OF AQUACULTURE IN BOSNIA AND HERZEGOVINA

Bosnia and Herzegovina has a very long tradition in aquaculture assured by its favourable geographical, hydrological and ecological conditions that are conducive to intensive production and trade in aquaculture products. Some of the important advantages that Bosnia and Herzegovina possesses include abundant high-quality water, educated and inexpensive labour, high fish processing capacity, and the high quality of its hatcheries.

However, some of the weaknesses that affect aquaculture development in Bosnia and Herzegovina should also be mentioned. The most important of these weaknesses are the existence of unregistered fish farms, a black market, an unfinished system of veterinary certification, low domestic fish consumption, a lack of domestic fish feed production, limited cold storage facilities for fish transportation, undeveloped road infrastructure, lack of adequate support for aquaculture production, poor bank loan conditions and an uncoordinated market. These disadvantages were observed in the analysis conducted in the spring of 2007. However, with the help of FAO Project TCP/BiH/3101 “Strengthening Capacity on Aquaculture Health Management” numerous activities were initiated in 2007 and 2008 that have resulted in improvement of some of these weaknesses. This was possible due to the active involvement of the relevant competent authorities and other stakeholders (the SVO and the relevant ministries, inspectorates and laboratories) in solving the ongoing problems.

The Department of Aquaculture, Veterinary Faculty of the University of Sarajevo was appointed as the National Reference Laboratory for Viral Diseases (NRL) (Jažić and Zuko, 2004). Its diagnostic performance was significantly improved through a comprehensive diagnostic training of NRL staff at the Community Reference Laboratory, Aarhus, Denmark, which was one of the major outputs of the Project. Currently, the NRL is being equipped to undertake the internationally required diagnostic method of cell cultivation. In addition, activities aimed towards certification of the NRL according to the BAS EN ISO/IEC 17025:2005 standard are also in progress.

Development of aquaculture is supported by a desirable health status of salmonids and cyprinids, especially in relation to the occurrence of bacterial and viral diseases in 2007 and 2008. Along with this, veterinary inspectors and fish farmers were trained in the control and surveillance of fish diseases. At the same time, registration of unregistered fish farms is in progress according to the relevant national legislation¹, which provides the legal basis for the registration of all facilities involved in the production and processing of fish. Entity competent authorities carry out registration of facilities for production and placing in market of fish and fish products and crabs and crab products.

According to the data obtained from the SVO, the last phase is completing the legislation and system of veterinary certificates and planning of monitoring of infectious diseases of fish in 2008. All this is supported by the relevant EU regulation², which permits exportation of fish and fish products to the EU market. In accordance with the information provided by the SVO, amendment of veterinary health certificates for live fish according to relevant new EU legislation is in progress, and it is planned to be in use very soon. As stated by the SVO officials, after permission to export Bosnia and Herzegovina aquaculture products to the EU market was received, few requests for EU export permission were submitted. During the period from May 30 to June 3, 2008 inspection by the SVO was performed with the aim to assess seven fish production facilities involved in the breeding and processing of fish and fish products. According to the inspection report, some weaknesses were found and recommendations for improvement were given to the facilities, along with the implementation deadlines.

Considering the opportunity to export Bosnia and Herzegovina's aquaculture products to the EU and regional markets, it is necessary to complete the process of updating and harmonizing state and entity legislation, achieve international accreditation and complete final equipping of the NRL, provide uniform registration of all fish farms at the national level, and maintain and improve an internationally recognized aquatic animal health surveillance and disease control system.

CONCLUSIONS

The natural resources of Bosnia and Herzegovina, such as its good geographical position, the abundance of high-quality water, and its favourable climatic, hydrological and ecological conditions provide very important conditions and a great potential for intensive aquaculture production and trade in aquaculture products. With the help of FAO Project TCP/BiH/3101 "Strengthening Capacity on Aquaculture Health Management" numerous activities were initiated in 2007 and 2008, and some key weaknesses were addressed. An active involvement of all competent authorities in solving the ongoing problems, which was initiated by official permission of exportation of fish and fish products from BiH to the EU market, contributed to these successes.

¹ Decision on veterinary-health conditions which have to be fulfilled in premises for farming, production and trading of fish and products thereof, and of crustaceans and products thereof (OJ of BiH, 5/04).

² Reg. 2008/156/EC amending Decision 2006/766/EC as regards the list of third countries and territories from which imports of fishery products in any form for human consumption are permitted (OJ L 50).

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Aquatic animal health surveillance and disease control system in Bosnia and Herzegovina

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ABSTRACT

The officially permitted export of aquaculture products from Bosnia and Herzegovina (BiH) to the demanding European Union (EU) market is the most important success of Bosnian and Herzegovinian agriculture in the post-war period. However, this breakthrough demands ongoing activities by all Bosnian competent authorities (CAs) and other stakeholders involved in aquaculture aimed toward sustainable export. The key issue for international recognition of the country's aquaculture production is the development and maintenance of an adequate aquatic animal health surveillance and disease control system. The current system, which reflects the complex political structure of Bosnia and Herzegovina, involves multilevel CAs. Additionally, shortcomings in communication, a lack of clearly defined responsibilities among CAs and an absence of use of standardized forms for collection, collation and analysis of disease surveillance and fishfarm registration data are inadequacies of the system. Some concrete and relatively unchallenging activities have been recommended to overcome these obstacles. A primary measure is the establishment and coordination of the Expert Panel for Aquaculture (EPA) by the State Veterinary Office (SVO) of Bosnia and Herzegovina, which should be a leader and coordinator of other recommended activities aimed toward strengthening the national aquatic animal health surveillance and disease control system as a crucial element for improving national aquaculture production.

INTRODUCTION

Bosnia and Herzegovina has a more than century-long tradition of aquaculture of freshwater fish species that dates back to the early Austrian-Hungarian occupation. During the 1992–1995 war, most of the production facilities were destroyed. In the post-war period, the aquaculture sector was renewed, and modern fish processing facilities were established. The most important cultured species are salmonids (e.g. rainbow trout, brown trout and grayling), while the principal cultured cyprinid species is common carp.

The economic and societal potential of the aquaculture sector has been officially recognized in Bosnia and Herzegovina due to its ability to generate cash income and foreign exchange, mitigating poverty, increasing the employment rate and fostering rural development, which results in strong support from the State Veterinary Office of Bosnia and Herzegovina (SVO) to the improvement of the sector.

Bosnia and Herzegovina is currently in the process of signing the Stabilization and Association Agreement (SAA) with the European Union (EU). While a full EU membership represents the only possible way to stabilization and improvement of the Bosnian and Herzegovinian economy and society, it also poses the great challenge of fulfilling the numerous EU requirements in various fields. One of the greatest challenges is to meet EU criteria in the field of agriculture production, particularly in aquaculture. Given that aquaculture is the only sector of agricultural production in Bosnia and Herzegovina that has already obtained an export licence to the EU market, establishment of an effective national aquatic animal health surveillance and disease control system represents an imperative for sustainable and internationally recognizable aquaculture production in the country and maintenance of its current permission to export to the EU market.

CURRENT AQUATIC ANIMAL HEALTH SURVEILLANCE AND DISEASE CONTROL SYSTEM IN BOSNIA AND HERZEGOVINA

Administrative organization of Bosnia and Herzegovina as a basis for an aquatic animal health surveillance and disease control system

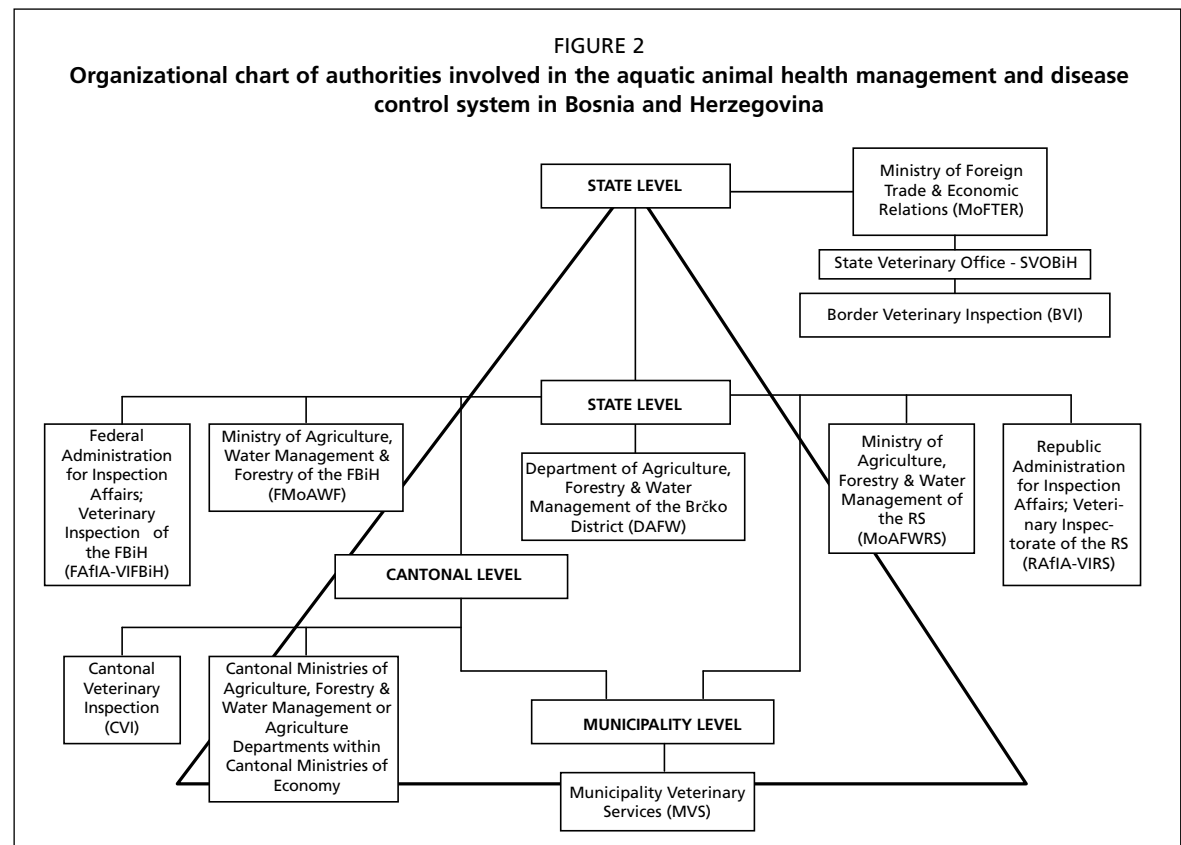
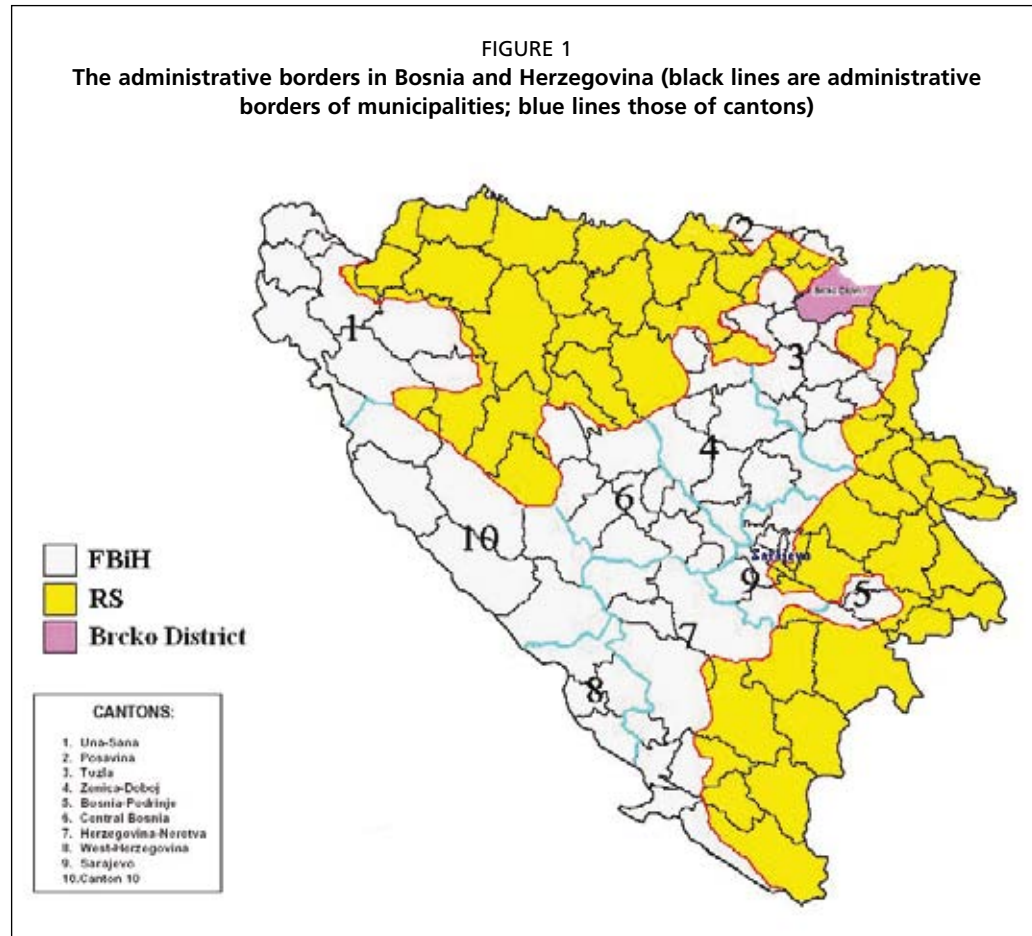
After the disintegration of the former Yugoslavia and the declaration of its independence in 1991, Bosnia and Herzegovina faced a devastating war that was ended by the signing the Dayton Peace Agreement in December 1995. The Agreement defined the current administrative organization of Bosnia and Herzegovina and enforced division of Bosnia and Herzegovina into two entities (administrative units), the Federation of Bosnia and Herzegovina (FBiH) and the Republic of Srpska (RS) and one internationally supervised district, the Brcko District (BD), as an administrative unit under the sovereignty of Bosnia and Herzegovina. The entities retain a large degree of autonomy from the central government, which is dependent upon them for most of its budget. Furthermore, the Federation of Bosnia and Herzegovina is divided into ten cantons as administrative units that also have political and financial autonomy from the central and entity governments to a great extent. Moreover, each of the ten cantons in the Federation of Bosnia and Herzegovina, as well as the whole RS, is divided into municipalities. In addition, the Agreement also established the Office of the High Representative to supervise the implementation of the Agreement. Figure 1 shows the administrative borders in Bosnia and Herzegovina.

Organizational framework of aquatic animal health management and disease control system

The specific political organization of Bosnia and Herzegovina is reflected in a multi-level structure of authorities responsible for planning, realization and supervision of the national aquatic animal health management and disease control system (Figure 2). The following authorities and are engaged in the system:

State level

- *Ministry for Foreign Trade and Economic Relations (MoFTER) of the Council of Ministers of Bosnia and Herzegovina* – With regard to the aquatic animal health management and disease control system, the MoFTER is responsible for the development of basic legislation in the veterinary, phytosanitary, quality control and food safety areas, as well as for establishment of institutions that are directly responsible for its implementation. Due to the adoption of the Inspection Laws



(*Law on Inspections in the Federation of Bosnia and Herzegovina* [OJ of FBiH, 69/05]; *RS Law on Inspections* [OJ of RS, 113/05]) at the entities level, most of the inspection services performed by the ministries responsible for the above named areas now seem to be eliminated from the scope of their activities.

- *State Veterinary Office of Bosnia and Herzegovina (SVO)*: Under the MoFTER jurisdiction, the SVO acts as the Central Competent Authority (CCA) at the state level. Its major competencies, duties and authorities are defined by the State Veterinary Law (*Veterinary Law of Bosnia and Herzegovina* (OJ of BiH, 34/02). From the aspect of the aquatic animal health management and disease control system in Bosnia and Herzegovina, the SVO, alone or in cooperation with the entity and the DB competent authorities (CAs), is charged with the following duties:
 - Drafting proposals of veterinary legislation, which then go to the MoFTER and the Council of Ministries of Bosnia and Herzegovina and to parliamentary procedure.
 - Issuance of veterinary health certificates (licences) and import licenses.
 - Border Veterinary Inspection (BVI) – the Veterinary Inspection Department is an integral part of the SVO. It is also in charge of animal identification and movement controls through the Agency for Animal Identification and Movement Control located in Banja Luka (RS).
 - Drafting the disease surveillance programmes.
 - Monitoring of animal infectious diseases within the national territory and abroad and informing all interested parties in Bosnia and Herzegovina and abroad (in cooperation with the entity and the DB CAs).
 - Coordinating and supervising the zoning process in Bosnia and Herzegovina aquaculture.
 - Cooperating with the relevant EU authorities and other international organizations.
 - Cooperating with and informing state veterinary offices of other states.
 - Adopting working programmes and implementing control and prevention measures for animal infectious diseases and epidemics.
 - Monitoring and analysis of Bosnia and Herzegovina’s veterinary epidemiological situation in accordance with criteria of the World Organisation for Animal Health (OIE) and the EU, and with Bosnia and Herzegovina’s animal health protection programme.
 - Managing legally imposed databases and publishing monthly reports on the occurrence of infectious diseases in Bosnia and Herzegovina.
 - Reporting to the OIE and to all interested parties in Bosnia and Herzegovina and abroad on the current epidemiological situation with regard to animal infectious diseases and related disease management activities and measures.
 - Assuring the linkage of veterinary databases in a unique Bosnia and Herzegovina veterinary information system and its connection to international veterinary information systems.
 - Operating reference veterinary diagnostic laboratories.
 - All other issues related to international trade of live animals and products of animal origin, and the veterinary health conditions in the establishments.

Entity level – Federation of Bosnia and Herzegovina

The Federal Ministry of Agriculture, Water Management and Forestry (FMoAWF), with its Veterinary Sector – Section for Animal Health Protection, is responsible for the implementation of state-level legislation. In addition, they have a right to enforce vertical legislation to regulate issues that are not addressed or précised by the state legislation. In the field of animal health protection, this CA has the following main duties and responsibilities (*Veterinary Law of FBiH* [OJ of FBiH, 46/00]):

- Animal health protection and human protection from zoonoses.
- Epidemiological investigations of infectious and parasitic disease outbreaks.
- Collecting and analyzing epidemiological data on the occurrence of infectious and parasitic diseases in the Federation of Bosnia and Herzegovina and collaboration with CCA and other CAs.
- Designing emergency response plans in cases of occurrence of especially dangerous infectious diseases.
- Proposing and organising teams for the implementation of measures for control and eradication of diseases.
- Establishing and maintaining the animal disease and health status database.
- Designing annual plans for disease monitoring and control.
- Planning and financing the implementation of control measures for infectious and parasitic diseases.
- Developing programmes for the detection, control, eradication and prevention of infectious and parasitic diseases and zoonoses in accordance with the current epidemiological situation.
- Defining veterinary, health and hygienic conditions for animal keeping and production.
- Auditing and registering establishments for animal production and maintaining the register of approved establishments.

The Veterinary Inspectorate of the Federation of Bosnia and Herzegovina (VIFBiH) is under the jurisdiction of the Federal Administration for Inspection Affairs in the Federation of Bosnia and Herzegovina (FAfIA) and both supervises and cooperates closely with the cantonal inspection authorities. Authorities for the overall inspection supervision on the entity level were established as independent administrative organizations for inspection affairs in 2006 under the *Law on Inspections in the Federation of Bosnia and Herzegovina* (OJ of FBiH, 69/05) and the *Law on Inspections in the RS* (OJ of RS, 113/05). Supervision of the operation of these inspections is performed by the entity governments. Consequently, the entity ministries of agriculture may not perform a direct supervision of their operations. Entity Veterinary Inspection (EVI) is responsible for the implementation of fish inspection with regard to enforcement of health monitoring and surveillance, food safety, facility standards and movement of aquatic animals and products thereof. Post-border veterinary inspection supervision is the responsibility of the above inspectors, except in the case of veterinary inspection organized at the state level. In addition, they follow-up registered establishments for animal production, perform on-site inspections, do daily updates if disease outbreaks occur, etc.

Entity level – Republic of Srpska

The Ministry of Agriculture, Forestry and Water Management of Republic of Srpska (MoAFWRS) and its Veterinary Department has similar authorities and duties as the FMoAWF as outlined in the *Law on Animal Health Protection and Veterinary Duties in RS* (OJ of RS, 11/95). The Veterinary Inspectorate of Republic of Srpska (VIRS) is a division of the Republic Administration for Inspection Affairs in RS (RAfIA). Its authorities and duties are similar to those of the FAfIA – VIFBiH. For veterinary purposes, RS is divided into six regions, each of which having been assigned a veterinary inspector.

Entity level – Brcko District

The Brcko District (BD), as an autonomous and internationally supervised part of Bosnia and Herzegovina territory, has its own government with different departments. Agriculture policy of BD is governed by the Department of Agriculture, Forestry and Water Management (DAFW), where the Veterinary Section is responsible for all

veterinary issues. Its duties and authorities are similar to those of entity ministries of agriculture. Veterinary Inspection in BD is under the jurisdiction of the Department of Public Security and has responsibilities and duties similar to VIFBiH and VIRS. Based on information given by SVO officials, there are no registered establishments for aquaculture in BD.

Cantonal level

From an organizational aspect, the development and implementation of agriculture policy is not identically addressed in all ten cantons of the Federation of Bosnia and Herzegovina. In six cantons, Cantonal Ministries for Agriculture, Forestry and Water Management exist within cantonal governments, while in the other four cantons there are only Agriculture Departments within the Cantonal Ministries of Economy. Their corresponding responsibilities and duties are similar to those of entity-level authorities. Their activity is supervised by the cantonal government and by the FMoAWF. They are obliged to monitor the epidemiological situation on their territory and to submit timely reports thereof to the FMoAWF (*Veterinary Law of F BiH* [OJ of FBiH, 46/00]).

Cantonal Veterinary Inspections (CVI) have duties and authorities within their respective territories similar to those of VIFBiH, and they are supervised in parallel by cantonal governments and the VIFBiH. It is important to emphasize that the cantonal veterinary inspectors are officials that bear full responsibility for the performance of official health control and the epidemiological situation in all registered fish farms, since they are personally designated by the entity CAs (following geographical and political criteria of jurisdiction) to one or more fish farms as the responsible veterinary inspector for the specific farm/zone. In some instances in FBiH, this responsibility is assigned to the federal veterinary inspectors, who are employees of the FAfIA – VIFBiH.

Municipality level

Municipality Veterinary Services (MVS) are responsible for the primary animal health protection, as well as for implementation of measures for prevention of infectious diseases, collection and distribution of specimens to authorized diagnostic laboratories in cases of suspicion on occurrence of infectious diseases and the mandatory notification of occurrence of infectious diseases. All MVS in RS are privatized, while those in the Federation of Bosnia and Herzegovina are either public or in the process of privatization. Some municipalities in the RS do not have an official inspector, and the task has been contracted by tender to a private-sector veterinarian who acts as “official veterinarian”.

CHARACTERISTICS AND PERFORMANCE OF THE AQUATIC ANIMAL HEALTH SURVEILLANCE AND DISEASE CONTROL SYSTEM IN BOSNIA AND HERZEGOVINA

Many different definitions of passive, active and targeted types of surveillance may be found in the literature. For the purpose of this paper, the definitions stated in the relevant EU regulation are used (*Reg. 2006/88/EC on animal health requirements for aquaculture animals and products thereof, and on prevention and control of certain diseases in aquatic animals* [OJ L 328]:

- **Passive surveillance** shall include mandatory immediate notification of the occurrence or suspicion of specified diseases or of any increased mortalities. In such cases epidemiological investigations shall be required (described in other sections of the regulation).
- **Active surveillance** shall include:
 - a) routine inspection by the CA or by other qualified health services on behalf of the CAs;
 - b) examination of the aquaculture animal population on the farm for clinical disease;

- c) diagnostic samples to be collected on suspicion of a listed disease or observed increased mortality during inspection;
- d) mandatory immediate notification of occurrence of specified diseases or of any increased mortalities.
- **Targeted surveillance** shall include:
 - a) routine inspection by the CA or by other qualified health services on behalf of the CAs;
 - b) prescribed samples of aquaculture animals to be taken and tested for specific pathogen(s) by specified methods;
 - c) mandatory immediate notification of occurrence of specified diseases or of any increased mortalities.

The Bosnia and Herzegovina aquatic animal health surveillance programme includes all these types of surveillance.

Passive and active aquatic animal health surveillance

According to the provisions of the *Veterinary Law of Bosnia and Herzegovina* (OJ of BiH, 34/02) and the provisions of the *Decision on the Infectious Diseases of Animals* (OJ of BiH, 44/03), as well as of the provisions of the *Decision on Veterinary-health Conditions which have to be Fulfilled in Premises for Farming, Production and Trading of Fish and Products Thereof, and of Crustaceans and Products Thereof* (OJ of BiH, 5/04), mandatory notification of any unusual change in animal health status and/or of any increased mortality to the CAs is required. Thus a sufficient general legal framework for passive surveillance of aquaculture animal health is in place.

The current national list of the aquaculture animal diseases that require mandatory notification and implementation of general and special preventive, control and eradication measures is based on previous OIE criteria for listing animal diseases (the A, B and C list approach). This list is defined through provisions of the *Decision on the Infectious Diseases of Animals* (OJ of BiH, 44/03) and it is presented in Table 1.

In addition, Decision OJ of BiH, 44/03 also prescribes the notification procedure in the case of suspicion of the occurrence of a listed disease. The notification procedure in the case of viral haemorrhagic septicaemia (VHS), spring viraemia of carp (SVC) and infectious haematopoietic necrosis (IHN) is the following:

- The Decision requires that the owners, farmers and all the other stakeholders operating with live fish are obligated to notify the nearest Municipality Veterinary Service (MVS) upon suspicion of the occurrence of any disease, which logically includes notification of the occurrence of any increased mortality.
- MVS alerts the responsible veterinary inspector and undertakes all necessary measures to prevent spread of the disease until arrival of the inspector.

TABLE 1

Aquaculture animal diseases that require mandatory notification and contingency planning for implementation of general and special preventive, control and eradication measures in Bosnia and Herzegovina

Fish diseases	Molluscan and crustacean diseases
Viral haemorrhagic septicaemia (VHS) ¹	Bonamiosis
Spring viraemia of carp (SVC) ¹	Haplosporidiosis (<i>Haplosporidium nelsoni</i> or <i>H. costale</i>)
Infectious haematopoietic necrosis (IHN) ^{1, 2}	Perkinsosis
Epizootic haematopoietic necrosis (EHN)	Marteiliosis
<i>Oncorhynchus masou</i> virus disease (OMVD)	Iridovirosis
	Mikrocytosis (<i>Mikrocytos mackini</i>)
	Taura syndrome
	White spot disease
	Yellowhead disease

¹ Disease for which immediate notification is mandatory.

² Disease for which immediate international notification is mandatory.

- The inspector collects the specimens, undertakes all the legal measures to prevent spread of the disease and sends the samples to an authorized diagnostic laboratory.
- The laboratory notifies the inspector of the diagnostic results by telephone, fax and/or e-mail, and the inspector further informs the respective entity CAs (ministries of agriculture, forestry and water management).
- In the case of occurrence of a primary outbreak of the above diseases, it is obligatory for the laboratory to notify both the respective entity CA and CCA (SVO) by telephone, fax and/or e-mail.

In the case of an occurrence of any of the other diseases listed in Table 1, the notification procedure requires MVS to notify the responsible veterinary inspector as soon as the disease has been confirmed by the required diagnostic methods.

Besides the emergency notification procedure mentioned above, the Decision also defines the timing and hierarchy of regular reporting on disease occurrence as the basis for both passive and active surveillance:

- The authorized laboratories are required to submit regular monthly comprehensive reports to the respective CA and CCA on the results of all diagnostic examinations undertaken during the past month until the 15th day of the current month. The means of reporting are by printed report or e-mail. In addition, the laboratories are required to send the results of diagnostic testing to the responsible veterinary inspector, as well as to the sender of the specimen.
- The entity CAs are obligated to submit regular monthly reports on the past-month occurrence of the diseases listed in Table 1 to the CCA until the 10th day of the current month.
- Mandatory immediate international notification is enforced only for IHN; it is the responsibility of the CCA (SVO) to report to the OIE, the European Community (EC) and the SVOs of neighbouring countries.

Permanent official inspection supervision of the aquaculture establishments, as the other requirement for an acceptable active surveillance programme, is also met in the Bosnia and Herzegovina aquaculture sector. Based on the provisions of the *Veterinary Law of Bosnia and Herzegovina* (OJ of BiH, 34/02), all registered fish farms, as well as those in the process of initial registration or revision of registration, are under the constant inspection control of appointed official veterinary inspectors, who are employed by municipal (RS) or cantonal CAs (FBiH) or by the entity veterinary inspection services (VIFBiH and VIRS). Appointment of the inspectors was done based on the geographical distribution of the fish farms and the geographically based jurisdiction of each CA. According to the provisions of the *Veterinary Law of Bosnia and Herzegovina*, one of the main responsibilities of each veterinary inspector is to send comprehensive monthly reports to the supreme-level authority. Also, according to the legal provisions, supervision of municipality (RS) and cantonal (FBiH) veterinary inspectors by the entity-level veterinary inspection (VIFBiH and VIRS) is also enforced. Besides the regular health surveillance of the farms by the appointed veterinary inspectors, inspection of all aquaculture establishments registered for export by SVO officials is also required by the *Decision on Veterinary-health Conditions which have to be Fulfilled in Premises for Farming, Production and Trading of Fish and Products Thereof, and of Crustaceans and Products Thereof* (OJ of BiH, 5/04) and 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 of BiH, 27/05]). Finally, according to the provisions of the *Veterinary Law of Bosnia and Herzegovina*, during any kind of official inspection, every inspector (municipal, cantonal, entity or CCA officials) is allowed and encouraged to collect as many samples as necessary if any suspicion of any disease or animal health disorder exists.

The requirement for an adequate active surveillance programme for aquatic animal health also includes on-farm examination of cultured animal populations for evidence of clinical disease, which also implies compulsory regular self-checking of aquatic animal health status on farms. This requirement is legally defined in the provisions of the above mentioned legislation, as well as in the *Decision on Implementation of the Compulsory Measures in Approved Establishments with Regard to the Reduction of Microbiological and Other Contaminations of the Meat, Meat Products and Other Products of Animal Origin Intended for Human Consumption* (OJ of BiH, 8/05, last amended 33/07), where is specified that, concerning the obligation of the owners to maintain good animal health and in order to ensure production of food safe for human consumption, it is mandatory for all establishments registered for aquaculture production to perform regular self-check controls of aquatic animal health status on farms. Such controls are realized through contracting the laboratories authorized for animal health diagnostics (six laboratories are specified by the *Decision on Conditions which must be Fulfilled by the Authorized Veterinary Laboratories* (OJ of BiH, 25/04, last amended 16/05). The personnel of these laboratories perform sampling of the respective animal population, on-site clinical examination of the fish population, clinical laboratory-based examination of samples and, if necessary, further diagnostic examinations to identify pathogens. On the other hand, oversight of these self-check results by the appointed veterinary inspectors is mandatory during their regular inspections. Results of such self-check samplings and laboratory analyses constitute valuable data needed for active aquatic animal health surveillance in Bosnia and Herzegovina.

According to information provided by the SVO, the officials of entity CAs, the designated veterinary inspectors responsible for health inspection of fish farms, and by Dr Adnan Jazic, Dr Jasmin Omeragić and other personnel of the DAVFS, no case of mass, increased or unusual mortality in Bosnia and Herzegovina fish populations has ever been observed or reported by either passive or active (including targeted) surveillance in the post-war period. This situation argues in favor of a good quality of fish and fish products, as well as of an epidemiologically acceptable health situation in the fish populations in Bosnia and Herzegovina.

Contingency planning and emergency response

The *Decision on the Infectious Diseases of Animals* (OJ of BiH, 44/03) specifies the list of animal infectious diseases for which emergency preparedness plans should be prepared. None of the diseases listed in Table 1 is included in the list of diseases that require the advance planning of emergency preparedness measures. However, the same Decision also indicates that for all the other infectious diseases (including the diseases listed in Table 1) the design and implementation of emergency preparedness measures depend on the epidemiological situation, which implies that contingency planning and emergency preparedness measures will be designed and implemented upon the identification of occurrence of certain diseases by the surveillance system.

The minimal elements that should be included in any disease contingency plan are as follows:

1. The means for establishing the Crisis Headquarters for disease surveillance, which leads and coordinates implementation of all the disease control measures at the state level.
2. The list of local crisis centers for disease surveillance that are properly equipped for coordination of measures for disease control at the local level.
3. A detailed list of personnel involved in implementation of disease control measures, including their educational level, expertise and responsibilities.
4. The fastest means for the local centers to contact persons and organizations that are directly or indirectly linked to the disease outbreak.

5. The availability of the equipment and other material necessary for a complete and correct implementation of the disease control measures.
6. Detailed instructions on measures and actions that must be carried out in the case of suspicion and confirmation of a disease, including the means for destruction of carcasses.
7. Organization of educational programmes concerning permanent improvement of expertise for implementation of field and management actions, which must be performed on a regular basis.
8. For diagnostic laboratories (as applicable), the space and equipment for post mortem examinations, including serological, histological and other necessary examinations, the capacity for rapid diagnostic procedures and the assurance of fast specimen delivery.
9. Information relating to the quantity of vaccines necessary in the case of implementation of emergency preventive vaccination.
10. A plan for implementation of the measures.

Mandatory epidemiological investigation of disease outbreaks

Mandatory epidemiological investigation of disease outbreaks, as an essential mechanism of the emergency response and the overall surveillance system, is generally enforced by the provisions of the *Veterinary Law of Bosnia and Herzegovina* (OJ of BiH, 34/02) on duties and responsibilities of the veterinary CAs and veterinary inspectors. In addition, this legislation ensures sufficient legal power for the SVO to issue mandatory instructions on implementation of emergency measures to the overall Bosnia and Herzegovina veterinary service in the case of any animal health emergency situation.

An example of the employment of contingency planning, emergency preparedness and response actions happened in 2004, when the presence of infectious pancreatic necrosis (IPN) virus was detected and confirmed in salmonid fish populations sampled from two river basins during the initial screening of the health status of the fish. Although the virus was not listed in the national pathogen list and no clinical cases of disease were observed, the emergency response mechanism was activated and the SVO issued the *Instruction on Implementation of Measures to Prevent the Spread of Infectious Diseases of Fish in Bosnia and Herzegovina* (SVOBiH Document No. 01-1-02-607-1/04 from July 20, 2004). This document was fully harmonized with the relevant EU legislation (*Reg. 2001/183/EC Laying Down the Sampling Plans and Diagnostic Methods for the detection of and confirmation of certain fish diseases and repealing Decision 92/532/EEC* [OJ L 67]) from the point of sampling framework and diagnostic procedures for related diseases, which served as the basis for sampling and later diagnostic aspects, as well as current targeted surveillance on viral fish diseases. During this crisis situation, the following main measures were realized:

- A Crisis Unit under the supervision and control of the SVO was established.
- Epidemiological investigation of the occurrence of the disease agent was conducted.
- A laboratory (DAVFS) responsible for developing a plan for sampling and diagnostic testing based on provisions of the relevant EU legislation was designated.
- Further testing for the presence of VHS, IPN and IHN viruses in salmonids and SVC in cyprinids was undertaken.
- Sampling was done by DAVFS personnel and responsible veterinary inspectors.
- Entity CAs established the lists of all fish farms under veterinary control with names of responsible veterinary inspectors, along with a centralized database.
- Entity chief veterinary inspectors delivered the information and data on epidemiological investigations carried out in 2004.
- DAVFS proposed control and eradication measures for the diseases based on the test results, including depopulation of infected farms and cleaning and disinfection of premises under the supervision of the responsible veterinary inspectors.

- Movement of live fish was regulated according to the health status of the fish farms of origin, based on the results of clinical and laboratory examinations.
- Timely feed-back information to responsible veterinary inspectors on the current health status of the farms and to the aquaculture stakeholders was provided by the SVO.
- Education of the veterinary inspectors was accomplished by the entity CAs.

The epidemiological investigation mentioned above included all activities needed to provide information on:

- the possible source of infection on the farm;
- the time period in which the disease was present on the farm prior to the suspicion of disease;
- a list of farms from which eggs, fry and/or live fish were introduced to the farm in question;
- in the case of imported eggs, fry and/or live fish, the country and farm of origin, place of quarantine and the type of diagnostic examination undertaken;
- all movements of live fish, eggs and/or fry from the farm;
- all movements of live fish, eggs, and/or fry to the farm;
- all movements of vehicles, equipment, raw materials and persons that could act as possible vectors of the virus in or out of the farm; and
- the possibility of transfer of the disease via other carriers of the virus.

The above information indicates that the legal and organizational capabilities of the aquaculture CAs are adequate to timely and effectively implement contingency planning and an emergency response mechanism in the case of an outbreak of aquatic animal disease.

Targeted surveillance of viral fish diseases

Implementation of targeted surveillance for fish viral diseases is legally based on provisions of the annually enforced *Decisions on Measures of Control of Infectious and Parasite Diseases of Animals and their Implementation and Financing*, and it is specified for all fish farms and for wild fish populations living in open waters.

Decisions regarding the inclusion of certain diseases in the surveillance programme are based on the results obtained from the overall surveillance programme, the current epidemiological situation for aquatic animal health and the provisions of the *Decision on Veterinary Health Conditions that must be Fulfilled when Putting into Trade Live Fish, Mollusks, and Crustaceans and Products Thereof* (OJ of BiH, 62/05), which is harmonized with the EU legislation (*Reg. 91/67/EEC Concerning the Animal Health Conditions Governing the Placing on the Market of Aquaculture Animals and Products Thereof* (OJ L 46), last amended 806/2003/EZ [OJ L 122]) and the OIE *Aquatic Animal Health Code* that were in effect at the time of its enactment. The list of aquatic animal diseases/pathogens and susceptible species that are considered for monitoring for the purpose of the zoning and approval of an area or a farm is presented in Table 2.

Inspection and sampling scheme for all salmonid fish farms

The inspection and sampling scheme for salmonid fish farms is harmonized with the provisions of the relevant EU regulation (*Reg. 2001/183/EC Laying Down the Sampling Plans and Diagnostic Methods for the Detection of and Confirmation of Certain Fish Diseases and Repealing Decision 92/532/EEC* [OJ L 67]) regulating this issue for VHS and IHN, and the same provisions are applied for IPN, as well as for other salmonid fish diseases of concern.

All samples are taken in triplicate. One set is delivered to the national reference laboratory (DAVFS), the second set is sent to one of the EU-recognized laboratories (the Community Reference Laboratory for Fish Diseases, Aarhus, Denmark, and the National Veterinary Institute, Ljubljana, Slovenia), while the third set is held in reserve by the veterinary inspector for the purpose of super-analysis.

TABLE 2

List of aquatic animal diseases/pathogens and susceptible species that are considered for monitoring purposes with regard to the zoning and approval of an area/farm in Bosnia and Herzegovina

Disease/pathogen	Susceptible species
Infectious salmon anaemia (ISA) ¹	Atlantic salmon (<i>Salmo salar</i>)
Viral haemorrhagic septicaemia (VHS) ²	Salmonid species
	Grayling (<i>Thymallus thymallus</i>)
	Whitefish (<i>Coregonus</i> spp.)
	Pike (<i>Esox lucius</i>)
Infectious haematopoietic necrosis (IHN) ²	Turbot (<i>Scophthalmus maximus</i>)
	Salmonid species
Bonamiosis (<i>Bonamia ostreae</i>) ²	Flat oyster (<i>Ostrea edulis</i>)
Marteiliosis (<i>Marteilla refringens</i>) ²	
Infectious pancreatic necrosis (IPN) ³	To be specified in monitoring programmes designed and performed by entity CAs – not mandatory for the zoning purposes
Spring viraemia of carp (SVC) ³	
Bacterial kidney disease (BKD) (<i>Renibacterium salmoninarum</i>) ³	
Furunculosis (<i>Aeromonas salmonicida</i>) ³	
Enteric redmouth disease (ERD) (<i>Yersinia ruckeri</i>) ³	
Gyrodactylosis (<i>Gyrodactylus salaris</i>) ³	
Crayfish plague (<i>Aphanomyces astaci</i>) ³	

¹ List I Diseases.

² List II Diseases.

³ List III Diseases.

Each sampling procedure must be followed by the official inspection record. Besides the usual data, each inspection record should include data on water temperature on the date of sampling, as well as species and categories sampled (official labels: broodstock [M]; one-year fry [0+]; fry more than one year old [1+]). One copy of the official inspection record shall be available on the sampled farm.

Sampling of farms for which continuous two-year surveillance with two samplings per year has not been completed shall be done according to the sampling scheme presented in Table 3, while sampling of farms for which the two-year surveillance programme has been completed shall be done in line with the sampling scheme presented in Table 4 (decreased number of samples).

Clinical inspections must be realized during the period October to June or whenever the water temperature is below 14 °C. When farms are to be clinically inspected twice per year, the interval between inspections must be at least four months. All production units (ponds, tanks, net-cages, etc.) must be inspected for the presence of dead, weak or abnormally behaving fish. Particular attention must be paid to the water outlet area where weak fish tend to accumulate because of the water current.

The criteria for the selection of fish to be sampled are as follows:

- If rainbow trout are present, only that fish species shall be sampled. If rainbow trout are not present, the sample must be obtained from all other fish species present that are susceptible to VHS and IHN viruses (the list of pathogens and the susceptible species are specified in the relevant Bosnia and Herzegovina legislation (*Decision on Veterinary Health Conditions that must be Fulfilled when Putting into Trade Live Fish, Mollusks, and Crustaceans and Products Thereof* [OJ of BiH, 62/05]), which is harmonized with the equivalent EU regulation (*Reg. 91/67/EEC Concerning the Animal Health Conditions Governing the Placing on the Market of Aquaculture Animals and Products Thereof* [OJ L 46], last amended by *Reg. 806/2003/EZ* [OJ L 122]). The species must be proportionally represented in the sample.
- If more than one water source is utilized for fish production, fish representing all water sources must be included in the sample.

TABLE 3

Inspection and sampling scheme for salmonid fish farms under increased two-year targeted surveillance programme mandatory to achieve status of approved zone or approved farm in unapproved zone. (To be applied in the case of farms which have not finished the compulsory 2-year targeted surveillance)

	No. of clinical inspections per year	No. of laboratory examinations per year	Laboratory examination for presence of virus	
			Number of growing fish (organ material)	Number of broodstock fish (ovarian fluid)
Continental zones and farms				
(a) Farms with broodstock	2	2	120 (first inspection) ¹ 150 (second inspection)	30 (first inspection) ² 0 (second inspection)
(b) Farms with broodstock only	2	1	0	150 (first or second inspection) ³
(c) Farms without broodstock	2	2	150 (first and second inspection)	0
Coastal zones and farms				
(a) Farms with broodstock	2	2	120 (first inspection) 150 (second inspection)	30 (first inspection) ³ 0 (second inspection)
(b) Salmonid farms without broodstock	2	2	30 (first and second inspection) ³	0
(c) Non-salmonid farms without broodstock	2	2	150 (first or second inspection)	0

Maximum 10 fish per one pooled sample; ¹ Clinical inspection; ² In exceptional circumstances, if it is impossible to obtain ovarian fluid, organs may be sampled instead; ³ The samples have to be collected no sooner than three weeks after transfer of fish from fresh to saltwater.

TABLE 4

Inspection and sampling scheme for salmonid fish farms under decreased targeted surveillance programme mandatory to achieve status of approved zone or farm in unapproved zone. (To be applied in the case of farms that have finished the compulsory 2-year targeted surveillance)

	No. of clinical inspections per year	No. of laboratory examinations per year	Laboratory examination for presence of virus	
			Number of growing fish (organ material)	Number of broodstock fish (ovarian fluid)
Continental zones and farms				
(a) Farms with broodstock	2	2	0 (first inspection) ¹ 30 (second inspection)	30 (first inspection) ² 0 (second inspection)
(b) Farms with broodstock only	2	1	0	30 (first or second inspection) ³
(c) Farms without broodstock	2	2	30 (first and second inspection)	0
Coastal zones and farms				
(a) Farms with broodstock	2	2	0 (first inspection) 30 (second inspection)	30 (first inspection) ³ 0 (second inspection)
(b) Salmonid farms without broodstock	2	2	30 (first and second inspection) ³	0
(c) Non-salmonid farms without broodstock	2	2	30 (first or second inspection)	0

Maximum 10 fish per one pooled sample; ¹ Clinical inspection; ² In exceptional circumstances, if it is impossible to obtain ovarian fluid, organs may be sampled instead; ³ The samples have to be collected no sooner than three weeks after transfer of fish from fresh to saltwater.

- If weak, abnormally behaving or freshly dead (but not decomposed) fish are present, such fish should be primarily sampled. If such fish are not present, the sample must include normally appearing, healthy fish in such a way that all parts of the farm, as well as all year classes, are proportionally represented in the sample.

Inspection and sampling scheme for cyprinid fish farms

Examination for the presence of SVC virus in cyprinid broodstock has to be carried out during the spawning time. For the purpose of examination, a sample of ovarian

fluid has to be taken at the end of squeezing (one pooled sample includes specimens of ovarian fluid from five broodstock in one tube).

Clinical examination of cyprinid fry (0+ and 1+ age categories) must be carried out in the spring (when the water temperature is below 20 °C) and in autumn (when the water temperature is below 18 °C). At the same time, samples that include 150 fish shall be delivered for testing for the presence of SVC virus.

Collection, distribution and laboratory examination of samples

Precise information on the collection of samples and their distribution to authorized laboratories is also given in the annually enforced *Decisions on Measures of Control of Infectious and Parasite Diseases of Animals and their Implementation and Financing*, which is based on provisions of the relevant EU legislation (*Reg. 2001/183/EC Laying Down the Sampling Plans and Diagnostic Methods for the Detection of and Confirmation of Certain Fish Diseases and Repealing Decision 92/532/EEC [OJ No. L 67]*). The tissues to be examined are the spleen, anterior kidney, and either the heart or the brain. In some instances, when examining broodstock, ovarian fluid is to be collected. In addition to live fish, whole dead fish may also be sampled.

The same legislation also regulates diagnostic methods for virological examination of samples and the confirmation of viral diseases (VHS and IHN) in suspected outbreaks. In the case of suspected outbreaks, at least 10 fish showing typical signs of VHS or IHN must be selected for examination. To diagnose the diseases, one or more of the following diagnostic procedures shall be applied:

- a) conventional viral isolation (inoculation on to cell cultures and observation of cytopathic effect by microscopy) with subsequent serological viral identification (virus neutralization technique, immunofluorescence technique (IF) and/or enzyme linked immunosorbent assay (ELISA) technique)
- b) isolation of virus with simultaneous serological virus identification
- c) rapid serological virus identification (ELISA and/or indirect fluorescent antibody test (IFAT)), which must be followed by the above “a” or “b” diagnostic procedure within 48 hours after the sampling, if a negative result is obtained, or if a positive result is obtained with material representing the first case of VHS or IHN in an approved zone.

Other alternative diagnostic methods may be applied such as reverse transcriptase-polymerase chain reaction (RT-PCR) or immunohistochemistry (if frozen sections), but they must always be accompanied by cell culture inoculation with diagnostic material.

In addition to the above provisions, the Decision on the Infectious Diseases of Animals (OJ of BiH, 44/03) specifies laboratory tests and methods for examination and confirmation of the infectious diseases listed in this Decision, as well as the specimens that need to be taken and their delivery to laboratories. For infectious diseases for which the required methods, equipment or space do not exist in Bosnia and Herzegovina, it is specified that diagnostics is to be performed in the OIE reference laboratory or other international reference laboratories with which the SVO has a signed contract for provision of diagnostic services. Finally, it is also specified that the SVO is responsible for coordination of sampling and the distribution of samples to reference laboratories. The lists of prescribed and alternative diagnostic methods, required specimens and specimen delivery methods for all aquatic animal diseases listed in Table 1 are given in Annex 4 of the Decision. In addition, the Annex also provides the same information for other significant diseases from the OIE list: viral encephalopathy and retinopathy (VER), IPN, infectious salmon anaemia (ISA), bacterial kidney disease (BKD) and crayfish plague. A list of laboratory tests and methods for sampling and specimen delivery to laboratories for some fish diseases in Bosnia and Herzegovina is presented in Table 5.

TABLE 5

List of laboratory tests and sampling methods for some fish diseases in Bosnia and Herzegovina

Disease ¹	Diagnostic method ²		Sampling and delivery of samples	
	Compulsory	Other	Specimens	Delivery
EHN	Virus isolation and serological identification	IF, ELISA, molecular methods	Whole fry if smaller than 4 cm; intestine with kidney from fry 4-6 cm in size; from bigger fish, kidney, spleen and liver from clinically diseased fish; in the case of unapparent infections, the same as above; statistically representative number of fish or parental ovarian and seed fluid	Live diseased fish, fresh dead fish or slaughtered fish on ice. Organs or ovarian and seed fluid in transport fluid 1:10 at 4 °C
IHN	Virus isolation, identification with SN, IFAT, ELISA, molecular methods			
VHS	Virus isolation, identification with SN, IF, ELISA			
SVC	Virus isolation, identification with IF, ELISA	IF, ELISA	Whole fry if smaller than 4 cm; intestine with kidney and brain from bigger fish; in the case of unapparent infections, kidney, spleen, gills and brain of a statistically representative sample	
OMVD			The same as for EHN, IHN, and VHS with addition of brain and ulcerative skin lesions in clinically diseased fish, and brain in unapparent infections.	

¹ EHN = epizootic haematopoietic necrosis, IHN = infectious haematopoietic necrosis, VHS = viral haemorrhagic septicaemia, SVC = spring viraemia of carp, OMVD = *Oncorhynchus masou* virus disease.

ELISA = enzyme linked immunosorbent assay, IF = immunofluorescence, IFAT = indirect fluorescent antibody test, SN = semi-nested.

Source: Decision on Infectious Diseases of Animals (OJ of BiH, 44/03)

Laboratories involved in aquatic animal health surveillance

In Bosnia and Herzegovina, the designation of laboratories for performance of examinations with regard to animal health is regulated by the *Decision on Conditions which must be Fulfilled by the Authorized Veterinary Laboratories* (OJ of Bosnia and Herzegovina, 25/04, last amended 16/05) and the *Decision on Designation of Referent Laboratories in Bosnia and Herzegovina* (OJ of Bosnia and Herzegovina, 68/05, last amended 90/05). According to this legislation, the DAVFS is designated as the National Reference Laboratory for Viral Fish Diseases (NRL). The other laboratories that are authorized to perform diagnostics for aquatic animal diseases are the Veterinary Institute "Dr Vaso Butozan" in Banja Luka, RS, and the Veterinary Institute in Mostar, FBiH. The above mentioned legislation specifies that the authorized laboratories and the NRL must have all the necessary equipment and materials to carry out the diagnostic analyses in accordance with the OIE *Manual of Diagnostic Tests for Aquatic Animals*, 4th Edition, 2003. As for their diagnostic performance, all laboratories are currently performing only ELISA testing for fish diseases. However, confirmatory laboratory technique (virus isolation) is ensured by employment of the EU Reference Laboratory for Fish Diseases in Aarhus, Denmark (CRL), which has been officially contracted by the SVO for this purpose since 2005. In this way, the shortcoming in full implementation of appropriate screening and confirmatory diagnostics of fish diseases has been successfully addressed. In addition, one of the major activities of the FAO-funded project is the provision of equipment and training of laboratory staff of the NRL in order to achieve an internationally recognized level of diagnostic performance for fish diseases. According to NRL and SVO officials, a fully equipped and capable laboratory is expected to be in place not later than the middle of 2008.

Another important requirement for an authorized or reference laboratory is that, in order to retain its authorization, it must organize its operative diagnostic work according to the provisions of the national BAS EN ISO/IEC 17025:2005 standard, which is fully harmonized with the international standard ISO/IEC 17025:2005¹. The accreditation

¹ ISO/IEC International Standard 17025 (2005). *General requirements for the competence of testing and calibration laboratories*. International Organisation for Standardisation (ISO), ISO Central Secretariat, 1 rue de Varembe, Case Postale 56, CH - 1211, Geneva 20, Switzerland.

is performed by a national accreditation body (the Institute for Accreditation of Bosnia and Herzegovina), which is not officially a part of an EU accreditation body. Neither the NRL nor the other two laboratories are presently accredited, which is a very important obstacle to international recognition of their diagnostic results. Nevertheless, personnel of the NRL and of the Veterinary Institute in Banja Luka have expressed optimism concerning this problem, since extensive activities have been undertaken to prepare their laboratories and personnel for accreditation, which should be obtained during the current year.

Concerning evaluation of the effectiveness of the surveillance programme and the dissemination feed-back information, the Decision clearly indicates that the CCA is responsible to ensure implementation, coordination and analysis of the implemented measures through the Expert Group for Epidemiology, which is responsible for further improvement of the surveillance programme based on scientific findings and analysis. The Expert Group is responsible for preparing an annual report on the scope and effectiveness of the surveillance programme at the end of the current year, in which necessary improvements should be proposed for the coming year. In addition, the NRL is obliged to establish cooperation with the OIE reference laboratories and/or the CRL and to participate in ring testing trials. The dissemination of feed-back information is a responsibility of the CCA and the entity CAs, who are in charge of organizing training and providing information to veterinarians, fish farmers, inspectors and other aquaculture stakeholders by the means of symposia, scientific events, bulletins, manuals, etc. According to officials of the SVO and the FMoAWF, besides the regular preparation and distribution of the *Monthly Bulletin on Occurrence of Infectious Diseases*, many seminars, conferences, trainings and expert consultations have been organized. However, according to the officials of the CCA and the CAs, the Expert Group for Epidemiology has never been officially established, which is surely a very important shortcoming that needs to be appropriately addressed.

Results of the Bosnia and Herzegovina targeted surveillance on fish diseases

Results of the Bosnia and Herzegovina targeted surveillance programme for viral fish diseases implemented during the period 2004-2007, based on available data provided by SVO officials, are presented in Table 6. Targeted surveillance of fish diseases started in 2004 as an initial screening of health status of salmonid fish farms in two river basins for the presence of the viral diseases VHS, IHN and IPN.

TABLE 6
Results of targeted surveillance for the presence of certain viral agents of fish disease implemented in Bosnia and Herzegovina fish farms during 2004-2007

Year	Salmonid species ¹			Cyprinid species ²	
	VHS virus ³ a / b ⁴	IHN virus a / b	IPN virus a / b	ISA virus a / b	SVC virus a / b
2004	0 / 32	0 / 32	17 / 32	NA ⁵	NA
2005	0 / 30	0 / 30	26 / 30	0 / 30	0 / 7
2006	0 / 34	0 / 34	6 / 34	NA	0 / 5
2007	0 / 28	0 / 28	0 / 28	NA	0 / 6

¹ Rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta m. fario*), brook trout (*Salvelinus fontinalis*), grayling (*Thymallus thymallus*), and Adriatic salmon (*Salmothymus obtusirostris*). In 2007 one farm producing arctic char (*Salvelinus alpinus*) was also included in the surveillance programme.

² Common carp (*Cyprinus carpio*).

³ IHN = infectious haematopoietic necrosis, ISA = infectious salmon anaemia, SVC = spring viraemia of carp, VHS = viral haemorrhagic septicaemia.

⁴ a – Number of farms having fish populations in which the presence of the virus is confirmed in the respective year. No increased or unusual mortality or any specific clinical sign of the respective diseases were observed during implementation of the surveillance programme. b – Total number of fish farms included in the surveillance programme per year. All officially registered farms and those in the process of registration were included in the programme in the respective year.

⁵ NA – Not applicable. The agent was not under official targeted surveillance.

In 2005, based on recommendations of the relevant EU CA², besides these three viral diseases, the targeted surveillance was modified to include preventive examinations for ISA virus. Surveillance for ISA virus was not continued in the following years because of confirmation of all negative results for monitoring done in 2005, the absence of Atlantic salmon (the species susceptible to ISA) in Bosnia and Herzegovina aquaculture, the desirable overall epidemiological situation in Bosnia and Herzegovina aquaculture (absence of any increased mortality) and the high expenditures for confirmatory testing in the CRL. Also, from 2005 systematic targeted surveillance for the presence of SVC virus in common carp was initiated.

In 2006, besides surveillance for the viruses causing IHN, VHS, IPN and SVC, the relevant annual Decision requiring surveillance for BKD and gyrodactylosis was also implemented. However, in spite of the legal provisions, surveillance for these two non-viral diseases was not realized due to a lack of implementing budget. It is important to emphasize that Bosnia and Herzegovina is one of only a few countries that pays all the expenses associated with targeted surveillance without any participation of the fish farmers, although it is primarily their interest to gain access to the international markets, which may be only reached by international recognition of the surveillance system as the backbone of aquaculture animal health management.

The laboratory examination of the samples included use of ELISA screening methods for fish viral diseases performed at the NRL, followed by ELISA and viral isolation, a simultaneous diagnostic system for confirmation performed by the CRL in Aarhus, Denmark. This approach was used during 2004-2005, while in 2006 and 2007 samples were not sent to the CRL due to the extremely high costs of their service. This approach may be provisionally accepted due to the absolute absence of any increased or mass mortality in Bosnia and Herzegovina aquaculture, which argues in favor of a historical freedom of disease. However, efforts to ensure sustainable and cost-effective access to diagnostics services for important fish diseases must be available. The solution to this problem is provided by implementation of the FAO-funded project, whose major outputs include strengthening the capability of the NRL such that it can provide reliable, internationally recognized diagnostic services.

Bearing in mind the absence of any increased mortality in aquaculture during the post-war period and longer, the detection of IPN virus in salmonid fish without any clinical manifestation of disease may be taken as a positive characteristic of the overall performance of surveillance in Bosnia and Herzegovina aquaculture. The facts that this virus is recognized as free-living microorganism in freshwater, and that the disease is not currently among the diseases listed by the OIE or the EU, as well as the fact that the agent was not detected in 2007, may be taken as arguments in favor of deleting the disease from the Bosnia and Herzegovina national list of diseases in aquacultured animals.

Finally, from the results of targeted surveillance and the historical freedom of Bosnia and Herzegovina's aquaculture from diseases, it may be concluded that Bosnia and Herzegovina salmonid and cyprinid fish production is based on a desirable epidemiological status with regard to the diseases that have been under surveillance. Also the listing of Bosnia and Herzegovina among the third countries for which the imports of fishery products in any form for human consumption to the EU market are officially permitted without any restriction³ argues in favour of such an opinion. However, since the current EU regulation on this matter enforces changed criteria for aquatic animal disease listing, and having in mind a sustainable export of Bosnia and

² FVO Inspection Mission to Bosnia and Herzegovina; Ref.No.DG(SANCO)/7720/2005.

³ Reg. 2008/156/EC amending Decision 2006/766/EC as Regards the List of Third Countries and Territories from which Imports of Fishery Products in any Form for Human Consumption are Permitted (OJ L 50)

Herzegovina aquaculture products as a long-term national objective, an update and improvement of the surveillance system in BiH aquaculture becomes necessary.

DEFICIENCIES, INCONSISTENCIES AND RECOMMENDATIONS FOR THEIR IMPROVEMENT

The issues identified with regard to aquatic animal health surveillance in Bosnia and Herzegovina can be divided into:

- organizational and structural issues;
- legislative issues; and
- issues related to the management of domestic movement of aquatic animals.

Organizational and structural issues

Problems and inconsistencies

The organizational structure of all the CAs responsible for aquatic animal health management and disease control in Bosnia and Herzegovina (Figure 2) is pyramidal and hierarchical in terms of their relevant competencies and duties. This structure, in addition to a sufficient legal framework, provides an essential foundation for their mutual cooperation in establishing and implementing an effective system. However, to accomplish the numerous duties and competencies in a well-coordinated and productive manner, problems related to the issues identified below need to be addressed:

The need for clear designation of institutional and personal responsibilities for aquaculture issues within the CAs and associated shortcomings in effective communication and coordination

One of the basic requirements for a productive aquatic animal health management and disease control system is to clearly assign personal duties and responsibilities in all CAs (FAO, 2004). In addition, the existence of an appropriate system of communication and coordination is one of the major requirements for the effective functioning of animal health surveillance systems in general (Zepeda and Salman, 2003). However, the problems of miscommunication and lack of enthusiasm may be identified as common obstacles to efficacious functioning in all complex and multilevel systems, particularly in those systems that involve many bureaucratic components, even in countries that are more developed and have a less structured administrative organization than Bosnia and Herzegovina (Anon., 2002).

The organizational structure of the CCA and the entity-level CA, besides their other sections and departments, also includes those responsible for animal health management and control issues in general. Nevertheless, from discussion with representatives of the CCA and entity-level CAs, it is clear that there are no personally assigned responsibilities and duties related to aquaculture animal health issues in these sections and departments. This is rather contradictory to the recognition by Bosnia and Herzegovina officials of aquaculture as one of the leading and most-promising agricultural sectors and certainly deserves appropriate attention to improve Bosnia and Herzegovina aquaculture. Also, despite the fact that a sufficient legal basis for communication has been established, the effective and constructive exchange of data and information among CAs at all levels was not observed during the mission. From visits to institutions, insights into the existing databases in the SVO, and discussions with representatives of all CAs and other stakeholders, it is clear that one of the main problems facing aquatic animal health management and disease control in Bosnia and Herzegovina is the lack of effective communication among all the CAs.

This organizational problem may be partially explained by a current shortage of adequate personnel in the responsible institutions. For instance, the human resources of the SVO in Sarajevo on 1 September 2007 comprised only 10 veterinarians in total,

including all the decision-makers, operative personnel and three apprentices. Given the numerous duties and responsibilities of the CCA, this obvious shortcoming in human resources results in unclear personal responsibilities of the personnel for performing specific duties. Similar situations and problems may be identified within the entity and cantonal CAs responsible for aquatic animal health management and disease control. Without clear assignment of personal responsibilities for managing aquaculture animal health issues within the CAs, a lack of effective communication among them arises as another institutional and organizational problem.

The need for timely collection, uniformity, transparency and analysis of epidemiological data and dissemination of feedback information

BiH and the EU legislation (*Veterinary Law of BiH* (OJ of BiH, No. 34/02) and *Reg. 2006/88/EC on Animal Health Requirements for Aquaculture Animals and Products Thereof, and on Prevention and Control of Certain Diseases in Aquatic Animals* [OJ No. L 328]) requires that all decisions on aquatic animal health management and disease control should be based on appropriate epidemiological analysis and risk assessment procedures, ensuring that reliable and scientifically based decisions are made and that resulting measures and activities will be disseminated to all stakeholders and elements involved in the MOSS. However, formal epidemiological units within the CCA or the entity CAs have not been created, mainly due to the fact that personal responsibilities for the aquaculture sector have not been designated. In order to be able to provide appropriate epidemiological analysis, make scientifically based decisions, enforce measures and disseminate feed-back information to stakeholders, it is essential for any epidemiological unit to have reliable and timely data on hand.

In spite of the above legal provisions, and from discussion with contacts within the CAs at all levels, it is clear that one of the major constraints of the system is a lack of timely collation of data and reports. This is considered a reflection of other identified problems (e.g. lack of clearly designated personal responsibilities for aquaculture issues in CAs and human resource shortcomings), but it is also a consequence of a lack of willingness to cooperate and of failure to recognize the importance of timely reporting. However, this is acknowledged as a general problem in the implementation of animal disease surveillance systems (Thacker, Parrish and Throwbridge, 1988; Håstein *et al.*, 2001; Zepeda and Salman, 2003), and it is the responsibility of the CA of each country to find the most appropriate means to address it. Consequently, timely updated databases on issues related to the aquaculture sector could not be found. For instance, the results of the laboratory examinations done within the monitoring programme on viral fish diseases are centralized in an electronic format only for 2004 and 2005, while the data obtained during 2006 and 2007 are still contained in the paper-based reports of the NRL and the inspectors. In addition, the established electronic database is not structured in a useful way that could provide a fruitful analysis of the data. A similar situation exists for the database on registered fish farms, which, although organized in a better and simpler way, is not updated in a timely manner.

Recommendations

The importance of the aquaculture sector in the overall development of national agriculture and the fact that it is the only segment of Bosnia and Herzegovina agriculture that is officially permitted to export products to the EU market speaks to the essential importance of the following actions:

- *Assign clear personal responsibilities for managing aquaculture issues in the SVO and in the entity CAs.* Such assignments should improve effectiveness of communication between the CCA and the CAs, which may lead to increased managerial capability within the state and entity-level CAs.

- *Officially establish the Expert Panel for Aquaculture (EPA).* Besides the Deputy Director of the SVO as the coordinator of the panel, the EPA may include people personally responsible for aquaculture in the SVO, both entity ministries for agriculture (FMoAWF and MoAFWRS), the Chief Veterinary Inspectors from VIFBiH and VIRS, and a representative from the Bosnia and Herzegovina Association of Aquaculture Producers. The EPA should be under the supervision of the SVO, and its members should be adequately compensated for their activities from the SVO budget. This group should hold their meetings at least on a quarterly basis. The primary role of the EPA should be to coordinate all activities related to Bosnia and Herzegovina aquaculture among the CCA and the entity CAs. In addition, the EPA should provide expert opinion on the current status and requirements for improving Bosnia and Herzegovina aquaculture, as well as suggestions and recommendations for drafting new legislation related to aquaculture.
- *Design and implement internal Standard Operating Procedures (SOPs) for the timely collection of data and establishment of updated and operational databases in all CAs involved in aquatic animal health surveillance.* This may be a suitable approach to appropriately address the problem of lack of timely collection of data by CAs.
- *Design and implement uniform report sheets for collection and submission of monthly data on disease occurrence, laboratory testing results, registration of aquaculture establishments and all the other areas relevant to the surveillance system.* This should be legally required and addressed through the SOPs in all CAs. Report sheets should be designed to ensure the generation of a centralized electronic database at the SVO that contains data of uniform format that can be used to generate variables of interest for reliable statistical analyses (e.g. data on the number, profile and age categories of susceptible species for each farm; date, number and type of samples taken for laboratory analysis; geographical location of each farm; codes for each farm and the responsible veterinary inspectors, etc.). The establishment of such a uniform electronic database within the CCA and its presentation on the Internet should ensure transparency of the data and an easy access to the official status of each registered aquaculture establishment.
- *Establish an epidemiological and risk analysis unit within the SVO.* This should include well-trained epidemiologists and risk analysts able to form and manage uniform and centralized databases related to Bosnia and Herzegovina aquaculture; perform statistical analyses of the surveillance and registration data; and undertake appropriate risk analyses that should permit risk analysis-based decision-making to support the designation of health status and zoning of farms and zones, the level and scope of an aquatic animal health surveillance programme, and a sound policy for movements of aquatic animals. In addition, the activities of this unit and the EPA are prerequisites for ensuring the dissemination of scientific-based feed-back information.

The need to address problems with self-checked data

Despite the fact that all authorized laboratories are required to submit monthly reports on all of their diagnostic activities, which would include information on all of diagnostic tests performed regardless of who paid for them, none of the self-check results are submitted to the CCA. In addition, these data should be accessible to the responsible veterinary inspectors designated for each farm.

Recommendations

- *CAs and the CCA should more completely enforce submission of the official reports from their subordinates (i.e. veterinary inspectors personally assigned to each fish farm) with regard of their content and timing, as well as to standardize the*

procedures for data collection and collation. Recommendations for improvement of the system of data collection and collation are provided above (through SOPs and uniform data sheets). Since a more thorough enforcement of the self-checked data is suggested, this recommendation refers both to the organizational and legislation-related shortcomings of the Bosnia and Herzegovina aquatic animal health surveillance programme.

Legislative issues

Problems and inconsistencies

Compared to the other animal production sectors in Bosnia and Herzegovina, the national legislation that regulates the management and control of diseases and the other aspects of aquaculture is more advanced and up-to-date with EU legislation. This confirms the general recognition of aquaculture as one of the most-promising animal production sectors in Bosnia and Herzegovina and highlights the efforts of the SVO and others to ensure the necessary legal basis for promotion and international recognition of national aquaculture.

Considering the existing legal framework for aquatic animal health management in Bosnia and Herzegovina, it is clear that there exists a sufficient legal basis for establishing and maintaining a comprehensive disease surveillance programme, including both passive and active components. However, some problems related to the legal basis may be identified.

The need for timely harmonization and updating of relevant legislation and improving unclearly defined institutional jurisdictions and responsibilities

Further improvement and strengthening of the capacities of the aquaculture sector is needed to ensure the sustainable export of aquaculture products to the European Union and regional markets. To reach the goal, timely harmonization of Bosnia and Herzegovina legislation with the corresponding EU legal acts is essential. This will be the one of permanent major challenges facing the Bosnia and Herzegovina legislative system. An example of such a challenge is the enforcement of a risk assessment-based approach in the EU regulation concerning the general health requirements for aquaculture animals and the prevention and control of their diseases through the zoning process (*Reg. 2006/88/EC on Animal Health Requirements for Aquaculture Animals and Products Thereof, and on Prevention and Control of Certain Diseases in Aquatic Animals [OJ L 328]*), which is not mentioned in the corresponding Bosnia and Herzegovina legislation (*Decision on Veterinary Health Conditions that must be Fulfilled when Putting into Trade Live Fish, Mollusks, and Crustaceans and Products Thereof [OJ of Bosnia and Herzegovina, 62/05]*). Furthermore, one of the consequences of the multi-level decentralized political and operational competencies in Bosnia and Herzegovina is a corresponding reflection of this structure in the legislation, which may lead to a lack of harmonization and overlapping of the legal acts that regulate the same issues at different levels of jurisdiction. For instance, in addition to the *Veterinary Law of Bosnia and Herzegovina*, two entity-level laws are in force, the *Veterinary Law of the Federation of Bosnia and Herzegovina*, (OJ of FBiH, 46/00) and the *Law on Animal Health Protection and Veterinary Duties in RS* (OJ of RS, 11/95). Although the national law is obsolete (e.g. with regard to the current OIE and EU listings of aquatic animal diseases), the entity-level laws are still not harmonized with the already outdated state-level law. This lack of harmonization results in insufficiently clear jurisdictions and competencies and confusion in the implementation of the relevant legislation.

One of key requirements for establishing a productive and dynamic animal health surveillance system is a clear legal definition of jurisdictions and responsibilities for each of its components, particularly in countries like Bosnia and Herzegovina where

a multilevel jurisdiction and competence is in place. As previously mentioned, until 2006 the entity veterinary inspection services (VIFBiH and VIRS) were under the jurisdiction of their respective ministries for agriculture (FMoAWF and MoAFRS), an arrangement that provided more practical capability and a mechanism for the ministries to implement relevant legislation and to have clearly defined responsibilities. Since 2006 VIFBiH and VIRS have been placed under the jurisdiction of the entity inspection administrations (FAfIA and RAfIA), an operational structure in which FMoAWF and MoAFRS do not have any direct jurisdiction. This situation complicates implementation of many duties and responsibilities of the entity CAs and requires necessary updates of relevant legislation. Other examples of indistinctly defined legal responsibilities of the CCA and the entity CAs may also be identified in the *Veterinary Law of BiH* with regard of collection and analysis of epidemiological data and dissemination of feed-back information.

Recommendations

- *Assign the EPA a lead role in harmonizing and updating national legislation.* As stated above, one of the duties of the proposed EPA is to provide suggestions for drafting new legislation. The EPA should be assigned a lead role in harmonizing national legislation with the relevant EU legislation, and of the entity legislation to the national legislation.
- *Clearly define the competencies and duties of the SVO and the entity veterinary services.* This should be accomplished during the next revision of the *Veterinary Law of Bosnia and Herzegovina*.
- *Harmonize Bosnia and Herzegovina legislation with Directive 2006/88/EC.* This should be considered as one of the crucial actions for improvement of the legal basis for aquatic animal health surveillance, since this Directive provides summary legislation regulating most aspects of aquatic animal health surveillance and trading requirements. In addition, it is important to emphasize that the SVO has already taken necessary steps for the harmonization of Bosnia and Herzegovina legislation with EU Directive 2006/88/EC (translation of the EU regulation has already been done).

The need for legal flexibility in defining the national list of animal diseases, mandatorily notifiable diseases and other necessary elements of a surveillance programme

Animal diseases of national concern are those diseases that require the design and implementation of general and specific measures for their prevention, control and eradication depending on the current epidemiological situation. The Bosnia and Herzegovina disease list is imposed in the *Veterinary Law of Bosnia and Herzegovina* (OJ of BiH, 34/02), which is the horizontal Bosnian and Herzegovinan veterinary legislation and, as such, is inflexible and difficult to amend or repeal, particularly given the complicated and extremely slow parliamentary procedure existing in Bosnia and Herzegovina. On the other hand, changes in epidemiological characteristics such as the occurrence and spread of a disease are often very dynamic and thus require timely changes in the legal basis for surveillance and management. Thus, to allow needed flexibility, the supreme legal definition of such a dynamic and essential component of the national surveillance system should be established via vertical sub-law legislation.

Recommendations

- *Specify the national list of diseases and susceptible species for aquaculture animals in the Decision on Measures of Control of Infectious and Parasite Diseases of Animals and their Implementation and Financing.* This mechanism will allow annual

updating and redefinition of diseases and susceptible species, legal prerequisites needed to ensure improved flexibility and overall performance and efficiency of the surveillance system.

- *Require mandatory notification to domestic and international CAs for all diseases and susceptible species included in the national list of aquaculture animal diseases.* In this way, the EU requirements for a sufficient passive surveillance would be met. It is also recommended to enforce these legal provisions in the above mentioned annual Decisions, which would again ensure enough legal flexibility and the ability to make necessary changes in a timely manner.
- *Legally define the definitions of contingency planning, minimal elements of epidemiological investigation of disease outbreaks, and minimal control and eradication measures for diseases.* These should be legally defined in similar way to ensure sufficient legal flexibility and updating.

The need to improve legally imprecise responsibility for health surveillance of wild fish populations

An appropriate approach to include health monitoring of wild fish populations within the overall disease control system is one of basic requirements needed to establish an adequate and internationally recognizable aquatic animal health surveillance programme. This issue is not adequately addressed in the annual plan for targeted surveillance, since it does not define a clear responsibility for the practical implementation of the health monitoring of wild fish populations.

Recommendations

- *Legally enforce clear responsibilities of veterinary inspection and related CA activities for surveillance of health status of wild fish populations based on the geographical jurisdiction of assigned veterinary inspectors and the geographical location of recreational fishing and catchment areas for each river basin.* To implement this recommendation, close collaboration between veterinary and agricultural inspection and recreational fishing associations may be required. The fact that entity inspection services are organized as independent administrations (FAfIA and RafIA) and include all types of inspection services provides a sound basis for the close cooperation of different inspection services whose jurisdictions may overlap with regard to inspection of open-water sources.
- *Assign the responsibility to undertake a pilot project to investigate the health status of wild fish populations to the SVO and the entity CAs.* This will initiate activities aimed at obtaining species profiles for wild fish populations, particularly their health status with regard to fish diseases of national concern. This pilot-project should include all the river basins in Bosnia and Herzegovina where registered fish farms exist. Project design and diagnostic examinations may be the responsibility of the NRL, while sampling of wild fish populations would require close cooperation with recreational fishing associations and the veterinary inspectors responsible for health supervision of farms. A proxy sampling approach (sampling without the probability sampling frame where the sampling frame is defined by spatial locations) should be used. The output of such a pilot-project would be more precise information on the susceptible species present in each drainage basin and their health status with regard to the proposed list of fish diseases, which may serve as a basis for more precise legal definition of surveillance of health status of wild fish populations in Bosnia and Herzegovina.

The need to address inconsistencies in official registration of aquaculture production establishments and problems related to consistency and timing in data collection.

Registration of fish farms and other aquaculture production establishments is regulated by the *Decision on Measures of Control of Infectious and Parasite Diseases of Animals and their Implementation and Financing in the Year 2007* (OJ of BiH, 35/07). According to this legislation, food business enterprises intending to export their products must be registered by the FMoAWF, while establishments whose products are intended for the domestic market are registered by the cantonal CAs. There is a sufficient legal basis for a uniform procedure for registration of the enterprises and for establishment of a uniform and centralized database on registered farms and processing as a basis for issuing the official control veterinary numbers (codes) for registered establishments. Farms and processing plants whose products are intended for export are subject to the regular controls of the SVO Inspection Department.

However, examination of documents provided by the SVO concerning farms registered on the cantonal and entity levels shows that the registration data for the two groups do not have the same level of precision. The registration documents for farms intending to export includes information on the species that are intended for farming and trade, farming capacity, etc., while such information is not included in the registration license for farms registered at the cantonal level for domestic trade only. SVO activities to improve the registration process have included a request to the entity CAs to carry out the process of revision of registration of the farms, followed by the uniform checklist for the processing plants in accordance with the above legislation as a basis for issuing the official control veterinary numbers (codes) for registered establishments. Nevertheless, this effort seems to be insufficient to ensure a consistent and timely updated database on registered enterprises.

Recommendations

- *Design and implement the use of uniform report sheets for collecting and submitting registration data on the number, profile and age categories of susceptible species for each farm, regardless of its status in domestic and international movement of animals.* This activity will ensure collection of better quality data on registered fish farms, including more reliable and timely data on species profiles and the farming capacities of all registered farms. Such data is essential for epidemiological analyses and a consistent aquatic animal health surveillance programme. These data sheets should be completed and dispatched to the SVO by responsible veterinary inspectors on monthly basis. This would ensure establishment of a centralized and timely updated database on registered farms and their production profiles and would serve as a prerequisite to collect necessary input data for risk assessment of health status for each farm by the proposed epidemiological and risk analysis unit at the SVO. It would also provide timely and sufficient information on the health status of registered aquaculture establishments for use by responsible veterinary inspectors and other stakeholders.

Issues related to the management of movement of aquatic animals

Problems and inconsistencies

Aquaculture zoning is internationally accepted as a useful tool for effective risk assessment-based decision making and an essential requirement for consistent management of aquaculture animal health and domestic and international movement of aquaculture animals and their products (FAO, 2004). This requirement has been legally enacted in BiH since 2005 via the *Decision on Veterinary Health Conditions that Must be Fulfilled when Putting into Trade Live Fish, Mollusks, and Crustaceans and*

Products Thereof (OJ of BiH, 62/05). This Decision clearly states that the movement of live aquatic animals can be done only between zones/farms with the same health status (approved [disease-free] zone, approved [disease free] farm, unapproved zone, unapproved farm, approved [disease free] farm in the unapproved zone disease free, buffer zone). However, a zoning programme has never been implemented.

Lack of enthusiasm and political cooperation to initiate aquaculture zoning

By the provisions of the above mentioned Decision, the system of approved aquaculture establishments and zones has been foreseen. The entity CAs (FMoAWF and MoAFRS) are designated as the authorities responsible for implementation of the zoning process, while the SVO has a coordinating and supervisory role; thus initiative for the zoning has to come from entity CAs. However, officials of the FMoAWF underline that the initial steps must be done by the fishfarm owners. Another related problem highlighted by the officials of SVO and entity CAs is that all river basins in BiH are shared between the two entities, a fact which complicates the field situation. Therefore, there appears to be insufficient enthusiasm and political cooperation to initiate the zoning process in Bosnia and Herzegovina aquaculture. Nevertheless, according to the provisions of the relevant EU legislation (*Reg. 2006/88/EC on Animal Health Requirements for Aquaculture Animals and Products Thereof, and on Prevention and Control of Certain Diseases in Aquatic Animals (OJ L 328)*), the sustainable export of aquaculture products from Bosnia and Herzegovina to the EU market may be achieved only if the decision-making and disease management system is based on an appropriate zoning of aquaculture as a prerequisite for reliable risk analysis and communication procedures.

Recommendations

- *Initiate signing of an Agreement of Mutual Understanding and Political Cooperation.* An agreement addressing aquaculture issues is needed between the governments of the Federation of Bosnia and Herzegovina and RS or between their respective ministries (FMoAWF and MoAFWRS). Such an agreement is a common initial step when issues of sharing inter- or intranational hydrographic areas among countries or regions occur (FAO, 2004), and it should provide sufficient formal and political grounds to initiate cooperation between the BiH entities with regard to the zoning process.
- *Start with a precise geographical delineation of all river basins and the differentiation of zones within.* This activity should be coordinated by the EPA and SVO and would require the involvement of other services such as agricultural and water management, which are already under jurisdiction of entity CAs.
- Differentiate fish farms within established zones according to their health status as demonstrated through results of targeted surveillance programmes carried out to date.

The need for transparency of animal movement data

Despite the fact that the official process for the international and domestic movement of aquaculture animals generates a significant amount of animal health data (date and location of all international and domestic movements, quarantine, aquaculture species, samples taken, laboratory test results, etc.), these data are not collected and analysed in a way that ensures their consistent utilization. Consequently, there are no transparent, well-timed and easily accessible databases that would serve as a reliable basis for analysis and decision making to aid in the proper management of the animal movement process. As a result, the veterinary inspectors responsible for control of the health status of the farm of origin are not able to have on-time and accurate information on the health

status of the farm of destination of the shipment. In general, the sole responsibility for international and domestic movements of live aquatic animals lies with the officially designated veterinary inspectors for each zone/farm. Appropriate realization of the zoning process, backed up by a consistent, transparent and easily accessible database on the health status of all registered establishments is essential to improve national policy concerning domestic and international movement of aquatic animals.

Recommendations

- *Design and enforce implementation of uniform report sheets for collecting and submission of registration data.* Use of uniform report sheets for collection data on the number, profile and age categories of susceptible species for each farm, regardless of its status in domestic and international movement of animals, should be considered. This was also included among the recommendations for improvement of the organizational and legislative framework for aquatic animal health surveillance.

CONCLUSIONS

Following the 1992–1995 war and the consequent enormous human losses and devastation of infrastructure, aquaculture production in Bosnia and Herzegovina was successfully renewed and has now reached a level of development that has resulted in an officially permitted export of aquaculture products to the demanding EU market. This achievement should be considered a significant breakthrough for Bosnian and Herzegovinian agriculture and as an initial benchmark for other agricultural sectors in the long and challenging way to EU market access.

On the other hand, permission to export to the EU market also represents an ongoing challenge for all Bosnian and Herzegovinan CAs and other stakeholders and requires continuous improvement of all aspects of national aquaculture production. Establishment and maintenance of an adequate aquatic animal health surveillance and disease control system is surely one of the key elements of a successful and internationally recognized aquaculture production.

The current complexity of the Bosnia and Herzegovina aquatic animal health surveillance and disease control system is an unavoidable outcome of the country's complex political structure, which involves multilevel CAs. Consequently, a lack of effective communication and clearly defined responsibilities among the CAs and deficiencies in the use of standardized forms for collection, collation and analysis of disease surveillance and fishfarm registration data have been highlighted as the major inconsistencies of the system. To address these limitations, some practical and relatively undemanding actions have been recommended, primarily to establish the Expert Panel for Agriculture (EPA), which should be coordinated by the SVO and take a lead role in coordinating and implementing the other recommended activities.

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Health status of aquatic animals in Bosnia and Herzegovina

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ABSTRACT

According to the State Veterinary Office (SVO) of Bosnia and Herzegovina, there are 34 salmonid, five cyprinid and two marine fish farms registered. Additionally, a number of fish farms are in the process of registration. Regular monitoring of viral fish diseases began in 2003. The National Reference Laboratory (NRL) for viral fish diseases, in cooperation with veterinary inspectors, has implemented all decrees assigned by the SVO and has performed analyses at registered fish farms. The situation in Bosnia and Herzegovina with regard to the presence, distribution and spread of viral diseases of salmonid species is favourable because the country is a major fish producer in the region and is oriented to its own production of fry through the existence of quality hatcheries and thus imports only a small percentage of fry. Because there are no cyprinid hatcheries in Bosnia and Herzegovina, the country is forced to import fry from other countries in the region. Fortunately, cyprinid viral diseases have not been reported from these sources. Because of the implementation of preventive measures at fish farms and the internal control of health status, especially at full-system fish farms, the presence of bacterial and parasitic pathogens is minimal.

INTRODUCTION

Bosnia and Herzegovina has very advantageous climatic, geographical, hydrological and ecological conditions for the intensive production of freshwater and marine fish and molluscs in controlled production systems. Its water resources, which belong to the basins of the Black and Adriatic seas, include 20 000 km of rivers and streams, 400 ha of lakes and 1 400 ha of coastal waters. These clean and abundant water resources have enabled the presence of some 119 species of salmonid and cyprinid fishes.

The beginning of artificial breeding in Bosnia and Herzegovina dates back to 1894 when the first salmonid fish farm “Vrelo Bosne” was established on the headwaters of the Bosna River with a capacity of 600 000 fry. The first cyprinid fish farm was founded in 1902 in Prijedor with an area of 300 acres.

Among the countries of the former Yugoslavia, Bosnia and Herzegovina leads in the production of salmonids and plays a significant role in the production of cyprinids. During the 1992–1996 war, most fish farms were ruined and production stopped. After 1996, privatization of state fish farms occurred, the reconstruction and modernization of production began, and new fish farms were established. It is important to note that by 1999 the nation's aquaculture production had returned to the pre-war level of production in 1991. Apart from significant increases in the production of rainbow trout and brook trout, new technologies for the breeding of grayling, Adriatic trout and arctic char are being adopted. In marine culture, the production of seabass and gilthead seabream has increased several times, and the production of toothfish, mussels and oysters is starting.

The advantages that Bosnia and Herzegovina possesses for potential aquaculture development are the quality of its waters, the absence of major fish diseases in open waters, the high-quality of its hatcheries and other fish-breeding facilities, its trained and available work force and the existence of facilities for fish processing. Bosnia and Herzegovina thus has the capacity to increase its fish production and the exportation of live fish. There is also the possibility of producing native fish species for ranching in local waters and their exportation to the European Union (EU).

HEALTH STATUS OF AQUATIC ANIMALS

Today, according to the State Veterinary Office (SVO) in Bosnia and Herzegovina, there are 34 salmonid, five cyprinid and two marine fish farms registered. A certain number of fish farms are also in the process of registration.

The development of the aquaculture sector and the growth in intensive aquaculture production in Bosnia and Herzegovina has been accompanied by the development of associated scientific expertise. In particular, the growth of the sector that has occurred since 2003 has been accompanied by the active involvement of the veterinary profession. The SVO, with the collaboration of the Department of Aquaculture, Veterinary Faculty of the University of Sarajevo and the veterinary inspectors in the Federation of Bosnia and Herzegovina (FBiH) and the Republic of Srpska (RS), has created an operational model and established a system for the monitoring and of control fish diseases at the State level with the aim of preventing, controlling and eradicating infectious diseases of fish and shellfish according to the standards of the World Organisation for Animal Health (OIE). At the same time, appropriate legislation has been established that will regulate problems in Bosnia and Herzegovina's aquaculture and is in accordance to EU directives.

The monitoring of viral fish diseases was begun for viral haemorrhagic septicaemia (VHS), infectious haematopoietic necrosis (IHN) and infectious pancreatic necrosis (IPN) of salmonid fish and for spring viraemia of carp (SVC) at the State level, which includes almost all of full-system (hatchery and grow-out) and the majority of half-system (grow-out only) fish farms. Reference laboratories have been established, with a National Reference Laboratory for viral fish diseases (NRL) being established at the Department of Aquaculture, Veterinary Faculty of the University of Sarajevo. At the same time, the training of veterinary inspectors and fishfarm owners in the control and monitoring of fish diseases has taken place.

As mentioned above, since 2003 regular monitoring of viral fish diseases has occurred. The NRL for viral fish diseases, in cooperation with veterinary inspectors, has implemented all decrees assigned by the SVO and has performed analyses at registered fish farms. Initially the NRL was unable to apply certain diagnostic procedures because it lacked necessary equipment. Thus samples were processed in Bosnia and Herzegovina by using enzyme-linked immunosorbent assay (ELISA) tests, and the same samples were sent to the European Reference Laboratory for Fish Diseases in Aarhus, Denmark. The results of analyses confirmed the existence of IPN,

while the presence of VHS, IPN, SVC and infectious salmon anaemia (ISA) were not confirmed. By long-term monitoring and the application of measures assigned by the NRL and SVO, the existence of IPN was reduced to few cases.

The national situation related to the presence, distribution and spread of viral diseases of salmonids is favourable because Bosnia and Herzegovina is a major fish producer in the region and is oriented to its own production of fry through the existence of quality hatcheries, with only a small percentage of fry being imported. As there are no cyprinid hatcheries, fish farmers are forced to import fry from neighbouring countries; however, a favourable circumstance is that these countries have not reported the presence of cyprinid viral diseases.

Although there are no national monitoring programmes for bacterial or parasitic diseases, data obtained from fish farms, veterinary inspectors and through the collaboration of the NRL with fish farms indicate that important bacterial diseases such as bacterial kidney disease and yersiniosis have not caused massive morbidity or mortality, although there have been sporadic cases of furunculosis in salmonids and erythrodermatitis in carp. Parasites such as *Ichthyobodo necator*, *Ichthyophthirius multifiliis*, *Gyrodactylus* spp., *Dactylogyrus* spp. and *Diplostomum spathaceum* are seen in six-month-old salmonid and cyprinid fry in intensive production systems but have not been reported to cause mortality. Through the use of preventive measures on fish farms and internal controls on health status, especially at full-system fish farms, the presence of bacterial and parasitic pathogens is reduced to a minimum.

Thanks to the FAO Project TCP/BIH/3101 "Strengthening capacity for the management health in aquaculture in Bosnia and Herzegovina", training of staff of the NRL was conducted at the European Reference Laboratory for Fish Diseases in Denmark, and necessary equipment for analysis through cell culture was purchased. With these improvements, Bosnia and Herzegovina will be able to be actively involved in the control of infectious fish diseases by using appropriate diagnostic methods.

Apart from monitoring and controlling the national fish health status, it is necessary to improve those factors that can significantly influence national aquatic animal health status and the sustainable development the country's aquaculture sector, such as:

- adopting new legislation and modifying existing Bosnia and Herzegovina legislation regulating aquaculture to ensure conformity with EU legislation;
- financing and equipping the NRL and other authorized laboratories so that they can perform relevant specialized diagnostic procedures;
- registering unregistered fish farms;
- implementing disease zoning programmes;
- controlling the transportation of fish and fish products through Bosnia and Herzegovina; and
- controlling fish markets within Bosnia and Herzegovina.

CONCLUSIONS

Bosnia and Herzegovina has very advantageous climatic, geographical, hydrological and ecological conditions for the farming of freshwater and marine fish and molluscs. The national situation with regard to the presence, occurrence and transmission of viral diseases of salmonid species is favourable because Bosnia and Herzegovina is a major fish producer in the region and is oriented to its own production of fry through quality hatcheries. The results of analyses conducted by the NRL and at the European Reference Laboratory for Fish Diseases in Denmark confirmed only the existence of IPN.

Through the implementation of preventive measures on fish farms and the internal control of health status, the presence of bacterial and parasitic pathogens is reduced to a minimum. Apart from monitoring and controlling the national fish health status, it is necessary to improve another factors that can significantly influence national

aquatic animal health or impact upon the sustainable development of the Bosnian and Herzegovinian aquaculture sector.

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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.

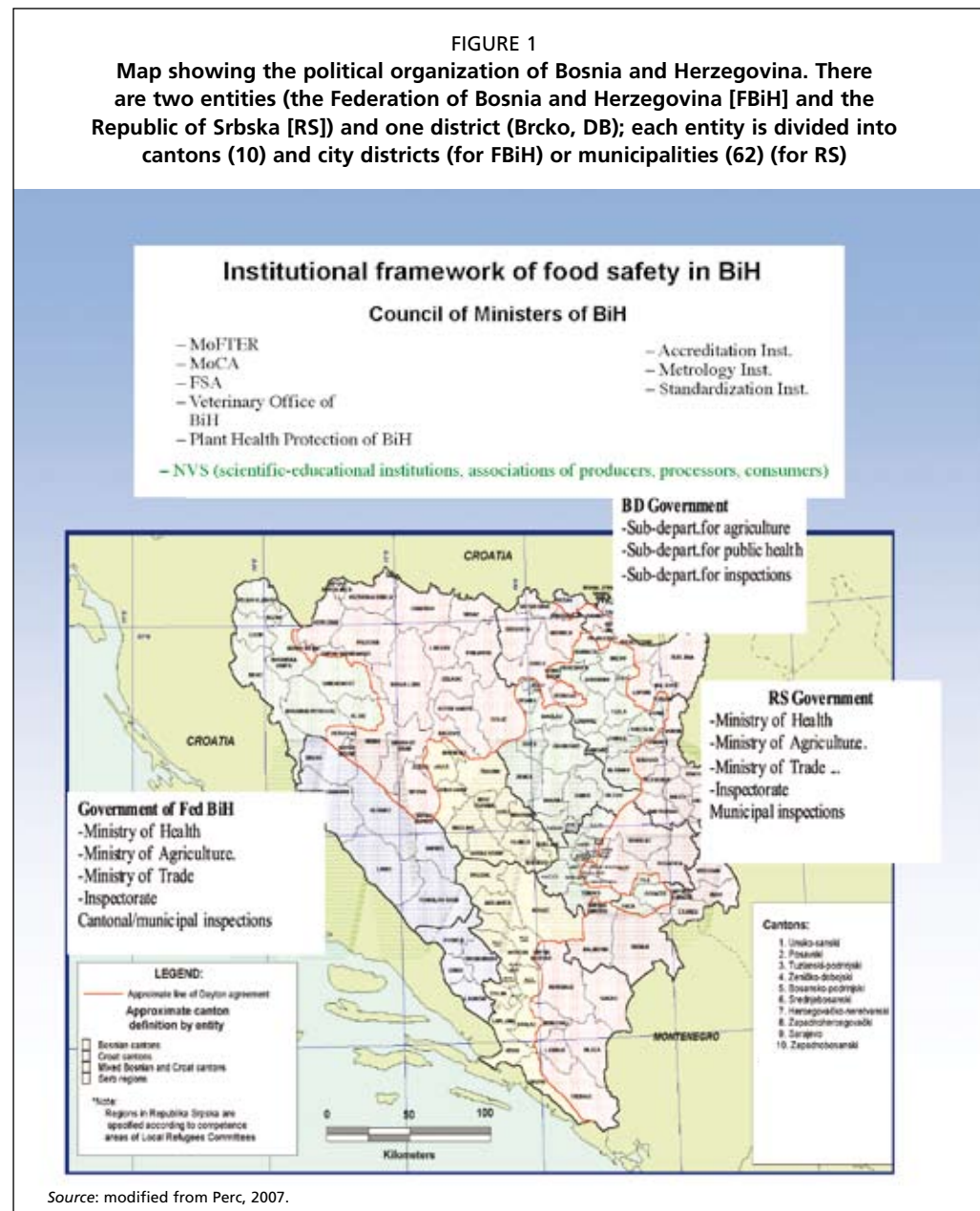
This project’s ultimate goal is the compliance of Bosnia and Herzegovina’s fish producing and processing operators with all requirements that must be met in order for them to be approved for export to the European Union (EU) and other countries. The project’s outputs were to be implemented in 2008, and 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

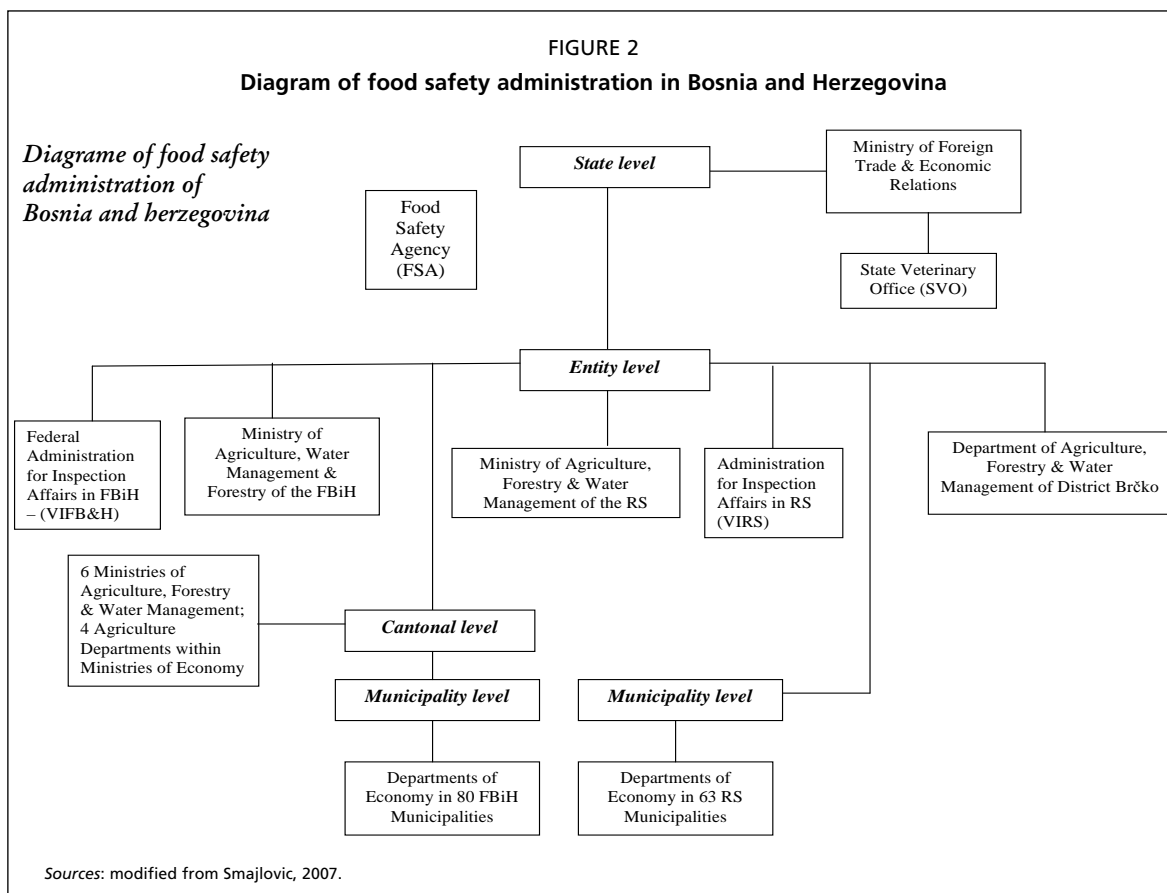


between the entity authorities and international cooperation). The proposals then go to the MoFTER and the Council of Ministries of Bosnia and Herzegovina. The SVO also gathers surveillance data and publishes it in the Official Gazette of Bosnia and Herzegovina.

- **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 to 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.

