UNDP/FAO Regional Project for
Inland Fisheries Planning,
Development and Management in
Eastern/Central/Southern Africa
RAF/87/099-TD/24/91 (En)

DENMARK FUNDS-IN-TRUST
FI : GCP/INT/392/DEN
Report on Activity N° 29

REPORT ON THE REGIONAL TRAINING COURSE ON FISH STOCK ASSESSMENT

Kariba, Zimbabwe
21 January – 15 February 1991

DANISH INTERNATIONAL DEVELOPMENT AGENCY
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
UNITED NATIONS DEVELOPMENT PROGRAMME

Bujumbura, 1991

This report was prepared during the course of the projects identified on the title page. The conclusions and recommendations given in the report are those considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project.

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Bujumbura, 1991

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TRAINING COURSE ON FISH STOCK ASSESSMENT
21 January-15 February 1991
KARIBA, ZIMBABWE

1. INTRODUCTION

This training course was organized by the FAO/UNDP Regional Project for Inland Fisheries Planning, Development and Management in Eastern/Central/Southern Africa (IFIP), RAF/87/099, based in Bujumbura and the FAO/DANIDA project Training in Fish Stock Assessment and Fishery Research Planning, GCP/INT/392/DEN, based at FAO, HQ, Rome. The Lake Kariba Fisheries Research Institute, Kariba, Zimbabwe, was the host institution.

The course was attended by 28 participants: 26 scientists from eleven countries in Eastern/Central/Southern Africa and two FAO associate professional officers. An expert from the NORAD/DANIDA Zambia/Zimbabwe SADCC project participated as observer. Nearly all participants originated from institutions directly involved in fish stock assessment and were assigned to tasks relating to stock assessment. Approximately two-thirds of the participants had several years of working experience in assessment-related work prior to the course.

Dr. Cecil Machena, Lake Kariba Fisheries Research Institute (LKFRI), Zimbabwe, was Course Director.

The lecturers were Poul Degnbol (Co-Director), Eskild Kirkegaard, Siebren Venema (21-26 January) and Erik Ursin (29 January-14 February).

Mr. George Ssentongo, Fisheries biologist of the IFIP project was responsible for disbursing and organizational matters, in close cooperation with the staff of LKFRI and the lecturers.

A list of participants and staff is attached as Annex 1. Funds for travel and subsistence allowance of participants were provided by the following organizations and projects:

Zambia/Zimbabwe SADCC Fisheries Project	3
European Economic Community	1
FAO Regional Office for Africa	1
MLW/86/013	3
MOZ/86/030	1
RWA/87/012	1
RAF/87/099	14
GCP/INT/392/DEN	2
APO funds	2

The main inputs of project GCP/INT/392/DEN consisted of the lecturing staff, lecture material, supplies and funds for local operating costs and hospitality.

The main inputs of project RAF/87/099, in addition to the substantial travel funds referred to above, consisted of organizational support staff and funds for local travel.

LKFRI provided secretarial services, including telephone and telefax, equipment for the lecture room, local transport by car, bus and boat and organizational inputs, in particular for all types of excursions.

The FAO Representative's office in Harare organized the transfer of funds, accommodation in Harare and transportation by road between Harare and Kariba.

Thanks to the joint efforts of all the institutions and projects mentioned above this course could be held . It is a good example of cost sharing of a large international training activity.

2. PROGRAMME AND COURSE CONTENTS

The course opened on the morning of 21 January and closed on the afternoon of 14 February. Working hours were Monday to Friday, 09.00-13.00 and 14.00-17.00. Saturdays were used for excursions or for teaching.

The course consisted of:

1. A basic course, covering the manual (FAO Fish.Tech.Pap. 306) through lectures and exercises using a Sharp EL-5100S programmable pocket calculator.

2. A major exercise synthesizing the manual and introducing the use of microcomputers, in particular the programs COMPLEAT ELEFAN and LFSA.

3. Local data analysis, processing of data supplied by the participants.

4. Excursions and an evaluation.

For a detailed programme see Annex 2. A list of lecture material is provided in Annex 3.

The basic course was concentrated in the first two weeks plus four morning lectures given in parallel with the major exercise in the third week. This concentration was achieved by being selective in respect to methods covered, rather than by being brief or leaving less time for exercises than usual. Methods selected are listed in the programme given in Annex 2. Among the subjects skipped or only covered cursorily were various graphical methods for cohort separation, a few mortality estimation methods, and Beverton and Holt's Y/R formula, which was just referenced as a special case of Thompson and Bell.

The major exercise was given in five days (minus four morning lectures). Eight groups were formed (corresponding to the number of PCs available) and simulated data for four different species were given, each set to two groups. The exercise was meant to serve both as a synthesis of the course and as an introduction to the assessment packages. The exercise text describing the task and the data were given to the groups and they were requested to produce a work plan to be presented and discussed with the lecturers before starting the analyses. The groups were then allowed to proceed independently at their own pace. No collective introduction to the PCs or the packages were given, but instruction was given to the groups as and when needed.

The expectations of the computer skills of the participants were later found to be much too optimistic. Several participants were used to PCs, but most of them had mainly experience with application programs and very little knowledge of MS-DOS. The two assessment packages, LFSA and ELEFAN, are furthermore so loaded with oddities/bugs/problems that it generally takes some close monitoring to get through the first time. Synthesizing the methods and simultaneously getting acquainted with the software seems to be too demanding. Therefore, it is probably better to give first collective introductions of the software (including basic MS-DOS operations) and also to make a more rigid, stepwise structure alternating between introductions to the next step and group work.

In spite of the difficulties, the group did present coherent reports in the end and it was quite impressive how much agreement there was between the results of two groups dealing with the same species. They were able to come up with estimates of all the parameters which were very close to the input values used for producing the simulated data sets.

It therefore appears that the exercise does assist the participants in getting all the pieces together and represents an improvement to the course. These benefits must, of course, be weighed against alternative uses of the time used such as case studies or additional time for local data analyses. Some of the experiences from this course have been included in the introduction to the major exercise as "hints to lecturers".

The local data sets available ranged from sets including regular length frequency samples and catch data for an extended time period to sets representing sporadic catch and effort data for a minor part of the fishing fleet. Only sets representing a reasonable series of length frequency data were utilized for group work, but individual guidance was given to participants whose data sets were not considered usable for group work. The seven selected data sets were used by groups of participants as indicated below:

1. Chambo (*Oreochromis* spp.) data from Lake Malawi: Alimoso, Magasa, Mwanyama, Seisay

2. Trawl survey data from Lake Victoria, Ugandan side: Kamanyi, Msuku, Okaronon, Othina

3. *Limnothrissa miodon* from Lake Kivu: Kabagambe, Mannini, Masundire, Ojuok

4. Kapenta (L. miodon) from Lake Kariba: Abay, Mtsambiwa, Ngalande, Paulsen

5. L. miodon and Stolothrissa tanganicae from Lake Tanganyika: Bekele, Maes, Mambona, Mwaiko

6. Various species, gill-net catches from Namibia (Hardap Dam) and Zambia (Lake Iteezhi-tezhi): David, Hoza, Mbewe, van Zijl

7. Hydrocynus vittatus from Lake Kariba: Machena, Mhalanga, Munandalu, Mwape

Written reports were produced by most groups. The abstracts are provided in Annex 4.

The benefits from the group work were variable, depending on the quality of the data available and the complexity of the problems encountered. A few groups were able to get results which seemed to be reliable and useful in their own right, but most groups were forced to make compromises and assumptions. It was concluded that their analyses mainly served as an exercise and an indicator of the contents and extent of the data to be collected in the future in order to allow a more reliable analysis next time.

The excursions brought the participants to landing sites, a kapenta fishing cooperative, a private kapenta fishing rig operator, a prawn farm and a crocodile farm. Trips were furthermore arranged on the lake on two evenings to kapenta rigs in operation.

A social event was arranged on the evening of 14 February, hosted by LKFRI and the course.

The closing ceremony took place in the afternoon of 14 February. Speeches were made by the IFIP representative, Mr. G.W. Ssentongo, by the Course Director, Dr. C. Machena, the Course Co-Director, Mr. P. Degnbol, Mr. A. Andreasson, Programme Coordinator of the ALCOM project, on behalf of Mr. C.R. Mac Culloch, the FAO Representative in Zimbabwe, and by the Deputy State Secretary for the Ministry of Natural Resources and Environment, Mr. Moyo. The Deputy State Secretary presented certificates to participants and officially closed the course. A dinner was arranged in the evening for participants and invited guests.

3. LOGISTICS

The course was held in the conference room of the Lake View Inn, Kariba which was at the full disposal of the course. The room was very suitable for lectures and there was ample room for group work, with a sufficient supply of tables and other installations, including air-conditioning. An overhead projector, blackboard, whiteboards, flip-charts and an ample supply of chalk/pens were provided by LKFRI. Facilities were thus as near to ideal as possible and the LKFRI was very supportive both in terms of services (transport, photocopying, etc.) and when problems arose.

A total of eight personal computers was available. Three portable PCs belonging to GCP/INT/392/DEN were brought by the lecturers, two PCs were from RAF/87/099 and RWA/87/012 and three were made available by the LKFRI and the staff of the NORAD/DANIDA project at LKFRI. This brought the number of participants per PC to 3.5. Although this is better than seen in many courses, the lecturers still felt that four participants per PC as we had in some groups is one too many. The minimum target should be one PC per three participants.

4. COURSE EVALUATION

The opinion of the participants

The evaluation was based on a questionnaire allowing participants to express their views in free text (see Annex 5). The replies can be summarized as follows:

Course contents: Overall contents were found to be good and relevant, but more emphasis should be put on local problems. The overall balance between the major parts of the course was found to be right, but more time should be allocated to lectures and exercises and more time to local data and computer use. In general: more time.

Course material: Written materials were found to provide good reference, to be relevant but there are too many corrections, the material was not fully self-explanatory and there was too little time to read during the course. Wishes for supplementary material included photocopies of overheads, scientific papers, biostatistics and sampling. The Sharp EL-5100S programmable calculator was found to be OK, if anything too limited rather than too complicated.

Logistics: Responses on notification and information were variable from OK to insufficient. The course turned out to be as expected or better than expected. The supply of materials was generally assessed to be sufficient, but too few PCs and shortage of paper and sharpeners, etc. was mentioned. Accommodation was assessed to be OK, but lack of variation in food was mentioned by some.

Lectures: The lectures were found to be on an adequate level and the language understandable. They were found to be too fast by some participants.

Overall balance and timing: This was found to be good, but some missed an introduction to the use of PCs and more on biological aspects. The time assigned was commented on in slightly contradictory ways: 4 weeks was found to be an adequate time period for a course, but the course was too concentrated and too short.

Future: Most participants expected to use the methods introduced. There was a general request for follow-up courses and seminars on local problems.

The opinion of the lecturers:

It is probably true that a structured introduction to PCs should have been included (see comments on major exercise above). The requests for more locally-related material may partly reflect the fact that we did not include any case studies in the present course. It is also a problem that most of the course material, and especially the course manual (FAO Fish.Tech.Pap. 306/1), is biased toward marine fisheries. Gill-nets need good coverage for inland waters, and rivers and floodplains represent problems which need supplementary treatment. We have a case study on gill-nets (see Annex 3) which could be extended, but we do not have any course materials for rivers and floodplains. The Lake Tanganyika case study (see Annex 3) was given to participants (or one copy to each institution represented), but there was not enough time to include a formal treatment of this case study. With the present time schedule any case study will have to substitute either the major exercise or the treatment of local data.

The participants were enthusiastic and interested throughout. Many came with a good background of experience. The professional level was generally high and most participants were very receptive to the subjects and methods presented. The participants were able to produce a general atmosphere of friendliness and openness which helped a lot both to the well-being of participants and lecturers and to the positive result of the course.

5. FUTURE ACTIVITIES

The participants made suggestions for activities (seminars, follow-up courses) focusing on local problems and local data. There were also several requests for support for future data analysis through contact with lecturers. It is obvious that several special subjects are of interest to a wide group among the participants and to their colleagues working in fresh waters including:

Gill-net assessments
Rivers and floodplains
The large lakes (the clupeids, special problems with pelagic stocks, comparative studies, acoustic assessments of pelagic stocks, etc.)
Multispecies assessments

Consideration should be given to offering some follow-up within such fields. Since the training project GCP/INT/392/DEN may be focusing on this region in a proposed third phase, it seems worthwhile to develop such follow-up activities, both in terms of material and course/seminar concepts.

ANNEX 1

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ANNEX 2

TIME SCHEDULE

Date	Subject	Manual section	Exercise
Week 1			
20/1	Group travel by bus from Harare		
21/1	Distribution of materials Opening Course introduction, practicals Introduction to tropical fish stock assessment Use of Sharp calculator No. 1: general	1	
22/1	Kapenta (local clupeid) samples: LF measurements for biostatistics: biostatistics: mean and variance	2.1	Practical kapenta samples
	Use of Sharp No. 2: statistics mode Normal distribution and confidence limits	2.2-2.3	- do -
	Linear regression, correlation	2.4-2.5	
23/1	Use of Sharp No. 3: regression		- do - SL-FL-TL
	Linearizing transforms, Length-Weight	2.6	
	Growth: introduction	3.0	
	Use of Sharp No. 4: programming von Bertalanffy growth equation	3.1	Mov. ave 3.1
	Input data for growth parameter estimation	3.2	
	Estimation of growth parameter Gulland-Holt plot	3.3.1	3.3.1

Date	Subject	Manual section	Exercise
24/1	- do - von Bertalanffy plot	3.3.3	3.3.3
	Maximum likelihood, weight converted von Bertalanffy	3.3.4 + 3.3.6	
	Linearization of normal distribution	2.6 (2)	
	Bhattacharya method	3.4.1	
	Bhattacharya exercise		3.4.1
	PC demo of Bhattacharya method		
25/1	Bhattacharya exercise (cont.)		3.4.1
	Modal progression analysis	3.4.2	3.4.2
	Seasonalized von Bertalanffy growth equation	3.5.0	
	ELEFAN I	3.5.1	
	Maximum likelihood methods, limitations, gonadal maturity data	3.5.3	
	Summary of Chapter 3: growth	3.6	
	MORTALITY: introduction	4.1, 4.2	4.2
26/1	Catch curve, constant time intervals	4.4.1-4.4.3	4.4.3
	Afternoon free		
Week 2			
27/1	Excursion to landing sites, fishing cooperatives and private kapenta rig operator		
28/1	Catch curve, variable time intervals	4.4.4	
	Catch curve, length converted, summary	4.4.5-4.4.7	4.4.5
	Beverton and Holt's Z equations	4.5.1-4.5.4	4.5
	Powell-Wetherall method	4.5.5	new 4.4.5
29/1	Catchability and CPUE	4.3	4.3
	Estimating F and M from Z versus effort	4.6	4.6
	Natural mortality	4.7	
	VPA: introduction	5.1	
	VPA: Pope's approximation	5.2	5.2

Date	Subject	Manual section	Exercise
30/1	Jones' length-based cohort analysis	5.4	5.4
	Mortality: summary		
	Prediction: introduction		
	Prediction, age-based, short term	5.3	new
31/1	Prediction, age-based, long term	5.3, 8	new
	Prediction, length-based	5.5	5.5
	Gear selectivity, trawl	6	new (covered codend)
1/2	Gear selectivity trawl + gill-net (cont)	6	
	Data: introduction		
	Sampling, simple random + stratified random	new + 2.8 2.7-2.8	(sample size)
2/2	Sampling commercial catches	7	

Week 3

3/2	Free		
4/2	Surveys - stratification		new
	Major exercise: introduction		
	Major exercise: Group discussions and work plan		
5/2	Summary of length-based assessments (lecture)		
	Major exercise: data input and growth		
6/2	Major exercise: mortality, VPA, predictions		
7/2	Recruitment (lecture)	12	
	Major exercise: mesh change assessment		
8/2	Surplus production models (lecture)	9	
	Major exercise: finalizing analysis, preparing reports, reports and discussion		

Date	Subject	Manual section	Exercise
9/2	Excursion: prawn and crocodile farms (morning) Local data analysis: introduction (afternoon)		
Week 4			
10/2	Free		
11/2	Local data analysis (cont)		
12/2	Species interaction models (lecture) Local data analysis (cont)	10	
13/2	Local data analysis (cont)		
14/2	Local data analysis: reporting Evaluation of the course Closing ceremony followed by dinner		
15/2	Discussion of the results of the evaluation Group travel by bus to Harare		

ANNEX 3

LIST OF LECTURE MATERIAL

A. MANUALS AND DOCUMENTS

Sparre, P., E. Ursin and S.C. Venema, 1989. Introduction to tropical fish stock assessment. Part 1. Manual. FAO Fish.Tech.Pap. 306/1. Rome, FAO. 337 p. + errata sheets.

Sparre P., E. Ursin and S.C. Venema, 1989. Introduction to tropical fish stock assessment. Part 2. Exercises. FAO Fish.Tech.Pap. 306/2. Rome, FAO. 92 p. + errata sheets.

Sparre P., 1987. Computer programs for fish stock assessment. Length-based Fish Stock Assessment for Apple II computers. FAO Fish.Tech.Pap. (101) Suppl. 2: 218 p.

B. SOFTWARE

ICLARM, 1989. The Compleat ELEFAN (Version 1.10) by Gayanilo, Soriano and Pauly, International Center for Living Aquatic Resources Management, MC P.O. Box 1501, Makati, Metro Manila, Philippines. 11 diskettes plus hard disk installation and sample data disk ($5\frac{1}{4}$"), MS-DOS, BASIC

FAO, 1989. LFSA (Length-based fish stock assessment). Version 1.1 (Jan. 1989) by P. Sparre. 3 diskettes ($5\frac{1}{4}$") MS-DOS/CGA, BASICA/GW BASIC

Degnbol, P., 1990 STMTOT, Simulation Exercise using LFSA and ELEFAN files. 1 diskette ($3\frac{1}{2}$") MS-DOS, BASIC

C. CALCULATORS

Sharp EL-5100S Programmable Scientific Pocket Calculator
- Multilingual manual
- User's instructions: overhead sheets and photocopies

D. COMPUTERS, etc.

8 Microcomputers
3 Diconix printers
1 Kodak Data View system

E. CASE STUDIES

Case study No. 8: Kirkegaard, E. and H. Lassen, 1990. Analysis of length frequencies from a gill-net fishery. 93 p. plus Solutions to Exercises 17 p. (Based on Amara Cheunpan: An assessment of King Mackerel (Scomberomorus commerson) in the inner Gulf of Thailand, FAO Fish.Rep. 389. (Note: Distributed but not used in the course)

Case study No. 9: Degnbol, P. and N.A. Nielsen. Fish yields of the pelagic zones of large tropical lakes. (Note: Not distributed at the course, reference only)

ANNEX 4

ABSTRACTS OF THE ANALYSIS OF SELECTED DATA

An assessment of chambo (Oreochromis spp.) fishery of the south - east arm of Lake Malawi

by

S. Alimoso, J.H. Magasa, N.C. Mwanyama, M.B.D. Seisay

Chambo is a species complex consisting of three tilapine cichlids (Oreochromis lidole, O. squamipinnis, O. karongae) endemic to Lake Malawi. Taxonomic identification is problematic at the young stages of the fishes. Chambo constitute the basis of an important commercial and artisanal fishery. Length frequency data were collected three times per month from a commercial midwater trawl. The von Bertalanffy growth parameters obtained by the Bhattacharya method and Gulland and Holt plot are considered not valid according to the authors knowledge of the species biology and fishery. Then a set of growth and natural mortality parameters was forced to proceed into the analysis. Catch curve method was applied to achieve an estimate of the total mortality. Virtual population analysis (Jones' length cohort analysis) shows that only the large size fish are exposed to the fishing mortality. It was also stressed that there is need for more representative samples to get more meaningful results.

Synodontis victoriae in Lake Victoria

by

J. Kamanyi, B.S. Msuku, J.O. Okaronon, A.N. Othina

Experimental bottom trawl-survey was carried out between 1981-1986 in the Ugandan side of Lake Victoria. Daily commercial catches from various fish landings were available. The individual length and weight data set used in the analysis was from Jana-Nsadzi area of the lake. Data have been collected in June, September, November and December 1981. Batthacharya method and Gulland and Holt plot were used to estimate the growth parameters. The catch curve analysis supplied the total mortality value. Jones' length cohort analysis was applied to obtain the exploitation pattern. Finally long term prediction was carried out using the Thompson and Bell model. The total yield and the calculated Maximum Sustainable Yield (MSY) for the Ugandan side of the lake seem to suggest the overexploitation of Synodontis victoriae. This scenario is considered unrealistic

by the authors. Analysis results are strongly affected by the data unsuitability as time coverage and quantity. Moreover data from trawl survey are assumed to represent the situation in the predominantly gill net commercial fishery. The results achieved are, then, not significative of the status of S. victoriae fishery in the Ugandan side of Lake Victoria.

Stock parameters estimates of Lake Kivu Limnothrissa miodon

by

J.B. Kabagambe, P. Mannini, H. Masundire, J.E. Ojuok

Limnothrissa miodon is the main commercial species of Lake Kivu, it was introduced from Lake Tanganyika in 1959 to fill the ecological vacant niche due to the absence of a planktivorous fish population. Length frequency samples as well total individual weight were collected weekly from commercial catches during the year 1990. Total catch was also available for the same period. A set of von Bertalanffy growth equation parameters for Lake Kivu L. miodon from literature was used to get a preliminary indication. ELEFAN I method was then applied to obtain the final parameters. Total and fishing mortality rates were estimated by using a length converted catch curve and Jones' length cohort analysis. The first method was later discarded because the basic assumption of the data representativeness of the population was clearly not met. Natural mortality estimate was possible only by Pauly's empirical formula. Long term predictions were made applying Thompson and Bell length based model. The resulting growth pattern confirms that L. miodon is a short-lived fast growing species. Both natural and total mortality rates are quite high so meaning the population must have an high turnover rate. Only a restricted range of the population is exposed to the fishing mortality, which is little affecting the remaining part of the exploitable biomass. It appears that the fishery does not match properly with the fish behavior. Present yield and the potential Maximum Sustainable Yield (MSY) also suggest the stock is underexploited and there is a good evidence that it can supply an higher fish yield.

Assessment of kapenta (Limnothrissa miodon) stock in Lake Kariba 1989-1990

by

B. Abay, M.Z. Mtsambiwa, P. Ngalande, H. Paulsen

Data of length frequency and individual total weight were collected during the years 1989-1990. The total catch of the Zimbabwean side over the same period was also available. The length-weight relationship for the species is established. The estimates of the von Bertalanffy growth parameters and mortality rates were strongly biased. Monthly length distributions show little evidence of modal class progression. The commercial data used, unrepresentative of the true population, do not allow valid results. The possible origins of the data unsuitability are discussed.

Report on Stolothrissa and Limnothrissa from Lake Tanganyika (zairian side)

by

M. Wa Bazolana, K. Bekele, M. Maes, S. Mwaiko

Stolothrissa tanganicae and Limnothrissa miodon are endemic clupeids of Lake Tanganyika, which contribute about 85% of the total catch in the North part of the lake (both in Zaire and Burundi). The length frequency data used for the analysis were collected, twice a week, from Uvira landing station between January and December 1990. The von Bertalanffy growth parameters were estimated by Batthacharya and ELEFAN I methods. A preliminary indication on the growth performances was supplied by the specific available literature. Catch curve analysis was performed to obtain the total mortality estimate, as well Pauly's formula to get the natural mortality value. Jones' length cohort analysis was applied to have the fishing mortality array by length group. Finally, long term predictions were made using Thompson and Bell model. Results are thought to be affected because the commercial data are not fully representative of the true population. The data selectivity can also explain the high total mortality values, especially in the case of L. miodon, from the catch curve analysis. The fishing mortality pattern shows, for both S.tanganicae and L. miodon, that only a restricted part, as range of size, of the stocks are vulnerable to the commercial fishery. The possible reasons of this exploitation pattern are discussed. Long term scenario seems to indicate that it is more profitable eventually to increase the effort on Stolothrissa than on Limnothrissa. It is pointed out, however, that biomass and potential yield figures are not much significative due to the lack of the samples weight as well of the total catch.

Gill-net catches from Namibia and Zambia

by

B.Q. David, R.B. Hoza, M. Mbewe, B.J. Van Zijl

Data from gill-net survey in Lake Iteezhi-tezhi, 1989, (Zambia) and Hardap Dam, 1990, (Namibia) were available. Only the last one were chosen as more suitable for the analysis. Hardap Dam data on Labeo capensis were collected for one year on a quarterly basis. A fleet of gill-nets consisting of seven different mesh size was used for the samples. The growth parameters obtained from Batthacharya method and Gulland and Holt plot seem to be not correct with respect of the knowledge of L. capensis biology. The high total mortality rate computed from the catch curve analysis could be affected by the selectivity of the gill-nets. The non categorization of the length frequencies, according to the different mesh size gears, strongly weakens the results. The population should be raised according to the selectivity factor of the different mesh size gill-nets. The raised population for each nets have to be summed to obtain a total population, which could be used in the analysis of growth and mortality parameters. It is also pointed out the need of an higher sampling frequency in a year.

Analysis of the growth and mortality parameters and yield predictions of Hydrocynus vittatus

by

C. Machena, W. Mhalanga, P.C. Munandalu, L.M. Mwape

The length frequency data used in evaluating the growth and mortality of Lake Kariba Hydrocynus vittatus were taken from the commercial purse seine fishery. The data comprised of monthly individual length and weight records of samples collected, during the year 1981, in the eastern basin of the lake (Zimbabwe). Total catch was the average annual production of H. vittatus from the commercial gill-net fishery. The von Bertalanffy growth formula parameters were obtained by the Batthacharya and ELEFAN I methods. Catch curve analysis was performed to get an estimate of the total mortality rate. Pauly's empirical formula supplied a value for the natural mortality. Jones'length cohort analysis was used to get the fishing mortality array by length class, the results were used as input in the Thompson and Bell model for the long term prediction. Growth parameters seem to fit well the length frequency distribution so the successive estimates of the mortality rates are accepted. The yield prediction indicates that the present exploitation rate is now close to the Maximum Sustainable Yield (MSY) level. The significance of this forecast is discussed considering that purse seine fishery does not contribute significantly to the annual yield. This is mostly due to the gill-net fishery which has different selection parameters.

ANNEX 5

EVALUATION QUESTIONNAIRE

Please give your opinion in relation to the following questions. Write freely and do not hesitate to include supplementary comments which you may think are not covered by the questions. Do not write your name anywhere: it is an anonymous questionnaire.

Course contents

1. What do you think of the overall contents of the course - the problems addressed, the methods presented, etc. ? Do you think it is relevant to your work ? Were some approaches missing or superfluous, problems not addressed, etc. ?

2. Please comment on the major parts of the course (manual presentation, major exercises, the two case studies, local data analysis). Is the emphasis on each part right ? Should something have received more attention ? Was something useless or should it have been dealt with in another way ?

Course material

3. Give your comments on the written materials used in the course - manual and exercises. Are the contents relevant ? Are they readable ? Do you think it will be possible to use them as references after the course, etc. ?

4. Do you have suggestions for other or supplementary written materials ?

5. The Sharp calculator - is it too complicated or too limited in possibilities ? (We can not provide PCs for everybody, but might a calculator more or less sophisticated than the present model be a better choice ?)

Logistics

6. Notification and information: Do you think you got proper notice about the course ? Has the information you received before the course been sufficient for your preparations ? Was the kind of course you got the kind of course you expected (contents and level) ?

7. Was the supply of working materials adequate (stationary, availability of PCs, etc.) ?

8. Was the physical framework adequate - accommodation, lecture room, etc. ?

Lectures

9. Please comment on the lectures. Was the level too high or too low ? Did you have problems in understanding the language ? Was the form used adequate - was it just a boring show throughout ?

Overall balance and timing

10. Was the balance between lectures, exercises and PC data analysis right ?

11. Was the time assigned to each subject appropriate ? Was the overall course too long or too short, both in terms of contents of the course and in terms of your preference for maximum time to stay away from your home base ?

The future

12. Do you expect to use the methods introduced in the course in your future work ? If not or if you are in doubt please state why (working in another field altogether, not part of job assignment, methods useless, do not have access to any data, can not initiate data collection, etc.).

13. Do you have suggestions for future activities within the framework of the Training Project which you think might be useful for you (follow-up courses, seminars on special topics/stocks/areas, etc.) ?

Miscellaneous

14. Please give any additional comments on the course - frustrations, suggestions for future improvements, etc. etc.

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