FISHERIES TRAINING IN NIGERIA'S TERTIARY INSTITUTIONS – CURRICULUM, STAFFING, EQUIPMENT AND OTHER FACILITIES: A CRITIQUE OF NUC'S MINIMUM BENCHMARK ACADEMIC STANDARDS (MBAS) DOCUMENT

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ABSTRACT

A review of the curriculum, staffing, equipment, field and laboratory requirements prescribed by the National Universities Commission (NUC) for training of Fisheries graduates is made. This is made as these are guidelines against which Fisheries programmes, now being proliferated in many Nigerian tertiary institutions, can be evaluated for possible accreditation. The critique shows that some courses are highly under-weighted e.g. "Aquatic Flora and fauna" as a 2 credit unit. There is a high degree of overlap between courses. Some are not clearly and sharply delineated, defined or described. Staff needs are not defined or described. Staff needs are not defined in terms of core course areas of specialization. Limnology & Oceanography have their descriptions restricted to physico – chemical features and not viewed in the desired comparative perspective. Suggestions are made on a wider listing of equipment, field laboratory, and library need to sharpen the NUC guideline. A review committee is recommended.

LECTURE OUT LINE

1. Introduction**:** Technical definitions of fisheries science ***sensu lato*** and its two pronged attack capture & aquaculture fisheries differentiated.

2. Fisheries & Aquaculture curricula for undergraduate programmes: Evaluation of courses under NUC's Benchmark Minimum Academic Standards from 1st to 5th year programme specification/guidelines.

3. Designation and Affiliation of the Fisheries Programmes

4. Academic staffing, qualifications and discipline/subdiscipline of specialization dispositions

5. Technical staffing
   (i) Field staff
   (ii) Laboratory staffing

6. Equipment, facilities and other needs ***vis-à-vis*** the courses adjudged core courses

7. Conclusions and recommendations

8. References

Introduction: One of the critical issues in the initiation, development and sustenance of any academic programmes at the primary, secondary or tertiary level of education is the articulation of the teaching curricula. The curricula must be predicated on the objectives, aims and targets of the programmes and the theoretical/practical skills / expertise or knowledge that the graduates are expected to acquire. Associated with the curricula are the requisite staffing (academic, field, laboratory and other technical support staff, equipment & other facilities, field transportation, library and ICT based information acquisition & retrieval facilities).

This paper examines the above within the context of the development of Fisheries as a scientific/agricultural academic discipline domiciled in dedicated departments in tertiary institutions at the undergraduate and postgraduate levels. This has arisen as a result of the current need for specialization to fast-track science and technology development in Nigeria instead of the earlier "jack-of-all trade" approach used in the first

and second generation Nigerian Universities. For example, most of these universities offered Fisheries and related hydrobiology/oceanography as one or two courses at the final year of Zoology, Biology or General Agriculture undergraduate programmes.

An NUC document titled Approved minimum academic standards comments as follows with respect to fisheries – "*Some form of training in fisheries takes place in many Nigerian universities in the Departments of Biology, Marine Biology or Forestry & Wildlife. It is only in the few cases such as in the Rivers State University of Science & Technology, Port Harcourt and in the University of Benin that the training of fisheries graduates is provided in a proper Fisheries department in the Faculty of Agriculture & Wildlife. In a few universities, Fisheries programmes offer introductory courses in Agriculture, fish ecology, fish population dynamics and marine biology to students who are not taking a degree in Fisheries in the Faculty of Agriculture while students pursuing a degree programme in Fisheries are exposed to a wide range of courses in areas such as Fish Ecology, Ichthyology, Limnology, Oceanography, Fish diseases, Fish nutrition, Fish gear technology, Fish production, Fish engineering (aquaculture engineering presumably, my addition↓),etc*". To achieve the task posed in this paper, the NUC's benchmark guideline would be the focus of the analysis and discussions with references where necessary, on the curricula in some local and foreign universities. For justice to be done to this title, an appreciation of the Science of Fisheries has to be made so as to properly situate this contribution.

2. Fisheries as a discipline of applied biology or applied zoology or applied animal biology. Nwadiaro (2009) tried to articulate views on this issue with a position which is reiterated or restated hereunder:
"*Contrary to the understanding of the non-fisheries scientific public, natural wildlife fisheries resources science is highly interactive and integrative of all components of the aquatic ecosystem and the complexity of the food chain. No component can be taken in isolation of the other as you focus on the fisheries. That explains why you must look into all the components, establish the database before you can produce the fish or conceive a development/production/management strategy".*

Fisheries and aquaculture are applied biological natural sciences concerned with the biology, production, population dynamics and management of fin fisheries, shellfisheries and other related aquatic animals used as food by man or even the exploitation of aquatic plants used by man such as algae and macrophytes. Fisheries domiciles its activities in natural water bodies – rivulets, rivers, streams, ponds, swamps, estuaries, coastal waters, inshore and offshore marine

ecosystems, oceans and lagoons, natural and floodplain lakes. Aquaculture's emphasis is on fisheries activities in man-made aquatic basins or fabrications. Fisheries uses and manipulates existing and developing knowledge of target exploitable fish species and their aquatic environment ***sensu lato*** to increase production (either in terms of biomass or number) and their catchability to man (fishermen) based on the effectiveness and technology of man's fishing gears. It follows that fisheries could be artisanal (subsistence low technology level), capture medium scale (motorized, dug-out canoe-based fisheries) and industrial trawler – based offshore fisheries. The same scaling applies to aquaculture production wherein 1000, 10,000 and 100,000m^2 of pond surface basins refer to small scale (homestead), medium and commercial scale aquaculture ventures respectively. Fisheries and aquaculture are very multi-disciplinary sciences – drawing on physics and chemistry and microbiology for water quality assessment of the medium of production, algae and aquatic plants (macrophytes) for the fish and fisheries primary production food and feeding stuff, secondary level producer foods (either planktonic or benthic – zooplanktonic rotifers, micro & marco crustacean, fish eggs, detritus) and even tertiary producers such as fish fry, juveniles or fingerlings. These aspects constitute the hydrobiology, limnology or oceanography that is usually inevitable adjuncts of fisheries/aquaculture sciences, giving the broad scope of the discipline. In these, the fisheries scientist/manager, like his colleagues in crop agriculture, poultry, goatery, piggery, etc must, should and does concern himself with the diseases that can and do militate against his anticipated animal production to optimal and maximum realizable levels. These apply to both his wildlife capture fisheries and in particular, the aquaculture/fish farming systems. In the latter, ascertaining the type and quality of the feed to be used to grow and fatten his target cultural species is a major concern for which immense expertise is required.

In wildlife natural water fisheries, the knowledge of the taxonomic composition and population, dynamics of the fishable stock in the fisheries constitute a ***sine qua non*** for his fisheries management. Herein comes in fisheries statistics, model and methods for stock population estimates, definitions of catch efforts, organization of fishermen crews and their gears, dedication of landing sites for catches (temporally and spatially), routine data gathering and statistics. All in all, fisheries, not different from aquaculture is predicated on the basic sciences of the "fish" – taxonomy, biology, anatomy, morphology, ecology, ethnology, geography/distribution, breeding & genetics etc.

Designations and affiliations of fisheries degree programmes in Nigeria's tertiary institutions and universities in particular. There is a lot of disarray, disharmony and discord in the title or designation of Fisheries degree programmes in Nigeria's universities as shown by the following, to mention but a few and their subsumation in various departments:

(i) B. Sc Fisheries & Aquatic Resources Management – Michael Okpara University of Agriculture, Umudike, Abia State; Rivers State University of Science & Technology, Port Harcourt, Rivers State.

(ii) B. Agric. Tech. (Fisheries & Aquaculture Technology) – Federal University of Technology, Owerri, Imo State.

(iii) B. Sc (Fisheries) in the Department of Animal Science & Fisheries – University of Port Harcourt, Port Harcourt, Rivers State.

(iv) B. Agric. (Fisheries option) – University of Ado-Ekiti, Ado-Ekiti, Ekiti State; Joseph Ayo Babalola Univeristy, Ikeji-Arakeji, Osun State.

(v) B.Sc. Fisheries & Wildlife

(vi) B. Sc. Fisheries

(vii) B. Sc. Fisheries & Aquaculture

From the above, it appears that we are still treating Fisheries as an attachment to another discipline as it was during the days of the first and second generation Universities and their practices wherein it was a course in the Department of Zoology to be taken as a final year special area. This was and most probably still the case now in the Departments of Zoology, of the University of Nigeria, Nsukka and premier University of Ibadan. We are like going back and forth. Ibadan has however duplicated the fisheries programmes as Fisheries Management in their Faculty of Agriculture in the same way as the University of Port Harcourt is doing in their now Faculty of Agriculture and Department of Animal & Environmental Biology. We must not shy away from just a Department of Fisheries simplicita and should be reminded that the University of Washington, Seatle, U.S.A has a whole College of Fisheries established in the early 19^{th} century. Our attitude towards Fisheries as a degree programme derives from our narrow interpretation of the discipline. NUC must insist on just a B.Sc. Fisheries, no more, no less, with no such

attachment as Technology, Management or any other as these are embodied in the discipline.

Fisheries Curriculum, NUC's Minimum Benchmark Academic Standards, Courses & Weighting for the 1st to the 5th year of the programme as follows:

100 LEVELS

A.	**First Semester**	**Credits**
1.	Use of English	4
2.	Philosophy & Logic	2
3.	General Chemistry (Physical)	2
4.	Botany	2
5.	Zoology	2
6.	General Physics	2
7.	Mathematics	2
8.	Organic Chemistry I	2
	Sub -Total	18 credits

B.	**Second Semester**	**Credits**
9.	Nigerian People and Culture	2
10.	Social Sciences	2
11.	General Chemistry (inorganic)	2
12.	Organic Chemistry II	2
13.	Botany	2
14.	Zoology	2
15.	Mathematics	2
16.	Practical Physics	2
	Sub -Total	16 Credits

200 LEVELS

A.	**First Semester**	**Credits**	**L**	**P**
1.	Climatology and Biogeography	3	3	-
2.	General Agriculture	3	3	-
3.	Anatomy and Physiology of Farm Animals	2	1	1
4.	Crop Anatomy, Taxonomy and Physiology	2	1	1
5.	Principles of Soil Science	2	1	1
6.	Principles of Agricultural Economics	2	1	1
7.	Principles of Forestry (introduction to Forestry Resource Management)	2	2	-
	Sub – Total	16 Credits		

B.	**Second Semester**	**Credits**	**L**	**P**
8.	Principles of Animal Production	2	1	1

9.	Principles of Crop Production	2	1	1
10.	Principles of Food Science and Technology	2	1	1
11.	Introductory Agricultural Biochemistry	2	1	1
12.	Introduction to Computers	3	2	1
13.	Introduction to Fisheries and Wildlife	2	2	-
14.	Introduction to Home Economics	2	2	-
15.	Entrepreneurial Studies	2	2	-
	Sub – Total	17 Credits		

300 LEVELS

A.	**First Semester**	**Credits**
1.	Fish Biology	2
2.	Ichthyology	2
3	Limnology	2
4	Fish Ecology	2
5.	Aquaculture	3
6.	Aquatic Flora and Fauna or Hydro-Biology	2
7.	Fish Farming Techniques and Hatchery Management	3
	Sub-Total	16 Credits

B.	**Second Semester**	**Credits**
8.	Fish Nutrition	2
9	Fish Gear Technology	2
10	Fish Parasites and Diseases	2
11	Elementary Seamanship and Navigation	2
12.	Oceanography	2
13.	Agricultural Bio-Chemistry	2
14.	Fish Pond Construction and Management	2
15	Fish Adaptation and Physiology	2
	Sub-Total	16 Credits

400 LEVELS

		Credits
1.	Fish Gear Use, Design, Production And maintenance	3
2.	Fish Processing, Preservation Marketing	3
3.	Fish Production, Management Techniques and Accounting Practice	4
4.	Pond construction and Management	3
5	Fish Hatchery management, Fingerling and Fry Production	3
6.	Oceanography Techniques	3
7.	Aquatic environmental survey	2
8.	Fish Nutrition and Fish Food Technology	3

9.	Fisheries (aquaculture) Engineering	3
10	Report Writing	3
	Sub-Total	30 Credits

500 LEVELS

A.	**First Semester**	**Credits**	
1.	Fish Production and management	2	Core
2.	Production of other marine products	2	"
3.	Ornamental Fisheries and Aquaria Design	2	"
4.	Nigerian Feeds and Feeding Stuffs	2	"
5.	Fish Population Dynamics	2	"
6.	Fish Farming Engineering	2	"
7.	Administration and Programme Planning in Extension	2	"
8.	Seminar	2	"
	Sub-Total	16 Credits	

B.	**Second Semester**	**Credits**	
9.	Fishery Technology, Processing and Storage	2	Core
10.	Advanced Fish Nutrition	2	"
11.	Fishery Economics	2	"
12.	Water Quality Management and Population Control	2	"
13.	Farm Management and Fishery Business Management	2	"
14.	Fisheries Policy and Legislation	2	"
15.	Project	4	"
16	Electives	2	"
17.	Special Project	4	

Course descriptions from 300 levels to the 500 levels for a Fisheries B.Sc programme

First Semester:

1. Fish Biology (2 credits). The gross external and internal anatomy of a typical bony and a typical cartilaginous fish. The different types of anatomical systems and basic functions of such system of organs in the fish. Embryology and life history of a fish with special reference 1 hour of lectures and 2 laboratory hours.

2. Ichthyology (Systematic of Fish) (2 Credits). Principles of systematics. Taxonomy and detailed study of principal commercial species of Nigerian fish; inland, estuarian and ocean, water invetebrates and reptiles identification of species using keys and monographs. Important

world species sardine, tuna, anchornveta etc. Biological attributes of fish populations. Phylogenetic relationships. 1 hour of lectures and 3 laboratory hours.

3. Limnology (2 Credits). Physical and chemical properties of both inland and sea water. Hydrology and water cycle, Properties of natural and man-made lakes. Thermal properties and stratification. 1 hour of lectures and 3 laboratory hours.

4. Fish Ecology (2 Credits). Ecology of fishes with special reference to distribution and natural history and application of this knowledge for fisheries management and obtaining maximum returns from fishery resources. Characteristics of the aquatic environment. Organic production in aquatic fauna and flora-algal blooms and eutrophication; plankton, and benthos, biomass assessment. Food and feeding habit of fish, food and habit of fish, food and habitat selection, population, niche concept. Food chains. Reproductive behaviour of and life cycles of some selected species. 1 hour of lectures and 3 hours of practicals/week.

5. Aquaculture (3 Credits). Aims and types of aquaculture. History, present organization and status of aquaculture in Nigeria. Principles of aquaculture – liming and pond fertilization; food supply; growth rate and food conversion; selection of culture species, introduction of exotic species and their implications. Water requirements. Stocking, feeding and harvesting practices. Fish farm design. Economics consideration of aquaculture. 2 hours of lectures and 3 hours of laboratory per week.

6. Aquatic Flora and Fauna (2 Credits). Study and identification of the characteristic flora and fauna of importance in the fresh water and coastal swamps of the tropics. The ecology, utilization and management of aquatic flora and fauna. Control of aquatic weeds in ponds – chemical, mechanical and biological. I hour of lectures and 3 hours of laboratory/week.

8. Fish Farming Techniques and Hatchery management (3 Credits). Artisanal and commercial fishing methods and importance in fishing boats, trawlers and gears – hooks, traps and nets – different types of fish culture techniques, monoculture, polyculture, selected breeding, intensive and extensive culture in inland and brackish water, in rice fields, in floating cages and rafts. Gear selectivity; electro fishing. Spawning methods; artificial fertilization; incubation, rearing, harvesting and transportation of fry and fingerlings. Selection and care of breeders; larvae and fingerlings. Control of weeds, parasites and diseases in the hatchery, control of ph

Second Semester

8. Fish Nutrition (2 Credits). Principles of fish nutrition. Chemistry and Nutritive value of various classes of fish food. Nutrient requirements of fish. Nutrient sources and practical considerations in fish feeding.

9. Fish Gear Technology (2 Credits). Study of types of gear and fishing craft. Properties of the materials used in the construction of fish gears. Construction of hooks, traps and nets. Assessment of efficiency of fishing gear. I hour of lectures and 3 hours of practials/week

10. Fish Parasites and Diseases (2 Credits). Identification, morphology, taxonomy, life history of fish parasites. The ecological and pathological effects of parasites and diseases of fish, Epidemiology of parasite populations in water body common bacterial, fungal and viral fish diseases and their control. Other enemies of fish. International restriction binding the transportation of fish across country boundaries. Fish ponds and public health, 1 hour of lectures and 3 hours practicals/week.

11. Elementary Seamanship and Navigation (2 Credits). Important sea terminology; parts of a boat, strength of win and state of sea. Coast lights and light vessels. Measurers for distance, depth, speed etc. Launching and boarding of small boats. Life saving and fire fighting equipment and methods. Swimming 1 hour of lectures and 3 hours of practicals/weeks.

12. Oceanography (2 Credits). Study of the temperature and chemistry of sea water, Biological activities and their distribution. Salinity, chlorinity, currents tides waves, sound and radiation in the sea, conductivity diffusion, viscosity and dynamics of sea water. Distribution and behaviour of plankton. Brackish water conditions and fauna. Interrelationship of an physiological adaptations of marine organisms. 1 hour of lectures and 3 hours of practicals/week.

13. Fish Pond construction and Management (2 Credits). Principles of fish pond construction. Preparation of ponds for stocking. Management of flora and water quality, Maintenance of ponds. Harvesting from ponds 1 hour of lectures and 3 hours of practicals/week

14. Fish Adaptation and Physiology (2 Credits). The different shapes and adaptive designs in fish in relation to the aquatic environment. Natural environmental adaptation of fish. Migration, reproduction, feeding

habits, salinity, temperatures and life cycles. Modified environmental behaviour of fish to pressure, light, electrical field and noise. 1 hour of lectures and 3 hours of practicals/week

500 Level Fisheries First Semester

1. Fish Production and Management (2 Credits). Practical aspects of handling and care of fish. Breeding of fish. Production of fingerling and fries; management of breeders; rowers and other types of fish and marine products; buildings and equipment needed in a fish far; procurement of feed and systems of feeding. Harvesting and marketing. Appraisal of management structure and effectives of fisheries management policies Preparation of management plan for fisheries project.

2. Production of other marine Products (2 Credits). Ecology, life histories of crustacean and aquatic mollusks, culture of shrimps, oysters; crabs, crayfish, lobster, cockles, periwinkles, marine gastropods, frogs, edible sea weeds and fresh water plants. Deep sea and shore farming of some products. Processing and preservation of marine products. 1 hour of lectures and 3 hours of practicals/wk.

3. Ornamental Fisheries and Aquaria Design (2 Credits). Ornamental Fish breeding, management and nutrition; design and maintenance of various aquaria.

4. Nigeria Feeds and Feedingstuffs (2 Credits). Classification of foods, feeding stuffs and feed supplements. An extensive coverage of the chemistry and nutritive values of succulent feeding stuffs, concentrate feeds (cereals and legumes). Chemistry and Nutritive values of some Nigerian grasses and legume species. Consideration of methods of their biological value evaluation.

5. Fish Population Dynamics (2 Credits). Fishing effort and catch per unit effort, Population estimation, age and growth; natality and mortality, Computation of yields from given recruitment. Stock assessment.

6. Fish Farming Engineering (2 Credits). General surveying, site selection: Fresh water and brackish water pond construction. Design and construction of dykes, sluice gates, drainage facilities, tanks, ponds, pens, cages, rafts and other types of fish rearing facilities, design of inland fish farms, pumping stations and fish hatcheries.

7. Administration and Programme Planning in Extension (2 Credits). Concepts, theories, principles and guideline of administration, organization, supervision as applied to extension; importance of

programme planning in extension, Principles and concepts of Programme planning in agricultural extension need, educative objective, learning experience, clientele participation, plan of work, calendar of work. The role of good public relations, good leadership and cooperation for agricultural extension programmes.

8. Seminar (2 Credits). Each student will be required to give a seminar in the final year and participate in all departmental seminars.

500 level Second Semester

9. Fishery Technology, Processing and Storage (2 Credits). Post harvest spoilage; principles and methods of preservation, packaging, storage, product evaluation and quality control Estimation of nutrients in fish flesh. Traditional versus modern preservation techniques.

10. Advanced Fish Nutrition (2 Credits). Advanced principles of fish nutrition. Requirements for energy, protein, vitamins and minerals, and non-nutrient components; feed computation and formulation methods; the fish feed industry; feed pelleting; fish feed habits; feed evaluation; practical considerations in fish feed. Feed formulation, feed mixing and manufacture of feed on commercials scale.

11. Fish Economics (2 Credits). Major economic constraints in fishery development; fee access fishery, sustainable yield curve and total revenue curve. Bionomic equilibrium, factor rents, welfare economic theory and its relevance for fisheries externalities in fisheries; capital investment and depreciation of equipment; consumer and consumption patterns; fishery resources and right of ownership.

12. Water Quality management and Pollution Control (2 Credits). Physical composition of water bodies water chemistry and nutrient cycles, sampling methods; management of selected marine, brackish and fresh waters. Chemical, mechanical, and biological methods for maintaining and improving water quality; biological, ecological characteristics of polluted waters; effect of pollution on fish planktons, benthic macro invertebrates, algae and water quality.

13. Farm Management and Fishery Business Management (2 Credits). Fish farm planning and organization; farm budgeting; farm growth, problems of organizing and managing fish farms under commercial and peasant systems. The scope of fishery business and management, types of business management; types of credit extended to fish farming; sources of credits and loans; marketing arrangement; fish farm record and accounting; financial management.

14. Fisheries Policy and Legislation (2 Credits). Fisheries Institution. Conservation strategies. Fisheries Policy and laws of Nigeria International laws, Law of the Sea.

15. Project (4 Credits). Each student is required to choose and execute a special project under a supervisor. Duration of the project is two semesters.

The following analysis and views on the Fisheries curriculum and courses as contained in the NUC guidelines are restricted to the 300 level courses as the 100 and 200 level courses are agreeably common to all programmes in the general agricultural training of all such graduates – Agricultural Economics, Agricultural Extension, Agricultural Engineering, (most usually domiciled in Faculties/Schools of Engineering, Animal Science, Crop Science, Fisheries, Food Science & Technology, Forestry & Wood Technology/Wifldlife, Soil Science Home Economics. There is undoubtedly the need for all students in Schools/Faculties of Agriculture to have a good grasp of all the aspects of agriculture at least at the introductory levels as displayed in the NUC document. The worry here is that most universities overtly overload the Mathematics/Statistics/Computer Science components of the first & second levels of the programme to as much as 15 – 19 credit units. It is a very demonstrable fact that most biology or applied biology/agriculture students have comparatively low mathematical aptitude/acumen and disposition. Most just barely scratch out a pass in the Mathematics to make up as a prerequisite for registration for the first year. Even some universities wave mathematics as a prerequisite for their admissions to Agriculture programmes. The consequence of such heavy credit loadings is that most of the students fail and continue to fail the courses from year 1 leading to very low grade point averages from the first session. The intimidating situation may and indeed pushes them to drop off, either by regulation or out of their own volition. This should be discouraged by NUC as agricultural experts have hardly become wonderful mathematicians or computer gurus.

The courses proposed from 300 levels to 500 levels are re-examined one after the other in terms of their content, appropriateness, degree of overlap ad weighting as follows:

(i) First Semester 300 Level Courses: NUC recommended the minimum list of courses as Fish Biology, Ichthyology, Limnology, Fish Ecology, Aquaculture, Aquatic Flora & Fauna (or Hydrobiology), and Fish farming techniques and hatchery management, all rated 2 credits with the last named course as 3 credits. The course descriptions given for Fish Biology/ Ichthyology, Fish and Fish Ecology are all strictly ichthyology fragmented into bits and pieces. Ichthyology is the science of finfishes ***sensu stricto*** as different from shell fishes. A good perusal of any standard/classic text book on Ichthyology such as Lagler ***et al*** (1979) shows that it concerns gross external and internal anatomy as the beginning to ichthyosystematics, taxonomy, phylogenetic

relationships, through reproduction, respiration, food & feeding strategies, nutrition, excretion, respiration, growth, migration, etc through ecology, adaptation and adaptive radiation. Selection of one of the above as an Ichthyology course to the exclusion of the others is rather misleading. Instead they should be referred to as Ichthyology 1, 11, 111, etc. since all concern the finfish. What is rather bizarre and a little upsetting is the absence of any reference to the critical shell fishes (crayfishes, prawns, oysters, lobsters, scallops, periwinkles, cockles etc) as if fisheries concern finfish only. Perhaps this is an error made covertly; an omission!

(ii) Limnology as a course is weighted low by the NUC guideline probably because it is described therein to mean physico-chemical studies of inland waters (and sea water!) to the exclusion of its biology. This disposition can be frowned at seriously as it is ostensibly a misrepresentation. The inclusion of seawaters here leaves one to wonder what then should Oceanography be concerned with. Associated with Limnology as described is course No. 12 (Oceanography) which is given its due and adequate coverage - physical, chemical and biological attributes (plankton, fauna and other marine organisms other than finfishes). The mix-up here has disposed some of us and this author is one to preach the use of a course titled Limnology & Oceanography so as unearth in our teaching, comparisons between inland waters and marine/estuarine waters (sea waters) and further subdivide them, for fear of overload in physico-chemical and biological Limnology/Oceanography courses.

(iii) The course "Aquatic Flora & Fauna (or Hydrobiology)": It is unfair and unjust to mount such a course, an omnibus course for undergraduates or even postgraduates. The course amounts to joint B.Sc degrees in Botany and Zoology rated 2 credit units. The NUC benchmark minimum standards describes this course as "*Study and identification of the characteristic flora and fauna of importance in the freshwaters, coastal swamps of the tropics, the ecology, utilization and management of aquatic flora & fauna, control of aquatic weeds, in ponds – chemical, and biology".* It is impossible to be agreeable to such a course when one browses through what constitutes aquatic flora and fauna and the book edited by Durand & Leveque (1981) titled ***"Flore et faune aquatique de l' Afrique Sahelo –Soundanienne".*** This author is translating to English for Anglophone African students of Fisheries and Aquatic Biology. The book referred to is a 2 – volume textbook, the type of which is virtually non-existent in English; 390 pages and 14 chapters in Volume I – on Algae, aquatic plants, protozoa, Coelenterates (Cnidaria), sponges, rotifers, turbellarians, Oligochaetes, Lophophores, molluses, branchiops, copepods, ostracods and decapods; each chapter by a different author. Volume II has 483 pages (pp 391 – 873), 21 additional chapters differently authored on insects (in general), glossary of key entomological terms, Collembola

Ephemeroptera(mayflies), Odonata (dragonfilies & damselflies), Plecoptera (stonefilies), Coleoptera (beetles), Neutropteid . Trichoptera (caddisflies), Diptera (Flies), Culicidae (mosquitoes), Chironomidae (bloodwarms) Tabanidae (tabanids) ceratopogonidae, Simulidae (blackflies), Heteroptera (bugs), Fishes, Amphibia (frogs), Reptiles (lizards & snakes), Aves(birds) and Mammalia(mammals). Sixteen chapters are devoted to aquatic insects alone!!

The essence of giving the above details on the book referred to above, is to demonstrate the immense scope of the course titled "***Aquatic Flora and Fauna"***, its wide spread and obviously non-achievatability as a course with 2 credits units. It is highly unrealizable, unfair and untenable. That is not to say that it should be dismounted. Indeed, it is a must for fisheries graduates and scientist but it is a very good candidate for dismemberment into more feasible courses or group of courses such as:

i. Algae & Aquatic macrophytes (Primary producers)
ii. Aquatic microinvertebrates (protozoa, sponges rotifers, branchiopods, copepods & ostracods
iii. Aquatic macroinvertebrates (Lophophores, Cnidaria, Mollusca, Decapoda and Insects).
iv. Aquatic Vertebrates.

Each of these should be either a 2 credit unit course or 3 units in cases of (i), (ii) and (iii). The courses are critical to the study of fish feeding electivity, growth and production ***in situ***. It is my firm position that instead of fisheries students being saddled with 12 – 20 credits units of mathematics/statistics/computer science most of which I seriously and honestly consider theoretical and irrelevant in terms of the envisioned training, these should be allocated to the group of the courses listed above.

(IV) **The Course No. 7 (Fish farming Techniques & Hatchery Management, 3 Credits) and course No. 9 (Fish Gear Technology, 2 Credits)**: There is significant mix-up and high degree of overlap in the NUC document's description of these two courses. To buttress this observation, the descriptions are quoted verbatim from the document's page 60 as follows:

"*Fish farming techniques and hatchery management: Artisanal and commercial fishing methods and importance of fishing boats, trawlers and gears – hooks, traps and nets, monoculture, polyculture, selected breeding, intensive and extensive culture in inland and brackish water, in rice fields, in floating cages and rafts, Gear selectivity, Electrofishing. Spawning methods, artificial fertilization, incubation, rearing, harvesting and transportation of fry and fingerlings. Selection and care of breeders, larvae and fingerlings. Control of weeds, parasites and diseases in the hatchery, control of physico-chemical properties of water".* The above paragraph is nothing but a huge mix – up, lines 1, 2 & 3 are topics for Gears and Gear technology. The rest are core issues for aquaculture/fish culture except gear selectivity and electrofishing.

(V) "**Fish Gear Technology: Studies of gear and fishing craft Properties of materials used in the construction of fish gears, construction of hooks, traps and nets. Assessment of fishing gears."**

Unarguably, the last sentences in the fish quoted course belongs here and so should be transferred into this fish gear course to enrich its description. The Chapter 2 in Bagenal, T. B. ed.(1978) by Lagler(1978) – "Capture, sampling and examination of fishes" and the text written by Reed ***et al***.(1967) serve as good references for a more enriched description of a course on Gear technologies.

(VI) **Fish Production and Management**: The NUC document classified this as a 500 level course No. 1. As described herein, it is a fish culture course in content but brings other course topics such as "appraisal of management structure and effectiveness of fisheries management policies, preparation of management plan for fisheries projects" Are these on legislative aspects of fish culture systems and associated feasibility reports of fish culture projects. The content and description should be made less equivocative.

(VII) **Production Of Other Marine Products**: This is classed as a No. 2, 500 level core course whose content is recapitulated as follows: "***Ecology, life histories of crustacean and aquatic mollusks, culture of shrimps, oysters, crabs, crayfish, lobsters, cockles, periwinkles, marine gastropods, frogs, edible weed and freshwater plants. Deep sea and shore farming of some products. Processing and preservation of marine products".*** This course is apt, relevant and quite embracing of all the shellfishes and the other non-conventional exploitable aquatic food resources. The critic is however on the title which appears to restrict the shellfish fauna of use to marine ecosystems as if the freshwaters and estuaries can be excluded. It is suggested that the title be changed to "Shellfishes and other Aquatic Food Resources."

(VIII) **Administration and Programme Planning in Extension:** This course as described is synonymous with fisheries extension studies. In theory, principle and objectives, it could be better domiciled in their Department of Agricultural Extension which all universities have in their Faculties/Schools of Agriculture.

(IX) **Fish Economics:** This course as described is rather extraneous and can, as a suggestion, be subsumed in a course such as Fisheries Legislation and Capital inputs and Assessment in order to avoid proliferation of fisheries programme core courses. Some aspects included herein could be taken and offered from an Agricultural Economics Department where better trained faculty members are more readily and easily found.

(X) **Water Quality Management and Pollution Control** – a core Course No. 12 as per NUC Minimum Standards guideline: The content of this course is given as follows: "*Physical composition of water bodies; water chemistry and nutrient cycles, sampling methods, management of selected marine, brackish and freshwaters. Chemical, Mechanical and biological methods for maintaining and improving water quality, biological and ecological characteristics of polluted waters effects of pollution on fish (and supposedly shellfish) plankton, benthic macroinvertebrates, algae and water quality"* Scientifically speaking, this course is a repetition of several earlier enlisted courses such as Limnology Hydrobiology, Oceanography, Aquatic Flora and Fauna. A versatile and broadly trained aquatic sciences academics should and must subsume the issue of aquatic pollution/ control in his teaching of the courses described prior to this. For example when the physico-chemical features of waters are taught in Limnology and Oceanography, highlighting the baseline data and the levels above which the associated pollution can be alleged as Nwadiaro (2010) advocated. The same could be said of the appropriate pollution control via the water and wastewater treatment options to improve the water quality to legally acceptable levels. Fish species composition, phytoplankton, algae, zooplankton and benthic macro-invertebrate fauna have taxa which are good pollution indicators with established indices and these are well given by Hellawell (1978) and many other biological pollution works. From above, it can be deleted as it has earlier been taken care of.

(XI) **Farm Management and Fisheries Business Management** – a core course No. 13: This course as described concerns fish farm planning and organization, farm budgeting, farm growth, problems of organization and management of fish farms under commercial and peasant systems, scope of fisheries businesses and management, types of business management, types of credits extended to fish farming, sources of relevant credits and loans, marketing arrangement, fish farm record and accounting, and financial management. In most curricula on Agriculture training, this a common course taken by all the students in the School, irrespective of their departments as either an Agricultural Economics & Extension. Farm records and accounting have little specificities to warrant a specialized course for each programme. It could therefore be expunged without foregoing anything in the Fisheries Degree training.

From the critique of the core courses done above, the following suggestions could be made:

(i) The Courses 1, 2, 4, 8 totaling 8 credits should be renamed Ichthyology I, II, III, & IV with same credit weightings to be taken with the first two in the 1st semester and the other two in the 2nd semester

(ii) That the course No. 6 (Aquatic Flora and Fauna) be split into **FOUR**, 2 credit courses – Algae & aquatic macrophytes, Micro-invertebrates, Macro-invertebrates & Aquatic insects and Aquatic Vertebrates. These should be taken with the first two in the first semester and the last two in the second semester. This is the only way to do justice to the course. These should be better taken in the 400 levels of the Fisheries programme and if adequately taught, would cover up for the conspicuous absence of Shellfish and its fisheries in the curriculum. This would also serve as a good basis to collapse the course No. 2 of the 500 Level proposed – Production of other marine products. In any case segregating between freshwater, estuarine and marine ecosystems does not make for good teaching and course delivery. A comparative approach should be adopted. For example, students taught about algae should know what they are, their various taxonomic unit, their ecology, dominance pattern and environmental pollution indicator potential in freshwaters, estuarine and marine ecosystems, their economic importance, ecological & size classifications (phytoplankton, periphyton, etc).

(iii) Limnology & Oceanography should be taught as one 3 – 4 credit course to enhance comparability of thought for fresh, estuarine and marine waters. To adequately streamline the course and avoid overlap or padding, they could be restricted to physical, morphometric and chemical features. Is it not the same principles and methodologies with modifications here and there that is expoused in teaching - pH, conductivity, temperature/heat, content/thermal stratification, salinity, hardness, dissolved oxygen, BOD, COD, etc.

(iv) The course “Water quality management & Pollution Control should be removed as it can, with adequate weighting be covered more pungently in “Limnology & Oceanography” as advocated in (iii) above.

(v) The courses – “Administration and Programme Planning in Extension” and Fish Economics could be subsumed in appropriate courses in Agricultural Economics & Extension Departmetns and removed as core courses for fisheries students. This would make moreroom for a number of critical under – weighted core courses in the Fisheries programme in the NUC guideline.

14. **ACADEMIC STAFFING.** NUC Guideline here is concerned with the ratio of staff categories – Professors/Associate Professors (20%), Senior Lecturers (25%), Lecturers I & II/Assistant Lecturers (55%), their qualifications and teaching / research experiences. This review is concerned here with the type of the Bachelors, Masters & Ph. D degrees, areas of specialization, areas of cumulative research experience, publications and exposure or inclination. NUC has to continue its guide lining to extend beyond what it has now. It has to define the core courses and ensure that the programme has for every

core course at least, one specialist with at least a Master degree, be he an Assistant Lecturer, Lecturer I or II, Senior Lecturer, Reader or Professor. Any deficiency in such staff disposition/spread, could be remedied by use of contract or adjunct staff or part – time lecturers. This is generally what it should be but it is much more essential for a Fisheries programme than for many others. The multi-disciplinary nature of Fisheries or Aquatic Science cannot be over emphasized.

Academic staff should be distributed to cover specialists in Ichthyology and Fisheries Biology, Capture Fisheris, Shellfish and Fisheries, Gears, Aquaculture, Hydrobiology/Limnology/Oceanography and Aquacultural Engineering. To have many Professors, Readers, Senior Lecturers, Lecturers I & II and Assistant Lecturers compliant with the 20, 25 & 55% NUC recommended ratios but all just in one or two areas of specialization makes effective teaching & research activity delivery unachievable. The situation would amount to a sort of academic in-breeding similar to having a programme faculty made up completely with alumni and alumnae of the same University that offers that programme. Nigeria's current Minister of Information and Communications, Professor Dora Nkem AKunyili, an eminent "lioness" of our great UNN (me, an eminent lion), alluded to and frowned at this scenario when she delivered the 39th Convocation Lecture of our great University of Nigeria, Nsukka on Thursday, 5th August, 2010 titled **"Re-Branding of Nigerian Universities"** (see the Nation newspaper edition of Monday, August 9, 2010 at pages 10 and 11). Whilst advising ***inter alia***, that universities should possess universal faculty, Akunyili opined that "the academic staff members of a university must be universal in qualifications and orientation. This because the name, "university" refers to the universality of knowledge and learning …… A universal faculty does not only refer to the mixture of people from different places but, and more importantly, lecturer trained at different places. The growing culture of universities filled with faculty of its alumni should be discouraged …..". I cannot agree more with Professor Akinyili on this, which is, within the context of this paper, relevant in general and with, particular reference to the versatility, diversity and universality of training, expertise, research and experience of the Faculty of Fisheries programmes.

15. **Senior Technical Support Staffing.** These are a vital team for effective teaching and research generally and this is more so for pure and applied sciences engineering, technology and medicine. The technical team synergizes the efforts of the academic staff for optimal service delivery to students. In my view, the ideal synergy between academic and technical support staff has hardly been achieved in our universities. The situation with the medical team approaches the ideal. The medical doctors, consultants, nurses, pharmacists' physiotherapists, radiographers, all have clearly defined roles which result in an ideal synergy for health care maximum delivery. The trainings are better defined than that of universities. Here, the technical teams are a little half-backed and mediocre. Often, they tend to be

treated or regard themselves as mere subordinates of the academic staff, and often are limited or even limit themselves to inferior qualifications. The NUC guideline lends credence to my view here since it regards a B.Sc or its near equivalence as the basis of appointment and progression, from Technologist II to the highest level of a Chief Technologist. This should not be so.

Again, the area for their training, specific academic programmes is often not defined, and so you can, as one has observed in some universities, B.Sc graduates in Food Science & Technology, Animal Science and Biology being employed as technologists or technical farm staff in such a specialized Department as Fisheries. Often, they had never had any opportunity to work with fish and are never required to have any relevant fisheries in-service formal training. Such staffs become dimities, irrelevant to the actual needs of the department, a burden to themselves and the fisheries department, with nothing specific to offer to the student or the lecturer. In this regard, I advocate a B.Sc/HND/FTC/AIST in Fisheries and or relevant on the job in-service training for progression and promotion.

4. **Critical teaching and research facilities for a Fishery programme**. The NUC guideline on minimal needs in terms of physical facilities – lecturer rooms, laboratory and office spaces are wonderful and must be vigorously aimed at but to be correlated with numbers of students' intake and staff size. The issue here is that the peculiarity of individual programmes must be meticulously identified and provided for in spite of the cost inspired provision of common Faculty/School facilities. In a School of Agriculture, the laboratory, field and equipment needs of Departments of Fisheries, Animal Science, Crop & Soil Sciences far surpasses those of the Departments of Agricultural Economics, Agricultural Extension & Rural Sociology and Forestry/Wildlife. Therefore, there should be more priority, attention and dedication in favour of the first group of departments. The needs of a Department of Fisheries can be divided into (a) those that can be used in common or shared with other students in the School/Faculty and (b) those that must be exclusive and dedicated as follows:

(a) Group that can be shared as listed by NUC overhead projectors, slide projectors, projection screens and other paudio-visual aids, weighing balances centrifuges, deep freezers, colorimeters and types of spectrophotometers including at least one functional flame photometer, one Atomic Absorption Spectrophotometer (AAS), incubators, oven, autoclaves, distillation units, water baths, ashing and digestive units, Autoanalysers, microscopes of various types, calculators and computers and

(b) Facilities that must be dedicated to a Department of Fisheries:

(i) 1 or 2 dedicated laboratories for Limnology/Oceanography/Ichthyology, etc
(ii) Fish Museum for local freshwater/marine fin & shellfish
(iii) Fish ponds (limitless numbers, earthen or concrete for teaching & research for academic staff 2nd, 3rd, 4th, & 5th, year students)
(iv) Diversity of fishing nets of various meshes and designs hooks & lines, trap of various designs
(v) Plankton nets of various meshes & designs
(vi) Fish pelleting machines
(vii) Demonstration trawher and nets
(viii) Water samplers of various designs
(ix) Aquatic macrophyte herbarium.
(x) Bottom sediment grabs & corers of various designs
(xi) Current meters
(xii) Echo sounders, Secchidiscs,
(xiii) Reversing thermometers
(xiv) A wide array of water analytic chemicals

(c) **Library:** A department of Fisheries library is a critically needed as any of he above. It has to store core course textbooks classical works, reference materials, back issues of a few journals & periodicals current journals placed under monthly subscription especially local journals. Classic references should include, ***inter alia,*** the works of Boulange (1900 – 1915) and Daget ***et al*** (1984 – 1986) checklist of freshwater fishes of Africa; Schneider (1990) and Ajayi & Tobor (1989) on marine finfishes and shellfish, Holthius (1950, 1980) and Bayagbona ***et al*** (1971) on crustacean (1970) Abowei ***et al*** (2006) shellfishes of the world, tropical West Africa and Nigeria.

Conclusions. For better and practical programme audit and accreditation visitation by the NUC, some aspects of the guideline must be made more stringent and pungent as this critique found for the curricula, staffing, equipment, library and field needs. Some courses overlap with other and need to be more strictly defined. There is need for NUC to re-examine the issues discussed above via setting up an adhoc committee of experts and stakeholders in Fisheries & Aquatic sciences. The curriculum leans more on finfishes, virtually excluding the shellfishes.

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