

INVESTMENT IN THE TRAINING OF  
TECHNOLOGISTS FOR COMMERCIAL AQUACULTURE

by

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ABSTRACT

The protein shortage in Nigeria is noted and the role of aquaculture (=fish farming) as a complement in increasing the dwindling food supply is registered. In addition, the manpower shortage especially in the technology cadre is noted and attributed to the lack of co-ordination and standard curricula especially in aquaculture.

An inventory of tasks performed in the Aquaculture industry was taken and these were classified and validated, then their final priority level was used to assess which ones were critical, important or desirable and which ones would result in disaster or not with inadequate mastery.

Based on above, recommendations are made that all critical and important tasks be included in the teaching curriculum for aquaculture in both theory and practicals: while it is advocated that all tasks listed be undertaken in fish farm operations. This will raise the competence of technologists to run the commercial aquaculture projects.

INTRODUCTION

The basic concept of protein shortage in Nigeria is well known and the role of fish as a very suitable substitute is well documented by many authors. Also the development of Aquaculture as a discipline needed to increase the dwindling food supply and to complement productivity of landed fish from both deep sea fisheries and inland fishing by local fishermen is appreciated. In the 1981 - 1985 plan period, aquaculture netted ₦12,000,000 next only to Fishing Infrastructure.

However, most authors agree that one of the most pressing factors militating against the proper fisheries development is lack of trained manpower at various levels especially at the middle level manpower, (Ita, 1980 ; NFDC, 1979 ; Ita & Sado, 1983 , Olaniawo, 1983) ; and in virtually all specialised aspects of aquaculture (Afinowi, 1983). The manpower requirements for the aquaculture industry in Nigeria was put for 1985 at 2,936 viz:-

- 174 Fisheries Officers, 243 Superintendents, 1214 Fisheries Assistants and 1305 Artisans/Fishermen.

The manpower needs of the country in the Fisheries Subsector can only be met by designing appropriate curricula for the various programmes of training. In the design for a curriculum for Agric. Technical Education, it is important that the curriculum should be responsive to industrial needs. Thus training must be consistent with the need of the industry within a given period. The Agriculture industry of which aquaculture is one has an extremely narrow adequate technology base and so without a prescribed performance skill (Ndukwe, unpublished). The major constraints of Agricultural development and training in the developing countries include among others the following:

1. There is an adoption rather than adaptation of programme objective, and practice in Agriculture Education and training from developed societies where social, economic, cultural structures, techniques and traditions are different.
2. The curricula content of teaching methodology in many agric institutions are not sufficiently relevant to national goals but this according to Mosher (1986) as quoted by Ndukwe (unpublished) is wrong since vocational agriculture must be strongly oriented to practical training and acquisition of skills essential to successful operations of a training enterprise. In his unpublished report, Ndukwe has suggested that to formulate a programme of study the need for it must be established, as well as the need for the resulting difference between what is and what ought to be, and objectives then formulated to satisfy these needs. Olaniawo (1983) has outlined the 3 universal objectives for fisheries development:
  - to increase food supply and improve nutritional standards,
  - provide increased income earning opportunities,

- where possible expand fish exports and foreign exchange earning and suggested that manpower development in the fishing industry should at a given time be tailored to one of the above. Even though manpower problem of fisheries is the same as other sectors of the economy Cole & Hall (1973) as quoted by Olaniawo (1983) identified the main industry specific personnel of fisheries as sea going, commerce and development, research, education and economic. Nobody has done this for aquaculture.

This paper is based on identified tasks involved in aquaculture and is used here for the purpose of establishing guidelines for an appropriate curriculum in Aquaculture to suit the requirements of fish farming operations. The aim is to identify all the tasks and skills in relation to total operations in the aquaculture industry, compare these tasks identified with what already obtains in the institutions for the training of technical manpower OND/HND levels and what ought to be. At the end of the analysis, it should be possible to design a good curriculum in line with prescribed industrial skills and learning outcomes, thus guaranteeing the skills currently in use in the industry. While Olaniawo (1983) had traced the efforts in the training of manpower in the Fisheries subsector in Nigeria, he noted that there has been no effective co-ordination of training programmes due to lack of a standard curriculum, and suggested that better impact will be made if the schools concentrated on fewer areas of training excellence since no school can run all the Fisheries programmes effectively. In Nigeria, many Schools/Colleges of Agricultural Science and Technology have been opened to meet the manpower requirements in the various sectors, most of these offer technical courses and are involved in the training of middle level manpower for Agricultural development. Because of the increasing number of schools and colleges, there are variations in physical facilities, equipment, staff strength and experience and type of course, syllabi, course content and certification, all these without co-ordination, Okpechi (1985) unpublished.

The National Board For Technical Education (NBTE) is currently visiting some of the Technical/Technological Schools in relation to their accreditation. Some of these colleges offer Fisheries courses. There is thus absolute need for standard criteria for a review of their fisheries curricula. This paper will therefore go a long way in helping draw up a curriculum for aquacultural education. In addition a professional body could be formed based on the curriculum to control the practice of fish-farming (Aquaculture being a branch of Agric. which is practised freely without a formally organised professional body that controls its practice through ethics formulation as if there were no possibility of malpractice).

Guidelines to an appropriate curriculum in Aquaculture training thus examines the tasks usually encountered in aquacultural practice, and their relevance at each level, their priority level having first classified and validated them in the aquaculture industry in Nigeria using Imo and Rivers States as examples. It therefore makes recommendations towards an appropriate curriculum design in aquacultural training.

## METHODS

A list of tasks was drawn up based on experience and existing curricula at the School of Fisheries, Michael Okpara College of Agriculture Umuagwo, and the Federal Fisheries School Lagos. Fish Farms in Imo and Rivers States were also randomly selected and visited at every level of technical development and all operations documented and decomposed into tasks. These were then characterised, classified and validated. Final classification was done in order to determine the final priority level of each task in consonance with Skull (1979). All the items on the list were based on observations in fish farms and interviews of personnel and trainees as to what they do - and in most cases orally because of anticipated constraints including illiteracy and numerosity of tasks. Account was also taken of the components of fish culture outlined by Sagua (1983).

Analysis of these were then made using the Licket scale for task statement and the tasks were scored.

### 1. TASK STATEMENTS USING THE LICKET SCALE 1 - 5

- a) Whether performed (No = 1 Yes = 5)
- b) Frequency of Performance (Rare/once = 1  
Once/Yr: Low = 2; 2 - 3 times/Yr: moderate = 3;  
Forthnightly/monthly: High = 4; Daily/ Twice Daily:  
Very High = 5;
- c) Perceived difficulty in performance (None = 1;  
Low = 2; Moderate = 3; High = 4; Very High = 5).
- d) Relative benefits of Training received (No  
training = 1; Training of maximum benefit = 5).

### 2. TASK CLASSIFICATION:

- a) Name of task
- b) Task objectives (Specific to industrial operations)
- c) Learning category (cognitive/physcomotor effective)
- d) Environmental condition for tasks
- e) Equipment used

- f) Completion time
- g) Learning time
- h) Consequences of inadequate mastery (None = 1; Negligible = 2, Significant = 3; Serious = 4; Disastrous = 5)
- i) Probability of use (Rare = 1; Low = 2; Moderate = 3; High = 4; Very High = 5)
- j) Importance (Desirable = 1; Important = 3; Critical = 5)
- k) Reaction Speed (Over-learning = 1; Mastery = 5)
- l) Proficiency (None = 1; Low = 2; Moderate = 3; High = 4; Perfect = 5)
- m) Category of Worker (Labourer = 1; Sales Clerk/pond attendant = 2; Trained tractor driver/Fisherman = 3; OND = 4; Fish Officer HND = 5).

### 3. TASK VALIDATION

- a) Consistency of task with outcome specification (Rare = 1; Low = 2; Moderate = 3; High = 4; Very High = 5).
- b) Specification
- c) Precision (Rare = 1; Low/Significant = 2; Moderate/Permissible = 3; High/Little or no error = 4; Very High/Accurate = 5).
- d) Feasibility (Not possible = 1; Possible = 5).
- e) Functionality (Not useful/Rare = 1) Low = 2; Moderate = 3; High = 4; Very High = 5).
- f) Significance (Desirable = 1-3; Important = 4; Critical = 5).
- g) Appropriateness (Not appropriate = 1; Low = 2; Moderate = 3; High = 4; Very High = 5).

### 4. FINAL PROOXY LEVEL OF TASK

- a) Importance (Desirable = 1; Important = 3; Critical = 5).
- b) Frequency of use (Rare = 1; once pond is under construction Low = 2; Moderate = 3; High = 4; Very High = Daily/2ice daily = 5).
- c) Benefit (Rare = 1; Low = 2; Moderate = 3; High = 4; Very High = 5).

- d) Consequence of inadequate mastery (None = 1; Negligible Significant = 3; Serious = 4; Disastrous = 5).

TASKS DOCUMENTED

- |   |   |
|---|---|
| A. <u>LAND OPERATIONS</u>                   | 21. Counting and parking of fingerlings/fry |
| 1. Site selection                           | 22. Transportation of fry/brooder           |
| 2. Surveying                                | 23. Checking them into ponds                |
| 3. Clearing                                 | 24. Supervision                             |
| 4. Stumping                                 | 25. Rearing of brood fish/induced breeding  |
| 5. Pegging of Site                          |   |
| B. <u>METHOD OF POND CONSTRUCTION</u>       | D. <u>FEEDING</u>                           |
| 6. Excavation by bulldozer                  | 26. Determination of feeding rates          |
| 7. By labour - digging & carrying earth     | 27. Weighing of feed to be administered     |
| 8. Raming of bunds                          | 28. Administration of feed                  |
| 9. Clay Collection                          | 29. Preparation of feed                     |
| 10. Pilling at the Centre                   | 30. Supervision                             |
| 11. Construction of sluice gates and monks. | E. <u>FERTILIZING THE POND</u>              |
| C. <u>WATER DELIVERY SYSTEM</u>             | 31. Determining the type to be used         |
| 12. Construction of channels                | 32. Weighing out quantity to be used        |
| 13. Mechanical                              | 33. Carry it to the pond                    |
| 14. Plumbing jobs                           | 34. Administration of fertilizer            |
| 15. Filling of pond with water              | 35. Supervision                             |
| 16. Stocking of the ponds                   | 36. Sampling                                |
| 17. Determination of species and size       | F. <u>WATER QUALITY</u>                     |
| 18. Determination of stocking density       | 37. Field tests/laboratory tests            |
| 19. Collection of Fish seed from wild       | 38. Collection of sample                    |
| 20. Importation from other farms            | 39. Conveyance to the laboratory            |
|   | 40. Determination of temperature            |

41. Determination of pH
42. Determination of DO , CO<sub>2</sub>, and turbidity.
- G. CROPPING
43. Draining the pond
44. Harvest using seine net
45. Separation into species
46. Placing of price tags
47. Marketing
48. Processing
49. Storing
50. Pond clearing/removal of silt layer.
- H. LIMING
51. Determination of type
52. Determination of wt.
53. Carry to pond site
54. Administration of lime into pond.
- I. CONTROL OF WEEDS
55. Mechanical - by labour.
56. Biological - use of fish spp
57. Chemical
58. Determination of spp to use
59. Determination of type of spray to use
60. Weed control on banded water channels
61. Regular checks on sluice gates/monks
62. Repairs of sluice gates/ leakages
63. Clearing of inlet pipes and screens.
- J. GENETICS AND HYBRIDIZATION
64. Selection of brood fish
65. Separation into breeding pond.
66. Determination of type of feed
67. Feed administration
68. Determination of gonad maturity
69. Induced breeding
- K. ENVIRONMENTAL MANIPULATION
70. Raising the volume of water in pond.
- L. HORMONE EXTRACTION
71. Determine spp to be used and extract the pituitary
- M. INJECTION
72. Holding of the fish
73. Administration of injection
74. Putting back into pond
- N. PREPARATION OF BREEDING POND
75. Put materials at bottom for eggs of female
76. Get water supply for pond at hand
77. Strip eggs and sperm from females and male
78. Mixing of the two
79. Pour into incubator troughs
- O. FISH DISEASES
82. Fish Detection
83. Diagnosis

P. CONTROL OF DISEASE

84. Removal of infected individuals
85. Removal of secondary hosts
86. Determination of chemical to be used
87. Treatment by application of chemical to H<sub>2</sub>O
88. Application of drug to infected individuals
89. Routine checks for fish enemies
90. Prevention by removal
91. Prevention by hunting for them
92. Fencing the pond
93. War Against filth = pollution
94. Trapping
95. Regular checks on water quality to prevent proliferation by ectoparasites.

RESULTS

Summary on Task inventory in Aquaculture

In Fish Farm Operations/ Aquaculture practice; 54% tasks	Levels	Licket Code	Score	%
Performed are critical	Critical	5	51	54
23% are important and 23% are desirable	Impor- tant	4	22	23
	Desirable	1 - 3	22	23

Out of a total of 95 tasks in aquacultural skills, 50 are critically required and need to be handled by trained personnel. These require knowledge and skill and category of staff are OND/HND/and Fisheries Officers. These require high proficiency as inadequate mastery will cause very serious problems or have disastrous consequences.

Some tasks on the other hand are important and cannot be overlooked. They are not critical but require capable hands to tackle them effectively. They make up 23% of the tasks documented in aquaculture.



Therefore a total of 74 tasks documented are very essential in aquacultural practice and their importance cannot be over-emphasized. Mastery and proficiency is needed for them and time allocated for proper training in theory and practicals must be adequate. Effionayi (1981) perceived the positive acquisition of appropriate skills, abilities and competences both mental and physical as a pre-requisite for development of aquacultural industrial skills. The training of workers/and or technologists should therefore be carried out bearing in mind these tasks to which attention should particularly be emphasised in the practicals, if the trainees are to become active members of the fish culture team.

About 23% of the tasks are desirable (1-3). While most of them do not require training, and mastery is not important, complete co-ordination will only be achieved when they are in practice.

- \* Critical tasks as selection of site (Task I) and stocking density determination (Task 16) have very disastrous consequences if omitted e.g. bad site selection results in seepage and water delivery expenses while wrong density determination, leads to over population and stunted growth.
- \*\* Important tasks as weighing out quantity of fertilizer (Task 32) and administration of fertilizer (task 33) need proficiency and are beneficial. Improper fertilizer application will lead to serious effects.
- \*\*\* Desirable tasks are carrying lime to pond site.

#### CONCLUSION AND RECOMMENDATIONS

- Critical and important tasks outlined should be taken into serious account in designing a curriculum for Aquaculture.
- Enough time should be given for both theory and practicals to ensure high proficiency expected of the grade of workers handling these operations/tasks.
- Construction of model and standard fish ponds be encouraged in the institution to inculcate practical skills in the students.
- Students should also participate in pond construction work with the equipment provided.
- This type of analysis should be made in other areas of Fisheries from time to time to ensure that products of the Fisheries Schools will fit into the industries for which they are trained.

- A council of Registered Aquaculturists of Nigeria should be formed as a matter of urgency to regulate the practice of Aquaculture in Nigeria.

#### REFERENCES

- AFINOWI, M.A. (1983) Aquaculture Practices in Brackish Waters - Present Status, constraints and Potentials. Paper presented at the 3rd Annual Conference of the Fisheries Society of Nigeria FISON, Maiduguri, Feb. 1983.
- EFFIONAYI, JAB (1981) Manpower Development and Training in Agric., Forestry, Fisheries, Livestock, Home Economics and related Sciences pg. 58.
- ITA, E.O. (1980) A review of recent advances in Warm Water. Aquacultural Research and a proposed experimental design for maximising fish production in Nigerian Fish ponds. Kainji Lake Research Institute, Tech. Report. Series No. 5.
- ITA, E.O., & E.K. SADO (1983) Preliminary Survey of Inland Water Resources in Nigeria with Special reference to ponds, Lakes and Reservoirs. Paper presented at the 3rd Annual Conference of the Fisheries Society of Nigeria FISON, Maiduguri, Feb. 1983.
- MOSHER, A.T. (1966) Getting Agriculture moving. New York Praeger for the Agricultural Development Council cited by Kane J.E. 1976 - Curriculum Development in Physical Education.
- NDUKWE, K. (1984) (Unpublished report) "Practical and productive activities in Agricultural Education.
- NFDC (1979) Report of the NFDC Sub-Committee on the study of Problems of Aquaculture (Fish Farming) in Nigeria.
- OKPECHI, C.U. (1985) (Unpublished) Task Inventory and Analysis in Aquaculture. HND Project Report Michael Okpara College of Agriculture, Umuagwo.
- OLANIAWO, A.A. (1983) Fisheries Manpower Development in the Eighties. Paper presented at the 3rd Conference of the Fisheries Society of Nigeria (FISON) Maiduguri, Feb. 1983.
- SAGUA, V.O. (1983) The role of Research and Research Institutes in Fisheries Development in the 1980's. Paper presented at the 3rd Annual Conference of the Fisheries Society of Nigeria (FISON) Maiduguri, Feb. 1983.
- SKULL, J.C. (FAO Publication 1972) An-on-farm approach to Farmer Training in South Australia, Pg. 94.