

**UNIVERSITY OF ZAGREB
FACULTY OF SCIENCE
Department of Geology**

in cooperation with

**Ruđer Bošković Institute, ZAGREB, ROVINJ
Institute for Oceanography and Fisheries, SPLIT
Institute for Marine and Coastal Research of University in Dubrovnik**

(in review)

INTERDISCIPLINARY DOCTORAL STUDY IN OCEANOLOGY

**Area of Natural Sciences
Field of Geosciences
Branch of Oceanology**

Zagreb, December 2008

1. INTRODUCTION

1.1. Reasons for the proposal of the doctoral study in oceanology

The proposers of the doctoral study in oceanology see the proposed study as a continuation of successful postgraduate study since 1971 at the University of Zagreb, jointly organized by the Faculty of Science of University of Zagreb, Division for Marine and Environmental Research (formerly Center for Marine Research, Zagreb) and Center for Marine research, Rovinj of the «Ruđer Bošković» Institute in Zagreb and Institute for Oceanography and Fisheries in Split and Dubrovnik.

The founder and long-time head of the study was late Marko Branica, DSc professor, senior scientist of the «Ruđer Bošković» Institute and full professor at the Faculty of Science, University of Zagreb. During the former period of time (including academy year 2003/04) there were 236 students enrolled, whereof 169 so far have earned masters degree. Thereby this study appeared as one of the most efficient postgraduate studies at University of Zagreb. Many students with master degree in Oceanology work in scientific research and/or teaching, and have earned doctors degree within their basic branch (physics, chemistry, biology and geology). Numerous students with masters degree in oceanology are successfully working in business (aquaculture especially), public administration and public institutions (national parks, nature parks).

Oceanology has been introduced in 1997 as a separate (interdisciplinary) scientific branch in the field of geosciences (in the area of natural science) in classification of scientific areas of former Ministry of Science and Technology.

At the end of the year 1999 Scientific Council of Oceanology has been established within Ruđer Bošković institute in Zagreb and it is competent for the promotions in the oceanology branch. So far, 41 scientists have been promoted in scientific degrees in oceanology and 51 researcher in assistant degrees. Most of them are employed in Ruđer Bošković Institute (Zagreb, Rovinj) and Institute for Oceanography and Fisheries (Split, Dubrovnik).

Necessity for the doctoral study in oceanology in Croatia is obvious. The country that has sovereignty over about 54.000 km² of sea bottom (in comparison to 57.000 km² of mainland), that is insufficiently utilized, has to make an additional effort to explore that area. In order to be able to use and preserve the marine environment, it is necessary to know and understand the processes in it. Resource utilization of the Adriatic Sea is a Croatian economic, as well as a strategic scientific – research priority.

The sea research is one of the areas in which Croatian researchers have so far shown excellent results and falls into one of the rare areas in which they are competitive at the world level.

Based on the model of the postgraduate study in Oceanology that has been successful so far, competent and leading institutions related to marine education and research in Croatia propose this unique and joint doctoral study. Expectations and wishes of the proposers are to make this study a regional center of excellence for educating oceanologists/oceanographers in the SE Europe and Mediterranean.

In many countries the development of the marine research has led to the establishing of «Graduate School of Oceanography», in Europe eg. in the UK: Southampton (<http://www.soc.soton.ac.uk/>), or Plymouth (<http://www.plymouth.ac.uk/seoes>), in Poland: Gdanjsk (http://www2.univ.gda.pl/fac_eng.html#biol) and in Spain: Mallorca (<http://www.imedeia.uib.es/index>), but also in the USA (<http://www-ocean.tamu.edu/>) and Canada (<http://oceanography.dal.ca/index.html>).

1.2. Previous experience of proposers in realization of postgraduate doctoral studies and other postgraduate studies

Based on what has been stated above, so far the interdisciplinary postgraduate study in oceanology represents positive experience. This proposed program is a model of interinstitutional cooperation with the aim to pursue a quality doctoral study in Croatia at national level.

1.3. Openness of the study towards students' mobility

The same as the previous study, the proposed study will be open to graduates from natural science studies (without conditioned enroll), whereas graduates from unrelated studies (agronomy, veterinary medicine, mechanical engineering, electrical engineering ...) may enroll on the conditions that ask for additional courses in pursuance of the decision of the Doctoral Study Council.

The proposed program ensures transfer of ECTS credit points from related doctoral studies from other universities.

1.4. Possibility of fully or partly joint study programs with universities abroad

Prominent lecturers from numerous European countries (the UK, France, Italy, Germany) and from the USA have expressed their readiness to participate in the doctoral study in Oceanology. Creating shared programs as well as finding financial support needs to be considered.

2. GENERAL TERMS

2.1. The name of the study

Interdisciplinary Doctoral study in Oceanology (Area of Natural Sciences, Field of Geosciences, Branch of Oceanology)

2.2. The holder of the study

University of Zagreb, Faculty of Science, in cooperation with Ruđer Bošković Institute (Zagreb, Rovinj), Institute for Oceanography and Fisheries (Split) and Institute for Marine and Coastal Research of University in Dubrovnik.

Coordinator for study pursuance: Geology Department of the Faculty of Science.

2.3. Institutional strategy on doctoral program development

Scientific research programs and projects of the Ministry of Science, Education and Sport that are the basis for the doctoral study in oceanology will be largely held at cooperating institutions and the Faculty of Science, which contain the main laboratory basis of the proposed study. At the same time, the Faculty of Science will be the holder of the study being the basic institution of higher education that organizes lectures for all natural science disciplines.

2.4. Innovativeness of the doctoral program

As defined, the proposed doctoral study is interdisciplinary (and as such stands out in the previous thirtyfour-year period) since it includes marine physics, marine chemistry, marine biology and marine geology. Moreover, the proposed program is opened to related areas (veterinary medicine, agronomy, law, technologies...). Proposers have positive experience in cooperation, planning and

pursuing education on several locations, in separate institutions, and in field and laboratory activities.

2.5. and 2.6. Conditions of enrolment in the study, in particular conditions for attendants with previous qualifications under the pre-2005 system, and criteria and procedures of the selection of applicants

Applicants with a degree in natural science have the right to enroll in the doctoral study in oceanology. The ones with unrelated degrees (agronomy, veterinary medicine, mechanical engineering, electrical engineering ...), may enroll on the conditions that ask for additional courses in pursuance of the decision of the Doctoral Study Council. Applicants for the doctoral study have to have the average grade in the undergraduate study equal to or higher than 4.0. If the average grade is lower than 4.0 and higher than 3.50 the applicant has to enclose two relevant recommendations (of which one by the mentor). The applications for the enrolment in the doctoral study are reviewed by the Doctoral Study Council and then approved by the Geology Department Council.

So far the postgraduate study in oceanology has offered the possibility of earning either Master's or Doctor's degree. Thus, in the transitional period (until the first Masters are produced under the Bologna Process) the doctoral studies will accept graduate students with a degree from a four-year natural science study (ingeneer or teacher degree) whose average grade equals or is higher than 4.0. Graduate students with a degree from a related four-year study with the above mentioned average will enroll by Doctoral Study Council's special decision on condition that they take additional courses.

2.7. Competency achieved upon completing the studies

Having completed the doctoral study in oceanology, the doctor in natural

sciences, in the field of geosciences, branch of oceanology, will be competent to carry out modern scientific research in the area of oceanology (marine sciences), and obtain basic and profound insight into interactive functioning in the marine system.

A general methodological preparation (understanding of the scientific method, personal practical experience in scientific research and publishing) provides the postgraduate students with a valuable knowledge for business (especially aquaculture), environmental management, higher education and public administration in knowledge-based society.

3. PROGRAM DESCRIPTION

3.1. *The structure and organization of the doctoral program. Full-time and part-time organization.*

The doctoral program in oceanology comprises two components: teaching and research under the supervision of mentor. It is structured in a manner that the emphasis of the first (and partly the second) year of the study lies on the teaching and in later years it is on the scientific research, which eventually results with the doctoral dissertation.

In order to complete the doctoral study, each student needs to collect 180 ECTS credit points, has to publicly defend his/her doctoral thesis and prior to the defense of the dissertation has to have at least one article published in a scientific journal with international review as the main author, and in the end they have to defend the doctoral dissertation.

In the first year of the study the student, candidate for a doctor's degree, in agreement with the study counselor registers for courses totaling 60 ECTS credit points that are connected to the topic of the future doctoral dissertation. As a result of pronounced interdisciplinarity of the study, courses are classified within three classes: (i) obligatory courses for all attenders; (ii) selection of courses within the course group for particular branch (physics, chemistry, biology, geology); (iii) optional courses. Besides the oceanological courses, there might be courses from other postgraduate studies, *i.e.* if needed, courses from other undergraduate studies as well. To register for those courses one has to have a special permission of both the Supervisor of the postgraduate study in oceanology and Supervisors of those other studies. During the first year of the study the student is obliged to hold Seminar I in presence of all the students of the doctoral study. The seminar is a written and publicly presented outline of a current scientific problem, based partially on secondary literature (book, review article), and partially on primary literature. The topic of the seminar and the three-member committee are both chosen by the Doctoral Study Council at the

proposal of the Study Supervisor. If the student does not pass the seminar I he can not continue the study.

Course lecturers direct the student. Course lecturer grades the overall success in the course based on both the student's success in all aspects of the work and his/her test grade.

If the opportunity for additional quality lectures arises (e.g. visiting professor), the Study Supervisor can, with the consent of the Study Council, determine subsequent enrolment and compulsory attendance of one or two courses in any year of the study.

During the second and the third year the student, candidate for a doctor's degree, is included in the research of the chosen research laboratory and in the scientific field of the mentor. The mentor is appointed by the Doctoral Study Council, following suggestion of the professional committee after the defense of the doctoral thesis.

During the second and third year and before the defense of their doctoral dissertation, the students, candidates for doctor's degrees, have to earn 120 ECTS credit points as follows:

- 40 credit points for the writing of the doctoral dissertation
- up to 40 ECTS credit points for being the author or co-author of a published article (in a journal with international review 20 ECTS credit points and in a WoS scientific journal 40 credit points);
- 20 ECTS credit points for two public seminars in mentor's research laboratory in presence of at least 50 % students-candidates enrolled in the same year and the three-member committee appointed by the Doctoral Study Council following the mentor's proposal. One seminar during the third year of the study is from a broad field (Seminar II), and the other is the public defense of the doctoral thesis (Seminar III). Seminar III can be given in the second or the third year of study. The seminar topics are determined by the Doctoral Study Council following the mentor's suggestion.
- up to 40 ECTS credit points by enrolling and passing optional courses.

3.2. The list of compulsory and optional courses with the number of teaching hours required for their fulfillment and the respective ECTS credit points.

(i) obligatory courses for all attenders (180 teaching hours need to be registered, i.e. 24 ECTS credits need to be collected):

Code	Lecturer	Course	Hours of teaching	ECTS credit
8700	M. Orlić	Physics of the Sea	30	4
8300	M. Plavšić	Marine Chemistry	30	4
8400	D.Viličić	Marine Biology	30	4
8500	M. Juračić	Marine Geology	30	4
8800	F. Kršinić	History of Marine Research	15	2
8801	T.Legović, M.Juračić, M.Orlić	Science in Society and Ethics	15	2
8802		Seminar I	30	4
8803		Seminar II	40	10
8804		Seminar III (public defence of thesis)	40	10

(ii) Selection of courses within the course group for particular branch (physics, chemistry, biology, geology);

Selected courses for the marine physics group (minimum 60 teaching hours need to be registered, i.e. 10 ECTS credits need to be collected):

Code	Lecturer	Course	Hours of teaching	ECTS credit
8701	V. Dadić	Measurement in physical oceanography	20	4
8702	M. Kuzmić	Satelite oceanography	15	3
8703	Z. Pasarić	Time series analysis in oceanography	20	4
8704	N. Supić	Interaction at the air-sea interface	15	3
8705	B. Grbec	Natural and anthropogenic climate changes	15	3

8706	M. Gačić	Selected Topics in Physical Oceanography	15	3
8707	M. Kuzmić, I. Janeković	Numerical modelling in physical oceanography	15	3
8708	M. Morović, D. Risović	Ocean optics	15	3
8709	P. Vukadin	Ocean acoustics	15	3

Selected courses for the marine chemistry group (minimum 60 teaching hours need to be registered, i.e. 10 ECTS credits need to be collected):

Code	Lecturer	Course	Hours of teaching	ECTS credit
8301	B.Čosović	Organic matter in the sea	20	4
8302	N.Mikac, V. Cuculić	Trace elements in seawater, marine organisms and sediments	20	4
8303	V. Žutić, V.Svetličić, A.Hozić	Marine organic matter organization and function	20	4
8304	R. Precali, D. Fuks	Primary and secondary production in shallow seas	15	3
8305	D. Hršak	Biotransformation of organic pollutants in marine environment	15	3
8306	B. Raspor T. Smital	Biological effects of metals and organic pollutants on marine organisms	15	3
8307	S. Terzić	Analytical chemistry of organic contaminants in the marine environment	15	3
8308	M. Ahel M.Najdek-Dragić	Biomarker organic compounds in the marine science	20	4
8309	H. Bilinski	Precipitation and adsorption processes in the sea	15	3
8310	I.Ciglencečki Jušić	Anoxia and hypoxia in marine environment	15	3
8311	V. Žutić	Oxidation-reduction processes in the sea	15	3
8312	G. Kniewald	Geochemical equilibria and processes in seawater	15	3
8313	S.Lulić	Radioecology	15	3

8314	B. Ćosović	Physical chemistry of the sea and seawater	15	3
8315	M. Mlakar, D. Omanović, N. Mikac	Analysis of trace elements in marine environment	15	3

Selected courses for the marine biology group (minimum 60 teaching hours need to be registered, i.e. 10 ECTS credits need to be collected):

Code	Lecturer	Course	Hours of teaching	ECTS credit
8401	B. Antolić	Marine Phytobenthos	15	3
8402	T. Bakran Petricioli, I. Grubelić	Biodiversity and ecology of sponges	15	3
8403	A. Benović, M. Batistić	Planctonic cnidaria	15	3
8404	N. Bihari	Marine Molecular Toxicology	15	3
8405	R. Batel	Programmed Biosynthesis and Genotoxic Risk	15	3
8406	J. Dulčić	Reproduction and embryology of fishes	15	3
8407	I. Katavić , L. Grubišić	Aquaculture	20	4
8408	N. Krstulović	Marine Bacteriology	15	3
8409	F. Kršinić	Marine Zooplankton	15	3
8410	T. Legović	Modelling in ecology	20	4
8411	I. Marasović	Marine phytoplankton	15	3
8412	M. Peharda Uljević	Bivalve biology	15	3
8413	A. Požar- Domac	Marine Zoobenthos	15	3
8414	G. Sinovčić	Biology of pelagic fish	15	3
8415	M. Šolić	Marine Ecology	15	3
8416	E. Teskeredžić	Diseases of fish, shellfish and crustaceans	15	3
8417	Z. Teskeredžić	Nutrition requirements of fish, shellfish and crustaceans	15	3
8418	A. Traversi	The meiofauna of marine sediments	15	3
8419	N. Vrgoč, I.	Fisheries	20	4

	Jardas			
8420	A. Požar-Domac	Marine biodiversity preservation and protection	15	3

Selected courses for the marine geology group (minimum 60 teaching hours need to be registered, i.e. 10 ECTS credits need to be collected):

Code	Lecturer	Course	Hours of teaching	ECTS credit
8501	M. Juračić	Selected topics in marine geology	20	4
8502	M. Juračić	Recent sedimentation in the sea	15	3
8503	V. Čosović	Environmental micropaleontology	20	4
8504	N. Horvatinčić, L. Palinkaš	Isotope Oceanography	20	4
8505	I. Sondi	Biomineralization	15	3
8506	E. Prohić	Geochemistry of marine environment	15	3
8507	I. Sondi	Mineral Particles and Pollution Processes	15	3

(iii) optional courses for all attenders (120 teaching hours need to be registered, i.e. 24 ECTS credits need to be collected):

- All optional courses from course groups on this doctoral study
- courses from doctoral studies in physics, chemistry, biology, geology, geography, veterinary medicine, and biotechnology at University of Zagreb,
- Courses from the following list:

Code	Lecturer	Course	Hours of teaching	ECTS credit
8805	Pečar-Ilić, Ružić	GIS in Oceanography	15	3
8806	T. Legović	Data analysis in oceanography	20	4
8807	L. Klasinc, T. Cvitaš	Atmosphere and the sea	20	4
8808	A. Jaklin,	Methods and Techniques in	15	3

	E.Teskeredžić, I.Sondi	Oceanology		
8809	B. Jergović	Science communication	15	3
8810	B.Vukas	Legal Aspects of the Protection and Uses of the Sea	15	3

In the first year of the study, student has to register courses with minimum of 60 ECTS credit points.

3.3. Compulsory and optional activities and criteria for ECTS credit point allocation

Compulsory activities consist of carrying out research resulting in the writing of the doctoral dissertation, giving seminars and passing exams in the required number of courses. Students can obtain a part of the needed ECTS credit points through optional activities such as participation in scientific meetings (one poster earns up to 3 credit points, one oral presentation up to 4 credit points), residence and research in eminent research laboratories and groups, participation in summer schools (workshops) – 4 credit points, assistance in undergraduate and graduate lecturing (maximum 6 hours a week – 60 hours of assistance earn 5 ECTS credit points). The allocation of credit points is carried out by the committee that follows the candidate's performance and it consists of the study counselor, mentor and another lecturer.

3.4. Description of each course and/or module

CURRICULA

Notice: Curricula are in the other document:

http://geol.gfz.hr/poslijediplomski/OCEANOLOGY_Curricula.pdf

3.5. The rhythm and students' obligations. Conditions for progress through the study, registering in the next semester or trimester, i.e. next study year and preconditions for each course or course group.

The applicants for the doctoral study who meet the enrolment requirements and have permission, register the first year of the doctoral study as a whole, in principle by October 1, of the current academic year.

In the first year of the study, student, candidate for a doctor's degree, in agreement with the study counselor registers for courses totaling 60 ECTS credit points that are connected to the topic of the future doctoral thesis. The name of the Study Supervisor is put as the holder of Seminar I. There are no prerequired courses except for students who don't have an adequate degree and who have to pass the required undergraduate courses, that they had to register when they enrolled to the doctoral study, before taking tests in doctoral study courses.

Besides the oceanological courses, there might be courses from other postgraduate studies, i.e. if needed, courses from other undergraduate studies as well. To register for those courses one has to have a special permission of both the Supervisor of the postgraduate study in oceanology and Supervisors of those other studies. During the first year of the study the student is obliged to hold Seminar I in presence of all the students of the doctoral study. The seminar is a written and publicly presented outline of a current scientific problem, based partially on secondary literature (book, review article), and partially on primary literature. The topic of the seminar and the three-member committee is chosen by the Doctoral Study Council following the proposal of the Study Supervisor. If the applicant doesn't pass the seminar I he can not continue the study.

Student has to register a year as completed. All attended courses and tutorials need to be signed by the lecturer. All unattended courses are stamped „Not accomplished“.

To register for the second year it is necessary to pass the exams in courses bearing at least 30 credit points, including the compulsory Seminar I. Seminar II, Doctoral thesis and courses from the first year that were not held are

then entered.

To register for the third year all courses from the first year need to be accomplished and Seminar III has to be registered (if it was not registered in the second year).

Students of the doctoral program register for all but degree (ABD) years (maximum three) after they have registered the third year as completed. When registering for an ABD year the Head of the Department has to be handed a short report on the work with the mentor's commentary.

In order to complete the doctoral study, each student has to have collected 180 ECTS credit points, has to publicly defend his/her doctoral thesis proposal before the defense of the doctoral dissertation, has to be the main author of at least one scientific paper published (or accepted) in a scientific journal with an international review and finally defend the doctoral dissertation.

3.6. System of counseling and leading through the study, student selection method, obligations of study counselors and doctoral dissertation mentors, as well as of candidates for the doctor's degree.

When enrolling, each student is assigned a study counselor who is chosen by the Doctoral Study Council, the advisory body of the Geology Department Council.

Doctoral Study Council comprises fifteen members, from the doctoral study teaching staff that are chosen by the Department Council, that has to take into consideration the presence of fields and institutions which participate in carrying out the programme, also keeping in mind that its members have to be the Study Supervisor and Deputy Study Supervisor.

Doctoral Study Council also chooses the committee consisting of a counselor, Study Supervisor and another lecturer at the doctoral study which then monitors the student's performance and the earning of the ECTS credit

points.

When registering the doctoral thesis the student is assigned a mentor who takes over the obligations of the study counselor. Mentor's main task is to help the student with advice and working conditions to produce the doctoral dissertation. They share the responsibility for the student's progress, their inclusion in the scientific research and scientific improvement. If a mentor does not have an academic title, but has a title of a junior researcher (or higher), or is not from the Department of Geology at the Faculty of Science, a reporting co-mentor fulfilling that requirement will be assigned. A mentor has to be scientifically active in the area of the student's future thesis, which has to be proven by scientific paper published in the last five years. Mentors are appointed by the Department Council following the suggestion of the student and the committee before which the doctoral thesis is to be defended. Mentor has to consent to the appointment.

Study Supervisor and Deputy Study Supervisor as well as the lecturers at the study are chosen by the Geology Department Council at the Oceanology Study Council's proposal. Study Supervisor is in charge of the smooth operation of the study as a whole, he suggests to the Head the solutions to current operational problems, and they chair the Study Council sessions. The Deputy takes over the Study Supervisor's obligation when they are unable or upon an „ad hoc authorization”. Only a person with an academic title in science (assistant professor or research fellow) can be appointed study official, lecturer, Study Counselor or Mentor.

Applicants with a degree in natural sciences have the right to enroll in the doctoral study in oceanology. The ones with related degrees which don't fit (agronomy, veterinary medicine, mechanical engineering, electrical engineering...), may enroll the study in oceanology under the condition that they have to accomplish additional courses connected to natural graduate studies according to the Resolution of the Doctoral Study Council. The additional courses are not included in the 60 ECTS credit points that the students of the first year register, but are included in the ones registered in the second and third year.

The applications for enrolment are reviewed by the Doctoral Study Council and approved by the Department Council.

Applicants for the doctoral study have to have the average grade at the undergraduate study of at least 4.0 or 3.5 with two relevant recommendations (of which one has to be by the mentor).

3.7. The list of courses and/or modules that students can choose from other postgraduate doctoral and specialist study programs.

Besides the courses in the Doctoral Study in Oceanology, students can take courses in other doctoral studies, i.e. if needed from other undergraduate studies in accordance with the statutes of the University and the Faculty of Science. Those courses can amount to a maximum of 15 ECTS credit points in the first year of the study. In order to register those courses, consents by the Supervisor of the Doctoral Study in Oceanology and the Supervisors of the other studies are needed.

3.8. The list of courses and/or modules that can be held in a foreign language (stating the language).

In case there is interest (over 50% of all students), all listed courses can be held in English.

3.9. Criteria and conditions of transfer of ECTS credit points – allocating the credit points to courses that can be chosen from other studies at the University – to the proposer or other Universities.

Students that register courses from other doctoral studies are in principle

granted the ECTS credit points that are given to those courses at their original studies.

3.10. Concluding the study and conditions for registering for the doctoral thesis. Procedure and conditions for the acceptance of the doctoral thesis. Procedure and conditions for the grading of the doctoral dissertation. Conditions and ways of defending the doctoral dissertation.

To complete the doctoral study, each student has to have 180 ECTS credit points, has to publicly defend his/her doctoral thesis, prior to the defense has to have at least one article published (or accepted) in a scientific journal with international review as the main author, and in the end has to defend his/her doctoral dissertation.

During the second or third year the applicant publicly explains and defends the thesis of the suggested doctoral dissertation („thesis acceptability test“). At least 14 days prior to the thesis defense the applicant has to present the elaborated proposal of the doctoral thesis to the public (in the Geology Department office). The applicant presents the aim of the work and the expected scientific contribution. The three-member committee, which is appointed by the Study Council following the proposal of the Study Supervisor, judges the real contribution of the work and its possibilities according to the requirements for a doctoral dissertation. Special attention is paid to the methodological part and the testing of the candidate on research methods that he/she intends to use. The possibility of completion in the given time frame is also assessed. The Committee issues a written report of the checking. If the judgment is positive, the thesis is approved by the Study Council and then forwarded through the Faculty of Science Council to the Senate for approval. In case of a positive decision the applicant can proceed with the production of the doctoral dissertation.

If the judgement is negative, the applicant has a right to come in front of the Committee after three months. If the judgement should be negative again he

loses the right to make a doctoral theses.

The student can hand in the doctoral dissertation for grading having previously accomplished all the exams and defended the seminars. The dissertation is graded by the committee with an odd number of members (three or five) appointed by the Department Council, provided that at least one of the members be from outside the Faculty of Science and proposed by the Doctoral Study Council. Members of the Committee can be lecturers and scientists with the title of assistant professor, research fellow or higher. Candidate's mentor can not be the Chairperson of the Committee. The committee grade the dissertation, bearing in mind that a doctoral dissertation has to contain original scientific contribution, which in their opinion corresponds to at least three scientific articles in scientific journals with international review, of which at least one in a scientific journal from the WoS list. Moreover, the thesis has to prove the student's knowledge of the modern scientific problem areas in the area of the thesis, his/her knowledge of theoretical principles and methods used, and in the end their ability to present his/her ideas, results and knowledge in a coherent and legible text on his/her own. The written committee report is submitted to the Study Council for adoption.

The candidate then binds the doctoral dissertation after it has been adopted and before its defense.

The student can defend his/her doctoral dissertation before the end of the third study year on condition that he/she has met all the requirements, collected the prescribed number of ECTS credit points, published at least one article in a journal with international review as the main author, and if his/her written application has been approved by the Study Council.

Doctoral dissertation is publicly defended, in front of a committee with an odd number of members (three or five) that has been appointed by the Study Council following the same principles as for the Doctoral Committee, except that one deputy has to be appointed as well. Candidate's mentor can not be the Chairperson of the committee. The defense consists of the candidate's uninterrupted presentation that can last up to 60 minutes, of his/her responses to

the committee members' questions and of his/her responses to the questions from the audience.

A majority of committee member votes is needed for the candidate to defend his/her doctoral dissertation, and the committee has to publicly announce its decision.

A record has to be kept on the defense of the doctoral dissertation and later signed by all the members of the committee. Candidate's curriculum vitae, dissertation's summary and a list of published paper are enclosed to the record.

The diploma of a doctor of science is issued by the University, and is presented by the Head of University at a graduation ceremony.

3.11. Conditions under which students who discontinued the study or were stripped of their right of attendance in one study program can proceed with the study.

Students can continue their education, in accordance with regulation 3.10. and 3.14., where they interrupted it unless they were stripped of their rights of attendance in the way predicted by the University Statute.

3.12. Conditions under which a student is entitled to a certificate of all-but-degree status, as a part of the life-long education.

If the student reaches the all-but-degree stage of the doctoral study, he/she can be issued a certificate on taken and accomplished courses and undertaken professional scientific activities. The text and layout, as well as the fee for such a certificate have to be coordinated at the level of the Faculty of Science and the University.

3.13. Conditions and way of obtaining the degree of a doctor of science by

enrolling in the doctoral study without attending courses and passing exams.

Obtaining the degree of a doctor of science by enrolling in the doctoral study without attending courses and passing exams can be granted to persons who have published papers in the area of oceanology as main authors bearing at least 140 ECTS credit points and after two compulsory public seminars in front of a three-member committee in accordance with regulation 3.1.

3.14. The maximum time elapsed between the beginning and the completion of the study (recommended four years for full-time students and seven for part-time students for a doctoral degree).

Students have their student's rights during the first six years of study (three study years and three at ABD stage). If there are legitimate and documented reasons and if the student requests it, the Department Council can exceptionally extend the student's rights to two more academic years. Should the student fail to earn his/her degree of science in that time, he/she will be issued a certificate on taken and passed courses and undertaken professional scientific activities.

4. CONDITIONS OF THE STUDY REALIZATION

4.1. *Locations of the study program*

A part of the study program will take place on the premises of the Faculty of Science (Horvatovac Street, Roosevelt Square), while a part of the program will be achieved in cooperation with cooperational institutions (*Ruđer Bošković Institute, Institute for Oceanography and Fisheries Split, Institute for Marine and Coastal Research, Dubrovnik*). Research work of the study program will take place mainly on the premises of the laboratories, within the institutions of applicant's employment (PMF, IRB, IOR, IMP...). The field work and field research that will be coordinated with the sailing out of the research vessels should be pointed out.

4.2. *Data on the premises and equipment envisaged for the study, especially the data on the research resources (research equipment, human resources).*

The premises within Faculty of Science (Department of Geology, Department of Biology and Department of Geophysics), Ruđer Bošković Institute (ZIMO - Zagreb and CIM - Rovinj), IOR Split and IMP Dubrovnik completely serve the needs of teaching within Oceanology doctoral study program. Faculty of Science and above mentioned institutes own various researchal equipment which fulfil conditions of a reasarch work in oceanography. The research vessels *Vila Velebita, Bios, and Naše more* present a specific educational and research base that will use students of proposed doctoral study.

The most of active researchers and lecturers in oceanology have been employed within institutions that proposed this program.

4.3. *The list of scientific projects on which the doctoral study is based.*

Some of the recent projects financed by the Ministry of Science, Education and Sport:

0119411- The Role of Sampling Media in the Geochemical Investigations

Esad Prohić, DSc, professor

0119413 - Thermal Events in the Adriatic-Dinaric Carbonate Platform

Ladislav Palinkaš, DSc, professor

0119402 - Sediments from the Adriatic Sea and Coastal Zone

Mladen Juračić, DSc, professor

0119330 - Atmosphere-Adriatic System -Prof.dr.sc. Mirko Orlić

0098119 – Tidal and longer-period dynamics of the northern Adriatic.

Milivoj Kuzmić, DSc.

0098120 – Analysis and biogeochemistry of organic compounds in the aquatic environment. Marijan Ahel, DSc, professor

0098121 – Physical and biogeo- chemistry of trace metals in natural aquatic systems. Ivanka Pižeta, DSc.

0098122 – Nature and reactivity of organic compounds in the sea and environment. Božena Čosović, DSc.

00098123 – Electroanalytical research in liquid and solid electrolytes. Milivoj Lovrić, DSc

0098124 – Models and Informa-tion Systems for Envi-ronmental Protection and

- Fairway Control. Ivica Ružić, DSc
- 0098125 – Protection of biocoenotic balance in aquaculture receiving waters.
Emin Teskeredžić, DSc.
- 0098126 – Preparation and properties of metal surfaces in the environmental protection. Dunja Čukman, DSc.
- 0098127 – Processes at interfaces and eutrophication. Vera Žutić, DSc.
- 0098128 – Radionuclides in environmental systems. Delko Barišić, DSc.
- 0098130 – Metals and cellular biomarkers. Biserka Raspor, DSc.
- 0098131 – Persistent organohalogen pollutants in some coastal area of Dalmatia. Mladen Picer, DSc.
- 0098132 – Geochemistry of recent and ancient sedimentary systems of the Adriatic platform. Goran Kniewald, DSc., professor
- 0098133 – Models of aquatic ecosystems. Tarzan Legović, DSc, professor
- 0098134 – Microbial communities as catalysts in biotransformation processes. .
Dubravka Hršak, DSc.
- 0098135 – Multixenobiotic Resistance Mechanism as a Biomarker of Environmental Quality. Tvrtko Smital, DSc.

4.4. Institutional management of the doctoral program.

The holder of the doctoral study in oceanology is the University of Zagreb, Faculty of Science, Geology Department in cooperation with «Ruđer Bošković» Institute (Zagreb, Rovinj), Institute for Oceanography and Fisheries – IOR (Split) and the Institut for Marine and Coastal Research (IMP) of University in Dubrovnik, while the main coordinator of the doctoral program is the Geology Department of Faculty of Science.

The management of the proposed doctoral program is subsidiary. The holder of the program is the faculty of Science at the University of Zagreb. Organizational and financial control is at the level of the Geology Department of the Faculty of Science. The fundamental body that takes care of the study is the Council of the Doctoral Study in Oceanology. The council members are chosen among the lecturers of the study taking into consideration the presence of the groups and institutions that participate in carrying out the program and by the Council of the Geology Department of the Faculty of Science. The person responsible for the program management is the Supervisor of the doctoral study appointed by the Council of the Geological Department, following the proposal of the Council of the Doctoral Study in Oceanology.

4.5. Contractual relations between the student and the holder of the doctoral study, i.e. fellow institutions: for obtaining ECTS credit points, carrying out research work, defending doctoral dissertation, undertaking compulsory and optional activities.

They will be regulated during the year.

4.6. List of lecturers and collaborators that will participate in the courses at the beginning of the study. Data on each engaged teachers.

List of lecturers that will participate in the courses at the beginning of the study:

Ahel, Marijan	Kniewald, Goran
Antolić, Boris	Kršinić, Frano
Bakran-Petricioli, Tatjana	Krstulović, Nada
Batel, Renato	Kuzmić, Milivoj
Batistić, Mirna	Legović, Tarzan
Benović, Adam	Lulić, Stipe
Bihari, Nevenka	Marasović, Ivona
Bilinski, Halka	Mikac, Nevenka
Ciglencečki-Jušić, Irena	Mlakar, Marina
Cuculić, Vlado	Morović, Mira
Cvitaš, Tomislav	Najdek-Dragić, Mirjana
Ćosović, Božena	Omanović, Dario
Ćosović, Vlasta	Orlić, Mirko
Dadić, Vlado	Palinkaš, Ladislav
Dulčić, Jakov	Pasarić, Zoran
Fuks, Dragica	Pečar-Ilić, Jadranka
Gačić, Miroslav	Peharda-Uljević, Melita
Grbec, Branka	Plavšić, Marta
Grubelić, Ivana	Požar-Domac, Antonieta
Grubišić, Leon	Precali, Robert
Horvatinčić, Nada	Prohić, Esad
Hršak, Dubravka	Raspor, Biserka
Jaklin, Andrej	Risović, Dubravko
Janeković, Ivica	Ružić, Ivica
Jardas, Ivan	Sinovčić, Gorenka
Jergović, Blanka	Sondi, Ivan
Juračić, Mladen	Smital, Tvrtko
Katavić, Ivan	Supić, Nastjenjka
Klasinc, Leo	Svetličić, Vesna

Šolić, Mladen

Terzić, Senka

Teskeredžić, Emin

Teskeredžić, Zlatica

Travizi, Ana

Viličić, Damir

Vrgoč, Nedo

Vukadin, Predrag

Vukas, Budislav

Žutić, Vera

4.7. The list of teaching premises for the realization of the study (teaching and research), consent of the supervisor of the teaching premises for workshops, statement on the existence of the required equipment and space for the workshops in accordance with the study program, and the list and qualifications of the collaborators that will participate (teach and hold workshops)

Include amphitheatre, seminars and laboratories at the Faculty of Science, University of Zagreb, laboratories and amphitheatre of the cooperational institutions (IRB Zagreb, Rovinj, IOR Split, IMP University of Dubrovnik), and especially the research vessels that are managed by the mentioned institutions.

4.8. Optimal number of students that can be enrolled in terms of space, equipment and number of lecturers, especially with respect to the number of potential mentors

Optimal number of students that can be enrolled in the doctoral study with respect to the available material and human resources and the scientific field work is up to 15 students per year.

4.9. Estimated expenditures of the doctoral program and student fees

The estimation of the average expenditure is defined by the Geology Department Council every academic year at the proposal of the Doctoral Study Council.

4.10. Financing of the doctoral program

It is expected that the junior researchers scheduled by the Ministry of Science, Education and Sport will be financed by the Ministry. For part-time students (from abroad, for personal needs, employees of various companies) a

price list will be determined in cooperation with the management of the Faculty of Science and the University of Zagreb.

4.11. Quality of the doctoral program

The program of the postgraduate study in oceanology, which was the basis for this proposal and program, was granted a work permit in 2000. In year 2004 a visitation and evaluation of the work of the Geology Department (which is the coordinator of carrying out the program) was performed and our efforts in changing the program and the implementation of the changes were commended. In order to have a student feedback on quality control and course efficiency we plan to continue with student questionnaires. Such system of monitoring has proven to be very successful in the past. For such a system department councils have been established at the Faculty of Science.

Discussions and interviews with graduate students are an important corrective for the program evaluation and its improvement.

Geology Department in cooperation with the Students' Office of the postgraduate studies at the Faculty of Science has established a database on alumni which registers their further professional development, thus evaluating the previous programs retroactively.