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P.O. Box 1390, Skulagata 4
120 Reykjavik, Iceland
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A COURSE IN FISHING GEAR TECHNOLOGY

Mathews Emmanuel Chirwa
Fishing Technology Department
Malawi College of Fisheries
Private Bag 7
Mangochi
Malawi

Supervisors
Larus Palmason, Sudurnes Comprehensive College
larus@fss.is
and
Gudbjorg Palsdottir, Teacher College of Iceland
gudbjorg@ismennt.is

ABSTRACT

The objective of the project is to develop a syllabus documenting training materials that are relevant to the fisheries sector in Malawi. It will be used hand in hand with a trainer's guide. It is a guide to the learning objectives that need to be delivered along with the suggested assessment methods. The content of this syllabus deals with the fundamentals of designing, constructing, and assembling fishing gears, fishing gear materials and accessories, rope work, net repair, principles of operation of fishing gears, classification of fishing gears, net braiding, interpretation of fishing gear schematic diagrams and/ or plans, efficiency and selectivity of fishing gears and the electronic aids to fishing. It also covers students' assessment and evaluation, course evaluation, lesson planning, schemes and records of work, and resources. The resource has been developed at the United Nations University (Iceland) in consultation with supervisors and fellows in the speciality of Fishing Technology. To a larger extent, information gathering has been through literature reading, the print media, lecture notes and personal experience in the field of Fishing Gear Technology accumulated over the years. The resource will bring about change of attitudes in participants, develop skills and reduce the knowledge gap in the field of fishing gear technology.

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1 INTRODUCTION

1.1 A brief overview of the role of the fisheries sector in Sub-Saharan Africa

Sub-Saharan Africa has immense inland waters covering a total of 520,000 km^2 of which large lakes occupy 41%, river floodplains occupy 34% and larger reservoirs occupy 8%. However, the area of standing waters that form small reservoirs and particularly those, which are used for communal purposes, remain unknown in many countries of the Sub-Saharan Africa region. The region has 35,000 km of main river channels.

The fresh water fisheries in Sub-Saharan Africa are dominated by artisanal fisheries. The sector plays an important role in providing food and employment to the rural populace and it is significantly important in contributing to foreign exchange.

Sub- Saharan Africa has a greater demand for training, however, opportunities for training are limited by the availability of only a small number of training institutions. Opportunities for high-level training do exist in local universities but in most cases individuals have to pursue training abroad. Technical institutions in the region have been established to provide an opportunity for training in general fisheries administration and in some specific areas of specialisation. Generally speaking, reliance is placed on gaining knowledge and skills by on-the-job training.

Short-term or tailor made courses in Sub-Saharan Africa are effective in addressing training needs of small and specialised groups and as such the nature of training is demand driven. A vivid example is that of Senegal and Ghana in West Africa where traditional structures in co-management systems play an important role in fisheries.

1.1 The role of the fisheries sector in Malawi

Malawi, a country in Sub-Saharan Africa, situated in southern Africa east of Zambia, covers a total area of 118,480 km^2 of which 96,080 km^2 is land and 24,400 km^2 is water (Malawi: Geography). The Great Rift Valley traverses from north to south. In this deep trough lies Lake Malawi, the third largest lake in Africa and largest in Malawi. Lake Malawi is not only the largest but is also the most significant water body in terms of fish production. The other lakes (Lake Chilwa, Lake Malombe, Lake Chiuta and the Lower Shire Valley) contribute varying amounts to the total production but are all of high local importance.

However, per capita consumption of fish is declining as the human population in Malawi is growing at a rate of 2.0% per annum whereas the potential for increased fish production from the natural waters of Malawi is limited.

Fish provides a major source of protein supply, estimated at approximately 70% of animal protein and the total protein intake for the majority of the rural poor. Fish also

provides essential minerals and vitamins. It is available throughout the year, is accessible to the vast majority of the people, is available in times of drought and remains largely within the purchasing power of the majority of the population. Fish guarantees a nutritionally balanced diet to a population suffering from high levels of malnutrition. The fisheries sector provides employment to over 200,000 people and supports about 14% of the Malawi population which resides along the lakeshores of Lake Malawi through fishing, processing, marketing, fishing gear construction, boat building and other ancillary activities. While the potential importance of fisheries resources in meeting food security and nutritional needs is apparent, so are the inevitable pressures that will be exerted on these resources as Malawi's human population increases (Fisheries Department 2001).

1.2 Suppliers of fishing gear materials

The fisheries sector in Malawi depends on two private companies as the only providers of fishing gear materials.

The twines and netting provided by one of the companies are mainly of twisted multi-filament polyamide-PA (nylon). These materials to a larger extent are utilised by the artisanal fisheries. The company also provides the fisheries sector with polypropylene ropes that come in different diameters depending on need and cork floats for use in gill nets, beach seines and open water seines.

However, fishing gear materials and netting are purchased from local dealers who obtain the materials and netting from neighbouring Tanzania. There are two main reasons why artisanal fishers purchase from local dealers. The first is the fact that there is a problem in distributing the products after manufacture from the factory to the respective areas where fishing activities are being carried out. The result of this is that few products are delivered in the fishing areas hence making it insufficient for the sector. The second is due to the difference in price whereby, fishermen prefer to buy the netting materials and accessories which are supplied by the local dealers because they are cheaper.

In contrast, commercial fisheries utilise netting materials supplied by the other of the two companies. These products are imported from the United Kingdom. In this case the netting materials and twines are of twisted multi-filament polyethylene (PE).

1.3 Fishing gear design, construction and assembly

As highlighted above the role of the two companies is simply to supply the fisheries sector with raw materials and not to design, construct and assemble the fishing gears.

The fishing gears that are being used by many fishing operators with exception to those owned by a private company fishing on a commercial basis and the Fisheries Research Unit, are designed, constructed and assembled by the indigenous Malawians who have the technical know-how. These individuals were trained in design,

construction and assembly of fishing gears particularly trawl nets from the Fisheries Training Institute in the 1970s. However, since the 1970s to-date, no formal training has been conducted for the net makers in the fisheries sector. The Fisheries Training Institute has now been upgraded and is called Malawi College of Fisheries. The sector's goal in training is to develop capacity, knowledge and skills by providing appropriate training programmes for the Department of Fisheries and the user communities in Malawi and in the SADC region. For the purposes of this report, only two of the objectives in achieving this goal will be considered, namely:

1) To develop and provide a broad range of demand-driven courses for the fisheries, co-management and aquaculture to support user communities by identifying training needs and then conducting short term courses (Fisheries Department 2001); and
2) To ensure appropriate knowledge and attitudes for fisheries personnel by conducting in-service and pre-service courses amongst several others (Fisheries Department 2001).

In view of these objectives, a syllabus that is generic for the fisheries sector in Malawi is necessary. The syllabus will be used by both the Malawi Marine Training College and Malawi College of Fisheries. The Malawi Marine Training College is currently training fishing cadets particularly in the Master Fisherman's course needs this information because currently it does not have a syllabus in Fishing Gear Technology to make the course complete. The Malawi College of Fisheries will use the syllabus to train field staff on the "in-service programme." The current syllabus is not that detailed to enable the graduates to have a wider knowledge, which in turn can be communicated to the fishing communities.

2 SYLLABUS

2.1 The objective of syllabus development

The objective of the project is to develop a resource (syllabus) documenting the fishing gear design, construction and assembly, fishing gear materials and accessories, the principle of operating the fishing gears, the efficiency and selectivity of fishing gears, the electronic aids to fishing, and the interpretation of the fishing gear schematic diagrams and/or plans for the fisheries sector in Malawi through collecting, organising and synthesising relevant training materials.

The syllabus aims to provide the most effective preparation for the students so that they are competent enough in the field of Fishing Gear Technology to enable them to meet their job responsibilities. It has been designed to provide appropriate knowledge and practical skills thereby, enhancing their full participation in the sustainable fisheries resource management programmes.

2.2 Target groups

The syllabus has been designed for a course, which is to run for one year and is intended for fishing cadets currently operating fishing vessels, which are in the range of 14 to 20 metres in length. It is also intended for the Fisheries Assistants currently working in the fields of research, extension and fisheries inspectorate.

The intention is that the resource should provide generic information for the fisheries sector in Malawi (Secretariat of the Pacific Community, Government of Taiwan (ROC). In view of this, the syllabus will also be used for short term courses and/or tailor made courses. An example would be a course for net makers who are able to read and write English.

2.3 General objectives

The students on completion of the course should be able to::

i) Identify appropriate materials required to construct and maintain fishing gears.

ii) Specify the details required to order fishing gear materials, fishing equipment and fishing gear accessories.

iii) Describe net repairing methods in relation to the degree of the tear.

iv) Calculate mathematical problems involved in the design and construction of fishing gears.

v) Describe how fishing gears currently in use in Malawi operate.

vi) Classify the fishing gears used in Lake Malawi.

vii) Distinguish different knots that are used in the fishing industry and their application.

viii) Justify the use and importance of fish finding equipment on board fishing vessels.
ix) Describe the procedures that are followed in designing, drawing and constructing fishing gears.

x) Select appropriate fishing gear materials for the various fishing gears.

xi) Analyse the factors that would influence the design and\or the selection of fishing gears and fish catching methods.

xii) Prepare and assess a fishing trip.

xiii) Apply the general theory of design and construction of fishing gears to most of the fishing gear designs and construction.
xiv) Assess the impact of fishing gears on the ecosystem.

xv) Identify fishing gears in use in the water bodies of Malawi.

2.4 Content of the syllabus

The contents of this syllabus have been divided into three major areas namely;

a) Fishing Gear Materials and Accessories

b) Fishing Gears

c) Fishing Methods

A. FISHING GEAR MAETERIALS AND ACCESSORIES

Fishing gear materials
- Natural fibres
- Synthetic fibres
- Selection and purchase of fishing gear materials
- Care and handling of materials, nets and ropes
- Construction of twines and ropes
- Properties and characteristics of fishing gear materials
- Numbering systems of twines and ropes
- Quantity and weight estimation of materials

Fishing gear accessories
- Type of accessories
- Use of accessories
- Characteristics of floats and selection criteria
- Ordering of equipment and accessories
- Trawl door selection criteria and practical considerations

Ropes and rope work
- Knots and splices
- Hitches, bends, knots, splices and whipping
- Splicing technique

B. FISHING GEARS
- Fishing gear design, construction and assembly
- Interpretation of trawl diagrams
- Net braiding
    - Materials and equipment
    - Use of clove hitch, sheet bend and double sheet bend
    - Half meshes and meshes
    - The braiding process
    - Bating and creasing
    - Forming selvedge in a webbing

- Net mending
  - Cutting and trimming small and large holes/Cleaning the tear
  - Braiding, patching and cobbling
  - Mending tools and their use

C. FISHING METHODS

Factors that influence choice of fishing gears and fishing methods
- A market for the product
  - Biological factors
  - Fisheries legislation
  - Fishing port and support facilities
  - Fishing vessel
  - Environmental factors

Classification of fishing gears
- Towed or dragged fishing gears
- Static fishing gears
- Encircling fishing gears
- Other mobile fishing gears

Fishing gear selectivity
- Definition of selectivity
- Factors affecting selectivity
  - Fishing gear parameters
  - Parameters related to fish
  - Parameters related to vessel

Principle use of fishing gears
- Trawling
- Gill netting
- Long lining
- Beach seining
- Kauni fishery (fishing with light)
- Open water seining using chirimila

Electronic aids to fishing
- Echo sounder
- Sonar
- Net sounder

2.5 Resources

In the implementation stage, the syllabus will utilise a variety of resources. In order to successfully capture the objectives of this syllabus, participants should be exposed to hands on experience as they undergo the training. It is therefore, important to point out that efforts should be made to use real materials where necessary in order to ensure effective and efficient delivery of the topics that will be covered. In this regard, the following resources should be used:

Classroom
TV and video
Videotapes
Overhead projector
Models (Fishing gears, netting, twine ropes etc)
Fishing vessels
Fishing gears
Flip charts
Blackboard
Handouts etc.

2.6 Teaching methods

The teaching methods that will be employed in this course are based on a book by Fisher and Muirhead (2001). In teaching the contents of this syllabus, several methods will be employed depending on the topics that are being covered for the participants to gain maximum benefits from the set objectives. The teaching methods will include the following: individual study, group work, lectures, practical work, demonstrations and visits

2.6.1 Individual study

Students should be allowed to continue working in their own time after the end of the regulation time however; tasks that have been given need to be pre-defined. The pre-defined tasks should include assignments, small projects such as net braiding and should encourage individuals to work independently. Progress should be monitored regularly.

2.6.2 Group work

This method of teaching encourages students to interact as they discuss pre-defined or perform tasks that have been assigned to them. It is advantageous especially working in smaller groups because it improves self-understanding and the understanding of others. It is important that in formulating the tasks, the students know their role, the expected outcomes and that contributing ideas or commenting is not an offence to the group members and the trainer. It is therefore, proper to engage students in small tasks such as net braiding and group work during lectures.

2.6.3 Demonstration

It is of great importance that a trainer should demonstrate or perform a skill e.g. gill net mounting by half. After observing the demonstration, students should take turns demonstrating and performing the same skill. Teaching and learning aids such as pictures with step-by-step instructions on a skill being performed can be used. This process has to be repeated and it should be supplemented with written instructions.

2.6.4 Practical work

It is always the case that we learn more by doing. Practical lessons in this course should therefore, be emphasised if real competency is to be achieved. Practical work develops manual and applied skills, problem solving skills and improves understanding of concepts. As it is the case with other methods, the aims and objectives for practical work should be quite clear to the students.

2.6.5 Lecture

In most cases, in most lessons, especially those that are practical in nature, the lecture method should be used to introduce a concept or a task. However, in situations whereby the lesson is more based on theory students' interaction in the lecture should be encouraged to avoid boredom. In this context, some lectures (depending on the topic), should be accompanied by the use of question and answer sessions, pictures, demonstrations, and video.

2.6.6 Visits

To complement classroom activities, visits for the students should be arranged. A clear aim and objective of the visit needs to be set in order to give the students an overview of what they need to do or know from the visit. These objectives should be given to students a day or two prior to the departure date or time. As a measure of whether any learning took place on a visit, students should be required to submit written reports of the visit individually or as groups as part of assessment. The need for them to write a report should be communicated prior to the visit.

2.7 Assessment and evaluation of students

It should be noted here that the essence of carrying out an assessment and evaluation exercise is simply to find out the extent of students´ knowledge on the subject matter and as a measure of the degree of learning that has taken place (Fisher and Muirhead 2001). The assessment of this course will serve three purposes which are; motivation, grading, and provision of feedback to both students and teachers.

Being practical in nature, students will be required to both demonstrate and apply skills and describe the fundamentals of fishing gear materials and accessories, fishing gears and fishing methods depending on the topics that will be covered hence the assessment of the subject will be based on:

Practical examination;

Written examination; and

Assignments.

A grade in an assignment, written examination and practical examination, will contribute 20%, 40%, and 40% respectively to the final grade (100%) in a term. Since it is a continuous type of assessment, a grade in the first term will positively or negatively affect a grade in the second term and the grade in the second term will positively or negatively affect a grade in the third term. The grade in the first term will be added up to the grade in the second term and the average of the two grades will be the final grade for the second term and so on.

At the end of an assignment, mid-term test, end of term examination and the end of the course in general, students will be given grades a reflection of what has been achieved therefore, letters A, B, C, D and E will denote passes with distinction, credit, pass, marginal pass and fail respectively. In addition passes with distinction, credit, pass, marginal pass and fail, will be represented by a range of numbers (see Table 1).

Table 1: Grading system

Distinction	Credit (B)	Pass	Marginal	Fail (E)

(A)		(C)	Pass (D)	
80-100	70- 79	60- 69	50-59	00-49

2.7.1 Assessment criteria

Evidence of students' ability to complete or partly complete a task that has been assigned will attract points. The points will be awarded for every description made or step that has been laid down towards the completion of such a task(s). They will be awarded in this order; 5, 4, 3, 2, and 1 respectively denoting distinction or grade A, credit or grade B, pass or grade C, marginal pass or grade D, and fail or grade E respectively. In awarding these points, consideration will be given to the content, organisation, presentation of facts, and level of demonstration of skills amongst several other factors. The points are indicators of how much work has been done and how thorough it has been (Table 2).

Table 2: Assessment criteria

STUDENT TASK	GRADE A	GRADE B	GRADE C	GRADE D	GRADE E
Net Braiding (Practical)	Evidence of finished and correct work with very few mistakes	Evidence of a student's ability to learn with few mistakes	Evidence of a student's ability to learn with many mistakes.	Evidence of a student's insignificant ability.	Evidence of a student being incompetent

The students' assessment and evaluation methods suggested in this syllabus will go hand in hand with the learning objectives that have been set in the guide (see Appendix 1).

2.8 Trainer's guide

The trainer's guide has been designed to work hand in hand with the syllabus. It is a guide to the learning objectives that need to be delivered, along with the suggested assessment methods. It is to be used hand in hand with the suggested reference material listed in the Course Information of this Guide. It has therefore, been developed to assist trainers who will be teaching and assessing students at Malawi College of Fisheries in Fishing Gear Technology as part of the Fisheries Management Course and Master Fisherman Class 3 Course offered at Malawi Marine Training College (Secretariat of the Pacific Community, Government of Taiwan (ROC).

The Trainer's Guide, as is the case with the syllabus, is intended for fishing cadets currently operating fishing vessels, which are in the range of 14 to 20 metres in length. It is also intended for the fisheries assistants currently working for research, extension, and inspectorate.

The guide will also serve the purposes of short-term courses and tailor made courses, which can be mounted by the two institutions. An example would be a course for net makers who are able to read and write English.

2.8.1 Time allocation

The total time allocated for this course is 120 hours of which 60% is for practical lessons and 40% for theory lessons. 120 hours is equivalent to 40 weeks of lessons. These 40 weeks are composed of three terms, two terms of 14 weeks each and one term of 12 weeks (see Table 3).

Teaching will be three hours per week (three fifty minute lessons). This is in line with the total allocated time per term (see Table 4).

It should be noted that the guide does not show the time allocation for specific sub-topics. The reason for this is that there are variations in areas of emphasis between Malawi College of Fisheries and Malawi Marine Training College for which this resource has been developed.

Table 3: Time allocation

	Total credit 120 hours	Practical 72 hours (60%)	Theory 48 hours (40%)
Fishing gear materials and accessories - Natural and synthetic fibres - Fishing gear materials and accessories - Rope and rope work		25 hours	17 hours
Fishing gears - Fishing gear design, construction and assembly - Interpretation of fishing gear schematic diagrams and/or plans - Net repair/net mending - Net braiding		27 hours	15 hours
Fishing methods		20 hours	16 hours

- Factors that influence the choice of fishing gears and fishing methods - Classification of fishing gears - Principle of operation of fishing gears - Efficiency and selectivity of fishing gears - Electronic aids to fishing			
	120 hours	72 hours	48 hours

2.8.2 Schemes and records of work

It is necessary to plan what should be taught during the whole term. The planning in this respect takes into account the following: number of periods per week, work planned, work done, strategies or teaching methods, reference, remarks, week number and date and finally term and year. This information can be given in a table form or any other form (see Table 4). The columns in table 4 have the following headings:

2.8.2.1 Number of periods

This indicates the number of hours that should be used. For the purpose of this scheme, there are three, fifty-minute lessons per week. This is broken down from a total number of hours to be covered in one term.

2.8.2.2 Work planned

This indicates the work that has been planned to be covered on a weekly basis for a term.

2.8.2.3 Work done

This indicates work that has been done out of the work which was planned to be carried out. This section should be filled after finishing a lesson

2.8.2.4 Week number and date

This indicates the number of weeks of instruction per term and the dates within which planned activities are conducted.

2.8.2.5 Teaching methods

This indicates strategies or methods that will be employed in teaching the specific lessons.

2.8.2.6 Reference

This indicates books that are appropriate for the lessons. The books referenced should include pages from where specific information has been taken.

2.8.2.7 Remarks

This indicates what has been done and what has not been done. This part includes comments such as whether the lesson was clear or for any other reasons it was not properly delivered. In cases where there were problems in delivery, it should be indicated whether it is necessary to repeat the lesson or not.

Table 4: Schemes and records of work

No. of periods 3	Term : 1			In- Service : 2003/2004	
Week no. & date	Work planned	Methods/ Strategies	Reference	Work done	Remarks
1.1 Jan 5-9 (2 hours)	Net Braiding - materials and equipment - loops and meshes - knots	Lecture Demonstration Practice	Garner J. 1989, Net Work Exercises, 2nd ed. pp 11-26	- materials and equipment - loops and meshes - knots	Few students mastered the skills after a demonstration therefore, it requires to be repeated especially knots and meshes
(1 hour)	- Knots and meshes	Demonstration Practice	Garner J. 1989, Net Work Exercises, 2nd ed. pp 11-26	- Knots and meshes	Most of the students mastered the skills on knots and meshes however, the lesson will continue for the next two week
1.2 Jan 12-16	- Knots and meshes	Practice	Garner J. 1989, Net Work Exercises, 2nd ed.	- Knots and meshes	Observations show that mastering is not to the expected level

(2 hours)			pp 11-26		
(1 hour)	- Knots and meshes	Practice	Garner J. 1989, Net Work Exercises, 2nd ed. pp 11-26	- Knots and meshes	Skills mastered, two students still have problems in tying knots and forming uniform meshes
1.3 Jan 19-23 (2 hours)	- Knots and meshes	Practice	Garner J. 1989, Net Work Exercises, 2nd ed. pp 11-26	- Knots and meshes	Skills mastered - tying knots and forming uniform meshes

2.8.3 Lesson plan

In the process of developing this resource, it was felt important that implementers (trainers) should draw up a lesson plan based on the detailed syllabus and the objectives provided for in this guide when delivering lessons. In the guide references have been suggested however, when planning a lesson, other references may be included where necessary.

A lesson plan will act as a checklist or a guide to specific lessons that the trainer intends to teach the students. In this case therefore, it should comprise the following columns or areas:

2.8.3.1 Subject

This indicates the subject to be taught e.g. fishing gear technology.

2.8.3.2 Topic

This indicates the specific topic which will be taught e.g. net braiding.

2.8.3.3 Duration

This indicates the length of the lesson that has been prepared to be delivered to the participants of the course.

2.8.3.4 Aim

This indicates a generalised statement of the intended learning goals to be achieved by students or participants.

2.8.3.5 Objectives

This indicates the specific learning objectives to be achieved by the students or participants.

2.8.3.6 Introduction

This indicates that a lesson will be prepared with the bankground and knowledge of the participants taken into consideration. Therefore, with a proper introduction, the trainer will be able to decide where to start from i.e. what topics to cover during the lesson.

2.8.3.7 Lesson development

This indicates the methods that will be used in teaching the prepared lesson e.g. an explanation of the subject followed by a demonstration and then practice by participants or students.

2.8.3.8 Conclusion

This indicates how the lesson will finish. A trainer might choose to conclude or end the lesson by simply asking questions and getting feedback from the students. The trainer may also wish to give an assignment to the students or participants with specified tasks and objectives. The conclusion will be an important part of lesson planning as it is one way of assessing and evaluating both students and oneself. On

the part of the students, it is a way of getting feedback from students as to whether they have learned. On the part of the trainer, this part will give an opportunity to revisit the set objectives if learning did not take place. On the other hand, it will give the trainer some confidence in the objectives that were set if learning took place.

2.8.3.9 Teaching and learning aids

This indicates the teaching and learning aids that are intended to be used for a particular lesson. It is important for the trainer to select and use appropriate teaching and learning aids in order to make the lesson interesting hence drawing the attention and full participation of the students or participants.

2.8.3.10 Forward planning

This indicates what will be the next topic to be covered after the one that has been covered. If on the other hand, the trainer feels that the lesson needs to be continued or to be repeated it should be indicated in this column of the lesson plan. The trainer should indicate how much time will be spent introducing a topic, how much time will be spent on the development and how much time will be spent concluding a lesson e.g. 5 minutes, 90 minutes and 5 minutes respectively (see Table5).

Table 5: An example of a 100 minutes lesson

Subject: Fishing Gear Technology	
Topic: Net Braiding	
Duration: 100 minutes	
Aim: To impart skills and knowledge in making nets by hand	
Objectives: At the end of the lesson students should be able to: i) Tie sheet bend and clove hitches ii) Braid loops or half meshes and meshes iii) Braid uniform meshes	
Content of training session Introduction Students will be asked to explain how net webbings are made by hand Development - Explanation - Demonstration - Practice Conclusion Demonstration repeated	Timing 5 minutes 90 minutes 5 minutes
Teaching and learning aids: Netting needles, netting twine, knife, a string or a rope, gauge or spool	

Forward planning Net braiding (continuation)

2.9 Course evaluation

The Fishing Gear Technology Syllabus will be part and parcel of a Fisheries Management Course and a Master Fisherman Class 3 Course offered at Malawi College of Fisheries and Malawi Marine Training College respectively. In the course of its implementation it has to undergo an evaluation process as a means of getting feedback on its overall performance as stipulated by Fisher and Muirhead (2001) on course evaluation. The feedback which can be obtained through observation, interviews, and a questionnaire can be provided by sources but not limited to the following; the current students, the ex-students (graduates), the trainers, administrators of the institution, the employers of the graduates, local related institutions, the course (curriculum) documents and materials and the specific equipment and other resources

It is anticipated that a course having been designed and at a later stage implemented, will be effective in that it will purposely achieve the set objectives. However, to determine the effectiveness of a course, it is necessary that it should be evaluated. In evaluating this course therefore, consideration should be made to all aspects that make up this course which are; the aim, general objectives, teaching methods, content, assessment methods, specific learning objectives and/or assessment criteria. Usually the type of information that will be collected for an evaluation exercise and the methodology applied in collecting such information will have an impact on the final decision that will be taken on the worthiness of this course. In this respect therefore, it should be borne in mind that this exercise is costly in that it is time consuming and resource demanding hence, care should be exercised in selecting the methods. It is only appropriate that the aims and objectives of conducting the exercise highlighting what is intended to be achieved are explicitly clear. The results of an evaluation exercise will reflect an overall performance of this course as to whether it conforms to the standards of the Fisheries Management course or the Master Fisherman Course offered at Malawi College of Fisheries and Malawi Marine Training College respectively. In addition the results of this exercise will be used as a measure to determine an extent to which this course can undergo changes highlighting the specific areas that need to be changed.

According to Fisher and Muirhead (2001) three methods of evaluating a course or a unit of study exist namely; internal evaluation, external evaluation, and internal + external evaluation. In evaluating this course, the type of method to be used will largely depend on the level of evaluation. Evaluation of this course can be done by teaching members of staff and will be termed internal evaluation. Besides this, an external evaluation method can be used whereby, an individual with expertise in

course evaluation can be contracted out to carry out an evaluation exercise and make some recommendations on the findings. As has been indicated earlier on, internal and external evaluation methods can be combined as one way of evaluating this course. If the intention is to use this method then it would require that the teaching members of staff should be guided by an external evaluator.

Knowledge of an environment where a course will be conducted and participation of the course designers in the implementation process is essential in facilitating smooth and effective course implementation. However, for evaluation purposes, close involvement in this course and knowledge of the environment where a course is to be run, is not a guarantee that internal evaluation will achieve the best results. It is usually the case that internal evaluators are less objective while external evaluators are more objective and critical hence they are able to portray a true picture of what is on the ground.
Evaluation in general terms can be conducted to evaluate all the programmes which an institution is running e.g. the pre-service courses, in-service course and the user community courses (tailor made courses) to verify as to whether they are performing as required. On the other hand, it might be an intention to evaluate only the pre-service courses or only the first year pre-service course with particular interest in fishing gear technology and a trainer involved in the teaching of the subject.

3 CONCLUSION

The aim is that the resource should ensure provision of appropriate knowledge and bring change in attitudes in fisheries personnel through the provision of in-service courses and/or refresher courses. On the other hand it should ensure the provision of appropriate knowledge and change in attitudes in those who work in fishing vessels as master fishermen.

The resource should also assist in the formulation and provision of a broad range of demand driven courses thereby supporting the user communities e.g. net makers. The participants in this area are expected to improve skills in the design of fishing gears e.g. trawl nets which will be selective. In so doing, they will be indirectly participating in the fisheries management programmes that aim at maximising the fisheries resources.

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LIST OF REFERENCES

In developing this course, a wide range of literature has been used. This includes books and the print media (websites) however, Prado J.1990, has been the main resource in designing this course. The book contains information on materials and accessories, ordering of equipment, fishing gear and operations, equipment for deck and wheel house, formulae and tables for calculating various fishing gear designs. However, more detailed information on other areas for example fishing gear materials can also be found in a book by Klust G., 1989 and on fishing operations in a book by Sainsbury J. C. 1996.

Even though other publications have not been included as part of the resources that have been used to design this course, journals would similarly provide useful information. Information from these sources is also reliable and in most cases the most recent be it in technology or any other field of study.

The resources below are those that have been used in designing this course:

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Prado J.1987, Small Scale Catelogue of Fishing Gear Design. 2nd ed. 1 Long Garden Walk, Farnham, Surrey, England, Fishing News Books Ltd.

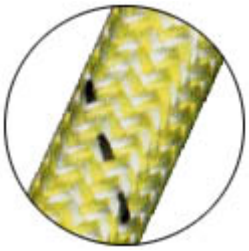
Prado J. 1990, Fisherman´s Work Book, Oxford, Fishing News Books Ltd

Sainsbury J. C. 1996, Commercial Fishing Methods 3rd ed. 1 Long Garden Walk, Farnham, Surrey, England, Fishing News Books Ltd.

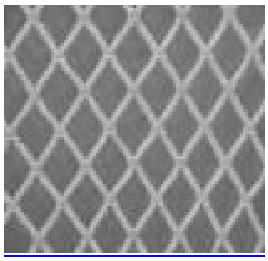
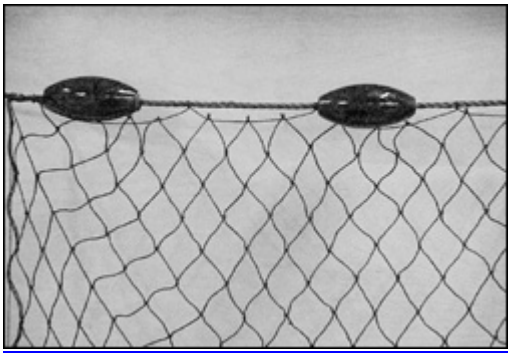
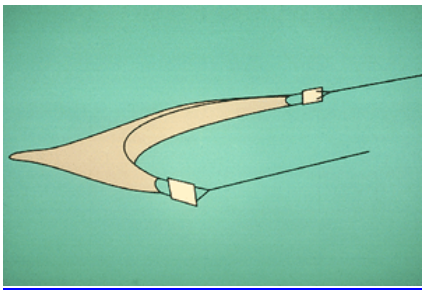
Secretariat of the Pacific Community, Government of Taiwan(ROC), Outboard Motors for the Pacific Island Mariners Trainer´s Guide (http://www.spc.org.nc/coastfish/Sections/training/PDF%20pour%20Site/OB%20Trainers%20Guide.pdf) (17.12.2003)

Sudurnesja Comprehensive School 2000, Fishing Gear Technology Syllabus for Net Makers Keflavik (Iceland), Sudurnesja Comprehensive School

APPENDIX 1 : LEARNING OBJECTIVES

Competency Unit	Learning Objectives Students should be able to:
Fishing Gear Material (Natural and synthetic fibre)  Dyneema Rope (Synthetic fibres)  Manila Rope (Natural fibre)	Distinguish the two main groups of fishing gear materials Distinguish between trade and chemical names Identify materials using the available tests (visual inspection, water and burning tests Define the following: - Safe working load (SWL) - Breaking load (BL) - Safety factor - Runnage - Titre (Denier) - Metric number - English cotton count (Nec) Describe rope and twine formation in terms of : - fibre, yarn, folded yarn, finished twine, - fibre, strand, rope - laid or twisted rope, braided rope, - direction of twist (Z and S twists) Describe the following characteristics of synthetic fibres:

	- Endurance in water - Resistance to weathering - Density - The melting point Describe the following properties of synthetic fibres: - Abrasion resistance - Elasticity - Knot breaking strength - Shrinkage - Extensibility - Mesh breaking strength - Knot stability - Toughness Describe the handling, care and maintenance of fishing gear materials Calculate weight of materials both in air and in fresh water Describe the effect of different materials on the buoyancy and the resistance of a fishing gear to be constructed

Ordering of Fishing Gear Materials and Accessories Webbing (netting) 	Specify: - The size, type of twine, and direction of twist - Mesh size - Intended use - Dimension of netting - Knots used
Gill net (mounted) 	Specify: - intended use or give a detailed drawing - mesh size and nature of twine - twine material and twine size - net height (MD) - number and types of floats and sinkers - colour of the net - hanging ratio and net mounted length
Trawl net (mounted) 	Specify: - intended use or give a detailed drawing - mesh size(s) - twine size and type - length of headline and footrope - nature, diameter and mounting of groundrope - cod-end (chafer or the double

	protection) - list of accessories to be supplied with the net
Twine in spool 	Specify: - trade name - size of twine and colour - breaking strength - quantity - formation
Warp  	Specify: - intended use and composition - length, diameter and breaking strength - direction of twist and preparation of ends
Floats  	Specify: - intended use - material and shape - size - quantity
Buoys	Specify: - intended use - desired buoyancy or volume in litres and

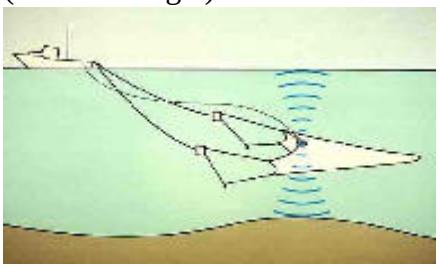
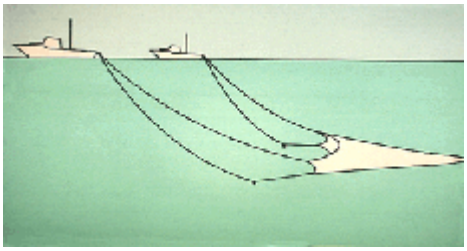
	- quantity
Trawl doors or Otterboards 	Specify: - type of board - power of trawler - length, heigh and weight of the board - quantity
Drum for net 	Specify: - intended use - desired winding speed - pulling power - capacity - source of power - means of power transmission
Winch 	Specify: - intended use - size of trawler and or tonnage and or power of - type of fishing - driving means: mechanical, hydraulic or electric - power or pull winding speed - monobloc or separate drums - capacity and power of main engine
Rope Work	

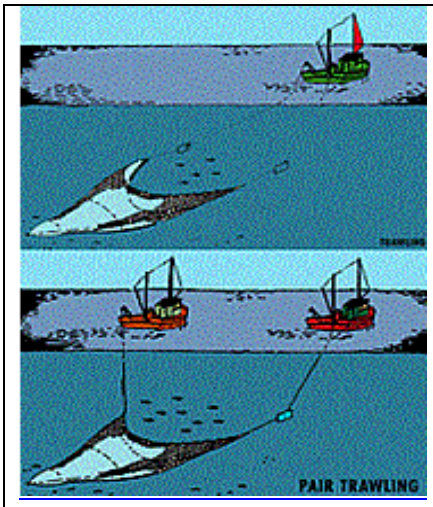
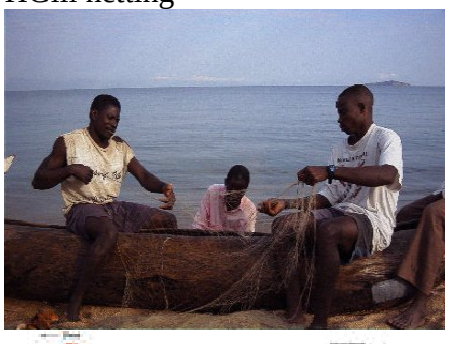
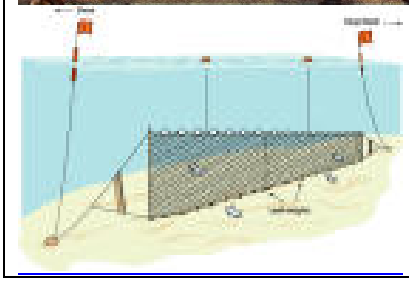
(Knots, splices and whipping) 	Identify commonly used knots and splices Demonstrate tying of knots, splices, and whipping Describe the characteristics and effectiveness of knots and splices State the splicig techniques and their application Describe the efficiency of knots, splices and whipping
The general theory of design and construction of fishing gears	Calculate: - Hanging ratios - Tapering ratios - Cutting rates - Twine surface area - Weight of netting Shape a webbing using the following cuts - AB , AP, T, P and B cuts Describe with examples - A mesh, bar, row, halfer, % hang in
Gill net construction	Define a gill net Identify materials for construction Define the meaning of hang in by half, two thirds, three quarter and quarter Select a hanging ratio appropriate for mounting of a gill net Differentiate between gill net

	mounting and gill net reeving State the type of knots to be used in the mounting process Describe the effect of hanging ratio on the catching efficiency of the gear Assess the effect of hanging ratio on the amount of fishing gear materials to be used Identify fishing gear accessories Describe the efficiency factors in gill nets Prepare a detailed gill net specification Calculate the floatation and sinking forces Calculate the mounted height and the mounted height as a % of the stretched height Calculate the twine surface area of a gill net Rig a gill net .
Trawl net design, construction and assembly 	Define a trawl net Identify parts of a trawl net Identify materials and accessories Differentiate between a two panel and a four panel trawl net Differentiate between a bottom trawl net and a mid-water trawl net Interpret the schematic trawl diagrams Estimate materials that would be required Calculate : - Hanging ratio - Cutting rates - Tapering ratio - Take-ups

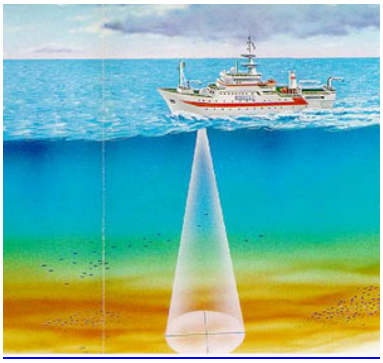
	- The area covered by netting - Weight of a trawl net - Bridle, sweep and fork lengths Use the scale to calculate: - Bar length - Half bar length - Points
H Drawing of a trawl net (manual and computer aided drawings)	Draw a 2 seam(panel) bottom trawl net using data from the calculations above Establish co-ordinates for computer aided drawings Calculate trawl net length using whole meshes and points
H Model making(2 panel or seam bottom trawl net)	Scale down the original trawl net using a scale 1:20 Select materials appropriate for a trawl net model Use the same cutting rate as on the original trawl net to taper the parts of the model Join the parts of the model using the same take-ups as that of the original trawl net Assemble or seam the lower section and the upper section of the trawl model
H Chirimila design and construction	Identify materials Identify the parts of the gear Select mesh sizes for the various parts of the fishing gear Calculate a hanging ratio appropriate for joining each part of the fishing gear State the type of knots to be used in the mounting process Describe the effect of hanging ratio on the catching efficiency of the gear Assess the effect of hanging ratio on the amount of fishing gear materials to be used Identify fishing gear accessories Calculate the take-ups for the various parts of the fishing gear Calculate the buoyancy and floatation

	forces Rig the fishing gear
H Beach Seine Net design, construction and assembly 	Identify materials Identify the parts of the gear Select mesh sizes for the various parts of the fishing gear Calculate a hanging ratio appropriate for joining each part of the fishing gear State the type of knots to be used in the mounting process Describe the effect of hanging ratio on the catching efficiency of the gear Assess the effect of hanging ratio on the amount of fishing gear materials to be used Identify fishing gear accessories Calculate the take-ups for the various parts of the fishing gear Calculate the buoyancy and floatation forces Rig the fishing gear
H Longline construction	Identify materials for the following: - main line - snoods - anchoring line Select the hook size in relation to the targeted species Select the required distance between the hooks Tie snoods to hooks and the main line Describe the main line, snoods, snood attachment, the hook and accessories
H Net braiding	Define net braiding Describe the instruments and their use Use the instruments Differentiate between a row and a mesh Differentiate between bating and creasing Calculate the bating and creasing of meshes Apply bating and creasing to a webbing that is being braided Demonstrate loop or half mesh,

	double sheet bend and sheet bend formation Select mesh size basing on the target species Braid a double selvedge in a webbing Differentiate a mesh from a selvedge
H Net mending or net repair 	Assess the degree of tear Identify materials and instruments to use Identify the run of knots Create a starting bar and an ending bar (three leggar) or a halfer Apply a method appropriate to the type of damage that has occurred Cut and trim the small and large tear Choose the appropriates knots Assess the importance of using twine of the same diameter
H Trawling (bottom and mid-water trawling (Pair and single)  Mid-water stern trawling  Midwater pair trawling Bottom - Stern trawling	Describe the effect of rigging and towing speed on: - vertical opening of a trawl net while fishing - Horizontal opening of a trawl net while fishing - Trawl net contact with the bottom (bottom trawls) while fishing - Trawl door or danleno contact with the bottom while fishing (bottom trawling) - Selectivity of the fishing gear Describe the behaviour of fish in the catching process Select a trawling speed suitable for the target species Describe the following steps in relation to a trawling operation: - Searching for fish - Setting the trawl net - Hauling the fishing gear - Handling the catch State the fisheries regulation in relation to both mid-water and bottom trawling in Lake Malawi Differentiate between bottom trawling and mid-water trawling

 Bottom – Pair trawling	State the use of equipment on board a trawling vessel Describe how to determine length of warp to pay out Effect of mesh size on trawl drag and fuel consumption of the fishing vessel Differentiate between pair and stern trawling State the zone of operation for trawl nets Distinguish between target species and by-catch
H Longlining 	State the principle of operation (setting and retrieving of the fishing gear) Describe feeding behaviour as a basis for fishing with baited gears Describe how fish locate the baited longline Describe the hooking process Describe how the hook size and the type of bait affect selectivity in longlining
HGill netting  	Define gill netting Describe the principle of operation of a gill net Describe the effect of mesh size and hanging ratio on the selectivity of the target species State the importance of twine diameter in gill netting fishery Describe how fish are caught in gill netting State the importance of colour of a mounted net in gill netting Differentiate between gilling and entangling State the fisheries regulation regarding gill netting

HBeach Seining 	Define beach seining Identify the target species in beach seining Describe the principle of operation for a beach seine State the fisheries regulation for beach seining Demonstrate beach seining Describe the effect of mesh size on the selectivity of a beach seine Describe the impact of beach seining on the marine ecosystem State the impact of beach seines on the bottom
HKauni fishery for usipa (Engraulicypris sardella) 	Describe the behaviour of the target species towards light Describe the principle of operation of the gear Describe the conditions favouring fishing with light Describe the light source that is employed during Kauni fishery
H Factors that influence the choice of fishing gears and fishing methods (Biological factors)	Describe the influence of the following on the choice of fishing gear and method: - size, shape, and habitat of fish species - fish reaction to gear, sound etc - feeding habits - fish swimming speed - breeding ground and habits
HThe fishing port and support facilities	- landing place(beach, dock) - fuel supplies - repair facilities - ice facilities - gear suppliers - transport and cold storage

HFisheries legislation	- closed seasons - net and mesh size regulations - closed areas
HEnvironmental factors	- sea/lake bed conditions - currents - turbidity - weather conditions - oxygen levels - thermocline - upwelling, - temperature
HThe fishing vessel	- type of hull - vessel size(length and breadth) - engine type and power - deck layout and deck machinery
H A market for the product	Internal market - analysis of supply and demand External market - analysis of supply and demand
H Electronic Aids to Fishing (Echo Sounder)  	Describe an echo sounder as a fish finding equipment Identify types of echo sounder Describe the principle of operation of an echo sounder Tell where to mount a transducer on the hull State how to remove and replace the echogram Interpret the signals as they come on the screen Identify the causes of noise State the depth range for different types State the type of display

Sonar	Identify the main components of sonar Identify the types of sonar Describe the principle of operation Interpret the displayed signals
Net sounder	describe the use of the net sounder identify the main components of a net sounder identify where to mount the transducer describe how to use control buttons on the control panel for various modes of functions interpret the displayed information on the screen identify different types of receivers

APPENDIX 2: EXAMPLES OF EXERCISES FOR STUDENTS

Task 1: Gill net mounting

Students working in groups will be asked to demonstrate knowledge and skills in mounting gill nets. Several netting with different mesh sizes will be given to the students and different hanging ratios will be applied to the nets.

STUDENT ACTIVITY	EVIDENCE OF DEMONSTRATION OF COMPETENCY AND KNOWLEDGE
Identify gill net accessories	Identification is correct
Select twine size appropriate for gill net mounting.	Twine size is appropriate
Demonstrate the difference between mounting and reeving.	Demonstration is correct
Calculate sinking and floatation forces	Values are collect
Select hanging ratio appropriate for the target species.	Hanging ratio appropriate
Apply the hanging ratio to the netting being mounted.	Application is correct
Apply knots appropriate for the mounting process.	Application is appropriate
Calculate mounted height and mounted height as a % of stretched height.	Values are correct
Calculate twine surface area of the net	Value is correct
Assess the effect of hanging ratios on the amount of netting used.	Assessment is correct
Rig the gill net.	Rigging is correct

Task 2: Net specification

Students should demonstrate knowledge in gill net specification. They will be provided with mounted gill nets which they have to work on in groups

STUDENT ACTIVITY	EVIDENCE OF DEMONSTRATION OF COMPETENCY AND KNOWLEDGE
Identify Netting material	
	Netting material correct
Mesh size	
	Mesh size correct
Identify twine diameter (size)	
	Twine diameter correct
Headrope and footrope material type, size, and construction	Material type, size and construction correct
Material type and shape of floats	
Material type and shape of sinkers	Material type and shape correct
	Material type and shape correct
Number of meshes per staple	
	Number of meshes correct
Number of floats and sinkers	
	Number of floats and sinkers correct
Colour of the net	
	Colour is correct
Count the number of floats and sinkers	
Measure Distance between staples	Distance is correct
	Distance is correct
Distance between floats/sinkers	
Calculate Hanging ratio	Value is correct
	Value is correct
Mounted height	
	Value is correct

Stretched length Draw a diagram showing net specification	Diagram is correct

Task 3: Distinguishing a two seam trawl net from a four seam trawl net/Bottom trawl net from mid-water trawl net.

Students should demonstrate knowledge in distinguishing a two seam bottom trawl net from a four seam trawl net or a bottom trawl net from a mid-water trawl net. They will be divided in groups so that at the end they will discuss their findings and the instructor will assist in concluding their findings.

STUDENT ACTIVITY	EVIDENCE OF DEMONSTRATION OF COMPETENCY AND KNOWLEDGE
Compare literature by the different authors on the same topic.	Comparison is correct

Compile a summary of the literature. Present the findings with demonstrations where appropriate. Report the findings , answer questions and give comments during discussion time.	Organisation and content are correct Explanation and demonstrations are correct. Feedback and comments are appropriate

Task 4: Net braiding/net making by hand

On an individual basis, students will be required to demonstrate knowledge and skills in making nets by hand. The instructor will monitor progress of the work being done.

STUDENT ACTIVITY	EVIDENCE OF DEMONSTRATION OF COMPETENCY AND KNOWLEDGE
Select twine size in relation to the intended purpose of the net being braided.	Twine size appropriate
Braid mesh sizes appropriate for the target species.	Uniformity consistent
Distinguish between knots which are used to form meshes and those that are used to form loops or half meshes.	Knots distinguished and consistent
Demonstrate the difference between a row and a mesh.	Demonstration is correct