

FIS 309: AQUACULTURE (3 UNITS)

Topics to be taught:

1. Definition, Aims and types of aquaculture.
2. History, present organization and status of aquaculture in Nigeria .
3. Principle of aquaculture, liming and pond fertilization; food supply; selection of culture species, introduction of exotic species and their implications.
4. Water requirements.
5. Stocking, feeding and harvesting practices.
6. Fish farm design.
7. Economic consideration of aquaculture.

This course will be taught by 4 Lecturers and 2 3 field instructors.

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The venues of the course shall be at the designated classrooms in the Oba Lipede Multipurpose Building and the University Fish farm/ Hatchery centre.

Lecture 1

What is Aquaculture

Aquaculture is fish farming. It is the art and science of controlled rearing of fish in ponds, farms and in some instances natural water bodies from hatchlings to matured size. Unlike fish that grow in the wild water bodies, without human interference, in aquaculture, activities such as feeding, fertilization, stocking, reproduction and harvesting are controlled.

Aquaculture has been defined by the Japanese Resource Council, Science and Technology Agency as follow:

Aquaculture is an industrial process of raising aquatic organisms up to final commercial production within properly partitioned aquatic areas, controlling the environmental factors and administering the life history of the organism positively and it has to be considered as an independent industry from the fisheries hitherto.

Aquaculture is organised production of a crop in the aquatic medium. The crop may be that of an animal or a plant. Naturally, the organism cultured has to be ordained by nature as aquatic.

Examples are:

Finfish: Tilapia, carp, trout, milkfish, bait minnow, yellow tail, mullet, cat fish.

Shellfish: Shrimps, prawns, oysters, mussels, pearl oyster for cultured pearls (eg. Japanese pearl oyster, *Pinctada fucata*).

Plants: Water chestnut (*Trapa natans*). Red alga of Japan, “Norie” (*Porphyra*). Red alga of Philippines & U.S.A. (*Eucheuma*)
Brown alga of Japan, “Wakame” (*Undaria*).

Aims of Aquaculture

- i. Production of protein rich, nutritive, palatable and easily digestible human food benefiting the whole society through plentiful food supplies at low or reasonable cost.
- ii. Providing new species and strengthening stocks of existing fish in natural and man-made water-bodies through artificial recruitment and transplantation.
- iii. Production of sportfish and support to recreational fishing.
- iv. Production of bait-fish for commercial and sport fishery.
- v. Production of ornamental fish for aesthetic appeal.
- vi. Recycling of organic waste of human and livestock origin.
- vii. Land and aquatic resource utilization: this constitutes the macro-economic point of view benefiting the whole society. It involves (a) maximum resource allocation to aquaculture and its optimal utilization; (b) increasing standard of living by maximising profitability; and (c) creation of production surplus for export (earning foreign exchange especially important to most developing countries).
- viii. Providing means of sustenance and earning livelihood and monetary profit through commercial and industrial aquaculture. This constitutes the micro-economic point of view benefiting the producer. In the case of small-scale producer, the objective is to maximise income by greatest possible difference between income and production cost and, in the case of large scale producer, by maximising return on investment.
- ix. Production of industrial fish.

Types of Aquaculture

The different kinds of aquaculture are:

- i. Static water ponds.
- ii. Running water culture.
- iii. Culture in recirculating systems: in reconditioned water and in closed systems.
- iv. Culture in rice fields.
- v. Aquaculture in raceways, cages pens and enclosures
- vi. Finfish-culture cum livestock rearing.
- vii. Hanging, 'on-bottom' and stick methods of oyster culture.

Based on the number of species that are cultured in a system aquaculture may be classified into: (a) Monoculture and
(b) Polyculture.

(a) Static freshwater ponds

Ordinary fresh water fish culture ponds are still-water ponds. They vary a great deal in waterspread area and depth. Some are seasonal and some perennial. The ponds may be rainfed (also called sky ponds) and/or may have inlet and outlet systems. The water supply may be from a stream or a canal or from an underground source such as wells, tubewells etc.

(b) Running water culture

In Japan, at places where there is abundant supply of water, common carp is cultured in running water ponds. The most intensive common carp is cultured in running water ponds. A very high common carp production rate of 980 t/ha has been achieved at the Tanka Running water fish farm in Japan where there is plentiful supply of running water of high dissolved oxygen content and optimum range of temperature for feeding. Running water culture of common carp is done in a small way in Europe, Indonesia and Thailand.

(c) Culture in recirculatory systems

This system is comparable to running water culture system except that in the latter, water goes waste whereas here the same water is reused. In this system, water is filtered continuously and recirculated, often after aeration, to the fish pond. The filtering element is a biological filter comprising 3 – 4 cm diameter pebbles, or honey-comb synthetic strips, designed to arrest faecal matter and to denitrify catabolic wastes through bacterial action.

(d) Culture in Rice Fields

Culturing fish and growing rice together in the same paddy fields is an old practice in Asia and the Far East. Interest in producing rice and fish together had declined in recent years because of use of fish-toxic pesticides required to protect high yielding varieties (HYV) of rice introduced as part of green revolution in Asia.

(e) Aquaculture in Raceways: Cages, Pens and Enclosures

Marine aquaculture farms may be located at six possible sites viz. either on the shore with pumped sea-water supply; in the intertidal zone; in the sublittoral zone, or offshore with surface floating, mid-water floating or seabed cages. The first three are enclosures and the last three cages.

(f) Finfish Culture-cum-Livestock Rearing

Commercial scale fish-cum-duck culture is practiced in Central European countries such as Czechoslovakia, East Germany, Hungary and Poland, as well as in Taiwan Province of China. This is a synergic system of mutual benefit to each organism cultured: duck droppings manuring the pond, duck foraging consuming a variety of unwanted biota for fishculture such as tadpoles, frogs, mosquito and dragonfly larvae, molluscs, aquatic weeds etc.

(g) Monoculture

Monoculture, as the name implies, is the culture of a single species of an organism in a culture system of any intensity, be it in any type of water, fresh, brackish or salt.

e.g. Fresh water: Catfish, Clarias gariepinus in Africa.

Common carp in East Germany, Common carp in Japan

Tilapia nilotica in several countries of Africa,

(h) Polyculture

Polyculture, as the name implies, is the culture of several species in the same waterbody. The culture system generally depends on natural food of a waterbody sometime augmented artificially by fertilization and/or by supplementary feeding. If artificial food is given it is a common food acceptable to all or most species that are cultured.

e.g. Fresh water: Polyculture of *Clarias gariepinus* and tilapias in Africa.

Lecture 2

History, Present organisation and Current status of Aquaculture in Nigeria.

The agricultural history of Nigeria is intertwined with its political history. This is discussed broadly in the context of the varying constitutional frameworks, viz: Colonial, the Internal Self Government and the Post-1960 periods, according to sectors.

- A. The history of fisheries development in Nigeria is a comparatively recent one, although reports have shown that a fishing company operated from the coastal waters of Lagos long before 1915. Deliberate efforts at developing the country's fisheries can be said to date back to the Second World War when, because of the naval blockade of the high seas, the then

Colonial Administration decided to develop the country's local resources, including fisheries.

- B. A fisheries organisation was established in 1941 as a Fisheries Development Branch of the Agricultural Department of the Colonial Office and a Senior Agricultural Officer was appointed to conduct a survey of the industry and its possibilities. The headquarters was sited at Apese village and later at Onikan in Lagos, from where, assisted by a part-time voluntary officer, preliminary experiments in fish culture in brackish water ponds at Onikan were carried out and surveys were conducted on the canoe fisheries of Apese village and Kuramo waters around Victoria Island, Lagos. A small fisheries school was also established at Onikan.
- C. Early in 1945, the Fisheries Development branch was temporarily transferred from the Agricultural Department to the Development Branch of the Secretariat. A Fisheries Development Officer was appointed and a Five-Year Plan for Fisheries Development was formulated and incorporated in the Ten-Year Plan of Development and Welfare in Nigeria, laid on the table of the Legislative Council on 13th December, 1945.
- D. From this date to 1947, the Branch became a section of the Department of Commerce and Industries with a Principal Fisheries Officer in charge. In addition to the brackishwater fish culture experiments and canoe fisheries surveys, other activities were initiated. Small motor fishing crafts were acquired for exploratory fishing in the estuaries, lagoons and creeks. It was considered "that these fisheries should receive priority treatment at this stage in Nigeria over sea fisheries".

- E. Between 1948 and 1950, major efforts were made at extending the artisanal fisheries programme to other coastal areas of Nigeria. An active extension service was established to demonstrate the benefits of improved fishing techniques and gear to the coastal canoe fishermen. A Fish Farmer was appointed to extend this aspect of production and this culminated in the establishment in 1951, of a 160ha industrial-scale fish farm at Panyam on the Jos Plateau. By the end of this period, the branch had grown to become the Federal Fisheries Services under the Federal Ministry of Economic Development.
- F. Under the 1954 Constitution of Nigeria, the fisheries organisation was split between the Federal and Regional Governments. The Federal Fisheries Service of the Federal Ministry of Economic Department was headed by a Director with laboratories and headquarters in Lagos. The Western Region Fisheries Division of the Ministry of Agriculture and Natural Resources was headed by a Principal Fisheries Officer. Its headquarters and offices were at Ibadan and a Sea Fisheries Section at Lagos, a Marketing and Distribution Section at Warri, Organisation and Inspectorate at Epe and Fish Culture Section at Ibadan and Asaba. The Eastern Region Fisheries Division of the Ministry of Agriculture was under the charge of a Principal Fisheries Officer and the headquarters at Aba and an outstation at Opobo.
- G. The Fisheries Section of the Ministry of Agriculture of the Northern Region was under the charge of a Senior Fisheries Officer while the headquarters was located first at Baga and later at Malaranfatori, Lake Chad. In addition, the Northern Region Fish Farm at Panyam was placed under the administration of the Region's Ministry of Trade and Industry, and was under the charge of a resident Fish Farmer. The

Federal Fisheries Service had the constitutional responsibility for fisheries development and research in the Lagos Federal Territory and research in any other part of the country where the Regional Government invited it to carry out any specific research activity.

H. The period 1956-66 witnessed great expansion in Nigeria's fishing activities. In the coastal trawler fleet, from a single registered trawler in 1956, the fleet was built up, by 1960, to 13 while the total fish catch increased ten-fold during the period. This level of production was sustained up to 1963 but catches fell in 1964-66, following heavier exploitation of the Lagos fishing grounds. By this period, however, commercial quantities of prawns had been discovered in the eastern parts of the country and many of the vessels converted to prawn fishing, thus reducing the pressure on the fish stock. By 1970, the fishstock had fully recovered and the expansion of inshore fishing activities was becoming so rapid that plans were then made to regulate fishing in order to conserve the rather limited resources. The period also saw a considerable increase in the artisanal fisheries. This has been attributed to the concentration of fishing activities close to the rich grounds; higher money returns for efforts; general improvement in processing, storage and distribution methods; improvement in the type of fishing craft used and, especially, to the higher gear efficiency due to a complete changeover to synthetic fibre. The general result was that the contribution of fisheries to the country's QDP quadrupled between 1960 and 1970.

I. Awareness Years (1991-2001): In this decade aquaculture witnessed some level of robust development in term of awareness both among private investors, institutions and government as sure means of producing cheaper protein and source of employment. The picture at the turn of this decade

evidenced clearly the unmitigated failures of government farms especially Agricultural Development Programmes, (ADP) in most of the states. In spite of the huge fund from the World Bank as part of its intervention programme to boost fish production the objectives were clearly off from being realized as the progress recorded can at best be described as marginal. The number of manpower increased although quality of expertise remained suspicious. Some levels of growth were recorded, profile of investors and scale of investment saw some level of improvement in the number of small (31,500-100,000kg/ha/yr) and medium scale entrepreneurs with some fish farm having an average output of 10 ton/ annum. Although, the appreciable degree of success of these fish farms had been traced to foreign support as provided by their foreign technical or financial partners; it showed the level of production which can be attained once the right mix of technical and financial input is made available.