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National Association of Partners of the Americas

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**SPECIAL REPORT**  
**UNIVERSITY OF SOUTH CAROLINA**  
**SCAMPI**  
**OCTOBER 1 - DECEMBER 10, 1989**

1988/89 EL SALVADOR CAPS PROGRAM

Prepared for USAID El Salvador

Contract Number: 519-0337-C-00-8491-00

Submitted by Peter Aron, Project Director

**SPECIAL REPORT**  
**University of South Carolina**  
**South Carolina Aquaculture and Marine Internationals (SCAMPI)**  
**Aquaculture**  
**October 1 - December 10, 1989**

I. Technical Training

After the El Salvador CAPS scholars completed their aquaculture internships in South Carolina, Georgia, Alabama, and Florida, the group returned to Myrtle Beach, SC, and spent the last week of October presenting their experiences to the each other and discussing the applicability of their learnings to El Salvador.

In early November, the group went through a week-long intensive fresh- and salt-water shrimp course at the James M. Waddell Jr. Mariculture Research and Development Center in South Carolina. The center is part of the South Carolina Wildlife and Marine Resources Department.<sup>1</sup>

During the last three weeks, each student, with the assistance of the technical trainers, prepared a detailed plan for an aquaculture project which could be implemented in El Salvador. Developing the project allowed the students to analyze the information they had acquired through the training, and formulate a plan to utilize it in a way that is feasible for the limited resource context of their home communities and adapted to address the specific needs of El Salvador.<sup>2</sup>

II. Departure Program

On December 8, 1989, Anita Friedman, Assistant Director of the El Salvador CAPS Program, conducted a one-day departure program with the scholars. The departure program consisted of the following components: 1) evaluating the SCAMPI aquaculture program in order to understand what was positive, what was negative, and what could be improved in the future, 2) analyzing major U.S. values to see what each individual had adopted for themselves and how this could help them confront future situations, 3) creating a forum in which the students could openly discuss their feelings about returning home, and 4) informing them about the Follow-On program and the support that NAPA can provide to returned scholars.<sup>3</sup>

The group was accompanied by Ms. Friedman from their Myrtle Beach apartments to their Miami flight to San Salvador.

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<sup>1</sup> Attachment A contains an outline and schedule of the shrimp course, as well as a class ranking of the students' performance in the course.

<sup>2</sup> Copies of the students' projects are available from both NAPA's San Salvador and Washington, D.C. offices.

<sup>3</sup> Attachment B contains an outline of the departure program and a copy of the program evaluation form utilized for discussion.

### III. TCA

A TCA report reflecting program activities for the October 1 - December 10, 1989 period, is attached. A final TCA report of the total program costs at SCAMPI will be sent under separate cover as soon as all payments are completed.

Note: We are still awaiting final reports from the SCAMPI staff. These will be forwarded under separate cover.

CLASP TRAINING IMPLEMENTATION PLAN (TIP) BUDGET  
Training Cost Analysis (TCA)

----- Academic  
----- x ----- Technical

School Name: University of South Carolina - SCAMPI

Technical Field: Aquaculture

Project Number: 519-0337

PID/P Number: 519-0337-1-80108

No. Trainees in Group: 25

10/30/89

Training Dates for this PID/P: From: 01/30/89 To: 12/10/90

Reporting Period: From: 10/01/89 To: 01/31/90

Program Categories/ Training Activities:	BUDGETED 2/24/89	BUDGET AMENDMENT 5/9/89	EXPENDED 1/30/89 - 9/30/89	EXPENDED 10/1/89 - 12/31/89	EXPENDED 1/1/90 - 1/31/90	EXPENDED TO DATE	REMAINDER
A. Education/Training Costs.....	\$126,651	\$199,246	\$109,085	\$9,076	\$0	\$118,161	\$81,085
1. Tuition/Fees.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
2.a. Training Costs (US).....	\$100,000	\$125,000	\$85,230	\$9,076	\$0	\$94,306	\$30,694
b. Trng Cost (ES) (CHP)	\$26,651	\$74,246	\$23,855	\$0	\$0	\$23,855	\$50,391
3. Package Program Costs.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
4. Other (Mission Option)....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
B. Allowances.....	\$133,750	\$150,325	\$102,891	\$33,450	(\$164)	\$136,177	\$14,148
1. Maintenance Advance.....	\$5,000	\$7,500	\$7,385	\$0	\$0	\$7,385	\$115
2. Living/Maintenance.....	\$125,000	\$137,825	\$94,881	\$33,450	(\$164)	\$128,167	\$9,658
3. Per Diem.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
4. Books & Equipment.....	\$3,125	\$5,000	\$625	\$0	\$0	\$625	\$4,375
5. Book Shipment.....	\$625	\$0	\$0	\$0	\$0	\$0	\$0
6. Typing.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7. Thesis.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
8. Doctoral Dissert.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
9. Professional Membership...	\$0	\$0	\$0	\$0	\$0	\$0	\$0
10. Other (Mission Option)	\$0	\$0	\$0	\$0	\$0	\$0	\$0
C. Travel.....	\$17,250	\$21,200	\$7,478	\$388	\$0	\$7,866	\$13,334
1. International (CHP)	\$16,500	\$20,225	\$7,478	\$388	\$0	\$7,866	\$12,359
2. Domestic	\$0	\$0	\$0	\$0	\$0	\$0	\$0
3. Local (CHP)	\$750	\$975	\$0	\$0	\$0	\$0	\$975
D. Insurances.....	\$10,200	\$11,317	\$8,249	\$211	\$0	\$8,460	\$2,857
1. HAC for US.....	\$10,200	\$9,350	\$7,446	\$211	\$0	\$7,657	\$1,693
2. Required by Institution..	\$0	\$0	\$0	\$0	\$0	\$0	\$0
3. In-Entry. Insur (CHP)	\$0	\$1,967	\$803	\$0	\$0	\$803	\$1,164
E. Supplemental Activities.....	\$2,425	\$26,591	\$46,270	\$0	\$0	\$46,270	(\$19,679)
1. ELT, In-country (CHP)	\$1,825	\$25,765	\$18,568	\$0	\$0	\$18,568	\$7,197
2. ELT, US.....	\$0	\$0	\$27,500	\$0	\$0	\$27,500	(\$27,500)
3. Academic up-grade.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
4. Reception Services.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
5. Arrival Orientation	\$350	\$350	\$0	\$0	\$0	\$0	\$350
6. Intrprs/Escorts (CHP)....	\$250	\$476	\$202	\$0	\$0	\$202	\$274
7. Internship/cooperative...	\$0	\$0	\$0	\$0	\$0	\$0	\$0
8. Enrichment Programs.....	\$0	\$0	\$0	\$0	\$0	\$0	\$0
9. Mid-winter commun. semina	\$0	\$0	\$0	\$0	\$0	\$0	\$0
10. Follow-up career devel...	\$0	\$0	\$0	\$0	\$0	\$0	\$0
11. Other (Mission Option) ..	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TOTAL PROGRAM COSTS:	\$290,276	\$408,678	\$273,973	\$43,125	(\$164)	\$316,934	\$91,743
Total U.S. Costs:	\$243,675	\$285,025	\$223,067	\$42,737	(\$164)	\$265,640	\$19,385
Total E.S. Costs:	\$46,601	\$123,653	\$50,906	\$388	\$0	\$51,294	\$72,359

## COURSE OUTLINE AND SCHEDULE

### DAY 1 - Monday, November 6

#### LECTURE:

- I. Welcome and Introduction [Sandifer]
- II. Overview of Shrimp Farming Industries [Sandifer]
  - A. The Asian industry
    1. Primary countries involved
    2. Species of choice
    3. Production
  - B. Shrimp farming in the Western World
    1. Primary countries involved
    2. Species of choice
    3. Production
  - C. Brief outline of culture technology
    1. hatchery technology
      - a. single-tank method
      - b. multiple tank method
    2. growout technology
      - a. extensive
      - b. semi-intensive
      - c. intensive pond
      - d. intensive tank
- III. Shrimp Taxonomy and Natural History [Sandifer]
  - A. Macrobrachium
    1. Generalized life history of Macrobrachium
    2. Species differences
    3. Impact of life history on culture technology
  - B. Penaeids
    1. Generalized life history of penaeids
    2. Species differences
    3. Impact of life history on culture technology
- IV. Macrobrachium Reproduction [Sandifer]
  - A. Aspects of female reproduction
    1. Gamete development
    2. Mating
    3. Spawning
    4. Hatching
    5. Behavioral aspects
  - B. Aspects of male reproduction
    1. Gamete development
    2. Mating
    3. Behavioral aspects
  - C. Reproduction culture technology
    1. Broodstock production in ponds
    2. Broodstock selection
    3. Spawning tanks
  - D. Impact of reproduction on performance in growout
    1. Effect of gamete production on female growth
    2. Male reproduction social interactions

#### LAB:

- I. Shrimp Harvesting Techniques [Baird]

- A. Importance of pond design on harvesting efficiency
- B. Automated handling of harvested product
- II. Handling and Packing Harvested Product [Stokes]
  - A. Importance of icing and proper handling
  - B. Interview with shrimp wholesaler
  - C. Overview of shrimp marketing

DAY 2 - Tuesday, November 7

**LECTURE:**

- I. Penaeid Reproduction [Browdy]
  - A. Spawning wild mated females from sourcing boats
    - 1. On-board handling
    - 2. Identification of ovarian development stage
    - 3. Identification of mated females
  - B. Maturing males and females in tanks
    - 1. Environmental conditions
      - a. temperature
      - b. salinity
      - c. light
      - d. other
    - 2. Maturation diet
      - a. components
      - b. feed handling
    - 3. Manipulation of endocrine system
      - a. eyestalk removal
      - b. hormone regulation
  - C. Spawning females from maturation tanks
    - 1. Sourcing females from maturation tanks
    - 2. Spawning tank design and management
- II. Penaeid Nauplii Handling [Holloway]
  - A. Larval rearing tank environmental conditions
    - 1. temperature
    - 2. salinity
    - 3. pH
    - 4. ammonia and nitrite
    - 5. aeration
  - B. Estimating nauplii numbers
  - C. Larval stocking densities
- III. Algae Production for Penaeid Hatcheries [Holloway]
  - A. Algae taxonomy
  - B. Species of choice
  - C. Concept of expanding volume of axenic cultures
  - D. Obtaining starter cultures
  - E. Media preparation
    - 1. formulation
    - 2. commercial supplies
  - F. Media sterilization
    - 1. test tubes and flasks
    - 2. mass culture vessels
  - G. Inoculating vessels
    - 1. test tube inoculation
    - 2. flask and carboy inoculation
    - 3. mass culture tank inoculation

- H. Production algae system management
- I. Harvesting Algae

**LAB:**

- I. Penaeid Zoea Culture [Holloway and McGovern]
  - A. Determining development stage
  - B. Population estimation
- II. Algae Culture [Holloway and McGovern]
  - A. Determining algae density
  - B. Inoculating vessels

**DAY 3 - Wednesday, November 8**

**LECTURE:**

- I. Culturing Penaeid Larvae (past nauplii) [McGovern]
  - A. Penaeid zoea culture
    - 1. Environmental conditions
    - 2. Feeding rates
    - 3. Feeding methodologies
    - 4. Water management
    - 5. Population estimation
  - B. Penaeid mysis culture
    - 1. Environmental conditions
    - 2. Feeding rates
    - 3. Feeding methodologies
    - 4. Water management
  - C. Brine shrimp hatching
    - 1. Artemia life history and culture implications
    - 2. Determining hatch rates
    - 3. Predicting brine shrimp requirements
    - 4. Brine shrimp hatching system design
    - 5. Brine shrimp hatching system operation
  - D. Supplemental (non-living) larvae feeds
    - 1. Types of supplemental feeds
    - 2. Preparation of supplemental feeds
    - 3. Providing supplemental feeds
- II. Macrobrachium Larval Rearing [McGovern]
  - A. Environmental conditions
    - 1. salinity
      - a. salinity requirements
      - b. source of saltwater
    - 2. temperature
    - 3. ammonia and nitrite
    - 4. pH
    - 5. suspended solids and other
  - B. Macrobrachium larval development stages
    - 1. characteristics for identification
    - 2. differences in feeding protocol
  - C. Larval diets
    - 1. Brine shrimp
      - a. feeding rates
      - b. feeding methodologies
    - 2. Supplemental feeds
      - a. feeding rates
      - b. feeding methodologies

- D. Holding Macrobrachium and penaeid postlarvae
  - 1. Environmental conditions
  - 2. Feeding rates
  - 3. Feeding methodologies
  - 4. Water management
  - 5. Population estimation
- III. Macrobrachium and Penaeid Nursery Systems [Baird]
  - A. Purpose of nursery systems
    - 1. head-start nurseries for temperate climates
      - a. temperature requirements
      - b. temperature supplementation techniques
    - 2. head-start nurseries for tropical climates
      - a. inventory control
      - b. facility utilization
  - B. Tropical nursery pond design
    - 1. pond size
    - 2. substrate conditions
    - 3. bottom slope
    - 4. drain structure
  - C. Pond preparation
    - 1. drying
    - 2. plowing and regrading
  - D. Pre-stocking fertilization
    - 1. inorganic fertilizers
      - a. types and formulations
      - b. application rates
    - 2. organic fertilizers
      - a. types and sources
      - b. application rates
  - E. Pond filling
    - 1. inlet screening
    - 2. filling rate
  - F. Monitoring pond biota
    - 1. phytoplankton sampling
    - 2. zooplankton sampling
    - 3. benthos sampling
  - G. Pond stocking
    - 1. stocking rates
    - 2. stocking procedures
  - H. Pond harvesting
    - 1. harvesting procedures
    - 2. juvenile transfer procedures

**LAB:**

- I. Hatchery Water Quality [McGovern and Holloway]
  - A. Using refractometer to measure salinity
  - B. Using test kits to measure ammonia and nitrite
  - C. Using meter to measure pH
- II. Algae culture
  - A. Preparing media
  - B. Sterilizing media
  - C. Determining feed rates

DAY 4 - Thursday, November 9

**LECTURE:**

- I. Macrobrachium and penaeid growout [Stokes]
  - A. Extensive production systems
    1. pond size
    2. stocking rates
    3. fertilization program
    4. water exchange
    5. predator control
  - B. Semi-intensive production systems
    1. pond size
    2. stocking rates
    3. fertilization
    4. feeding rates
    5. water exchange
    6. emergency aeration
  - C. Intensive pond production systems
    1. pond size
    2. stocking rates
    3. feeding rates
    4. water exchange
    5. aeration
    6. controlling bottom conditions
  - D. Intensive tank systems
    1. tank size
    2. stocking rates
    3. feeding rates
    4. water exchange
    5. aeration
  - E. Water quality monitoring schedule
    1. dissolved oxygen
    2. other
  - F. Feeding growout systems
    1. feed rate calculations
    2. feeding methods
    3. water quality : feed rate relationships

**LAB:**

- I. Brine Shrimp Hatching [McGovern and Holloway]
  - A. Determining demand
  - B. Hatching procedures
  - C. Feeding shrimp larvae
- II. Pond Water Quality Monitoring [Stokes and Baird]
  - A. Dissolved oxygen
  - B. Secchi disk visibility

**DAY 5 - Friday, November 10**

**Lecture:**

- I. Farm Design and Construction [Hopkins]
  - A. Site selection
    1. Water quality for Macrobrachium hatcheries
    2. Water quality for penaeid hatcheries
    3. Soil and water for Macrobrachium ponds
    4. Soil and water for penaeid farms
    5. Availability of support services

- 6. Proximity to markets
  - B. Sizing components
    - 1. Macrobrachium hatcheries
    - 2. Penaeid hatcheries
    - 3. growout and nursery ponds
  - C. Facility layout
    - 1. generalized Macrobrachium hatchery
    - 2. generalized penaeid hatchery
    - 3. growout ponds and water distribution system
  - D. Construction techniques
    - 1. seawater distribution system for hatcheries
    - 2. larval rearing tank construction
    - 3. hatchery building considerations
    - 4. pond construction
    - 5. pond water distribution system
    - 6. calculating flow and head loss through pipe
    - 7. balancing cut and fill in pond construction
    - 8. pump sizing
  - E. Equipment selection
    - 1. hatcheries
      - a. intake pumps
      - b. water filtration units
      - c. water heating units
      - d. laboratory equipment
      - e. aeration equipment
    - 2. pond systems
      - a. intake pumps
      - b. aeration equipment
      - c. feeding machines
      - d. harvesting machines
      - e. other equipment
  - F. Economic analysis of proposed shrimp farms
    - 1. Macrobrachium hatcheries
    - 2. Penaeid hatcheries
    - 3. growout facilities
- II. Sources of Additional Information and Concluding Remarks [Hopkins]

## TEACHING MATERIALS

Teaching materials for this course will include most of the resources at the Waddell Mariculture Center including:

- o Turnure House Conference Center for lectures
- o larval rearing tanks
- o algae production facilities
- o brine shrimp production facilities
- o seawater distribution system
- o water heating and filtration equipment
- o growout ponds
- o pond harvesting equipment
- o pond feeding equipment
- o pond population sampling equipment
- o water quality monitoring equipment
- o microscopes and other laboratory equipment and supplies

Hand-out material will be provided on all aspects of penaeid and Macrobrachium culture.

The laboratory portion of the course (3-4 hours per day) will include hands-on training on various aspects of shrimp culture.

## INSTRUCTIONAL STAFF

The instructional staff are internationally recognized experts in the field of shrimp mariculture. The group of seven course instructors have a combined total of 72 years of experience in Macrobrachium and/or penaeid culture and include:

Paul A. Sandifer, Ph.D., Director, Marine Resources Division and the Waddell Mariculture Center

J. Stephen Hopkins, Manager, Waddell Mariculture Center

Alvin D. Stokes, Assistant Manager, Waddell Mariculture Center

John Holloway, Hatchery Systems Manager, Waddell Mariculture Center

May Baird, Pond Systems Manager, Waddell Mariculture Center

Kathleen M. McGovern, Hatchery Production Specialist

Craig L. Browdy, Ph.D., Maturation Research Specialist

Laura L. Von Harten, Information and Public Affairs Specialist, will provide Spanish/English translation as needed and will assist with the logistics.

**CLASS RANKING**

**CULTURE OF FRESHWATER AND MARINE SHRIMP**

**WADDELL MARICULTURE CENTER**

**November 6-10, 1989**

Manuel Armando Gochez  
Carlos Alfredo Flores  
Julio Americo Palacios  
Angel Rolando Alvarado  
Hector Gustavo Lucha Diaz  
Remberto Paul Viscarra Valladares  
Rolando Coreas Funes  
Arnulfo Israel Figueroa Leiva  
Jose Otsmaro Ramos Lopez  
Jaime Americo Santos  
Jose Armando Solorzano Gonzales  
Carlos Anibal Beltran  
Ricardo Melara Gomez  
Jorge E. Hernandez Herrera  
William Nelson Santos Garcia  
Carolina Ramos Morales  
Julio Enrique Garcia R.  
Jose Roberto Vega  
Irvin Campost  
Luis Jose Lopez Calderon  
Otsmaro Ramos Lopez  
Hector Cardoza  
David Ernesto Cornejo

**DEPARTURE PROGRAM  
AQUACULTURE GROUP**

**AGENDA OF THE DAY**

<b>Introduction to Day:</b>	15 minutes
<b>Evaluation</b>	1 hr. 15 minutes
Introduction	5 minutes

Come with evaluation filled-out.

Break into 4 groups of 5-6/each. Share written evaluation in small groups. (25 minutes)

In large group, recap. positive and negatives experiences (45 minutes).

**Facilitator asks group:**

- What was it about this experience that made it positive/negative?
- What kind of learning methodology was employed that facilitated learning in these experiences?
- Given that you will be teaching aquaculture in El Salvador, you can utilize these methodologies in your teaching, in order to promote positive learning.

**U.S. Value Mime**                      1 hr. 50 minutes

Break into 5 groups of 4-5/each.

Develop 2 mimes- one for "A U.S. Value that you identify/understand most and one that you identify/understand least".

To discuss and develop mime (5 minutes/mime)  
(1/2 hour)

Back in large group - each group takes 5 minutes to perform mime, 3 minutes to have other groups say what they saw and at end (15-30 minutes for large discussion.  
Total= 80 minutes (25 minutes performance; 15 minutes interpretation; 30 minutes discussion and 10 minutes for writing personal list).

Facilitator is listing major values/points.

**End:**

Each person should take 10 minutes and write down on a piece of paper - "out of these values, which have contributed most to your personal growth". (10 minutes).

**LUNCH**

### **Feelings about returning home**

Each person writes down 1 word that best encompasses what your feelings are about returning home. Don't show it to anyone. Go around the room and have each person state their word aloud. Facilitator writes down words--leave space for grouping together words--according to "fear, hope. etc.

Group discusses what lies behind central themes/feelings.

- Why are we afraid?
- Why are we looking forward to going back/not looking forward?

Facilitator acknowledges reality of El Salvador with group.

You are Salvadorans. Sense of duty to "salir adelante" for your country and your family.

- Do you want to contribute to this improvement? If so, in what way can you contribute?
- What are you taking back to El Salvador to help contribute to improve the country in terms of what has helped you grow personally?

### **Valija/Corazón**

There are some things you can take home materially.

If one paper is you valija--and in this you can put anything material you want, what would you put in it? If the other is your heart, and in it you can only put "lo que llevas adentro", what will you put in it? What things from your personal list are you taking with you in your hearts, to help you grow and contribute to your country? What can't you take with you? What don't you want to take with you?

1/2 hour Follow-On Description - 10 components

Specific things they need/want for support after returning to El Salvador.

- What do they think they'll do upon returning, how can we help them?
- What role should we play?

## Evaluación del Programa de CAPS/El Salvador

Nombre (opcional): \_\_\_\_\_

Area técnica: \_\_\_\_\_

Sírvanse llenar este formulario y traerlo a la clausura del programa, viernes, el 8 de diciembre. Con la ayuda de ustedes podremos evaluar el programa de estudios, el desempeño de los coordinadores del programa y las necesidades de cada uno de ustedes. Conteste a cada una de estas preguntas de una manera explícita, y breve y sobre todo con honestidad.

### 1. Evaluación del programa de Inglés:

- a. ¿Qué aspecto del programa le benefició más?
  
  
  
  
  
  
  
  
  
  
- b. ¿Qué aspecto del programa le benefició menos?
  
  
  
  
  
  
  
  
  
  
- c. ¿Qué sugerencias tiene para el mejoramiento de este programa en el futuro?

### 2. Evaluación del programa de Entrenamiento Técnico:

- a. ¿Qué aspecto del programa le benefició más?

**4. Evaluación del Hospedaje**

- a. ¿Se sentía cómodo en sus apartamentos? ¿Le habría gustado haber vivido con familias norteamericanas o en dormitorios?
  
  
  
  
  
  
  
  
  
  
- b. ¿Qué sugerencias tiene para mejorar este aspecto del programa en el futuro?

**5. Evaluación de los Coordinadores del Programa**

- a. ¿Recibía suficiente atención de parte de los coordinadores y/o instructores?
  
  
  
  
  
  
  
  
  
  
- b. ¿Qué tipo de relación tenía con sus coordinadores y/o instructores?
  - i. A nivel profesional
  
  
  
  
  
  
  
  
  
  
  - ii. A nivel personal