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ABSTRACT

A 1989-90 project determined the knowledge and skills necessary for employment in the aquaculture industry. The study identified technical materials and other resources available in private industry and higher education institutions. Two surveys determined the status of aquaculture in Texas school districts and identified tasks performed by crawfish and catfish producers. Analysis of these surveys (of five crawfish producers and six catfish producers) showed that about one-half of the 50 task details of crawfish producers and over one-half of the 55 task details of catfish producers were performed on a daily, weekly, monthly, or yearly basis. Performance of all crawfish producer tasks and 53 catfish producer tasks was determined to be very important. Aquaculture research result from industry and higher education were reviewed, and aquaculture curriculum materials nationwide were evaluated. Textbooks tended to be very specialized and were written at college-level understanding and readability. The following recommendations were made: (1) preparation of an introductory curriculum; (2) planning of laboratory facilities; (3) use of an articulated curriculum development approach; and (4) supplementing of agricultural experience programs with aquaculture principles and procedures. (Following the 18-page report are 136 references, survey results, preliminary aquaculture science course outlines, instruments, and correspondence.) (YLB)

A STUDY OF THE AQUACULTURE INDUSTRY IN TEXAS TO ASSIST IN ESTABLISHING AQUACULTURE AS A COURSE OFFERING IN AGRICULTURAL SCIENCE AND TECHNOLOGY

FINAL REPORT

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A Study of the Aquaculture Industry in Texas to Assist in Establishing Aquaculture as a Course Offering in Agricultural Science and Technology

Completed June 30, 1990

The project reported herein was performed through a contract with the Texas Education Agency under the provisions of the Carl D. Perkins Vocational Education Act (Public Law 98-524). Contractees undertaking such projects are encouraged to express freely their professional judgement in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Texas Education Agency position or policy.

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Problem

Aquaculture, defined by Webster (1987) as the cultivation of water plants and animals for human use, has been designated as an expanding industry in Texas (Chamberlin, 1990). Various state and national agencies have acknowledged the economic importance of aquaculture and the educational training needs of the industry.

Aquaculture production of plant and animal species consists of a scientific and technical knowledge base which can be presented to secondary school students enrolled in agricultural science and technology classes in Texas. According to a report edited by Chamberlin (1990), only three universities offer specific degrees in aquatic sciences. None of the post-secondary programs in Texas offers technical training in aquaculture production, even though laboratory training exists as a portion of the degree. Programs in aquaculture have not been instituted in Texas vocational technical schools.

Since 1984, program improvement for secondary agricultural sciences and technology programs in Texas has resulted in up-dated curriculum, courses offered on a semester basis, and entirely new curricula. Prior to granting a school district permission to offer aquaculture courses (or any course), the basis for curriculum preparation and justification must be established. Modern curriculum development methods consist of a series of sequential steps organized by occupational areas and task statements which should be validated by industry, approved by teachers, monitored by state education agency staff, and eventually approved by the state education agency (Bortz, 1981). Final curriculum development stages done by a trained specialist should precede actual implementation into classrooms.

Industry and education should coordinate curriculum development efforts to educate students in occupational areas where a demand exists for employees. In an occupational survey of diversified agriculture enterprises in Texas, the aquaculture production industry will have an increasing need for technically trained employees (NSI Research Group, 1990). In an aquaculturally bountiful state, Hawaii, a task analysis and industry survey was used to identify plans for expansion of aquacultural industries and the technical training needed to amply provide labor for the enterprises (Dung, Wakui 1980).

Various technical bulletins, as noted in the bibliography, have been prepared by educational, scientific, professional, and commercial organizations to provide an array of information regarding the aquaculture industry and training needs. As found through a review of the literature and from correspondence with curriculum centers, availability of aquaculture curricula was limited.

To appropriately provide program improvement regarding aquaculture science as an approved agricultural science and technology course, project staff were

charged to review existing curriculum and to establish a basis on which to develop an aquaculture curriculum for secondary students in Texas.

Goals and Objectives

The goal of this project was to research the aquaculture industry to determine the knowledge and skills necessary for employment and to identify technical materials and other resources now available in private industry and institutions of higher education.

To fulfill the stated goal, the following objectives were accomplished:

1. to identify skills needed for successful employment in the aquaculture industry;

2. to locate and review aquaculture research results available from industry and institutions of higher education;

3. to locate and review curriculum material available in Texas and other states.

Procedures

Staffing

Project staff were selected based on their expertise and diversity. Staff included Dr. Bob Davis, agricultural economics; Dr. Glenn Longley, biology; Dr. Lon Shell, agricultural mechanics; Dr. Paul Raffeld, testing and counseling; Dr. John Dillingham, agriculture teacher education; and Ms. Andrea Pearson, graduate student.

General Project Design

Two surveys, one to determine the status of aquaculture in Texas school districts, and the other to identify tasks performed by crawfish and catfish producers, were used. Data were described and are displayed as frequency data.

On August 2-4, 1989, in Lubbock, Texas (Appendix A), an aquaculture industry survey developed by project staff was administered to agricultural science and technology teachers at the Professional Improvement Conference for agriculture teachers. Involvement of teachers at the on-set of the project was useful in determining the status of aquaculture in school districts and the existing interest

of the teachers in agriculture. The survey was completed by 675 teachers of the 900 departments. Only one teacher per department completed the survey to avoid duplication of responses. A summary of the aquaculture-related survey of school districts in Texas is included in Appendix B. In Table 1, Table 2, and Table 3, the status of aquaculture industry in Texas as perceived by teachers is displayed.

Another survey was mailed to crawfish and catfish producers in May 1990. The task surveys were developed by project staff, reviewed by agricultural graduate students, and mailed to 30 crawfish and 36 catfish producers. A follow-up survey was mailed and follow-up phone calls were made to non-respondents. Only five crawfish producers and only six catfish producers returned surveys. Data were complied as frequency data.

An occupational needs assessment to determine diversified agriculture enterprises and the employment trends in each area was accessed by project staff. The needs assessment was conducted by the NSI Research Group (1990) and was reported to the Agricultural Industry Curriculum workshop participants in early stages of completion. Accessing employment trends for Texas agriculture enabled project staff to coordinate the curriculum planning process with occupational demands.

Tours, workshops, and seminars were utilized to review the status of the aquaculture industry. In August 1989, the Texas State Director of Agricultural Education, Mr. Jay Eudy, toured facilities at Southwest Texas State University and spoke with project staff concerning the expectations for aquaculture (Appendix C). Personnel from the Aquatic Biology Department and the Edwards Aquifer Research and Data Center presented their comments. Also, the A. E. Woods State Fish Hatchery and the Federal Fish Hatchery facilities, which are located in close proximity to the campus, were visited.

Selected aquaculture industry personnel, educational leaders, agency coordinators, agricultural science teachers, and project staff attended the Aquaculture Industry Curriculum Workshop (Appendix D) on March 8-9, 1990, at Southwest Texas State University and at the A. E. Woods State Fish Hatchery. Essentially, the participants reviewed curriculum materials previously collected, presented their opinions regarding aquaculture initiatives, and shared technical aquaculture expertise. At this workshop, teachers were presented an overview of aquaculture, after which the teachers developed preliminary outlines based on industry expectations and needs. Preliminary outlines (Appendix E) were submitted by May 1, 1990, and reviewed June 15, 1990, at the Instructional Material Service in College Station, Texas. Participants produced the topic outline for the proposed aquaculture science 382 course (Appendix F).

Results and Accomplishments

Results and accomplishments for the project and specific outcomes are reported respectively by objectives.

Table 1

Aquatic Species Produced within School Districts

Rank	Species Produced	Districts
1	Catfish	321
2	Baitfish	191
3	Sportfish	184
4	Crawfish	81
5	Frogs/Turtles	77
6	Ornamental/Tropical	61
7	Alligators	49
8	Saltwater Fish Species	36
9	Shrimp	36
10	Crab/Oysters	33

Note: Total number of teachers responding was 675.

Table 2

Industries Located within School Districts

Industry	Number of Districts
Freshwater Hatcheries	90
Saltwater Hatcheries	18
Freshwater Species (Processing)	60
Saltwater Species (Processing)	31
Aquatic Plant (Processing)	13
Saltwater Retail/Wholesale	76
Freshwater Retail/Wholesale	141
Aquatic Plant Retail/Wholesale	25

Table 3

1989 Status of Aquaculture in Texas School Districts as Reported by Agricultural Science and Technology Teachers

Statement	Number Responding Yes
Aquaculture farming industries are important in my district.	140
Aquaculture courses are currently offered.	19
Facilities are available to offer aquaculture courses.	48
Aquaculture courses would be offered if curriculum were available.	182

Note: Total number of teachers responding was 675.

Objective one

Skills needed for successful employment in the aquaculture industry were identified by a task survey (Appendix G). Crawfish and catfish producer addresses were obtained from Texas Department of Agriculture sources. Thirty surveys were mailed to crawfish producers. A follow-up mailing was made and five completed task surveys were returned. Of the 30 original surveys, ten producers were no longer in business and five surveys were returned with no forwarding address. Of 15 surveys mailed to current producers, five (33 percent) returned surveys. Only 16.5 percent of the original producers returned surveys.

As shown in Table 4, of the 50 task details presented to producers, 27 were performed on a daily basis, 26 were done on a weekly basis, 15 were done on a monthly basis, and 28 were done on a yearly basis by at least one producer. All of the tasks were done by at least one producer.

Crawfish producers generally agreed that performance of all tasks are important as indicated in Table 4. Thirty-seven of the 50 task details were of moderate importance to at least one producer, and only 11 task details were not too important.

Learning difficulty of 34 of 50 task details were categorized as easy by producers. Forty-eight of 50 task details were categorized as requiring medium

learning difficulty, and 17 of 50 task details were rated by producers to be difficult to learn.

From Table 5, data indicated that the owner and manager share responsibilities for crawfish management tasks while employees, to a lesser extent, are responsible for task performance.

Skills needed for catfish producers were determined by a review of literature. The tasks and task details for catfish producers are shown in Table 6. Six of 36 producers returned usable data regarding catfish production. Of 55 task details, 32 were performed on a daily basis, 26 performed on a weekly basis, 39 performed on a monthly basis, and 27 performed on a yearly basis by one or more of the producers.

As seen in Table 6, 53 of 55 task details were determined to be very important by one or more producers, while 41 task details were given moderate importance ratings. Only 14 task details were rated as not too important.

Learning difficulty of 29 of 55 task details was rated as easy, while 54 of 55 were rated as medium learning difficulty by one or more producers. Forty-nine of 55 task details were rated as difficult to learn, while none of the task details for harvest catfish were rated as difficult.

In Table 7, persons most responsible for performing task details were the owners and managers. Employees were responsible for performing task details in 25 of 55 instances in at least one production facility.

A comparison of the consultants utilized to assist crawfish and catfish producers is given in Table 8. Use of consultants for crawfish production and catfish production is similar since engineers, extension, and water quality specialists were utilized. One producer consulted a marketing specialist, and one consulted a fisheries specialist.

A summary of crawfish and catfish producers' comments are as follows:

1. aquaculture needs an interested educated work force;

2. the more difficult the item (task), the more responsibility is put on the owner or owner manager;

3. our biggest problem has been finding consistent labor willing to work outdoors for good pay;

4. most of the jobs on a fish farm are very important. The jobs are not difficult. Everyone is responsible.

Table 4

Summary of Crawfish Production Task Details by Frequency of Performance, Importance, and Learning Difficulty

TASKS	FREQUENCY OF PERFORMANCE				IMPORTANCE			LEARNING DIFFICULTY		
	daily	weekly	monthly	yearly	very	moderate	not too	easy	medium	difficult
A. Select a pond site										
1. Analyze soil type	0	0	0	4	3	2	0	3	2	0
2. Survey pond site	0	0	0	4	2	1	1	1	3	0
3. Design & layout pond	0	0	0	3	5	0	0	2	1	2
4. Construct pond	0	0	0	2	4	0	0	1	2	1
5. Maintain pond	3	1	0	0	4	1	0	3	1	1
B. Maintain water for ponds										
1. Identify needed depths	2	0	1	0	3	2	0	2	3	0
2. Monitor evaporation/rainfall	3	1	0	0	3	0	1	2	2	0
3. Control water loss	5	0	0	0	4	1	0	3	2	0
C. Fill and drain ponds										
1. Determine equipment needed	0	0	1	3	4	0	0	1	3	0
2. Design water system	0	0	0	3	3	1	0	0	2	2
3. Determine fill rate/time	0	0	0	3	2	1	1	2	1	1
4. Determine drain rate/time	0	0	0	3	2	2	0	2	1	1
5. Determine pumping costs	0	2	1	1	3	2	0	1	3	1
6. Estimate pumping costs per pound of product	0	3	0	1	2	2	0	0	2	2
D. Determine water quality										
1. Identify dissolved gases	0	3	0	1	1	2	1	0	2	2
2. Determine pH	2	1	0	1	2	2	0	1	3	0
3 Measure dissolved solids	1	1	1	0	1	1	1	0	2	1
4. Monitor O2 content	3	1	0	0	3	1	0	1	3	0
5. Disinfect water source	0	2	1	0	1	1	1	1	1	1
6 Interpret water analysis	0	3	0	1	2	1	1	0	4	1
E. Prevent O2 depletion										
1. Identify signs of O2 depletion	3	2	0	0	3	2	0	2	3	0
2. Identify causes of O2 depletion	4	0	0	0	3	1	0	1	2	1
3. Calculate carrying capacity	3	1	0	0	3	1	0	1	3	1
4. Control weeds	0	0	3	1	1	1	2	1	2	0
5 Prevent over feeding	0	2	1	1	2	1	1	2	2	0

Table 4 (continued)

Summary of Crawfish Production Task Details by Frequency of Performance, Importance, and Learning Difficulty

TASKS	FREQUENCY OF PERFORMANCE				IMPORTANCE			LEARNING DIFFICULTY		
	daily	weekly	monthly	yearly	very	moderate	not too	easy	medium	difficult
F. Manage ponds										
1. Fertilize ponds	1	0	0	4	2	2	0	1	3	0
2. Lime ponds	0	0	0	4	1	2	0	0	3	0
3. Renovate ponds	0	0	0	4	1	3	0	1	3	0
G. Manage crawfish populations										
1. Select crawfish species	0	0	0	4	2	2	0	1	3	0
2. Establish populations	1	0	2	1	3	0	0	0	3	2
3. Stock habitats	0	0	0	3	2	1	0	0	2	1
4. Maintain forages/feed	2	1	0	2	4	0	0	2	2	0
5. Use multiple cropping systems	0	0	1	1	1	1	0	1	1	0
H. Harvest crawfish										
1. Identify types of equipment	0	0	0	3	2	2	0	1	3	0
2. Use baited traps	3	0	1	0	4	0	0	3	1	0
3. Use trawls	0	1	0	0	1	0	1	0	1	0
4. Use seines	0	1	0	0	1	0	1	0	1	0
5. Utilize boats for transport	2	1	0	0	3	0	0	1	2	0
6. Plan collecting/handling	2	1	0	0	3	1	0	2	2	0
7. Schedule harvest procedures	2	1	0	0	3	1	0	2	2	0
I. Market crawfish										
1. Plan budget strategies	3	1	1	0	2	1	0	0	1	2
2. Determine marketing methods	2	1	1	1	3	1	0	0	0	4
J. Maintain equipment										
1. Pumping systems	4	0	0	0	4	0	0	0	4	0
2. Drainage systems	1	1	0	2	2	1	0	0	3	0
3. Water analysis	3	0	1	0	2	2	0	2	3	0
4. Pond management equipment	2	1	1	0	2	1	0	0	3	0
5. Harvesting equipment	2	1	0	1	3	0	0	0	3	0
6. Delivery equipment	2	1	0	1	2	1	0	0	3	0
7. Clearing tanks	2	1	0	0	2	1	0	3	2	0
8. Aeration systems	4	0	0	0	4	0	0	1	3	0
No. of Task Details=50										
Details chosen once or more	27	26	14	28	50	37	11	33	54	17

Table 5

Summary of Persons Most Responsible for Crawfish Production Task Details

TASKS		Person Most Responsible		
		owner	manager	employee
A.	Select a pond site			
1.	Analyze soil type	3	1	1
2.	Survey pond site	2	2	0
3.	Design and layout the pond	5	0	0
4.	Construct the pond	0	0	0
5.	Maintain the pond	2	1	2
B.	Maintain water for ponds			
1.	Identify needed depths	2	2	1
2.	Monitor evaporation/rainfall	1	1	2
3.	Control water loss	1	1	3
C.	Fill and drain ponds			
1.	Determine equipment needed	1	3	1
2.	Design water system	3	1	0
3.	Determine fill rate/time	2	3	0
4.	Determine drain rate/time	1	2	2
5.	Determine pumping costs	5	1	0
6.	Estimate pumping costs per pound of product	4	1	0
D.	Determine water quality			
1.	Identify dissolved gases	2	3	1
2.	Determine pH	2	3	0
3.	Measure dissolved solids	1	3	0
4.	Monitor oxygen content	0	2	3
5.	Disinfect water source	0	2	2
6.	Interpret water analysis	2	2	0
E.	Prevent oxygen depletion			
1.	Identify signs of O2 depletion	2	2	2
2.	Identify causes of O2 depletion	2	2	1
3.	Calculate carrying capacity	2	1	0
4.	Control weeds	1	2	2
5.	Prevent over feeding	2	2	1

Table 5 (continued)

Summary of Persons Most Responsible for Crawfish Production Task Details

TASKS	Person Most Responsible		
	owner	manager	employee
F. Manage ponds			
1. Fertilize ponds	1	2	1
2. Lime ponds	0	2	1
3. Renovate ponds	2	3	2
G. Manage crawfish populations			
1. Select crawfish species	3	2	0
2. Establish populations	3	2	0
3. Stock habitats	2	2	0
4. Maintain forages/feed	3	2	1
5. Use multiple cropping systems	1	1	0
H. Harvest crawfish			
1. Identify types of equipment	2	1	1
2. Use baited traps	1	2	3
3. Use trawls	0	1	0
4. Use seines	0	1	0
5. Utilize boats for transport	1	2	2
6. Plan collecting/handling	2	3	1
7. Schedule harvest procedures	1	3	0
I. Market crawfish			
1. Plan budget strategies	4	0	0
2. Determine marketing methods	4	0	0
J. Maintain equipment			
1. Pumping systems	1	3	3
2. Drainage systems	3	2	1
3. Water analysis	1	2	1
4. Pond management equipment	2	3	0
5. Harvesting equipment	3	2	0
6. Delivery equipment	3	2	0
7. Clearing tanks	0	2	1
8. Aeration systems	1	2	2
No. of Task Details=50			
Details chosen once or more	43	46	27

Table 6

Summary of Catfish Production Task Details by Frequency of Performance, Importance, and Learning Difficulty

TASKS	FREQUENCY OF PERFORMANCE				IMPORTANCE			LEARNING DIFFICULTY		
	daily	weekly	monthly	yearly	very	moderate	not too	easy	medium	difficult
A. Select a farm site										
1. Evaluate farm size & shape	0	0	1	2	4	1	0	0	3	2
2. Determine climate conditions	1	0	1	2	4	2	0	1	3	2
3. Determine accessibility	1	0	1	2	3	2	0	1	3	2
4. Analyze water supply	2	1	1	1	6	0	0	1	3	2
5. Analyze soil type	1	0	1	2	6	0	0	0	4	2
6. Survey pond site	1	0	0	3	5	1	0	0	4	2
7. Design & layout pond	0	0	0	3	4	1	0	0	3	2
8. Construct pond	0	0	0	3	4	1	0	0	4	1
9. Maintain pond	1	1	1	0	4	1	0	1	2	2
B. Control diseases/parasites										
1. Determine chemicals needed	3	1	1	0	6	0	0	0	4	2
2. Evaluate control methods	2	2	1	0	6	0	0	0	4	2
C. Determine water quality										
1. Identify dissolved gases	2	1	1	0	4	1	0	0	4	1
2. Determine pH	1	2	1	1	3	3	0	2	3	1
3. Measure dissolved solids	0	3	0	2	1	4	1	2	3	1
4. Monitor O2 content	4	1	0	0	5	1	0	2	3	1
5. Disinfect water source	0	2	0	1	1	3	0	0	3	1
6. Interpret water analysis	1	2	0	1	3	2	0	2	3	1
D. Prevent O2 depletion										
1. Identify signs of O2 depletion	5	0	0	0	6	0	0	2	2	1
2. Identify causes of O2 depletion	4	1	0	0	6	0	0	0	4	1
3. Calculate carrying capacity	2	2	1	0	5	1	0	0	4	1
4. Control weeds	1	2	2	0	4	1	1	2	2	2
5. Prevent over feeding	3	1	1	0	4	2	0	1	3	1
E. Control predators										
1. Identify predators	5	0	0	0	5	0	1	2	2	1
2. Determine methods of control	4	0	1	0	4	2	0	3	2	1

Table 6 (continued)

Summary of Catfish Production Task Details by Frequency of Performance, Importance, and Learning Difficulty

TASKS	FREQUENCY OF PERFORMANCE				IMPORTANCE			LEARNING DIFFICULTY		
	daily	weekly	monthly	yearly	very	moderate	not too	easy	medium	difficult
F. Feed catfish										
1. Identify nutrient requirements	0	0	4	1	3	3	0	1	2	2
2. Analyze feed ingredients	0	0	4	1	3	3	0	0	3	2
3. Analyze types of rations	0	0	4	1	3	2	0	0	3	1
4. Use different feed forms	1	0	2	1	3	2	0	0	3	1
5. Use different feeding methods	1	0	2	1	1	4	0	0	3	1
6. Use differend feeding schedules]	1	0	3	1	2	4	0	0	3	1
7. Identify different feed sources	0	0	3	1	2	3	0	1	3	1
8. Use storage methods	0	0	1	4	2	3	1	2	2	1
G. Harvest catfish										
1. Grade catfish	0	4	0	0	3	2	1	4	1	0
2. Identify harvest methods	0	2	1	0	1	3	2	3	2	0
3. Determine lifting methods	0	2	1	0	0	4	1	2	2	0
4. Use holding equipment	1	2	1	0	2	3	1	3	2	0
5. Utilize boats for transport	0	0	0	0	0	0	1	0	1	0
6. Schedule harvest procedures	0	3	1	0	2	3	1	2	4	0
H. Market catfish										
1. Plan budget strategies	0	0	2	1	3	1	0	0	2	3
2. Determine available markets	0	1	1	1	4	0	0	0	3	2
3. Establish market contacts	2	1	0	0	4	0	0	0	3	2
4. Use marketing promotions	0	0	1	1	1	1	1	0	1	3
5. Use vide.. tape marketing	0	0	0	0	1	0	0	0	0	1
6. Determine transportation costs	0	1	2	0	2	3	0	1	3	1
I. Maintain equipment										
1. Pumping systems	3	0	1	0	5	0	0	1	3	2
2. Drainage systems	1	0	3	0	1	4	0	3	1	1
3. Water analysis	2	0	2	0	4	1	0	2	2	1
4. Pond management equipment	1	2	1	0	2	3	0	1	3	1
5. Harvesting equipment	1	1	2	0	3	2	0	2	2	1
6. Delivery equipment	1	3	0	0	5	0	0	0	4	1
7. Clearing tanks	1	0	1	1	3	1	0	1	2	2
8. Aeration systems	1	2	1	0	4	0	0	1	2	2
J Diversify crops										
1. Determine available plans	0	0	2	2	2	2	1	0	2	3
2. Identify benefits of plan	0	0	2	2	3	2	1	0	2	3
3. Establish a plan	0	0	0	4	3	1	1	0	2	4
No of Task Details=50										
Details chosen once or more	32	26	39	27	53	41	14	29	54	49

Table 7

Summary of Persons Most Responsible for Catfish Production Task Details

TASKS	Person Most Responsible		
	owner	manager	employee
A. Select a farm site			
1. Evaluate farm size & shape	4	2	0
2. Determine climate conditions	4	3	0
3. Determine accessibility	4	2	1
4. Analyze water supply	4	3	0
5. Analyze soil type	5	2	0
6. Survey pond site	4	3	1
7. Design & layout pond	4	2	1
8. Construct pond	3	2	0
9. Maintain pond	2	2	1
B. Control diseases/parasites			
1. Determine chemicals needed	3	4	1
2. Evaluate control methods	3	4	0
C. Determine water quality			
1. Identify dissolved gases	3	3	0
2. Determine pH	3	4	0
3. Measure dissolved solids	2	4	0
4. Monitor O2 content	3	4	0
5. Disinfect water source	2	1	1
6. Interpret water analysis	3	4	0
D. Prevent O2 depletion			
1. Identify signs of O2 depletion	3	3	1
2. Identify causes of O2 depletion	3	2	1
3. Calculate carrying capacity	2	4	0
4. Control weeds	2	2	2
5. Prevent over feeding	2	3	2
E. Control predators			
1. Identify predators	2	3	0
2. Determine methods of control	3	3	1

Table 7 (continued)

Summary of Persons Most Responsible for Catfish Production Task Details

TASKS	Person Most Responsible		
	owner	manager	employee
F. Feed catfish			
1. Identify nutrient requirements	3	4	0
2. Analyze feed ingredients	3	4	0
3. Analyze types of rations	3	3	0
4. Use different feed forms	3	2	1
5. Use different feeding methods	3	2	1
6. Use differend feeding schedules]	3	3	0
7. Identify different feed sources	3	2	0
3. Use storage methods	3	2	1
G. Harvest catfish			
1. Grade catfish	2	2	2
2. Identify harvest methods	2	2	2
3. Determine lifting methods	2	2	1
4. Use holding equipment	2	2	2
5. Utilize boats for transport	2	0	0
6. Schedule harvest procedures	3	3	0
H. Market catfish			
1. Plan budget strategies	4	3	0
2. Determine available markets	4	3	0
3. Establish market contacts	4	3	0
4. Use marketing promotions	3	2	0
5. Use video tape marketing	2	0	0
6. Determine transportation costs	3	3	0
I. Maintain equipment			
1. Pumping systems	3	3	1
2. Drainage systems	3	0	3
3. Water analysis	3	4	0
4. Pond management equipment	3	2	2
5. Harvesting equipment	3	1	3
6. Delivery equipment	3	2	2
7. Clearing tanks	3	1	2
8. Aeration systems	4	1	2
J. Diversify crops			
1. Determine available plans	5	2	0
2. Identify benefits of plan	5	2	0
3. Establish a plan	5	2	0
No. of Task Details=50			
Details chosen once or more	55	53	23

Table 8

Use of Consultants by Crawfish and Catfish Producers

Producer	Type of Consultant Used					
	none	extension	engineer	marketing	water quality	fisheries specialist
Crawfish	0	3	1	0	1	0
Catfish	2	2	1	1	2	1

Objective 2

Aquaculture research results available from industry and institutions of higher education were reviewed by project staff. As viewed in Appendix H, a filing system was implemented to maintain an orderly catalog system (Miller & Woodin, 1981). A vast amount of scientific and technical knowledge exists. Two extremely important documents, Hanfman, Tibbitt and Watts (1989) and Chamberlin (1990), contain aquaculture-related bibliographies and technical information sources. Textbooks and technical bulletins which were determined to be of value as reference books are listed in the bibliography. Suggested references are as follows:

> Animal Guides for Texas (1990), Boyd (1988), Grown and Gratzek (1980), Chamberlin (1990), Eddy and Underhill (1978), Huner and Brown (1985), Inland aquaculture handbook (1988), Lock and Steinback (1987), Lovell (1989), McLarney (1987), Meade (1989), Ponds--planning, design construction (1982), Seagrave (1988), Stocking and management recommendations for Texas farm ponds (1986), Swift (1988), Treece (1989), and Treece and Yates (1988). Additionally, videotapes which were reviewed and suggested as valuable audio visuals are Rollason (1989 a), Rollason (1989 b), Williams (1989), and Williams (1985).

Input was secured by project staff during the 1990 Texas Aquaculture Conference in Corpus Christi, Texas. Industry workshops, a bus tour of research and commercial aquaculture farms, and a trade show sponsored by industry representatives were highlights of the conference (Appendix I). A collection of commercial literature was gathered.

Communication networks established throughout the project were utilized during the Aquaculture Industry Curriculum Workshop at Southwest Texas State University, San Marcos, Texas. At this workshop, Texas Education Agency personnel, legislative, commercial and private industry, curriculum and professional educators presented an overview of aquaculture in Texas. The

agenda of the Aquaculture Industry workshop is presented in Appendix D. The workshop served a three-fold purpose:

1. industry personnel were informed of the curriculum development process;

2. industry personnel and teachers interfaced on aquacultural concerns;

3. teachers and staff evaluated curriculum materials and developed tentative curriculum outlines (Appendix E).

Objective 3

Aquaculture curriculum material which was available in Texas and from other states was evaluated by project staff and the agricultural science teacher advisory committee. Numerous textbooks which are listed in the bibliography were collected as favorable reviews were made. The textbooks tended to be very specialized and were written at college level understanding and readability. However, excellent aquaculture subject-related textbooks are available. A 1990 curriculum project completed by Mid-American Vocational Curriculum Consortium (MAVCC) included a 15-unit text of all aspects of fish farming, but focused primarily on fresh water species. Aquaculture, available from MAVCC, has both teacher and student editions and should be included as an aquaculture production teaching reference.

Another basic curriculum reference which should be included is the Inland Aquaculture Handbook which is reproduced from a Texas Agricultural Extension service publication and can be used to produce introductory aquaculture lesson plans. An Aquaculture Resource Guide (Office of Instructional Services/Occupational Development and Student Services Branch, Department of Education, Hawaii, 1983) can be used as a model for aquaculture curriculum development. The objective, sub-concepts, and suggested learning activities are applicable in other states.

Evaluation Procedures and Findings

Agricultural science and technology teachers attending the Aquaculture Industry Workshop developed a topic outline for presentation at the June 15 workshop. Their comments and outlines are included in Appendix E. Each teacher has presented additions or deletions to the proposed Topic Outline for Aquacultural Science 382, as indicated in Appendix F. Agricultural science teachers are generally favorable to an aquaculture curriculum.

Additionally, comments made by producers during personal contact and task surveys are favorable. In Appendix J, general correspondence which documents the progress of the project is presented.

Conclusions and Implications

1. Aquatic species production requires an intense labor system.
2. The majority of tasks performed in an aquaculture production enterprise are very important.
3. The majority of tasks performed may be learned with medium difficulty.
4. Training and education are needed to prepare aquaculture employees.
5. The owners and/or managers of aquaculture production enterprises are responsible for a majority of the production related tasks.
6. Aquaculture research availability from industry and institutions of higher education is vast.
7. More literature exists regarding production than exists for marketing and processing strategies.
8. One major curriculum project sponsored by MAVCC has been completed. The material is complex and probably is designed for post-secondary level students.
9. Numerous reference texts exist, but many are very expensive.
10. The teaching of aquaculture will require a strong biology and chemistry background prior to understanding of concepts.

Recommendations

1. An introductory aquaculture curriculum should be prepared for Texas agricultural science and technology programs.
2. Laboratory facilities either outdoors or indoors should be planned to facilitate aquaculture programs.
3. Since aquaculture is not currently taught in most secondary and post-secondary schools, an articulated curriculum development approach should be used.
4. Industry personnel should be involved in the evaluation of the aquaculture curriculum.
5. Pre-employment laboratory programs should eventually be linked with industry internships (similar to cooperative training) to provide training.

6. Supervised agricultural experience programs should be supplemented by including aquaculture production principles and procedures.

7. Inservice workshops should be held for pilot schools prior to offering the courses.

8. Aquaculture courses should not be taught in schools until curriculum materials with laboratory exercises are available.

9. Additional task analyses are needed to identify skills for mariculture enterprises.

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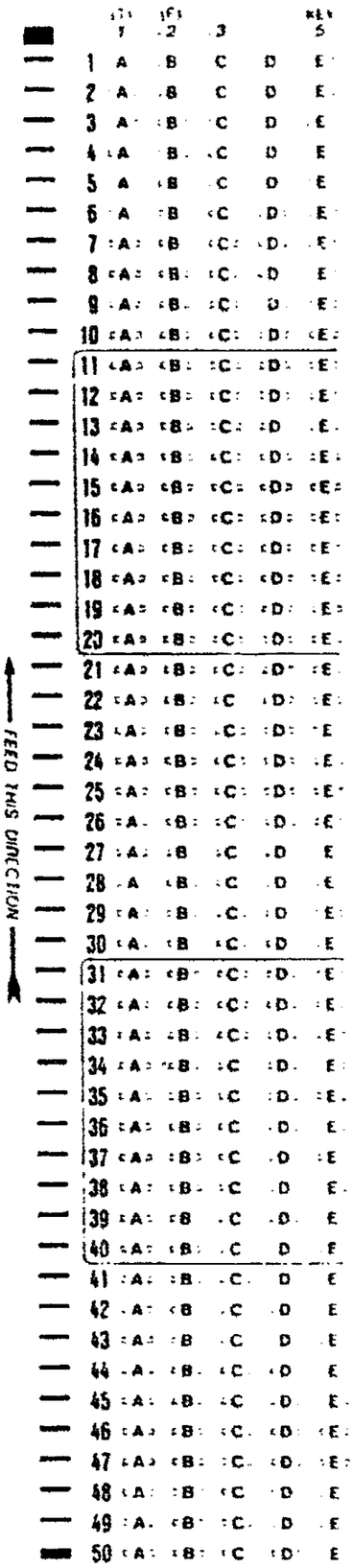
APPENDIX A

SURVEY OF AQUACULTURE RELATED INDUSTRY

IN SCHOOL DISTRICTS OF TEXAS



NAME OF TEACHER_____

AREA_____

NAME OF SCHOOL DISTRICT_____

NAME OF SCHOOL_____

Below, please list the industry names, locations (city/town), and contact persons for aquaculture related industries located in your school district. These people will be contacted to assist in developing the aquaculture curriculum that will be developed for Texas Teachers of Agricultural Science and Technology.

THANK YOU!

SURVEY OF AQUACULTURE RELATED INDUSTRY
IN SCHOOL DISTRICTS OF TEXAS

Aquaculture encompasses a wide variety of occupations. The purpose of this survey is to determine the importance of aquaculture in each school district in Texas. As you complete this survey, consider that freshwater and marine species of fish and organisms are produced, processed, and marketed in Texas. Please be certain to complete only <u>one</u> survey per agriculture department.

Use a number 2 lead pencil and answer each statement by marking an "a" for **yes** and a "b" for **no** on the scantron scoring sheet.

In my school district:

1.	Shrimp are produced.	yes no
2.	Crawfish are produced.	yes no
3.	Catfish are produced.	yes no
4.	Baitfish are produced.	yes no
5.	Gamefish (sportfish) are produced.	yes no
6.	Ornamental and/or tropical fish are produced.	yes no
7.	Alligators are produced.	yes no
8.	Saltwater fish species are produced.	yes no
9.	Crabs, oyster and other salt water food organisms are produced.	yes no
10.	Frogs and/or turtles are produced.	yes no
11.	Phytoplankton are produced.	yes no
12.	Algae are produced.	yes no
13.	Freshwater species hatcheries are located.	yes no
14.	Saltwater species hatcheries are located.	yes no
15.	Freshwater species processing industries are located.	yes no
16.	Saltwater species processing industries are located.	yes no
17.	Aquatic plant processing industries are located.	yes no
18.	Retail and/or wholesale saltwater species industries exist.	yes no
19.	Retail and/or wholesale freshwater species industries exist.	yes no
20.	Retail and/or wholesale plant industries exist.	yes no
21.	Aquaculture farming industries are important.	yes no
22.	Aquaculture course(s) are currently offered.	yes no
23.	Facilities are available to offer aquaculture courses.	yes no
24.	Aquaculture course(s) would be offered if the curriculum was available.	yes no

APPENDIX B

SUMMARY OF AQUACULTURE RELATED INDUSTRY SURVEY IN SCHOOL DISTRICTS IN TEXAS

1. Shrimp are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	1	4	18	0	1	0	0	0	5	7	36
No	74	51	65	69	74	57	54	67	61	63	635

2. Crawfish are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	2	25	1	7	11	1	5	22	7	81
No	75	53	58	69	68	46	54	63	44	63	593

3. Catfish are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	13	22	57	25	34	41	19	24	55	31	321
No	63	32	26	45	41	16	36	43	11	39	352

4. Baitfish are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	2	10	39	22	22	21	9	14	31	21	191
No	74	44	44	48	53	36	46	54	35	49	483

5. Gamefish (sportfish) are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	4	14	34	23	20	19	13	12	26	19	184
No	72	41	49	47	55	38	42	56	40	51	491

6. Ornamental and/or tropical fish are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	2	2	22	3	11	3	3	1	7	7	61
No	74	53	61	67	64	54	52	66	59	62	612

7. Alligators are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	0	15	0	1	5	1	2	19	6	49
No	76	54	68	70	74	52	54	66	47	64	625

8. Saltwater fish species are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	1	4	17	0	1	0	0	0	6	7	36
No	75	51	66	70	74	57	55	68	60	62	638

9. Crabs and/or oysters are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	2	18	0	0	0	0	2	6	5	33
No	76	53	65	70	75	57	55	66	60	65	642

10. Other saltwater food organisms are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	2	13	0	1	2	0	0	6	4	28
No	76	53	70	70	74	55	55	68	60	66	647

11. Frogs and/or turtles are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	9	23	6	6	8	2	2	11	10	77
No	75	46	60	64	68	49	53	66	55	60	596

12. Phytoplankton are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	3	10	4	3	2	1	2	6	5	36
No	75	52	71	66	71	55	54	66	60	64	634

13. Algae are produced.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	3	17	5	3	5	2	1	8	6	50
No	76	52	65	65	71	52	53	67	58	64	623

14. Freshwater species hatcheries are located.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	2	9	18	7	12	10	7	6	9	10	90
No	74	46	64	63	62	47	48	62	57	60	583

15. Saltwater species hatcheries are located.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	3	10	0	0	0	0	0	2	3	18
No	76	52	72	70	75	57	55	68	64	66	655

16. Freshwater species processing industries are located.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	7	9	3	9	8	2	4	15	3	60
No	76	48	73	67	66	49	53	64	51	67	614

17. Saltwater species processing industries are located.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	4	13	0	1	0	0	0	7	6	31
No	76	51	69	70	74	57	55	68	58	64	642

18. Aquatic plant processing industries are located.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	0	6	0	1	0	1	0	2	3	13
No	76	55	75	70	74	57	54	68	63	67	659

19. Retail and/or wholesale saltwater species industries are located.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	2	4	25	1	10	4	0	3	14	13	76
No	74	50	57	69	64	53	54	65	50	57	593

20. Retail and/or wholesale freshwater species industries are located.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	7	10	29	9	20	15	6	9	27	9	141
No	69	45	53	61	55	42	49	59	38	61	532

21. Retail and/or wholesale aquatic plant industries are located.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	1	0	11	0	6	1	2	2	1	1	25
No	75	54	69	70	68	56	53	66	64	69	644

22. Aquaculture farming industries are important.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	12	6	30	10	12	12	5	10	23	20	140
No	64	49	52	60	62	45	50	57	42	50	531

23. Aquaculture course(s) are currently offered.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	0	0	6	0	3	0	1	2	4	3	19
No	76	55	76	70	71	57	54	66	60	67	652

24. Facilities are available to offer aquaculture courses.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	2	0	11	3	6	7	2	2	8	7	48
No	73	55	70	66	67	50	53	66	57	63	620

25. Aquaculture course(s) would be offered if the curriculum were available.

Area	1	2	3	4	5	6	7	8	9	10	Total
Yes	12	3	45	10	16	21	10	19	25	21	182
No	63	52	35	56	55	35	42	48	40	49	475

APPENDIX C

AGENDA FOR TOUR OF AQUATIC FACILITIES

SOUTHWEST TEXAS STATE UNIVERSITY

AGENDA FOR TOUR OF AQUATIC FACILITIES
SOUTHWEST TEXAS STATE UNIVERSITY
AUGUST 21, 1989

PURPOSE:

1. To familiarize Mr. Jay Eudy, State Director of Agicultural Education, Texas Education Agency, with the educational resources available to support aquaculture study for agricultural sciences and technology curriculum development.

2. To familiarize aquaculture project staff with the dynamics of the agricultural sciences and technology curriculum development

AGENDA:

8:30 a. m.	Coffee and Staff Visit at Agriculture Department
9:00 a. m.	Tour Facilities of Aquatic Biology. Tour Resources of Edwards Aquifer Research and Data Center - Dr. Glenn Longley
10:00 a.m.	Tour Facilities of Parks and Wildlife Department, State Fish Hatchery Office and Laboratory - Mr. Pat Hutson
11:00 a.m.	Tour of U.S. Fish and Wildlife Service, Fish Cultural Development Center - Mr. Bill Seawell, Mr. Tom Brandt
12:00 p.m.	Lunch

APPENDIX D

AQUACULTURE INDUSTRY CURRICULUM WORKSHOP

STAFF, PRESENTERS, AND CONSULTANTS

Agricultural Science and Technology Teachers

Mr. John Roderick
Community High School

Mr Chester Booth
Whitney High School

Mr. Erwin Janssen
Palacios High School

Mr. Jerome Tymrak
Banquette High School

Mrs. Cindy Schnuriger
Clear Creek High School

Mr. Richard New
Calallen High School

Mr Tom Heffernan
Pleasanton High School

Mr. Larry Peveto
Buna High School

Mr Travis Hayden, Jr.
Floresville High School

Mr. John Mack
Madison High School

Aquaculture Industry Consultants/Presenters

Mr Jay Eudy
State Director
Agricultural Education, TEA

Mr. Joe Dettling
IMS
Texas A&M University

Dr Sammy Ray
Marine Biology Dept
Texas A&M at Galveston

Mr Peter Gryska
Manager, Seafood
H E B , Inc

Mr Pat Hutson
Regional Director
Fish Hatcheries

Mr Jim Ekstrom
President, Texas
Aquaculture Assn

Dr. Wallace Klussman
Wildlife and Fisheries Specialist
Texas A&M University

Mr Jack Boettcher
Assistant Land
Commissioner

Mr Chuck Nash
Chairman, Texas Parks
and Wildlife Commission

Mr James Thieul[illegible]
San Antonio Colle[illegible]

Mr Red Ewald
Ewald Enterprises, Inc

Mr Mike Brown
Regional Manager
Delta Pride

Mr Charles Stevens
Manager, Clear Springs

Mr Cliff Caskey, CEA
Hays County

Southwest Texas State University Faculty and Aquaculture Project Staff

Dr Gene Martin, Dean
Applied Arts and Technology

Dr John Dillingham
Agricultural Education

Dr Bob Davis, Chairman
Agriculture Department

Dr Lon Shell
Agricultural Mechanics

Dr Glenn Longley
Edwards Aquifer Research and
Data Center

Ms Andrea Pearson
Graduate Assistant

AQUACULTURE INDUSTRY CURRICULUM WORKSHOP

Sponsored by

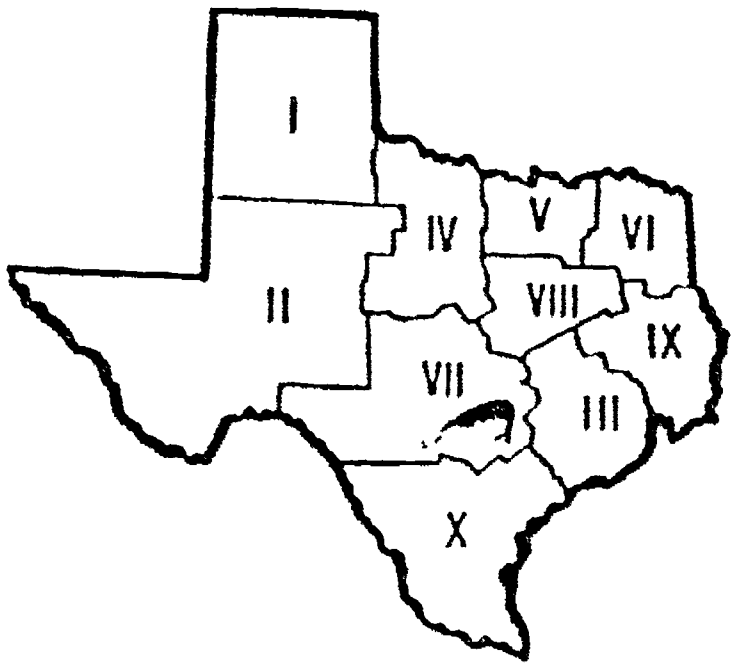
TEXAS EDUCATION AGENCY

and

DEPARTMENT OF AGRICULTURE

SOUTHWEST TEXAS STATE UNIVERSITY

March 8-9, 1990



**"A study of the aquaculture industry in Texas
to assist in establishing aquaculture
as a course offering in agricultural science and technology"**

**Funded by TEA Project Grant
for Program Development**

July 1, 1989-June 30, 1990

AQUACULTURE CURRICULUM WORKSHOP
MARCH 8-9, 1990
Southwest Texas State University
San Marcos, Texas

Thursday, March 8

8 00 - 8 30 a m	Registration, Agriculture Buil ng Room 204
8 30 - 8 45 a m	Welcome from SWT--Dean Gene Martin Introduction of Guests--Dr John Dillingham
8 45 - 9 15 a m	Charge to Aquaculture Workshop--Mr. Jay Eudy, Director of Agricultural Education, Texas Education Agency
9 15 - 9 30 a m	Introductory Aquaculture, Review of Project Dr John Dillingham, Ms. Andrea Pearson, Graduate Assistant
9 30 - 9 45 a m	Aquaculture Needs Assessment--Mr. James Thieubaud, Technical Education Specialist, San Antonio College
9 45 - 10 15 a m	Essential Elements for Agriscience and Technology Mr Joe Detting, Instructional Material Service
10 15 - 10 30 a m	Break
10 30 - 11 15 a m	Outlook for Aquaculture--Mr. Red Ewald, Ewald Enterprises, Inc , Karnes City
11 15 - 11 30 a m	Regulation of Aquaculture in Texas--Mr Jack Boettcher, Assistant Land Commissioner
11 30 - 1 00 p m	Lunch On Your Own
1 00 p m	Workshop Consultants

1 Marine Education Curriculum--Mr. Erwin Janssen,
Agricultural Science Teacher,
Marine Education Center, Palacios I S D

2 Oyster Industry--Dr. Sammy Ray,
Professor of Marine Biology, Texas A&M at Galveston

3 Marketing Aquaculture Products--Mr Peter Gryska,
Manager of Seafood Merchandising, H E B , San Antonio

4 Water Quality --Dr Glenn Longley, Director,
Edwards Aquifer Research and Data Center, SWT

4 00 p m	Group assignments, present material packets for study
7 00 p m	Dinner, Clear Springs--Meet at San Marcos Inn (Ramada Inn) at 6 00 p m Retailing and Wholesaling Catfish Mr Mike Brown, Regional Sales Manager, Delta Pride and Mr Charles Stevens, Manager, Clear Springs Restaurant

Friday, March 9

8 00 - 9 30 a m.	Tour, State Fish Hatchery--Mr. Pat Hutson (Meet at State Hatchery, Staples Road, San Marcos--see attached map)
9 30 - 9 45 a m.	Mr. Chuck Nash, Chairman TP&W Commission
9 45 - 10 00 a m.	Break
10 00 a m	Dr. Wallace Klussman, State Extension Service, Fishery and Wildlife Department, Texas A&M University
11 00 a m	Mr. Jim Ekstrom, President Texas Aquaculture Association, Managing Partner--Aquaculture Enterprises, Seguin, Texas
11 30 - 1 00 p m.	Lunch On Your Own
1 00 - 4 00 p m	Group Discussion Room 205 Agriculture Agricultural Science Teachers and Project Staff

Objectives for Aquaculture Industry Curriculum Workshop

1 Obtain input from professional personnel regarding status of the aquaculture industry

2 Review resource materials which have been collected.

3 Develop an outline for a cluster course in aquaculture

4 Develop an outline for an advanced/honors course(s) in aquaculture.

APPENDIX E

PRELIMINARY AQUACULTURE SCIENCE COURSE OUTLINES

PRESENTED BY AGRICULTURAL SCIENCE TEACHERS

Submitted by Irwin Janzen - 16 days

AQUACULTURE SCIENCE - COURSE OUTLINE

Units and Topics of Instruction	Periods of Instruction

A. Analyze the importance of aquacultural science
   1. Understand the ecological benefits of aquaculture
   2. Reach the economic benefits of aquaculture
   3. Identify the aesthetic benefits of aquaculture

B. Describe the history of aquaculture and fish management
   1. Identify historical aspects throughout the world
   2. Identify historical development in Texas
   3. Research the development of finfish and shellfish management

C. Explore career opportunities in aquaculture
   1. Identify career opportunities
   2. Determining educational requirements
      a. Field technician
      b. Laboratory technician
      c. Research and development
      d. Business and management

D. Discuss governing policies
   1. Identify state, federal and international agencies
   2. Review state and federal laws and trends affecting aquaculture
   3. Understand permits and licenses required for aquaculture production

E. Identify fisheries species
   1. Identify species as to local and regional common names
   2. Recognize distinguishing physical characteristics
   3. Distinguish according behaviors

F. Analyze anatomy and physiology
   1. Analyze the external anatomy
   2. Analyze the internal anatomy
   3. Analyze the reproductive systems
      a. Maturation
      b. Spawning
      c. Larvaculture

G. Determine nutritional requirements for aquatic animals
   1. Analyze the physiology of fish digestion

Units and Topics of Instruction	Periods of Instruction

2. Determine nutritional requirements of fisheries species
3. Identify sources of nutrients
4. Identify uses of vitamins, minerals, and feed additives
5. Formulate rations
6. Analyze the quality of commercially prepared feeds
7. Discuss feeding techniques for various types of fisheries species

H. Identify types of culturing facilities
1. Research pond culture
2. Understand raceway and tank culture
3. Understand cage and pen culture

I. Identify environmental factors
1. Identify oxygen needs
2. Research temperature requirement
3. Understand photoperiod as related to fisheries species
4. Identify toxic materials

J. Determine requirements for efficient fisheries facilities
1. Determine economic strategy
2. Research sight selection
3. Identify soil type and contour conditions
4. Identify water source and quality
5. Develop design and construction strategy
6. Select effective equipment to nurture, handle, and restrain fisheries species

K. Recognize proper water management techniques
1. Identify water use for aquaculture
2. Understand water pH and alkalinity
3. Filling and draining fish ponds
4. Controlling water losses
5. Research water well systems
6. Selecting and operating pumps
7. Understand pipe sizing and water transport systems

L. Recognize proper pond management techniques
1. Determine stocking rates in single and multi-culture pond systems
2. Employ proper stocking strategy
3. Identify oxygen depletions in ponds, its causes, signs and corrections
4. Understand pond fertilization

Units and Topics of Instruction	Periods of Instruction

5. Identify methods of cleaning muddy ponds
6. Identification and prevention of aquatic weed growth

M. Identify diseases, their causes, and treatments in fisheries species
1. Examine the roles of bacteria, fungi, viruses, genetics, and nutrition in causing diseases
2. Identify methods of controlling and preventing diseases
3. Identify common diseases and methods of treatment
4. Identify infestations and recognize methods of controlling internal and external parasites
5. Identify seasonal incidences of disease
6. Recognize mortality patterns and behavioral changes during an outbreak of disease
7. Identify causative agents of disease
8. Identify the use of pharmaceuticals to improve fisheries' health
9. Recognize methods of maintaining pond efficiency and safety

N. Explore harvesting methods
1. Identify harvesting technique
2. Analyze efficient methods of transporting line and fresh frozen fisheries products
3. Analyze efficient methods of transporting in sealed containers

O. Identify marketing systems and methods
1. Identify types of markets according to geographic locations and consumer demand
2. Interpret market cycles and trends

P. Recognize record keeping in fisheries
1. Record production levels
2. Collect and analyze data for present and future use

Submitted by John Mack

AQUACULTURE SCIENCE - COURSE OUTLINE - BASIC LEVEL

Units and Topics of Instruction	Periods of Instruction
A. Importance of aquaculture	
1. Introduction of aquaculture	
2. Current impact on Texas, U.S.A., and global economy	
3. Economic benefit of aquaculture to individual communities	
4. Future of aquaculture	
B. History of aquaculture and fish management	
1. Historical aspects throughout the world	
2. Historical development in Texas	
C. Career opportunities	
1. Identify the opportunities	
2. Determine the educational and skill development requirements for the opportunities	
D. Types of production operations	
1. Fish for food	
2. Brood fish	
3. Fingerlings	
4. Stockers	
5. Fee lakes for recreation fishing	
E. Types of culturing facilities	
1. Pond	
2. Raceway and tanks	
3. Cage and net pens	
F. Fish species	
1. I.D. fish species	
2. Distinguish physical characteristics	
3. Behavior differences	
4. Potential market for local usage	

Units and Topics of Instruction	Periods of Instruction
G. Nutritional requirements for aquaculture animals	
1. Physiology of digestion	
2. Nutrient requirements	
3. Sources of nutrients	
4. Feeding methods	
H. Environmental factors	
1. Oxygen needs	
2. Temperature requirements	
3. Photoperiod	
4. Toxic materials	
I. Water management techniques	
1. Water use	
2. Water pH	
3. Water quality	
4. Water sources	
J. Diseases	
1. Bacteria, fungi, viruses, genetics, and nutrition as they relate to disease	
2. Prevention and control	
3. Common diseases and treatment	
K. Predators, trashfish, and other pests	
1. I.D. the pests	
2. Methods of control	
L. Harvesting methods	
1. I.D. harvesting techniques	
2. Lifting fish	
3. Methods of holding	
4. Methods of hauling	
M. Marketing systems and methods	
1. Types of markets	

Submitted by John Roderick

AQUACULTURE SCIENCE - COURSE OUTLINE

Units and Topics of Instruction	Periods of Instruction
A. Analyze the importance of aquacultural science	
1. Understand the ecological benefits of aquaculture	
2. Reach the economic benefits of aquaculture	
3. Identify the aesthetic benefits of aquaculture	
B. Describe the history of aquaculture and fish management	
1. Identify historical aspects throughout the world	
2. Identify historical development in Texas	
3. Research the development of finfish and shellfish management	
C. Explore career opportunities in aquaculture	
1. Identify career opportunities	
2. Determine educational requirements	
a. Field technician	
b. Laboratory technician	
c. Research and development	
d. Business and management	
D. Analyze anatomy and phusiology	
1. Analyze the external anatomy	
2. Analyze the internal anatomy	
3. Analyze the reproductive systems	
a. Maturation	
b. Spawning	
c. Larvaculture	
E. Determine nutritional requirements for aquatic animals	
1. Analyze the physiology of fish digestion	
2. Determine nutritional requirements of fisheries species	
3. Identify sources of nutrients	
4. Identify uses of vitamins, minerals, and feed additives	
5. Formulate rations	

Units and Topics of Instruction	Periods of Instruction
6. Analyze the quality of commercially prepared feeds	
7. Discuss feeding techniques for various types of fisheries species	
F. Identify environmental factors	
1. Identify oxygen needs	
2. Research temperature requirements	
3. Understand photoperiod as related to fisheries species	
4. Identify toxic materials	
G. Determine requirements for efficient fisheries facilities	
1. Determine economic strategy	
2. Research sight selection	
3. Identify soil type and contour conditions	
4. Identify water source and quality	
5. Develop design and construction strategy	
6. Select effective equipment to nurture, handle, and restrain fisheries species	
H. Recognize proper water management techniques	
1. Identify water use for aquaculture	
2. Understand water pH and alkalinity	
3. Filling and draining fish ponds	
4. Controlling water losses	
5. Research water well systems	
6. Selecting and operating pumps	
7. Understand pipe sizing and water transport systems	
I. Recognize proper and management techniques	
1. Determine stocking rates in single and multi-culture pond systems	
2. Employ proper stocking strategy	
3. Identify oxygen depletion in ponds, its causes, signs and corrections	
4. Understand pond fertilization	
5. Identify methods of cleaning muddy ponds	
6. Identification and prevention of aquatic weed growth	

Units and Topics of Instruction	Periods of Instruction
J. Identify marketing systems and methods	
1. Identify types of markets according to geographic locations and consumer demand	
2. Interpret market cycles and trends	
K. Recognize record keeping in fisheries	
1. Record production levels	
2. Collect and analyze data for present and future use	
L. Plan and conduct leadership activities related to aquaculture	
1. Developing leadership skills	
2. Participate in leadership activities	

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Submitted by Cindy Schnuriger

AQUACULTURE SCIENCE - COURSE OUTLINE

Units and Topics of Instruction	Periods of Instruction
A. Analyze the importance of aquaculture science	
B. Describe the history of aquaculture and fish management	
C. Explore career opportunities in aquaculture	
D. Identify aquaculture species	
E. Analyze anatomy and physiology	
F. Determine the nutritional requirements for aquatic animals	
G. Identify the environmental factors	
H. Recognize proper water management	
I. Recognize proper pond management techniques	
J. Identify diseases, their causes and treatments in fisheries species	
K. Identify marketing systems and methods	
L. Recognize record keeping in fisheries	
M. Recognize organizational leadership importance	

Submitted by Jerome Tymrak

AQUACULTURE SCIENCE - COURSE OUTLINE

Units and Topics of Instruction	Periods of Instruction	
A. Analyze the importance of aquacultural science		3
1. Understand the ecological benefits of aquaculture	1	
2. Reach the economic benefits of aquaculture	1	
3. Identify the aesthetic benefits of aquaculture	1	
B. Describe the history of aquaculture and fish management		3
1. Identify historical aspects throughout the world	1	
2. Identify historical development in Texas	1	
3. Research the development of finfish and shellfish management	1	
C. Explore career opportunities in aquaculture		3
1. Identify career opportunities	1	
2. Determine educational requirements	2	
a. Field technician (.5)		
b. Laboratory technician (.5)		
c. Research and development (.5)		
d. Business and management (.5)		
D. Discuss governing policies		3
1. Identify state, federal and international agencies	1	
2. Review state and federal laws and trends affecting aquaculture	1	
3. Understand permits and licenses required for aquaculture production	1	
E. Classes of fish species		4
1. Finfish	2	
a. Bony (1)		
b. Cartiligenous (1)		
2. Shellfish	2	
a. Mollusks (1)		
b. Crustaceans (1)		

Units and Topics of Instruction	Periods of Instruction
2. Geographic location supply and demand	
3. Market cycles and trends	
N. Record keeping	
1. Basic record keeping	
2. SAEP	
O. Leadership	

Units and Topics of Instruction		Periods of Instruction
F.	Analyze anatomy and physiology	4
1.	Analyze the external anatomy	1
2.	Analyze the internal anatomy	1
3.	Analyze the reproduction systems	2
	a. Maturation	
	b. Spawning	
	c. Larvaculture	
G.	Determine the nutritional requirements for aquatic animals	10
1.	Analyze the physiology of fish digestion	1
2.	Determine nutritional requirements of fisheries species	2
3.	Identify sources of nutrients	1
4.	Identify uses of vitamins, minerals, and feed additives	1
5.	Formulate rations	2
6.	Analyze the quality of commercially prepared feeds	1
7.	Discuss feeding techniques for various types of fisheries species	2
H.	Identify types of culturing facilities	3
1.	Research pond culture	1
2.	Understand raceway and tank culture	1
3.	Understand cage and pen culture	1
I.	Identify environmental factors	4
1.	Identify oxygen needs	1
2.	Research temperature requirements	1
3.	Understand photoperiod as related to fisheries species	1
4.	Identify toxic materials	1
J.	Determine requirements for efficient fisheries facilities	6
1.	Determine economic strategy	1
2.	Research sight selection	1
3.	Identify soil type and contour conditions	1
4.	Identify water source and quality	1
5.	Develop design and construction strategy	1
6.	Select effective equipment to nurture, handle, and restrain fisheries species	1

Units and Topics of Instruction		Periods of Instruction
K.	Recognize proper water management techniques	7
1.	Identify water use for aquaculture	1
2.	Understand water pH and alkalinity	1
3.	Filling and draining fish ponds	1
4.	Controlling water losses	1
5.	Research water and well systems	1
6.	Selecting and operating pumps	1
7.	Understand pipe and sizing and water transport systems	1
L.	Recognize proper and pond management techniques	10
1.	Determine stocking rates in single and multi-culture pond systems	2
2.	Employ proper stocking strategy	2
3.	Identify oxygen depletion in ponds, its causes, signs and corrections	2
4.	Understand pond fertilization	1
5.	Identify methods of cleaning muddy ponds	1
6.	Identification and prevention aquatic weed growth	2
M.	Identify diseases their cause and treatments in fisheries species	6.5
1.	Examine the roles of bacteria, fungi, viruses, genetics, and nutrition in causing diseases	1
2.	Identify methods of controlling and preventing diseases	1
3.	Identify common diseases and methods of treatment	.5
4.	Identify infestations and recognize methods of controlling internal and external parasites	1
5.	Identify seasonal incidences of disease	.5
6.	Recognize mortality patterns and behavioral changes during an outbreak of disease	.5
7.	Identify causative agents of disease	.5
8.	Identify the use of pharmaceuticals to improve fisheries health	.5
9.	Recognize methods of maintaining pond efficiency and safety	1
N.	Explore harvesting methods	2.5
1.	Identify harvesting techniques	.5
2.	Analyze efficient methods of transporting live and fresh frozen fisheries products	1

Units and Topics of Instruction		Periods of Instruction
	3. Analyze efficient methods of transporting in sealed containers	1
O.	Identify marketing systems and methods	3
	1. Identify types of markets according to geographic locations and consumer demand	2
	2. Interpret market cycles and trends	1
P.	Understand Experience Programs in Agricultural Science and Technology	5
	1. Identify the various types of Supervised Aquacultural Experience Programs	1
	2. Describe the characteristics of successful Supervised Aquacultural Programs	1
	3. Select and plan individual Supervised Aquacultural Experience Programs	3
Q.	Plan and conduct leadership activities in applied Agricultural Science and Technology	3
	1. Develop life skills for effective leadership	2
	2. Practice leadership skills for Agricultural Science and Technology	1

Submitted by John Mack

AQUACULTURE SCIENCE - COURSE OUTLINE - ADVANCED LEVEL

Units and Topics of Instruction	Periods of Instruction
A. Importance of aquaculture	
1. Ecological benefits	
2. Aesthetics benefits	
3. Review economical benefits	
B. Governing policies	
1. State, federal, and international agencies	
2. State and federal laws affecting aquaculture	
3. Permits and licenses required	
C. Anatomy and physiology	
1. External anatomy	
2. Internal anatomy	
3. Reproductive systems	
D. Nutritional requirements for aquatic animals	
1. Review nutritional requirements of fish	
2. Review sources of nutrients	
3. Uses of vitamins, minerals, and feed additives	
4. Formulate rations	
5. Analyze the quality of various feeds	
E. Efficient fishery facilities	
1. Size and shape of the farm	
2. Economic strategy	
3. Climate and soil conditions	
4. Equipment requirements	
5. Design and construction strategy	
F. Pond management techniques	
1. Stocking rates and multi-culture systems	
2. Oxygen depletion, signs and depletion	

Units and Topics of Instruction	Periods of Instruction
3. Fertilization	
4. Cleaning muddy ponds	
5. Weed control	
G. Water management techniques	
1. Review water use for aquaculture	
2. Filling and draining ponds	
3. Controlling water loss	
4. Research water well systems	
5. Select and operate pumps	
6. Pipe sizing and water transport systems	
H. Disease, cause and treatment	
1. Review factors causing disease	
2. I.D. seasonal incidences of disease	
3. I.D. causative agents of disease	
4. Using pharmaceuticals	
5. Maintaining pond efficiency and safety	
I. Harvesting methods	
1. Grading fish	
2. Review harvesting techniques	
3. Transporting line and fresh frozen products	
4. Transporting in sealed containers	
J. Record Keeping	
1. Advanced record keeping	
2. SAEP	
K. Leadership	

APPENDIX F

TOPIC OUTLINE FOR AQUACULTURE SCIENCE 382

AGENDA FOR DISCUSSION OF AQUACULTURE COURSE POSSIBILITIES

I.M.S.--COLLEGE STATION, TEXAS

JUNE 15, 1990

I. CLUSTER COURSE

II. TECHNICAL COURSE

III. PRE-EMPLOYMENT COURSE

IV. COOPERATIVE EDUCATION COURSE

V. LABORATORY MANUAL

- A. PRODUCTION
- B. HATCHERY
- C. GROW-OUT
- D. PROCESSING

VI. SAEP ACTIVITIES

VII. HONORS COURSES

VIII. AG RESOURCES PRE-LAB REVIEW

IX. ANIMAL & PLANT PRODUCTION

A copy of the topic outline for Aquaculture Science 382 has been attached. This effort has been accomplished by the Aquaculture Industries Study funded through Texas Education Agency. Please review the outline and return to Dr. Dillingham with any additional comments.

REVIEWED BY:

_____

ADDITIONAL COMMENTS:

TOPIC OUTLINE FOR
AQUACULTURE SCIENCE 382

I. Introduce Aquaculture Industries
   A. Importance
   B. History
   C. Scope (International to Texas)

II. Survey of Aquaculture Enterprises
   A. Identify types of enterprises
      1. Sportfish
      2. Baitfish
      3. Food fish
      4. Tropical/Ornamental fish
      5. Aquatic plants
   B. Classify fish development
      1. Fry
      2. Fingerlings
      3. Stockers
      4. Brood fish

III. Evaluate Facilities, Management, and Production Techniques
   A. Ponds
   B. Raceways
   C. Cages
   D. Developmental Strategies
   E. Daily Management Requirements
   F. Weekly Management Requirements
   G. Seasonal Management Requirements
   H. Methods of Evaluating Survival
   I. Evaluating Growth Rate

IV. Identify Aquatic Environmental Factors
   A. Evaluate Water Quality and Quantity
      1. Availability
      2. Water Temperature
      3. Water Turbidity
      4. Dissolved Oxygen in Water
      5. Water Toxicity
      6. Water Chemistry and pH
      7. Depth
      8. Aquatic Plant Control
   B. Determine Climactic Conditions
      1. Temperature
      2. Rainfall and Drought
      3. Drainage and Flooding

V. Classify and Identify Aquatic Species
   A. Identify species as to local and common names
   B. Recognize distinguishing physical characteristics
   C. Distinguish according to behaviors

VI. Analyze Anatomy and Physiology
- A. Analyze the external anatomy of finfish
- B. Analyze the external anatomy of crustaceans
- C. Analyze the external anatomy of shellfish
- D. Analyze the internal anatomy of finfish
- E. Analyze the internal anatomy of crustaceans
- F. Analyze the internal anatomy of shellfish
- G. Analyze the reproductive system of finfish
- H. Analyze the reproductive system of the crustacean
- I. Analyze the reproductive system of the shellfish

VII. Identify and Analyze Feeds and Nutrition
- A. Analyze Digestive systems of Aquatic Species
- B. Determine Nutrient Requirements of Aquatic Species
- C. Identify Natural and Commercial Feed Sources
- D. Identify Use of Vitamins, Minerals, and Feed Additives
- E. Determine Feeding Techniques

VIII. Evaluate Harvesting, Handling, & Transportation Techniques
- A. Analyze Types & Methods of Harvesting
- B. Maintain Harvesting Equipment
- C. Determine Methods of Handling
- D. Identify Types & Methods of Transportation

IX. Economics & Marketing Systems
- A. Analyze Production Costs
- B. Identify Types & Methods of Marketing
- C. Determine Market Trends & Cycles
- D. Identify Financial Requirements of an Aquaculture Entrepreneur

X. Records - SAEP

XI. Leadership

XII. Career Opportunities

APPENDIX G

TASK SURVEY INSTRUMENTS

name, person completing survey _____ title _____ name of business

Please answer the following statements by providing either numbers or x's where appropriate.

Type of consultant utilized

____none ____extension ____water quality
____engineer ____marketing ____other scientist, list_____

Tasks for Aquaculture Entepreneur-Crawfish Production

The following tasks indicated by (A) and the task details (1...) have been identified by interviewing producers and through a review of literature.
Please evaluate tasks and task details by circling the appropriate number value in each column.

TASKS	FREQUENCY OF PERFORMANCE				IMPORTANCE			LEARNING DIFFICULTY			PERSON MOST RESPONSIBLE		
	daily	weekly	monthly	yearly	very	moderate	not too	easy	medium	difficult	owner manager		employee
	1	2	3	4	1	2	3	1	2	3	1	2	3
A. Select a pond site	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Analyze soil type	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Survey pond site	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Design and layout the pond	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Construct the pond	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Maintain the pond	1	2	3	4	1	2	3	1	2	3	1	2	3
B. Maintain water for ponds	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Identify needed depths	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Monitor vaporation/rainfall	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Control water loss	1	2	3	4	1	2	3	1	2	3	1	2	3
C. Fill and drain ponds	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Determine equipment needed	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Design the water system	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Determine the fill rate/time	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Determine the drain rate/time	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Determine pumping costs	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Estimate pumping costs per pound of product	1	2	3	4	1	2	3	1	2	3	1	2	3
D. Determine water quality	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Identify dissolved gases	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Determine pH	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Measure dissolved solids	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Monitor oxygen content	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Disinfect water source	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Interpret water analysis	1	2	3	4	1	2	3	1	2	3	1	2	3
E. Prevent oxygen depletion	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Identify signs of oxygen depletion	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Identify causes of oxygen depletion	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Calculate carrying capacity	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Control of weeds	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Prevent overfeeding/overfertilization	1	2	3	4	1	2	3	1	2	3	1	2	3

TASKS	FREQUENCY OF PERFORMANCE				IMPORTANCE			LEARNING DIFFICULTY			PERSON MOST RESPONSIBLE		
	daily	weekly	monthly	yearly	very	moderate	not too	easy	medium	difficult	owner manager		employee
	1	2	3	4	1	2	3	1	2	3	1	2	3
F. Feeding catfish	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Identify nutrient requirements	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Analyze feed ingredients	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Analyze types of rations	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Use of different feed forms	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Use of different feeding methods	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Use of different feeding schedules	1	2	3	4	1	2	3	1	2	3	1	2	3
7. Identify feed sources	1	2	3	4	1	2	3	1	2	3	1	2	3
8. Identify & use of storage methods	1	2	3	4	1	2	3	1	2	3	1	2	3
G. Harvest catfish	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Grading of catfish	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Identify types & methods used	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Determine methods used to lift fish	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Use of holding equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Utilize boats for transport	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Schedule harvesting procedures	1	2	3	4	1	2	3	1	2	3	1	2	3
H. Market catfish	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Plan budgeting strategies	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Determine available markets	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Establish market contacts	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Use of marketing promotions	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Utilization of video tape marketing	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Determine transportation costs	1	2	3	4	1	2	3	1	2	3	1	2	3
I. Maintain equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
1 Pumping systems	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Drainage systems	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Water analysis	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Pond management equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Harvesting equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Delivery equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
7. Clearing tanks	1	2	3	4	1	2	3	1	2	3	1	2	3
8. Aeration systems	1	2	3	4	1	2	3	1	2	3	1	2	3
J. Crop Diversification	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Determine available plans	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Identify benefits of plan	1	2	3	4	1	2	3	1	2	3	1	2	3
3 Establishing a diversification plan	1	2	3	4	1	2	3	1	2	3	1	2	3

_____ _____ _____

name, person completing survey title name of business

Please answer the following statements by providing either numbers or x's where appropriate.

Type of consultant utilized

_____none _____extension _____water quality

_____engineer _____marketing _____other scientist, list_____

Tasks for Aquaculture Entepreneur-Catfish Production

The following tasks indicated by (A) and the task details (1...) have been identified by interviewing producers and through a review of literature. Please evaluate tasks and task details by circling the appropriate number value in each column.

TASKS	FREQUENCY OF PERFORMANCE				IMPORTANCE			LEARNING DIFFICULTY			PERSON MOST RESPONSIBLE		
	daily	weekly	monthly	yearly	very	moderate	not too	easy	medium	difficult	owner	manager	employee
	1	2	3	4	1	2	3	1	2	3	1	2	3
A. Select a farm site	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Evaluate farm size & shape	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Determine climate conditions	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Determine accessibility	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Analyze water supply	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Analyze soil type	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Survey pond site	1	2	3	4	1	2	3	1	2	3	1	2	3
7. Design and layout the pond	1	2	3	4	1	2	3	1	2	3	1	2	3
8. Construct the pond	1	2	3	4	1	2	3	1	2	3	1	2	3
9. Maintain the pond	1	2	3	4	1	2	3	1	2	3	1	2	3
B. Control diseases/parasites	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Determine chemicals needed	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Evaluate physical control methods	1	2	3	4	1	2	3	1	2	3	1	2	3
C. Determine water quality	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Identify dissolved gases	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Determine pH	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Measure dissolved solids	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Monitor oxygen content	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Disinfect water source	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Interpret water analysis	1	2	3	4	1	2	3	1	2	3	1	2	3
D. Prevent oxygen depletion	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Identify signs of oxygen depletion	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Identify causes of oxygen depletion	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Calculate carrying capacity	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Control of weeds	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Prevent overfeeding/overfertilization	1	2	3	4	1	2	3	1	2	3	1	2	3
E. Control predators, trashfish, & pests	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Identify predators/trashfish/pests	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Determine methods of control	1	2	3	4	1	2	3	1	2	3	1	2	3

TASKS	FREQUENCY OF PERFORMANCE				IMPORTANCE			LEARNING DIFFICULTY			PERSON MOST RESPONSIBLE		
	daily	weekly	monthly	yearly	very	moderate	not too	easy	medium	difficult	owner	manager	employee
	1	2	3	4	1	2	3	1	2	3	1	2	3
F. Manage ponds	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Fertilize ponds	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Lime ponds	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Renovate ponds	1	2	3	4	1	2	3	1	2	3	1	2	3
G. Manage crawfish populations	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Select crawfish species	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Establish sustaining populations	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Stock habitats	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Maintain forages/feed	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Use multiple cropping systems	1	2	3	4	1	2	3	1	2	3	1	2	3
H. Harvest crawfish	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Identify types of equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Use baited traps	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Use trawls	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Use seines	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Utilize boats for transport	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Plan collecting/handling	1	2	3	4	1	2	3	1	2	3	1	2	3
7. Schedule harvesting procedures	1	2	3	4	1	2	3	1	2	3	1	2	3
I. Market crawfish	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Plan budgeting strategies	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Determine marketing methods	1	2	3	4	1	2	3	1	2	3	1	2	3
J. Maintain equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
1. Pumping systems	1	2	3	4	1	2	3	1	2	3	1	2	3
2. Drainage systems	1	2	3	4	1	2	3	1	2	3	1	2	3
3. Water analysis	1	2	3	4	1	2	3	1	2	3	1	2	3
4. Pond management equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
5. Harvesting equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
6. Delivery equipment	1	2	3	4	1	2	3	1	2	3	1	2	3
7. Clearing tanks	1	2	3	4	1	2	3	1	2	3	1	2	3
8. Aeration systems	1	2	3	4	1	2	3	1	2	3	1	2	3

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APPENDIX H

AQUACULTURE FILING SYSTEM

AQUACULTURE FILING SYSTEM

10000 - AQUACULTURE
11000 - FRESHWATER AQUACULTURE
12000 - SALTWATER AQUACULTURE
13000 - AQUATIC PLANTS

SUB-FILES

010 - ALGAE
020 - ALLIGATORS
030 - BAIT FISH
040 - BASS
050 - CATFISH
060 - CLAMS
070 - CRABS
080 - CRAYFISH
090 - EELS
100 - EXOTIC FISH
110 - FROGS
120 - GAMEFISH
130 - MUSSELS
140 - ORNAMENTAL FISH
150 - OYSTERS
160 - PADDLEFISH
170 - PHYTOPLANKTON
180 - REDFISH
190 - SALMON
200 - SALTWATER FOOD ORGANISMS
210 - SHRIMP & PRAWNS
220 - STURGEON
230 - TROPICAL FISH
240 - TROUT
250 - TURTLES

SUB-FILE DIVISIONS

030 BAITFISH
    031-FATHEAD MINNOW
    032-GOLDEN SHINER
    033-GOLDFISH
    034-WHITE SUCKER

040 BASS
    041-LARGEMOUTHED BASS
    042-STRIPED BASS
    043-SUNSHINE BASS

040 BASS CONTINUED
044-WHITE BASS

050 CATFISH
051-BROWN BULLHEAD
052-YELLOW BULLHEAD
053-BLUE CATFISH
054-CHANNEL CATFISH
055-FLATHEAD CATFISH
056-WHITE CATFISH

060 CLAMS
061-ANGELWING CLAMS
062-NORTHERN QUAHOG (HARD)
063-SOUTHERN QUAHOG (HARD)

080 CRAYFISH
081-PAPERSHELL CRAYFISH
082-RED CRAYFISH
083-RUSTY CRAYFISH
084-SIGNAL CRAYFISH
085-VIRILIS CRAYFISH
086-WHITERIVER CRAYFISH

100 EXOTIC FISH
101-BIGHEAD CARP
102-COMMON CARP
103-CHINESE CARP
104-GRASS CARP
105-SILVER CARP
106-NILE PERCH
107-TILAPIAS

120 GAME FISH
121-RED DRUM

130 MUSSELS
131-BLUE MUSSELS

140 ORNAMENTAL FISH
141-ANGELFISH

150 OYSTERS
151-AMERICAN OYSTER
152-EUROPEAN OYSTER
153-OLYMPIA OYSTER
154-PACIFIC OYSTER

190 SALMON
191-CHINOOK SALMON
192-CHUM SALMON
193-COHO SALMON
194-KOKANEE SALMON
195-LANDLOCK SALMON

190 SALMON CONTINUED
196-PINK SALMON
197-SOCKEYE SALMON

210 SHRIMP & PRAWNS
211-BANANA PRAWN
212-FRESHWATER PRAWN
213-MALAYSIAN PRAWN
214-BLUE SHRIMP
215-BRINE SHRIMP
216-VAHNAMEI
217-WHITE SHRIMP

220 STURGEON
221-ATLANTIC STURGEON
222-SHORTNOSE STURGEON

230 TROPICAL FISH
231-CICHLIDS
231.5-CHARACINS
232-CLOWN BARB
232.5-CORYDORAS CATFISH
233-GOURAMIES
233.5-GUPPY
234-KILLIFISHES
234.5-SAILFIN MOLLY
235-SWORDTAIL
235.5-ZEBRA DANIO

240 TROUT
241-BROOK TROUT
242-BROWN TROUT
243-CUTTHROAT TROUT
244-DOLLY VARDEN
245-GOLDEN TROUT
246-LAKE TROUT
247-OHRID TROUT
248-RAINBOW TROUT
249-SUNAPEE TROUT

13000 AQUATIC PLANTS

300 - WATER CHESTNUTS

310 - WATERCRESS

300 WATER CHESTNUTS
301-CHINESE WATER CHESTNUTS

GENERAL OPTIONS

00 - SCIENCE
- 00 - PRODUCTION-GENERAL
- 01 - GENERAL REFERENCES, HANDBOOKS, TABLES, LISTS, & CATALOGS
- 02 - PROFESSIONAL ORGANIZATIONS, MEETINGS, PUBLICATIONS
- 03 - ASSOCIATIONS, MEETINGS, PUBLICATIONS, NEWSLETTERS
- 04 - JOURNALS PERIODICALS, MAGAZINES
- 05 - SCIENCE - GENERAL
- 06 - BIOLOGY & ZOOLOGY
- 07 - ANATOMY & PHYSIOLOGY
- 08 - BACTERIOLOGY & CHEMISTRY

10 - MANAGEMENT
- 10 - MANAGEMENT - GENERAL
- 11 - SELECTION & ADAPTATION
- 12 - MARKET PRODUCTION
- 13 - QUALITY PRODUCTION, SANITATION, PRODUCT HANDLING
- 14 - LOSS PREVENTION
- 15 - BREEDING STOCK PRODUCTION
- 16 - FEEDER PRODUCTION
- 17 - HATCHERY MANAGEMENT
- 18 - SPECIALIZED ENTERPRISES

20 - CARE & HUSBANDRY
- 20 - CARE & HUSBANDRY - GENERAL
- 21 - BREEDING SCHOOLS
- 22 - BROOD STOCK & MATERNITY CARE
- 23 - YOUNG STOCK - BREEDING, REARING, & RAISING

20 - CARE & HUSBANDRY CONTINUED
- 24 - PRODUCTION SCHOOLS
- 25 - PRACTICES
- 26 - MANURE & MANURE HANDLING

30 - BREEDS & BREEDING
- 30 - BREEDS & BREEDING - GENERAL
- 31 - BREED SELECTION & ADAPTATION
- 32 - BREEDS - CHARACTERISTICS, DESCRIPTIONS
- 33 - BREED ORGANIZATIONS, BREED PROMOTION A TO Z
- 34 - BREED REGISTRY, PEDIGREES, STANDARDS, SIRE LISTS, RECORDS
- 35 - BREEDING GENETICS - GENERAL
- 36 - ARTIFICIAL BREEDING
- 37 - BREEDING ASSOCIATIONS
- 38 - BREEDING STOCK SOURCES, SALES BREEDERS, DEALERS, CATALOGS, LISTS

40 - IMPROVEMENT
- 40 - IMPROVEMENT - GENERAL
- 41 - PRODUCTION & PERFORMANCE TESTING
- 42 - PRODUCTION RECORDS & ANALYSIS
- 43 - IMPROVEMENT ASSNS. TESTING & ACCREDITING PROGRAMS
- 44 - PRODUCTION RESEARCH & TESTING
- 45 - JUDGING
- 46 - CLASSIFICATION, GRADING, CULLING, MARKET GRADES
- 47 - FAIRS, SHOWS, & EXPOSITIONS

50 - FEEDING
- 50 - FEEDS & FEEDING - GENERAL
- 51 - NUTRITION

50 - FEEDING CONTINUED
- 52 - RATIONS
- 53 - FEED REQUIREMENTS
- 54 - FEED EFFICIENCY
- 55 - FEEDING RESEARCH
- 56 - FEEDING METHODS
- 57 - FEED HANDLING, EQUIPMENT
- 58 - OTHER FEEDING PRACTICES

60 - FEEDS
- 60 - FEEDS - GENERAL
- 61 - GRAINS & CONCENTRATES
- 62 - PROTEIN SUPPLEMENTS
- 63 - MINERALS
- 64 - VITAMINS
- 65 - FEED ADDITIVES, HORMONES, DRUGS
- 66 - OTHER FEEDS

70 - PROCESSING - TECHNOLOGY
- 70 - PROCESSING PRODUCTS
- 71 - TECHNOLOGY
- 72 - PROCESSING
- 73 - PACKING
- 74 - PROCESSING QUALITY CONTROL
- 75 - PACKAGING
- 76 - STORAGE QUAILITY CONTROL
- 77 - OTHER PROCESSING TECHNOLOGY

80 - PRODUCTS & UTILIZATION
- 80 - PRODUCTS - GENERAL
- 81 - FOODS - FOOD PRODUCTS

80 - PRODUCTS & UTILIZATION

82 - BY-PRODUCTS & INDUSTRIAL USES
FEEDS, FERTILIZERS, FATS, & OILS

83 - JUDGING & SCORING PRODUCTS, STANDARDS,
MARKET GRADES

84 - LABORATORY & RESEARCH USES

85 - SPORTS & RECREATION

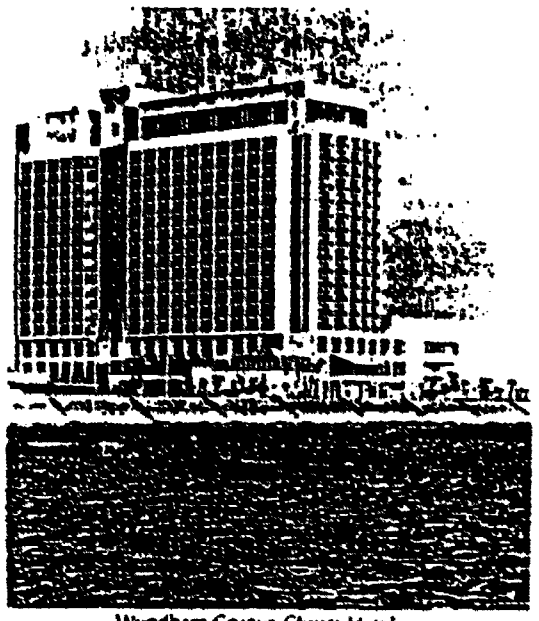
86 - WILDLIFE CONSERVATION

87 - CHEMURGY & PRODUCT RESEARCH

APPENDIX I

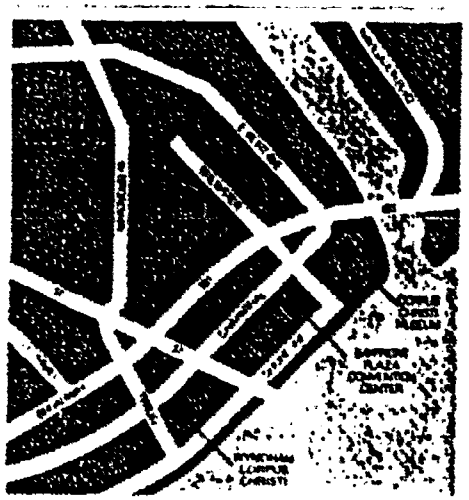
AGENDA FOR 1990 TEXAS

AQUACULTURE CONFERENCE



Wyndham Corpus Christi Hotel
900 North Shoreline Boulevard
Corpus Christi, Texas 78401
(512) 887-1600

Located on Shoreline Boulevard overlooking the bay, the Wyndham Corpus Christi is conveniently located near the Bayfront Convention Center and is only 15 minutes from Corpus Christi International Airport

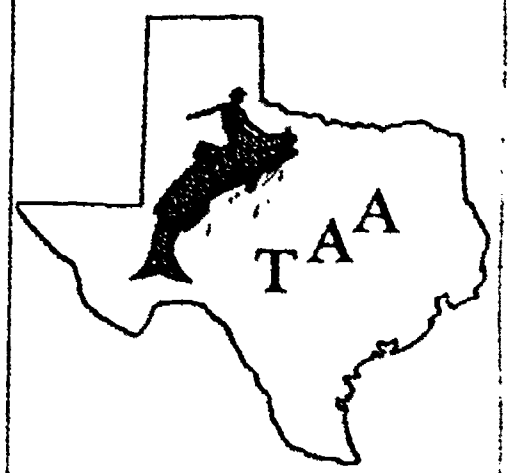


Contributors

Much of the educational cost of this conference is defrayed by contributions from aquaculture support groups. Their strong commitment to aquaculture in Texas has allowed us to offer an outstanding program. We wish to acknowledge and thank the following contributors:

Central Power and Light Company
Corpus Christi Area Economic Development Corporation
Corpus Christi State University
Department of Wildlife and Fisheries Sciences, Texas A&M University
Guadalupe-Blanco River Authority
Gulf States Utilities Company
Jackson Electric Cooperative, Inc
Lower Colorado River Authority
Matagorda County Navigation District No. 1
Texas Agricultural Experiment Station-Corpus Christi
Texas Feed Industry Association
Texas Water Commission
Wharton County Electric Cooperative, Inc

1990 Texas Aquaculture Conference



Planning for Growth

Jan. 29 - Feb. 1, 1990
Corpus Christi, Texas

Organizers
Texas Aquaculture Association

Texas Agricultural Extension Service
Texas A&M University Sea Grant Program

Co-sponsors
Texas Department of Agriculture
Texas General Land Office
Texas Parks and Wildlife Department

The 1990 Texas Aquaculture Conference will be a landmark event for Texas aquaculture. It marks the 20th anniversary of the Texas Aquaculture Association (formerly the Fish Farmers of Texas), and it commemorates the passage of the Fish Farming Act of 1989. *Planning for Growth* is the theme for this conference, since industry leaders will use this occasion as a forum for developmental planning.

Educational Presentations

Sessions will summarize the status of aquaculture in Texas, provide a four-hour review of introductory fundamentals, and focus on the latest technology for each of nine species during concurrent sessions. These sessions will be video taped and tapes will be available for sale after the conference.

Publication

A Preliminary Status Report and Development Plan for Aquaculture in Texas is being drafted through collaboration of more than 100 producers, researchers and agency representatives. This comprehensive document will include status reports and proposed development plans for each major aquaculture species in Texas. It will also include chapters on aquaculture resources, regulatory policy, processing and marketing, financing, and sources of technical information. This draft report will be distributed at the conference to each registered participant for review.

Industry Workshops

Four-hour workshops by species groups are scheduled for producers to discuss and revise the draft report. This should be an excellent and unprecedented opportunity for industry-wide brainstorming about current situations, problems and collective solutions. All producers are urged to participate.

Poster Session

Current aquaculture research will be displayed during a poster session. The first 15 students submitting posters for this session will be provided with complimentary full registration.

Trade Show

A 6,300-square foot ballroom will be used by manufacturers and dealers to display the latest equipment and supplies for the fish farmer. Several economic development groups also plan to take booths to promote aquaculture in their areas. Contact Brian Brawner (512/780-3304) for further information.

Bus Tour

A bus tour to surrounding facilities is offered Feb. 1 to reinforce information presented during the conference. The tour is scheduled to depart from the hotel at 8 a.m. for visits to public and private farms that produce shrimp, tilapia, crawfish, redfish and hybrid striped bass. Lunch is included; the bus returns to the hotel at 6 p.m.

Reception and Banquet

A seafood reception is scheduled in the Trade Show area Jan. 30, and a gourmet seafood banquet will be Jan. 31. Both events will feature an array of farm-raised Texas seafood prepared in a variety of ways.

Hotel Arrangements

To commemorate this special conference, the location has been changed from the traditional Texas A&M University site to Corpus Christi's prestigious bayfront Wyndham Hotel (see map). A special conference rate of $55 per single or double room has been arranged for Jan. 29 through Feb. 2, but reservations should be made prior to Jan. 1 to ensure availability. The hotel will provide courtesy van service to and from Corpus Christi International Airport by prior arrangement. Hotel reservations should be made directly with the Wyndham Hotel by calling 512/887-1600.

Registration

Full registration includes conference participation, the special publication, the reception and banquet, and all refreshment breaks. Spouse registration excludes the publication, and student registrations excludes beverage tickets for the reception as well as the banquet. The charge for the bus tour is in addition to the registration fee.

Registrations are transferrable within an organization. A 50 percent fee will be imposed for cancellations received after Jan. 1, 1990.

Tentative Agenda

Monday, Jan. 29		
5:00	- 5:00	Registration
Tuesday, Jan. 30		
8:00	- 9:00	Registration
9:00	- 9:50	Opening remarks featuring Commissioner Jim Hightower of Texas Department of Agriculture, Commissioner Garry Mauro of Texas General Land Office, and Chairman Chuck Nash of Texas Parks and Wildlife Commission
9:50	- 10:00	Video of Texas aquaculture
10:00	- 10:20	Coffee Break
10:20	- 10:45	Summary of Aquaculture Resources in Texas
10:45	- 11:10	Species Presently Cultured in Texas
11:10	- 11:35	Hurdles Impeding Commercial Development
11:35	- 12:00	Summary of Research Highlights
12:00	- 1:30	Lunch (on your own)
1:30	- 5:00	Concurrent Sessions — A. Introductory Aquaculture B. Industry Discussion Groups
6:30	- 8:30	Reception with complimentary drink tickets and Texas aquaculture hors d'oeuvres in Trade Show area
Wednesday, Jan. 31		
		Concurrent Sessions —
8:00	- 10:00	A. Crawfish B. Tilapia C. Penaeid Shrimp
10:00	- 10:30	Coffee Break
10:30	- 12:00	Concurrent sessions A. Softshelling B. Ornamental C. Penaeid shrimp (continued)
12:30	- 1:30	Lunch (on your own)
1:30	- 3:00	Concurrent Sessions — A. Catfish B. Bivalves C. Red drum/Hybrid Striped Bass
3:00	- 3:30	Coffee Break
3:30	- 5:00	Concurrent Sessions — A. Catfish (continued) B. Indoor systems C. Red drum/Hybrid Striped Bass
5:30	- 6:30	Cash Bar
6:30	- 9:30	Gourmet Seafood Banquet, Review of results of industry discussion groups and Texas Aquaculture Association business meeting
Thursday, Feb. 1		
8:00	- 6:00	Bus tour of research and commercial aquaculture farms (both indoor and outdoor facilities) that raise redfish, tilapia, shrimp, crawfish and hybrid striped bass. Lunch provided.

For further information about the program, contact:
Mary Boston
Texas Agricultural Extension Service
Route 2, Box 589
Corpus Christi, Texas 78410
(512) 265-9203

APPENDIX J

AQUACULTURE INDUSTRY CORRESPONDENCE

September 1, 1989

Dr. XXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXX

Dear Dr. XXXXXXXXX,

Thank you for the opportunity to tour your facilities. We were greatly impressed with the facilities and staff. With the development of the Aquaculture Project, we hope for increased involvement with your staff and facilities. We feel that your guidance can be the deciding factor in the success of this project. Once again, we thank you for your assistance and cooperation.

Sincerely,

Dr. John M. Dillingham

JD/alp

October 23, 1989

Dr. Richard Hilton
American Association for Vocational
Instructional Materials
120 Driftmier Engineering Center
Athens, Georgia
30602

Dear Dr. Hilton,

I am conducting a survey of aquaculture curricula for the Texas Education Agency. The study will eventually lead to the establishment of a secondary school curriculum for agricultural science and technology programs in Texas. One of the objectives of the project is to review videotapes and audio-visuals which will possibly support classroom and laboratory aquaculture instruction. I want to request that our project staff be allowed to review the following videotape prior to actual acquistion to determine whether it is appropriate for subject matter and for the age and grade-level for our students.

Aquaculture: Farming The Waters - No. V525

Your time and consideration is certainly appreciated. I can assure you of the prompt return or purchase of the tape upon completion of our assessment.

Sincerely yours,

John M. Dillingham

October 26, 1989

Van Nostrand Reinhold
Attention: Order Purchasing
7625 Empire Dr.
Florence, Kentucky 41042

To whom it may concern,

Attached are the brochures requesting review copies of 3 of your books regarding aquaculture and our letter of September 14, 1989. Please send us books # 0-442-20570-8, 0-442-25927-1, and 0-870-55341-0. If you have any questions, please contact Dr. John Dillingham or Andrea Pearson at (512)245-2130.

Sincerely,

Dr. John M. Dillingham

January 25,1990

Aquaculture Information Center
National Agricultural Library
Rm. 304; ATTN: POTENTIALS
10301 Baltimore Blvd.
Beltsville, MD 20705

Dear Sirs;

Please send me a copy of publication No. 90, Bibliographies and Literature of Agriculture. Currently, I am working on the development of an Aquaculture curriculum for secondary agricultural science classes. Your cooperation would be appreciated.

Sincerely,

Andrea Pearson
Graduate Assistant

February 14, 1990

Mrs.Cindy Schnuriger
Clear Creek High School
2305 E. Main
League City, Texas 77573

Dear Mrs. Schnuriger,

Enclosed you will find an agenda, maps, and parking permit needed for the upcoming Aquaculture Curriculum Workshop to be held on March 8 & 9, 1990.

Lodging will be provided for you at the San Marcos Inn (previously Ramada Inn) with check in time beginning Wednesday, March 7. You will need to confirm your reservations by March 1, 1990 by calling Shelly Hurt at 512-353-7770. Lodging and per diem will be reimbursed by the research grant.

Any questions you might have, please contact Dr. John Dillingham, Janet Roberts, or Andrea Pearson at Southwest Texas State University, 245-2130 or 245-3329.

We are looking forward to seeing you at the workshop.

Sincerely,

Dr. John M. Dillingham

cc: Dr. Bob Davis

Enclosures

April 5,1990

Dr. David Drueckhammer, Head
Department of Agriculture
University of Southwestern Louisiana
P.O. Box 44650
Lafayette, LA 70504-4650

Dear Dr. Drueckhammer,

I would like to thank you for the curriculum guides for wildlife and specialty animals. These guides will be beneficial to the development of an aquaculture curriculum in Texas. While reviewing your curriculum, I saw a number of topics that could be adapted for use in Texas.

Again, thank you for your cooperation. If I or my staff can be of any assistance to you, please do not hesitate to contact me.

Sincerely,

Dr. John M. Dillingham
Director, Aquaculture
Industries Study

April 16, 1990

XXXXXXXXX
XXXXXXXXXX
XXXXXXXXXXX
XXXXXXXXXXX

Dear XXXXXXXXX,

The May 1 target date to secure input from the aquaculture industry curriculum group is approaching. Your input is very important in establishing a uniform cluster course for aquaculture.

A follow-up workshop will be June 15, 1990 at the Instructional Materials Service at Bryan, Texas. At this workshop, final decisions for Texas' aquaculture curriculum will be made.

I certainly commend each participant for your patience (in waiting for travel reimbursement) and for the valuable input during the March workshop. Your travel is being processed and will be forwarded to you as soon as possible.

The Manor House in College Station has been requested to block a group of rooms for the evening of June 14 prior to the June 15 meeting at the I.M.S. Mileage, per diem (meals and lodging) will be reimbursed to you from the project account. Please make plans to represent your school and area on behalf of establishing a state aquaculture curriculum.

Please find enclosed a letter to be submitted by you to your school administration requesting your attendance at the
June 15, 1990 curriculum session at the I.M.S.

Sincerely yours,

John M. Dillingham

April 16, 1990

Dear School Administrator:

Mr. John Roderick is currently serving as an advisory member of the state aquaculture industry curriculum committee. The next meeting of the advisory committee will be June 15, 1990 at the Instructional Materials Service in Bryan, Texas. Travel and per diem will be paid by the aquaculture project which is funded by the Texas Education Agency.

Please allow your agricultural science teacher to attend this important meeting to assist in curriculum development for the Texas program. Your time and the consideration of your school district is greatly appreciated.

Sincerely yours,

John M. Dillingham
Associate Professor

May 15, 1990

Dear Sir:

The Texas Education Agency in cooperation with the Department of Agriculture, Southwest Texas State University, is establishing a school curriculum in aquaculture. Producers, like yourself, are being asked to assist by providing information about the job of managing an aquaculture enterprise. Your name was furnished by the Texas Department of Agriculture and by the Texas Aquaculture Assoc., and we value your input.

Please complete the enclosed survey and return by June 1, 1990. Describe your business and tasks which you or your employees perform to manage your aquaculture business. Any additional comments which you provide are appreciated.

Thank you for completing the survey: a self-addressed stamped envelope has been included for your convenience.

Sincerely yours,

John M. Dillingham
Associate Professor

May 17, 1990

Mr. Pat Hutson
State Fish Hatchery
P.O. Box 947
San Marcos, Texas 78667

Dear Mr. Hutson,

The aquaculture industry curriculum committee will meet at 8:30 am June 15, 1990, at the Instructional Materials Service in College Station. Committee members have responded to our request to develop tentative curriculum outlines based on the March workshop at SWT.

Project staff value your input and want you to attend the meeting as a consultant to assist in establishing an outline for essential elements for high school aquaculture.

A block of rooms has been reserved at the Manor House for workshop participants. You are invited to travel with the SWT group Thursday, June 14, and stay with us at the Manor House.

A consultant fee of $200 will be paid to you for your input and advice. If your schedule does not permit attendance, please contact me at SWT.

Sincerely yours,

John Dillingham

JD:dg

May 17, 1990

Dr. Wallace Klussmann
Wildlife & Fisheries
Texas A & M University
College Station, Texas 77843

Dear Dr. Klussmann,

The aquaculture industry curriculum committee will meet at 8:30 am June 15, 1990, at the Instructional Materials Service in College Station. Committee members have responded to our request to develop tentative curriculum outlines based on the March workshop at SWT.

Project staff value your input and want you to attend the meeting as a consultant to assist in establishing an outline for essential elements for high school aquaculture.

A consultant fee of $200 will be paid to you for your input and advice. I look forward to visiting with you in College Station. If your schedule does not permit attendance, please contact me at SWT.

Sincerely yours,

John M. Dillingham

JD:dg

May 17, 1990

Mr. Jay Eudy
Director, Agricultural Education
Texas Education Agency
1701 North Congress Avenue
Austin, Texas 78701

Dear Jay,

The aquaculture industry curriculum committee will meet at 8:30 am June 15, 1990, at the Instructional Materials Service in College Station. Committee members have responded to our request to develop tentative curriculum outlines based on the March workshop at SWT.

I certainly want to extend an invitation to you and any of your staff members who can attend. Your presence is certainly important since final plans and groundwork for the next phase will be established. A block of rooms has been reserved at the Manor House for workshop participants.

The meeting will begin at 8:30 and conclude about 3:00 pm. I look forward to visiting with you at College Station.

Sincerely yours,

John Dillingham

JD:dg

June 4, 1990

^F1^
^F2^
^F3^

Dear ^F4^:

Recently an aquaculture survey form was mailed to you to obtain a list of tasks you perform in your ^F5^ production business. Your response is vitally needed to help design an agricultural science curriculum for high school students.

If you have already completed and returned your survey form, I appreciate your response. If you did not receive the initial survey form, another survey is included. Please take a few minutes to complete the questionnaire and return it in the addressed, stamped envelope.

Your response is confidential and greatly appreciated. I will appreciate your cooperation in returning the survey prior to June 15.

Sincerely Yours,

John M. Dillingham
Associate Professor

JD:dg

June 14, 1990

Ewald Enterprises
Mr. Brian L. Brawner, Manager
P.O. Box 519
Karnes City, Texas 78118

Dear Mr. Brawner:

I'm writing in reference to our phone conversation on June 1, 1990, regarding a design for a production shrimp/fish grow-out lab demonstrator. The proposed lab facility is an approximate 40' x 50' shop.

The design needs to include an equipment and price list as we will possibly be purchasing this demonstrator through the Aquaculture Industries Research Grant, depending on the cost.

Monies from this grant must be allocated by June 30, 1990. Therefore, if at all possible, I will pick up the design and price list on Monday, June 25 when we visit your facility.

Thank you for your assistance in this matter.

Sincerely,

Andrea Pearson
Graduate Student

June 27, 1990

Mr. Red Ewald
P.O. Box 519
Karnes City, Texas 78118-0519

Dear Red,

Thank you for the tour of your fiberglass plant and aquaculture facilities. Andrea and I are impressed with the hospitality of you and your entire staff. If you can bottle your enthusiasm and desire to excel, I will be your first customer and I want to be the SWT distributor.

The plans and price list for a laboratory facility will be valuable in our future plans at SWT in designing a fish culture training program. Brian Brawner is a very helpful individual: please express our appreciation to him.

I am looking forward to meeting with you in Corpus Christi during the ag teachers conference.

Thank you again.

Sincerely,

John M. Dillingham
Associate Professor

JD:dg

July 27, 1990

Mr. Paul Barrett
NAIAD
12901 County Road 171
Liverpool, Texas 77577

Dear Mr. Barrett:

Andrea Pearson and I appreciated the tour of the field and processing facilities at NAIAD provided by your staff. We at Southwest Texas State University have been conducting an aquaculture curriculum development project for the past 12 months and the tour of your facility certainly provided first-hand observation of textbook information.

The processing plant manager and Mr. Brett Rowley were very congenial hosts, and we were very impressed by the entire operation.

Thank you for your time and consideration.

Sincerely yours,

John M. Dillingham
Associate Professor

July 27, 1990

Mr. Brett Rowley
Fisheries Biologist
12901 County Road 171
NAIAD
Liverpool, Texas 77577

Dear Brett,

Thank you for the tour of the field facilities and laboratory at NAIAD. Andrea Pearson and I appreciate your hospitality and information about the catfish industry in your immediate area. Your expertise in aquaculture will certainly be of increasing value as the industry becomes stronger in Texas.

Dr. Tom Dayberry and I are in the process of submitting a federal proposal to develop aquaculture teaching laboratories at SWT. Hopefully, if the grant process is successful, we will be able to communicate into action some of the suggestions you might have for a training program.

Your time and consideration is certainly appreciated.

Sincerely yours,

John M. Dillingham
Associate Professor