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PROJECT APPRAISAL REPORT (PAR)

1. PROJECT NO. 931-0526	2. PAR FOR PERIOD: Jan. 1975 TO May 1976	3. COUNTRY TA Bureau	4. PAR SERIAL NO.
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5. PROJECT TITLE

Artificial Propagation of Milkfish

7p

6. PROJECT DURATION: Began FY 1975 Ends FY 1978	7. DATE LATEST PROP RAC-10-74	8. DATE LATEST PIP -	9. DATE PRIOR PAR NA
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10. U.S. FUNDING	a. Cumulative Obligation Thru Prior FY: \$ 250,000	b. Current FY Estimated Budget: \$ 265,000	c. Estimated Budget to completion After Current FY: \$ 950,000
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11. KEY ACTION AGENTS (Contractor, Participating Agency or Voluntary Agency)

a. NAME	b. CONTRACT, PASA OR VOL. AG. NO.
Oceanic Foundation, Waimanalo, Hawaii	AID-TA-C-1189

I. NEW ACTIONS PROPOSED AND REQUESTED AS A RESULT OF THIS EVALUATION

A. ACTION IX			B. LIST OF ACTIONS	C. PROPOSED ACTION COMPLETION DATE
XX	AID/W	MOST		
AA			Respond to "Specific Comments" in Report	12/76
X	X		Augment contract by \$30,000 for stress studies	done 6/22/76
	X		Obligate third year funds of approx. \$250,000	done 8/13/76
X	X		Hold the review called for after 32 months in May 1977 instead of Sept. 1977	5/77
	X		Reach decision as whether to extend the project beyond January 1978	6/77

Best Available Document

D. REPLANNING REQUIRES						E. DATE OF MISSION REVIEW	
REVISED OR NEW:	<input type="checkbox"/> PROP	<input type="checkbox"/> PIP	<input type="checkbox"/> PRO AG	<input checked="" type="checkbox"/> PIO/T	<input type="checkbox"/> PIO/C	<input type="checkbox"/> PIO/P	
PROJECT MANAGER: TYPED NAME, SIGNED INITIALS AND DATE				MISSION DIRECTOR: TYPED NAME, SIGNED INITIALS AND DATE			
Philip M. Roedel				Leon E. Hesser, Director, TA/AGR			

REVIEW OF THE RESEARCH PROGRAM RESEARCH IN ARTIFICIAL PROPAGATION OF MILKFISH CONDUCTED BY THE OCEANIC FOUNDATION FOR AID

BACKGROUND

This review was held at the Oceanic Institute, Waimanalo, Hawaii on May 6 and 7, 1976, in accordance with the terms of the contract between AID and the Oceanic Foundation (now Oceanic Institute) entered into on January 13, 1975.

This contract, AID-TA-0-1189, is in the amount of \$498,532 for the 3-year period ending January 12, 1978. Of this sum, \$250,000 was allotted initially. The balance, \$248,532, was to be provided if funds were available and "contingent upon ... favorable AID review and evaluation of the results of the program after 18 months." The review was actually held after 16 months to avoid a session during the spawning season.

The original research proposal, which was submitted to the AID Research Advisory Committee on 16 October 1974, covered a 5-year study at a total cost of \$870,000. Whether the contract will be extended for two additional years will be determined by a second review which, under the terms of the contract, is to be held after 32 months.

The review team consisted of:

Philip M. Roedel, Fisheries Advisor, AID, Washington, D. C.,
H. R. Schmittou, Fisheries Advisor, USAID Mission, Manila, Philippines,
James A. Storer, Office of Marine Resources, NOAA, Rockville, Md.

The principal Oceanic Institute staff participants in the review were:

H. Burr Steinback, President
Colin J. Nash, Director of Research
Ching-Ming Kuo, Head, Aquaculture Division
Guy N. Rothwell, Jr., Senior Engineer
Albert C. Smith, Marine Pathologist

SUMMARY FINDINGS

The team agreed that the work being done is in accordance with the terms of the contract, that it is generally on schedule, and that the timetable for the next year remains valid. The project projections for the proposed years 4 and 5 will require careful scrutiny at the second (final) review of the existing contract. The project staff, while small in numbers, is obviously extremely competent professionally. There are some questions with respect to certain aspects of the work which are addressed in the report. The program as a whole, however, is sound and fully deserving of continued AID support. The team endorsed Oceanic's request for additional funds (\$30-35,000) for pathology work and recommended that the program be funded for its third year at no less than the level indicated in the contract.

PURPOSE OF THE RESEARCH

The program objective set by AID for the contractor was to breed the milkfish, Chanos chanos, in captivity and to raise the fry from the egg, undertaking any research and development which might be necessary to attain that goal.

Specific objectives are:

- a. To induce spawning of milkfish in captivity economically and over long periods.
- b. To increase the survival rate of eggs and larvae.
- c. To increase the hardiness of juveniles.
- d. To develop handling techniques for juveniles that will assure the lowest possible mortality.

The original proposal from Oceanic Foundation proposed research, design, and construction of low-cost pens and enclosures for aquacultural production of brackish-water fish. The revised research project excludes any work on pens and enclosures for commercial production.

PROJECT PLAN

The review team agreed that the Institute is carrying out the research program in a very satisfactory fashion. The original plan was well conceived, the staff has been able to adhere to it, and Oceanic expects to be able to achieve its objectives within the allocated time. This is not due simply to an automatic adherence to the original plan but rather to the staff having periodically examined the plan to determine its continuing validity and productivity, as well as their progress under its terms.

STAFF

The team was impressed with the attitude, enthusiasm and general approach of the staff. It is a talented group of professionals who seem to work very well together, stimulate one another, have respect for each other's special area of competence, thereby achieving a good degree of interaction and esprit de corps. The leadership provided by Colin Nash appears to be most effective,

The breadth of approach is exemplified by the role of Dr. Smith who took his doctorate in biology but more recently obtained his MD. With that unique training he can bring to his fish pathology work the training and interest of a physician. He is, for instance, pursuing a number of

by-products of his pathology research that may have significant medical application. Such a result that would, of course, increase the pay-off of the project. This broad capacity of the staff is to be highly valued and bodes well for the continued health of the Institute and for its potential not only in aquaculture but as well in other activities.

The staff tends to be academically and intellectually oriented, yet it maintains a strong practical orientation manifested in such ways as in efforts to reduce the cost of feed.

The team had, however, some concern that the staff might be overly academically oriented, with not enough contact with practical fishermen or practicing aquaculturists. In that sense there was a feeling that the staff feels itself to be something of an "intellectual elite" and that it wishes to keep it that way.

RELATIONSHIPS WITH OTHER ORGANIZATIONS

The staff was well aware of the activities of the other institutions working in the fisheries field with AID support -- Auburn University and the University of Rhode Island. They were quite open to the possibilities of closer cooperation with either or both, at the same time pointing out quite correctly that such cooperation could more easily be effected with the University of Hawaii.

However, they appear to be quite selective in their relations with other professionals at that University. While the staff seems to have associated regularly with some groups, they have almost no contact with others, particularly social scientists, including economists. They should exert a greater effort in this direction.

FUNDING

The Institute is operating on a very tight budget, but should be able to carry out the work as scheduled in the contract. It is essential that the full \$249,000 budgeted for the third year be obligated in FY 1977, and equally essential that certain studies of stress be funded immediately. Cost is estimated at \$30-35,000. (Note: The budget was augmented by \$30,000 on June 22, 1976).

As we have noted, the project proposal presented to the AID Research Advisory Committee called for a 5-year study at a cost of \$870,000. The contract finally let covered the first three years only for which approximately \$500,000 was budgeted. Requirements beyond the third year are to be considered by the review to be made "after 32 months". If the project is to continue, this review will in fact have to be made after about 28 months (e.g. in May 1977) to permit the Agency sufficient time to process extension documents, this assuming the board so recommends.

Oceanic noted in the executive summary of its annual report for 1975 that the essentially similar 5-year program for gray mullet cost \$1-3/4 million including capital construction. It believes that the milkfish work will require funding support of the same order of magnitude -- perhaps \$1 million exclusive of construction.

SPECIFIC COMMENTS

Sexual Maturity and GSI

The following is based on a comment from one of the board members: So little is known about the biology of milkfish that it is not valid to make concrete comparisons between two apparent subpopulations. There are some important apparent differences in spawning biology between milkfish in Hawaii and in Southeast Asia such as:

1. Reported minimum sizes of sexually mature fish in SEA are almost 5 kg while Hawaii fish are 2.5 to 3 kg.
2. SEA fish apparently spawn over a long season with only a relatively few females gravid at any given time while Hawaii fish apparently all develop and spawn within a short season during July and early August.
3. Reported minimum spawning temperatures for SEA fish have been 28°C while waters around Hawaii do not exceed 26°C.

Another apparent difference of possible significance is in gonad weight relative to total body weight -- GSI. The most developed Philippine fish studied had GSI values of 5 to 7 for males and 8 to 12 for females, while GSI's for both sexes in Hawaii were only approximately 3.3 during peak development (based on available data).

The Board suggests that the Staff should consider what the apparent differences mean and what importance they may have.

Supplemental Feed

Oceanic is using feeds to supplement natural growth of vegetation in the tanks and pools. An example of the supplemental feed reported consists of:

Wheat middlings	55.0%
Cottonseed meal	14.0
Soybean meal	14.0
Tuna meal	14.0
Propylene glycol	1.4
Visorbin	1.4
Vitamin pre-mix	0.2

A Board member points out that total protein in this feed could not be more than 20% and animal protein not more than about 9%; carbohydrates are high and fats, vitamins and minerals are low. Supplemental feeds for fish should be high in protein (30% or more) and low in carbohydrates. The feed may not be nutritionally adequate for developing breeders especially since there appeared to be very little natural foods available in Oceanic tanks and ponds. The fish may not be able to get enough nutrients, especially protein to develop sex products and especially viable products.

The team suggests that Oceanic begin using some of the proven nutritionally complete trout diets. Since little is known about milkfish nutrition, it would appear Oceanic could collaborate profitably with a fish nutritionist

Electronic Tagging

Oceanic intends to locate milkfish spawning grounds by tracking from a boat a released gravid female equipped with an electronic tag. The odds for success of this method seem extremely small. For example, the spawning grounds may be as much as 300 km from the Hawaii beaches where the larvae and postlarvae are collected.

Other troublesome factors include:

1. The problem of selecting and preparing the specimen for tagging.
2. The possibility if not probability that handling stress will cause altered behavior to a point where these tagged fish will not move immediately to the grounds for spawning, will spawn outside of the normal spawning grounds, will lose their eggs to atresia or premature release.

It seems to the team that in addition to electronic tagging, upcurrent sampling of larvae and eggs be used to locate spawning grounds. Theoretically, larvae development would become less developed as sampling progressed upcurrent away from shore.

Some advantages of these methods are that:

- a. There is a greater chance index for success than with the electronic tagging method;
- b. It would be less expensive than electronic tagging;

- c. It will provide valuable information on development of wild eggs and larvae for use in artificial spawning studies; and
- d. It will provide information on the environment in which eggs and larvae exist between spawning grounds and shore, as well as just the spawning grounds.

One team member has suggested to Oceanic that they consider mass tagging as a possible preliminary to electronic tagging. This could provide valuable information on distribution, range, migration habits and subpopulations. Releases of mass-tagged milkfish should be considered in a broad geographic area including Indonesia, Philippines, and Taiwan as well as Hawaii and possibly other Pacific Islands. The tagging program requires especially careful consideration before final plans are made for the 1977 spawning season.

Milkfish Pathology Project

It became apparent in 1975 that naturally-occurring organic disease and stress induced by confinement could seriously affect the outcome of the entire program. Consequently, in October 1975, Oceanic made a formal application to AID for supplementary funding so that it could intensify the work being carried out by Dr. Smith. This includes studies of basic pathology and studies of diseases that manifest themselves under condition of contamination. In the latter case, Oceanic hopes to develop a fundamental understanding of the stress state and how to cope with it. Preliminary work is promising.

The team fully endorsed this project and believed it should be adequately funded. As noted under "Funding", the budget was augmented by \$30,000 in June, 1976.

FUTURE WORK

The study as authorized will provide answers to only part of the questions no matter how successful the scientific work may be. Oceanic can with its present staff and facility develop the laboratory techniques needed for artificial propagation. However, with its present physical facilities, Oceanic cannot carry out pilot production operations designed to field-test the techniques that are needed as an intermediate step leading to the design and operation of large-scale production hatcheries. There is a real question as to whether, even if the facilities in Hawaii were expanded, the work should be done there. The team feels, as does the staff, that this should be carried out in South East Asia where production operations will ultimately take place.

This question requires full consideration at the second review team which will determine where and in what form the project will continue.