REPUBLIC OF INDONESIA
MINISTRY OF EDUCATION AND CULTURE
DIRECTORATE GENERAL OF HIGHER EDUCATION

Marine Sciences Education Project

Central Project Implementation Unit, Jakarta

Final Report - Team Leader
Consultants' Activities

Prepared by

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31 October 1995

Lavalin International Inc.

In association with

International Development Program of Australian Universities and Colleges
P. T. Hasfarm Dian Konsultan

ACKNOWLEDGMENT

This is to acknowledge **Eduplus Management Group, Inc**., whose management of the Consultancy Services Contract of the Marine Sciences Education Project on behalf of SNC-Lavalin International, Inc. is greatly appreciated.

Special thanks go to Dr. Farid Ma'ruf, and Dr. Sahala Hutabarat who both served as project director during my consultancy. I would also like to thank Mr. F. M. Suranto for his constant support and assistance.

Of course, I would also like to thank all the MSEP consultants who worked so hard to make the project a success.

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Summary

The consultancy services portion of the Indonesia Marine Science Education Project commenced in November of 1990. During the five years of the consultancy services contract 84 individual consultants from 15 countries provided services covering approximately 33 different subject areas of marine science. Approximately 60 percent of the 618 months of consultancies were provided directly to the 6 participating universities and most of the remaining 40 percent was provided via consultants who traveled among the universities. Consultants' specialties covered core marine sciences such as oceanography and marine ecology, marine conservation, marine chemistry, remote sensing, mariculture, marine physiology, marine resources assessment, marine acoustics, curriculum development, training vessel design, training vessel operation, a number of areas of technical support related to equipment and laboratories, plus project benefits monitoring and evaluation.

Consultants provided guidance, advice, and recommendation in the form of on-the-job training, formal seminars, classes, lab sessions and field trips, and via more than 300 written reports. Consultants also regularly worked with counterparts, and directly with students, via cooperative field and laboratory projects. In addition to academic advice, consultants also provided advice concerning civil works design, vessel design and construction, book and equipment purchases, laboratory management and various other technical subjects.

Success of the consultancies was limited by lengthy delays in the delivery of books and equipment, by delays in the construction of training / research vessels, and by limited financial support for consultants' activities at the universities. The short tenure of many consultants, and the part time nature of most Indonesian faculty work schedules also limited consultants' effectiveness.

Introduction

Project Background

The Government of Indonesia has named as a national priority the development and careful use of its marine resources. However, the development of marine resources is hampered by a lack of well qualified personnel, and by a lack of knowledge about the resources due to inadequate research capability. Thus, recognizing the need for more highly trained professionals to take up employment in the marine sector, the Government of Indonesia signed an agreement with the Asian Development Bank (ADB), in which the ADB agreed to provide a loan[1] for the purposes of financing a Marine Sciences Education Project (MSEP) with particular emphasis on living marine resources.

The ultimate development objective of the MSEP is the optimal sustained use of Indonesia's living marine resources. The more specific objective of the project is to improve country-wide education and training of professionals who will work in those marine sciences related to living marine resources and their environment.

One part of the overall MSEP was the "contract on consultancy services for marine sciences education" which was signed on 16 November 1990. This was a contract between the Directorate General of Higher Education within the Indonesian Ministry of Education and Culture, and Lavalin International Inc. (Canada)[2] in association with the World University Service of Canada, the International Development Program of Australian Universities and Colleges, and P.T. Hasfarm Dian Konsultan.[3] Activities carried out under the consultancy

[1]ADB Loan No. 894-INO/895-INO SF

[2]Now called SNC-Lavalin International Inc.

[3]Shortly after the signing of the contract a new company, Eduplus Management Group, split from Lavalin. Eduplus Management Group has been responsible for management of the project on behalf of Lavalin. Also, the World University Service of Canada left the project in 1993, and the International Development Program of Australian Universities and Colleges is now called IDP Education Australia.

services contract commenced in November 1990 and are scheduled to end on 31 December 1995.

Six public universities are the primary targets of the project. These are Universitas Riau (UNRI) in Pekanbaru, Institut Pertanian Bogor[4] (IPB) in Bogor, Universitas Diponegoro (UNDIP) in Semarang, Universitas Hasanuddin (UNHAS) in Ujung Pandang, Universitas Sam Ratulangi (UNSRAT) in Manado, and Universitas Pattimura (UNPATTI) in Ambon.

Educational consultants were provided for each university to assist in establishing the new marine science program and curriculum, and to train counterparts. Local Project Implementation Unit (LPIU) offices, for use by project consultants at each institution, were provided with support. Some consultants were based in Jakarta where a Central Project Implementation Unit (CPIU) office was established. The main fields of specialization of consultants were: core marine sciences such as oceanography and marine ecology, marine conservation, marine chemistry, remote sensing, mariculture and related fields, physiology, marine resources, marine acoustics, curriculum development, naval architecture and training vessels operation, various fields of technical support related to facilities and equipment, and project benefits monitoring and evaluation.

Relation of Consultancy Services to Other MSEP Project Components

As indicated in Figure 1, the Indonesia Marine Sciences Education Project consisted of seven components. This report covers the activities of consultants carried out under the Educational Consultancy Services component. In several instances these consultants provided advice regarding activities within other project components, and a discussion of those activities is included in this report. However, this report does not cover details of the other project components.[5] For clarification a brief summary of other project components, and how consultants' activities were related to these, is given here.

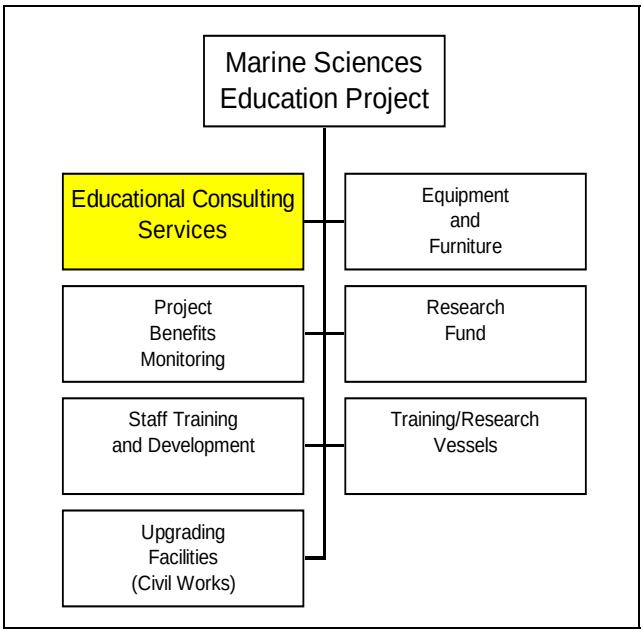

Figure 1. Components of the Indonesia Marine Sciences Education Project. This report covers activities carried out within the Educational Consultancy Services component.

The Educational consulting services component is the subject of this report. Most consultants were stationed at individual universities and performed their duties there. These duties were to help improve teaching and research activities. This was done by working with local faculty on a day to day basis, by presenting short courses and seminars, and by preparing lecture notes, laboratory manuals and other course materials. In many cases the academic consultants also provided advice directly to students, especially with regard to their senior thesis research. Some consultants were based in Jakarta. In such cases the consultants traveled and provided similar services to each of the six project universities in a particular field. Some of these consultancies were related directly to other project components.

The component to provide *training and research vessels* included the design and construction of a 17 meter vessel for each project university. The design of the vessel was completed by a

[4]Bogor Agricultural Institute

[5]For example, this report describes activities of consultants who provided advice regarding civil works modifications, but it does not provide an overview of the civil works component of the project.

consultant, a naval architect. In addition the naval architect provided advice to the builder and the ministry during construction of the vessels (see page 54).

Equipment planning specialists (page 57) provided advice regarding the purchase of *equipment and furniture*, and equipment maintenance and repair specialists were provided toward the end of the project to assist with the setup and repair of equipment (page 59).

During the early phases of the *upgrading of facilities* component most consultants provided limited advice, but no consultants were specifically requested during these design and construction phases. However, later in the project, facilities inspection specialists (page 58) were requested to assist with the assessment and redesign of some civil works components, especially marine water systems. They were assisted by a mariculture / water systems specialist (page 38).

Many consultants provided suggestions and comments for the *staff training and development* component. The early team leaders in particular provided suggestions regarding suitable overseas marine science universities. Virtually all consultants provided suggestions and considerable assistance with research proposals, planning, and projects, but none were specifically assigned to assist with the *research fund*.

Within the consultancy services contract there was a PBME component consisting of three phases: a baseline study, a mid-term review and a final review.[6] PBME consultants provided under the consultancy services contract worked in conjunction with the *project benefits monitoring and evaluation* component of the project. In general, PBME consultants within the consultancy portion concentrated on setting up the PBME survey and monitoring system and the *project benefits monitoring and evaluation* component was to implement these (see page 63 for more details).

Team Leaders

This report constitutes the final report of the team leader through 31 October 1995. It aims to provide an overview of consultancy services activities provided since the start of the project. However, because previous reports have included comments of the previous team leaders, comments herein emphasize activities carried out since January 1994.

Craig	Kensler	Nov-90	Sep-91
Robert	Brick	Oct-92	Jan-94
Richard	Dudley	Jan-94	Nov-95

Table 1. Consultant services team leaders. Dates shown may include periods of leave or other non-project time. During other periods there was no team leader.

Three consultants served as team leader during the project (see Table 1). For about one year (from September 1991 to October 1992) there was no team leader. The team leaders served as liaison between the project administration and the consultants, briefed and debriefed consultants, arranged local travel, assisted consultants who were having problems, and otherwise managed the day to day operation of consultancy activities.

Previous reports were submitted by Craig Kensler, Robert Brick and Richard Dudley. These reports and the final reports of all consultants should be consulted for additional detail. Team leaders' reports are listed here.[7]

[6]The final PBME review was underway when this report was written.

[7]In 1994 it was agreed that the team leader would submit quarterly rather than 6 monthly progress reports.

Team Leaders' Reports

Brick, Robert W. 1/11/93 Draft progress report no. V

Brick, Robert W. 1/11/93 Progress report no. IV : Team leader & higher education specialist

Brick, Robert W. 1/10/93 Progress report no. III : Team leader & higher education specialist

Dudley, Richard G. 15/10/95 Quarterly progress report -- third quarter of 1995

Dudley, Richard G. 1/7/95 Quarterly progress report -- second quarter of 1995

Dudley, Richard G. 30/4/95 Quarterly progress report -- first quarter of 1995

Dudley, Richard G. 31/1/95 Quarterly progress report -- fourth quarter of 1994

Dudley, Richard G. 15/10/94 Quarterly progress report for consultancy service : third quarter of 1994

Dudley, Richard G. 15/7/94 Quarterly progress report for consultancy services : second quarter of 1994.

Dudley, Richard G. 15/4/94 Quarterly progress report for consultancy service : first quarter of 1994

Kensler, C.B. 1/4/92 Executive summary of progress report : Team leader & higher education specialist

Kensler, C.B. 1/4/92 Progress report : Team leader & higher education specialist

Kensler, C.B. 1/8/91 Executive summary of six month progress report : Team leader & higher education specialist

Kensler, C.B. 1/8/91 Six month progress report : Team leader & higher education specialist

Amount and Type of Consultancies Provided

Eighty-four consultants from 15 different countries with expertise in 33 different subject areas assisted the project universities during the project's five years of operation. The original contract called for 607 months of consultancies. This amount was increased via two memoranda and an amendment to 640 person months.[8] At the time this report was written, 618 person months had been provided or contracted, and 22 months remained un-contracted.

The total number and subject areas of foreign consultancy months provided are displayed in Figure 2 and Figure 3. Areas of expertise of domestic consultants and months provided are indicated in Figure 4. During the project about 60 percent of the consultancy time was allocated to consultants stationed at the universities and about 40 percent allocated to Jakarta based consultancies.

A summary of consultancy positions and months provided through the end of the project are also presented in Table 2. Table 3 indicates the status of all consultancies provided under the contract in relation to contracted amounts[9], and Table 4 provides a summary of the amount of consultancies provided to each university.

[8]MOU 1 was signed on 23 May 1994, MOU 2 on 21 November 1994, and Amendment 1 on 29 May 1995.

[9]The numbers presented in Table 3 (and related tables), represent the team leader's understanding of the situation as of 31 October 1995. These figures may not coincide exactly with other calculations, but are believed to be correct.

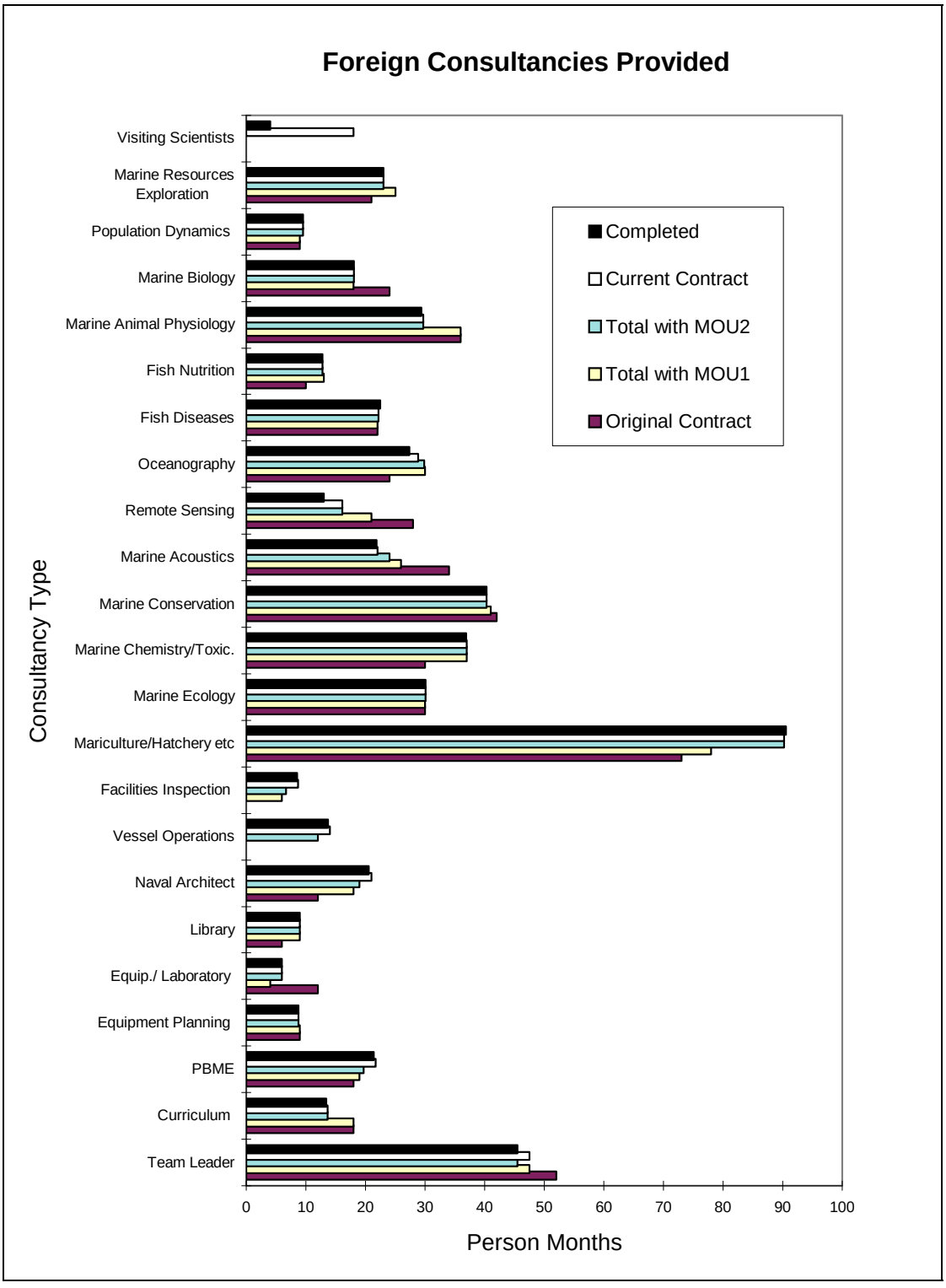

Figure 2. Foreign consultancies provided to the MSEP in each consultant category.

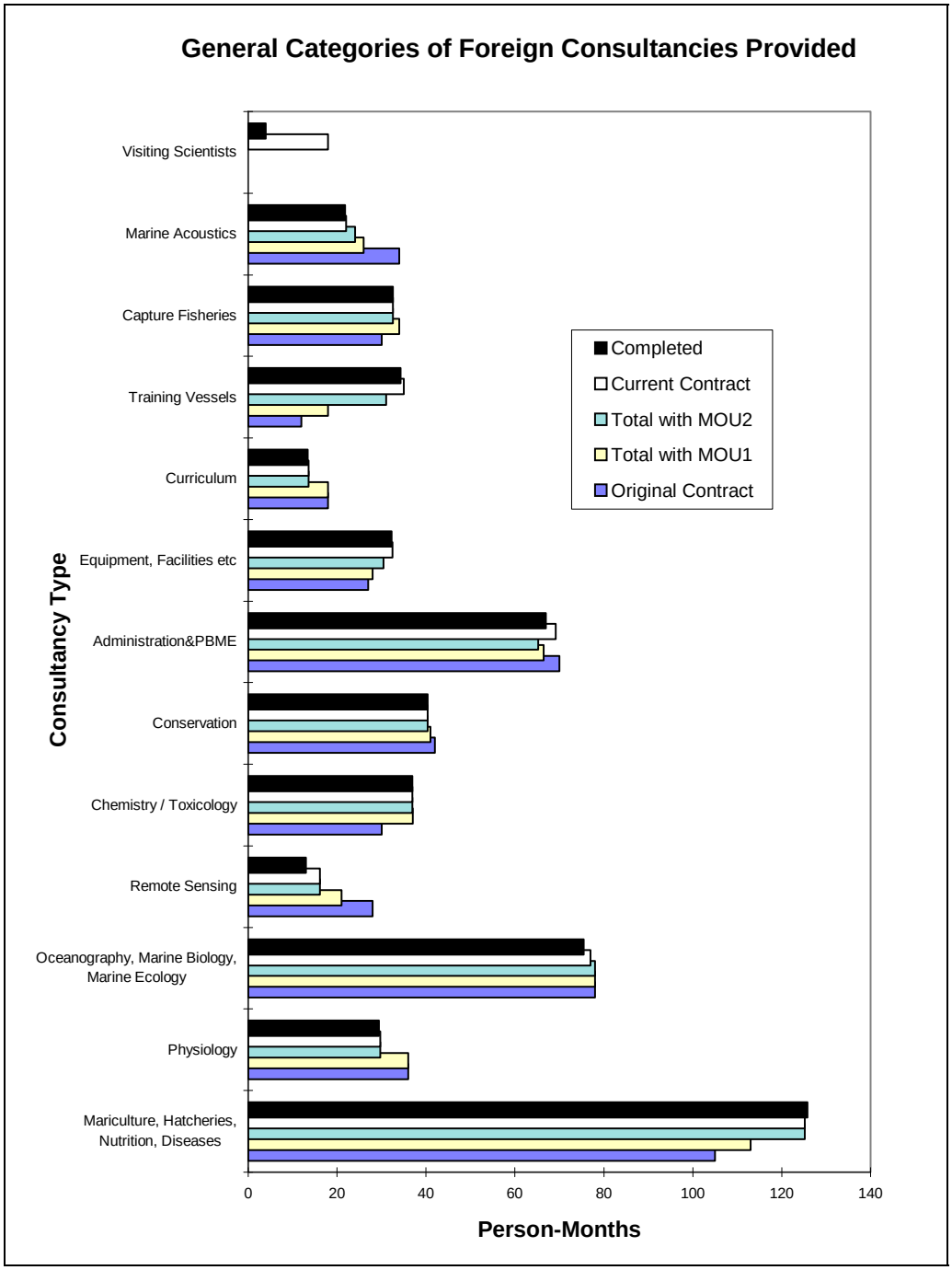

Figure 3. General categories of foreign consultancies provided to the MSEP.

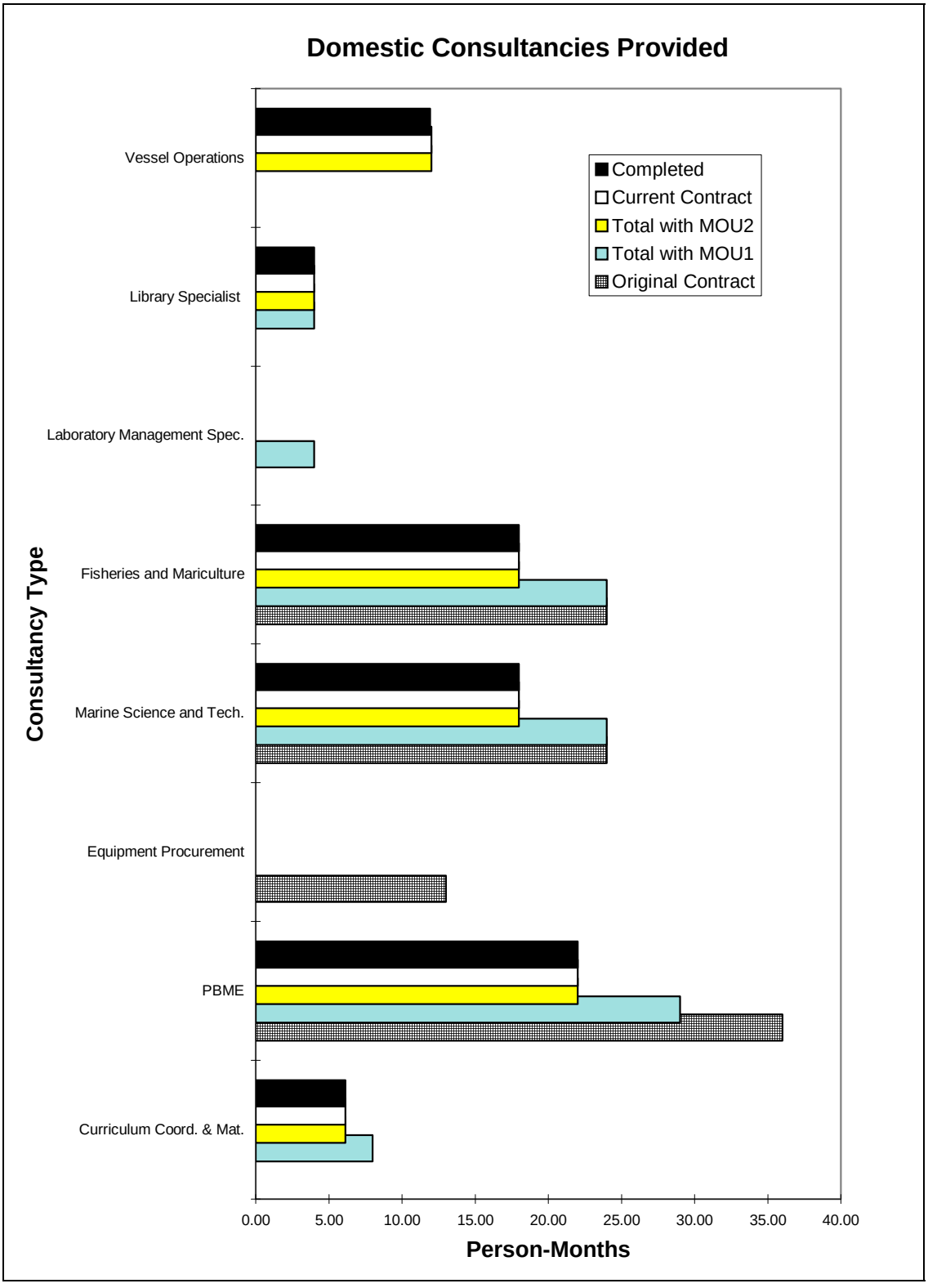

Figure 4. Domestic consultants provided to the MSEP.

		Person Months Provided					
		Quarter 4, 1995 Nov. & Dec.			Estimate Quarter 4	Prior to	
	Assignment	Oct	Nov	Dec	95	Oct 95	Completed
CPIU	Team Leader	1.00	0.23		1.23	44.26	45.49
CPIU	Curriculum Coordinator					13.39	13.39
CPIU	PBME	2.00	1.63	1.00	4.63	16.79	21.42
CPIU	Equipment Planning Specialist					8.77	8.77
CPIU	Equip. Maint. Spec.						
CPIU	Library Specialist					9.00	9.00
CPIU	Naval Architect					20.56	20.56
CPIU	Facilities Inspection Specialist					8.50	8.50
CPIU	Laboratory Management Spec.					4.00	4.00
CPIU	Vessel Operations	1.00	0.63		1.63	12.10	13.73
CPIU	Equipment Technician Development Specialist					2.00	2.00
CPIU	Marine Lab. Equip. Maint. & Repair	1.00	0.20		1.20	10.87	12.07
CPIU	Mariculture / Water Systems					6.07	6.07
CPIUd	Curriculum Coord. & Mat. (dom)					6.13	6.13
CPIUd	PBME (dom)	1.00	1.00	1.00	3.00	19.00	22.00
CPIUd	Equipment Procurement (dom)						
CPIUd	Marine Science and Tech. (dom)					18.00	18.00
CPIUd	Fisheries and Mariculture (dom)					18.00	18.00
CPIUd	Laboratory Management Spec.(dom)						
CPIUd	Library Specialist (dom)					4.00	4.00
CPIUd	Vessel Operations (dom)	1.00			1.00	10.93	11.93
UNRI	Mariculture Specialist					6.00	6.00
UNRI	Marine Ecology Specialist					18.17	18.17
UNRI	Marine Chemistry Specialist					18.90	18.90
UNRI	Marine Conservation Specialist					17.00	17.00
UNRI	Visiting Scientists						
UNRI	Marine Toxicology Specialist					6.00	6.00
IPB	Marine Acoustics					13.05	13.05
IPB	Remote Sensing					6.07	6.07
IPB	Fisheries Oceanography					12.04	12.04
IPB	Living Marine Resources					14.06	14.06
IPB	Visiting Scientists						
UNDIP	Mariculture (ponds)					5.97	5.97
UNDIP	Hatchery Specialist					3.80	3.80
UNDIP	Fish Diseases					10.00	10.00
UNDIP	Fish Nutrition					12.79	12.79
UNDIP	Marine Ecology					11.91	11.91
UNDIP	Marine Animal Physiology					11.80	11.80
UNDIP	Marine Conservation					11.30	11.30
UNDIP	Visiting Scientists			2.00	2.00		2.00
UNHAS	Mariculture Specialist (shellfish)					12.41	12.41
UNHAS	Hatchery Management					12.14	12.14
UNHAS	Fish Disease					12.46	12.46
UNHAS	Marine Biology					12.03	12.03
UNHAS	Marine Animal Physiology					11.61	11.61
UNHAS	Visiting Scientists		0.83	1.17	2.00		2.00
UNSRAT	Mariculture Specialist					20.49	20.49
UNSRAT	Marine Biology					6.00	6.00
UNSRAT	Marine Animal Physiology					5.99	5.99
UNSRAT	Marine Conservation					12.03	12.03
UNSRAT	Marine Chemistry					6.03	6.03
UNSRAT	Natural Products Chemist					6.00	6.00
UNSRAT	Physical Oceanography					4.00	4.00
UNSRAT	Visiting Scientists						
UNPATTI	Mariculture Specialist					23.63	23.63
UNPATTI	Fisheries Oceanography					11.33	11.33
UNPATTI	Population Dynamics					9.57	9.57
UNPATTI	Marine Acoustics					8.77	8.77
UNPATTI	Remote Sensing					6.97	6.97
UNPATTI	Marine Resources Exploration					8.97	8.97
UNPATTI	Visiting Scientists						
	Totals	7.00	4.53	5.17	16.70	601.65	618.35

Table 2. Summary of consultancies provided including estimates of person months provided during the last quarter of 1995.

Position		Person Months: Contract Amounts						Estimated Status at End of Project (estimated end of October 1995)			
		Original Contract	New Total MOU1	New Total MOU2	Amend. 1	Other Changes	Current Contract Amount	Completed	Still Scheduled	Total Provided & Scheduled	Balance
CPIU	Team Leader	52.00	40.00	45.49	2.00		47.49	45.49		45.49	2.00
CPIU	Curriculum Coordinator	18.00	18.00	13.62			13.62	13.39		13.39	0.23
CPIU	PBME	18.00	19.00	19.72	2.00		21.72	21.42		21.42	0.30
CPIU	Equipment Planning Specialist	9.00	9.00	8.77			8.77	8.77		8.77	
CPIU	Equip. Maint. Spec.	12.00									
CPIU	Library Specialist	6.00	9.00	9.00			9.00	9.00		9.00	
CPIU	Naval Architect	12.00	18.00	19.02		2.00	21.02	20.56		20.56	0.46
CPIU	Facilities Inspection Specialist		6.00	6.70		2.00	8.70	8.50		8.50	0.20
CPIU	Laboratory Management Spec.		4.00	4.00			4.00	4.00		4.00	
CPIU	Vessel Operations			12.00	2.00		14.00	13.73		13.73	0.27
CPIU	Equipment Technician Development Specialist			2.00			2.00	2.00		2.00	
CPIU	Marine Lab. Equip. M&R A			12.00			12.00	12.07		12.07	-0.07
CPIU	Mariculture / Water Systems			6.00			6.00	6.07		6.07	-0.07
CPIUd	Curriculum Coord. & Mat. (dom)		8.00	6.13			6.13	6.13		6.13	0.00
CPIUd	PBME (dom)	36.00	29.00	22.00			22.00	22.00		22.00	
CPIUd	Equipment Procurement (dom)	13.00									
CPIUd	Marine Science and Tech. (dom)	24.00	24.00	18.00			18.00	18.00		18.00	
CPIUd	Fisheries and Mariculture (dom)	24.00	24.00	18.00			18.00	18.00		18.00	
CPIUd	Laboratory Management Spec.(dom)		4.00								
CPIUd	Library Specialist (dom)		4.00	4.00			4.00	4.00		4.00	
CPIUd	Vessel Operations (dom)			12.00			12.00	11.93		11.93	0.07
UNRI	Mariculture Specialist	12.00	6.00	6.00			6.00	6.00		6.00	
UNRI	Marine Ecology Specialist	18.00	18.00	18.17			18.17	18.17		18.17	
UNRI	Marine Chemistry Specialist	18.00	19.00	18.93			18.93	18.90		18.90	0.03
UNRI	Marine Conservation Specialist	18.00	17.00	17.00			17.00	17.00		17.00	
UNRI	Visiting Scientists				3.00		3.00		3.00	3.00	
UNRI	Marine Toxicology Specialist		6.00	6.00			6.00	6.00		6.00	
IPB	Marine Acoustics	18.00	17.00	15.02		-2.00	13.02	13.05		13.05	-0.03
IPB	Remote Sensing	12.00	12.00	9.10			9.10	6.07		6.07	3.03
IPB	Fisheries Oceanography	12.00	12.00	12.04			12.04	12.04		12.04	0.00
IPB	Living Marine Resources	12.00	14.00	14.03			14.03	14.06		14.06	-0.03
IPB	Visiting Scientists				3.00		3.00		3.00	3.00	
UNDIP	Mariculture (ponds)	10.00	6.00	5.97			5.97	5.97		5.97	
UNDIP	Hatchery Specialist		4.00	3.80			3.80	3.80		3.80	
UNDIP	Fish Diseases	10.00	10.00	10.00			10.00	10.00		10.00	
UNDIP	Fish Nutrition	10.00	13.00	12.79			12.79	12.79		12.79	
UNDIP	Marine Ecology	12.00	12.00	11.91			11.91	11.91		11.91	0.00
UNDIP	Marine Animal Physiology	12.00	12.00	11.73			11.73	11.80		11.80	-0.07
UNDIP	Marine Conservation	12.00	12.00	11.30			11.30	11.30		11.30	
UNDIP	Visiting Scientists				3.00		3.00	2.00	1.00	3.00	
UNHAS	Mariculture Specialist (shellfish)	12.00	12.00	12.41			12.41	12.41		12.41	
UNHAS	Hatchery Management	12.00	12.00	12.14			12.14	12.14		12.14	
UNHAS	Fish Disease	12.00	12.00	12.16			12.16	12.46		12.46	-0.30
UNHAS	Marine Biology	12.00	12.00	12.03			12.03	12.03		12.03	
UNHAS	Marine Animal Physiology	12.00	12.00	12.00			12.00	11.61		11.61	0.39
UNHAS	Visiting Scientists				3.00		3.00	2.00	1.00	3.00	
UNSRAT	Mariculture Specialist	18.00	18.00	20.46			20.46	20.49		20.49	-0.03
UNSRAT	Marine Biology	12.00	6.00	6.00			6.00	6.00		6.00	0.00
UNSRAT	Marine Animal Physiology	12.00	12.00	5.99			5.99	5.99		5.99	
UNSRAT	Marine Conservation	12.00	12.00	12.03			12.03	12.03		12.03	
UNSRAT	Marine Chemistry	12.00	6.00	6.03			6.03	6.03		6.03	0.00
UNSRAT	Natural Products Chemist		6.00	6.00			6.00	6.00		6.00	
UNSRAT	Physical Oceanography		6.00	6.00		-1.00	5.00	4.00		4.00	1.00
UNSRAT	Visiting Scientists				3.00		3.00		3.00	3.00	
UNPATTI	Mariculture Specialist	9.00	20.00	23.46			23.46	23.63		23.63	-0.17
UNPATTI	Fisheries Oceanography	12.00	12.00	11.83			11.83	11.33		11.33	0.50
UNPATTI	Population Dynamics	9.00	9.00	9.57			9.57	9.57		9.57	
UNPATTI	Marine Acoustics	16.00	9.00	9.00			9.00	8.77		8.77	0.23
UNPATTI	Remote Sensing	16.00	9.00	7.00			7.00	6.97		6.97	0.03
UNPATTI	Marine Resources Exploration	9.00	11.00	8.97			8.97	8.97		8.97	
UNPATTI	Visiting Scientists				3.00		3.00		3.00	3.00	
	Total	607.00	602.00	615.32	24.00	1.00	640.32	618.35	14.00	632.35	7.97
	Domestic	97.00	93.00	80.13			80.13	80.07		80.07	0.06
	Foreign	510.00	509.00	535.19	24.00	1.00	560.19	538.28	14.00	552.28	7.91

Table 3. Detail of person months contracted and provided.

Foreign CPIU Totals	Person Months
Provided	164.99
Remaining	3.33
Total	168.32
Original contract	127.00
Changes	41.32
Current Contract	168.32

Domestic CPIU Total	Person Months
Provided	80.07
Remaining	0.06
Total	80.13
Original contract	97.00
Changes	-16.87
Current Contract	80.13

CPIU Totals	Person Months
Provided	245.06
Remaining	3.39
Total	248.45
Original contract	224.00
Changes	24.45
Current Contract	248.45

UNRI Totals	Person Months
Provided	66.07
Remaining	3.03
Total	69.10
Original contract	66.00
Changes	3.10
Current Contract	69.10

UNDIP Totals	Person Months
Provided	69.57
Remaining	0.93
Total	70.50
Original contract	66.00
Changes	4.50
Current Contract	70.50

UNSRAT Totals	Person Months
Provided	60.55
Remaining	3.96
Total	64.51
Original contract	66.00
Changes	-1.49
Current Contract	64.51

Foreign Consultants	Person Months
Provided	538.28
Remaining	21.91
Total	560.19
Original contract	510.00
Changes	50.19
Current Contract	560.19

IPB Totals	Person Months
Provided	45.22
Remaining	5.97
Total	51.1
Original contract	54.00
Changes	-2.81
Current Contract	51.1

UNHAS Totals	Person Months
Provided	62.65
Remaining	1.09
Total	63.74
Original contract	60.00
Changes	3.74
Current Contract	63.74

UNPATTI Totals	Person Months
Provided	69.24
Remaining	3.59
Total	72.83
Original contract	71.00
Changes	1.83
Current Contract	72.83

All Consultants	Person Months
Provided	618.35
Remaining	21.97
Total	640.32
Original contract	607.00
Changes	33.32
Current Contract	640.32

Table 4. Summary of consultancies provided to each LPIU and the CPIU.

Comments Related to All Consultancies

General Considerations

A typical consultant schedule consisted of a few days stay in Jakarta followed by mobilization to the assigned university. During the short stay in Jakarta the consultant visited the project director to discuss the upcoming assignment. The consultant then moved to the assigned university and met local staff, arranged housing and started work. After initial discussions with counterparts and other staff, the consultant wrote a work plan which outlined expected activities. These activities were then carried out in cooperation with counterparts, if available. During the work period the consultant was required to file monthly reports with the head of the LPIU and the team leader. The consultant usually also wrote various technical reports consisting of such things as laboratory manuals, lecture notes and identification guides. Each consultant also wrote an end of assignment report. During demobilization the consultant also visited the project director to discuss items of particular interest.

A typical consultant's activities started with a period of familiarization with the local teaching and research situation. This included such things as the review documents, course structure and content, and discussions with counterparts. Following this consultants arranged teaching activities, small research projects and laboratory activities and presented seminars and short courses. As a part of these activities they also prepared technical documents. Ordinarily some activities were more successful than others. These usually would then be expanded and other less successful ventures would be dropped.

The overall success of a particular consultancy was determined by many factors. For most of our consultancies, which dealt with the transfer of technical knowledge and ability, the most important success factors were:

1. the availability of counterparts and other co-workers to receive the information and training
2. a consultant with a suitable personality
3. a consultant with reasonable technical competence
4. reasonable financial support for work to be carried out
5. reasonable access to equipment and supplies needed for training and work

The presence of all five factors usually resulted in a successful consultancy, so it was the consultant's challenge to try and make sure that all were present. When problems did occurred they were most often encountered with item 1, frequently with items 4 and 5, and sometimes with item 2.

Other factors which also enhanced success of consultancies were:

1. consultants with prior experience in Indonesia (or in similar situations)
2. consultants with the ability to speak some Indonesian
3. an appropriate length of assignment

In cases where several consultants worked at the same institution, a certain benefit was derived by having the periods of the consultancies overlap. Often this was not the case, and in many instances a second consultant in the same or similar field arrived at the university more

than a year after the first had left. In many of these situations the second consultant would have benefited by having closer contact with the earlier consultants. [10,11]

For the most part comments about specific consultancies are included in the narrative descriptions starting on page 20. However, in some cases the same generic concerns and were raised, and suggestions made, by many consultants. These more general comments are summarized in this section. These are divided into comments about factors affecting the success of marine science education in Indonesia, and comments about the project and its administration as seen through the eyes of the consultants.

Comments Related to Marine Sciences Education

Quality of Marine Science Education

Consultants found that students were generally eager to learn and in many cases students seemed to be the primary motivating force on campus. Nevertheless, even at the end of the project, most consultants found that Indonesian marine science students were poorly prepared in basic sciences (physics, chemistry and biology) and mathematics. This problem extended into the basic marine sciences. Many graduates, for example, were unable to identify common species of marine fishes or invertebrates, and had only a general knowledge of oceanography. Although this situation may have been changing toward the end of the project due to the increasing number of courses being taught by M.Sc. and Ph.D. holders, it is still an item of serious concern for the reasons listed below.

Consultants noted a need to improve the analytical thinking skills of the students. Many commented that students seem to have difficulty solving previously un-encountered problems when given a variety of relevant facts. Students are used to learning primarily by memorization. There is a serious need for experimental problem solving experiences within the courses offered.

In the view of almost all consultants, the weakest component of Indonesian marine sciences education is the lack of practical field and laboratory training in all subject areas. During much of the project this shortcoming could be attributed to lack of facilities, but most consultants felt that there was little organized effort to make use of existing facilities and opportunities. Individual faculty and students tried to organize field exercises or laboratory training, but most were of a limited nature and of short duration, perhaps a few days per semester. Most consultants lamented the students' lack of hands on experience. This is one reason why, in the words of one consultant, the "level of understanding of [Indonesian] students is very low in comparison with other countries."

Our consultants believed that field trips need to be more frequent, have a smaller number of students per trip, and must be well planned with a specific purpose. Also, regular laboratory sessions should be incorporated into many courses on a weekly basis.

In addition, consultants found an almost universal agreement on the need to increase the amount of English taught. Both students and faculty realize that much of the scientific literature is written in English, and those able to read that language have a significant advantage when seeking employment. One consultant found that 96 percent of the students questioned wanted more English language training.

Many consultants found that the learning environment for Indonesian students could be improved greatly. The most obvious target for change is the teaching system itself. Consultants were surprised to learn that many courses were taught only once per week in a

[10]Many consultancies were delayed deliberately as the result of a management decision to postpone many of them until equipment and books were delivered and laboratories were closer to completion (See also page 19).

[11]However, it is also true that in some cases where several consultants were stationed at one location the consultants tended to work more with each other and less with Indonesian staff.

single long lecture. During a 16 week semester only 16 lectures would be presented, if the lecturers showed up for class. Often they did not. In the most extreme case reported by our consultants, students received credit for a course in which only six lectures were presented during the semester. In another case, no faculty member had been assigned to teach a course until halfway through the semester.

Classes are often taught by teams of faculty members, not by a single person. Although this approach can sometimes be effective, it requires careful coordination. Our consultants found that such coordination was often lacking resulting in a series of disconnected lectures.[12]

Some classes, consultants found, were taught by persons completely unfamiliar with the subject matter. This was sometimes because no faculty member had the appropriate training, and this issue was addressed quite successfully by the MSEP fellowship program. However, our consultants found several instances where well qualified staff had no teaching assignment or were given assignments in inappropriate fields. Also, some consultants felt that a number of courses offered within the marine science programs are not appropriate at the undergraduate level, and that teaching time would be better used in teaching the basics of marine science.

In summary, our consultants consistently reported three shortcomings in the existing marine sciences education system:

A need for graduating students to have a better understanding of the detail of basic sciences and marine science,

A lack of a well developed problem solving / analytical ability in graduating students, and

A serious lack of meaningful laboratory and field sessions within courses.

The following actions might be tried to remove these shortcomings:

Encourage, via appropriate incentives, faculty to teach full courses, meeting several times per week.

Assure that courses are taught by the best available qualified staff.

Discourage team teaching and emphasize fixed teaching assignments within each faculty member's area of expertise. Faculty should be encouraged to become the local expert in their field.

Assure that courses offer, in conjunction with lectures, appropriate laboratory activities at least once per week. Some of these activities should be experimental in nature where students investigate, with faculty guidance, various scientific phenomena.

Concentrate on better teaching of basic sciences and basic marine science, with less emphasis on attempting to teach overly advanced courses. Advanced courses should be reserved for a graduate program.

Assure that organized field trips, with clear learning objectives, are offered on a regular basis.

Research

Many consultants assisted faculty with research proposals and students with senior thesis research. Some also provided special seminars or short courses on preparing research proposals. However, most consultants found it surprising that most faculty had little, or no,

[12]The apparent reasons for this system of teaching are complex and beyond the scope of this report. Suffice it to say that faculty, because of low salaries, are often away from campus attending to other business as consultants, as teachers at other campuses, or at other jobs. The solution to this problem is to provide sufficient incentives, both financial and otherwise, for faculty to remain on campus for research and teaching activities.

active research program. There seemed to be little interest on the part of most faculty to carry out research. As a consequence, faculty members only rarely present seminars on campus and many are not well informed about the most recent developments in their fields. Virtually all consultants found this to be true and most ended up working primarily with interested students who needed assistance with their thesis research.

Because an active research program is one way in which faculty members maintain their knowledge of a field, the lack of active research programs also adversely affects teaching. It is also, of course, a great loss to Indonesia if the large number of faculty with M.Sc. and Ph.D. degrees don't apply their knowledge to appropriate scientific and societal questions.

To a certain extent the lack of active research programs is a result of the need for faculty to be away from the campus much of the time.[13] However certain administrative constraints appear to discourage faculty from embarking on active research programs. Management of the MSEP research fund is the one example with which the consultants were familiar. Early in the project one consultant reported that faculty did not apply for research funds because they were still awaiting the funds from the previous year. Also payment of the funds was not made until a large portion of the research was completed. This in turn required that the faculty member pre-finance the research. Also research funding often reaches each faculty member only after passing through a chain of administrative offices. Each of these may remove an administrative charge, and each step delays delivery of the money. More research by faculty should be encouraged, but this should be combined with a more rigorous research review process and more efficient management of research funds.

Surprisingly our consultants found that undergraduate students do more research than faculty, because they are required to carry out a senior thesis project. They manage to do this work with limited equipment and relatively little guidance from faculty, although several formal steps are required to complete the thesis.[14] The senior thesis is the single most important portion of the Indonesian undergraduate system, and is the system's strong point. This system encourages students to be independent and provides them with a strong incentive to learn as much as possible in their courses so they will be prepared to carry out their project. It is a shame then that the requirement to do research is not often found among faculty.

In summary, our consultants found comparatively little active research interest among faculty. There were, however, exceptions to this general finding particularly among recently returned fellowship recipients. Consultants reported that the fellowship recipients, and other key active faculty, are anxious to develop strong research programs, but seem to be discouraged buy the administrative and financial system in which they find themselves.

In general actions needed to improve research productivity seem to be primarily administrative in nature:

> Transparent and efficient methods of administering research funds are needed. The faculty member receiving a research grant should have management of the granted funds. Faculty who have received research funds should not have to pre-finance their research.
>
> Overhead or administrative charges should be determined in advance and should be based on a fixed, clearly stated university policy.
>
> Special support should be considered for those returning from overseas study to allow them an opportunity to establish an active research program.
>
> Faculty with active research programs should be given substantial financial and other incentives. Financial incentives could be funded from their research grants and

[13]See footnote number 12

[14]These steps involve three courses covering 11 credits, and include such things as preparing proposals, presenting preliminary and final seminars, collecting and analyzing data, and passing oral examinations.

contracts. These in turn will keep them actively involved with research and teaching and will improve their understanding in their field.

Faculty without research programs can be given disincentives as appropriate.

Equipment and Books and Vessels

All consultants agreed that better care and storage of equipment is essential for the future of marine sciences teaching and research at the project universities. In general air-conditioned laboratories and storage facilities are needed for much of the equipment. Also, a good equipment inventory, care and maintenance program is badly needed. Nevertheless, little action has been taken by the universities to address these issues in spite of advice provided. Consultants often found equipment from previous projects unusable due to lack of maintenance or proper storage. Recent consultants have found that some of the MSEP equipment is already unusable for the same reasons.

The excuse usually given to explain this situation is that the universities lack the operating budget to pay maintenance costs and electrical bills for air conditioning. Unfortunately, the fact that the budget is not available does not change the need. To paraphrase one consultant, "if there are insufficient funds for care and maintenance of equipment, then the universities must realize that they cannot afford to do quality marine research and teaching."

Lack of maintenance results not only in loss of valuable equipment, but in lack of use of facilities too. Libraries and laboratories, for example, that have poor lighting and no air conditioning not only result in deterioration of the books and equipment, but also are uncomfortable for students as well.

The research vessels present a special problem due to the high cost of maintenance and operation. Nevertheless, these vessels may help us focus attention on the problems. It is fairly obvious to all concerned that external funding will be necessary to make efficient use[15] of these vessels. Some of this external funding could come from research grants and contracts, and by charting the vessel to other scientific users.[16] With the vessels, this approach will be essential; with the laboratories it is a possibility. Research funds could be used to pay additional electrical costs of air conditioning. In fact, this would be a normal use of research grant overhead paid to each university's administrative office.

Project consultants also identified management of equipment as an area of concern needing special attention. The project supplied four consultants with expertise in that area, but at the end of the project only little progress had been made. Several consultants were concerned about a "lock and key mentality [in which] equipment is a commodity to be controlled instead of a resource to be used by staff and students." In general, consultants encountered a situation in which those responsible for equipment were very reluctant to have the equipment actually used. Of course, there is a good reasons for this "mentality": the difficulty and cost of getting equipment repaired or replaced if it is broken or lost.[17] Unfortunately this situation carries over to items such as microscopes which are needed for every day teaching.

In summary, all consultants found that better care, maintenance and storage of equipment were needed. Easy solutions are not available. The cost of a good equipment inventory, care,

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[15]Because of the high initial cost of the vessels it is generally agreed that they should not be left at the dock unused. In any case, even at the dock the maintenance cost is high. To be used efficiently these vessels should, ideally, be in operation perhaps 150 to 200 days per year. This would give students and faculty ample time to carry out research and teaching programs. Such a schedule, however, will cost each university up to US$60,000 per year.

[16]Some have suggested that funds could be earned by using the vessels for commercial fishing. This is highly unlikely, given the design of the vessel and the lack of commercial fishing and business management experience on the part of the universities.

[17]Although this was the usual reason for the "lock and key" mentality, several consultants encountered situations where senior faculty or administrators deliberately withheld use of needed MSEP equipment from other staff.

and maintenance program may be high, but it is an essential part of a marine sciences program. As with the vessels, lack of maintenance and operating funds for laboratories and equipment will result in the loss of the equipment and the effective use of the laboratories. Although a strict inventory control process is needed, it must also allow properly trained faculty and staff access to needed equipment.

One solution to this dilemma of availability versus protection is to allow only those properly qualified, to use the equipment, particularly if they have research grants which will allow it to be maintained properly or replaced when needed. Also, as one consultant recommended, users of laboratory equipment should be tested prior to being given permission to use the equipment. This policy should be applied to students wishing to use teaching laboratory items as well. The first part of any laboratory assignment could be to pass a test showing understanding of the equipment.

Marine Science Education Administration

During the course of their assignments most consultants became aware of various situations within the operation of the universities which limited the effectiveness of faculty efforts at teaching and research. Although each consultant can only sense a very small part of the overall educational system, as a group they consistently discovered several items which may be of interest.

Course Scheduling

Most consultants were dismayed to find that scheduling of courses and teaching assignments was often done in haphazard and confusing manner. Often faculty members did not know what courses they would be teaching until early in the semester, sometimes even after the semester had started. Planning of course sequences is almost impossible because, seemingly, no one knows what courses will be offered within a given semester. Course schedules are usually not available to students. This situation is not only confusing for students and faculty, but it hampers careful curriculum planning. Many consultants offered suggestions for better course sequencing and the publication of teaching assignments and course descriptions. Some universities have attempted this.

Faculty Cooperation and Participation

Consultants found that cooperation among faculty members and between faculties was very limited. This was especially true in cases where there was a movement to establish a marine science as well as a fisheries faculty. For example, the two programs (fisheries and marine science) presented problems for students doing research. In one case students who received help from a fisheries faculty member were told that that their research could not be used for a marine science thesis. Consultants visiting another university were told not to mention "fisheries", because this was a marine science program. Students (and faculty) should be encouraged to carry out cooperative programs. Marine science is inherently an interdisciplinary field. All consultants felt that closer cooperation among faculty was essential, and that cooperation with outside agencies, which may also have equipment, laboratories, and trained staff, should be encouraged.

Even within a faculty there is a need to improve communication among scientists. Individual faculty often feel isolated. To a large extent this may be due to the part-time nature of their on-campus work.[18] Nevertheless various consultants commented that there needed to be more exchange of information between faculty on a personal level, and that faculty must do more to support one another.

[18]See footnote number 12, page 13.

Absence of most staff from campus most of the time is probably the most serious factor preventing the development of a rigorous marine science program.[19] In spite of the difficulties, administrators should strive to offer better workplace incentives. In some cases, for example, consultants found that the marine science offices were locked after two o'clock. Often libraries were not open when faculty and students needed to use them. Other incentives might include provision of better transport to and from campus, more operating budget for minor teaching and research supplies, and more moral support in terms of personal contact and encouragement. Other incentives which might increase the enthusiasm of faculty include more opportunities for continuing their education both within Indonesia and overseas. Most importantly, salary and rank should be more closely linked to active participation in research and teaching.

Safety considerations

Boats, research vessels, chemicals, and some types of equipment can pose dangers to students and faculty if not used properly. Several consultants encountered serious safety risks. Electrical systems must be properly grounded, vessels and boats must be carefully maintained, and chemicals must be handled properly. Also, lack of student supervision and the normal absence of staff from the laboratories create potentially dangerous situations. One consultant reported finding students carrying out an unsupervised laboratory exercise using cyanide which, at the end of the lab was thrown down the drains and ended up outside in open ditches where children were playing.

University administrators need to be aware of these risks and should ensure that they are minimized. The laboratory management (page 60), vessel operations (page 55) and several other consultants have provided suggestions to minimize these risks.

Comments Related to MSEP Management

Many consultants made suggestions to improve project management. Some of these were incorporated into the project and some could be incorporated into new projects. Those of most interest are reported in this section.

One interesting situation encountered throughout the project was that there was no agreed working definition of the term "marine science". Most, but not all, consultants assumed, based on the project documentation, that "marine science" in the context of this project meant sciences dealing with living marine resources and their environment. Not everyone agreed, however, and one of the recurring problems within the project was the desire at some universities to change this definition. Some attempted to expand into additional subject areas (such as marine engineering) and others tried to restrict the scope of marine science by eliminating the field of fisheries from the project.[20] This latter effort was particularly confusing for some of the consultants, since many were carrying out assignments dealing with fisheries.

Consultants' Briefing

Consultants assigned toward the start of the project would have benefited from more specific terms of reference. Some consultants felt that the very general terms of reference provided distracted them from work in their areas of expertise.[21] Consultants would also have

[19]This statement is not meant to criticize the need of faculty members to have outside sources of income, but merely points out that without a full time faculty, a rigorous teaching and research program cannot be maintained. See also footnote number 12, page 13.

[20]The motives for creation of a marine science program divorced from fisheries were several, but the most common was the desire to have a separate faculty of Marine Science because it was believed that a new faculty would draw additional funding from Jakarta.

[21]Consultants hired under the contract memoranda 1 and 2 were provided a more specific terms of reference.

benefited if they had had earlier contact with staff at each university and a clearer explanation of what was expected of them. Also, consultants could have done a better job if they had been given a better idea of the situation at the universities with regard to facilities, equipment and staff.

Many consultants felt that short term assignments were not effective unless there were very specific terms of reference. Short time consultants sometimes had inadequate time to form good working relationships with staff and students. Also, most consultants realized the need to speak at least some Indonesian. Longer term assignments would make training in the Indonesian language more feasible.[22]

Project Structure

Early consultants believed that better information about the project structure would have helped them to be more effective. Many, especially those arriving early in the project, felt they had not been adequately briefed on the administrative arrangements within the project and were unclear as to the role of the MSEP versus the role of the university itself. Some consultants were not sure where questions and suggestions should be directed. In several instances consultants found that although many faculty agreed with various recommendations, there did not seem to be any standard approach for review and implementation. As a result many acceptable recommendations of consultants were ignored.

Consultants complained of "no effective stepwise decision making process." For example one consultant noted that there was no "mechanism for incorporating suggestions of consultants regarding equipment and civil works, [and marine] station siting." Some longer term consultants, once they learned the system, were quite successful at working with university administrators to put recommendations into action. Nevertheless, in future projects it would be helpful to have a standardized process to review consultants' work and recommendations at frequent intervals.

Because of the lack of a clear administrative path within their university setting, many consultants concentrated on making recommendations for the MSEP to carry out. While some of these (those related to project management for example) were appropriate in that channel, many recommendations would have been better directed to the faculty and university where they were working.

On Site Support for Consultants

Most consultants reported enthusiastic local support at the universities in terms of interest. Unfortunately one of the biggest limitations facing consultants was the lack of project support in terms of funding. The consultants need for office support and miscellaneous research and field funds was extremely small in relation to the size of the project, but even so, virtually no money was available to them except for office costs. This was a serious shortcoming in project design because it prevented earlier consultants from implementing many small scale activities to assist faculty and students. In July of 1994 "technical materials funds" for use by consultants became available.[23] Future projects should provide some sort of petty cash for consultants.

Unfortunately the management of the consultants' office support fund (which included office staff and transport costs) was flawed during much of the project. In the words of one

[22]At the start of the project a number of consultancies were scheduled for 10 to 18 months. For various reasons these longer assignments were gradually divided into shorter components. One reason for this was the rescheduling of consultancies during 1993 (see also footnote 10). This in turn created difficulty in getting replacements for the originally identified consultants. Also, limited funding, from the local currency budget, for housing for long term consultants limited the practicality of more long term positions.

[23]Technical materials funds were made available with Memorandum of Understanding Number 1. This allowed the consultants to purchase various types of supplies for their work at the universities.

consultant "the system for moving money to the LPIU consultants' office was poorly designed and implemented". This system improved gradually, but at some sites management of the fund continued to be a problem throughout the project, and this limited the consultants' effectiveness.

The other obstacle sometimes faced by consultants was the lack of suitable counterparts and other faculty co-workers. To a certain extent, this was caused by the fact that counterparts were often attending to other activities both on and off campus, or even out of the country. Consultants usually found others to work with, often students. Nevertheless, consultants felt a need for more opportunities to work with faculty on a day to day basis. In situations where consultants had full time Indonesian co-workers, even for limited periods, the consultants were much more productive.[24]

Assignment of counterparts was a continuing problem. Some consultants suggested that better briefing of both consultants and faculty on the interests and assignments of the other would help to create a better working situation. This approach was tried with good success at some universities, but had little effect at others.

Scheduling of Consultants, Equipment and Facilities

The most commonly cited deficiency of the project from the consultants' point of view was the fact that consultants never had access to new equipment, facilities and vessels. In fact the delivery of these occurred long after the departure of most consultants. During part of 1992 and 1993 most consultancies were postponed to avoid this problem. This was partly successful in that progress was made on civil works and placing of equipment orders prior to the return of consultants in 1994. However, the vessel, book and equipment contracts were not finalized until the first half of 1994. Thus, even toward the end of the project, in late 1994 and 1995 most of the equipment had not yet been delivered, and academic consultants present at that time worked with more or less the same equipment which their predecessors had used two years earlier.[25]

The five year length of the project was, perhaps, too short to allow for a centrally planned project to organize the needed stepwise approach. Ideally the schedule would have started with a period of construction and educational (fellowship) inputs with consultancy support for laboratory design and construction. This would be followed by a period of academic consultants working side by side with newly returned fellowship recipients[26] to order and use new equipment on a as needed basis. More decentralization may have helped too. For example consultants suggested that equipment could have been ordered directly by each university as it was needed, rather than being ordered via a central committee.

Civil Works Contracting

Consultants found that there was an unfilled need for better advice and monitoring of civil works design and construction. Although virtually all consultants provided advice of some sort at all stages of construction this was done primarily on an ad-hoc basis. Also, facilities consultants found that better coordination between the university contracting officer and the marine science faculty would have avoided some problems with technical aspects of civil works. A long term civil works advisor with marine experience would have been helpful.

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[24]Finding suitable and compatible coworkers, particularly when there is a language barrier is difficult. During early stages of the MSEP many well qualified university staff were away for training making potential counterparts more scarce.

[25]Books and equipment were not available for consultants to use in their work until mid to late 1995. Vessels were not available to any consultants until late August 1995, and were not fully accepted by the universities until after the departure of the last academic consultant.

[26]Typically just the fellowship training for an M.Sc. (with a research thesis) including personnel selection and language training would take three years.

Consultancy Details

Core Marine Sciences

Activities

Oceanography, Fisheries Oceanography, Physical Oceanography

George Cresswell, assigned to IPB, was one of the first project oceanographers. He assisted the university with equipment planning, laboratory design, student field projects, and curriculum improvement. He felt that more recent oceanographic papers should be used, and discussed, in advanced classes. Cresswell also noticed that mathematics training at the undergraduate level at IPB was insufficient for those intending to study oceanography and he recommended a more complete mathematics training program. For a successful graduate program (one of IPB's goals) Cresswell indicated a need for more research and improved support for research.

Cresswell felt that Pelabuhan Ratu would be an ideal local study area and helped IPB with initial plans for carrying out regular sampling there.

	Burhanuddin	Marine Science & Technology	CPIU	Apr-91	Mar-92
Richard	Dudley	Marine Ecology	UNRI	Jul-91	May-92
George	Cresswell	Oceanography	IPB	Aug-91	Nov-91
John	Green	Oceanography	UNPATTI	Sep-91	Dec-91
Victor	Anderlini	Marine Ecology	UNDIP	Oct-91	Apr-92
Rand	Dybdhal	Marine Biology	UNHAS	Nov-91	May-92
Salvadore	Pamplona	Marine Biology	UNHAS	Aug-92	Feb-93
John	Culliney	Marine Biology	UNSRAT	Jan-94	Jul-94
Kenneth	MacKay	Oceanography	UNPATTI	Mar-94	Jun-94
Paul	Dinnel	Marine Ecology	UNRI	Apr-94	Jul-94
Andrea	Frische	Oceanography	UNPATTI	Jun-94	Aug-94
Steven	Bollens	Oceanography	IPB	Jul-94	Jul-94
Laura	Lazo	Marine Ecology	UNDIP	Jul-94	Jan-95
Ferit	Bingel	Oceanography	IPB	Jul-94	Jan-95
Alan	Willsie	Marine Ecology	UNRI	Aug-94	Jan-95
Steven	Bollens	Oceanography	IPB	Sep-94	Sep-94
John	Harvey	Oceanography	UNSRAT	Sep-94	Jan-95
R.	Soekarno	Marine Science & Technology	CPIU	Dec-94	May-95
Robert	Pett	Oceanography	UNPATTI	Mar-95	Jun-95
Jurgen	Saeger	Oceanography (cruise advisor)	IPB	Apr-95	Jun-95

Table 5. Consultants who served in core marine sciences positions. Dates shown may include periods of leave. In cases of long breaks, or assignment to a new position, the consultant's name may appear twice. Presented in order of starting date.

Steve Bollens had planned to serve in the oceanography position at IPB in two stages: a short planning stage followed by a longer period of participation. Unfortunately, after completing his two week stay in July 1994, during which he presented several seminars, he returned to IPB in September only to learn of a family sickness which required him to leave the project.

Ferit Bingel arrived at IPB more than two years after Cresswell's departure. He spent much of his time preparing lecture notes for subjects related to practical aspects of at-sea research and research cruise planning. He also presented lectures on fish age determination. Bingel also discussed the vessel modifications with the naval architect, and prepared a number of draft proposals for research to be carried out on board the new vessel. He also provided faculty and students with computer programs for teaching of fisheries applications, and worked with the library consultant to prepare sets of abstracts of selected marine science topics.

John Green arrived at UNPATTI in September 1991. Like Cresswell at IPB Green noticed a need to establish routine oceanographic sampling in that area and felt that UNPATTI staff and students could play a role in this effort. This theme was later picked up (in 1994) by Andrea Frische and Robert Pett (see below) who established the beginnings of a standard oceanographic sampling system. To strengthen teaching and research Green wrote an oceanography course manual and assisted with the preparation of research proposals. Green felt that there was no need for UNPATTI to build a field station since the Poka campus is only a short walk from Ambon Bay.[27] However, he felt there was a strong need for UNPATTI to develop cooperative programs with the Indonesian Institute of Marine Sciences and the national fisheries research agency.

Kenneth McKay, the next oceanography consultant stationed at UNPATTI, reviewed the fisheries oceanography course and felt that the emphasis was inappropriate. Examples were both out of date, and were from temperate rather than tropical areas. The course also emphasized more efficient fishing via use of oceanographic data rather than better understanding of oceanographic effects on fish stocks. McKay suggested a revised syllabus. Also, like most consultants McKay suggested a more intensive teaching schedule with more lectures per week. McKay also gave a coral reef monitoring and survey short course in cooperation with the university's Environmental Studies Center.

Andrea Frische, the next UNPATTI oceanography consultant, was successful in getting staff and students into the field on a regular schedule. Because she felt it was important to give students (and faculty) practical experience with equipment she started an "Ambon Bay Experiment" with students and staff using whatever equipment was available and the small work-boats ("Boston Whalers").

Frische also strongly recommended that a new course called "Oceanography of Indonesian Seas" be taught at all universities. She wrote a syllabus for the course and provided a detailed list of references.

When Pett arrived at UNPATTI in March of 1995 he set up field work on inner and outer Ambon Bay where he and his counterparts continued and expanded Frische's Ambon Bay Experiment. Also to increase field activities, Pett organized a baseline field survey of waters and shoreline near UNPATTI's Hila field station. Pett also held workshops on the collection and field processing of water samples (including safety issues), and statistical considerations for oceanographic data collection. He also prepared some example proposals which could make use of the new training/research vessel to carry out surveys near commercial oil facilities in Maluku. This proposed work would help to identify environmentally sensitive areas. Pett also prepared reprint collections covering 13 subject areas.

During Pett's assignment some of the oceanographic equipment was delivered so he worked with staff to set up and demonstrate it.

At UNSRAT John Harvey provided comments and suggestions to improve the oceanographic curriculum. More teaching of basic science (math, chemistry and physics) are needed. He also supported Frishe's idea of a course on the Oceanography of Indonesian Seas. Harvey also provided a list of practical research projects which could be easily carried out near Manado. This included such things as investigations of areas where rivers enter the sea, the circulation pattern in Manado Bay, and the depth of the thermocline in Manado Bay.

Harvey also presented a 10 day intensive workshop on oceanography for UNSRAT faculty.

Marine Biology

Many of the early marine biology consultants on the MSEP were frustrated by lack of basic equipment and facilities for teaching. Rand Dybdahl at UNHAS approached these problems by adjusting his consultancy to address other related areas. He attempted to improve teaching abilities, provide improved course structure and improve the understanding of basic

[27]The marine station was built.

scientific procedure. With regard to teaching he felt that there was a need for better understanding of the basis of science and the scientific method. He suggested that teachers should strive more for understanding of scientific principles rather than memorization of facts. To get these ideas across, Dybdahl presented seminars on use of scientific literature and its importance, and on topics to generate discussion of science.

Salvadore Pamplona faced similar problems at UNHAS and followed a similar solution. Although he wrote a laboratory guide for marine invertebrates, much of his work was related to the improvement of research planning and administration. He also worked with other consultants to assist with aquaculture related activities.

John Culliney arrived later in the project, but faced similar problems at UNSRAT due to a lack of facilities. Nevertheless, Culliney presented lectures on various invertebrate groups and deep sea ecology to the marine biology and marine conservation classes. Culliney also worked closely with the mollusc research group at UNSRAT to set up a small laboratory for teaching and research with marine invertebrates. He also assisted students with senior theses about intertidal invertebrates.

Culliney investigated employment possibilities for marine science graduates in the growing marine tourism sector in Manado, and also worked with other consultants to advise on the new marine science curriculum at UNSRAT.

Marine Ecology

Dudley was the first MSEP consultant assigned to UNRI. At the time he arrived, in July of 1991, the Dumai marine station was still in the planning stages and he provided specific comments related to such things as laboratory design and possible water supply problems. Noting that UNRI could become a center for mangrove studies, Dudley wrote a key to mangrove tree species (with accompanying photographs and slides) and tested this during field trips with students and staff. He also wrote a series of mangrove ecology laboratories, covering 9 subjects and 13 to 15 lab sessions, for use in the mangrove ecology course. Dudley helped faculty learn the BILKO remote sensing software for possible use in teaching. He also developed, with faculty, a course sequence that would allow completion of a B.Sc. degree in 4 years, noting that there was no justification for a longer program. Dudley was also involved in the early planning of the Nias project which was later funded by Caltex.

Almost two years after the departure of Dudley, Paul Dinnel joined the project as the second marine ecologist at UNRI. Dinnel, in cooperation with Dr. Pragatheeswaran (see page 29), completed a review of the status of the Dumai Laboratory and made many specific suggestions for its completion and improvement including suggestions related to the lack of fresh and marine water and electrical power. Dinnel also wrote a manual for "Toxicity Testing in the Marine Environment", and presented seminars related to toxicity testing and bioassay monitoring. He also assisted with the preparation of proposals to be presented to P.T. Caltex Indonesia and other potential funding sources.

Dinnel also interviewed, or provided questionnaires to, a number of former students, present students and faculty about the MSEP, course content, job prospects and related topics.

Alan Willsie later took up the marine ecology position at UNRI. He worked with his counterpart to revise the course content for benthic ecology and assisted students and staff with field work particularly that related to polychaete[28] identification. To accomplish this he established a small reference collection of polychaetes, and set up a small benthos[29] study laboratory. He also worked with his counterpart to develop better benthos sampling techniques, and wrote a technical manual for polychaete identification. A small collection of sea grasses and algae for student use was also established.

[28]a common group of marine worms.

[29]bottom organisms

Willsie wrote laboratory practicals for several courses: tropical marine ecology, coastal oceanography, mangrove ecology, and benthic ecology. He assisted faculty in teaching ecological methods related to the study of mangrove areas and the collection of benthic organisms. He assisted staff to develop oceanography research projects, and assisted students with senior thesis projects by providing advice on field techniques and numerical and statistical analysis.

Willsie also participated in field trips with students, and worked with the Marine Science Students Organization by providing English conversation, planning a computer course, and by assisting them in cataloging over 400 publications they had already collected. In cooperation with the student clubs and consultant's secretary, he provided additional references and the cataloged collection reached over 1,000 marine science references.[30]

Willsie worked with the other consultants to examine the possibility of using rainwater to supply fresh water to the Dumai marine station. Although this approach could have supplied some of the water requirements, it could not supply the full need.

After his arrival at UNDIP in 1991, Victor Anderlini established a research project in cooperation with his counterpart and students. This project examined a local species of bivalve shellfish which might be used as an indicator of pollution. During his consultancy all field work in Semarang harbor was completed and a paper was planned in cooperation with his counterpart. Anderlini also started a study of benthic community structure of Jepara area where he also accompanied Scuba divers from among the UNDIP students and faculty. He also gave lectures about the use of Scuba in marine research, and provided advice concerning the layout of the new laboratories.

Anderlini felt that there was a need to clarify the relationship between fisheries and marine science, and saw a need to emphasize basic science during first two years of study.

The next marine ecologist at UNDIP was Laura Lazo who joined the MSEP in July of 1994. She presented lectures in field ecology techniques, lectures and laboratories for marine botany, and assisted faculty in writing scientific papers. She also helped students with senior thesis research projects. She also gave a short course on population demography and a presentation on economically important seaweed species.

Lazo promoted the Jepara campus as a possible resource for cooperation with foreign universities and assessed methods of increasing cooperation between the university and foreign universities and local businesses. She attempted to form a better link between UNDIP and businesses who might be interested in hiring marine science graduates by working to set up a "coop program" with Indonesian firms. Lazo and her counterpart met with several firms in Jakarta to promote this idea.

Marine Science and Technology

Soekarno joined the project's CPIU office in December 1994 to provide project universities with advice and expertise in the field of marine resources especially coral reef survey, assessment, protection and management. Soekarno provided information on the role of the Center for Oceanographic Research and Development[31] so that faculty and students would be more likely to approach that agency when seeking cooperative research arrangements or information. At each university Soekarno presented lectures to students, discussed possible senior thesis topics and otherwise provided information about marine resources in Indonesia. He also presented information on possible links between the universities and government agencies which work in the realm of marine science. He suggested specific contacts in each location, and provided names of individuals working with government agencies and their areas of specialization.

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[30]It is significant that this collection of scientific information was not being established by the library personnel or by faculty, but by students.

[31]Pusat Penelitian dan Pengembangan Oseanologi

Soekarno felt that there is a need to strengthen basic biological and ocean sciences if Indonesia is to improve its understanding of, and ability to protect and manage, its diverse marine ecosystem. Courses covering taxonomy of both vertebrates and invertebrates, anatomy, and physiology need to be strengthened. He felt that Scuba diving should also be offered since most students do not have funds to pay for this individually. He felt that the current courses are mostly derived from a fisheries curriculum and the differences between marine science and fisheries curricula still need to be clarified. Both are important. Soekarno also emphasized the need to have one faculty of Fisheries and Marine Science, and stated that a single faculty is essential for good cooperation and for sharing of information, facilities and equipment.

Reports

Anderlini, Victor. 1/4/92. End of assignment report: Marine ecology specialist

Anderlini, Victor. 1/2/92. Proposed academic and research activities

Bingel, Ferit. 1/1/95. End of assignment report : Fisheries oceanography specialist

Bingel, Ferit. 1/11/94. Draft proposals for studies in field and laboratory works (supported by abstracts)

Bingel, Ferit. 1/10/94. Practical aspects of sampling in the sea cruise planning and implementation and the laboratory work

Cresswell, G.. 1/11/91. Final report: Fisheries oceanography

Culliney, John L.. 1/7/94. End of assignment : marine biology specialist

Culliney, John L.. 1/5/94. Laboratory & field exercise in marine biology and biological oceanography

Dinnel , P.& V. Pragatheeswaran. 1/6/94. Status of the University of Riau Dumai Marine Laboratory

Dinnel, Paul A.. 1/7/94. End of assignment report : marine ecology/pollution

Dinnel, Paul A.. 1/7/94. Toxicity testing in the marine environment

Dudley, Richard G.. 1/4/92. Collected reports and papers

Dudley, Richard G.. 1/4/92. End of assignment report

Dudley, Richard G.. 1/2/92. Six month report part 2. Marine ecology at the University of Riau: possibilities for development

Frische, Andrea. 1/8/94. End of assignment report: fisheries oceanography

Frische, Andrea. 26/8/94. Ambon bay experiment (ABEX) : cruise and data report for ABEX 1-3

Frische, Andrea. 26/8/94. Ambon bay experiment (ABEX) : hydrographical, meteorological, and biological conditions in Ambon Bay

Green John, M.. 1/12/91. Final report: fisheries oceanography

Green, John M.. 1/11/92. Manual for introduction to oceanography

Harvey, John G.. 1/1/95. End of assignment report: physical oceanography specialist

Harvey, John G.. 31/12/94. Physical oceanography: exercises for S1 classes, methods of current measurement and bibliography

Lazo, Laura. 31/1/95. End of assignment report: marine ecology specialist

Lazo, Laura. 1/1/95. Projects, lectures, and exercises in marine ecology

Lazo, Laura. 31/8/94. Assessment of economically important seaweed species

MacKay, Kenneth. 1/6/94. End of assignment report: Fisheries oceanography

Pamplona, Salvador. 1/2/93. End of assignment: Marine biology

Pamplona, Salvador. 1/9/92. Inception report & action plans marine biology specialist MSEP UNHAS

Pamplona, Salvador. . Aquaculture based laboratory : training manual

Pamplona, Salvador. . Marine sciences industry related survey

Pamplona, Salvador. . Practical laboratory guide for marine invertebrates

Pamplona, Salvador. . Program evaluation survey

Pamplona, Salvador. . Project feasibility study preparation

Pamplona, Salvador. . Proposed system for research planning management & control

Pamplona, Salvador. . Research methodology (research process overview)

Pett, Robert J 1/5/95 Environmental Sensitivity Mapping Near Oil Production Sites in Central Maluku : An example proposal

Pett, Robert J. 1/5/95. Environmental sensitivity mapping near oil production sites in Central Maluku : an example proposal for consideration by the marine

Pett, Robert J.. 1/6/95. End of assignment report : fisheries oceanography specialist

Pett, Robert J.. 1/6/95. Tainting of commercial fish stocks : a lab practical for the marine pollution and fisheries oceanography courses

Pett, Robert J.. 1/5/95. A planning guide for field surveys

Pett, Robert J.. 1/5/95. Hila baseline survey : May 1995 data report

Saeger, Jürgen. (Report listed under Marine Resources Exploration on page 45)

Willsie, Alan. 1/1/95. An overview of bio-indicators of aquatic disturbance

Willsie, Alan. 1/1/95. Collected technical memos in marine ecology

Willsie, Alan. 1/1/95. End of assignment report : marine ecology specialist

Willsie, Alan. 1/11/94. Outline of marine ecology, coastal oceanography, mangrove ecology, benthic ecology

Conservation

Activities

John Boers at UNSRAT was the project's first marine conservation consultant. Boers participated in the marine conservation courses and wrote detailed lecture material which provided some of the theoretical background needed to understand conservation issues (such as the effect of size of nature reserves on biodiversity). Boers found the curriculum too ambitious and found a serious need for emphasis on basic science. He found students' knowledge of basic ecology very poor.

John	Boers	UNSRAT	Feb-91	Feb-92
John	Rubin	UNRI	Aug-91	Aug-92
Ian	Dutton	UNDIP	Jul-92	Jul-93
John	Carter	UNRI	Aug-94	Jan-95

Table 6. Consultants who served in marine conservation positions. Dates may not include short periods of leave.

Boers also emphasized the need for better taxonomic training of students and thus for taxonomic materials and identification guides for teaching. Of special concern is the need for specialists among the faculty who are well trained in the identification and ecology of specific species groups. For example, at each university one might expect to find a coral reef fish specialist, or a sponge specialist. Boers noted a need for conservation training as well as an improved research capability. Such capability would then allow the faculty to become involved with regional large scale marine monitoring projects, studies of re-colonization of reef areas, larval fish ecology, and long term studies of the region's flora and fauna. Boers felt that special attention might be paid to the octocorals a group of corals which are known to contain bioactive substances. These might be of interest because UNSRAT wishes to place some emphasis on marine natural products.

UNDIP's marine conservation advisor, Ian Dutton, in addition to assisting with the marine conservation course, carried out an investigation of marine tourism in Indonesia. From this Dutton found that students in the marine science program will need diving experience, better English skills, a good knowledge of marine ecology, and sea experience if they are to work with the marine tourism industry. Dutton also developed a coastal management planning game so that students and faculty could better understand the issues surrounding coastal area management.

Dutton assisted students with their senior thesis work and prepared a report on management of the senior thesis program. He also obtained about 500 reference works on marine conservation and placed these in UNDIP's LPIU library.

Dutton encouraged the university to advertise the Jepara laboratory as a location where international scientists might wish to carry out research, and also attempted to increase inter-university contacts by starting an MSEP newsletter.

At UNRI, John Rubin was the first MSEP conservation specialist. He wrote a report on marine conservation in Indonesia which placed special emphasis on mangrove conservation, and prepared a guide to coral identification which would be helpful in the Riau Islands. He also worked to improve methods of planning field trips and assisted staff with research proposals. He was also involved with the start of the Nias project which was later funded by funded by CALTEX.

UNRI's next conservation advisor, John Carter, did not join the project until August 1994. He presented lectures in the conservation and the marine pollution courses and also provided literature about these topics to faculty and students. He also completed and tested training modules for marine conservation and participated in the UNRI short course on coastal resources.

Carter provided assistance to a number of student projects related to artificial reefs, coral reef management, oil contamination of mangrove areas, and crab ecology. He went with students to Pulau Soreh to examine sea grass and coral habitats, and also assisted members of a student club to identify mollusks and crustaceans..

Carter's reports on marine conservation with special reference to eastern Sumatra and his contributions to a photo log of coastal habitats were helpful in teaching marine conservation. Carter prepared an interesting report on the employment prospects for marine science students.

Reports

Boers, J.J.. 1/2/92. End of assignment: Marine conservation

Boers, J.J.. 1/2/92. Proposed lecture material: Marine conservation

Carter, John. 1/11/94. A series of marine conservation practicums for Universitas Riau

Carter, John. 1/11/94. Assessment of the curriculum and research related to marine conservation and coastal zone management at Universitas Riau

Carter, John. 1/11/94. Employment prospects for marine science students at Universitas Riau

Carter, John. 1/11/94. End of assignment report: marine conservation specialist

Carter, John. 1/11/94. Modul training: konsep dasar konservasi laut dan relevansinya dengan Sumatra Bagian Timur

Carter, John. 1/11/94. Practical aspects of environmental monitoring of offshore oil and gas development

Carter, John. 1/11/94. Training module: an introduction to integrated coastal zone management

Carter, John. 1/11/94. Training module: coral reef management issues

Carter, John. 1/10/94. Modul training : tainting (perubahan rasa & bau alami) pada species laut (mata kulilah pencemaran laut)

Carter, John. 1/10/94. Training module: tainting of marine species

Carter, John. 1/9/94. Training module: basic concepts of marine conservation and their relevance to East Sumatra

Dutton & Ludvianto. 1/6/93. An integrated coastal management plan for Jepara: background discussion paper

Dutton & Ludvianto. 1/4/93. A survey of UNDIP staff and their Interest in the Coastal Environment of Jepara

Dutton & Sutterlin. 1/3/93. Fisheries and Marine Sciences at UNDIP: Towards a functionally integrated curriculum

Dutton, Ian. 1/12/93. Mid-term report

Dutton, Ian. 1/7/93. End of assignment report: marine conservation

Dutton, Ian. 1/5/93. Readings in marine conservation: a tutorial resource book.

Dutton, Ian. 1/3/93. An overview of the Indonesian marine tourism industry

Dutton, Ian. 1/12/92. Student experience & attitude toward the marine sciences program at UNDIP

Dutton, Ian. 1/11/92. Guidelines for skripsi management related to marine conservation

Dutton, Ian. 1/8/92. Marine planning education game: instruction manual & playing kit

Rubin, J.. 1/8/92. Additional course materials

Rubin, J.. 1/8/92. End of assignment: Marine conservation

Rubin, J.. 1/2/92. Field work planning, organization & management

Rubin, J.. 1/1/92. An introduction to marine conservation with particular reference to Indonesia

Rubin, J.. 1/1/92. Functions, economic uses and conservation of the mangal of South East Asia

Marine Chemistry and Related Fields

Activities

Marine chemistry specialists were provided to two universities, UNRI and UNSRAT. These specialists concentrated on basic marine chemical processes as well as the sub-specialties of marine pollution at UNRI, and natural products chemistry at UNSRAT.

Robert	Pett	Marine Chemistry	UNRI	Apr-92	Jun-93
Robert	Pett	Marine Chemistry	UNSRAT	Jan-94	Jul-94
Vinayaga	Pragatheeswaran	Marine Toxicology	UNRI	Apr-94	Oct-94
Frank	Chen	Natural Products Chemistry	UNSRAT	Jul-94	Jan-95
Richard	Tokarczyk	Marine Chemistry	UNRI	Aug-94	Dec-94

Table 7. Consultants in marine chemistry and related fields. Dates may include periods of leave.

Marine Chemistry

Robert Pett[32] joined the project at UNRI in early 1992 where he immediately became involved in developing a project proposal for funding by Caltex[33]. This project was funded and allowed staff and students to participate in an environmental assessment at Nias Island. Later Pett helped with project planning for the Rupat Island project, also funded by Caltex.

Pett also assisted with a training course on marine pollution, prepared teaching aids, and helped set up laboratories and arrange use of field equipment. He prepared a syllabus for the marine chemistry course and suggested field activities for marine chemistry. He also participated in several field trips to Dumai and made detailed suggestions for improvement of the Dumai field station.

Pett noted that faculty did little research and rarely published research results. Also, he found little coordination among faculty members. Pett felt that faculty needed assistance in preparing research proposals and in improving their skills for planning and managing projects. He therefore presented several workshops to assist faculty in these efforts.

Richard Tokarczyk took up the marine chemistry post at UNRI about one year after Pett's departure. Tokarczyk worked with counterparts to improve the environmental chemistry course by providing handouts, overheads, reading materials and a new course syllabus. He also worked directly with three faculty members to teach weekly laboratory sessions, but encountered significant difficulties in that labs were not yet operable even in late 1994. Tokarczyk also trained counterparts to use a gas chromatograph, but because the equipment had not yet been delivered, this training was based on lecture and discussion only.[34]

Tokarczyk found that students' knowledge of basic laboratory equipment was minimal. Although students are well motivated and willing to work, Tokarczyk warned that better training about equipment care must be provided. Lack of training in basic chemistry is also a problem for those expecting to study marine chemistry and pollution.

Robert Pett returned to the project in early 1994 to take up the marine chemistry position at UNSRAT. In addition to presenting lectures in oceanography and related fields, he worked with faculty to develop a better teaching and research capability. Toward this end, Pett wrote eight handbooks (listed below) which will guide faculty toward better research and improved research project management. During the seminars Pett also assisted faculty in writing research proposals which were then discussed with Pett and other faculty. As part of this effort Pett contacted potential sources of research funding on behalf of the university. For

[32]Also see Pett's related contribution under "Core Marine Sciences" on page 20

[33]P. T. Caltex Pacific Indonesia.

[34]However, Tokarczyk later returned as an equipment specialist and was able to provide additional training when the equipment had arrived. See "Equipment Maintenance and Repair" page 59.

example, he discussed possible AMDAL (environmental impact assessment) projects with officials at Public Works in relation to coastal zone planning.

Marine Toxicology

Vinayaga Pragatheswaran was assigned to UNRI in early 1994 as a marine toxicology specialist to assist with the development of UNRI's interest in marine pollution.

Pragatheeswaran discussed the content of courses related to pollution and toxicology with appropriate faculty, and provided comments for the improvement of these courses. In addition, Pragatheeswaran worked with counterparts to set up an analytical laboratory for water analysis. This activity was complemented by the review of the related laboratories at the Dumai campus where these subjects will be taught in the near future. Pragatheeswaran worked with Dinnel[35] to report on the status of the Dumai Laboratory.

Pragatheeswaran helped staff and students with research projects about marine pollution, particularly pollution related to heavy metals and hydrocarbons.

Pragatheeswaran also attempted to improve contacts with Caltex, the biggest employer in Riau, because close contacts with Caltex's environment division will lead to better employment opportunities for marine science students and improved research opportunities for faculty.

Natural Products Chemistry

Frank Chen joined the project at UNSRAT in early July 1994. He worked with several faculty and staff at UNSRAT to improve teaching and research capabilities in natural products chemistry. He presented a series of lectures in marine natural products chemistry, and worked to arrange equipment for teaching and research use. He reported on curriculum revisions needed at UNSRAT if a program in this field is to be viable.

Chen also developed a syllabus for a natural products chemistry course and assisted in teaching the course by giving lectures and leading several laboratory sessions. He also taught special lab sessions in techniques for gas chromatography, high pressure liquid chromatography and held a workshop on atomic absorption spectroscopy. He also provided recommendations for improvement of the instrumentation room and held a tutorial for experimental methods.

Chen faced a difficult task in attempting to establish an undergraduate program in natural products chemistry at UNSRAT. Chen strongly recommended that better basic chemistry courses be taught at UNSRAT. He stated that students must have a good background in organic chemistry prior to studying natural products chemistry, and that at present that background was not being provided. Chen felt that a program in natural products chemistry should be at the graduate level.

Chen recommended future research projects in natural products chemistry at UNSRAT, and he worked closely with UNSRAT staff to help develop these. Working with local staff he selected seaweeds as a starting point for extraction of natural products.

Chen also worked to build international contacts for cooperation on research into natural products. He suggested this as a viable way to rapidly build a new program which has only limited initial capability.

Reports

Chen, Frank S.C. 31/12/94. End of assignment report: Natural product chemistry specialist

[35]See under Marine Ecology starting on page 22.

Chen, Frank S.C. 31/10/94. Marine natural products chemistry: research feasibility study and recommendations

Chen, Frank S.C. 31/8/94. Marine natural product chemistry: Objective and scope in MSEP course at UNSRAT

Pett, Robert J. 1/7/94. End of assignment report : Marine chemistry specialist

Pett, Robert J. 1/6/94. Chemical ecology of marine plants and animals: lecture for the marine biochemistry course

Pett, Robert J. 1/5/94. Particulate fluxes and pollutant chemistry : a lecture for chemical oceanography course

Pett, Robert J. 1/4/94. Bacterial production & dissolved organic matter cycling: a lecture for the chemical oceanography course

Pett, Robert J. 1/3/94. Air sea exchange of gases & pollutants: a lecture for the chemical oceanography course

Pett, Robert J. 1/3/94. Collection & field processing of water and sediment samples

Pett, Robert J. 1/3/94. Collection of good data: protocol for quality assessment and quality control (QA/QC)

Pett, Robert J. 1/3/94. Statistical consideration & design of oceanographic surveys and laboratory / field experiments

Pett, Robert J. 1/2/94. Primer on proposal preparation & project planning

Pett, Robert J. 1/6/93. End of assignment: marine chemistry

Pett, Robert J. 1/4/93. Suggested syllabus for a chemical oceanography course. An introductory lesson and key reference material

Pett, Robert J. 1/3/93. Sekumpulan metoda laboratorium untuk parameters pemilihan qualitas air

Pett, Robert J. 1/11/92. Pengertian dampak lingkungan dari eksplorasi lepas bumi terhadap biota laut

Pett, Robert J. 1/11/92. Understanding environmental impact of offshore oil exploration on marine biota : some thought on the procedures

Pett, Robert J. 1/4/91. Syllabus usulan untuk kursus oceanography kimia, pelajaran pendahuluan, dan materi referensi kunci

Pragatheeswaran, V. 1/7/94. Manual of methods in aquatic environment research part 1. analytical procedure for heavy metals pesticides & petroleum hydrocarbon

Pragatheeswaran, V. 31/10/94. End of assignment report: marine pollution/toxicology

Pragatheeswaran, V. 1/9/94. Manual of methods in aquatic environment research. Part II: analytical procedures for PCBs & Hexachlorobenzene

Pragatheeswaran, V. 1/7/94. Manual of methods in aquatic environment research part 1. analytical procedure for heavy metals pesticides & petroleum hydrocarbon

Pragatheeswaran, V. 1/6/94. Practical laboratory guide for natural water analysis

Pragatheeswaran, V. 1/6/94. Selected physical methods for water parameters & method for estimation of plankton

Pragatheeswan, V. 1/8/94. Manual of analytical methods for animal biochemistry

Tokarczyk, Richard. 1/12/94. A brief introduction to gas chromatography: basic concepts, equipment, and laboratory requirements

Tokarczyk, Richard. 1/12/94. End of assignment report: environmental chemistry specialist

Tokarczyk, Richard. 1/12/94. Suggested syllabus for environmental chemistry laboratory with the practical guide for environmental chemistry laboratory

Tokarczyk, Richard. 1/10/94. Suggested syllabus for environmental chemistry course: introduction to the concept of environmental modeling

Remote Sensing

Activities

When Bryan Long first arrived at UNPATTI to take up his duties he found that no appropriate textbook for remote sensing was available. Consequently he prepared a three volume course reference. Because UNPATTI had no remote sensing equipment or suitable computing equipment during his stay there, Long prepared specifications for that equipment. This equipment was eventually purchased and was set up and used in 1995 by consultant Daniel DeLisle.

Bryan	Long	UNPATTI	May-92	Sep-92
Paul	LaViolette	IPB	Jan-94	Apr-94
Daniel	De Lisle	IPB	Mar-95	Jun-95
Daniel	De Lisle	UNPATTI	Jun-95	Sep-95

Table 8. Consultants who served as remote sensing specialists. Dates may include periods of leave.

De Lisle completed the set up of UNPATTI's remote sensing laboratory shortly after he arrived in late 1995. He assisted with the installation of BILKO, IDRISI, and Micro-Brian software.[36] De Lisle also provided specific advice on each type of software: BILKO software (free from UNESCO) is best used for teaching the basics of remote sensing and underlying principles, and is ideal for an advanced undergraduate course. It can run on any PC type computer. IDRISI software (also obtained from UNESCO) can also use any type of PC and is good for teaching somewhat more advanced aspects of image processing. The Micro-Brian software requires a specially adapted PC and is suitable for advanced users for research and teaching involving image processing. Terascan software is very specialized and limited to a specific type of image processing. It requires a specialized computer and is not really suitable for teaching.

To facilitate the use of this equipment De Lisle received and installed images for Ambon and the Saparua Islands, and also provided images on compact disks (from the coastal zone color scanner - examples covering the whole world, and from radarsat with examples covering parts of Canada). He also provided 200 slides for teaching remote sensing and revised the syllabus for the remote sensing course. De Lisle also assisted with a student project to assess corals via remote sensing. He also gave a one week workshop on image processing.

DeLisle had difficulty finding counterparts to work with him. He also found that no one at UNPATTI has training in modern remote sensing and image processing techniques.

At IPB remote sensing consultancies got underway in 1994 with the arrival of Paul La Violette. La Violette presented a series of lectures to faculty and advanced students which covered the basics of remote sensing for marine research. He also provided a detailed report to IPB regarding the design and requirements for a satellite receiving station and data processing station. After visits to other agencies which might provide remote sensing data, he concluded that, for sophisticated marine remote sensing work, IPB should have its own receiving station.

Daniel De Lisle followed up on La Violette's activities at IPB when he first joined the project in 1995. De Lisle concentrated his efforts on providing IPB staff with the basic tools for remote sensing teaching and research. To accomplish this goal he provided workshops on principles of remote sensing, basics of image processing, radar images, and introduction to geographic information systems. For introductory courses De Lisle prepared sets of the UNESCO's BILKO software packages for each LPIU. These provide an introduction to remote sensing and image processing for oceanography.

De Lisle also set up a database of images for use by IPB staff and students which includes images illustrating applications in coastal zone research and management, as well as images of Pulau Seribu, wetlands of Kalimantan, Sumatra, Jakarta, and Pelabuhan Ratu. De Lisle also completed a users' guide to image processing for the system he was using at IPB, and also provided a set of 186 35mm slides for teaching remote sensing concepts.

[36]Installation of TeraScan was done by technicians from the vendor.

Reports

De Lisle, Daniel A. 1/9/95. End of assignment report: Remote sensing consultant

De Lisle, Daniel A. 1/9/95. Technical report; Remote sensing and image processing workshop

De Lisle, Daniel A. 1/9/95. Technical report; TeraScan image processing software user's guide

De Lisle, Daniel A. 1/6/95. End of assignment report : remote sensing

De Lisle, Daniel A. 1/6/95. User's guide on image processing

La Violette, Paul E. 1/4/94. Lecture notes on the application of satellite remote sensing to oceanography analysis

Long, Bryan. 1/9/92. Introduction to remote sensing : basic principles with application to the marine environment. Part 1 - remote sensing

Long, Bryan. 1/9/92. Introduction to remote sensing : basic principles with application to the marine environment. Part - 2 marine remote sensing

Long, Bryan. 1/9/92. Introduction to remote sensing : basic principles with application to the marine environment. Part - 3 glossary, appendices & reference

Long, Bryan. 1/9/92. Remote sensing equipment specification

Mariculture and Related Fields

Activities

MSEP activities in mariculture included consultants stationed at all project universities except IPB. Sub areas within the mariculture category were quite varied as indicated in Table 9.

David	Fletcher	Mariculture/Hatchery	UNHAS	Feb-91	Aug-91
Alfredo	Santiago	Pond Engineering	UNDIP	Jul-91	Feb-92
Mikkel	Christensen	Mariculture	UNSRAT	Jul-91	Jan-92
Leigh	Owens	Fish Disease	UNDIP	Jul-91	Nov-91
Robert	Cordover	Mariculture/Shrimp	UNHAS	Sep-91	Apr-92
Stephen	Goddard	Fish Nutrition	UNDIP	Sep-91	Apr-92
Mikkel	Christensen	Mariculture	UNRI	Jun-92	Dec-92
Richard	Braley	Mariculture/Hatchery	UNPATTI	Jul-92	May-93
Chan	Lee	Mariculture	UNSRAT	Jul-92	Dec-92
Jean-Yves	Mevel	Fish Disease	UNHAS	Aug-92	Feb-93
Daniel	Lee	Mariculture/Shrimp	UNHAS	Oct-92	Apr-93
Felicitas	Pascual	Fish Nutrition	UNDIP	Jan-94	Sep-94
Richard	Braley	Mariculture/Hatchery	UNHAS	Jan-94	Jul-94
Alfredo	Santiago	Mariculture	UNSRAT	Jan-94	Jul-94
Charles	Angell	Hatchery Management	UNDIP	Mar-94	Jul-94
Clyde	Tamaru	Mariculture/Hatchery	UNPATTI	Mar-94	Sep-94
Antonio	Mines	Mariculture	UNPATTI	Apr-94	Jun-94
Stewart	Johnson	Fish Disease	UNDIP	Jul-94	Dec-94
Richard	Braley	Mariculture/Hatchery	UNPATTI	Aug-94	Nov-94
Emin	Teskeredzic	Fish Disease	UNHAS	Aug-94	Sep-94
Alfredo	Santiago	Mariculture	UNSRAT	Jan-95	Apr-95
Richard	Braley	Mariculture / Water Systems	CPIU	Jan-95	Jul-95
Frank	Roubal	Fish Disease	UNHAS	Jan-95	Mar-95
M. Victoria	Alday-Sanz	Fish Disease	UNHAS	Mar-95	Jul-95

Table 9. Consultants in mariculture and related fields. Dates shown may include periods of leave.

Mariculture (pond engineering)

Alfredo Santiago joined the project in mid 1991 to provide expertise in engineering aspects of mariculture related to ponds. His brief included providing advice on the design and construction of ponds at UNDIP's Jepara field station. Santiago provided advice on the design and location of the Jepara ponds, but this advice was not followed. Santiago also drew up specifications for equipment and supplies needed for the hatchery and pond culture facilities.

Santiago provided training to staff although supporting funds were quite limited. Six seminars were presented and several short practical courses for students in such subjects as pond design and construction were also given. Santiago also wrote training modules for pond engineering.

Santiago realized the need for faculty to be more involved with research activities and he worked with faculty to prepare research proposals. Unfortunately research funds were not readily available.

Mariculture (shellfish)

Robert Cordover was stationed at UNHAS early in the project. He noted a serious need to improve knowledge of research methods. In response to this need he gave a series of seminars

on research methods, and assisted staff in writing research proposals. He also organized a seminar series for the faculty to present their own research results and held meetings with the mariculture industry to learn about research needs.

Cordover also assisted with planning for field trips, and held several field training sessions for students and staff. He also assisted with curriculum and syllabus development for mariculture courses and provided recommendations for the field station.

Cordover's interviews with 132 students surprisingly revealed that most of them had hoped to be studying aspects of marine science not related to mariculture or living marine resources. Apparently, at that point in the development of the marine science program, there was still confusion over the relationship between "marine technology" and "marine science" as used in Indonesian.

Daniel Lee arrived at UNHAS about 6 months after Cordover's departure. He surveyed shrimp farms and examined the employment prospects for UNHAS graduates.

After interviewing students Lee realized that a significant problem for mariculture employers was finding high quality employees who had practical skills. Students, he found, did not get these skills within the UNHAS program and had a poor basic understanding of science and biology. Based on this finding Lee provided several suggestions for practical training of aquaculturists at UNHAS and provided a series of slides and handouts illustrating shrimp farming techniques. Lee also assisted students and staff with statistical analysis of shrimp data.

Hatchery Management

Hatchery management specialists worked with the project at three universities: UNHAS, UNDIP, and UNPATTI. Consultants assigned toward the beginning of the projects spent most of their time providing advice on the design of hatchery facilities and on course content. Some who came later in the project were able to use these facilities to provide practical training.

David Fletcher was the first hatchery specialist assigned at UNHAS. He found several limitations in the facilities and courses that hampered teaching and research about marine hatcheries. In response to this need he designed a hatchery for clam and topshell (*Trochus*) complete with lists of equipment needed, and also prepared a hatchery operations manual. In response to the staff's somewhat limited knowledge of the fundamentals of biology, Fletcher presented seminars on such things as the environmental requirements of marine larvae, larval nutrition, and the use of filters in hatcheries.

Fletcher also pointed out that the site for the field station at Barang Lompo Island had a high human population and a very limited fresh water supply. He provided some suggestions as to how problems there might be avoided.

When Richard Braley arrived at UNHAS in 1994 the Barang Lompo hatchery was nearing completion. One of Braley's primary tasks was to make the hatchery operational. His work included, for example, the installation of a safer seawater header tank, a new seawater pump,[37] and the renovation of various laboratories within the hatchery. Braley obtained good cooperation from the university which was able to purchase the needed items.

Braley initiated monthly meetings between UNHAS staff and local people on the Barang Lompo island. This helped in establishing good relationships between them, which was important in view of the limited fresh water supply.

Braley's field activities included the collection of 90 adult giant clam (genus *Tridacna*) specimens, of five different species, for broodstock. Braley trained counterparts to operate the clam hatchery and provided training in such topics as induced spawning of giant clams and maintaining algae cultures to feed clam larvae. By the end of Braley's assignment the

[37]The pumps installed by the contractors were corroded and useless.

hatchery was operational and held broodstock of several species of giant clam. The hatchery staff, under Braley's direction, successfully spawned *Tridacna derasa*. On a later visit to the hatchery Braley found that about 1.8 million clams had survived to age 3 months, an excellent survival rate.

Hatchery activities at UNDIP were limited to the four month assignment of Charles Angell. Angell presented a 10 lecture training course in hatchery design and operation including a week long practical session at Jepara. Angell also suggested, and discussed, several possible research topics with UNDIP staff, and assisted in starting up some of these research activities at Jepara. He also completed a syllabus for the hatchery technology course, and a report on the design and operation of shrimp hatcheries.

Angell provided advice regarding the Jepara shrimp hatchery and recommended several changes to improve the usefulness of the hatchery for teaching and research. Some of his suggestions addressed safety issues such as proper grounding of electrical systems.

Prior to his later assignment at UNHAS (see above) Richard Braley was stationed at UNPATTI where he worked with the UNPATTI administration and faculty to rebuild and modify the Polka mariculture facility.[38] During this period (starting in July 1992) Braley also gave a short course on hatchery techniques, collected bivalve broodstock with faculty, and held discussion groups with students and faculty. In addition he surveyed of local reefs for giant clams and *Trochus*, and prepared a questionnaire for local mariculture businesses.

Clyde Tamaru, who joined the project at UNPATTI in May of 1994, concentrated his work at the Poka mariculture facility where he provided training in methods for spawning and raising eggs and larvae of selected marine fish species. Topics of his training sessions included such things as gender and maturity determination, plankton culture techniques, and zoological photography. Tamaru also set up a system of regular visits to the fish market to demonstrated the amount of useful knowledge that could be obtained by sampling there. Information collected included such things as spawning seasons, growth rates, and size at sexual maturity for several species of fish which are targets for mariculture.

Tamaru also started, or assisted, with several research projects which produced useful and interesting results. One of these, for example, found that clove oil and eucalyptus oil are both useful as fish anesthetics. Another successfully raised the double ended pipe fish which commands a good price in both the aquarium trade and as a traditional eastern medicine. He also provided details for the completion of the hatchery at Hila.

Tamaru assessed training needs by using questionnaires to learn about student understanding of topics related to hatchery science. Surprisingly, his survey of fourth year students revealed that only 25 percent had used a microscope and fewer than 10 percent had used a computer.

Richard Braley returned to UNPATTI after his 1994 assignment at UNHAS. His activities at UNPATTI included improving the phytoplankton culture laboratory, presenting a workshop on hatchery hygiene and management, and instructed faculty on proper protocols for phytoplankton culture. In addition he completed trials for culture of rotifers (used as food for larval fish) at the hatchery and prepared a manual on this subject.

Braley also ordered and installed air blowers, purchased by the project, at the cultivation laboratory, and suggested a number of civil works improvements. [39]

During this assignment Braley traveled to Jepara (UNDIP) to teach at the mariculture workshop being held there. He also wrote a popular article about giant clams which was published in an Indonesian language newspaper.

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[38]At UNPATTI there is a new marine station at Hila, 45 minutes by road from the campus, plus the older mariculture facility at Poka which is very near the campus.

[39]Also see Braley's contribution under "Mariculture / Water Systems" on page 38.

Mariculture (other)

Mikkel Christensen joined the project at UNSRAT in mid 1991. He helped teach the introductory aquaculture course and wrote a manual for it. Christensen also commented on other courses which were needed to support mariculture training. In particular he felt that senior staff should teach more, and should work more closely with junior staff who did much of the teaching.

Christensen also carried out an evaluation of senior level students and found that they lacked skills in some basic subject areas. They had difficulty using microscopes and other basic equipment properly. They did not have sufficient knowledge of basic taxonomy of marine organisms, and did not understand basic concepts in ecology. They also lacked sufficient training in basic statistics, and had difficulty with abstract problem solving. Christensen provided suggestions as to how these shortcomings could be solved. He also suggested a format for reporting on course content and effectiveness.

Christensen also provided detailed suggestions for a proposed hatchery at the field station.[40]

Chan Lee arrived at UNSRAT about six months after Christensen's departure. As a part of his teaching, he prepared mariculture lecture and laboratory notes for distribution to students. During his assignment he found that students need more experience writing reports and doing practical laboratory work. Lee also reviewed plans for the field station at Likupang and recommended modifications related to aquaculture facilities and laboratories. He also provided research ideas for mariculture of local species of fish and shellfish.

At the start of 1994[41] the mariculture work at UNSRAT was resumed by Alfredo Santiago who attempted to make practical use of the mariculture facilities at the Likupang field station. Because some dikes of the brackish water ponds were inadvertently constructed so they were underwater at the highest tides, Santiago had to devise various techniques by which the ponds could be used for fish culture activities. Santiago arranged for some of the ponds to be repaired while he worked on projects with faculty and students in others. One project, for example, involved milkfish research. These fish were later sold, thus recovering the cost of the research. Santiago also made several specific recommendations for the improvement of the existing brackish water ponds, and assisted the university to implement these recommendations.

Santiago prepared materials for laboratory and field practicals and assisted several students with their senior thesis mariculture projects. He also completed a teaching manual on pond culture of the tiger prawn. Many other consultants agree with Santiago's view that the marine science curricula as implemented at UNSRAT is too specialized for an undergraduate program. He recommended a more straightforward program emphasizing a good background in basic sciences.

Fred Santiago returned for a three month follow-up assignment at UNSRAT in early 1995 to oversee the reconstruction of the brackish water ponds at the Likupang field station. Santiago provided specific advice on the repair of the pond dikes, canals, water source and other details in cooperation with CPIU consultants Braley (page 38) and Kneale (page 58). Unfortunately the meshing of construction contracts with consultants' advice was difficult.

During this period Santiago also worked with UNSRAT faculty and students to contact local mariculture industries, and assisted in the preparation of research proposals on seaweed farming and semi-intensive shrimp farming.

Mikkel Christensen was the only mariculture consultant assigned to UNRI. He took up his assignment there in mid 1992 after completing his assignment at UNSRAT. At UNRI Christensen developed and tested teaching materials for two courses: "an introduction to aquaculture", and "aquaculture and the environment" and also gave lectures in other courses.

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[40]Most consultants' recommendations regarding the Likupang field station were not followed.

[41]During 1993 there were no consultants at UNSRAT.

Christensen assisted UNRI staff with the Caltex Funded Nias Environmental Baseline Project by explaining ecological survey techniques and helped develop field guides to various marine species. During this activity Christensen realized that the staff lacked experience in planning and carrying out projects. As a consequence he also helped UNRI staff develop new research proposals.

In addition, Christensen helped with planning for Dumai field station, provided recommendations for book and equipment purchases, and tried to develop better links with Bung Hatta University in Padang.

Antonio Mines arrived at UNPATTI in January of 1994 but was only officially assigned to mariculture in April. His efforts were primarily directed at making the aquacultural aspects of the Hila field station operational. He provided advice regarding the redesign of parts of the station and ponds, and received financial support from the university for carrying out this work. The ponds were also used, under his direction, as research sites for students doing their senior theses. Research/ demonstration work included the raising of milkfish fry and fingerlings as well as some work with other species.

Mines also proposed a 5 year development plan for the Hila station and discussed possible cooperative arrangements with outside groups whereby funding for the station might be made available.

Mariculture / Water Systems

Richard Braley re-joined the project in 1995 as a CPIU consultant. In close cooperation with Doug Kneale (facilities inspection) and other consultants he provided advice regarding the use of seawater systems for mariculture teaching and research. This information was later placed into a special report for each university intended as a practical guide to assist them in continuing to use and improve their seawater systems. At each university Braley set up a seawater systems committee to coordinate and share the use of the mariculture and related facilities. Although Braley received good cooperation from marine science staff, his effectiveness would have been improved by better coordination between marine science staff and the university administrative offices responsible for civil works improvement.

Braley used funds allocated from the consultancy contract to purchase needed technical materials[42] (especially air blowers, micro filters and pumps) which provided universities the basic ability to activate their mariculture teaching and research programs.

At UNHAS Braley presented a seminar on giant clam culture and provided advice to students for senior thesis research on the same topic. He also worked with faculty on ocean culture techniques for giant clams and worked out cooperative programs between UNHAS and the World Wide Fund for Nature to move young clams from the UNHAS hatchery to Taka Bone Rate and Bunaken marine reserves. During his visits to other universities he gave workshops on hatchery hygiene and management, and seawater systems, and assisted in improving the micro-algae laboratories. He also discussed possibilities for future research projects with rabbit fish (*Siganus*), and *Trochus*.

Braley also wrote the report "Supplies for Seawater Systems" which lists local suppliers for seawater and mariculture systems.

Fish Diseases

Fish disease specialists were assigned to UNDIP and UNHAS. In both cases a consultant was assigned near the start of the project, but the following consultants, because of delays in equipment procurement, were not assigned until much later.

[42]Technical materials funds were first made available to consultants for such uses in May 1994 as specified in memorandum of understanding 2.

Leigh Owens arrived at UNDIP in late 1991. He noted that all commercial mariculture facilities visited faced serious disease problems, but also noted that there was no scientific infrastructure for disease investigations at UNDIP or elsewhere in Central Java. He recommended several courses of action to provide appropriate training of UNDIP staff.

Owens prepared a list of equipment needed for fish disease teaching and research, and provided training for counterparts. He also prepared teaching aids, and assisted with planning the Jepara laboratory.

Stewart Johnson joined the project at UNDIP at the beginning of July 1994, over two and one half years after Owens' departure. He assisted with the move of the consultant's office to the new building in Jepara and then started a number of activities related to diseases of fish and shellfish. Johnson's activities were severely limited by the lack of staff and students at the Jepara campus.[43] In spite of this problem, he wrote a manual on microscope use and care, set up a modest phytoplankton laboratory, and wrote lecture notes on diseases of fishes. Johnson also conducted a small workshop on basic microscopy, made presentations about management techniques to reduce disease in aquarium and hatchery facilities, presented a tutorial and practical session on shrimp diseases, and assisted students with senior thesis research projects.

Jean-Yves Mevel started work at UNHAS in August 1992. Mevel refined the syllabus for the fish health management course and wrote course and laboratory manuals for it. He tested these manuals during a training program for junior staff. In cooperation with his counterpart, he wrote laboratory practicals and successfully tested some of these within the limitations of the existing equipment. Mevel also provided advice on equipment, books and lab materials needed for fish disease courses and for research.

Mevel provided training in the design of aquaculture facilities and methods of literature research, and helped with a workshop on mariculture in Sulawesi. He also assisted staff with writing proposals, and had students complete a questionnaire related to mariculture.

Emin Teskeredzic was only with the project at UNHAS for two weeks before having to return home for family reasons.

Frank Roubal arrived early in 1995 and got off to a good start working with UNHAS faculty in the laboratory. He instructed counterparts in techniques for examining fish and shellfish for disease organisms. He also wrote an illustrated manual on histological techniques and a laboratory guide for dissection of bivalves. Unfortunately, Roubal had to return home for family reasons at the start of March. He was replaced by Victoria Alday-Sanz who started her assignment in late March 1995.

Alday-Sanz encouraged the UNHAS staff to work more closely with local shrimp farms. She learned about the needs of the farms and subsequently incorporated this information into a revised syllabus for both a fish disease and a fish health management course. She found that there is a critical need to improve laboratory practicals associated with the fish disease courses. She therefore designed practical courses without unreasonable demands for special equipment.

Alday-Sanz also established a shrimp disease survey in collaboration with UNHAS and the government's Coastal Aquaculture Research Center. This allowed her to work with local faculty to combine shrimp disease research with extension work at local shrimp farms. This included the preparation of extension brochures: "Use of Aerators" and "Checking the Quality of Post-Larvae". Thus Alday-Sanz's ultimate success was to get university personnel working with local shrimp farms and near-by government agencies.

Alday-Sanz also provided training to the staff via seminars on 1) shrimp defense mechanisms against disease, 2) the pathogenesis of vibrio infection in shrimp and 3) histological diagnosis

[43]During this period there was a several month long student strike at UNDIP related to the disagreement over whether the faculty would be a "Marine Science", a "Fisheries" or a "Marine Science and Fisheries" faculty. This situation also adversely affected the consultancies of Laura Lazo (marine ecology) and Rick Newitt (physiology).

of shrimp diseases. She also offered a short course "Shrimp Health Management and Diseases".

Fish Nutrition

Stephen Goddard, the first fish nutritionist to join the project, started his assignment at UNDIP in September of 1991. After examining the situation, Goddard found that fish culture industry is highly dependent on imported feeds. As a consequence he suggested that UNDIP could increase its role by providing technical assistance to the mariculture industry by developing feeds from local sources.

Goddard prepared proposals for research on fish feeds, and also developed practical laboratory exercises and a lab manual emphasizing practical studies. He also provided advise on the curriculum.

Starting in January of 1994 Felicitas Pascual followed up on some of Goddard ideas. She completed a course outline and presented several lectures related both to nutritional needs of fish and shrimp and to the development of fish and shrimp feeds using locally available ingredients. These lectures included such technical topics as "Protein and Amino Acid Metabolism in Fish" but also included other related topics such as "The Role of the Nutritionist, Feed Manufacturer, and Culturist in the Fish Culture Industry." These lectures and course outlines included practical demonstrations for students who later taught fish farmers.

As a follow-up Pascual helped UNDIP staff present a short courses for fish farmers about the use of locally made fish feeds. This activity helped both the university staff and local people, and is consistent with the triple role of the university - Teaching, Research, and Extension.[44] Pascual also wrote, in cooperation with her counterparts, a manual for fish farmers.

Pascual also assisted in the preparation of research proposals by faculty and helped students with senior thesis topics.

Reports

Alday-Sanz, Victoria 1/7/95 End of assignment report : Fish disease specialist

Alday-Sanz, Victoria 1/7/95 End of assignment report : Fish disease specialist

Alday-Sanz, Victoria 1/7/95 Technical report : Short course on shrimp diseases and health management

Alday-Sanz, Victoria 1/7/95 Technical report, short course on shrimp diseases and health management

Angell, Charles L. 1/7/94 A guide to the design and operation of penaeid shrimp hatcheries.

Angell, Charles L. 1/7/94 End of assignment report : Hatchery management specialist.

Angell, Charles L. 1/5/94 Comments regarding shrimp hatchery research and training

Angell, Charles L. 1/5/94 Teluk Awur hatchery review

Braley, Richard D 14/7/95 Universitas Pattimura : Final mariculture and water systems advisory report

Braley, Richard D. 14/7/95 Institut Pertanian Bogor : Final mariculture and waters systems advisory report

Braley, Richard D. 14/7/95 Universitas Diponegoro : Final mariculture and water systems advisory report

Braley, Richard D. 14/7/95 Universitas Hasanuddin : Final mariculture and water systems advisory report

[44]known locally as Tri-Dharma.

Braley, Richard D. 14/7/95 Universitas Riau : Final mariculture and water systems advisory report

Braley, Richard D. 14/7/95 Universitas Sam Ratulangi : Final mariculture and water systems advisory report

Braley, Richard D. 1/5/95 Supplies for seawater systems

Braley, Richard D. 30/11/94 End of assignment report : Mariculture specialist

Braley, Richard D. 1/11/94 Maintenance of stock cultures for rotifiers (*branchionus* sp)

Braley, Richard D. 1/7/94 End of assignment report : Hatchery management specialist

Braley, Richard D. 1/7/94 Notes on hatchery management

Braley, Richard D. 1/6/94 Notes on hatchery hygiene

Braley, Richard D. 1/12/93 End of assignment report : Mariculture specialist

Braley, Richard D. 1/4/93 Special report : Basic training course for hatchery operation

Braley, Richard D. 1/3/93 A Study of reproduction periodicity & stage of gonad development in tropical bivalves

Christensen, Mikkel S. 1/12/92 End of assignment report: Mariculture specialist

Christensen, Mikkel S. 1/1/92 End of assignment report: Mariculture specialist

Christensen, Mikkel S. 1/12/91 An introduction to aquaculture, with special reference to marine and brackish water environments

Cordover, Robert 15/4/92 Final report of the mariculture consultant at Hasanuddin University September 1991 to April 1992

Fletcher, David J. 1/8/91 End of assignment : Mariculture hatchery management specialist

Fletcher, David J. 1/8/91 Giant clam hatchery & larval research laboratory : Design & equipment

Fletcher, David J. 1/8/91 Hatchery operating manual for tridacnid clams the topshell & larval research.

Goddard, S. 1/4/92 End of assignment : Mariculture specialist

Goddard, S. 1/3/92 Practical laboratory guide for fish and shellfish nutrition

Johnson, Stewart C. 1/12/94 End of assignment report : Fish disease specialist

Lee, Chan 1/12/92 End of assignment : Mariculture specialist

Lee, Chan 1/11/92 A Review on the marine field station marine sciences building and the equipment and library lists for UNSRAT Manado

Lee, Chan 1/11/92 Laboratory/tutorial manual : Mariculture specialist

Lee, Chan 1/11/92 Lecture series in mariculture

Lee, D.O. 1/4/93 End of assignment : Mariculture / shrimp

Mevel ,J. 1/2/93 Fish health management laboratory

Mevel, J. 1/2/93 Fish health management

Mevel, J. 1/2/93 List of books available at consultant's office

Mevel, J. 1/8/92 Final report : Mariculture, fish disease

Mines, A. 1/6/94 A guide book on mariculture

Mines, A. 1/6/94 End of assignment report : Exploration of marine resources mariculture specialist

Mines, A. 1/9/92 A reference manual on exploration of the living resources

Mines, A. 1/9/92 End of assignment report : Living marine resources

Owens, Leigh 1/11/91 End of assignment : Mariculture-disease specialist

Owens, Leigh 1/9/91 Concept paper : Aquatic disease (mariculture)

Pascual, Felicitas P. 1/8/94 End of assignment report : Appendix I instruction materials

Pascual, Felicitas P. 1/8/94 End of assignment report : Appendix II research activities

Pascual, Felicitas P. 1/8/94 End of assignment report : Appendix III extension activities

Pascual, Felicitas P. 1/8/94 End of assignment report : Fish nutrition specialist

Pascual, Felicitas P. 1/4/94 Lecture notes and seminar handouts : Fish nutrition specialist

Roubal, Frank R. 1/3/95 End of assignment report : Fish health specialists

Roubal, Frank R. 1/2/95 Some basic techniques in histology

Santiago, Alfredo 1/4/95 End of assignment report : Mariculture specialist

Santiago, Alfredo 1/7/94 End of assignment report mariculture specialist

Santiago, Alfredo 1/7/94 Reference book on shrimp culture

Santiago, Alfredo 1/1/92 End of assignment : Mariculture, pond engineering

Tamaru, Clyde 1/9/94 Basic biology quiz and general information questionnaire

Tamaru, Clyde 1/9/94 End of assignment report : Mariculture specialist - fish hatchery

Tamaru, Clyde 1/9/94 Larval culture of the double-ended pipefish, *sygnathoides biaculeatus*

Tamaru, Clyde 1/9/94 Minyak cengkeh and minyak kayu putih as anesthesia for fish : Praktek ketrampilan (PKL) studies

Tamaru, Clyde 1/9/94 Semester VIII practium for the reproduction and cultivation of fish

Tamaru, Clyde 1/9/94 The local fish market as a resource for teaching and research

Tamaru, Clyde 1/9/94 Use of a hemocytometer in the culture of phytoplankton (in English and Bahasa Indonesia)

Tamaru, Clyde 1/9/94 Workshop on phytoplankton culture

Tamaru, Clyde 1/9/94 Zoological photography as a teaching and research tool

Physiology

Activities

Consultants specializing in marine animal physiology were assigned to three universities: UNSRAT, UNDIP and UNHAS. Although most activities of these consultants emphasized aspects of physiology related to mariculture, some also involved investigation of basic physiological principles as applied to marine organisms.

Arnold	Sutterlin	UNSRAT	Jan-92	Jul-92
Thomas	Carefoot	UNDIP	Apr-92	Jun-92
Ewen	McLean	UNHAS	Apr-92	Sep-92
Arnold	Sutterlin	UNDIP	Oct-92	Jan-93
Ewen	McLean	UNHAS	Jul-94	Jan-95
Rick	Newitt	UNDIP	Aug-94	Dec-94
Arnold	Sutterlin	UNDIP	Feb-95	Mar-95

Table 10. Consultants in physiology. Dates shown may include periods of leave.

Arnold Sutterlin was assigned to UNSRAT in early 1992. Sutterlin spent much of his time teaching a course in marine physiology and an aquaculture seminar series. Because there was considerable overlap with the general physiology course already offered, Sutterlin worked with counterparts to focus the scope of the marine physiology course and to include a series of laboratory sessions covering marine examples. Sutterlin also provided training in computer use and data analysis, and assisted with various laboratory activities.

Sutterlin found that students generally had a poor background in basic sciences and math. He suggested that teaching in these areas needs to be strengthened. He also found that equipment limitations could be made less severe if a better equipment management policy was established. Much of the equipment was kept locked up and was not available for most faculty or students.

Thomas Carefoot took up the physiology position at UNDIP in April of 1992. He wrote a comprehensive laboratory manual for marine physiology which included test questions and detailed laboratory demonstrations. He also, with counterparts, presented a lab practical on molluscs, and a workshop on blood glucose analysis. Carefoot also prepared several research proposals and helped implement some.

Carefoot suggested a course program for physiology which emphasized more basic science followed by specialized courses.

Sutterlin was assigned to UNDIP about four months after Carefoot's departure. To a large extent he performed the same duties as during his previous assignment at UNSRAT (see above). He presented several special topic seminars and made additional recommendations for the UNDIP marine science curriculum. Sutterlin emphasized the desirability of working with the Government's Jepara Brackish Water Fisheries Research Station, and suggested that staff there could serve as adjunct faculty at UNDIP.

Over one year later, Rick Newitt took up the physiology duties at UNDIP. Newitt found that very few staff or students were working in Jepara, and thus had difficulty carrying out his assignment.[45] He participated in a field trip with students to survey invertebrate species at Panjang Island, and also worked with students to build biological filters for holding invertebrate species for study in the laboratory. He also assisted students with the design of their senior thesis proposals. Newitt resigned from his position early.

Arnold Sutterlin returned to UNDIP in early 1995 where he worked with faculty to set up and teach a course in reproductive physiology. A course outline was developed and counterpart teaching assignments were made. Laboratory demonstrations and activities were designed and developed with counterparts, and a series of overheads to be used in teaching the course were created. Sutterlin moved to Jepara where the course was taught.[46] Lectures included

[45]See footnote 43

[46]Apparently the problems at UNDIP had been solved by this time, and students and some faculty were using the Jepara marine station. Also see footnote 43.

information about employment and research opportunities related to marine animal physiology. Sutterlin presented several lectures in the course covering such topics as the production of sterile animals and the energetics of reproduction. Sutterlin presented laboratory demonstrations to faculty assigned to teach laboratory sessions.

Ewen McLean filled two physiology assignments at UNHAS; one in 1992, and one in 1994-95. During his first assignment he prepared a physiology course outline and teaching aids (such as overhead transparencies), and made suggestions for course restructuring with an increased emphasis on laboratory teaching.

McLean also organized a workshop on aquaculture in South Sulawesi, assisted staff with proposal preparation, research activities and teaching assignments.

During his second assignment McLean presented seminars on several topics including spectrophotometry, use of biotechnology to reduce environmental impacts of mariculture, growth acceleration techniques for mariculture, and use of various marine science software packages. McLean also presented practicums to students in: osmoregulation, hematology, quality control, surgical techniques for mariculture, spectrophotometry, and endocrine manipulations. He wrote scientific papers in cooperation with counterparts, and also assisted with the preparation of several research proposals on a variety of subjects.

McLean assisted in getting the marine science laboratories in better working order by setting up and checking the spectrophotometer, and by preparing stocks of chemicals and providing directions for making them. He also worked to get the microtome operating properly.

Reports

Carefoot, Thomas H. 1/5/95 Interim final report[47]

Carefoot, Thomas H. 1/6/92 Practical lab guide for marine animal physiology: Marine animal physiology specialist

Carefoot, Thomas H. 1/5/92 A two-day laboratory practical on molluscs

Carefoot, Thomas H. 1/2/92 Practical laboratory guide for marine animal physiology

McLean, Ewen 1/1/95 End of assignment report : Marine animal physiology specialist

McLean, Ewen 1/9/92 End of assignment : Marine animal physiology

Newitt, Richard A. 1/12/94 End of assignment report : Marine physiology specialist

Sutterlin, A. 1/3/95 A teaching module for marine reproductive physiology

Sutterlin, A. 1/3/95 End of assignment report : Marine physiology specialist

Sutterlin, A. 1/1/93 End of assignment report : Marine physiology specialist

Sutterlin, A. 1/7/92 End of assignment : Marine physiology specialist

Sutterlin, A. 1/7/92 Proposed laboratory exercises : Marine physiology specialist

[47]Carefoot did not return for his second assignment so the interim report is actually the final report.

Marine Resources

Activities

Consultancy activities in the category "marine resources" included the following sub-categories: "Population dynamics" which deals with analysis of fish populations to determine stock health and to predict effects of fishing, "marine resources exploration" which deals with more general information about the biology and management of biological marine resources, and "fisheries and mariculture" which in this case refers to the provision of advice, seminars and workshops related to marine fisheries.

Aloysius	Dwipongo	Fisheries and Mariculture (d)	CPIU	Apr-91	Mar-92
Chris	Mathews	Marine Resources Exploration	IPB	Aug-91	Feb-92
Antonio	Mines	Marine Resources Exploration	UNPATTI	Sep-91	Sep-92
Trevor	White	Population Dynamics	UNPATTI	Nov-91	Apr-92
Antonio	Mines	Marine Resources Exploration	UNPATTI	Jan-94	Apr-94
Jurgen	Saeger	Marine Resources Exploration	IPB	Apr-94	Apr-95
Gomal	Tampubolon	Fisheries and Mariculture (d)	CPIU	May-94	Nov-94
Ricardo	Federizon	Population Dynamics	UNPATTI	Aug-94	Dec-94

Table 11. Consultants assigned to fields related to marine resources. Dates shown may include periods of leave.

Population Dynamics

Trevor White started work at UNPATTI in November 1991 where he helped with courses in population dynamics and assisted with a computer course taught by his counterpart. White also drew up a syllabus for population dynamics course.

Ricardo Federizon took up the UNPATTI population dynamics assignment in August of 1994, over two years after the departure of White. He presented seminars, and worked closely with faculty, staff, and cooperators from other agencies to improve the research approaches being used in the assessment of the beach seine fishery which supplies bait-fish to the tuna fishery. His work involved visiting the beach seine sites and, via observation and discussion with counterparts, learning which areas of data collection could be strengthened.

Federizon held a 15 day fish population dynamics workshop which was supplemented by field activities and sampling at the beach seine fishery sites where proper techniques for the field collection of fishery data were applied. This approach provided staff and students with both theoretical knowledge and an opportunity to apply that knowledge to a real world situation.

Federizon also assisted with revision of courses so that related courses would better complement one another. He also held a mini workshop on fisheries software and its application.

Marine Resources Exploration

Chris Mathews joined the project at IPB in August of 1991. He had hoped to carry out field work with counterparts as part of his assignment, but changes in plans for the national cruise[48] made this impossible. Instead Mathews assisted with the preparation of the cruise plan and also devised various shore based fisheries assessment activities for Pelabuhan Ratu.

Mathews held a workshop on applied stock assessment for participants from all six universities. During the workshop Mathews taught both theoretical and practical aspects of

[48]Several national cruises were carried out under the MSEP, but consultants were only occasionally involved with the planning and execution of these.

stock assessment. Mathews also worked with counterparts to revise the syllabus and wrote a manual for the living marine resources course. He also prepared guidelines for an MSc program at IPB, and prepared a list of equipment needed to support the MSc program.

Antonio Mines was assigned to UNPATTI in late 1991. He reviewed the curriculum related to living marine resources and made suggestions for its improvement. In particular he recommended more practical training, and the need for a course in conservation and management of marine resources. He also prepared a syllabus for the course Exploration for Living Marine Resources. Mines also assisted several staff to prepare research proposals and provided advice on the Hila Marine Station design.[49]

Jürgen Saeger started his consultancy at IPB in April 1994 as requested by IPB, but his services were not needed at that time because the training vessel was not available. Consequently Saeger was placed on extended duty travel to UNPATTI.[50] Prior to moving to UNPATTI Saeger discussed the deck layout of the training vessels with the naval architect and provided useful suggestions and practical comments regarding requirements for fishing operations. After his arrival at UNPATTI, Saeger assisted the staff there to prepare a research and training program related to the 17 meter training vessel and the Boston Whalers. Saeger was instrumental in getting the "Boston Whaler" boats into the water and useable. These were then used for a number of field trips on Ambon bay with staff and students in cooperation with the marine acoustics (Elminowicz) and oceanography (Frische) consultants. Saeger also recommended a program to modify the "Boston whaler" boats so that they would be safer and more useful. Saeger completed his temporary assignment at UNPATTI in August 1994 and returned to IPB.

At IPB he assisted staff in obtaining documents and software for marine resource assessment and also drew up a design for trawl and deck gear to be used with the research/training vessel. In addition Saeger worked with IPB staff on a report on the skipjack tuna fishery of eastern Indonesia and assisted with several proposals for at sea research.

Saeger accompanied a student field trip to Pelabuhan Ratu where he helped to teach species identification and sampling and data collection techniques with the help of Gomal Tampubolon, one of the vessel operations consultants.

Fisheries and Mariculture[51]

Gomal Tampubolon joined the project as a fisheries consultant, in late May of 1994. Because of his extensive experience in field aspects of fisheries, he worked with faculty and students to improve their field sampling skills. This work included assisting students carrying out their senior thesis research, and cooperating with staff members' project activities. During his visits to the various project universities he also discussed the opportunities for closer cooperation between the universities and fisheries agencies.

One of Tampubolon's major concerns was the need to give students practical field experience. He also emphasized the role that can be played by practical experience with data collection at fish auction places as well as onboard research and commercial vessels.

Tampubolon also worked with the university staff to select and purchase appropriate sea charts for each area, and assisted in the preparation of cruise plans.

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[49]Mines returned to UNPATTI in January of 1994, but during that assignment his work plan was changed in consultation with the dean and rector to emphasize mariculture activities at the Hila field station. Therefore his activities are listed under the mariculture component (see page 38).

[50]This move was done partly to offset the fact that Mines' terms of reference at UNPATTI were changed from marine resources exploration to mariculture.

[51]There is no report on file for Aloysius Dwipongo, but it is believed that he visited project universities where he presented lectures on Indonesia's marine resource assessment programs.

Reports

Federizon, Ricardo R. 1/12/94 End of assignment report : Fish population dynamics specialist

Federizon, Ricardo R. 1/12/94 Documentation on the workshop on tropical fish stock assessment held at faculty of fisheries UNPATTI

Mathews, C.P 1/12/91 Staff training work shop in applied stock assessment and living marine resources exploration & prospect

Mathews, C.P. 1/1/92 Final report volume 1 : Living marine resources exploration activity summary

Mathews, C.P. 1/1/92 Final report volume 2 : Living marine resources exploration curriculum.

Mathews, C.P. 31/1/92 Final report volume 3 : The workshop on applied stock assessment and living marine resources exploration (workshop manual)

Mathews, C.P. 1/1/92 A conceptual plan for the degree of master of marine sciences at the Institut Pertanian Bogor and in Indonesia

Mathews, C.P. 1/1/92 A proposal for carrying out field based, applied stock assessment research at Pelabuhan Ratu

Mathews, C.P. 1/12/91 A course based structure for the M.Sc. in the marine science program at IPB

Mathews, C.P. 1/12/91 Questionnaire on student impression and opinions about, progress on, and impact of the marine sciences and technology study program at IPB : results

Mathews, C.P. 1/11/91 Equipment needed for supporting the master of marine science degree at IPB

Mathews, C.P. 1/11/91 Possible areas of cooperation for developing the master of MS degree jointly with other specializations at IPB

Mathews, C.P. 1/11/91 Possible collaboration between the applied statistics center, IPB & the MSEP

Mathews, C.P. 1/11/91 Research & on job field training at Pelabuhan Ratu

Mathews, C.P. 1/10/91 Cooperation between the IPB/LPIU & the governmental fisheries research and management sector in Indonesia

Mathews, C.P. 1/9/91 Development of Pelabuhan Ratu as a fisheries research center

Mathews, C.P. 1/9/91 Result of visit to the office of the United Nation Scientific Education & Culture Organization. Jakarta

Mathews, C.P. 1/1/91 Activities & achievement report : Marine living resources exploration

Mines, A. 1/9/92 A reference manual on exploration of the living resources

Mines, A. 1/9/92 End of assignment report : Living marine resources

Saeger, Jürgen 1/6/95 Course and lecture manuscript in living marine resource exploitation

Marine Acoustics

Activities

Three marine acoustics experts were assigned to the project: two at IPB and one at UNPATTI. All three consultants faced difficulties due to the non-availability of the specialized equipment which was the primary target of their consultancies. At UNPATTI, the equipment order had been inadvertently delayed. At IPB the acoustics equipment was kept locked up much of the time. All three consultants managed to provide useful training and advice in spite of these shortcomings.

Andrzej	Stepnowski	IPB	Sep-91	Feb-92
Andrzej	Stepnowski	IPB	Jan-94	Mar-94
Andrzej	Elminowicz	UNPATTI	Mar-94	Dec-94
Andrzej	Stepnowski	IPB	Jan-95	Mar-95
Joanna	Szczucka	IPB	May-95	Aug-95

Table 12. Consultants in marine acoustics. Dates shown may include short periods of leave or other non-project time.

Andrzej Stepnowski was the first acoustics consultant assigned at IPB in September of 1991. He reviewed the curriculum and recommended that students interested in acoustics obtain a better background in mathematics, electronics, statistics, and instrumentation. He also suggested a revision of the course in marine acoustics, and assisted with development of an M.Sc. program in marine acoustics. Stepnowski recommended that the M.Sc. program be research rather than course oriented. Stepnowski also presented a workshop on applications of hydroacoustic data processing systems, and gave a short course for junior staff. He also prepared proposals to carry out acoustics research, planned field work, and prepared and distributed lecture notes.

Stepnowski also provided a design and specifications for a marine acoustic laboratory, including a revised the list of equipment.

Stepnowski returned to IPB for his second assignment in January of 1994 after an absence of almost two years. At this time the acoustics equipment had been delivered, but Stepnowski was not permitted to use it. Nevertheless, Stepnowski presented a training course in Marine Fisheries Acoustics to staff and graduate students from four project universities. In addition, Stepnowski trained his counterparts in the use of hydroacoustics for stock assessment purposes by using a hands on computer training program. He also gave them an introduction to a geographic information system (GIS) for fisheries. He also assisted with the design of an acoustics survey of the Java sea.

Although the marine acoustics equipment had been delivered to IPB prior to January 1994, the crates could not be opened, and the equipment could not be used or demonstrated by the consultant. In spite of considerable efforts this administrative problem was never solved.

Stepnowski returned to IPB in January of 1995. Surprisingly, the equipment delivered a year earlier was still not available for his use. This resulted in a significant decrease in Stepnowski's effectiveness. The fact that the research vessels had not been delivered[52] also severely hampered the training of faculty and students. Working with his counterpart and other faculty, Stepnowski prepared and presented a course titled "operation of a dual beam / echo integration system and its use in estimation of marine fish populations".

Joanna Szczucka joined the project in late May 1995. She immediately started work with IPB staff to prepare for the arrival of IPB's new training / research vessel "Stella Maris". With this goal in mind Szczucka discussed various options with IPB staff and with vessel operations advisor Andrzej Elminowicz,[53] and attempted to prepare for the arrival of the vessel by locating, testing and setting up the Biosonics acoustics equipment.

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[52]Although there were many delays in the construction and delivery of the vessels it was expected that they would have been completed by early 1995. In fact the IPB vessel was not delivered until late August 1995.

[53]Note: Stepnowski, Szczucka and Elminowicz were all marine acoustics consultants. Elminowicz also served as one of two vessels operations advisors (see page 55).

Unfortunately, due to a prolonged illness, Szczucka's counterpart was not available during her entire consultancy nor had he been available during the 1995 assignment of Stepnowski. The absence of the counterpart made it difficult for Szczucka to locate the various components of the equipment which were locked in various labs and offices. Also, when the equipment's computer was eventually located, its hard disk was found to be empty and new software had to be requested from the manufacturer. These problems, combined with the delay in the delivery of IPB's research vessel made Szczucka's consultancy less productive than it could have been.

In spite of these problems, Szczucka located the acoustics equipment, set it up and used it on board the training vessel "Stella Maris" shortly before her departure. Thus, when Szczucka left the project the acoustics equipment was in good working order. However, she strongly recommended that IPB assign a specialist to work with this equipment. The assigned person should be someone with formal electronics training, and should also have specific training provided by the manufacturer.[54]

As a substitute for her expected work on the vessel, Szczucka presented a series of lectures on the fundamentals of acoustic oceanography with applications to fish population estimation. The emphasis of these lectures was the effects of sound propagation conditions and scattering problems on fish population estimation as well as the operation of acoustic equipment and processing of the data obtained by the equipment.

Szczucka felt that there are great opportunities in this field especially if scientists at the various Indonesian agencies and universities work more closely together.

Andrzej Elminowicz took up the acoustics position at UNPATTI in March 1994. In carrying out his work, Elminowicz overcame the lack of acoustics equipment by initiating close cooperation with the UNPATTI physics laboratory, the Center for Oceanographic Research and Development, and the local technical high school for fisheries. In this way Elminowicz was able to borrow a scientific echosounder and other necessary equipment. Using this equipment he was able to provide training in fisheries acoustics and in the use of other electronics.

Elminowicz also examined the suitability of the curriculum and course content for work in marine acoustics and concluded that more basic math and physics training is needed.

After a short break Elminowicz undertook a second assignment at UNPATTI. During this assignment he held a workshop on acoustic calibration and target strength measurement, and used this training as a basis for carrying out a calibration cruise and hydroacoustic survey of Inner Ambon Bay. This effort resulted in a number of reports written by staff and students and provided everyone with practical hands on experience. As a follow-up, Elminowicz and counterparts put together a catalogue of echograms of Ambon bay, and also presented a series of seminars resulting from the Ambon bay surveys.

Elminowicz also prepared a proposal for the use of the new training vessel and advised students and counterparts on matters related to marine acoustics.

Reports

Elminowicz, Andrzej 1/12/94 End of assignment report : Marine acoustics specialist

Elminowicz, Andrzej 11/8/94 Latihan hidroacoustic : Pelajaran bagi staf dan mahasiswa

Elminowicz, Andrzej 1/7/94 Lecture notes on the introduction to the use of hydroacoustic systems for estimating fish biomass : Part I

Elminowicz, Andrzej 1/8/94 Lecture notes on the introduction to the use of hydroacoustic systems for estimating fish biomass : Part II.

[54]Biosonics, the manufacturer of the equipment in question, provides free training courses as part of the purchase agreement.

Elminowicz, Andrzej 27/7/94 General information questionnaire for students

Elminowicz, Andrzej 1/7/94 Special lecture notes on electronics and navigation : Marine acoustics

Elminowicz, Andrzej 1/6/94 Lecture notes for a special training course on marine instrumentation : Marine acoustics

Stepnowski, Andrzej 1/2/95 Lecture notes on operation of a dual beam processing/echo integration acoustic system and its use in assessing marine fish populations

Stepnowski, Andrzej 1/2/95 Proposal on acoustic survey using a dual beam processing/echo integration system for assessing marine fish populations off the western Java coast

Stepnowski, Andrzej 1/2/95 Recommendation to upgrade of the IPB research vessel "A"-frame for towing the towed body ("biofin") of a dual beam/echo integration acoustic system

Stepnowski, Andrzej 1/1/95 End of assignment report : Marine acoustics specialist

Stepnowski, Andrzej 1/4/94 Lecture notes on the application of hydroacoustic data processing systems

Stepnowski, Andrzej 1/2/92 The application of hydroacoustic data processing systems

Stepnowski, Andrzej 1/9/91 Final report : Marine acoustics

Szczucka, Joanna DR. 1/8/95 End of assignment report : Marine acoustics specialist

Szczucka, Joanna DR. 1/7/95 Lecture notes on fundamentals of acoustical oceanography in application to fish population estimation

Curriculum Development

Activities

Anthony Dickinson, the first curriculum development specialist, carried out an evaluation of marine science curriculum via several means. His findings were based on the conclusions of a curriculum review meeting in March 1991, discussions with faculty at each university, and meeting with students. Dickinson also compared his findings with those of similar projects obtained via discussions and reading reports. Dickinson made fifty recommendations related to the various parts of the MSEP (research, facilities etc.) and their effects on the curriculum.

Anthony	Dickinson	CPIU	Feb-91	May-91
Craig	Kensler	CPIU	Jan-92	Apr-92
Virginia	Aprieto	CPIU	Apr-94	Aug-94
Richardus	Kaswadji	CPIU	Jun-94	Dec-94
Linda	Farmer	CPIU	Aug-94	Dec-94

Table 13. Curriculum development consultants. Dates shown may include periods of leave or other non-project time.

With respect to the curriculum, Dickinson stressed the importance of the multi-faceted nature of Indonesia's marine environment. He believed that the course content must take this into account, and should avoid dividing the field into unlinked sub-fields. Thus he urged that the course sequence include "multidisciplinary courses which encourage logical thought, problem solving, and the development of appropriate integrated responses" to environmental challenges. But Dickinson correctly pointed out that such courses can only be offered if students have a "firm background in basic sciences and mathematics" and have experienced an "integration of laboratory and field work" into the courses.

Furthermore, Dickinson pointed out that this "firm background" would require appropriate "curriculum content, instructional methodologies, and staff training". Dickinson concluded that the quality of basic science education is critical to the overall success of a marine science program and that the quality of this basic science component needed to be carefully examined.

Dickinson made a number of other recommendations with respect to the curriculum: core courses should be standardized, overlap in similar courses should be eliminated, more appropriate course sequences should be designed. Of particular interest was his concern about the identity of "marine science". He noted that each university seems to have developed its own definition, and some of these are "clearly illogical."

Craig Kensler served as curriculum coordinator for a three month period in early 1992, but much of his time was devoted to other duties not directly related to this assignment.[55] Kensler worked with other consultants to further define the book and equipment needs of the universities. He emphasized the need for more books in Indonesian, especially in basic marine science subject areas. Kensler also agreed that there were too many specialized courses and that course subject overlap should be reduced.

Virginia Aprieto took up the curriculum position in April 1994 and was joined by Richardus Kaswadji in June. Aprieto held discussions with marine science faculty, students, and MSEP consultants to help her form a basic impression of the state of the marine science curriculum at each university. Aprieto also visited agencies which might employ marine science graduates in order to investigate the expectations of these agencies with regard to new graduates. Aprieto believed, as did other consultants, that the MSEP universities are trying to teach subjects which are too specialized for the undergraduate level. She believed that more stress on basic sciences was needed.

Also, Aprieto and Kaswadji discovered several factors which were confusing the effort to develop a realistic and sensible curriculum. Primary among these was the desire at some universities to create a distinct and somewhat artificial split between "marine sciences" and

[55]Craig Kensler also served as Team Leader (See page 3). Because of the fact that there was no team leader during his curriculum assignment, Kensler spent some of his time working as *de-facto* team leader.

"fisheries" in order to justify the existence of two faculties. Most MSEP consultants have suggested , in agreement with these curriculum consultants, that a single faculty of "Marine Sciences and Fisheries" would make best use of the limited resources available for teaching and research at each university.

In August 1994 Aprieto left the project and Linda Farmer took over the position of foreign curriculum consultant. She worked closely with domestic curriculum advisor Kaswadji. They examined the specifics of the marine sciences curriculum at each university and worked closely with the MSEP's curriculum committee.

Farmer and Kaswadji stressed the need to create, in cooperation with university faculty, statements giving the goals of each course. Each of these should include a statement of what a student will learn in each course and, should include a list of specific skills a student will have after completing the course.

The curriculum team participated in a successful workshop to discuss the marine science curriculum. Participants from all six universities discussed the various program areas, specializations, and courses offered at each university.[56] This was followed by the preparation of the team's final report.

The final report of the curriculum team outlines the challenges facing marine sciences in Indonesia and describes the skills needed to meet these challenges. The consultants then suggested a core curriculum to provide these skills, and also proposed various marine science specializations which will be needed. After reviewing the course offerings at each university, the consultants provide an overview of what will be needed to implement the program.

All consultants who have examined the curriculum have commented on the students' need to have the proper basis for learning specialized subjects. A strong background in science and mathematics is a prerequisite for the advanced marine science courses. Yet if more time is used for teaching the basics, then less time is available for advanced courses.

The solution to this problem has two components. Firstly, a decrease in the number of advanced courses is possible: many consultants have pointed out that many such courses are, in reality, beyond the scope of an undergraduate program. Secondly, intensification of the teaching within existing courses is necessary. Consultants found that most courses are team taught and most meet only once or twice per week[57] resulting in only a cursory understanding of a subject.

Clearly, an improved curriculum is only one component needed to improve the marine science course structure. The content of the courses is perhaps more important. The curriculum team of Farmer and Kaswadji made an effort to provide some idea of course content for core marine science courses, and other consultants have provided many course syllabus improvements. Ultimately those faculty teaching courses must coordinate their efforts with other teachers to present a smooth course sequence which will maximize the student learning experience.

Reports

Dickinson, A.B. 1/6/91 A preliminary evaluation of the marine sciences curriculum

[56]During this workshop, where one objective was to recommend the new core marine sciences curriculum, it was revealed that the Minister of Education and Culture had just issued a decree a few days earlier, on 30 November 1994, which set the marine science (and other related) curricula. Although this information surprised most attendees, all felt that the discussions were fruitful because of the substantial discussions which had taken place regarding the various areas of study (or majors) within the overall marine science program. The new approved curriculum did not seem to be substantially different from other related fishery curricula.

[57]Many consultants found that courses actually met only for one long lecture per week, and often the members of a teaching team do not coordinate their efforts. In addition, lecturers sometimes failed to appear for the lecture. (See footnote 12 and comments on page 12)

Farmer, Linda & R. Kaswadji 1/12/94 End of assignment report : Curriculum specialists

Kensler C.B. 1/4/92 End of assignment : Curriculum coordination, curriculum development

Training Vessels

Activities

Two types of consultancies were provided to assist with the provision of six training / research vessels to the universities. These were a naval architect who designed and advised on construction of the vessel, and four vessel operations advisors[58] who were to assist the universities with initial use of the vessels.

Bryan	Crutcher	Naval Architect	Mar-91	Jul-91
Bryan	Crutcher	Naval Architect	Feb-93	Mar-93
Bryan	Crutcher	Naval Architect	Jul-93	Jul-93
Bryan	Crutcher	Naval Architect	Jan-94	Jul-94
Bruce	Whitelaw	Naval Architect	Jul-94	Aug-94
Bryan	Crutcher	Naval Architect	Aug-94	Dec-94
Bryan	Crutcher	Naval Architect	Jan-95	Mar-95
Andrzej	Elminowicz	Vessel Operations	Feb-95	Aug-95
Clive	Jachnik	Vessel Operations	Feb-95	Oct-95
Gomal	Tampubolon	Vessel Operatons (d)	Feb-95	Aug-95
Bryan	Crutcher	Naval Architect	Apr-95	Jun-95
Alfred	Adli	Vessel Operatons (d)	May-95	Oct-95

Table 14. Consultancies related to the construction and operation of the training / research vessels. Dates shown may include periods of leave or other non-project time.

Naval Architect

Bryan Crutcher first joined the project as naval architect in March of 1991 to draw up the vessel design and bidding documents. At that time the vessel specifications were changed from 15 to 17 meters, and a number of discussions with the project's vessel steering committee took place regarding the design. Crutcher designed a vessel which would be relatively inexpensive to operate. The design defines a vessel with a comparatively narrow hull, a low power requirement and sail capability. Crutcher completed the design specifications and tender documents and submitted these, on schedule, to the ministry in July 1991.

Crutcher returned to the project for short assignments in 1993 to assist with the bidding process. Three submissions of bids for vessel construction took place. The first two had no bids within budget. The committee and the consultant discussed this and some items were deleted from the specifications. During these discussions several design modifications were suggested by vessel committee members. Crutcher constructed a model of the vessel to demonstrate the effects of the various changes suggested, and the committee accepted Crutcher's basic design with some modifications and the bidding and bid processes continued. The third bidding successfully produced an acceptable bid and the building contract was awarded to Marspec, a shipyard in Jakarta.

Crutcher returned in January of 1994 to work closely with the shipyard. This work continued over a prolonged period until June of 1995 with some breaks in service.[59] Vessel construction started in February 1994 although the contract for construction was not signed until early March. The laying of the first hull was started in late March. At the start of construction Crutcher initially predicted a completion date for the first vessel of July 1994. Actual delivery was not until August of 1995.

During construction Crutcher met regularly with the project director to clarify various aspects of the construction and to suggest actions which could make the construction go more smoothly. Suggestions were also made regarding a more flexible schedule of payments to the shipyard so that machinery could be purchased for each vessel as each hull became ready. However, making the needed contractual changes was not possible. A similar problem occurred when it was suggested that newer electronics could be substituted for the specified electronics.

Crutcher worked closely with the Indonesian Classification Bureau which had questions about design aspects with which they were not familiar since they normally deal with non-research

[58]Referred to as vessel activities advisors in some reports.

[59]During Crutcher's absence in August 1994, Bruce Whitewall provided continued monitoring of progress and advice to the shipyard and ministry.

vessels. These issues, such as the safety of flush hatch covers and the reliability of flexible couplings, were all resolved.

Crutcher returned to the project for 1.5 months from April to June 1995 after the vessels had been placed in the water on 19 April. During this period he completed (as much as possible) stability tests, preliminary sea trials, and an inspection for conformity to specifications.

Despite numerous minor problems and substantial delays, the construction of the vessels progressed satisfactorily during Crutcher's assignments. Subsequently some of these vessels were delivered. In his last report, Crutcher listed the status of each vessel and noted several items which needed to be resolved after his departure. Crutcher also strongly emphasized the desirability of delivering the vessels on their own, and not by cargo ship. This approach not only would allow a thorough testing, but would also emphasize the quality and capability of the vessels, and would allow the crew to become familiar them.[60]

The vessels remained unfinished at the end Crutcher's assignment at which time Crutcher believed they could easily have been completed by early July 1995.[61]

As of the end of October 1995 vessels had been delivered to IPB, UNDIP and UNRI and the other three were scheduled to leave Jakarta shortly. Several construction details remained to be resolved and none of the universities had officially received the vessels. Among the outstanding issues were non-functional toilets which were being replaced, problems with excessive weight of the anchor winch affecting the deck, and lack of a proper fire fighting system in the engine room. Nevertheless, all parties believe that these problems can be solved. In fact, the larger issue is the necessity for each university to find the budget to use and maintain these vessels.

Vessel Operations

The four vessels operations consultants were requested for the project in order to assist the universities in getting vessel research and training programs underway. Because of the delay in the completion of the vessels this assignment had to be modified. The initial vessel operations team (Andrzej Elminowicz, Clive Jachnik and Gomal Tampubolon) started work in February 1995 and were later joined by Alfred Adli. Because the vessels were not completed on schedule, these advisors visited each university to help prepare the universities for the arrival of the vessels. At each site they examined the preparedness of the university to receive and operate the vessel and advised the universities with regard to proper mooring locations, set-up of a vessel operations committee, and planning cruise activities.

On later visits the consultants met with each vessel operations committee. Jachnik presented a "Know your ship" lecture at each university and developed a vessel request form to assist with cruise planning.

The team's work complemented that of the naval architect. For example, Elminowicz worked closely with the shipyard to provide advice and direction on the installation of the electronic gear and Jachnik worked with the shipyard to assist with the layout of deck machinery. In addition Tampubolon worked to coordinate the activities and plans of the consultants with those of the Ministry of Higher Education.

The main accomplishment during May and June of 1995 was the completion of a training course for ship's captains and crew from each of the universities. This course was carried out at the shipyard under the guidance of Jachnik with help from Crutcher, Elminowicz, Tampubolon, Adli, and the shipyard manager Richard Sumarli. The course covered many aspects of ship safety and handling, navigation, electronics, and general ship operations with

[60]The shipyard subsequently decided to deliver three of the six vessels by cargo ship.

[61]In late June work on the MSEP vessels increased significantly and plans were made to deliver all vessels in July. However, the first vessel was not actually delivered until 20 August and the second on 30 August, the third in late September and the three remaining vessels had not been delivered as of late October.

specific attention paid to the MSEP vessels' equipment, design and characteristics. The course was intended to familiarize the crews with the vessels and their operation, but was not a full certification course.[62] Jachnik and Elminowicz with assistance from Tampubolon and Adli also prepared detailed ship's manuals for course participants.

Adli and Tampubolon assisted with delivery of the vessels to IPB (Pelabuhan Ratu), UNDIP (Jepara) and UNRI (Dumai). During the delivery of each vessel they helped the new crew from each university become more familiar with the ship. During and after vessel delivery the consultants also kept the project director informed about the condition of the vessels. Several minor problems were discovered by Tampubolon and Adli during the delivery trips and were investigated by Jachnik. Problems with the WC, seawater pumps, engine room ventilation, air conditioning and several other items were reported.

Jachnik, during his second assignment, visited the universities to assist faculty and students after delivery of the vessels. His work was hampered by the remaining problems which were awaiting resolution and by the fact that vessels had not been delivered to UNHAS, UNSRAT and UNPATTI.

Among recommendations of the vessel consultants was the need for closer cooperation with LIPI, fisheries agencies and foreign universities as potential cooperators to share the use, and cost, of the vessels. Vessel operating costs, for a research and teaching program making full use of a vessel, are estimated at approximately US$60,000 per year. It is unlikely that a university, on its own, will have this budget. Even with additional cooperation and support the universities will have to be very innovative to make full use of these vessels.

Reports

Crutcher, Bryan T. 1/6/95 End of assignment : Naval architect

Crutcher, Bryan T. 1/7/91 Design, specification & bid documents for 17 meter research vessel

Elminowicz, Andrzej 1/8/95 End of assignment report : Training vessel activities advisor, fishery surveys specialist

Jachnik, Clive V 20/11/95 End of assignment report : Training vessel activities

Jachnik, Clive V. 1/7/95 End of assignment report : Training vessels activities

Jachnik, Clive V. 1/6/95 Petunjuk pengoperasian Koden GPS GTD-07

Jachnik, Clive V. 1/5/95 Know your research ship : Sea training taskbook

Jachnik, Clive V., Andrzej Elminowicz 1/4/95 Know Your Research Ship : A Manual for the use of MSEP research vessels

Jachnik, Clive V., Andrzej Elminowicz 1/4/95 Mengenal kapal riset anda : Sebuah petunjuk untuk menggunakan kapal latih MSEP

[62]Captains and crew must be certified by the proper Indonesian authorities. It is our understanding that the captains from each university were already properly certified with the exception of the designated captain from UNSRAT.

Technical Support

Activities

The category "Technical Support" includes a number of unrelated consultancies. They have in common the fact that they are not academic consultancies *per se*, but rather were activities which would support teaching and research by providing additional necessary technical expertise which is a part of normal university operations. It is in these consultancy categories, as well as that of naval architect, that the consultancy services contract interfaced most closely with the other components of the marine sciences education project.

Robert	Roy	Library	Jan-91	Apr-91
Gerald	Mahy	Equipment Planning	Nov-91	Mar-92
Robert	Roy	Library	Nov-91	Mar-92
Irwin	Judson	Equipment Planning	Nov-93	Feb-94
Sean	McDonnell	Facilities Inspection	May-94	Jul-94
Sean	McDonnell	Facilities Inspection	Jul-94	Sep-94
Doug	Kneale	Facilities Inspection	Aug-94	Sep-94
Fuad	Gani	Library	Sep-94	Dec-94
Robert	Roy	Library	Sep-94	Dec-94
Doug	Kneale	Facilities Inspection	Jan-95	Apr-95
Richard	Tokarczyk	Equipment Maintenance and Repair	Apr-95	Sep-95
Helle	Gerstrom	Laboratory Management	Apr-95	Jul-95
Alan	Poole	Equipment Maintenance and Repair	May-95	Nov-95
Steve	Shaw	Equipment Technician Development	Jul-95	Aug-95

Table 15. Consultancies related to special areas of technical support. Dates shown may include periods of leave or other non-project time.

Equipment Planning

Gerald Mahy joined the project in November of 1991 to help the universities develop detailed lists and tender documents for purchase of teaching and research equipment. His work included the preparation of specific lists of equipment for each university complete with descriptions of the equipment, equipment catalog references and prices. These documents were completed in March 1992.[63] Mahy recommended that the lists be reviewed by senior marine science staff at each university, and revised as necessary. These lists subsequently went through several revisions via university based and Jakarta based committees.

Mahy recommended that the universities prepare for equipment arrival. To do this he suggested training for technicians in the operation and maintenance of laboratory, and other, equipment. He also strongly recommended that the universities provide dust free and air conditioned laboratories.

Irwin Judson arrived during the last quarter of 1993, a year and a half after the original detailed equipment lists had been finalized. He worked with the equipment procurement committee to try to streamline and improve the seriously delayed process by which scientific equipment was being purchased. However, this work was severely hampered by the fact that all copies of Mahy's reports and diskettes had been removed from the project offices. Those were only recovered toward the end of January 1994, too late in Judson's consultancy to be of much use.

Nevertheless, Judson visited all the universities and assisted the procurement committee with the preparation of final equipment lists and the bidding documents.

[63]In the absence of a team leader at this time, Mahy's reports and accompanying database of equipment procurement information was given directly to the project director.

From Judson's point of view, as well as that of most other consultants, the system for the purchase of equipment was one of the least successful aspects of the MSEP. Central control of the procurement process limited effective participation by university faculty who would use the equipment. In future projects more local participation might produce a better result. Local committees made up of faculty members could receive additional information regarding specific equipment from consultants or other specialists. Ordering specialized equipment via large quantity contracts also allows less time for careful planning. It would have been better if each university could have ordered its own equipment (with approval from Jakarta) over a two to three year period. Perhaps in future projects a trust fund might be set up for each university. Funds for the purchase of equipment could be withdrawn over a period of years to allow equipment to be purchased on an as-needed basis.

Much of the equipment ordered may be inappropriate, and most of it was delivered too late to be used in cooperation with academic consultants. Unfortunately Judson had no opportunity to significantly improve these underlying problems.

Facilities Inspection

No civil works consultants were assigned to the project until March of 1994 when the project director requested consultants who could provide advice on improvements and additions to the civil works which were nearing completion. His request was in response to requests from the project universities for additional construction activities. These consultancies were filled by Sean McDonald and Doug Kneale.

Sean McDonnell, an engineer, joined the project in late May, and visited all project universities and field stations prior to the end of June. He inspected the existing facilities (buildings, hatcheries, jetties etc.) and discussed details of desired new facilities with staff at each university. He submitted a report at the end of June 1994 which described the status of the new MSEP facilities at each university, repairs and improvements which needed to be made, as well as details and estimated costs and prioritization of additional construction activities.

McDonnell returned in late July and was joined by Kneale who is an aquacultural engineer. They provided detailed suggestions for the civil works improvements identified by McDonnell during his first visit. These details, in the form of a report for each university, were used as a basis for contracting of civil works improvements at each university.

Kneale returned to the project for three months in early 1995 to check on the progress made to civil works based on his and McDonnell's suggested actions. Unfortunately, he found that many of their earlier recommendations had not been incorporated into the re-construction contracts. As a consequence, Kneale instead suggested modifications to construction work already underway at each university. He prepared action plans designed to help the universities upgrade facilities and correct previous problems.[64]

Often however, Kneale found that the contracting system was not flexible enough to incorporate suggested changes. In some cases communication between the university contracting officer and the local marine science faculty was poor. Also, because the contractors and university staff are inexperienced in construction of marine facilities, they had a tendency to substitute inappropriate designs for those suggested by the consultants. Consequently, it is unlikely that the facilities, especially water systems, will provide the benefits expected for the amount of money spent.

Kneale provided a detailed report for each university. Each report listed findings, suggestions for improvement with detailed drawings, and commercial sources of necessary components. The reports also provided an updated action plan for each university.

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[64]In attempting to assure that the basic technical aspects of the water systems were durable and useful, Kneale worked closely with Braley (see page 38) who was assisting with the mariculture aspects of the systems.

Library

During his first two assignments in 1991-92 Robert Roy prepared a master book list for the MSEP book tendering document. He also provided library hardware and software recommendations, and listed library supplies to be purchased. He assisted with the installation of CD-ROM at IPB and used it to carry out literature searches for all universities.

Roy felt that there was a serious need for students to have better information about library use and literature searches. He felt that faculty should promote library use more in the classes they teach. He also noted a need to have Indonesian articles listed in abstracting journals.

Roy also prepared detailed proposals for training librarians and these were later implemented in part in 1994.

Roy returned to the project in 1994 and was joined by Fuad Gani. They visited each university where they assisted with library issues. They demonstrated the use of CD-ROM with Aquatic Sciences and Fisheries Abstracts (ASFA) and other electronic abstracting documents as tools for finding marine science information. They created disk copies of abstracts on particular subjects for local use at the request of faculty and students. In this way they provided training in the use of electronic abstracts and at the same time provided specific information related to senior theses and other research.

Roy and Gani emphasized the need to get the library books into the hands of the scientists and students who need them. Each university is different, and the best arrangement for one is not the best for the others. They said, for example, that UNHAS has a well organized central library which is willing to maintain marine science books in a way that will make them easily available to students and staff. At some of the other campuses the new books would be better housed within the Fisheries and Marine Science faculty library.

Roy and Gani also assisted with the training course for library technicians which was held in Bogor in October 1994.

Equipment Maintenance and Repair

Richard Tokarczyk arrived at the start of the quarter and was joined by Alan Poole in mid-May. They assisted the universities to set up and operate newly delivered and previously delivered equipment. They worked closely with Helle Gerstrøm, Laboratory Management consultant.[65]

This team first obtained copies of equipment contracts, delivery lists and related documents so that they could compare what had been delivered to what had been contracted. In this way missing components could be traced.

At each university the consultants carried out several tasks depending on the particular local need. Usually the first priority was to assist with the setup of equipment prioritized by the university staff. Other activities included the setup of an improved equipment storage system, the establishment of air conditioned labs for sensitive equipment and informal training on the use of specific pieces of equipment. In addition Tokarczyk prepared some short manuals to explain the use of specific equipment. An equipment inventory database was also started at each university, with labels applied to each piece of equipment.

The consultants found that the majority of equipment was in good condition but some items needed to be returned to the manufacturer. Several minor problems were fixed by the consultants. For example, an electronic balance was not operating properly and had to be cleaned, reprogrammed and adjusted to local conditions so that it would operate. A remote underwater video was designed to operate at 110 volts, but was modified, by Poole to work with 220. Several problems with electrical supply were pointed out by Poole and Tokarczyk.

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[65]See page 60

Unfortunately Poole and Tokarczyk both found that some items were incomplete, and usually this was due to a faulty purchasing system. For example, a remote underwater camera system (consisting of a deck unit, a cable, and the underwater camera) had been ordered for several universities, but none of the orders was complete.

The consultants reported good cooperation working with university personnel who were interested in getting their laboratories operating. However several of these co-workers were not regular marine science staff and will not be working with the equipment and labs in the future. Also, the universities' concerns about security of the equipment often results in a locked storage room full of boxes of equipment.[66] If someone needs an item of equipment then several boxes must be opened during the search. At one university the consultants partially overcame this problem by working with counterparts and a team of students to clean labs and arrange a reasonable storage space for equipment.

Proper storage of equipment is an item of serious concern. Items used at sea must be properly washed after use. Already some equipment is unusable. Also all universities should arrange air-conditioned laboratories to provide low humidity conditions. Any optical equipment (cameras, microscopes) and most equipment with electronic components can be damaged by long exposure to high humidity.

Poole pointed out the dangers of improperly earthed (or grounded) electrical systems. Improper grounding can cause damage to equipment and can cause equipment to report faulty information. He also warned that some laboratory equipment generates very high voltages and improper grounding could cause a fatal accident.

Laboratory Management

Helle Gerstrøm joined the project for four months in mid- 1995 to provide training and guidance in laboratory management. She assisted the universities to set up appropriate management programs for marine science laboratories, and was particularly interested in assuring the university personnel are aware of laboratory safety issues. She provided information about toxic materials management in Indonesia so university personnel would be aware of the approved methods of toxic waste disposal.

Gerstrøm found that often university staff needed very basic information about laboratory management. As a first step she assisted in the formation of laboratory management committees at each university. This was accompanied by short courses on various aspects of laboratory management, especially safety. Gerstrøm also provided posters and handouts about laboratory risks and safety. Of particular interest were her seminars on chemical waste treatment and the special requirements of university laboratories.

Gerstrøm discovered some potentially dangerous situations which could result in injury, sickness or death of students and staff.[67] For example, many laboratories have insufficient fume hoods for protecting laboratory workers from toxic fumes. In most laboratories the fume hoods are installed improperly, and in one case (UNHAS) the fumes actually entered other classrooms. In most laboratories Gerstrøm noted that chemicals were stored under unsafe conditions. Gerstrøm suggested corrective actions, and assisted in implementing them as time permitted.

Equipment Technician Development

Steve Shaw joined the project for a two month period in mid-1995 to assist with the setup of technical workshop equipment and to train technicians to operate it. During his short stay Shaw visited four of the six universities. In some cases (IPB and UNDIP) a workshop was

[66]Also see comments on pages 15, 43 and 48.

[67]Earlier an MSEP consultant working at the Jepara laboratory discovered that students were carrying out an unsupervised laboratory assignment with a very poisonous chemical and had not even been told it was poisonous.

successfully set up and was later used by other consultants for repair and modification of equipment for the research vessel. At other locations reasonable progress was also made. At UNRI a temporary workshop was set up in Pekanbaru because the workshop at the Dumai marine campus was inappropriate. At UNPATTI no workshop has yet been built, and Shaw offered a plan of action as well as courses for the technicians. In some instances Shaw was also asked to provide other types of technical advice.

Reports

Gani, Fuad 31/12/94 End of assignment report: Library specialist

Gani, Fuad 31/12/94 Indonesian citation (ASFA) -- Bibliography

Gerstrøm, Helle 1/7/95 End of assignment report: Laboratory management specialist

Gerstrøm, Helle 1/7/95 Technical report: Laboratory management specialist

Judson, Irwin 1/2/94 End of assignment: Equipment planning

Kneale, D.C. & McDonnell, S. 1/9/94 Universitas Hasanuddin facilities inspection final report

Kneale, D.C. & McDonnell, S. 1/9/94 Universitas Pattimura facilities inspection report

Kneale, D.C. & McDonnell, S. 1/9/94 Universitas Sam Ratulangi facilities inspection final report

Kneale, Douglas C. 1/5/95 Universitas Diponegoro facilities design report

Kneale, Douglas C. 1/5/95 Universitas Hasanuddin facilities design report

Kneale, Douglas C. 1/5/95 Universitas Pattimura facilities design report

Kneale, Douglas C. 1/5/95 Universitas Riau facilities design report

Kneale, Douglas C. 1/5/95 Universitas Sam Ratulangi facilities design report

Kneale, Douglas C. 1/9/94 Universitas Riau facilities inspection final report

Mahy, G. 1/4/92 End of assignment: Equipment planning

Mahy, Gerard J.D. 1/3/92 First assignment: Document # I--tender documents-list of equipments and specifications/prices/catalog references

Mahy, Gerard J.D. 1/3/92 First assignment: document # II--tender documents-list of equipments and specifications/prices/catalog references

Mahy, Gerard J.D. 1/3/92 First assignment: Document # III-1--tender documents-list of equipments and specifications/prices/catalog references

Mahy, Gerard J.D. 1/3/92 First assignment: Document # III-2 -tender documents-list of equipments and specifications/prices/catalog references

Mahy, Gerard J.D. 1/3/92 First assignment: Document # III-3 --tender documents-list of equipments and specifications/prices/catalog references

Mahy, Gerard J.D. 1/3/92 First assignment: Document # III-4 -tender documents-list of equipments and specifications/prices/catalog references

Mahy, Gerard J.D. 1/3/92 First assignment: Document # III-6 -tender documents-list of equipments and specifications/prices/catalog references

Mahy, Gerard J.D. 1/3/92 First assignment: Document # IV --tender documents-list and quantity of equipments from tender documents-technical component

McDonnell, Sean 1/9/94 Universitas Diponegoro facilities inspection final report

McDonnell, Sean 1/7/94 Facilities inspection report

Poole, Alan 10/11/95 End of assignment report: Equipment maintenance and repair specialist

Roy, Robert A. 22/12/94 End of assignment report: Library specialist

Roy, Robert A. 22/12/94 Indonesian mangroves -- bibliography

Roy, Robert A. 22/12/94 Indonesian marine sciences -- bibliography

Roy, Robert A. 22/12/94 Plastic pollution in the marine environment -- bibliography

Roy, Robert A. 22/12/94 Snellius expedition -- bibliography

Roy, Robert A. 1/4/92 End of assignment: Library specialist 1st phase assignment

Roy, Robert A. 1/2/92 End of assignment: Library specialist 2rd phase assignment

Roy, Robert A. 1/4/91 Proposal for trainning MSEP library staff

Roy, Robert A. 1/3/91 Selected list of marine sciences books, periodical & publishers

Shaw, Stephen 1/8/95 End of assignment report: Equipment technician development specialist

Tokarczyk, Richard 1/10/95 End of assignment report: Equipment maintenance and repair specialist

Project Benefits Monitoring and Evaluation

Activities

In January 1991 Neil MacPherson, Lucky Sondakh and Mangara Tambunan started to set up a system for monitoring and evaluation of project benefits. The consultants first prepared a concept paper which outlined the approach to be taken in carrying out the PBME activities and then, following the ideas in the concept paper, developed a "framework for the analysis of benefits". This latter document proposed forms and other approaches for the collection of various data at each university at the start, middle and end of the MSEP.

Neil	MacPherson	Jan-91	Aug-91
Mangara	Tambunan	Feb-91	Aug-91
Lucky	Sondakh	Apr-91	Jun-91
John	Wallace	Oct-93	Mar-94
Mangara	Tambunan	Oct-93	Mar-94
Seamus	McElroy	Jan-95	May-95
Mangara	Tambunan	Jan-95	May-95
Joerg	Hartmann	Sep-95	Dec-95
Richardus	Kaswadji	Sep-95	Dec-95
Robert	Pett	Oct-95	Dec-95

Table 16. Project Benefits Monitoring and Evaluation specialists provided during the project. Dates shown may include periods of leave or other non-project time.

Following the establishment of the framework, MacPherson and Tambunan undertook to measure the quality of marine science education at the six universities by applying the PBME survey techniques which they had developed. This provided the baseline data for future PBME activities.

MacPherson and Tambunan's report also gave some conclusions from the baseline survey. These included the confirmation that the activities of the MSEP were clearly necessary if the level of marine science education was to be improved. They also found that qualified teaching staff would still be limited even if projected MSEP fellowship programs were completed successfully. They suggested that either the curriculum should be reevaluated to determine if certain specialized courses should be eliminated, or additional staff training should be planned. Another limiting factor appeared to be book use by students. This was judged to be extremely low even on those campuses having a reasonable library collection. The PBME team suggested that purchasing of books is insufficient to solve this problem and that translation of key texts into Indonesian is essential.

John Wallace and Tambunan joined the project in late 1993 to analyze data from the mid-term PBME survey. They encountered significant difficulty in obtaining the results of the mid-term surveys which were to have been carried out by a local consultancy group specifically contracted for that purpose. Ultimately Wallace and Tambunan had to arrange much of the data collection directly with university staff. Consequently much of their time was spent collecting and processing data rather than analyzing it. Nevertheless, they completed the mid term report which detailed some of the progress made on the project since its inception. Unfortunately the format was not identical to the format of the McPherson report in that comparisons were made over a period of years and not against the baseline data provided by MacPherson and Tambunan.

Early in 1995 Seamus McElroy and Tambunan started the final PBME. Because of previous difficulties getting the PBME data collected by the other group, these two spent much of their time devising and testing questionnaires for a graduate tracer study. During this phase they also trained PBME assistants at each university and taught them how to use appropriate software for entry and analysis of data. Unfortunately this team did not make acceptable progress and left much of the planned work unfinished.

Joerg Hartmann and Richardus Kaswadji joined the project on 1 Sep 95 as the new PBME team. They have coordinated their work closely with the director's office and have clarified their assignment with respect to the project's other PBME component.[68] Basically it was

[68]The MSEP's PBME component was contracted to the Institute for the Development of Education Management (Lembaga Pengembangan Manajemen Pendidikan).

reaffirmed that the consultancy services portion of the PBME was responsible for setting up the PBME system. Actual execution of the various longer term PBME components (the system set up by MacPherson and the graduate tracer study designed by McElroy) were scheduled to be turned over to this other group. That group was given responsibility to provide the results of the surveys to the academic consultants for analysis.

Hartmann and Kaswadji were also given the new assignment of providing an overall qualitative review of project benefits to date. Hartmann and Kaswadji were joined by Robert Pett on 30 September 1995. Pett provided additional technical expertise for the evaluation of the project.

Reports[69]

MacPherson, N.J. 1/2/91 Project benefits monitoring & evaluation for the MSEP

MacPherson, N.J. and Mangara Tambunan (PBME Team) 1/8/92 Quality of MSE at six MSEP Universities: Indicators of the pre-project situations and likely effects of MSEP

Tambunan, M. & MacPherson N.J. 1/5/91 Framework for the analysis of the benefits from the MSEP.

Wallace, J & Tambunan, M 1/3/94 PBME-MID term study results: 6 volumes: UNRI IPB, UNDIP, UNHAS, UNSRAT, UNPATTI

Wallace, J & Tambunan, M 1/2/94 Project benefit monitoring and evaluation mid term report-A

[69]Note: The final PBME report was not written at the time this report was prepared.

APPENDIX 1: Schedule of Consultancies Provided

APPENDIX 2: List of Consultants

Nationality	Number
Australia	9
Canada	23
Croatia	1
Denmark	1
France	1
Germany	3
India	1
Indonesia	9
Kenya	1
Philippines	6
Poland	4
Spain	1
Turkey	1
United Kingdom	7
USA	16
Total	84

Table 17. Number of MSEP consultants by country of origin.

First Name	Last Name	Position	Nationality
Alfred	Adli	Vessel Operations	Indonesia
M. Victoria	Alday-Sanz	Fish Disease	Spain
Victor	Anderlini	Marine Ecology	USA
Charles	Angell	Hatchery Management	USA
Virginia	Aprieto	Curriculum	Philippines
Ferit	Bingel	Oceanography	Turkey
John	Boers	Marine Conservation	Canada
Steven	Bollens	Oceanography	USA
Richard	Braley	Mariculture/Hatchery Water Systems	Australia
Robert	Brick	Team Leader	USA
	Burhanuddin	Marine Science and Technology	Indonesia
Thomas	Carefoot	Physiology	Canada
John	Carter	Marine Conservation	Canada
Frank	Chen	Natural Products Chemistry	Canada
Mikkel	Christensen	Mariculture	Kenya
Robert	Cordover	Mariculture/shrimp	USA
George	Cresswell	Oceanography	Australia
Bryan	Crutcher	Naval Architect	Canada
John	Culliney	Marine Biology	USA
Daniel	De Lisle	Remote Sensing	Canada
Anthony	Dickinson	Curriculum	Canada
Paul	Dinnel	Marine Ecology	USA
Richard	Dudley	Marine Ecology Team Leader	USA
Ian	Dutton	Marine Conservation	Australia
Aloysius	Dwipongo	Fisheries and Mariculture	Indonesia
Rand	Dybdhal	Marine Biology	USA
Andrzej	Elminowicz	Marine Acoustics Vessel Operations	Poland
Linda	Farmer	Curriculum	USA
Ricardo	Federizon	Population Dynamics	Philippines
David	Fletcher	Mariculture/Hatchery	Canada
Andrea	Frische	Oceanography	Germany
Fuad	Gani	Library	Indonesia
Helle	Gerstrom	Laboratory Management	Denmark
Stephen	Goddard	Fish Nutrition	Canada
John	Green	Oceanography	USA
Joerg	Hartmann	Benefits Monitoring	Germany
John	Harvey	Oceanography	United Kingdom
Clive	Jachnik	Vessel Operations	United Kingdom
Stewart	Johnson	Fish Disease	Canada
Irwin	Judson	Equipment Planning	Canada
Richardus	Kaswadji	Curriculum Benefits Monitoring	Indonesia
Craig	Kensler	Team Leader Curriculum	USA
Doug	Kneale	Facilities Inspection	USA
Paul	LaViolette	Remote Sensing	USA
Laura	Lazo	Marine Ecology	Canada
Chan	Lee	Mariculture	Australia
Daniel	Lee	Mariculture/shrimp	United Kingdom
Bryan	Long	Remote Sensing	Australia
Kenneth	MacKay	Oceanography	Canada
Neil	MacPherson	Benefits Monitoring	Canada
Gerald	Mahy	Equipment Planning	Canada
Chris	Mathews	Marine Resources Exploration	United Kingdom
Sean	McDonnell	Facilities Inspection	Canada
Seamus	McElroy	Benefits Monitoring	United Kingdom
Ewen	McLean	Physiology	Canada
Jean-Yves	Mevel	Fish Disease	France
Antonio	Mines	Marine Resource Exploration Mariculture	Philippines
Rick	Newitt	Physiology	USA
Leigh	Owens	Fish Disease	Australia
Salvadore	Pamplona	Marine Biology	Philippines
Felicitas	Pascual	Fish Nutrition	Philippines
Robert	Pett	Marine Chemistry / Oceanography Oceanography Benefits Monitoring	Canada
Alan	Poole	Equipment Maintenance and Repair	Australia
Vinayaga	Pragatheeswaran	Marine Toxicology	India
Frank	Roubal	Fish Disease	Australia
Robert	Roy	Library	Canada
John	Rubin	Marine Conservation	United Kingdom
Jurgen	Saeger	Marine Resources Exploration	Germany
Alfredo	Santiago	Pond Engineering / Mariculture	Philippines
Steve	Shaw	Equipment Technician Development	United Kingdom
	Soekarno	Marine Science and Technology	Indonesia
Lucky	Sondakh	Benefits Monitoring	Indonesia
Andrzej	Stepnowski	Marine Acoustics	Poland
Arnold	Sutterlin	Physiology	Canada
Joanna	Szczucka	Marine Acoustics	Poland
Clyde	Tamaru	Mariculture/Hatchery	USA
Mangara	Tambunan	Benefits Monitoring	Indonesia
Gomal	Tampubolon	Fisheries and Mariculture Vessel Operations	Indonesia
Emin	Teskeredzic	Fish Disease	Croatia
Richard	Tokarczyk	Marine Chemistry Equipment Maintenance and Repair	Poland
John	Wallace	Benefits Monitoring	Canada
Trevor	White	Population Dynamics	Australia
Bruce	Whitelaw	Naval Architect	Canada
Alan	Willsie	Marine Ecology	Canada

Table 18. Names of MSEP consultants, areas of speciality, and country of origin.

APPENDIX 3: List of Consultants' Reports

Appendix 3: List of MSEP Consultants' Reports[70]

Alday-Sanz, Victoria 1/7/95 End of assignment report: Fish disease specialist

Alday-Sanz, Victoria 1/7/95 Technical report, short course on shrimp diseases and health management

Anderlini, Victor. 1/4/92. End of assignment report: Marine ecology specialist

Anderlini, Victor. 1/2/92. Proposed academic and research activities

Angell, Charles L. 1/7/94 A guide to the design and operation of penaeid shrimp hatcheries.

Angell, Charles L. 1/7/94 End of assignment report: Hatchery management specialist.

Angell, Charles L. 1/5/94 Comments regarding shrimp hatchery research and training

Angell, Charles L. 1/5/94 Teluk Awur hatchery review

Bingel, Ferit. 1/1/95. End of assignment report: Fisheries oceanography specialist

Bingel, Ferit. 1/11/94. Draft proposals for studies in field and laboratory works (supported by abstracts)

Bingel, Ferit. 1/10/94. Practical aspects of sampling in the sea cruise planning and implementation and the laboratory work

Boers, J.J.. 1/2/92. End of assignment: Marine conservation

Boers, J.J.. 1/2/92. Proposed lecture material: Marine conservation

Braley, Richard D 14/7/95 Universitas Pattimura: Final mariculture and water systems advisory report

Braley, Richard D. 14/7/95 Institut Pertanian Bogor: Final mariculture and waters systems advisory report

Braley, Richard D. 14/7/95 Universitas Diponegoro: Final mariculture and water systems advisory report

Braley, Richard D. 14/7/95 Universitas Hasanuddin: Final mariculture and water systems advisory report

Braley, Richard D. 14/7/95 Universitas Riau: Final mariculture and water systems advisory report

Braley, Richard D. 14/7/95 Universitas Sam Ratulangi: Final mariculture and water systems advisory report

Braley, Richard D. 1/5/95 Supplies for seawater systems

Braley, Richard D. 30/11/94 End of assignment report: Mariculture specialist

Braley, Richard D. 1/11/94 Maintenance of stock cultures for rotifiers (branchionus sp)

Braley, Richard D. 1/7/94 End of assignment report: Hatchery management specialist

[70]These reports are also listed by subject area within the body of the report

Braley, Richard D. 1/7/94 Notes on hatchery management

Braley, Richard D. 1/6/94 Notes on hatchery hygiene

Braley, Richard D. 1/12/93 End of assignment report: Mariculture specialist

Braley, Richard D. 1/4/93 Special report: Basic training course for hatchery operation

Braley, Richard D. 1/3/93 A Study of reproduction periodicity & stage of gonad development in tropical bivalves

Brick, Robert W. 1/11/93 Draft progress report no. V

Brick, Robert W. 1/11/93 Progress report no. IV: Team leader & higher education specialist

Brick, Robert W. 1/10/93 Progress report no. III: Team leader & higher education specialist

Carefoot, Thomas H. 1/5/95 Interim final report

Carefoot, Thomas H. 1/6/92 Practical lab guide for marine animal physiology: Marine animal physiology specialist

Carefoot, Thomas H. 1/5/92 A two-day laboratory practical on molluscs

Carefoot, Thomas H. 1/2/92 Practical laboratory guide for marine animal physiology

Carter, John. 1/11/94. A series of marine conservation practicums for Universitas Riau

Carter, John. 1/11/94. Assessment of the curriculum and research related to marine conservation and coastal zone management at Universitas Riau

Carter, John. 1/11/94. Employment prospects for marine science students at Universitas Riau

Carter, John. 1/11/94. End of assignment report: marine conservation specialist

Carter, John. 1/11/94. Modul training: konsep dasar konservasi laut dan relevansinya dengan Sumatra Bagian Timur

Carter, John. 1/11/94. Practical aspects of environmental monitoring of offshore oil and gas development

Carter, John. 1/11/94. Training module: an introduction to integrated coastal zone management

Carter, John. 1/11/94. Training module: coral reef management issues

Carter, John. 1/10/94. Modul training: tainting (perubahan rasa & bau alami) pada species laut (mata kulilah pencemaran laut)

Carter, John. 1/10/94. Training module: tainting of marine species

Carter, John. 1/9/94. Training module: basic concepts of marine conservation and their relevance to East Sumatra

Chen, Frank S.C. 31/12/94. End of assignment report: Natural product chemistry specialist

Chen, Frank S.C. 31/10/94. Marine natural products chemistry: research feasibility study and recommendations

Chen, Frank S.C. 31/8/94. Marine natural product chemistry: Objective and scope in MSEP course at UNSRAT

Christensen, Mikkel S. 1/12/92 End of assignment report: Mariculture specialist

Christensen, Mikkel S. 1/1/92 End of assignment report: Mariculture specialist

Christensen, Mikkel S. 1/12/91 An introduction to aquaculture, with special reference to marine and brackish water environments

Cordover, Robert 15/4/92 Final report of the mariculture consultant at Hasanuddin University September 1991 to April 1992

Cresswell, G.. 1/11/91. Final report: Fisheries oceanography

Crutcher, Bryan T. 1/6/95 End of assignment: Naval architect

Crutcher, Bryan T. 1/7/91 Design, specification & bid documents for 17 meter research vessel

Culliney, John L.. 1/7/94. End of assignment: marine biology specialist

Culliney, John L.. 1/5/94. Laboratory & field exercise in marine biology and biological oceanography

De Lisle, Daniel A. 1/9/95. End of assignment report: Remote sensing consultant

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Elminowicz, Andrzej 1/12/94 End of assignment report: Marine acoustics specialist

Elminowicz, Andrzej 11/8/94 Latihan hidroacoustic: Pelajaran bagi staf dan mahasiswa

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Elminowicz, Andrzej 27/7/94 General information questionnaire for students

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Elminowicz, Andrzej 1/6/94 Lecture notes for a special training course on marine instrumentation: Marine acoustics

Farmer, Linda & R. Kaswadji 1/12/94 End of assignment report: Curriculum specialists

Federizon, Ricardo R. 1/12/94 End of assignment report: Fish population dynamics specialist

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Goddard, S. 1/4/92 End of assignment: Mariculture specialist

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Jachnik, Clive V., Andrzej Elminowicz 1/4/95 Mengenal kapal riset anda: Sebuah petunjuk untuk menggunakan kapal latih MSEP

Johnson, Stewart C. 1/12/94 End of assignment report: Fish disease specialist

Judson, Irwin 1/2/94 End of assignment: Equipment planning

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Kensler C.B. 1/4/92 End of assignment: Curriculum coordination, curriculum development

Kensler, C.B. 1/4/92 Progress report: Team leader & higher education specialist

Kensler, C.B. 1/8/91 Executive summary of six month progress report: Team leader & higher education specialist

Kensler, C.B. 1/8/91 Six month progress report: Team leader & higher education specialist

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Lee, Chan 1/11/92 Laboratory/tutorial manual: Mariculture specialist

Lee, Chan 1/11/92 Lecture series in mariculture

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Mahy, G. 1/4/92 End of assignment: Equipment planning

Mahy, Gerard J.D. 1/3/92 First assignment: Document # I--tender documents-list of equipments and specifications/prices/catalog references

Mahy, Gerard J.D. 1/3/92 First assignment: document # II--tender documents-list of equipments and specifications/prices/catalog references

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Mathews, C.P 1/12/91 Staff training work shop in applied stock assessment and living marine resources exploration & prospect

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Mathews, C.P. 1/9/91 Development of Pelabuhan Ratu as a fisheries research center

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Mathews, C.P. 1/1/91 Activities & achievement report: Marine living resources exploration

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McLean, Ewen 1/1/95 End of assignment report: Marine animal physiology specialist

McLean, Ewen 1/9/92 End of assignment: Marine animal physiology

Mevel ,J. 1/2/93 Fish health management laboratory

Mevel, J. 1/2/93 Fish health management

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Mevel, J. 1/8/92 Final report: Mariculture, fish disease

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Mines, A. 1/9/92 A reference manual on exploration of the living resources

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Newitt, Richard A. 1/12/94 End of assignment report: Marine physiology specialist

Owens, Leigh 1/11/91 End of assignment: Mariculture-disease specialist

Owens, Leigh 1/9/91 Concept paper: Aquatic disease (mariculture)

Pamplona, Salvador. 1/2/93. End of assignment: Marine biology

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Pascual, Felicitas P. 1/4/94 Lecture notes and seminar handouts: Fish nutrition specialist

Pett, Robert J 1/5/95 Environmental Sensitivity Mapping Near Oil Production Sites in Central Maluku: An example proposal

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Pett, Robert J. 1/3/94. Statistical consideration & design of oceanographic surveys and laboratory / field experiments

Pett, Robert J. 1/2/94. Primer on proposal preparation & project planning

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Pett, Robert J. 1/3/93. A collection of laboratory methods for selected water and sediment quality parameters

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Roy, Robert A. 22/12/94 End of assignment report: Library specialist

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Roy, Robert A. 1/4/92 End of assignment: Library specialist 1st phase assignment

Roy, Robert A. 1/2/92 End of assignment: Library specialist 2rd phase assignment

Roy, Robert A. 1/4/91 Proposal for trainning MSEP library staff

Roy, Robert A. 1/3/91 Selected list of marine sciences books, periodical & publishers

Roubal, Frank R. 1/3/95 End of assignment report: Fish health specialists

Roubal, Frank R. 1/2/95 Some basic techniques in histology

Rubin, J.. 1/8/92. Additional course materials

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Rubin, J.. 1/1/92. An introduction to marine conservation with particular reference to Indonesia

Rubin, J.. 1/1/92. Functions, economic uses and conservation of the mangal of South East Asia

Saeger, Jürgen 1/6/95 Course and lecture manuscript in living marine resource exploitation

Santiago, Alfredo 1/4/95 End of assignment report: Mariculture specialist

Santiago, Alfredo 1/7/94 End of assignment report mariculture specialist

Santiago, Alfredo 1/7/94 Reference book on shrimp culture

Santiago, Alfredo 1/1/92 End of assignment: Mariculture, pond engineering

Shaw, Stephen 1/8/95 End of assignment report: Equipment technician development specialist

Stepnowski, Andrzej 1/2/95 Lecture notes on operation of a dual beam processing/echo integration acoustic system and its use in assessing marine fish populations

Stepnowski, Andrzej 1/2/95 Proposal on acoustic survey using a dual beam processing/echo integration system for assessing marine fish populations off the western Java coast

Stepnowski, Andrzej 1/2/95 Recommendation to upgrade of the IPB research vessel "A"-frame for towing the towed body ("biofin") of a dual beam/echo integration acoustic system

Stepnowski, Andrzej 1/1/95 End of assignment report: Marine acoustics specialist

Stepnowski, Andrzej 1/4/94 Lecture notes on the application of hydroacoustic data processing systems

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Sutterlin, A. 1/3/95 A teaching module for marine reproductive physiology

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Sutterlin, A. 1/1/93 End of assignment report: Marine physiology specialist

Sutterlin, A. 1/7/92 End of assignment: Marine physiology specialist

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Szczucka, Joanna 1/8/95 End of assignment report: Marine acoustics specialist

Szczucka, Joanna 1/7/95 Lecture notes on fundamentals of acoustical oceanography in application to fish population estimation

Tamaru, Clyde 1/9/94 Basic biology quiz and general information questionnaire

Tamaru, Clyde 1/9/94 End of assignment report: Mariculture specialist - fish hatchery

Tamaru, Clyde 1/9/94 Larval culture of the double-ended pipefish, sygnathoides biaculeatus

Tamaru, Clyde 1/9/94 Minyak cengkeh and minyak kayu putih as anesthesia for fish: Praktek ketrampilan (PKL) studies

Tamaru, Clyde 1/9/94 Semester VIII practium for the reproduction and cultivation of fish

Tamaru, Clyde 1/9/94 The local fish market as a resource for teaching and research

Tamaru, Clyde 1/9/94 Use of a hemocytometer in the culture of phytoplankton (in English and Bahasa Indonesia)

Tamaru, Clyde 1/9/94 Workshop on phytoplankton culture

Tamaru, Clyde 1/9/94 Zoological photography as a teaching and research tool

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Tokarczyk, Richard. 1/12/94. A brief introduction to gas chromatography: basic concepts, equipment, and laboratory requirements

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Wallace, J and Tambunan, M 1/3/94 PBME-MID term study results: 6 volumes: UNRI IPB, UNDIP, UNHAS, UNSRAT, UNPATTI

Wallace, J and Tambunan, M 1/2/94 Project benefit monitoring and evaluation mid term report-A

Willsie, Alan. 1/1/95. An overview of bio-indicators of aquatic disturbance

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