

# HIGHER EDUCATION FOR AQUACULTURE/FISHERY AT THE FACULTY OF AGRICULTURE UNIVERSITY OF BELGRADE: IMPLEMENTATION OF THE FIRST BOLOGNA REFORM – LINKING THEORY AND PRACTICE

VESNA POLEKSIĆ, ZORKA DULIĆ, MARKO STANKOVIĆ,  
BOŽIDAR RAŠKOVIĆ, MILAN SPASIĆ, DALIBOR VUKOJEVIĆ,  
ZORAN MARKOVIĆ

*University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia*

## VISOKO OBRAZOVANJE ZA AKVAKULTURU/RIBARSTVO NA POLJOPRIVREDNOM FAKULTETU UNIVERZITETA U BEOGRADU: IMPLEMENTACIJA PRVE "BOLONJSKE" REFORME – POVEZIVANJE TEORIJE I PRAKSE

### *Apstrakt*

U radu je opisana implementacija reforme visokog obrazovanja za Ribarstvo/Akvakulturu na Poljoprivrednom fakultetu Univerziteta u Beogradu. Proces stvaranja novih kurseva vezanih za vodene ekosisteme, njihovu zaštitu i eksploataciju i definisanje kompetencija studenata za akvakulturu na svim nivoima visokog obrazovanja (osnovne, diplomske, specijalističke i doktorske studije) omogućen je unapređenjem obrazovnih i istraživačkih objekata i sredstava, kao i bliskom komunikacijom sa proizvođačima ribe i ostalim interesnim grupama vezanim za gajenje riba.

*Ključne reči: visoko obrazovanje, akvakultura, ribarstvo, reforma, Poljoprivredni fakultet, Univerzitet u Beogradu*

*Keywords: higher education, aquaculture, fishery, reform, Faculty of Agriculture, University of Belgrade*

### INTRODUCTION

Despite the fact that fish farming in Serbia is practiced for more than 150 years, modernized semi intensive carp culture is an emerging agricultural practice in Serbia in the past decade (Markovic et al., 2011). The use of extruded feed adapted to requirements

of different age categories of fish, season and pond productivity, and the establishment of the first carp and trout selective breeding program, together with activities on aquatic resources preservation and remediation, required rethinking of the learning outcomes (LO) needed for modern aquaculture practice, and therefore a reform of the higher education (HE) for aquaculture/fishery. The fact that the teaching staff in Fishery of the Faculty maintained excellent relations with alumni, fish producers and other aquaculture practitioners, as well as the fact that the teaching and research staff managed to obtain several research and education projects to improve education and research facilities, made LO reconsideration a feasible task.

## **HISTORY**

Fishery was the course that was first introduced at the Faculty of Agriculture University of Belgrade as an elective subject from 1969. It emerged from the course Zoology. In 1987 Fishery became a compulsory one-semester course in Animal Sciences. It was thought by our late professor Vera Mitrović Tutundžić, doyen of Serbian aquaculture teaching. The pre- Bologna system consisted basically of: Diploma level - 4 years, and postgraduate levels: master (2 years study and master thesis) and a doctoral thesis. Fishery and Zoology courses were the unique ones dealing with aquatic ecosystems, their protection and exploitation at the undergraduate level. Postgraduate studies were also possible in Fishery, and were actually very accepted amongst students.

## **THE HE REFORM**

With the adoption of the Bologna Declaration in 2003 the reform process of the whole HE system in Serbia started. Courses modularization; ECTS; introduction of student mobility; 3 study levels – bachelor, Master, and PhD; definition of LO, are amongst the processes that enabled harmonization of Serbian HE with the European Higher Education Area (EHEA).

The reform process at the Faculty of Agriculture consisted of rather long discussions and critical reflections about reorganization, improvement, and need of the Serbian agricultural education to adapt to EHEA. With the assistance of the University of Hohenheim, Germany, and University of Thessaloniki, Greece, through the TEMPUS JEP project the Faculty started, and with the adoption of the Law on Higher Education in 2005, the Faculty completed its reform (Poleksic et al., 2006). The acceptance of courses modularization, introduction and allocation of ECTS, and different study levels: BSc, MSc, PhD, and Specialisation offered the opportunity to introduce courses related to aquatic biology and aquatic animals' protection and production. In this period a research area was defined as Applied Zoology and Fishery (AZA) thus profiling the research staff recruited mainly from the Faculty of Biology, from the Zootechnics Department of the Faculty of Agriculture, as well as from other faculties.

## **INTERNATIONALIZATION – BUILDING FACILITIES FOR AQUACULTURE PRODUCTION AND TRAINING**

The renewal of the international relations with leading European institutions made possible investigation and experiments on carp nutrition and the first Serbian selective breeding program, established within the cooperation with Norwegian colleagues from

NOFIMA MARIN, former AKVAFORSK. This cooperation led to the formation of the first Fish feeding Laboratory (in Zemun within the Faculty) and a Hatchery (in Radmilovac – faculty's school estate). Followed participation of the AZA group in one FP6 project: Water Resources Strategies and Drought Alleviation in Western Balkan Agriculture (WATERWEB) that studied Radmilovac experimental school estate aquatic resources and contributed to building of the first outdoor ponds in Radmilovac. Coordination of the FP7 REGPOT framework project "Reinforcement of sustainable aquaculture" (ROSA) with NOFIMA MARIN, Norway and HAKI, Hungary as partners, practically established the Centre for Fishery and Applied Hydrobiology, CEFAH (Markovic and Poleksic, 2009). The project brought the improved hatchery and laboratory equipment, established a Laboratory for waters quality analysis, and enabled building of the experimental carp farm at the Faculty of Agriculture University of Belgrade Experimental School Estate Radmilovac.

Recently, a new project "Little Danube" has started: a remediation of the polluted stream Sugavac and its transformation into a model of the Danube River flowing across Radmilovac. The project permitted construction of the Aquarium building for freshwater fish from the Danube region, and a whole polygon representing, to date, the lower course of the river and its ecosystems.

In addition to facilities built in Radmilovac, education projects (TEMPUS - EC and WUS - Austria) allowed foundation of the Histology laboratory and a research Microscopy laboratory as well as a Central Teaching Laboratory equipped with microscopes and computers.

Finally, modernization of equipment, laboratories foundation, and building facilities was amended with teaching staff additional education in modern teaching methodology (Poleksic et al., 2004); actually part of the teaching staff of AZA were trained in interactive teaching/learning (project with Education forum in 2003), and few years later, a group of teaching staff undergone training in e-learning methodology (WUS project, EPA Master in 2008/09). As a result, the principles of active teaching/learning methodology, including practical training are widely used by the AZA teaching staff, and up to now, there are 5 courses that are thought in the "blended" form (combining face to face and online teaching) and others that are in development, serving "at least" as a repository of the teaching material and information.

## **THE REFORMED CURRICULUM**

Accredited in 2008 in the first round of accreditation in Serbia, together with other study programs and the Faculty as institution, the Study Program Zootechnics contains compulsory and elective courses dedicated to aquaculture and environmental, particularly aquatic ecosystems protection and exploitation.

The following tables summarize the list of courses offered at all study levels by the group from the AZA scientific area:

**Bachelor level – 8 semesters 240 ECTS**

subject	semester	ECTS	Status*:
Zoology	1	7	C
Environmental protection	2	5	E
Earthworm and snail farming	4	6	E
Culture of ornamental aquatic plants, invertebrates and fish	5	6	E
Fishery / Aquaculture	6	6	C
Fishery and fishery waters management	6	6	E
Technical and technological aspect in construction and equipment of aquaculture facilities	6	6	E

\* C - compulsory, E - elective

Besides these, Bachelor in Zootechnics consists of all other courses needed for a BSc level in this discipline: Mathematics, Chemistry, Anatomy, Physiology, Genetics, Population genetics, Animal health protection, Agricultural mechanization, Statistics. Sociology, Economics and management group of subjects, etc..., thus providing student's competences defined for Bachelor in Zootechnics. Concerning aquaculture related subjects: after these subjects completion the student will be able to monitor aquatic environment (by monitoring abiotic and biotic environmental factors), describe diversity, distinguish and classify ichthyofauna, fish and aquatic organisms morphology, anatomy and physiology, customarily examine the fish, plan fish farm facilities, and participate in managing the farm technological process. It should be mentioned that the course Aquaculture is offered as elective subject in the Horticulture curriculum of the Faculty.

**Master level – 2 semesters 60 ECTS**

subject	semester	ECTS	Status*:
Nutrition of fish and other aquatic organisms	1	7	E
Reproduction of fish and other aquatic organisms	1	7	E
Health protection of fish and other aquatic organisms	2	7	E
Production technology in aquaculture	2	7	E
Animal histology	2	7	E

\* C - compulsory, E - elective

For this study level a Diploma work (15 ECTS in 2 semesters) is planned, as well as compulsory Planning of experiments and data analysis in Zootechnics (9 ECTS). Each Master specialization requires Professional practice – 3 ECTS and Study research work - 5 ECTS. Both are offered in the frame of CEFAH activities.

**Specialization level – 2 semesters 60 ECTS**

subject	semester	ECTS	Status*:
Fish nutrition	1	8	E
Fish reproduction	1	8	E
Fish culture	2	10	E

\* C - compulsory, E - elective

Specialization work (18 ECTS in 2 semesters) is obligatory for all students together with Management of production processes in Zootechnics (8 ECTS) and Study research work (8 ECTS).

In the frame of the Master studies "Environmental protection in agriculture (EPA)" offered by the Faculty, following courses are organized by AZA staff:

**Master studies Environmental protection in agriculture EPA**

subject	semester	ECTS	Status*:
Water pollution and monitoring	2	4	C
Ecological aquaculture	2	4	E
Ecological farming of non domestic animals	2	4	E

\* C - compulsory, E - elective

EPA teaches principles of sustainable and responsible agriculture including all aspects of resources protection and modern agricultural practice and legislation.

**Doctoral study level – 6 semesters**

subject	semester	ECTS	Status*:
Molecular genetics and histology of domestic and cultured animals	1	10	E
Animal Ecology	2	8	E
Fish Embryology	2	8	E
Production systems in aquaculture	3	6	E
Breeding technology in aquaculture	3	10	E
Monitoring of aquaculture systems and recipient protection	4	6	E
Fish processing	4	6	E

\* C - compulsory, E - elective

In addition to the subject listed, following make a profile of a Doctoral degree in Aquaculture: Experimental statistics (7 ECTS), Sampling and data analysis in Zootechnics (10 ECTS), Animal Genetics, Selection and Breeding (8 ECTS), Research methodology (10 ECTS), Study research work (40 ECTS), and Doctoral thesis (70 ECTS).

**NUMBER OF STUDENTS**

The reformed curriculum in Zootechnics enrolls 70 to 90 students each year. Among them, depending of the generation, approximately 30 to 40 reach the third year in Zootechnics and learn Fishery. In addition 20 to 30 students in Horticulture take each year Aquaculture as elective course. The MSc as well as Specialization level started enrollment only last year. Up to now 9 PhD students have enrolled the reformed Doctoral curriculum. First among these students defend their theses these days, and the AZA staff is looking forward to reinforcement of our group and improvement of the teaching/learning.

**HE IN AQUACULTURE - FUTURE PLANS**

For the new accreditation cycle in Serbia the Faculty of Agriculture has prepared and recently submitted a revised curriculum including revised LO. After the self evaluation, analysis of students' achievements, and reconsideration of the LO/qualifications needed for responsible aquaculture practice, and counting on the mentioned staff qualifications reinforcement the AZA group will be able to offer some new courses and improve/modify the existing ones.

Also, possibilities of vocational life long learning (LLL) trainings are envisaged through one submitted projects and existing programs in teachers' education will be continued.

## CONCLUSIONS

The reform process of Serbian higher education in the area of Agricultural Sciences allows studies flexibility and profiling from the BSc level, and particularly at MSc, Specialization, and PhD level. The specialization towards aquaculture was made possible with the development of a series of courses dedicated to aquatic environment, its protection and sustainable use that were incorporated in the curriculum for Animal sciences. For the new round of accreditation the AZA group has suggested some renewed courses and some new ones. Learning outcomes have been rethought and redefined.

## ACKNOWLEDGMENT

Supported by the Ministry of Education, Science and Technological Development (projects number TR31075 and 179018).

## REFERENCES

- Marković, Z., Poleksic Vesna (2009): Reinforcement of sustainable aquaculture – the ROSA project. 4th International Conference „Fishery“. Faculty of Agriculture, Belgrade. Conference proceedings, 15-21. (*in Serbian*)
- Marković, Z., Stanković, M., Dulić, Z., Živić, I., Rašković, B., Spasić, M., Poleksić, V. (2011): Aquaculture and fishery in Serbia - status and potentials. 5<sup>th</sup> International Conference “Aquaculture & Fishery” Conference Proceedings. Faculty of Agriculture, Belgrade-Zemun, Serbia, p. 36-40.
- Poleksic, Vesna., Quarrie, S., Pekic, S., Pesikan, A. (2004): Competence building of teachers: Case of the Faculty of Agriculture, University of Belgrade. 7<sup>th</sup> European Conference on Higher Agricultural Education (ECHAE), Profiling the graduate of the future, Copenhagen, August 2004.
- Poleksic, V., Pekic Quarrie, S., Cupina, B., Petric, D., and Drochner, W. (2006): Curricular reform at Serbian Agricultural Faculties: achievements of the TEMPUS JEP towards meeting the needs for rural development. Proceedings of the 8th European Conference on Higher Agricultural Education (ECHAE): The Public and the Agriculture and Forest Industry. 194-197.