S.04-17

SIMON FRASER UNIVERSITY

Senate Committee on University Priorities
Memorandum

TO: Senate

FROM: John Waterhouse
Chair, SCUP
Vice President, Academic

RE: Proposal for a Graduate Diploma in "Quantitative Methods in Fisheries Management"

DATE: January 30, 2004
(revised: February 9, 2004)

At its January 7, 2004 meeting SCUP reviewed the proposal from the Senate Committee on Graduate Studies for the Graduate Diploma in "Quantitative Methods in Fisheries Management" and recommended the following motion:

Motion

That Senate approve and recommend to the Board of Governors the proposal for a Graduate Diploma in Quantitative Methods in Fisheries Management.

encl.

c: J. Driver
W. Parkhouse
B. Lewis
R. Peterman
K. Lertzman

SCUP 04 - 002

SIMON FRASER UNIVERSITY
DEAN OF GRADUATE STUDIES
MEMORANDUM

TO: SCUP

FROM: Jonathan Driver, Dean of Graduate Studies

SUBJECT: Graduate Diploma: Quantitative Methods in Fisheries Management

DATE: 9th December 2003

cc: Dr. W. Parkhouse, Chair, Faculty Graduate Studies Committee, Faculty of Applied Sciences; Dr. B. Lewis, Dean of Applied Sciences; Dr. R. Peterman, School of Resource and Environmental Management; Dr. K. Lertzman, Graduate Program Chair, School of Resource and Environmental Management

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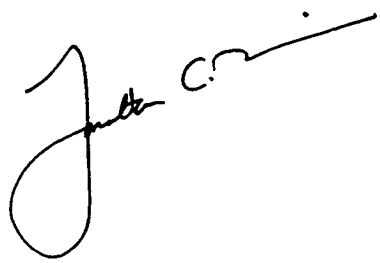
At its December 8th meeting SGSC passed a motion approving the Graduate Diploma in Quantitative Methods in Fisheries Management, and this is now being forwarded for consideration by SCUP.

SGSC notes that the proposed program fills a need for professional graduate education, and that the cost to the University is minimal.



SIMON FRASER UNIVERSITY

SCHOOL OF RESOURCE AND
ENVIRONMENTAL MANAGEMENT

FACULTY OF APPLIED SCIENCES
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8 January 2003

Proposal for a Graduate Diploma in "Quantitative Methods in Fisheries Management"

Sponsoring Department

The School of Resource and Environmental Management, in the Faculty of Applied Sciences. People to contact for further information are: Randall M. Peterman (phone 4683), Bill de la Mare (3067), or Sean Cox (5778).

Name of Diploma Program

Graduate Diploma in Quantitative Methods in Fisheries Management

Rationale

The purpose of this proposed diploma program is to provide professionals who work in the field of fisheries science or fisheries management with an opportunity to upgrade or enhance their quantitative skills. There are two main drivers behind upgrading the skill levels of current fisheries professionals within governmental and non-governmental organizations. Over the next 5 to 10 years, many of these professionals will retire, which will require that the remaining staff take on new tasks and that new talent be hired. We are already seeing evidence of this demographic trend. In addition, fisheries management and scientific analyses are becoming increasingly quantitative, and expectations for scientific advice and understanding of methods of analysis often go beyond the skills of current staff. Because a full commitment toward a graduate degree is impractical for many full-time working professionals, applying coursework toward a certified upgrading process is an attractive alternative. Interest in such a training program within the School of Resource and Environmental Management (REM) and the Department of Statistics and Actuarial Science (STATS) at SFU has already been expressed by fisheries and environmental scientists from Fisheries and Oceans Canada offices in Nanaimo, downtown Vancouver, and Annacis Island, as well as biologists from provincial government fisheries offices and environmental consulting firms such as Golder Associates and ESSA Technologies.

Benefits

A graduate diploma program in "Quantitative Methods in Fisheries Management" would provide two main lasting benefits to SFU, the School of Resource and Environmental Management, and the Department of Statistics and Actuarial Science. First, it would provide a modest infusion of new students to REM and STATS courses (about 3 to 5 each year), who will pay tuition fees without imposing additional supervisory duties on faculty. Second, networking

and collaboration among members of REM, STATS, and public and private agencies will increase by having practicing professionals actively participating in REM and STATS courses.

The diploma candidates will be the main beneficiaries of the program because they will learn state-of-the-art methods in fisheries stock assessment and management. For instance, nearly every public agency currently demands that fisheries professionals include measures of risk and uncertainty in their assessments of fishing and other human impacts on aquatic resources. However, many quantitative methods have been developed over the past decade, leaving professionals to learn them on their own with varying degrees of success. The proposed curriculum will provide a solid background of theoretical and practical experience that will increase each student's productivity and marketability.

Operation of the Diploma Program

Admission Requirements

Decisions on all applications will be made in the School of Resource and Environmental Management. Applicants are normally required to hold an undergraduate degree in one of the natural or applied sciences. Applications from students with other degrees or with equivalent professional training and experience will also be considered. Decisions on admissions will be based on undergraduate grades (normally, a CGPA of 3.0 is required), a one-page statement of student interest in the program, and three (3) letters of reference.

Candidates must submit the following documentation to the Graduate Secretary in the School of Resource and Environmental Management when applying for the program:

- SFU's standard application for admission to a graduate program, available from SFU's website: http://www.reg.sfu.ca/ps/admissions.html;
- Official copy of transcript of undergraduate and graduate grades (mailed directly from the granting institution);
- 3 confidential letters of reference (mailed directly from the referees);
- TOEFL and TWE test scores are required for applicants whose first language is not English.
- Students must meet the normal admission requirements for graduate diploma programs at Simon Fraser University (Section 1.3.2 of the Graduate General Regulations in the SFU Calendar).

Required Courses for the Diploma

Most existing fisheries professionals have backgrounds in fields such as biology or ecology, which typically under-emphasize quantitative methods. The proposed curriculum is intended to address this chronic problem directly by focusing on quantitative methods in modelling and statistics. However, most of these methods are presented in the courses below in a context of applied fisheries management problems, which will ensure that the material remains relevant and directly applicable to the real world.

Students must complete at least 22 credit hours, composed of the courses listed below, which will be offered at the Burnaby Mountain campus. The courses will provide a significant upgrade to the skills of most Bachelor's degree candidates, while also allowing them to specialize in a specific topic. Each of these courses is offered once per year. We do not anticipate any extra offerings of the courses in the proposed program due to the limited availability of faculty. Diploma program students will be graded on the same basis as regular SFU graduate students.

There will be a mandatory non-credit "Orientation Workshop" for all new students in this diploma program. This one-day workshop will provide diploma-program students with an overview of how the various courses below will help them meet the challenging issues in fisheries science and management. The workshop will also provide an opportunity to initiate dialogue between these diploma students (who will bring significant work experience to class discussions) and the faculty and fisheries graduate students.

Required Courses (the first four preferably taken in the following order)
REM 613-5 Current Topics in Fisheries Management
STAT 650-5 Quantitative Analysis in Resource Management and Field Biology
REM 663-5 Advanced Methods for Fisheries Stock Assessment
REM 661-5 Evaluation of Living Resource Management Strategies

***Plus** one or more of the following courses in REM or STATS, or others approved by the Academic Program Coordinator and instructor of the course:*

REM 612-5 Simulation Modelling in Natural Resource Management
REM 625-5 Risk Assessment and Decision Analysis for Management of Natural Resources
STAT 602-3 Generalized Linear and Non-linear Modelling

Brief Description of Each Course

REM 612-5 Simulation Modelling in Natural Resource Management
Methods of constructing simulation models and analysing them through sensitivity analysis. Application of simulation modelling to research and management of environmental and resource systems. Topics will include management of wildlife, forests, insect pests, fisheries, pollution problems, energy resources, and recreational land use. Prerequisite: REM 611 or permission of the instructor.

REM 613-5 Current Topics in Fisheries Management
Models of fish population dynamics, methods of data analysis, and management in the context of uncertainty. Case studies of management of various world fisheries. In-depth exploration of selected current fisheries problems including extensive data analysis. Focus will be primarily on biological aspects of fisheries management while illustrating how these interface with economic, social and institutional concerns of managers. Prerequisite: permission of instructor.

REM 625-5 Risk Assessment and Decision Analysis for Management of Natural Resources
Use of quantitative methods of risk assessment and decision analysis to explicitly take uncertainty into account when making decisions in management of natural resources. Methods of quantifying uncertainty and the resulting risks. Examples from management of forests, wildlife, fisheries, water resources, energy, and toxic chemicals. Communicating information about uncertainties and the resulting risks to resource managers, the public, and scientists. Advantages and limitations of various quantitative methods. Includes computer laboratories. Prerequisite: REM 612 and 621, or permission of instructor.

REM 661-5 Special Topics course: Evaluation of Living Resource Management Strategies
Use control-system ideas to describe the management of living resources, including open-loop (set-point) control, closed-loop (feedback) control, and passive and active adaptive management

approaches. Examine the process to design management systems for living resources, including interpreting policy as operational objectives, iterative analyses and stakeholder consultation, assessment methods, decision rules, evaluation of management options using closed-loop simulations, performance measures, trade-offs between multiple objectives, and methods for the presentation of results. The course includes a laboratory project to evaluate a management approach for a selected resource using control system computer simulation. Prerequisite: REM 613 or permission of instructor.

REM 663-5 Special Topics course: Advanced Methods for Fisheries Stock Assessment
Methods for conducting fisheries stock assessment by developing dynamic models of harvested populations, models for fisheries observations, and statistical fitting criteria for quantifying uncertainty. Course focuses on extensive simulation/estimation approaches to testing the limits of assessment algorithms and procedures. Combined lecture/computer labs. Prerequisite: REM 613 or permission of instructor.

STAT 602-3 Generalized Linear and Non-linear Modelling
A methods-oriented unified approach to a broad array of nonlinear regression modelling methods including classical regression, logistic regression, probit analysis, dilution assay, frequency count analysis, ordinal type responses, and survival data. A project will be assigned related to the student's field of study. Prerequisite: STAT 302 or 330 or permission of instructor.

STAT 650-5 Quantitative Analysis in Resource Management and Field Biology
The use of statistical techniques and mathematical models in resource management with special emphasis on experimentation, survey techniques, and statistical model construction. (5-0-0) Prerequisite: A course in parametric and non-parametric statistics.

Implications for existing courses

No course or credential will be discontinued as a result of this new diploma program in "Quantitative Methods in Fisheries Management".

Budget and Resource Implications

There will be minimal additional costs to offering this diploma program. First, there will only be a small number of students who will be admitted to this program (approximately 3 to 5 each year). Second, because they will likely be full-time working professionals, they will only take one course per semester (which will only be offered during regular daytime slots). Third, there will be room in each of the pre-existing courses listed below and in the computing facilities for this number of additional students. If there is any constraint on space in courses due to heavy enrollment by MRM and Ph.D. students (which we do not anticipate), the numbers of students admitted to the diploma program will be temporarily reduced. Fourth, reviewing the additional number of applications each year and advising the few who are admitted will not add significantly to the current workload of those who will be involved (the Graduate Secretary in REM and the Academic Program Coordinator). Fifth, no additional library resources will be required; existing holdings related to fisheries science and management will meet the needs of these additional students.

Tuition Fees

Tuition fees for students in this Graduate Diploma Program will be set on the same per-credit-hour basis as other graduate non-degree students.

Faculty involved in this program are listed in Appendix 1, and the exact text for the entry in the SFU Calendar is provided in Appendix 2.

Appendix 1

Faculty for Graduate Diploma in Quantitative Methods in Fisheries Management

Dr. Randall M. Peterman, Professor, School of Resource and Environmental Management

Randall M. Peterman specializes in quantitative methods to improve fisheries management. His research focuses on: (1) key processes that affect fish population dynamics, (2) effects of uncertainties on conservation risks and management decisions, and (3) approaches to reducing uncertainties. His research team uses large data sets, simulation modelling, classical and Bayesian statistics, and decision analysis methods.

In 1990, Dr. Peterman won Simon Fraser University's Excellence in Teaching Award and a University Research Professorship. In 2001 he was appointed as a Canada Research Chair in Fisheries Risk Assessment and Management. He has co-chaired a panel for the Canadian Global Change Program of the Royal Society of Canada.

Dr. William de la Mare, Professor, School of Resource and Environmental Management

William de la Mare has been very influential in international and national conservation and management bodies, both in science and policy development. He has specialized in the development of management methods for marine living resources, including extensive experience in the development of statistical methods for the scientific assessment of marine mammals, fish and seabirds. Dr. de la Mare was an early developer of the precautionary approach to the management of capture fisheries. Before joining REM he was Principal Research Scientist at the Australian Antarctic Division.

Dr. de la Mare was a consultant on two expert groups convened by the Food and Agricultural Organization of the United Nations, one on high seas Driftnet Fishing and the other on the Precautionary Approach to the Management of Capture Fisheries. He was a consultant on the classification of endangered species for the World Conservation Union (IUCN) and Chairman for the Working Group on Fish Stock Assessment of the Commission for the Conservation of Antarctic Marine Living Resources.

Dr. Sean P. Cox, Assistant Professor, School of Resource and Environmental Management

Sean Cox is fisheries scientist focusing mainly on the conservation and management of aquatic ecosystems. His research applies fisheries stock assessment methods, ecosystem modeling, and statistical decision theory to address complex issues involved in the management of B.C. commercial and recreational fisheries, native fish community restoration in the Great Lakes, and multi-species harvest policies in the Central Pacific ocean. His work emphasizes ecosystem-based management by taking into account the dynamics of physical, biological, and human components of aquatic systems.

Dr. Cox works closely with federal, state, and provincial fisheries management agencies and he has served as a consultant providing training and support for aquatic resource management programs in B.C., the U.S. Great Lakes, and Colorado River.

Dr. Carl J. Schwarz, Professor, Statistics and Actuarial Science

Carl Schwarz's research program is in two areas: capture-recapture experiments and statistical consulting in environmental impact studies. It is motivated by real problems

encountered by ecologists and health researchers.

Current research projects include: estimating of animal abundance, survival, movement and related parameters using mark-recapture methods; multi-list methods used to estimate the size of populations where incomplete lists are kept of members; and designing and analyzing environmental impact studies.

Appendix 2

Entry for SFU Calendar

Graduate Diploma in Quantitative Methods in Fisheries Management
School of Resource and Environmental Management
Simon Fraser University
8888 University Drive,
Burnaby, B.C. V5A 1S6

Academic Program Coordinators

R.M. Peterman	B.Sc. (UC-Davis); Ph.D. (UBC)
W. de la Mare	B.Sc.(CIT, Melbourne, Australia); Ph.D. (U. York, UK)
S.P. Cox	B.Sc.(Mass.-Lowell); M.Sc., Ph.D. (UBC)

This is an interdisciplinary program that provides an opportunity to study the latest quantitative methods in fisheries management. The program is aimed at those with a background in fisheries science and management, as well as those who would simply like to learn more about this field. The graduate diploma in Quantitative Methods in Fisheries Management (GDFM) provides a strong foundation in the quantitative tools that are necessary for doing fish stock assessment and providing scientific advice in support of fisheries management decisions. This diploma program will provide working professionals in the field with an opportunity to upgrade their skills in the increasingly important areas of statistics, simulation modelling, and analyses of uncertainties and risks. The diploma emphasizes both the theory and the application of these methods to real-world situations.

Application and Admission
Applicants are normally required to hold an undergraduate degree in one of the natural or applied sciences (a minimum CGPA of 3.0 or B). Applications from students with other degrees or with equivalent professional training and experience will also be considered.

Applicants must submit the following documentation to the Graduate Secretary in the School of Resource and Environmental Management:

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- Official copy of transcript of undergraduate and graduate grades (mailed directly from the granting institution);
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