

# Progress Report and Revised Budget

## **Deployment of an acoustic data logger on commercial fishing vessels to evaluate the potential of fishing-induced declines in local pollock abundance**

by

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## PROJECT DESCRIPTION

We undertook a “proof of concept” project to evaluate the feasibility of installing acoustic data loggers on catcher/processors in the EBS pollock fishery to study localized depletion of pollock. The project is developing a prototype data logger that interfaces with the ship’s 38 kHz echo sounder and captures the acoustic backscatter returns. To date, we have developed the system and installed it on three catcher/processors (Island Enterprise, Kodiak Enterprise, and Alaska Ocean). The system has been tested and implemented and works quite satisfactorily. The backscatter data is post-processed and integrated with observer and logbook data. A preliminary analysis has been conducted that shows that the devices record information that is correlated with pollock catches. Further work will include classifying the searching behavior of the vessel, identifying pollock aggregations detected while searching, and evaluating what inferences, if any, can be made concerning the rate at which those aggregations are reduced in abundance. We believe that this project has resulted in successful implementation of the proof of concept project. We propose that the research move into the second “operations” phase, in which the system will be installed on multiple fishing vessels, and more sophisticated analytical tools will be developed for inferring the temporal dynamics of pollock spatial pattern using multiple data sources.

## FUNDING TO DATE

In 2001 this project (SFOS 01-054) was proposed to the PCC Research Center for multiyear funding. The PCC Research Committee approved funding (\$23,229) for this project for one year (mainly salary). PCC further requested the investigators to locate other funding for requested equipment. Fortunately, we were able to obtain equipment from a NOAA Technology Grant in 2001 and were able to equip 3 vessels (Island Enterprise, Kodiak Enterprise, and Alaska Ocean) for data collection in 2002 and beyond.

PCC provided additional funding in 2002 (\$57,477) to continue this project to evaluate the technology and to develop analytical tools. In 2003 we are requesting the PCC to consider a similar amount of continued funding of this project (\$63,968).

The budget for 2002 included salary for Quinn and Weststad, travel to the field and for research meetings, money for a workstation and software, and 3 months salary for a Ph.D. graduate student to perform analysis of the acoustic data collected from the ships equipped to collect data. The principal investigators met in Seattle in October, 2002 to review the progress of the project and for future planning.

To date we have not been able to locate a quantitative student to work on the project. However, we were able to obtain a grant from the Alaska Fisheries Science Center for 2 additional years of student funding for this project. Consequently, it may be easier to attract a student with a guaranteed level of 3 years of support.

## OPERATIONS IN 2002

In 2002 acoustic data collection and storage systems were installed on three PCC vessels to test the system. This trial period was used to test and debug the systems and to investigate the feasibility of data collection and the quality of data collected. We were able to rapidly fix problems that developed at the early stages of deployment. One problem was that the computers

and operating software were dated on some of the vessels. However, industry cooperative research funding from the Alaska Fisheries Science Center enabled us to upgrade the systems and enable data capture and storage.

Preliminary analysis of portions of the data indicate that it is of sufficient quality to provide insight on fishing operations and examination of catches relative to fish density. Some of these results were presented at the 2002 ICES Hydroacoustic Symposium. That work was written up as Contribution 67 of the ICES Symposium on Acoustics in Fisheries and Aquatic Ecology, Montpellier, France, 10-14 June 2002. It was presented as a poster by co-PI Martin Dorn and is attached as an Appendix to show the results we have obtained. Vidar Westpestad also attended the symposium and related meetings to share our research findings.

The poster displayed acoustic backscatter along vessel cruise tracks for PCC vessels equipped the logging system in winter 2002. Cruise tracks were confined mostly to the area of greatest fishery removals, but showed considerable fine-scale structure, including multiple passes over the same area, and overlap between different vessels. These features are important because they would allow evaluation of changes in pollock distribution over time and comparison of data collected by different vessels. In contrast, the echo-integration survey by the NOAA research vessel *R/V Miller Freeman* made a single pass over the fishing grounds. Regularly spaced transects during the scientific survey enable straightforward inferences to population abundance, but the overall density of coverage is low compared to fishing vessels, and there is limited ability to assess changes in pollock abundance during the fishing season. The hydroacoustic signal was only weakly correlated with corresponding pollock catches, although it was possible that an exact correspondence between the integrated signal and the catch was not obtained due to inaccuracies in recording tow locations. However, the data need to be analyzed in greater detail, and further work regarding standardization and calibration is needed.

### PROPOSED RESEARCH IN 2003

In 2003 we plan to attempt to calibrate the hydroacoustic system on at least one vessel. We hope that through system calibration we can standardize the data collected and make inter-vessel comparisons. Also, there are vessels that have installed ES60 systems, and we will attempt to install data collection systems on three vessels to increase spatial coverage in the Bering Sea. We hope to install the acoustic data collection drives on the *Starbound*, the *American Triumph*, and perhaps one other vessel yet to be named. It is quite inexpensive to purchase the data loggers (only \$500 a piece).

For the analysis phase of the project, we wish to collaborate with Dr. Tony Booth, of Rhodes University in South Africa. Dr. Booth is spending 8 months with Terry Quinn in Juneau this year, under the auspices of the Fulbright program. Dr. Booth specializes in spatial analysis, data processing, and population dynamics, and is eager to lend his expertise to deal with the large-scale data issues involved. Dr. Booth's task will be to develop an efficient data-mining algorithm for extracting the important information from the disk drives. This work will provide the necessary intermediate step of obtaining useful information that a student can then develop into a thesis project. A copy of Dr. Booth's curriculum vitae is attached.

## BUDGET

Previously Awarded Budgets in 2001 and 2002 and Proposed Budget in 2003

	Awarded 2001		Awarded 2002		Proposed 2003	
	Months	Amount	Months	Amount	Months	Amount
<b>SALARIES AND BENEFITS</b>						
Quinn	0.5	5009	1	10517	1	11358
Student	1	1196	3	4860	8	14416
<b>TRAVEL</b>		1500		14000		14000
<b>SUBCONTRACT</b>						
Wespestad		12500		13000		13000
Booth						5000
<b>SUPPLIES</b>		0		0		3000
<b>EQUIPMENT</b>		0		12000		3000
Workstation, Software						
<b>TUITION</b>		3024		3100		194
<b>TOTAL</b>		<b>23229</b>		<b>57477</b>		<b>63968</b>

### *Budget Justification*

The budget for 2003 includes about 1 month of salary for Quinn, Wespestad (subcontract), Booth (subcontract), and 8 months salary for a Ph.D. graduate student. We request and anticipate a rollover of previous funds, which will then bring the total student funding up to 1 year and complete the amount necessary for a full workstation and the acoustic data processing package called Echoview. Supplies money will be used for disk drives and data cartridges for the data loggers.

Money is requested for travel to the field and for research meetings. The principal investigators plan to meet together in 2003 to review the progress of the project and for future planning. In addition, the investigators plan to show off research findings in Dutch Harbor and Seattle. Investigators also plan to attend an ICES meeting in Bergen, Norway in mid-May 2003, which deals with the use of commercial vessels to understand fish behavior, an ideal meeting related to this project. We also may need to use some of the money to get to the vessels in case of an equipment breakdown.

# CURRICULUM VITAE

## **Anthony John Booth**

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### **EDUCATION**

- 1994-1997 **Doctor of Philosophy** in Fisheries Science, Rhodes University  
1993 **Bachelor of Science (Honours)** in Ichthyology and Fisheries Science (Resource Management), with Distinction, Rhodes University  
1990-1992 **Bachelor of Science** in Zoology and Computer Science, Rhodes University.

### **SCHOLARSHIPS, BURSARIES AND AWARDS**

- 2002-2003 Fulbright Researcher Award  
2000 International Foundation for Science Scholarship, IFS/DANIDA Award<sup>1</sup>  
1998 International Foundation for Science Scholarship<sup>2</sup>

### **ACADEMIC POSITIONS HELD**

- 2001 - Senior Lecturer in Fisheries Science  
1998 – 2000 Lecturer in Fisheries Science

### **PROFESSIONAL RECORD**

Technical advisor to the Fishery/Aquatic GIS Research Group and member of the Zoological Society of Southern Africa and the *SANCOR* Linefish Research Group. Approached to appraise research proposals for the National Science Foundation (USA), Foundation for Research Development (RSA), Natural Sciences and Engineering Research Council of Canada, and the North Atlantic Treaty Organisation.

Authored/co-authored 28 peer reviewed scientific articles and presented 23 conference papers on aspects of GIS, spatial analysis, stock assessment and fish biology.

Supervised four MSc and one PhD theses. Currently supervising three MSc and three PhD students.

Keynote speaker at the *Second International Symposium on Spatial Analysis/GIS in the Aquatic Sciences* held in September 2002 at the University of Sussex, UK. Invited to be on the organising committee and co-edit the peer-reviewed proceedings of three international symposium proceedings.

### **RESEARCH INTERESTS AND CURRENT PROJECTS**

Research interests lie in quantitative fisheries biology and ecology, concentrating on spatial aspects of fish biology, stock assessment and management within Southern Africa. Current research focuses on spatial analysis and quantitative ecology. These research areas include the development of spatially disaggregated, age-structured models that are analysed within a Bayesian framework, and the development of GIS. Other research interests include the visualisation of multidimensional biological data, non-linear statistics and Monte-Carlo integration algorithm development.

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<sup>1</sup> Awarded for noteworthy peer-reviewed research in the sub-Saharan region.

<sup>2</sup> First South African to receive an International Foundation for Science research grant.

## APPENDIX.

Summary of research findings to date: Contribution 67 of the ICES Symposium on Acoustics in Fisheries and Aquatic Ecology, Montpellier, France, 10-14 June 2002.