Indira Gandhi National Open University
School of Sciences

BAQP-001

PROJECT ON
AQUACULTURE

PROJECT GUIDE

"शिक्षा मानव को बन्धनों से मुक्त करती है और आज के युग में तो यह लोकतंत्र की भावना का आधार भी है। जन्म तथा अन्य कारणों से उत्पन्न जाति एवं वर्गगत विषमताओं को दूर करते हुए मनुष्य को इन सबसे ऊपर उठाती है।"

– इन्दिरा गांधी

"Education is a liberating force, and in our age it is also a democratising force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances."

–Indira Gandhi

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PROJECT ON AQUACULTURE

PROJECT GUIDE

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INTRODUCTION

Project work is an exercise, which gives you an opportunity to explore and innovate. It is a concept of learning by doing. It enables you to apply the theoretical knowledge you have acquired and implement it practically. It exposes you to the real problems being faced in aquaculture and enables you to draw conclusions based on your observations and analysis.

This project guide will help you to become familiar with the different steps required to carry out a project in Aquaculture. This project guide has three major parts. The first part provides general guidelines and different stages of the project work. The second part deals with project suggestions in the form of units and the third with the annexure of different forms etc.

This Project work is of 4 credits and is to be carried out in about 120 hours starting from the selection of the project till its submission. You have to submit a typed and bound copy of your project work. If, however it is not possible for you to submit a typed project you can submit a hand written project report, but the handwriting should be legible and neat and written only on one side of the paper. Expected total length of your project is 4000 to 5000 words supported by tables, graphs, photographs and drawings etc. In general try to stay within the specified word limit for your project, but if your specific theme of the project demands, you may increase the number of words. You have the option to write your project in English or Hindi.

We hope you will enjoy doing this part of the course work too!

GENERAL GUIDELINES

After you have enrolled in this diploma programme on aquaculture, you have to select a suitable topic for your project work. A supervisor, who is familiar with the subject and also the skills of working on such projects, will guide you. You can take the help of your supervisor at all levels of your project work.

Preparation of Project Proposal

Once you identify the area of your study and select a topic for your project work, you have to prepare a project proposal / synopsis, which should not exceed 500 words. Your proposal should cover the following:

- what you want to do (Introduction)
- what your procedure will be (How)
- what the objectives of your project will be
- what background information is available in the area of study and
- what will be your work plan for undertaking the project

Through this project you will also find out the problems faced by the farmers / fish sellers / fishermen, or the issues you are going to raise as a conclusion to your study.

At each step of working for your project you can discuss with your counselor, experts in the field, your colleagues and friends.

While choosing the project, see that it is possible for you to conduct the study in a limited time frame. It is very important that you are familiar with the area of study. It should be accessible to you. Preferably select an area in your surroundings, which is close by, or within your traveling range.

Supervision of Project

For conducting and submission of your project you will be guided by a supervisor recognized by the Indira Gandhi National Open University. All counselors appointed for the Diploma in Aquaculture Programme are recognized as supervisors for the project. The Coordinator of your study center will provide you the list of supervisors. After choosing the broad area of your study (Units 1-12), please contact your coordinator. Based on your area of study he/she will assign you a supervisor.

With the help of your supervisor, you will prepare a project proposal. The supervisor will also help you in the following:

- Introducing you to the local farm / farmers / industry / fisherman / processing units / groups / agencies etc. relevant to your project
- Issuing you the authorization letters, which will help you for collection of data and informations, to make enquiry and investigation in different organizations, colleges, offices etc. related to your work.
- Using the library at the study center for consultation purposes and also can give you the reference letter to refer other good libraries in your vicinity related to your project work.
- In deciding the topic of your project, area from where you will collect data or the farm / processing unit / market you are going to visit, your general work plan to the best of his / her efforts.
- Inform you about the literature available on the area of your study / topic
- Guide you in the presentation of data (Graphs, tables, statistical analysis etc.)
- In arrangement of information in a systematic manner to form different chapters
- In finalization and submission of the project
- Provide you necessary certificates for submission

Submission of the Project Proposal (Read instructions carefully)

Once your project proposal is ready, prepare two typed copies of your proposal. Obtain approval of your supervisor on the format given in Annexure – A and send one copy to the following address:

Programme Coordinators
School of Sciences
Indira Gandhi National Open University
Maidan Garhi
New Delhi - 110 068

Keep the second copy of project proposal with you. Make sure that your project proposal is accompanied by a letter of approval by your supervisor (In Project Proposal Proforma - Annexure - A). Use only registered post to mail the project proposal to ensure its safe reaching to us. Once your project proposal topic is approved, you cannot change your topic or any wording of it. In fact, when you work, write and submit your final project to us, make sure that the title exactly matches with the original project proposal, submitted to us. Put the name and code of your course (in this case it is BLSP-001), your enrolment number, the name of your Study Centre and Regional Centre on the first page (Annexure – A).

The approval of the Supervisor is final, therefore, you need not wait for our approval for the Project Proposal. We need a copy of your Project Proposal for our own records, analysis and follow up. You can start working on your Project Proposal as soon as you send a copy to us.

DIFFERENT STEPS WHILE DOING A PROJECT

The project work, you would have understood by now passes through several stages. Using a step by step approach is a must. Each step is important and should not be neglected.

Identifying a Theme for your Project

The very first step for doing a project is to select a right theme for your project. Think carefully and discuss with your supervisor before selecting a topic for your project. Some of the suggested topics from which you can choose are given below. However, you are free to choose any other topic relevant to aquaculture in consultation with your supervisor.

Suggested Topics
1. Survey of local fish market to assess all aquatic products, their demand and market value. 2. Survey of rural ponds used for aquaculture, their conditions and viability for aquaculture and their present utilization for aquaculture. 3. Awareness of the public about aquaculture in relation to their food habits. 4. Survey of aquaculture-based industries. 5. Survey of ornamental fish trading unit. 6. Various ways of value addition for fish marketing 7. Village and Farm – family survey for identification of technological gaps and training needs of aquaculture. 8. Collection, identification and preservation of commercially important aquatic organisms. 9. Survey of fish harvesting devices. 10. Survey of an environmental friendly aquaculture farm practices (carp culture / pond culture / shrimp culture / prawn culture / integrated fish farming / sewage fed fish farming / paddy-cum fish culture -any one of them). 11. Visit to a fish-processing unit. 12. Study of soil type and water quality of an aquafarm.

Plan your Project

The first necessary step for the execution of your project topic is to have a proper plan of work for your project. This will include:

- deciding what steps are necessary to conduct the study:
- deciding what tools or technique will be used:
- finalising tools/techniques and pilot scale testing:
- identification of field level functionaries, community leaders, Industry, shops and farmers etc., and
- how to contact them.

How to Carry Out your Project

Collect your data

This is the most important phase of your project work. Data provide all the basic information and sources that are required while you will be writing the project. Considering its importance keep the following points in mind.

- **Set a time frame**: Fix up the total time required for data collection, survey, schedule in a set time frame. Make a schedule and set aside a certain number of hours each week for work on your project. Be realistic when you are making a schedule so that you can finish your work in time.

- **Arrange your notes**: Two to three hours, every alternate day, of concentrated work will gather all necessary data. Initially you may not know how much information should be noted and how that information should be arranged. The main point to be remembered is to accumulate as many notes as you can. Detailed notes taking at this stage will save a lot of time at later stages. The best way when gathering information is to prepare a detailed questionnaire and try it out with one or two persons. After doing a pilot study modify your questionnaire as per requirement.

While writing your project you should be able to present the major features of your project work in the best possible manner.

Go step by step: In the beginning prepare a synopsis of your project with the help of your supervisor. This synopsis will help you to organize your selection and order of reading and notes taking. While taking the notes the headings in the synopsis automatically become groups under which your notes may be arranged. Maintain separate files for different types of notes. This will help you at the time of writing your report. Also classify

and do cataloguing of data. Note down the date and place of study/interview/visit etc.

Summarize your data

It is impossible to write your project if the data collected is not processed in the form of tables / graphs etc. Data should also be analyzed statistically. This processing summarizes the data and also gives a clear picture about your findings or results.

HOW WILL YOU WRITE YOUR PROJECT REPORT

Before beginning to write your project report, organize the collected material for the report as mentioned above. Now after arranging the material and making separate files, you have to write the project report. Originality and clarity of thoughts are the key factors deciding the quality of your project. Your skill of communication is tested especially when you are analyzing your results. This also reflects how well you can organize your data and ideas.

You can write your project work in Hindi or English

Remember the following before and during writing your project

- For keeping clarity, as far as possible use diagrams, flow charts etc, to simplify your presentation
- Write in brief. Use small sentences
- Make a checklist and see whether you have covered all your objectives or not. Present only correct information and data.
- Use your creativity and imagination for presenting your project in the best possible manner.

COMPONENTS OF YOUR PROJECT

The project report that you write should have the following components:

Introduction: This is beginning of your project, through this you are introducing the topic and its importance in the present aquaculture scenario. It should include a description of what the project aims to achieve and why is it undertaken from your point of view as well as the community's. The introduction should end with a list of aims and objectives of the specific project.

Objectives: Objectives must be very clear, including not more than 3-4 brief points. These are the main aims around which you have planned and conducted your study.

Material and: Methods used This will include both material used during your study i.e. farm selected, questionnaire etc. and the methodology followed for the conduct of the study. Actually, it is the

description of the way in which the project was conducted. It includes important aspects such as:

- identification of work area,
- identification of people,
- design of survey / experiment,
- duration of work, with breakup,
- sampling duration and procedures and
- techniques used.

Observations: This is the actual recording of data when the project work was conducted. This does not include any interpretation, based on recorded data.

Analysis and: Results This is the main body of your project, where based on your study (data, graphs, etc.) and analysis, you will give your interpretation and findings of your study. Here the findings can be related to the objectives of your project mentioned initially.

Discussion: In this heading, you will give your opinion about your results / observation and can compare with other similar studies available in books / magazines etc. If you feel that the results you obtained were influenced by some special factors they must be discussed in detail. Similarly, there would be some features you might want to explain or highlight. This is the place in the project report to write this.

Conclusion: Lastly based on your results, and discussion, you can conclude the project. In this part you can give suggestions regarding improvement of the culture practices / improvement of product development, problems noticed during your study etc.

Bibliography: Before, during and after your study, field survey, data collection, you will refer to a number of books, articles and magazines. Do not forget to mention all the books, magazines, journals etc., you have referred in relation to your project work.

Annexures: You can put data tables, survey questionnaire etc. at the end of the project in the form of annexures.

SUBMISSION OF YOUR PROJECT REPORT

Prepare two copies of your project report, send only one copy to us on the following address

REGISTRAR
Student Registration & Evaluation Division
Indira Gandhi National Open University
Maidan Garhi, New Delhi – 110 068

Do keep a copy of your project report with you.

Make sure that your project should be accompanied by the following:

* declaration – given by you (Annexure B: First page of the project),
* certificate – given by your supervisor (Annexure C) duly signed by you and your supervisor,

EVALUATION OF YOUR PROJECT

After you submit the project to the Registrar, Student Registration and Evaluation Division, it will be sent to an examiner for evaluation. You must score a minimum of 40% marks in your project work for successful

completion of your course. Evaluation of your project will take a minimum of two months from the date of submission.

- Project work should be original and should be written in your own language.
- Do not copy or reproduce any published project or else it would be cancelled.
- Arguments given by you in favour or against should be supported by your data.
- Information should be properly documented
- Research methodology adopted by you should be clearly mentioned in the beginning of your work.

If you score less than 40% marks, we will inform you and also send you the evaluator's comments. You can take the following steps.

- In the light of evaluator's comments you can re-do and re-write your project.
- Attach annexures B and C (again)

The revised project complete in all the above respects should be sent for fresh evaluation to

REGISTRAR
Student Registration & Evaluation Division
Indira Gandhi National Open University
Maidan Garhi, New Delhi – 110 068

SUGGESTED TOPICS FOR PROJECTS

UNIT 1 SURVEY OF LOCAL FISH MARKET TO ASSESS ALL AQUATIC PRODUCTS, THEIR DEMAND AND MARKET VALUE

1.1 INTRODUCTION

The quantity and availability of different aquatic products sold in the fish market are indicators of their demand and consumption by the local people. This project will help you to understand the mechanism of price regulation in the market.

In each city, town, village there is always a fixed place where fish and other aquatic products are sold. At different places different aquatic products are sold in the fish market. Range of products depends on the location i.e. whether the place is coastal or inland; and species naturally available in the nearby areas.

1.2 OBJECTIVES

After doing this activity you should be able to:

- become familiar with different types of aquatic products e.g fish, prawn, shrimp, crab, molluscs etc. sold in the local fish market,
- list the indicators of demand and consumption of various aquatic products by the local people,
- explain the mechanism of price regulations in the market, and
- describe direct functionaries like wholesale retailer and middle man and their role in the fish market.

1.3 MATERIAL AND METHODS

Try to develop your project along the following lines:

- Identify and choose a nearby or a local fish market for your observations where different aquatic products like fish, prawn, shrimp, mussels, oysters etc. are sold.
- Plan your visit to the market during working hours, when all activities in the fish market can be observed.
- If the retailers are many, select those selling different types of aquatic products.
- Observe the functioning of different fish sellers carefully.
- You will need a field note book and a pencil to record different fish varieties sold, their price, quantity sold and left over with each fish seller.
- Use separate table for each shop at each visit (Table 1 & 2)
- Visit 3 or 4 shops in a day.
- During your next visit, do not repeat the same shops, select another 3-4 shops. A total of 30 shops, should be sufficient for your project work.
- At each visit at each shop, the observation period should be minimum of 30 minutes.
- Simultaneously, you need to observe intermediates / wholesalers from where fish seller is purchasing the fish and find out their selling rates.
- If you do not get this piece of information, you can ask questions about the source from where the fish and other aquatic products are procured and their purchase price, quality and arrival, quantity of the aquatic products, mode of transport, taxation, commission etc.
- If possible try to find out the scientific and local names of the aquatic products sold and record them in your record book.
- If you find difficulty in identification, collect the samples in polythene bags and bring to a laboratory to identify with the help of an expert / technician / project supervisor / counsellor.
- You can also draw the diagram or present the photograph of the important varieties sold in the market, in your project report.

1.4 OBSERVATIONS

You can take the following observations:

- Arrival of different varieties and quantities of aquatic products in the market.
- Abundant and rare varieties.
- Prices obtained for different varieties.
- Different intermediaries in the market.
- Services provided by the market.
- Record the prevailing price range of fish from vendor to vendor in the market.
- Involvement of Government Agencies / Cooperatives in the functioning of the market (e.g storage, transport etc.).

1.5 CALCULATION

Based on the above observations, calculate the following

- Species wise price of the fish or aquatic products (per unit weight)
- Total volume of fish or aquatic products
- The fish arrivals in the market.
- Price difference in the wholesale and retail markets.

1.6 ANALYSIS AND RESULTS

Compile all the informations in the form of "Data appendices" e.g Tables, graphs, statistical analysis etc. (whatever is possible) and interpret the results of your study in your own words i.e. major salient features of the market (number of shops, total arrival and sale of aquatic products, facilities, hygiene etc.) dominating species, maximum price fetching species and market operations structure etc.

1.7 CONCLUSION

Based on your study, observations, calculations, analysis and results, write your conclusions.

1.8 SUGGESTIONS

Based on your experience, give your suggestions to improve the market structure, facilities and operations.

1.9 BIBLIOGRAPHY

Do not forget to mention all the books, magazines, journals, articles etc. you have referred in relation to your project work.

Table 1.1: Different aquatic products sold in wholesale market.

Date: _____ **Name of the market:** _____

Name of wholesaler: _____

Sr. No.	Name of Product	Quantity (kg)	Unit Rate (Rs.)	Total (Rs.)

Table 1.2: Different varieties of aquatic products sold in the retail market.

Date : _____ **Name of the Market :** _____

Name of Seller/Shop: _____

Sr. No.	Name of Product	Source (Freshwater/ Marine)	Quantity (Kg)		Unit Price (Rs.)
	Fish		Total	Sold	
1.	Prawn/Shrimp				
2.	Molluscs				
3.	Crabs				
4.	Lobsters				
5.	Dry fish				
6.	Any other				
	Total				

UNIT 2 SURVEY OF RURAL PONDS/ RESERVOIRS USED FOR AQUACULTURE (THEIR CONDITIONS AND VIABILITY OF AQUACULTURE. THEIR PRESENT UTILIZATION FOR AQUACULTURE)

2.1 INTRODUCTION

Rural ponds, lakes and reservoirs are the main fishery resources in any inland area. All these water bodies have their natural fishery resources like small and big fishes, prawns, crabs etc. Sometimes these water bodies are used for aquaculture either by the State Govt. Fishery Department or by private farmers. Sometimes some co-operative societies also use these water bodies for aquaculture. Since reservoirs are big water bodies any activity related to aquaculture in these water bodies need large manpower. A survey of the use of large water bodies for aquaculture or any fishery activity will give you an idea of one of the large scale fishery operations.

2.2 OBJECTIVES

After doing this activity you should be able to:

- familiarize yourself with the type of aquaculture practices followed,
- describe the fish species cultured, their production and harvesting methods,
- explain the economics of doing aquaculture, and
- discuss the problems faced while practicing aquaculture in ponds and reservoirs.

2.3 MATERIAL AND METHODS

Try to develop your project along the following lines:

- Identify and choose a nearby rural pond / reservoir where aquaculture is in practice.
- Plan your visit to the pond / reservoir when the aquaculture operations are at the intensive level.
- You need polythene bags, formalin or ice box to bring the unidentified specimen to the nearest laboratory for identification.
- You need measuring board / scale, spring balance to record the length and weight of various fish specimen at fixed time intervals.
- You need plankton net, small plastic sample bottles, bucket, beaker to collect and preserve the plankton samples and bring them to laboratory for identification.

2.4 OBSERVATIONS

You need to take the following observations:

- Size of pond / reservoir (area) and depth.
- Capacity in which pond / reservoir is under operation for aquaculture i.e. co-operative society on lease / individual on lease, lease amount, lease terms.
- Type of pond / reservoir i.e. seasonal or perennial.
- Fish species already available in pond / reservoir.
- Species stocked.
- Number stocked species-wise and their cost.
- Size at stocking
- Any fertilizers, manures applied and their quantity, cost.
- Type of feed, mode of feeding, quantity of feed, and its cost .
- Colour of water, its transparency.
- Any natural fertilization in the water by cattle.
- Record growth of various fish species at fixed time intervals.
- Harvest size.

- Production per hectare.
- Mode of packing, transport, marketing etc.
- Manpower.

2.5 CALCULATION

Based on the above observations calculate the following

- Total cost of inputs i.e. seed, fertilizers, feed, manpower.
- Input cost per hectare.
- Total fish production species-wise.
- Fish production per hectare.
- Gross income
- Net income

2.6 ANALYSIS AND RESULTS

Compile all the information in the form of "data appendices" e.g tables, graphs, statistical analysis etc. and interpret the results in your own words i.e. major salient features of aquaculture operation.

2.7 CONCLUSION

Based on your study, observations, calculations, analysis and results, write down your conclusions.

2.8 SUGGESTIONS

Based on your experience, give your suggestions to improve the fish production with better management practices.

2.9 BIBLIOGRAPHY

Do not forget to mention all the books, magazines, journals, articles etc. you have referred in relation to your project work.

Table 2.1: Details of fish species available / cultured in the pond / reservoir.

1. Name of the owner / lease : _____

2. Name of the pond / reservoir : _____

3. Site of pond / reservoir : _____

Sr. No.	Date of stocking	Species	No. Stocked Per/ha.	Size at stocking		Present size	
				Length (in cm)	Weight (in g)	Length (in cm)	Weight (in g)
1	2	3	4	5	6	7	8

Quantity Harvested (kg)	Available Natural Species	Remarks
9	10	11

Table 2.2: Physico-chemical and biological features of water.

S.No.	Temp. (°C)	pH.	Colour of water	Transparency (in cm)	Plankton	
					*mL / 50 l	Common names

* Filter 50 L pond water through 100 micron plankton net and take the volume of plankton by displacement method i.e. fill the graduated 10 mL measuring cylinder up to 1 or 2 mL level and then add the filtered plankton bio-mass to the cylinder. The difference of volume gives the plankton biomass in 50 l of pond water.

Table 2.3: Schedule of fertilization.

Sr.No.	Name of fertilizer	Duration (in days)	Quantity per/ha. (kg)

Table 2.4: Feeding schedule.

Sr. No.	*Feed stuff	Nature (Powder / Pellet / wet dough)	** Mode of feeding	Quantity per day (kg)	Cost of feed per kg (Rs.)

* Feed stuff i.e. rice bran, oil cake, fish meal etc. or formulated feed.

** Mode of feeding i.e. broadcasting or keeping dough in trays / bowls or bag feeding

Table 2.5: Estimation of economics per hectare

1. OPERATIONAL COST :

i.	Lease amount per hectare per year	:	_____
ii.	Cost of pond / reservoir preparation	:	_____
iii.	Cost of fertilizers / manures	:	_____
iv.	Cost of seed	:	_____
v.	Cost of feed	:	_____
vi.	Cost of chemicals / medicines, if any	:	_____
vii.	Consultation fee	:	_____
viii.	Manpower	:	_____
ix.	Harvesting charges	:	_____
	Total		_____

2. FIXED COST

i.	Interest on operational cost @ 15%	:	_____
ii.	Operational cost	:	_____
	Total		_____

3. NET PROFIT

i.	Quantity of fish harvested per hectare (kg)	:	_____
ii.	Sale price of fish per kg (Rs.)	:	_____
iii.	Total sale price of fish in a year	:	_____

4. GROSS PROFIT

Net profit – fixed cost = _____

3.5 CALCULATION

Based on the above observations calculate the following

- Depending on food habits how many vegetarians know about aquaculture.
- Similarly how many non-vegetarians know about aquaculture.
- How many non-vegetarians know about the species that can be cultured.
- How many vegetarians and non-vegetarians are actually involved in aquaculture practices.

3.6 ANALYSIS AND RESULTS

Compile all the information in the form of a master table. Prepare relevant graphs. Do statistical analysis, wherever possible and interpret the results of your study in your own words on the following lines.

- Ψ If there is any relationship between food habits and knowledge of aquaculture.
- Ψ Ratio between the knowledge of aquaculture of vegetarians and the non-vegetarians.
- Ψ Ratio between the vegetarians and non-vegetarians that practice aquaculture.

3.7 CONCLUSION

Based on your study, observations, calculations, analysis and results write your conclusions.

3.8 SUGGESTIONS

Based on your experience, give your suggestions to involve more public in aquaculture activities and to increase fish production and consumption.

Table 3.1: Format for collecting data from an individual.

1.	Name and address	:	
2.	Vegetarian / Non – vegetarian	:	
3.	Knowledge of aquaculture	:	Yes / No
4.	Frequency of fish consumption	:	
5.	Species consumed	:	
6.	Quantity of fish consumption (in kg)	:	
7.	Knowledge of cultivable species	:	
8.	Involvement in aquaculture practice	:	Yes / No
9.	Culture organisms	:	
10.	Culture area (in ha)	:	

UNIT 4 SURVEY OF AQUACULTURE BASED INDUSTRIES

4.1 INTRODUCTION

With intensification of aquaculture, many ancillary aquaculture based industries have developed in recent years which are essential for the smooth running of aquaculture activities and also for better production. These aquaculture based ancillary activities include farm implements, feed mills, net making units, transportation, fertilizers / manures etc. In this project you will survey these aquaculture based industries and will find out their contribution in the development of aquaculture.

4.2 OBJECTIVES

After doing this activity you should be able to:

- identify supporting industries involved in aquaculture,
- find out quantitative estimation of various inputs obtained from supporting industries,
- find out the impact of aquaculture based industries in enhancing production and management of farm, and
- compare a traditional aquaculture farm with a farm using support from aquaculture based industries.

4.3 MATERIAL AND METHODS

Try to develop your project in the following lines.

- Identify one traditional and one modern (semi-intensive) aquaculture farms in your locality and their water spread area under aquaculture operation.
- While selecting the farms take care that both the farms are using similar culture species.
- Fix an appointment with modern aquafarm owner / operator and collect the information regarding the different inputs used.
- List out the inputs such as farm equipments, feeds, nets, chemicals, manures, fertilizers, transportation etc.
- Collect the information about the quantity of each input used in a year for aquaculture operation
- Collect the information about the source (manufacturers address) of above inputs
- Contact different manufactures / dealers and find out how much quantity of their total production is supplied to aquafarms.
- Collect information about the quantity of each input used in a year for aquaculture operation.
- Similarly fix an appointment with a traditional aquafarm owner and collect the information as dealt in points 4, 5, 6 and 7 above.

4.4 OBSERVATIONS

You need to take following observations:

- Record the quantity of each input used in traditional and modern aquafarms separately.
- Find out the cost of each input procured / used separately for both the farms.
- Record the production of each cultured species separately from both the farms.
- Note the length and weight of cultured species at the time of harvest for both traditional and modern farms separately.
- Record the selling price of the cultured species separately.
- Record the total quantity of fish / other aquaculture species sold.
- Note down the culture period i.e. stocking of seed to harvest.
- Record the total input, establishment and maintenance cost of both the farms separately.

4.5 CALCULATION

Based on the above observations calculate the following for traditional and modern farms separately :

- Calculate the quantity of each input separately per hectare.
- Calculate the cost of each input separately for one hectare water spread area.
- Calculate the establishment and maintenance charges for one hectare water spread area
- Calculate the production of fish / other aquatic organisms per hectare water area.

4.6 ANALYSIS AND RESULTS

Compile all the information in the form of 'Data appendices' e.g tables, graphs, statistical analysis etc. for both the farms separately and interpret the results in your own words in the following manner.

- Ψ Comparison of inputs from aquaculture based industries qualitatively and quantitatively for both the farms separately (quality indicates the type of input for example feed type i.e. fresh feed / dry pellets, etc).
- Ψ Compare the species wise production and total production of both the farms
- Ψ Compare the economics (input, out put and profit) of both the farms.
- Ψ Percentage of inputs of aquaculture based industries going to aquafarms.

4.7 CONCLUSION

Based on your study, observations, analysis and results write down your conclusions explaining about the impact of aquaculture based industries in enhancing production and management of farm.

4.8 SUGGESTIONS

Based on your experience gained during the above study give your suggestions how best the aquaculture based industries can improve the aquaculture production.

Table 4.1: Format for collecting information from traditional / modern aquaculture farms:

1. Name and address of farmer :
2. Total area of the farm (ha) :
3. Water spread area of the farm (ha) :
4. No. of ponds :
5. Size of each pond :
6. Depth of ponds (range in m) :
7. Fertilizers / manures applied :
8. Cost of fertilizers / manures :
9. Details of fish stocked :

Sr. No.	Species	No. stocked per ha.	Initial size		Cost of seed / 1000 (Rs.)
			Length (cm)	Weight (g)	

10. Feeds used :

11. Nature of feed (powder / pellets / dough):

12. Mode of feeding :

13. Quantity of feed (per ha) :

14. Cost of feed per ton (Rs.) :

15. Details of machinery used in the farm (pumps, tractor, aerators, feeders, etc.)

Sr.No.	Name of implement	Capacity	Number	Cost of each (Rs.)

16. Details of manpower

i. Managerial : No. Salary (per month)

ii. Technical : No. Salary (per month)

iii. Supporting : No. Salary (per month)

iv. Seasonal : No. persons :
No. of days :
Wages :

17. Details of fish production

Sr. No.	Species	No. harvested	Size at harvest		Sale price Per kg (Rs.)
			Length (cm)	Weight (g)	

18. Accessibility :

19. Mode of Transportation

20. Type of power supply (electricity / Generator etc.)

21. Details of equipment used in farm

Sr. No.	Name of equipment	No. per hectare	Total number	Cost of each piece (Rs.)	Total cost (Rs.)

Table 4.2: Details of supply of equipments to aquafarms.

Sr. No.	Name of Farm equipment	Name of supplier/ dealer	Total No. sold in a year	No. sold for aqua-farmers	% utilized for aquaculture

Table 4.3: Comparative study on economics of aquaculture in traditional and modern farm.

	Traditional	Modern
1. Capital costs i. Construction : ii. Major equipments : iii. Miscellaneous items :		
Total		
2. Operational cost i. Pond preparation : ii. Fertilizers / manures iii. Seed iv. Feed v. Chemicals / medicines vi. Consultation fee vii. Manpower viii. Fuel / electricity ix. Harvesting x. Miscellaneous		
Total		
3. Fixed costs i. Interest on capital cost @ 15% ii. Interest on operational cost @ 15% iii. Operational cost iv. Depreciation on equipments @ 10%		
Total		
4. Net profit i. Quantity of fish harvested per ha. (kg) ii. Sale price of fish per kg (Rs.) iii. Total sale price of fish per ha. (Rs.)		
Total		
5. Gross profit		
Net profit - fixed costs =		

UNIT 5 SURVEY OF ORNAMENTAL FISH TRADING UNIT

5.1 INTRODUCTION

Keeping ornamental fishes has gone much beyond from being just a hobby. Breeding and culture of ornamental fishes has become a flourishing business today. The world trade of ornamental fishes has touched one billion dollar mark and is striding further with an annual growth of 10% per year. Asian countries are major contributors, but India is yet to pick up momentum.

Indian waters harbors more than 100 indigenous varieties of freshwater and marine fishes which are of ornamental use. All these fishes have very high demand in both national and international ornamental fish trade. In any big or small city there will be a few ornamental fish trading units which breed ornamental fishes, and are involved in selling brooders, selling baby ornamental fish, selling aquariums and aquarium accessories and setting up of complete aquarium.

5.2 OBJECTIVES

After doing this activity you should be able to:

- list different types of ornamental fish sold in the unit and species more in demand and their price structure,
- identify the unit as fish breeder / retailer / wholesaler or combination,
- list out other accessories needed for ornamental fish keeping, sold by the unit and their selling price, and
- observe and record the maintenance of aquaria in that unit.

5.3 MATERIAL AND METHODS

During a survey of an ornamental fish trading unit you should

- Select 3 ornamental fish breeders / retailers / whole sellers / combination of any of the above.
- Fix appointment with the selected sellers for your visit and interview.
- Visit the shop at fixed date and time and find out what type and level of operation he/she is dealing with.
- Find out details of infrastructure facilities and fish varieties maintained / sold by him / her.
- Find out the price structure.
- Enquire about the aquarium accessories being sold by him / her and their selling price.
- Not forget to take your note book, questionnaire, pen / pencil etc.
- Repeat the same procedure for other two shops also.
- visit the same shop 5 to 6 times in a month during your study period since you need one month's data for your study.

5.4 OBSERVATIONS

You can take observations on the following lines:

- Identify the type of unit, whether it is breeding / retail / whole sale / combination of the above.
- Find out the different varieties and sizes of ornamental fishes sold in the shop.
- At what rates various ornamental fishes are sold
- If the shopkeeper is a breeder, find out what varieties he / she is breeding and their selling rate (whole sale rate)
- List out the freshwater and marine varieties separately.
- List out local / imported varieties.
- List which varieties are collected from natural resources and which varieties are bred and reared in the tanks/aquaria (ask the shopkeeper).
- Record the infrastructure facilities available in the shop i.e. aquaria, pumps, tanks, aerators, shed size, etc.
- List out what aquarium related accessories are sold in the shop for example aquaria, pumps, plants, aerators, filters, medicines, toys, air stones, screens, sand, pebbles, etc. and their selling price.

- Find out the number of persons employed for maintenance of aquarium shop and their monthly / daily wages.

5.5 CALCULATION

Based on the above observations calculate the following

- List out and calculate quantity of various ornamental fish sold.
- Calculate the total selling capacity of ornamental fish of a shop in a month.
- Calculate the maintenance charges per month.
- Calculate the total sales (in Rupees) through the aquaria accessories for month.

5.6 ANALYSIS AND RESULTS

Compile all the information in the form of data appendices i.e. tables, graphs, statistical analysis, etc., and interpret the results of your study in your own words i.e. ornamental fishes (exotic / indigenous / freshwater / marine) commonly sold in the shop and most preferred and price fetching varieties; infrastructure / accessories required for aquarium fish keeping / trading.

5.7 CONCLUSION

Based on your study, observations, calculations, analysis and results write the conclusions.

5.8 SUGGESTIONS

Based on your study give your suggestions for improvement of ornamental fish trade.

5.9 BIBLIOGRAPHY

Do not forget to mention all the books, magazines, journals, articles etc. you have referred in relation to your project work.

Table 5.1: Details of ornamental fish selling shop/unit.

1. Name and address of shop _____

2. Name of Shop owner _____

3. Year of establishment _____

Sr. No.	Name of the fish	Freshwater varieties Indigenous					
		From nature (wild)					
		Whole sale			Retail		
		Number	Unit price (Rs.)	Total (Rs.)	Number	Unit Price (Rs.)	Total (Rs.)
1	2	3	4	5	6	7	8

Freshwater varieties								
Indigenous						Imported		
Captive bred and reared								
Whole sale			Retail					
Number	Unit Price (Rs.)	Total (Rs.)	Number	Unit Price (Rs.)	Total (Rs.)	Number	Unit Price (Rs.)	Total (Rs.)
9	10	11	12	13	14	15	16	17

Marine varieties					
Indigenous			Imported		
Number	Unit Price (Rs.)	Total (Rs.)	Number	Unit Price (Rs.)	Total (Rs.)
18	19	20	21	22	23

Table 5.2: Details of total sales of various ornamental fishes.

Sr. No.	Freshwater (Rs.)			Marine (Rs.)		Total (Rs.)
	Indigenous		Imported	Indigenous	Imported	
	From Nature (wild)	Captive Bred and reared				

Table 5.3: Details of accessories and their sale in the ornamental fish shop

Sr. No.	Name	Price per piece (Rs.)	Total number sold in a month	Total sales Rs.

UNIT 6 VARIOUS WAYS OF VALUE ADDITIONS FOR FISH MARKETING

6.1 INTRODUCTION

In all periods and at all levels of technological progress, fish has usually played an essential part in man's diet. However, it is preferred fresh because it is more susceptible to spoilage than other animal protein food. As a result several methods of preservation along with value addition have been developed for the utilization of fish as food. The principal processes employed are curing, drying, smoking, salting, fermentation, cooling or even hard freezing In due course of time various value added products have been developed, but only a few were found sustainable. Out of these also a very little percentage is launched in the market. The products vary from country to country and from one place to another depending upon the availability of raw material, packaging & processing methods and lastly the local preferences.

6.2 OBJECTIVES

After performing this activity you should be able to:

- identify various fish based value added products and by - products available in market,
- identify the products which are more in demand, and
- find out price structure for fish-based products under different trade names.

6.3 MATERIAL AND METHODS

Value-added products will be available in the market, in those shops which are selling different processed products both indigenous and imported ones. Survey a few shops in your town. You have to check whether they are selling fish / crustacean / molluscan products or not. Select about 6-10 shops like this where fish products are sold. Contact manager / owner of the shop and fix up time for your visit to their shop. Select a time when you can talk to a number of customers also. Visit each shop at least six times. During each visit collect the information on:

- What are different value added / processed aquatic products (fish / crustaceans / molluscans) available in the shop.
- Ask the available customers individually about their choice, why they like that particular type and consumption of these products
- Check the frequency of selling fish products individually, their availability and their price structure.

6.4 OBSERVATIONS

You can take following observations:

- What different value-added products (fish based) are available in the shop. e.g canned fish (tuna), smoked fish, fish crisp, fish sausages, surimi etc.
- Note down the quantity available under each variety.
- Also note down the unit price for each variety.
- Take interview of 3-4 customers during each visit.
- Ask about their preferences about the above products. Also if there are any other products that they like and which not available in the shop.
- During the next visit in the same shop find the items sold out and those that are left over.
- Repeat the same procedure in the other shops too.

6.5 CALCULATION

Based on the above observations, calculate the following:

- List of fish food value-added products available in different shops.
- Quantity of stocks available

6.6 ANALYSIS AND RESULTS

Compile all the information in the form of data appendices i.e. tables, graphs, statistical analysis etc. (fitting to your data) and interpret the results of your study in your own words i.e. value-added fish products available in the market and their price structure, customer preferred products etc.

6.7 CONCLUSION

Based on your study, observations, calculations, analysis and results write your conclusions.

6.8 SUGGESTIONS

Based on your study, give your suggestions for new value-added products to be launched or more supply of a particular product or indigenous preparation of any popular imported product.

6.9 BIBLIOGRAPHY

Do not forget to mention all the books, magazines, journals, articles etc. you have referred in relation to your project work.

Table 6.1: Format for collection of data from individual shop.

1. Name of the shopkeeper / owner :

2. Name and address of shop :

3. Various fish products available in the shop :

Sr. No.	Name of the product	Brand name	Total quantity (in kg)	Daily sales (in kg)	Price per kg (in Rs.)	Total daily sales (in Rs.)	No. of customers per day*

* Can be collected from the bill book

Table 6.2: Format for Collection of data from individual customer / consumer.

1. Name of the customer / consumer :

2. Name and address of customer / consumer :

3. Details of various fish products consumption

Sr. No.	Name of the product	Brand name	Average consumption per month	Frequency of consumption (in days)

Table 6.3: Details of fish products liked by consumers.

Sr. No.	Most liked product			Moderately liked product		
	Name*	Availability (Yes / No)	Local/ imported	Name*	Availability (Yes / No)	Local/ imported
1	2	3	4	5	6	7

Rarely liked products			Disliked products	
Name*	Availability (Yes / No)	Local / Imported	Name*	Local / Imported
8	9	10	11	12

* Products known by the consumers but not available in the market also to be mentioned.

UNIT 7 VILLAGE AND FARM-FAMILY SURVEY FOR IDENTIFICATION OF TECHNOLOGICAL GAPS AND TRAINING NEEDS OF AQUACULTURE

7.1 INTRODUCTION

In the recent years the importance of aquaculture has been realised by many rural and urban people. It has been recognised as one of the highly preferred economic activity in many rural villages, because of its high returns as compared to agricultural crops. In this study an effort is made to find out the number of families involved in aquaculture in a selected village and to make the comparison of aquafarm family income with the agriculture farm family and also to find out the technological gaps and training needs of aquafarmers.

7.2 OBJECTIVES

After performing this activity you should be able to:

- to identify the number of families involved in aquaculture activities in a particular village,
- list the various technologies adopted, species cultured, production obtained and income of the families,
- identify the problems faced by farmers and their training needs, and
- compare the income generated by the aquafarm family with that of the agriculture farm family.

7.3 MATERIAL AND METHODS

Try to develop your project along the following lines:

- Identify and choose a village where regular aquaculture is in practice
- Collect the data about the total number of families in a village.
- Find out number of families involved in aquaculture and agriculture separately.
- Find out various aquatic species cultured by different families and the technologies adopted by them.
- Find out the families most commonly and predominantly engaged in agriculture in that village.
- Collect the income details of few selected aquafarm families and agriculture farm families to compare their income.
- Collect the data as per the developed format.

7.4 OBSERVATIONS

You need to take the following observations:

- Number of families involved in aquaculture in a selected village.
- Number of families involved inagriculture in a selected village.
- Number of families doing both agriculture and aquaculture.
- Number of persons working per unit area of aquafarm.
- Number of persons working per unit area of agriculture farm.
- Problems faced by aquafarm families.
- Randomly select 5 aquafarm families and find out the technologies adopted by them, problems faced and their training needs.
- Collect the income statement of 5 aquafarm families, 5 agriculture farm families and 5 families doing both aquaculture and agriculture. Collect the income per unit area i.e. per hectare or acre.

7.5 CALCULATION

Based on the above observations:

- Calculate the percentage of aquafarm families in a selected village
- Calculate the percentage of agriculture farm families in the same village.
- Calculate the income per unit area of the aquafarm.
- Calculate the income per unit area of agriculture.
- Compare the income of both aquafarm family and agriculture farm family and find out which is more.

7.6 ANALYSIS AND RESULTS

Compile all the information in the form of a master table, prepare relevant graphs. Do statistical analysis, wherever possible and interpret the results of your study in your own words on the following lines.

- Ψ Are there any technological gaps in doing aquaculture.
- Ψ Is there any possibility of increasing the existing income by introducing new species or change of species.
- Ψ Is there any training required by the aquafarmers.
- Ψ Ratio between the aquafarm families and agriculture farm families.
- Ψ Is aquaculture superior to agriculture.

7.7 CONCLUSION

Your conclusion can compare the merits and demerits of families involved in aquaculture activities with agriculture families regarding their income.

7.8 SUGGESTIONS

Based on your study, you can suggest how to improve production from the aquafarm, and whether aquafarms need to be encouraged or what steps should to be taken to improve the working of aquafarm.

7.9 BIBILIOGRAPHY

Do not forget to mention the names of books, articles, journals, etc. used for collection and analysis of data.

Table 7.1: Particulars of a village and farm family.

Name and address of village :
Date :

Sr. No.	No. of families doing aquaculture	No. of families doing agriculture	No. of families doing both aquaculture and agriculture	No. of families doing other activities	Total No. of families in the village
1	2	3	4	5	6

Sr. No.	Name of the head of families	Size of Farm (in ha/ acre)	No. of persons involved	Species cultured	Production obtained (kg)	Technology adopted	Problems
1	2	3	4	5	6	7	8

Table 7.3: Particulars of agriculture crop cultured by families involved in aquaculture.

Sr. No.	Name of the head of family	Size of farm (in ha/ acre)	No. of persons involved	Name of crop	Production obtained (kg)	Technology adopted	Problems
1	2	3	4	5	6	7	8

Table 7.4: Particulars of income of aquafarm family.

Sr. No.	Name of the aquafarm's head of the family	Size of aqua-farm (in ha/ acre)	Total Expen-diture (Rs.)	Expen-diture per crop per ha/ acre(Rs.)	Total Gross income (Rs.)	Gross income per ha/acre (Rs.)	Total net income (Rs.)	Net income per ha/acre (Rs.)
1	2	3	4	5	6	7	8	9

Table 7.5: Particulars of income of agriculture farm family.

Sr. No.	Name of the agriculture farm head of the family	Size of agri-culture family (in ha/ acre)	Total Expen-diture (Rs.)	Expen-diture per crop per ha/ acre(Rs.)	Total Gross income (Rs.)	Gross income per ha/acre (Rs.)	Total net income (Rs.)	Net income per ha/acre (Rs.)
1	2	3	4	5	6	7	8	9

UNIT 8 COLLECTION, IDENTIFICATION AND PRESERVATION OF COMMERCIALLY IMPORTANT AQUATIC ORGANISMS

8.1 INTRODUCTION

A good number of aquatic organisms are important in human life, some are consumed as food directly, some are used as food for other animals and others are harvested for various other purposes like extraction of chemicals, toxins, agar and other useful substances to us. This project will make you familiar with the commercially important aquatic organisms of your area.

8.2 OBJECTIVES

After performing this activity you should be able to:

- identify the commercially important cultivable species in your locality, and
- collect, identify and preserve the individual species.

8.3 MATERIAL AND METHODS

For collection of commercially important aquatic organisms you may select a local fish market or a local fish landing centre at a lake site, reservoir or the sea shore. This collection site will depend upon the locality from where you are operating You need to carry a few polythene bags, hand gloves, some cotton, formalin and a big carry bag . Tap water should be available near the collection site.

After reaching the collection point, collect 2-3 specimen of each commercial variety available. Collect at least eight fish (freshwater, brackishwater or marine), two crustaceans and two molluscans and if possible commercially two important aquatic plant species. Specimen should be of medium size since you may have to pay money for the specimens. Do not go for very big size. Very small size will also not be suitable, because identification characters will not be clearly visible.

After picking up 2-3 specimen of each aquatic product wash them thoroughly in clean freshwater, wipe off water with tissue paper and keep each variety in a separate polythene bag and bring them to your home or supervisor directly (immediately). First thing you have to do within 1-2 hrs of collection is to preserve all specimens in 10% formalin. (commercial formalin is 40%). Specimen should be completely covered with the formalin. With the help of your supervisor and books identify the specimens.

8.4 OBSERVATIONS

For identification of aquatic organism's morphological characters, fin formulae etc., are used. Take observations on the following aspects.

- Body shape
- Length of organism
- Weight of organism
- Colour of organisms (dorsal side, ventral side etc.)
- Any marks on the body e.g strips, dots etc.
- Number and types of fins (in fish)
- Number of fin rays, and spines in each fin (fin formula)
- Number of scales above lateral line
- Number and length of barbles
- shape of caudal fin

For Crustaceans

- Weight
- Length of carapace
- Length of abdomen
- Length of telson
- Length of antenna flagellum
- Length of post orbital spine
- Length of hepatic spine
- Length of uropod

For Molluscans

- Shape and colour of shell
- Location of umbo
- Length of organism (shell)
- Weight of organism
- Number of shell valves
- Number and size of aductor and abductor mussels
- Number of teeth in the lings

8.5 ANALYSIS AND RESULTS

Based on the above observations, aquatic organisms will be identified for their phylum, class, order and genus. If possible find out the species also. Common name of the organism in the area of collection should also be found out. For presentation of your results drawing of the individual organism along with labeling, classification and identification characters should be written.

8.6 CONCLUSION

Lastly, you will draw a conclusion, from the number of fish, crustaceans, molluscans in plants that were collected, what are their scientific names, common names and what are their main identification characters.

8.7 SUGGESTIONS

Based on your experience you can suggest convenient field method of collection of organisms and their preservation, labeling, storage and identification, etc.

8.8 BIBILIOGRAPHY

Do not forget to mention the names of books, articles, journals etc., used for identification of aquatic organisms, for collection and preservation methodology.

Table 1: Particulars of commercially important aquatic organisms.

Name of the place :

Address :

Date :

Sr. No.	Variety Fish / crustacean mollusc, plant etc.	Local Name	Vernacular name (Common name)	Scientific Name	No. of Specimen	Average length (cm)
1	2	3	4	5	6	7

Average Weight (g)	% from total catch	Important Identification character
8	9	10

Table 2: Morphological characteristics of individual fish species.

Sr. No.	Vernacular Name	Scientific Name	Body Shape	Colour	Marks (strips/dots
1	2	3	4	5	6

Length (cm)	Weight (g)	No. & types of fins	No. of fin Rays/spines fin formula	No. scales on lateral line	No. and length of barbles
7	8	9	10	11	12

Table 3: Morphological characteristics of individual crustacean classification.

Sr. No.	Vernacular Name	Scientific Name	Total length (cm)	Weight (g)	Length of Carapace
1	2	3	4	5	6

Length of abdomen	Length of telson	Length of Internnal Flagellum	Length of post orbital spine	Length Of Hepatic Spine	Length Of uropod
7	8	9	10	11	12

Table 4: Morphological characteristics of individual Molluscan.

Sr. No.	Vernacular Name	Scientific Name	Length (shell)	Width (shell)	Weight
13	14	15	16	17	18

Table 5: Morphological characteristic of individual plants.

Sr. No.	Vernacular Name	Scientific Name	Length (shell)	Width (shell)	Weight
13	14	15	16	17	18

UNIT 9 SURVEY OF FISH HARVESTING DEVICES

9.1 INTRODUCTION

In aquaculture operations, fish is grown at different stages in different sizes of water bodies i.e. nursery ponds, rearing ponds, culture ponds and also in cement tanks, fibre glass tanks etc. For harvesting different types and size of fish various types of harvesting devices are used, which are designed for the particular purpose. Different types of nets are used for harvesting various types of water bodies which are either operated manually or specially in big water bodies by using boats and manual power together. In the present project you will study the crafts and gears used in nearby aquaculture farm or a reservoir, their designs, operational methods and harvesting capacity.

9.2 OBJECTIVES

After doing this activity you should be able to find out:

- various fish harvesting devices used in different aquaculture operations / reservoirs, and
- the utility, durability and constraints during operation of these devices

9.3 MATERIAL AND METHODS

Try to develop your project along the following lines:

- Identify nearby localities where fishing is regularly practiced. It may be an aquaculture farm or a reservoir
- Make a pilot survey to find out main fishing period and hours in the aquaculture farm or the reservoir, when you can see the real fishing or harvesting activity and also can collect detailed information about the crafts and gears used.
- After collecting preliminary data, work out your visit schedule to the farm/reservoir.
- Observe the functioning of different harvesting devices carefully.
- You need a field note book, a pencil and a questionnaire to record different harvesting devices i.e. crafts and gears used in the farm / reservoir and their operational details.
- For taking observations on harvesting in aquaculture farms, you need to plan your visits in such a way that you can see all types of crafts and gears used on the farm i.e. harvesting in nursery ponds, in culture ponds, harvesting of different cultured species of fish and prawns
- Find out maintenance procedure used for wear and tear of the crafts and gears
- Observe one type of harvesting activity at a time. At one visit you can spend 2-4 hrs. for taking observations.
- Observe only one harvesting location in a day
- Make at least 10-15 such visits.
- Simultaneously, you need to ask the fishermen/farmer about the harvesting devices and their specific functioning Also gather data on the best harvesting devices according to the farmer and fishermen based on the durability and efficiency of crafts and gear.
- If possible find out the local names of different nets, boats etc.
- You can also draw diagrams or take photographs of the different harvesting devices observed / studied, for your project report.

9.4 OBSERVATIONS

You can take observations on the following:

- The different types of nets and boats and other local harvesting devices used in the farm / reservoir and their number per unit area
- Local common and technical names of different crafts and gears observed during your project work.
- Design (drawing, photograph) construction materials and construction of crafts and gears and their specific utility

- Operation of each craft and gear
- Maintenance schedule of crafts and gears
- Durability and efficiency of each craft and gear

9.5 CALCULATIONS

Based on the above observations, calculate the following:

Total number and varieties of operational crafts and gears used in a farm / reservoir

9.6 ANALYSIS AND RESULTS

Compile all the information in the form of "data appendices" e.g tables, graphs, statistical analysis etc. and interpret the results of your study in your own words i.e. major salient features of the harvesting devices (nets, boats, traps etc.), frequently used harvesting device in terms of efficiency, maintenance, durability etc.

9.7 CONCLUSION

Based on your study, observations, calculations, analysis and results, write conclusions.

9.8 SUGGESTIONS

Based on your experience, give your suggestions to improve the harvesting methods and devices and ultimately catch per unit.

9.9 BIBILOGRAPHY

Do not forget to mention all the books, magazines, journals, articles etc. you have referred to in your project work.

Table 9.1: Types of crafts used in a aquafarm / a reservoir.

Name of Farm / Reservoir:

Name of the owner / contractor

Address

Sr. No.	Name of craft		No. in use	Technical details	
	Local	Technical		Size	Capacity
1	2	3	4	5	6

Treditional/ Mechanical	Engine capacity	Manpower required	Cost per unit	Operational cost per hour (Rs.)	Maintance cost / yr. kg	Life spawn (years)
7	8	9	10	11	12	13

Table 9.2: Types of gears used in a aquafarm / a reservoir.

Sr. No.	Name of gear		No. in use	Technical details		
	Local	Technical		Mesh size	Length	Width
1	2	3	4	5	6	7

Manpower required	Cost per unit (Rs.)	Maintance cost of (Rs.)	Life spawn (years)
8	9	10	11

UNIT 10 SURVEY OF ENVIRONMENT FRIENDLY AQUACULTURE FARM PRACTICES (CARP CULTURE / POND CULTURE / SHRIMP CULTURE / PRAWN CULTURE / INTEGRATED FISH FARMING / SEWAGE FED FISH FARMING / PADDY CUM FISH CULTURE - ANY ONE OF THEM)

10.1 INTRODUCTION

Aquaculture is the culture of aquatic organisms in controlled conditions, so as to get better production in terms of quality as well as quantity. Various aquatic organisms which have economic value are cultured, which includes fishes, like carps, air breathing fishes, catfishes etc., prawns, shrimps, crabs, mussels, oysters etc. When these aquaculture systems are combined with other farming systems *viz* bird raising, animal husbandry, horticulture, agriculture, floriculture etc., it is termed as "Integrated fish farming".

In general an aquaculture farm may be only a fish culture farm, shrimp farm, prawn culture farm or a combination of paddy-fish, sewage-fed-fish or an integrated fish farming system. Therefore, when you visit a farm, you must know, the kind of aquaculture being practiced in the farm and also if there is any other economic activity taking place in the farm.

Selected example: Carp culture farm

The major cultivated fishes all over the world are the fishes belonging to the carp family. In fact there are three major systems of carp culture, such as Chinese system, where the Chinese carps are cultured together, the Indian system, where the Indian major carps are cultured together and the European system where common carp alone is cultured.

Carps are cultured under two culture systems *i.e.* monoculture and polyculture. The former is mainly practiced in European countries, whereas polyculture is practiced in India and China. In India, polyculture of carps is modified into a package of practice called "Composite fish culture" in which Indian major carps *i.e.* Catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*) alone or along with Chinese (silver carp and grass carp) and common carp are cultured under 3 and 6 species combination respectively.

Carp culture, composite fish culture or polyculture followed in India is either extensive *i.e.* traditional method (minimum inputs are supplied), semi-intensive method (few inputs are supplied) or intensive method where all parameters are under control. In Indian tropical climate, semi-intensive carp culture is most eco-friendly and technically and economically viable technology.

10.2 OBJECTIVES

After performing this activity you should be able to:

- find out various aquaculture operations followed in a particular farm,
- determine the economic structure of the surveyed farm,
- find out the social aspects (religion, customs, social taboos) of aqua-farming in the area, and
- find out the impact of aquafarming on environment.

10.3 MATERIAL AND METHODS

Try to develop your project along the following lines:

- Identify and choose a nearby aquaculture farm for your observations, where some aquaculture practices are followed.

- Plan your visits to the farm when most of the aquaculture activities can be observed.
- If there are many aquafarms around you, give preference to that farm which has more number of activities.
- Observe the different farm activities carefully.
- You need a field note book and a pencil/pen to record the details of each activity taking place in the farm.
- You also have to record the outlets of farm effluents discharged from the farm, its quantity and effect on the environment.
- Fix the number of visits in such a way that you can observe all operations of the farm performed during the year. At least eight to ten visits (full day) should be necessary to get essential information about the farm.
- Simultaneously, you need to collect data about the farm details, employees, involvement of the owner and his/her family inputs, expenditures, maintenance, sale and profit of the farm.
- You can also draw the diagrams of different components of the farm for presenting in your project report.

10.4 OBSERVATIONS

Take observations on the following:

- Different aquaculture operations conducted round the year in the aquafarm.
- Information about the inputs used round the year, expenditure for inputs and labour, money spend on maintenance, sale of produce, quantity of sale and income, net profit of the farm.
- Information on the social structure of the village, dominating religion, religion of farmer, customs in the village specially related with fisheries and aquaculture operations. Any inhibitions, taboos etc. specific to the area, village.
- Outflow effluent of the farm, receiving area, its ecology, past and present.

10.5 CALCULATIONS

Based on the above observations, calculate the following:

- Operation wise quantity of different inputs, total quantity of particular input used during each month and over the year.
- Operation wise total expenditure on specific inputs monthly and annual.
- Manpower used each month and annually, their salaries individual as well as total.
- Cost of maintenance (item wise, monthly statement)
- Monthly and annual quantity of different farm produce (fish, shrimp, vegetables, rice, ducks, eggs, chickens, milk etc.)
- Monthly and total sale of produce
- Income of the farm.
- Net profit of the farm.

10.6 ANALYSIS AND RESULTS

Compile all the information in the form of "data appendices" e.g tables, graphs, statistical analysis and interpret the results of your study in your own words i.e. salient features of the aqua-farm : carp culture farm - species cultured in the farm, area under fish culture activities performed during the year, quality and quantity of monthly and total inputs in the farm, item wise monthly and total expenditure of the farm, monthly and annual sale of different species/produce of the farm, quantity and value. Net income of the farm. Any specific feature of farm or village (socially, economically). Aquaculture effluent treatment practices followed by the farmer, if any.

10.7 CONCLUSION

Based on your study, observations, calculations, analysis and results, write your conclusions.

10.8 SUGGESTIONS

Based on your experience in the aquafarm, give your suggestions to improve the farm conditions, facilities, operations, production and profit.

10.9 BIBILIOGRAPHY

Mention all the books, magazines, journals, articles etc. you have referred to in your project work.

Table 10.1: Details of Aquaculture Operations.

Name of the owner:

Total area of the farm:

Water spread area of the farm:

Address:

S.No.	Month	Operational details in different months
1.	January	
2.	February	
3.	March	
4.	April	
5.	May	
6.	June	
7.	July	
8.	August	
9.	September	
10.	October	
11.	November	
12.	December	

Table 10.2: Details of imputs used in the aquafarm.

S.No.	Name of input	Quantity per ha. (kg)	Total (kg)	Cost per kg (Rs.)	Total cost (Rs.)
1					
2					
3					
Total					

Table 10.3: Economics of an aquafarm.

Operational cost

1. Lease, amount per year : Rs.
2. Cost of inputs : Rs.
3. Consultation fee, if any : Rs.
4. Manpower charges : Rs.
5. Harvesting charges : Rs.

Fixed cost

Interest on operational cost @ 15% : Rs.
Operational cost : Rs.

Gross profit

Quantity of fish (kg) :-
Sale price of fish / kg - Rs :-
Total sales of fish in a year - Rs. :-

Net profit

Gross profit - Fixed cost : Rs.

Table 10.4: Social structure of the village.

S. No.	Name of Religion	Population (No.)	Percent-age (%)	Occupation	Per capita income	No. of families/ persons involved in Aqua-culture / fisheries

Table 10.5: Details of effluents released from the aquafarm.

S. No.	Nature of effluent	Quantity per day/ month	Characteristics	Use (if any)

Table 10.6: Ecology of effluent receiving area.

S.No.	Conditions	Before	After
1.	Environmental conditions		
2.	Biological conditions		

UNIT 11 VISIT TO A FISH PROCESSING UNIT

11.1 INTRODUCTION

Consumption of fish may be greatly increased by making better use of the existing catch. Value addition of this catch may be achieved by use of improved handling and processing techniques on one hand and developing different products on the other. Preparation of value added product using a species in glut is a sure way of better utilization and distribution of the species when the landing is scanty.

Processing units are the necessary facilities required to develop value added products. A processing unit generally deals with freshly caught and killed fish. First the fish is handled physically, cleaning and cutting are done according to the requirement. The cleaned fish undergoes various treatments depending on the type of product is to be developed. Finally the product so developed is packed and sealed for sale. Thus this project will give you a comprehensive idea of the procedures and economics involved in processing aquaproducts.

11.2 OBJECTIVES

After performing this activity you should be able to:

- list out various varieties of fish processed in a particular unit,
- find out various processed products in that unit,
- find out quantity and value of each variety / species processed, finished product, export and turnover of the unit,
- find out quantity of waste generated, remedial measures taken and its utilization, if any, and
- find out the percentage / capacity utilization of processing plant.

11.3 MATERIAL AND METHODS

- Identify and select a nearby fish processing unit for your study, where regular processing of fish is done.
- Plan your visit to the fish processing unit, when processing activities are in progress, so that all activities can be observed and information can be gathered.
- At the predecided date and time, go to the fish processing unit. Do not forget to gather preliminary information about the processing unit before the visit. Carry a notebook, pen, pencil and necessary proforma with you.
- During your visit you can collect information in two ways i.e. (i) Directly by observing the activities and gathering the information on the ongoing activities.
- Collecting information from the manager/registers about the annual figures of the processing unit.
- You have to find out separately about their waste treatment facility (if any) and their details.
- You need to visit the processing unit at least 3-4 times, because one day visit may not be sufficient for gathering information from the registers.
- Some information which you do not get by direct observations or through registers, you can gather by fixing up personal interview with the manager of the unit.
- You can also take photographs of the unit using different processing methods and different varieties of fish, being processed.

11.4 OBSERVATIONS

You can take observations on the following:

- The different varieties and quantities of fish arrival in the processing unit.
- The abundant varieties and rare varieties
- Different methods of processing techniques used for different varieties of fish.
- Quantity and value of each variety of processed product (species processed)
- Quantity and value of total finished product export and turnover of the processing unit.
- Quantity of waste produced during processing of different fish products and their recycling procedure /

remedial measures etc.

- Lastly based on earlier information and direct questions find out the total capacity of the processing unit and also the quantum of utilization of the unit.
- Involvement of Govt./Govt. agencies / co-operatives in the functioning of the processing unit.

11.5 CALCULATIONS

Based on the above observations, calculate the following

- Species wise / product wise quantity, rates and total volume and value of the products.
- Total amount of raw fish used for processing in the unit.
- Total export from the unit both in terms of quantity, quality and value.
- Quantity of total waste generated in relation to raw material used and quantity / percentage recycled.
- Percentage utilization of the processing unit.

11.6 ANALYSIS AND RESULTS

Compile all the information in the form of "data appendices' e.g tables, graphs, statistical analysis etc. Interpret the results of your study in your own words i.e. major salient features of the processing unit (fish species processed in the unit, their quantity, different products, their volume, value and total turnover of the unit. Export component in terms of value & volume and utilization capacity of the unit etc.)

11.7 CONCLUSION

Based on your study, observations, calculations, analysis and results, write conclusions.

11.8 SUGGESTIONS

Based on your visit and experience, give your suggestions to improve the facilities and processing techniques at the unit.

11.9 BIBILIOGRAPHY

Do not forget to mention all the books magazines, journals, articles etc. you have referred in relation to your project work.

Table 11.1: List of various varieties of fish processed in a particular unit.

Name of the processing plant:-

Name of the owner:-

Address:-

Capacity of plant:-

Sr. No.	Name of fish	Quantity per day (kg/ton)	Quantity per month (kg/ton)	Quantity per year (kg/ton)	Method of processing

Table 11.2: List of various processed products.

Sr.No.	Name of product	Mode of packing	Total quantity (kg/ton)

Table 11.3: Details of disposal of various products.

Sr. No.	Name of the product	Total Quantity (kg/ton)	Quantity exported (kg/ton)	Value of product exported (Rs.)	
				per kg	Total
1	2	3	4	5	6

Quantity sold locally (kg/ton)	Value of product sold locally (Rs.)		Total value (Rs.)
	per kg	Total	
7	8	9	10

Table 11.4: Details of finished and waste products.

Sr.No.	Name of fish	Total Quantity of fish processed (kg/ton)	Total Quantity of finished product (kg/ton)	Total Quantity of waste (kg/ton)

Table 11.5: Utilization of waste products.

Sr. No.	Name of waste product	Quantity (kg/ton)	Name of by product produced from waste	Quantity (kg/ton)	Value	Remarks

Table 11.6: Details of raw materials and finished products.

Sr. No.	Raw material			
	Name of fish	Quantity (kg/ton)	Value (Rs.)	
			kg	Total
1	2	3	4	5

Finished products			
Name of fish	Quantity (kg/ton)	Value (Rs.)	
		kg	Total
6	7	8	9

Waste products			
Name of fish	Quantity (kg/ton)	Value (Rs.)	
		kg	Total
10	11	12	13

Table 11.7: Details of Man power in a processing unit.

Sr.No.	Name of post	Number	Wages per Month per head (Rs.)	Total wages (Rs.)

UNIT 12 STUDY OF SOIL TYPE AND WATER QUALITY OF AN AQUAFARM

12.1 INTRODUCTION

Normally in an aquafarm, study of soil quality is very important. Study of water quality is essential because the growth rate and survival of fish is directly related with the water quality. For example, the density of fishes is generally higher in the ponds than natural habitants and so, more oxygen is consumed in confined ponds, which may lead to oxygen depletion. This hampers the growth and survival rate of fish hence, adequate care should be taken to maintain the oxygen level by the use of oxygen blowers and other aeration devices etc. Similarly, the toxic excretory metabolites like CO_2, ammonia, urea etc, increase the pH levels of ponds in the aquafarm.

Bottom soil of ponds is called pond soil, mud and sediment and plays a very important role in the ponds of an aquafarm. Fluxes of nutrients and oxygen between soil and water play an important role in determining water quality in a pond.

12.2 OBJECTIVES

This project will help you:

- to find out the soil type and its suitability for aquaculture farm, and
- to find out the range of physico-chemical parameters of water and their suitability for aquaculture.

12.3 MATERIAL AND METHODS

Try to develop your project in the following lines:

- Identify and choose a nearby fish farm for your study, where aquaculture is regularly being practiced.
- Select water and soil parameters which are important for any aquafarm and which you can test conveniently either by purchasing the test kits, chemicals etc. or can test in a nearby laboratory suggested by your supervisor.
- Find out and learn the methodology to be used for the soil and water testing parameters.
- Prepare a sample collection field kit before you go to an aquafarm for taking samples
- Plan your visit to the aquafarm when aquaculture activities are in progress, so that the actual fish pond samples can be collected.
- At the predecided date go well prepared to the fish farm and collect the samples of soil and water. Some parameters can be analysed on the site itself, whereas for the others fixed / preserved samples are to be brought to your laboratory.

12.3.1 Soil Analysis

You need to do the following analysis for soil:

i. Water retention capacity
ii. Sand silt and clay percentage
iii. pH
iv. Organic carbon
v. Nitrogen content
vi. Phosphate content

Soil Sample collection

- Clean the area by removing stones, rubbish or trash to expose the soil.
- Push the soil sampler or dig the soil upto a depth of 15 cm.

- ❋ Collect about 100 g soil samples at 4-5 places in the given area using a spade or shovel if the soil sampler is not available.
- ❋ Mix sub-samples together to get about 500 g of soil.
- ❋ Weigh 100 g of sample in a pre-weighed petri-dish.
- ❋ Air dry the bulk sample by spreading on top of an absorbent paper in a shady place for 4-6 days. Also keep the sample in the petri-dish for drying nearby.
- ❋ Store the dry soil in plastic bags and label properly

A. WATER RETENTION CAPACITY

Materials Required

Container, analytical balance, distilled water and water dropper.

Procedure

For estimating water retention capacity of the soil sample,

- Determine the get the constant weight of one glass beaker of one litre capacity.
- Put the desired soil sample in it and weigh.
- Lastly saturate the soil sample with distilled water drop by drop and calculate the value as follows-

  i. Weight of container – 'a' g
  ii. Weight of container and soil sample – 'b' g
  iii. Weight of container, soil sample and retained water – 'c' g

Calculation

The water retention capacity of soil in percent is -

$$= \frac{(c - b) \times 100}{(b - a)}$$

B. DETERMINATION OF PERCENTAGE OF SAND, SILT AND CLAY

Materials required

One measuring cylinder, glass rod for stirring the soil sample; soil sample and clear water.

Procedure

- Take a measured quantity of soil (100 g) sample in a graduated measuring cylinder.
- Add suitable quantity of distilled water in the cylinder.
- Stir the soil sample and water with the help of a glass rod.
- After stirring for 10-15 minutes allow the sand, silt and clay particles to settle down.
- After a twelve hours period, there will be three clearly visible gradations in the cylinder with sand particles at the bottom, silt at the middle and clay at the top.
- Calculate the percent break-up of sand, silt and clay in the given sample.

Calculation

$$\frac{\text{Volume of sand / silt / clay} \times 100}{\text{Total volume of soil sample taken}} = \% \text{ of sand /silt/clay}$$

C. ESTIMATION OF SOIL pH

Recall that pH is the hydrogen ion concentration and is expressed by the pH scale method. It can be defined as the "logarithm of the reciprocal of the normality of free hydrogen ions". Colorimetric methods depend upon the addition of the proper sensitive indicator solution to the sample and a comparison of the colour so produced with graded, coloured standards, the pH values of which are known. Thus in this method, different dyes are used which manifest a definite but different colour for each particular pH value of the media into which they are introduced. These differences in colour of the indicators are an expression of the differences in hydrogen ion concentration.

Materials Required

Lovibond comparator with permanent glass colour disc; indicator solution; pure barium sulphate ($BaSO_4$); analytical balance; 100 mL beaker; glass rod; and distilled water.

Procedure

- Measure 10 g of the prepared soil sample in a 50 mL beaker.
- Add 20 mL distilled water and a pinch of barium sulphate.
- Stir intermittently for 1/2 hour and allow to settle.
- Pour the clear supernatant liquid in the comparator tube, add one drop of the indicator, and match the colour of the solution with the standard colours on the comparator disc. Read the corresponding pH.

You can use alternate method of measuring pH using pH paper or universal indicator

D. ESTIMATION OF ORGANIC CARBON

Material Required

1. 500 mL conical flask
2. 2, 10 and 20 mL pipette
3. 50 mL burette
4. 85% phosphoric acid
5. 20% sodium fluoride
6. 96% sulphuric acid
7. Standard 1N $K_2Cr_2O_7$ solution (dissolve 49g of $K_2Cr_2O_7$ in distilled water to make 1 litre.
8. Standard 0.5 N Ferrous ammonium sulphate (dissolve 196.1 g $FeSO_4$ $(NH_4)_2$ $SO_4.6H_2O$ in 800 mL water add 20mL concentrated H_2SO_4 dilute to 1 litre
9. Diphenylamine indicator solution (Dissolve 0.5 g of diphenylamine in a mixture of 100 mL sulphuric acid and 20 mL distilled water and store in a coloured bottle)

Procedure

- Measure 1.0 g of the dried and finely ground soil sample in 500 mL conical flask.
- Add 10 mL of 1 N K_2 Cr_2 O_7 solution and 20 mL concentrated H_2 SO_4 and swirl gently to (if mixed too vigorously then organic particles will stick to sides of flask out of the solution).
- Mix thoroughly and allow the reaction to complete for 30 minutes. Place the flask on an insulated pad to avoid rapid heat loss.
- Dilute the reaction mixture with 200 mL water to provide a clearer suspension for viewing end point.
- Add 10 mL H_3 PO_4 and 10 mL of NaF solution.
- Add 2 mL of diphenylamine indicator. Titrate the solution with the standard ferrous ammonium sulphate solution to a brilliant green colour. A blank without soil is run simultaneously.

Calculation

Weight of soil taken	=	wg
Volume of 0.5 N ferrous ammonium sulphate required for blank	=	x mL
Volume of 0.5 N ferrous ammonium sulphate required for soil sample	=	y mL

Difference = (x – y) mL
1 mL of 1 N $K_2Cr_2O_7$ = 0.003 g carbon

$$\text{Percentage of carbon in soil} = \frac{x - y \times 0.003 \times 100}{2 \times w}$$

Where w is the weight of the soil taken for estimation of organic carbon.

E. ESTIMATION OF NITROGEN CONTENT

Materials required

Kjeldahl digestion assembly; distilled water; H_2SO_4; K_2SO_4; selenium; granulated zinc; sodium hydroxide; phenolphthalein; hydrochloric acid; and sugar.

Procedure

- Transfer 10 g of soil to a flat-bottomed pyrex kjeldahl digestion flask and add 10 mL. of water. Shake and allow to stand for half an hour.
- Then add 30-35 mL. of concentrated sulphuric acid. Ferruginous and lateritie soils require a larger volume of sulphuric acid to keep the digest fluid during the later stages, owing to the formation of large quantities of ferric and aluminium sulphates.
- Start the digestion over a small flame and gradually increase the heat until white fumes of sulphuric acid are produced.
- Remove the flask and add 10 g of potassium sulphate (or anhydrous sodium sulphate) and 0.2 g of selenium.
- Replace the flask and continue the digestion for 1 to 1 1/2 hours after the digest has become colourless.
- Allow the flask to cool, dilute the contents with about 100 mL of water and transfer the fluid part to a 1,000 mL conical flask, leaving as much as possible of the sand behind.
- Wash the sandy residue with four or five lots of 50-60 mL of water, decanting the washings into the conical flask after allowing the sandy residue to settle for a few seconds each time.
- Add a piece of granulated zinc and then 100-110 mL of sodium hydroxide (453 g of sodium hydroxide + 1 litre of water) or sufficient NaOH to make the contents of the flask alkaline to phenophthalein.
- Pour the sodium hydroxide solution down the side of the flask so that it forms a heavy layer at the bottom.
- Place the stopper in the flask and connect it to the distillation apparatus.
- Mix the contents well by shaking and commence the distillation, collecting the ammonia in 25 mL of 0.1 N hydrochloric acid containing two or three drops of methyl red indicator solution.
- For soils high in nitrogen, absorb the ammonia in 35 mL of standard acid or use smaller quantity of soil for determination.
- Distil until about one-third of the liquid has passed over.
- When the distillation is completed, rinse the condenser tube which dips into the standard acid and titrate the excess of acid with tenth normal sodium hydroxide.
- Carry out a blank determination in exactly the same manner but using about 0.2 g of cane sugar in place of the soil, so as to correct for any nitrogen contained in the reagents.

Calculation

You can calculate the percentage of nitrogen in the soil, on the basis of a 10 g sample as following:

(B-T) x N x 0.14

Where B = blank titration, in mL of standard alkali
T = actual titration, in mL of standard alkali

and N = normality of the standard alkali

F. ESTIMATION OF PHOSPHATE

Two methods are recommended for determination of available phosphorus in soils *viz.*, Bray's method No.1 for acidic soils and Olsen's method for neutral or alkaline soils.

i. Bray's method no. 1

Material Required

1. Photoelectric colorimeter,
2. Multiple dispenser or automatic pipette - 5, 10, 50 mL,
3. Bray extractant No.1 - (0.03 N NH_4 F in 0.025 N HCl) dissolve 22.2 g of NH_4 F in 200 mL of distilled water. Filter and add to the filtrate 10 litres of water containing 40 mL of conc. HCl. Make up volume to 20 litres with distilled water.
4. Molybdate reagent - dissolve 1.5 g $(NH_4)_2$ MoO_4 in 300 mL distilled water. Add the solution to 350 mL of 10 N HCI solution, gradually while stirring. Dilute to 1 litre with distilled water,
5. Stanous chloride solution (stock solution) - dissolve 10 g $SnCl_2$. $2H_2$ O in 25 mL of conc. HCl. Add a piece of pure metallic tin and store the solution in a glass stoppered bottle, working solution - dilute 1 mL of the stock solution to 66.0 mL with distilled water just before use.

Procedure

- Preparation of the standard curve - Dissolve 0.1916 g of pure dry KH_2PO_4 in 1 litre of distilled water. This solution contains 0.10 mg P_2O_5 per mL. Preserve this (with a drop of toluene) as a stock standard solution of phosphate.
- Take 10 mL of this solution and dilute it to 1000 mL with distilled water. This solution contains 1 microgram (0.001 mg) of P_2O_5 per mL.
- Take 1,2,4, 6 and 10 mL of this solution in separate 25 mL measuring flasks. Add to each 5 mL of the extractant solution, 5 mL of the molybdate reagent and dilute with distilled water to about 20 mL.
- Add 1 mL dilute $SnCl_2$ solution, shake again and dilute to the 25 mL mark. After 10 minutes, read the blue colour of the solution on the photoelectric colorimeter, using 660 nm red filter (Klett No.66).
- Plot the meter reading against microgram of P_2O_5 and join the points with a straight line.

Extraction

Add with a multiple dispenser 60 mL of the Bray's extractant No.1 to 11 conical flasks (100 mL) in a wooden rack each containing 5 g measured soil sample, shake for 5 minutes and filter.

Development of colour

Take 5 mL of the filtered soil extract with a bulb pipette in a 25 mL measuring flask; deliver 5 mL of the molybdate reagent with an automatic pipette, dilute to about 20 mL with distilled water, shake and add 1 mL of the dilute $SnCl_2$ solution with a bulb pipette. Fill to the 25 mL mark and shake thoroughly. Read the blue colour after 10 minutes on the photoelectric colorimeter, using 600 nm red filter (Klett No.66), after setting the instrument to zero with the blank prepared similarly but without soil.

Calculation

Find the P_2O_5 content of the filtrate from the standard curve and calculate Kgs of P_2O_5 per acre (2,000,000 kg soil) by multiplying the curve reading in µg (microgram) by 4 as -

If A µg P_2O_5 is read from the curve then,

$$\frac{A}{1,00,000} \times \frac{50}{5} \times \frac{2,000,000}{5} \times \frac{453}{45} = 4A(\text{kgs } P_2O_5/\text{Acre})$$

ii. Olsen's method

Materials required

1. Photoelectric colorimeter;
2. Bicarbonate extractant; dissolve 840 g sodium bicarbonate in 20 litres of distilled water and adjust the pH of the solution to 8.5 by addition of dilute NaOH or HCI solutions. Filter the solution, if necessary
3. Activated carbon; any suitable decolorizing carbon made free from soluble phosphorus by repeated washings with the bicarbonate extracting solution;
4. Molybdate reagent same as for the Bray's method No.1 except that instead of 350 mL of 10 N HCI, add 400 mL of 10 N HCI, and stannous chloride solution - same as in Bray's method No.1.

Procedure

Preparation of standard and curve-procedure is the same as in Bray's method No.1.

Extraction

Add with a multiple dispenser 50 mL of the bicarbonate concentrate to 11 conical flasks (100 mL) in a wooden rack each containing 2.5 g measured soil sample. Add 1 g measure of the decolourising carbon. Shake for 30 minutes on the mechanical shaker and filter.

Development of colour

Procedure is same as described under the Bray's method No.1 Calculate Kg of P_2O_5 per acre by multiplying the curve reading in µg with 9\8.0.

Take following precautions while collecting and analysing soil samples.

i. Collect the composite soil sample with utmost care.
ii. Take the soil sample from seven feet depth
iii. Before starting the analysis work get the soil samples dried using an air dryer or an oven.
iv. After collecting the soil sample make it either air dry or oven dry. The entire dry soil sample is crushed with a wooden pestle in an iron, wooden or heavy porcelain mortar. The crushing of pebbles, concrete pieces roots and rock pieces should be avoided. The crushed soil is screened through a 2 mm sieve.

12.3.2 Water analysis

Collection of water sample : You need to collect water sample at two places

i. Sample for DO in BOD bottles of 125 mL / 250 mL.
ii. Sample for other water quality parameters in a wide mouth 1 litre plastic bottle.

A. DETERMINATION OF DISSOLVED OXYGEN

Materials required

250 mL glass stoppered BOD bottles, conical flasks, burrettes, pipettes.

i. Winkler's "A" solution :

- Dissolve 365 g of manganese sulphate dihydrate ($MnSO_4 2H_2O$) or 670 g of $MnSO_4 . 4H_2O$ in a small amount of distilled water

- Filter the solution
- Dilute it to 1 litre
- Store in a plastic bottle.

ii. Winkler's "B" solution :

- Dissolve 500 g of NaOH or 700 g of KOH in a small amount of distilled water.
- Dissolve 150 g of NaI or 300 g of KI in a small amount of distilled water
- Dissolve 10 g of a NaN_3 (Sodium azide) in a small volume of distilled water.
- Mix the 3 reagents together
- Dilute to 1 litre

iii. Sulphuric acid (concentrated H_2SO_4 Sp Gr. 1.84)

iv. Sodium thiosulphate (0.025 N)

- Dissolve 6.205 g of $Na_2S_2O_3.5H_2O$ in freshly boiled and cooled distilled water
- Dilute to 1 litre in a volumetric flask.
- Add 5 drops of chloroform (or 10 mL isobutyl alcohol) as preservative.
- Keep the solution in dark bottles in a cool place.

v. Starch indicator solution

- Dissolve 1 g of soluble starch in 100 mL of distilled water by warming until the solution becomes clear.
- Add 0.1 g of salicylic acid (or 0.5 mL of formalin as preservative)

vi. Potassium iodate (0.1 N)

- Dry some KIO_3 at 105°C for one hour.
- Cool in a desiccators
- Weigh out 3.567 g and dissolve in 200-300 mL of distilled water.
- Transfer to 100 mL, volumetric flask and make it up to the mark with freshly boiled and cooled distilled water.
- Store in a dark bottle in a cool place.

Procedure for fixation of sample:

- Collect water samples in 250 mL glass stoppered bottles, water should be filled slowly not permitting any air bubble to remain inside.
- Immediately add 1 mL Winkler's "A", followed by 1 mL of Winkler's "B", to the sample for preservation.
- Close the bottle with the stopper and shake vigorously. Allow the precipitate (Manganese hydroxide) to settle. In this precipitated form the sample can be stored for a longer time.

Estimation of dissolved oxygen

- Add 1 mL of con. H_2SO_4 to the sample bottle.
- Close the bottle with the stopper avoiding any air bubble.
- Shake until the precipitate dissolve.
- Transfer 100 mL of this sample to a conical flask.
- Titrate it with standard $Na_2S_2O_3$ solution at an even speed until a very pale yellow colour remains.
- Add 3 drops of starch indicator which changes the colour of the solution to blue.
- Continue titration drop by drop until the solution becomes colourless.
- Note burrette reading

Observations

- Observe the formation of a pale yellow colouration in the reagent blank and potassium iodate solution which marks the end point in the titration.

S.No.	mL of sample (V)	mL of titrant used (v)	DO mg / L
1			
2			
3			
4			

Calculation

One mL of 0.025 N soldium thiosulphate solution is equivalent to 0.2 mg oxygen

$$\text{DO in mg / L} = \frac{8 \times 1000 \times N}{V} v$$

where V = volume of sample (mL)
v = volume of titrant used (mL)
N = normality of the titrant

Result

Result will be expressed in mg / L

B. DETERMINATION OF CARBON DIOXIDE

Materials required

- Polyethylene bottles or borosilicate glass bottles, burette, stand, burette, pipettes, glass rods, measuring cylinders, conical flasks

i Standard NaOH (0.027 N or N44) solution

- Dissolve 4 g of NaOH in 1 litre of distilled water to make 0.1 N NaOH stock solution.
- Dilute 100 mL of 0.1 N solution to 440 mL in a volumetric flask to make it to 0.0226 N.
- Store the solution in polyethylene bottles in a cool place.

ii. Phenolphthalein indicator solution

- Dissolve 0.5 g of phenolphthalein in 50 mL of 95% enthyl-alcohol.
- Add 50 mL of CO_2 - free distilled water.
- Add drop-wise standard NaOH solution until a faint pink colour appears.

iii. Sulphuric acid (0.02 N)

- Dilute 2.8 mL of con. H_2SO_4 to 100 mL with CO_2 - free distilled water.
- Dilute 200 mL of this solution (0.01 N) to 100 mL in a volumetric flask with CO_2 - free distilled water.

Procedure

Estimation of CO_2

- Take 50 mL of water sample in a flask
- Add 4 drops of phenolphthalein indicator. If the water turns pink, free-CO_2 is absent and if it remains colourless it contains free - CO_2.
- Titrate rapidly with standard alkali solution, stirring gently with a rod.
- Observe the end point which is marked by the appearance of a faint pink colour which remains for 30 seconds.

Observations

- Observe initial burette reading

- Observe the end point which is marked by the appearance of a faint pink colour, which remains for 30 seconds.
- Observe the final burette reading
- enter your reading in the following table

S.No.	Amount of Sample (mL)	Amount of titrant used (mL)	Free carbon dioxide mg / L
1			
2			
3			
4			

Calculations

Calculate the amount of CO_2 by using the formula.

$$\text{Free } CO_2 \text{ mg / L} = \frac{\text{mL of titrant x 1000}}{\text{mL of sample}}$$

Results : Express the results as free CO_2 mg / L

C. DETERMINATION OF ALKALINITY

Alkalinity in most natural waters is due to normal carbonates, bicarbonates and hydroxides.

Materials required

- Titration assembly
- Conical flasks
- Sulphuric acid N/50 solution
- Methyl orange indicator (Dissolve 0.5 g of methyl orange in 1 litre of distilled water and store in dark bottle)
- Phenolphthalein indicator (as in free CO_2 estimation)

Procedure

- Take 50 mL water sample in conical flask and add two drops of phenolphthalein indicator solution
- If a slight pink colour appears, titrate with acid titrant to a colourless end point and note the reading as 'p' (mL of titrant used for phenolphthalein alkalinity)
- Add 2 drops of methyl orange indicator to the same sample; if a yellow colour is produced, hydroxides, normal carbonates, or bicarbonates are present.
- Add N/50 H_2SO_4 from the burette until the colour shows the first change from pure yellow. The end point is a faint orange tint. Record number of mL's of acid used "t" (total volume of the titrant used for both the titratins)

Observations

- Observe the initial burette reading
- Observe the end point marked by the appearance of a faint orange tint.
- Observe the final burette reading
- Find out the value of 'p' and 't'
- Tabulate the reading of 'p' and 't' in the following proforma

S.No.	mL of sample	mL of titrant used for 'p'	mL of titrant used for 't'
1			
2			
3			
4			

Calculations

Calculate the phenolphthalein and total (methyl orange) alkalinity by using following formula

Phenolphthalein alkalinity (p) as mg / L of $CaCO_3$

$$= \frac{\text{mL of titrant 'p' x 1000}}{\text{mL of sample}}$$

Total alkalinity (T) as mg / L of $CaCO_3$

$$= \frac{\text{mL of titrant 't' x 1000}}{\text{mL of sample}}$$

Result : Express the total alkalinity and contribution of bicarbonates (HCO_3^-), carbonates (CO_3^{--}) and hydroxide (OH^-) as mg / L of $CaCO_3$

D. DETERMINATION OF pH (COLORIMETRIC METHOD)

Material required

- pH comparator (Lovibond), indicator solution

Procedure

- Take 5 mL of water sample in two cuvettes provided with the pH Lovibond comparator.
- Place one of the cuvettes in the cavity facing the disc
- To the other cuvette add 2 drops of suitable indicator solution (select from the table), shake gently and place in the other cavity of the comparator box.
- Match the colour developed in the sample with the standard colour disc and record the corresponding value.

Indicator	pH-range
Bromophenol blue	3 - 4.6
Bromocresol green	4 - 5.6
Chlorophenol red	5.2 - 6.8
Bromothymol blue	6 - 7.6
Phenol red	6.8 - 8.4
Thymol blue	8 - 9.6

12.4 ANALYSIS AND RESULTS

Compile all the information in the form of table, prepare relevant graphs, and interpret the results of your soil and water analysis in the form of suitability of water and soil parameters for aquaculture, seasonal variations and the maxima and minima of these parameters.

12.5 CONCLUSION

Lastly, you will draw a conclusion in the form of different soil and water parameters of the aquafarm visited, and their suitability for aquaculture.

12.6 SUGGESTIONS

Based on your analysis, you can suggest how to improve water and soil quality of the aquafarm, to achieve better production.

12.7 BIBILIOGRAPHY

Do not forget to mention the names of the books, articles, journals, analytical methods etc. used for soil and water analysis, and analysis of data.

ANNEXURE – A

This is to certify that I have examined the proposal of the project entitled _____

_____

submitted by Ms/Mr. _____

(Roll No. _____) and have found it satisfactory.

_____

Signature of course counsellor

Date:

Study Centre Code:

Copy to:

The Registrar
School of Sciences
IGNOU
Maidan Garhi
New Delhi – 110068

ANNEXURE – B

This is to certify that the work embodied in the project titled _____

_____

has been carried out by me and has not been published in any form in any journal, magazine or book.

_____

Signature of the Student

Enrollment No. .....

ANNEXURE – C

This is to certify that the project entitled _____

_____

was undertaken by Ms./Mr. _____

(Roll No. _____) under my guidance. The enclosed report on the project is the result of bonafide work done by her/him during the period _____ to _____

_____

Signature of course counsellor

Date:

Study Centre Code:

Copy to:

The Registrar
S R and E Division
IGNOU
Maidan Garhi
New Delhi – 110068

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