A survey to findout the effectiveness of Aquaculture Service Centre in the field of shrimp farming in North Western province.

By

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DECLARATION

The work described in this thesis was carried out by me at coastal areas of North Western Province in related to Shrimp Farming under supervision of Mr. Lakshman Wijeyewardana and Mr. K. P.L. Nishantha. A report on this has not been submitted to any other university for another degree.

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MY EVER LOVING

PARENTS AND TEACHERS

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Abstract

Shrimp and prawn farming have developed rapidly in many tropical and sub tropical countries, but there has been a set back resulting from diseases and the growing awareness of the environmental and social impacts of shrimp farming.

Shrimp cultivation in Sri Lanka is spread in northwestern coastal region from Negombo to Puttalam. Aquaculture Service Center (ASC) is an institute, which produces laboratory service and the other necessary services in the field of aquaculture, especially in the field of shrimp farming in northwestern province.

To findout the effectiveness of ASC in the shrimp farming sector in the northwestern province this survey was conducted. Questionnaires for farmers, participatory rapid appraisal for both officers of ASC and other responsible officers in shrimp farming sector, were conducted for data collection.

By analyzing the collected data some suggestions were obtained for the development of the ASC and shrimp-farming sector.

Due to the small shrimp sample size and inadequate, time it was very difficult to analyze and compare relationships between various factors. The time period and money allocations were the limiting factors for these failures.

This type of surveys is very important in identification of the effectiveness of such an institute and also in determination of environmental effects from these types of industries.

Type of pollution from the shrimp culture must be studied for prevention and limitation the environmental damage. Therefore further studies are recommended for shrimp farming practice in Sri Lanka.

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Abbreviations

ASC - Aquaculture Service Center.
NWP - North Western Province.
ISB - Industrial Service Bureau.
EIAR - Environment Impact Assessment Report.
PRA - Participatory Rapid Appracial.
DO - Dissolved Oxygen.
PPM - Parts Per Million.
DNA - Deoxy ribo Nucleic Acid.
RNA - Ribo Nucleic Acid.
MBV - Monodon Baculo virus.
WSV - White Spot Virus.
PCR - Polymerrase Chain Reaction.
ppb - Parts per billion
ppt -Parts per trillion

CHAPTER 1
INTRODUCTION

1.1 Back ground.

Due to satisfactory income and profit from the shrimp farming, it has vastly expanded during the past two decades in coastal regions, especially in Negambo to Puttalam in Sri Lanka. Shrimp farming was started at the beginning of 80th decade. Information flow and laboratory investigations were few in those periods.

Intensive and semi intensive shrimp culture must be done with well-planed management. Due to the out brake situation shrimp farmers faced many difficulties during 1994 to 1996 and more than 50% of farmland was given up. Due to that reason the farmers emphasized on the importance of information and testing. In those days the private sector established several institutes which were to provide laboratory and consultancy service for shrimp farmers in the area. After conducting feasibility study Aquaculture Service Centre (ACS) was established.

The Aquaculture Service Centre (ASC) is an institute, which offers technical advises and laboratory service to the Aquaculture sector in the area especially for the shrimp farmers. It was established in 1998 as joint project, in collaborations of Ministry of Co-operative and Fisheries of North Western Province and Industrial Service Bureau (ISB).

1.2 Location.

Aquaculture Service Centre is located in Pambala at Chilaw. The Pambala center is used as research and production center of ASC.

1.3 Mission of the ASC.

ASC of NWP will promote and assist Aquaculture industry to be sustainable in the province while safeguarding surrounding environment by providing available advanced technologies to fish/shellfish farmers in NWP.

1.4 Objectives of ASC.

- To assist in promotion and development of Aquaculture industry in NWP.
- To fulfil the extension needs of shrimps and other farms in Aquaculture.
- To provide sustainable technologies and facilities easy implementation.
- To promote the application of modern technologies of Aquaculture production, management and distribution to enhance the sustainability and productivity.

1.5 Activities of ASC.

- Aquaculture extension and development activities
  1. Advisory services (contact advisory services and spot constancy)
  2. Laboratory services (soil, water quality, feed quality, seed quality and analysis)
  3. Facilitating the market and input supply
  4. Facilitating the diversification of Aquaculture
  5. Training
  6. Preparation of EIA report
  7. Liaison with national and provincial agencies
  8. Function as a fish breeding centre
  9. Re commencement of Macrobachium hatchery

- Planning functions
  1. Problems identification at Field level and informing to relevant authorities
  2. Facilitating the data base being developed by the PMF
  3. Aquaculture development planning in NWP

- ISB routing activities

Since the beginning if the institute, services are been continuing for Aquaculture farmers in the area. But no survey was conducted to assess its service as to whether it is able to achieve its mission.

The services, which are supplied by the ASC, are spread in a large area in the field of Aquaculture.The aim of the survey is to assess the services only the sector of shrimp farming.

1.6 Objectives of the survey

This survey was conducted for evaluation of services provided by the Aquaculture Service Centre (ASC) in the field of shrimp farming. Due consideration was given to identify problems of the farmers and to fill the gap between farmers requirement and the services supplied by the ASC in the field of shrimp farming in NWP. It was also necessary to find out alternative strategies and activities that might help to ensure the achievement of project objectives. This was the first time a survey was conducted to asses the services of ASC.

CHAPTER 2
LITERATURE REVIEW

Marine shrimp *(Penaus monodon)* farming is a century-old practice in many Asian countries. Until a decade ago, this commodity was generally considered a secondary crop in traditional fish farming practices. Shrimp fry trapped in coastal paddy fields or fishponds are allowed to grow up to marketable size and harvested as secondary crop. However, in recent years when higher income is derived from harvest of shrimp than principle crops many farmers converted their rice field, salt belts, fishponds and also some coconut land into shrimp farms.

In the traditional farming system the ponds are stocked with fry either collected from the field or concentrated through tidal water entering the ponds. Shrimps production is consistent and varies from year to year due to dependence on seasonal supply of fry from the world.

Tiger shrimp farming has now developed into an important export-oriented food industry especially in South Asian countries. The perception of an unlimited market demand, high export price, generation of high amount of employment and increase in foreign exchange earnings may have encouraged many countries in the region rich in aquatic resources to place high emphasis on the development of the shrimp culture industry.

IMPORTANCE OF TESTS

2.1 Water quality management

In any shrimp farming, management of water quality is one of the primary considerations, particularly in ponds with higher stocking rates. Degradation of water quality is detrimental to shrimp growth and survival. Good quality water is usually defined as the fitness or survivability to the water for survival and growth of shrimp.

2.1.1 Salinity

Younger shrimps appear to tolerate wider fluctuations of salinity than adults do. The post Laval stages of many penaeid species can tolerate wide salinity fluctuations, which has a little effect on their survival or growth. In pond condition *Penaeus monodon* can tolerate wide range of salinity from as low as 5ppt to a high 40ppt. Due to high rate of evaporation in some countries, salt concentration in pond gradually increases during the summer months. In such cases, the water should be changed frequently by pumping, through tidal exchange or through canal.

2.1.2 Temperature

Water temperature plays a vital role in regulating the activities of culture animals. In case of *P.monodon* the optimum temperature is about 25-30C.Higher temperature may be maintain through water exchange.

2.1.3 Dissolved Oxygen (DO)

Maintenance of adequate levels of DO in pond water is very important to shrimp growth and survival. Prolonged exposure to the stress or low concentration of Oxygen lowers their resistance to disease and inhibits their growth, often resulting in mass mortality. This is particularly common in intensive operation.

Dissolved Oxygen in the pond water comes from two sources by product of photosynthesis and from diffusion of atmospheric air. At night both plants and animals continue to respire while Oxygen is being added to the water from the atmosphere, cause total depletion of DO especially at the bottom.

Depletion of DO in pond can be controlled by the following measures:

a) Water exchange through renewal of pond water either by tidal flow or by pumping.
b) Installation of aeration system, but it is essential to consider maximal utilization of natural environment to maintain higher DO content in pond water.

In some conditions the pond becomes super-saturated condition with Oxygen. This situation is also toxic for organisms.

The DO concentrations vary with the time of the day. At the one set of sunrise, the lowest DO concentration can be seen. DO fluctuation range is high with the presence of planktons in water.

Various types of methods are used for aeration of pond i.e. diffuse aeration, paddle wheel. Paddle wheels are commonly used in semi intensive prawn culture and is one of the major capital cost items in the farm. Paddle wheel aerators are used to increase contact surface of water with air there by increasing the area through which Oxygen is absorbed by water through a circular movement of the pond water.

Because it is difficult to define the relation between biomass in the pond and the interaction of various water parameters there is no hard and fast rule regarding the number of paddle wheels to be used in a pond.

However, according to experience each paddle wheel can yield about 1000kg of marketable size of shrimps. Use of less than four aerators is not recommended.

Arrangement of paddle wheels in the pond is done to maximise circular efficiency and minimise the dead corner area. Aerators are usually arranged parallel along the banks at 5 to 10 metres distance from dike depending upon the pond size. Pond water movement through aeration has the following advantages.

a) It increases the dissolved Oxygen level of the water and prevents Oxygen depletion at night.
b) It not only accelerates diffusion effect of Oxygen but also enables release of CO2
c) It facilitates the volatilisation of undesirable gases such as N_2, NH_3, H_2S etc.
d) It reduces the daily fluctuation range of pH value.
e) It helps in mixing of pond water and maintenance of ideal condition of water at the correct column
f) As pond water moves in a circular fashion, pond bottom is cleaned, and the waster column gets accumulated in the centre and at the corners. By this method most of the pond bottom is kept clean.

Diffused aeration is the other method of aeration. It's becoming a popular method in some countries.

2.1.4 pH value

pH of the pond water is an indicator of its fertility or potential productivity. Water with pH ranging from 7.5 to 9.0 is generally regarded as suitable for shrimp production. The growth of shrimps is retarded if pH fails below 5.0 which can be corrected by adding lime to neutralised the acidity. Water of excessive alkalinity (pH below 9.5) may also be harmful. In ponds that are excessively rich in phytoplankton the pH of pond water usually exceed 9.5 during late afternoon which can be corrected by water exchange.

2.1.5 Nitrogen compounds

Nitrogen in ponds exists is different forms, such as nitrate, nitrite, ammonia and various forms of organic nitrogen .In pond culture activities, ammonia nitrogen (in the form of Un-ionized ammonia) is considered important since this compound is toxic to aquatic animals at a certain concentration.

pH and temperature of water regulates the proportion of total ammonia, which occurs in un-ionized form. Studies have shown that exposure to ammonia concentration of 0.45mg NH3-N/Lit would reduce shrimps growth by 50%. The problem can be overcome by water exchange.

Table – 01 The effects of Ammonia, Nitrite and Nitrate in culture pond.

UN-ionised ammonia concentration (ppm)	Nitrite concentration(ppm)	Nitrate Concentration (ppm)	Effect
0.000	0.000	0.000	Not harm
0.030	0.500	-	↓
0.031	0.600	-	↓
0.100	1.000	200.0	Stress
0.101	1.100	-	↓
1.000	4.000	500.0	Fatal situation

Source: ***Sri Lankawe kivul diya issan wagawa thakshanika, parisarika ha samajayeeya sankalpa***

2.1.6 Hydrogen Sulphide (H_2S)

Hydrogen Sulphide, which is produced by chemical reduction of organic matter that accumulates and forms a thick layer of organic deposits at the bottom, can severely affect Shrimp growth. At the levels of 0.1-0.2ppm in the water, shrimps appear to lose their equilibrium and die instantly if the concentration reaches 4.00ppm.

Using Iron Oxide (70% Ferrous Oxide) treatment to the bottom soil containing high levels of H_2S is not economical. The cheaper means is by frequent exchange of water to prevent building up of H_2S in the pond.

So far, water exchange is still the most effective and widely employed method to maintain good water quality. In normal course recommended daily water exchange schedules are given below.

Table 02 water quality management levels in shrimp culture

Culture periods in days	Salinity in ppt	Water exchange rate(Percent daily)	Water depth (cm)
0-15	25-30	2.5	80
16-30	20-25	5-8	90
31-45	20-25	10-12	100
46-60	15-22	12.5-15.0	120
61-90	15-20	15-20	120
91-120/Tillharvest	20-25	20-25	150

Source; Http://ag arizona.edu/puds/genaral/respt1997/aquaculture.html

2.1.7 Metal Irons

When there are large amount of metal iron such as Copper, Cadmium, Aluminium, and Zinc they badly affect shrimps. With the increase of acidity of water solubility of metal irons also increases.

2.1.8 Effect of insecticides

Farmers use large a amounts of insecticide for crop culture. These chemical compounds are collected with the runoff to the brackish water lagoons too. Very few amount of insecticides may cause fatal effect to the shrimps. 0.0004ppb of Malathion, 0.001ppb of Parathion.0.01ppb of Azodrin, 0.01ppb of Endosulphan are fatally damaging to the shrimps.

2.1.9 Alkalinity

The alkalinity of water depends on $CO_3^{-2}$and HCO_3^- concentration. The alkalinity is affects on the buffer capacity of t water. It's important to maintain the alkalinity higher than 50ppm when the Fries are stocking pond. Normally the alkalinity of water (for $CaCO_3$) is maintained higher than 80ppm is very good.

The alkalinity of water, which is constructed in acid soils, appears to be at low levels.

Virus Diseases in Shrimp Culture in Sri Lanka

There are tow kinds of viruses known to be responsible for diseases causing to shrimp in shrimp farms farming of Sri Lanka. They are DNA and RNA viruses.

2.2 DNA Virus

These viruses contain Deoxy ribo Nucleic Acid. These viruses are divided again as Parvo virus and Baculo virus.

Parvo viruses are single chain DNA virus and that type of viral disease are not recorded in Sri Lanka yet. Baculo virus is a double chain DNA virus Monodon Baculo Virus (MBV) is example for double chain Virus. White Spot Virus (wsv) is example for double chain virus, which is recorded in Sri Lanka.

2.3 RNA Virus

Ribo Nucleic Acid is containing in viruses. Yellow Head Virus (YHV) is one of the pathogenic viruses recorded in Sri Lankan Shrimp farms.

Polymerase Chain Reaction (PCR) Test

For identification of WSV, the PCR test is one of the important tests. By testing fry before stocking to the pond WSV can be reduced up to minimum level.

Dot Blot Method

This is one of the other tests used to identify White Spot Virus in shrimps.

2.4 Formaline Stress test

These tests are used for identification of weak fry in the sample. In these test the strong larvae are identified and are stocked in the ponds. Weak samples are given up. Then the spread of disease condition can be minimised.

2.5 Shrimp culture in Sri Lanka

Shrimp culture is one of the fastest growing industries in Sri Lanka. Shrimp farms were initiated during mid 80's.During the year 1992 number of shrimp farms amounted to 260 while the total area developed or earmarked amounted to 1400 ha. Total annual shrimp exports varied between 940 Mt. to 2500 Mt. during lasts 5 years. Shrimp export contributes significantly to the total foreign exchange earnings (48 to 70%) fin fisheries sector. Shrimp farms are

operated at a semi-intensive level at present with stocking densities between 6 and 20 post larvae (PL) per meter

The average production from one hectare varies between 1500 Mt. to 2000 Mt. per crop. During the growth phase of the industry (1985-1989) most of the farms operated under intensive conditions with stocking densities up to 70-90 post larval per m^2. All the shrimp farms developed in Sri Lanka are located in Northwestern province of Sri Lanka, Chilaw Lagoon, Dutch canal, Mundal lagoon system and Puttalam Lagoon being the water sources for farms. More than 70% of the Developments are concentrated along the Dutch canal and *Mundal* lagoon system. Farmers replenish water in their ponds to provide a better aquatic environment in culture ponds. The recommended exchange rate varies from 5% to 25% of the total pond volume daily, depending on the culture cycle and the stocking density of shrimps. Most of the established farms in Sri Lanka do not have capacity infrastructure and water of required quality to adopt to recommend water exchange rates. Inadequate exchange rates together with other poor Management practices resulted in unfavorable water quality conditions in shrimp culture ponds during disease outbreaks. Discharged water contained relatively high Concentrations of nutrients, suspended solids and toxic metabolites. It was apparent that the total suspended solid concentration was beyond acceptable range (Poernomo, 1990 and Jayasinghe 1991). Relatively high concentrates of Nitrites and sulfides were also recorded. These concentrations are highly toxic to culture organisms (Poernomo 1990). High nitrate concentrations damage gills of cultured-shrimps causing changes in gill colour, while relatively high sulfide concentrations can affect survival growth and general health conditions of cultured shrimps. Trends indicating increase in levels of pH, sulfides, nitrites and total suspended solids I in Dutch canal and *Mundal* lake system have been observed from 1987 to 1992. Commonly observed symptoms in shrimps during disease outbreaks were microfouling on shells, reduced feeding, black gills, soft-shell condition, tail rot, size disparity, empty guts, red/brown deposits on abdomen and reduced growth. A new pathogen, Monodon BaculoVirus (MBV) has been recorded in cultured as well as in wild shrimp populations after major disease outbreaks (ADB, 1990). An increased incidence of heavy infestations in gills with an ectocommensal protozoan was observed in cultured shrimps. These protozoans were found attached to the tops of the gill filaments. Zoothamnium establishes a colony between gill lamella and each colony get attached to the gill epithelium by means of acircular disc.

At severely infested stages, organism can obstruct respiratory-currents of the shrimp affecting normal gas exchange. More than 70% of the shrimp farms in Sri Lanka are on Pyretic

soils (Jayasinghe 1991), Pyrite (FeS_2) In deeper layers of soil get exposed during pond construction. The oxidation of pyrites results in production of various hydrated oxides of irons and acids. A detailed study (Jayasinghe 1991) has indicated several acid sulfate and potential acid sulfate soil classes in areas developed for shrimp farming. In shrimp culture ponds that are constructed on acid sulfate soils, there is an inherent tendency for decrease in pH levels. Very low pH values (3.2 to 4:7) have an acceptable ranging source of water quality.

2.6 Perspective on shrimp farming

Global farmed shrimp and prawn production amounted to 932 000 t in 1995 compared with some 170 000 t in 1984. Production has plateau since 1991. Eighty-seven percent originated in Asia.

Despite of the rapid growth of the industry, there have been constrains on further development due to diseases and due to the growing awareness of the environmental and social impacts of shrimp farming. Much of the debate has focused on the sustainability of shrimp farming. There is a trend for discussion on principles, the development of guidelines and the need for better management practices. It has been recognized that shrimp farming can be made more sustainable. Impacts can be reduced in a number of ways including through better regulatory and planning processes at state level. Key considerations are the sitting of shrimp farms and monitoring their development.

2.7 State of shrimp farming in Sri Lanka (Northwestern coast)

Shrimp farming began in Sri Lanka in the early 1980s. Farming of the black tiger prawn, *Penaeus monodon*, was a successful and lucrative venture until major disease outbreaks occurred in the late 1980s (Wijegoonawardena and Siriwardena, 1995). Although the main cause for these outbreaks was thought to be the introduction of an exotic viral pathogen, uncontrolled proliferation of farm operations and related aquatic environmental implications appear to have made a direct contribution. Similarly, lack of planned development was identified as one of six constraints on shrimp farming and suitable locations in the NW were said to be almost saturated (Piyasena, 1996).

Currently, the shrimp culture sector in Sri Lanka is facing many of the problems that were encountered previously in other countries. The technical knowledge base of the majority of the shrimp farmers is very low and becoming increasingly so as more small-scale farms are

been developed. Shrimp farming is still relatively small scale in Sri Lanka with a total area of approximately 2600 ha according to Funge-Smith (1998).

The majority of the unregistered farms have encroached into reserved areas and are small farm operations - their size generally being below 2 -3 ha. Farms over 4 ha are required to fulfill Initial Impact Investigation or Environmental Impact Assessment; small farms are exempted from this and this has contributed to the proliferation of small illegal operations.

Table 03 Size and relative occurrence of shrimp farms in Sri Lanka

Area (ha)	% of total area
> 20	32
10 - 20	9
4.5 - 10	15
2 - 4.5	10
< 2	6
Unregistered farms	28

Source: (Funge-Smith, 1998)

Table 04 Shrimp culture areas in Sri Lanka

Class of farm	Area (Hectares)
1996	6139.78
1998	8652.89
1999	8840.05
Difference 1999-1996	2706.27
Uncertain	213.39

Source: Http/www.FAO/Sd/index-em/htm

Small farms are usually owner operated and do not have a high level of technical input. There appears to be some form of technical service available whereby farmer groups are visited by local consultants. Large farms have well trained managers - often with overseas experience.

It is the lack of accurate information available to the farmers that results in inappropriate farming techniques, disease and production losses.

Plans are currently underway to develop shrimp farms in other parts of the country, utilising seawater abstracted from the sea (full salinity) and not the brackish water usually found in the Northwest Province lagoon systems. Culture in full strength seawater is possible provided that a regular water exchange regime is practised. Alternatively culture should only take place during the monsoon or rainy season, to prevent excessive salinity in the ponds. Before these developments proceed further, it is important to establish the principle factors underlying the disease problems in the Sri Lankan shrimp industry.

There is also the consideration that the Northwest Province may provide much of the country's broodstock, and the development of shrimp farms in this area would certainly increase the risk of contamination of the broodstock supply

2.8 Local fisherfolk protect the mangroves in Sri Lanka

Mangroves are wetlands rich in biodiversity that are suffering a severe depredation worldwide. In Sri Lanka mangroves are associated with 22 brackish water bodies, locally known as lagoons. Even if mangroves area in Sri lanka is limited to 12,000 hectares, it is of much value since it includes very rare species and types of plant associations in different climatological zones. Fishing in these lagoons is the livelihood for over 120,000 coastal people.

Over the past decade many of the lagoons and estuaries in Sri Lanka have been subjected to rapid destruction of its mangrove vegetation for commercial aquaculture. This powerful industrial group is composed by big politicians, top level bureaucrats and businessmen, who have shown their lack of interest in mangrove conservation.

As a consequence of this unsustainable activity lagoons are silted, estuaries are eroded and mangrove ecosystems are deteriorated. In *Puttlam* District, for example, where the most extensive and rare mangrove species occur, more than 3,000 hectares of mangrove lands were converted to industrial shrimp farms under the government's patronage. Where the commercial shrimp farms are nowadays located, 28,000 lagoon fishermen were engaged in fishing till 1994. After the construction of commercial shrimp farms two thirds of them lost their job and were obliged to migrate to the city in order to earn their living. Before the widespread of shrimp farming, the average fish catch per unit effort was 4 kg and by 1997, this had declined to 1.5 kg. Commercial shrimp has also polluted groundwater, what has directly affected drinking water, creating further problems for the fisher folk. At the village vicinity they do not have drinking water

now and most of the women walk 5 to 6 km daily looking for fresh water. Due to lack of drinking water most of the children at the school age do not attend school; the reason being that in the morning they do not have water in the house and therefore their primary task has become looking for water for their house consumption. The shrimp farmers who have constructed fences and maintain security personnel, which means that local fishfalks have even lost their right access to the traditional source of their food block the entire lagoon periphery.

Local communities of fishfalks have reacted by organising themselves to face this problem. The Small Fishers Federation was formed with the aim of mobilising fishing communities and other associated people to conserve the lagoons and mangroves ecosystem, through appropriate education programmes and practical conservation strategies.

The primary task of the newly created group was to put the conflict on the table of negotiations. A participatory organisational mechanism was established, where more than 4,000 fishermen actively participated in decision making on conservation of mangroves, negotiated with shrimp farmers to monitor mangrove destruction activities and work for the improvement of fish habitats in the lagoons (Htt://www.wrm.org.uy/bullatin/20/Srilankahtm#top).

2.9 Need for accurate information on shrimp farms development

Shrimp and prawn farming have grown rapidly in recent years in many tropical and subtropical countries, but there have been setbacks resulting from diseases and the growing awareness of the environmental and social impacts of shrimp farming. Inventory and monitoring of shrimp farms are essential tools for decision-making on aquaculture development, including regulatory laws, environmental protection and revenue collection. In the context of government aquaculture development policy, much attention has to be focused on the identification and monitoring of the expansion of shrimp farms, often located in remote areas (Http://ens.lycos.com/ens/sep2000/2002-09.22.09html).

CHAPTER 3

Methodology

3.1 Introduction

To find out the effectiveness of the ASC in the field of shrimp farming in North-Western Province (NWP), data from various relevant fields were collected. The collected data were analysed using statistical methods & by expressing. In this chapter, it is expected to review how they were done.

3.2 Data collection

Shrimp farmers and the responsible officers were the main source of data in this survey. The primary data were collected by contacting and questioning them..

3.2.1 Primary Data Collection

3.2.1.1 Questionnaire survey

To identify the views of farmers about the ASC services, ASC officers & environment consideration, a structured questionnaire was used. To identify the service supplied by the ASC preliminary study report of ASC was studied and discussed with the officers of the ASC. With the help of the survey Kit (How to analyse survey Ariewe fink) and the report of the survey on customer service of Commercial Bank in Sri Lanka (1986) the Questionnaire was prepared. Then it was pre test and re-prepared. The re-prepared Questionnaire was used to obtain farmers' view on the field of shrimp farming.

3.2.1.2 Selection of farmers for the survey

Shrimp farmers were selected randomly from currently activated form lands in *Puttalam* district. Using the registered farmers' list (2000) from the ministry of Fisheries of Northwestern province (NWP). 30 numbers of farmers were selected out of the 450.

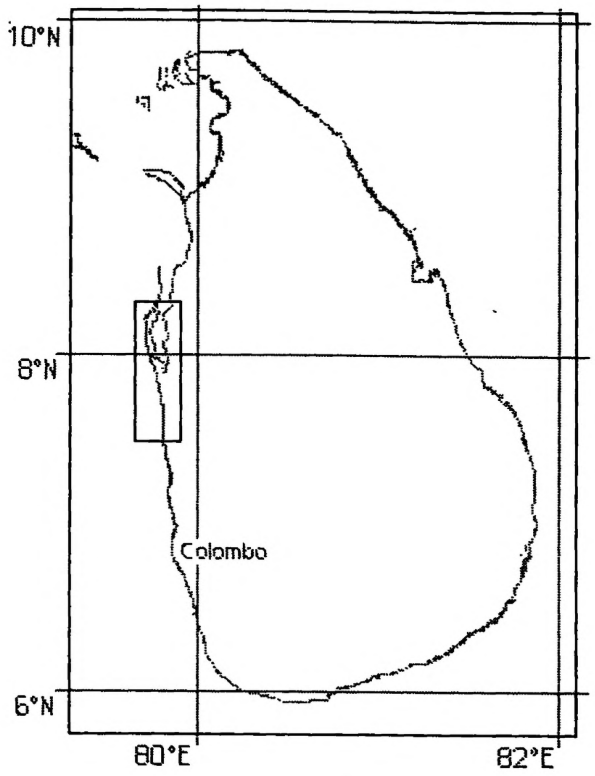
Table – 05 Farmers sample selection from the register

Size of Farm land in acre	No of farms	Per 30 farms
0-5	115	11
5-10	210	14
More than 10	75	05
Total	450	30

3.2.1.3 Field checking.

Shrimp farming practice is conducted in coastal areas closer to the lagoon. To identify the environment conditions, the methods followed by farmers & the mitigation methods followed by them, regular field checking was conducted with in first part of the survey.

Shrimp farming area in *Puttlam* district



Map No. 2

Source: http: www.fao/sd/index-en.htm

3.2.2 Participatory Rapid Appraisal (PRA)

- PRA for ASC officers

To obtain the views of the ASC officers' PRA was conducted .A check list was prepared and conducting a discussion individually with each ASC officer their view were obtained. In addition to that a small questionnaire was used to gather information from them.

- PRA for other service providers

A checklist was prepared to obtain the views of other service providers (appendix 4) Regarding their services, idea about shrimp farmers, environment consideration, and present state of the industry.

3.3 Method of data collection

Information was collected from farmers through structured questionnaires. Face to face interviews were conducted to fill the questionnaires. The interviews were conducted in *Sinhala* in their farm or in their residence. Show cards were also used for some questions to get a fixed answer without complications.

In addition to that additional information supplied by the farmers were also welcomed.

PRA was conducted for both ASC officers and officers of other related institutes. The officers were interviewed in their working place individually. Additional information was considered in addition to the checklist.

3.4 Method of sample allocation

Shrimps farmers were contacted randomly in the currently activated farmland in *Puttalam* district (map no 01). Due to the lack of information about the shrimp farms that are currently cultured contacting the farmers was very difficult.

3.5 DATA Presentation & Analysis method

To get the out comes from data, they must be analyzed. According to the types of data the analysis method also varies. Due to the small size sample it was very difficult to analyse the data by using statistical computer package. Therefore only the percentage analysis method was used to analyse numerical data.

3.5.1 Tables and Charts

Quantitative data can be presented by using tables & charts. Charts & tables in this report present number of observation & their percentage.

3.5.2 Analysis by expressing

The officers interview they expressed very important ideas for the development of the institute as well as the shrimp-farming sector. Also the farmers supplied valuable information for this. These types of data are difficult to quantitative. They are analyzed verbally without using any statistical method.

CHAPTER 4

4.1 Analysis of data

To get the out come of the collected data analyzed results and their expressions are contented in this chapter.

4.1.1 Age variation and education level

Comparing with the other culture practices there must be a good education level to maintain the shrimp culture farm. That is because the high amount of risk factors in this field. The age variation an education level of the shrimp farmers, were obtained in the question number one (0appendix 06)

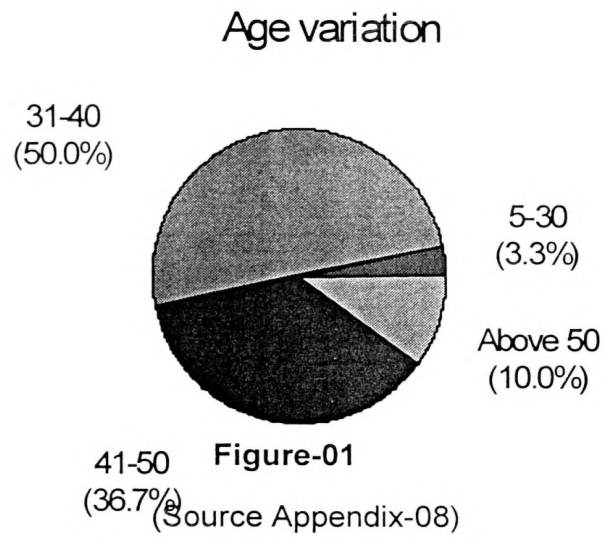


Figure-01

(Source Appendix-08)

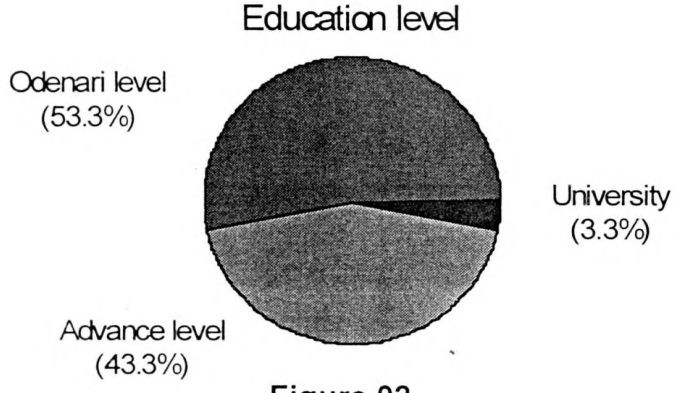


Figure 02

(Source Appendix-09)

4.1.2 Test followed by farmers

To find out already followed tests by the farmers 1.4 question was asked. In this question following information were observed.

Table-06 Important test followed by shrimp farmers

Test	Yes	%	No	%
SOIL				
pH	27	90	3	10
FRY QUALITY ANALYSIS TEST				
MBV	11	28.7	19	83.3
PCR	12	40.0	18	60.0
DOT BLOT Method	7	23.3	23	76.7
Formalin stress test	10	33.3	20	66.7
WATER QUALITY				
Salinity	30	100	-	-
D.O	28	93.3	2	6.7
Temperature	25	83.3	6	16.7
Ammonia	30	100	-	-
H_2S	7	23.3	23	76.7
Iron	18	63.3	11	36.7
Alkalinity	26	86.7	4	13.3
Nitrite	13	43.3	17	56.7
Nitrate	13	43.3	17	56.7
Phosphate	2	6.7	28	93.3
Chlorine	4	13.3	26	86.7
Turbidity	18	60	12	40.0
Heavy metals	1	3.3	29	66.7
pH	30	100	-	-

Source: Appendix 07 c3-c21

4.1.3 Services provided institutes to farmers

For the find out the participation of the institute in testing of shrimp farming 1.5 question was implemented. After the analysis the collected data following result were observed.

Table-07Service providing institute and their participation in shrimp farm practice

Test	ASC		NARA		GLOBLE		NASA		AQUA SERV:		OTERS	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
SOIL												
pH	10	33.3	-		6	20.0	-		-		13	43.3
FRY QUALITY ANALYSIS TEST												
MBV	-		2	6.7	4	13.3	-		3	10.0	4	13.3
PCR			12	44.0	-		-		-		-	
DOT BIOT Method	-		-		2	6.7	-		3	10.0	2	6.7
Formaline stress Test	-		-		4	13.3	-		1	3.3	4	13.3
WATER QUALITY												
Salinity	13	46.4	-		9	32.1	-		-		5	17.9
D.O	12	44.4	-		11	40.7	-		-		4	14.8
Temperature	9	30	-		4	13.3	-		-		15	50.0
Ammonia	15	50.0	-		11	36.7	-		-		2	6.7
H2S	3	10.0	-		2	6.7	-		-		1	3.3
Iron	7	23.3	-		7	23.3	-		-		3	10.0
Alkalinity	13	43.3	-		7	23.3	-		-		2	6.7
Nitrite	3	10	-		4	13.3	-		-		1	3.3
Nitrate	3	10	-		4	13.3	-		-		1	3.3
Phosphate	-		-		1	3.3	-		-		1	3.3
Chlorine	-		-		3	1.33	-		1	3.3	2	6.7
Turbidity	-		-		-		-		-		17	5.67
Heavy metals	-		-		3	1.33	-		-		-	
pH	15	53.3	-		10	33.33	-		-		4	13.3

Source Appendix 07 c22-c40

4.1.4 Farmers knowledge about the tests

Some of tests, which is done in shrimp farming, is very essential. Due to the lack of knowledge about the shrimp farming some farmers lose their harvest large in numbers. To find out the farmers knowledge of the tests the 1.6 question was asked. The summery of the result as followed.

Table-08 Farmers' knowledge about the important tests of shrimp farming

	Yes	%	No	%
SOIL				
pH	30	100.0	-	-
FRY QUALITY ANALYSIS TEST				
MBV	19	63.3	11	36.7
PCR	25	83.3	6	16.7
DOT BIOT Method	15	50.0	15	50.0
Formalin stress test	15	50.0	15	50.0
WATER QUALITY				
Salinity	29	96.7	1	3.3
D.O	29	96.7	1	3.3
Temperature	29	96.7	1	3.3
Ammonia	28	93.3	2	6.67
H2S	12	40.0	18	60.0
Iron	21	70.0	9	30.0
Alkalinity	21	70.0	9	30.0
Nitrite	15	50.0	15	50.0
Nitrate	16	53.3	14	46.7
Phosphate	6	20.0	24	80.0
Chlorine	6	20.0	24	80.0
Terbidity	24	80.0	6	20.0
Heavy metals	9	30.0	21	70.0
pH	29	96.7	1	3.3

(source Appendix 07 c41-c59)

4.1.5 Farmers satisfaction about the tests

50 percent of farmers were satisfied about the test results. 43.3 percent of farmers were somewhat satisfied. 3.3% have farmers had not idea about these tests and 3.3% had no any satisfaction. If they were no satisfied the tests results the reasons also obtained from them.

4.1.6 Reasons for results un-satisfaction

When the farmers were not satisfied the test the reasons were obtained.

Table-09 Farmers responds for un-satisfaction

Reason	No of farmers
Instruments are not good	1
Chemicals are expired	2
Test are done incorrect way	2

Source: Appendix 07 c61

4.1.7 Important tests expected by farmers

Many institutes are supplied services for the shrimp's farmers. Here it is expected to know farmers' expectation of tests. Following table summarized the extracted data from the shrimp farmers.

Table-10 Test expectation by the farmers

Test	Yes		No	
	Fr.	%	Fr.	%
SOIL				
pH	29	96.7	1	3.3
FRY QUALITY ANALYSIS TEST				
MBV	11	36.7	19	63.3

PCR	25	83.3	5	16.7
DOT BIOT Method	7	23.3	23	76.7
Formalin stress test	9	30.0	21	70.0
WATER QUALITY				
Salinity	29	69.7	1	3.3
D.O	27	90.0	3	10.0.
Temperature	11	36.7	19	63.3
Ammonia	28	93.3	2	67.0
H2S	1	3.3	29	96.7
Iron	7	23.3	23	76.7
Alkalinity	17	56.7	13	43.3
Nitrite	4	13.3	26	86.7
Nitrate	3	10.0	27	90.0
Phosphate	-	-	30	100
Chlorine	-	-	30	100
Turbidity	7	23.3	23	76.7
Heavy metals	1	3.3	29	96.7
pH	27	90.0	3	10.0

Source: Appendix 07 c68-c86

4.1.8 Services expected time by farmers

The ASC already supply mobile service. In these question expected to no the time period, the service required by the farmers. 93.3 Percent of farmers required the services in regular period in their culture cycle. 6.7 percent of farmers expected services when they informed. Percent of farmers told the water quality tests are advisable at site and percent of farmers' view was water quality tests are advisable only in sometimes.

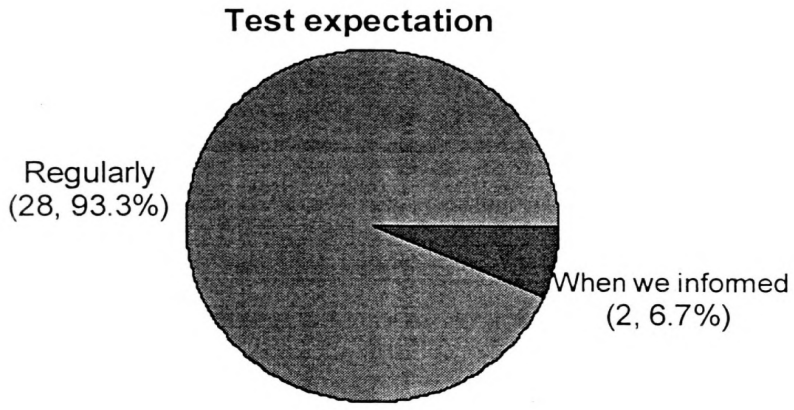


Figure-03

Source: Appendix 07 c87

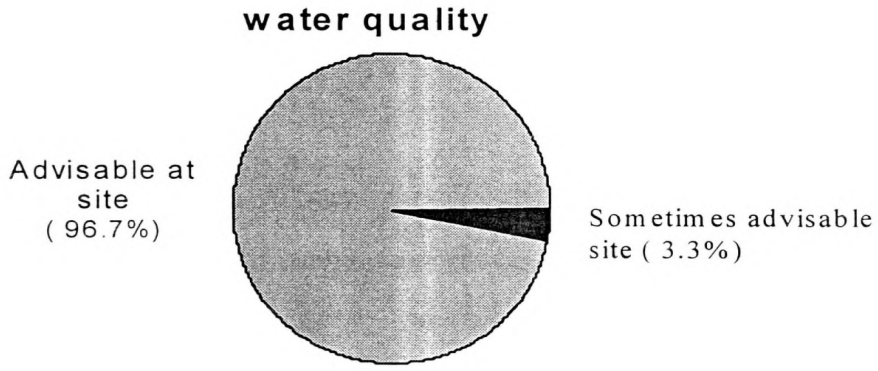


Figure 04

Source: Appendix 07 c88

4.1.9 Previous harvest per acre

The harvest may depend on various reasons. To find out the factors, which controls on shrimp farm practice, the harvest can be used as an indicator. Comparing various relationships with harvest and factors we assumed, it is expected to identify the dependent factors on shrimp culture.

The harvest gained in last culture cycle was considered. Following result were observed

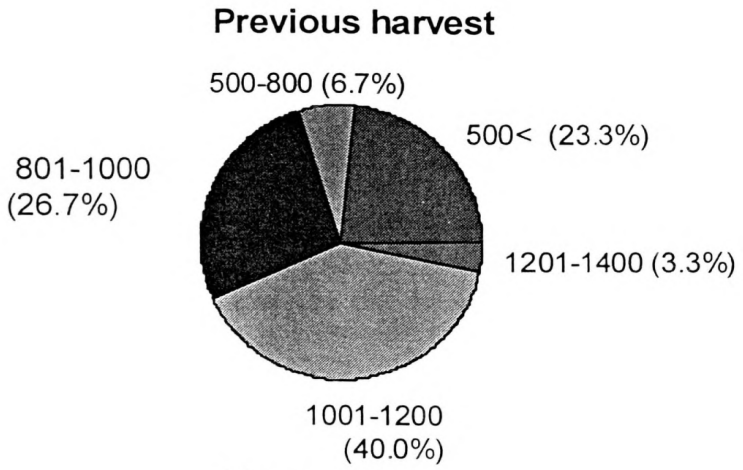


Figure-05

Source: Appendix 08

Duration of time for which they have been engaged, in shrimp farming, may be a very significant factor for their experience and their income. Following table expresses for how long have they being in the field of shrimp farming.

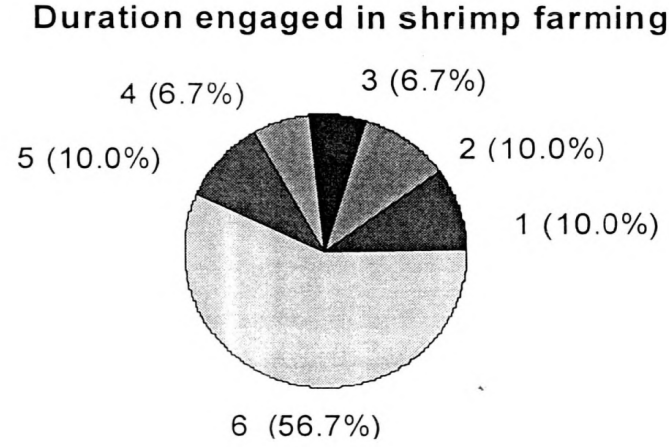


Figure-06
Source (Appendix 09)

4.1.10 Officers and consultants

4.1.10.1 Farmers' idea about the ability of ASC officers

In 2.1 question it was expected to get an idea about the farmers view on the ASC officers. Following results were observed.

Farmers satisfaction of ASC officers

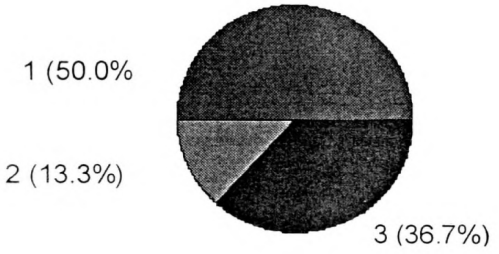


Figure o7 **Figure-08**

Source (Appendix 10)

4.1.10.2 Contacting of officers

Difficulties in contacting the officer may be the reason for farmers been unable to get services from the ASC. This reason is considered in question 2.2.

Contacting of ASC officers

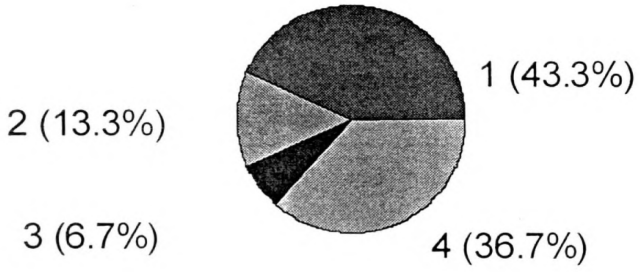


Figure 08

Source (Appendix 11)

4.1.10.3 REASONS FOR CONTACTING DIFFICULTIES

If the farmers' answers were sometimes difficult or very difficult reasons also for that are considered. Four farmers answer was "no transport facilities in the office"; two farmers answer was "no any officers in the officers" when we want the service of them.

4.1.10.4 Consultancy services expectation

Consultancy services are very important for shrimp farmers, especially for new farmers and in a period of outbreak spreading. In 1.4 was question expected to find out the farmers expectation consultancy services in addition to the laboratory services.

Consultancy expectation

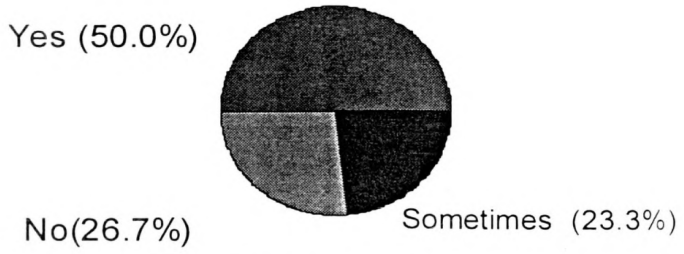


Figure-09

Source (Appendix 12)

4.1.10.5 Consultancy services at a fee

If the farmers were ready to get consultancy service from officers 2.5 question was asked to find out weather they would like or not to pay for it. In some fields consultancy other officers supply services except the laboratory services.

Constancy at fee

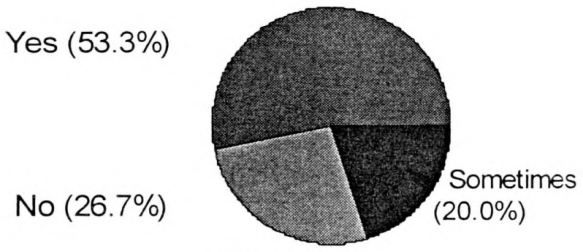


Figure-10

Source (Appendix 13)

When farmers were willing to pay for their consultancy service, 2.7 question expected to know the time period at which they can make the payment. In above chart it is revealed that 22 farmers are ready to pay for their constancy services. 3 of them mentioned they like to pay as monthly payment for the services. 8 of the farmers told they can pay at the time of service.11 farmers out of 16 who were willing to pay mentioned they could pay only after the harvest.

4.1.11 The farmers view about the ASC officers

To supply sound laboratory and consultancy services for farmers the officers must have enough knowledge. The farmers' view in this is very important to accept services from officers. The 2.7th question was expected to know it.

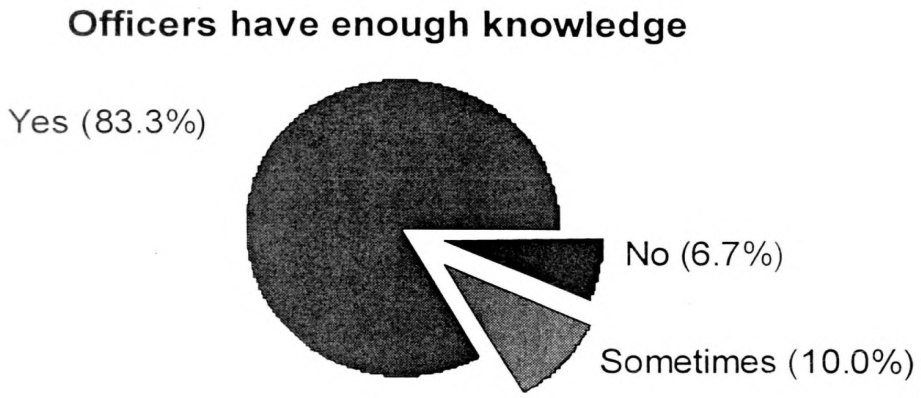


Figure-11

Source (Appendix 14)

4.1.12 Whether the farmers were following the advises of the officers

If the farmers don't follow the consulates or respective officers advises, their harvest may be lost and environment damage will dominate. Also it may cause to ease the desease spread. To find out whether the farmers were following the advises from officers, the 2.8th question was asked,.

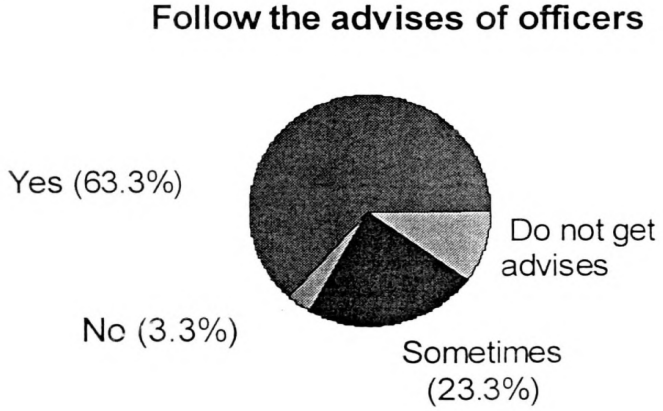


Figure 12

Source (Appendix 15)

If the farmers were not following the advises of officers, reasons were asked. Two of them answered as they do not have facilities and, while the other two answered as they do not consider these advisers.

Some of farmers used to follow the advises, after modifying. According to the 2.11question two farmers had modified and two farmers answers had not.

4.1.13 Environmental consideration of farmers

Without proper handling of the shrimp farm sustainable development in this field can never be achieved. Grater responsibility goes to the farmer on this fact as well as other factors too.

Disease condition may transmit when re-filling the tanks and the disease condition may spread when releasing the stagnated water to the lagoon. Before pond preparation, a very significant coastal habitat had being removed in a large quantity in past two diced. Questions 3.1 and 3.2 are focused on the farmers' environment considerations.

Consider about the environment

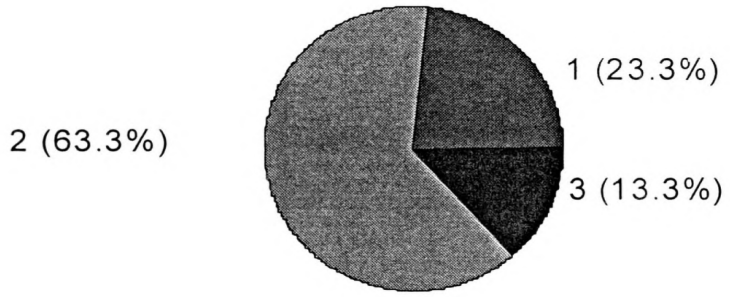


Figure-13

Source (Appendix 16)

When water exchanging, 30.0 percent of farmer's paid careful attention only in re-filling the water. 16.7 percent of farmers cared in both re-filling and releasing the water. Percentage of farmers had paid no attention in both. Only 3.3percent of farmers cared for releasing the stagnant water.

4.1.14 PRA analysis of ASC officers

For the identification of the officers' views about the institute and the shrimp cultivation, the PRA and the discussions were conducted. The results were analyzed as follows.

4.1.14.1 Education qualifications

All the ASC officers have a sound education background. They are all graduates. 80 percent of them expressed that they must be given additional knowledge to improve their knowledge in the field of shrimp culture.

4.1.14.2 Job satisfaction

40 percent of ASC officers are completely satisfied with their job. 60 percent of officers are somewhat satisfied. All the officers (100%) mentioned that they expect their incentives for their chargeable services.

4.1.14.3 Management system of the institutes

40 percent of the officers accepted that the current management system is good and 40 percent of the officers told that current system is complicated the reason being two institutes managing the institute. Therefore sometimes it creates management problems. 20 percent of the officers had no any idea about the management system.

4.1.14.4 Idea about the farmers in the field

60 percent of the officers expressed, the farmers do not have enough knowledge about shrimp farming and 40 percent of the officers told that the farmers followed the officers advises in the field.

4.1.14.5 Idea about the companions

80 percent of the officers expressed that they were well cooperating always during their activity. 20 percent of officers told that they do not have any cooperation in their activity.

4.1.14.6 Publicity of the institute

60 percent of officers accepted that the ASC does not have enough publicity and the remaning 40 percent told that although they have some publicity now too, there must be publicity methods to improve of the services.

4.1.14.7 Idea about the other institutes

20 percent of officers' idea was that there are no enough qualified officers in other institutes. 40 percent of officers mentioned that the other institutes are a necessity for development of the field and the remaining 40 percent of officers' idea was that the knowledge must be sheared among the institute.

4.1.14.8 Charges of ASC

20 percent of officers viewed as the charges are too cheap and 80 percent of the officers considered their charges as reasonable.

4.1.15 Analysis and discussion of PRA for other institutes' officers

Only two officers were contacted due to lack of time for the survey. Following a prepared check list important things were obtained from them in shrimp forming (appendix-6)

Both of the officers were under the idea that there must be a mutual interconnection between all relevant institutes in shrimp culture filed and information sharing was emphasized by both of them. One officers idea was that some officers and consultants do not have enough knowledge to provide services of shrimp farmers, and those who have enough knowledge they must be renewing their knowledge in the filed of shrimp farming regularly.

Small-scale farmers do not maintain stoking tank, and they directly release stagnant water to the lagoon water body. This situation leads pollution of the lagoon. One of the officers mentioned the necessity of environmental enforcement group stability by the government.

Some of the officers mentioned that the major problem is no government attention paid to monitor the farmers' activities.

CHAPTER 5
DISCUSSION

5.1 Problems

Find out the effectiveness of ASC in the field of shrimp farming in NWP was the main objective of this survey. According to the data observed from this survey following out comes were obtained.

Soil pH is a very important factor to maintain the culture pond. Therefore it is very important test to do before pond preparation.

90 percent of farmers who faced the survey had done the soil pH test. The ASC was responded 33.3 percent of the pH test.

Before stocking the PL to culture pond MBV, PCR, DOT, BLOT, and formaline stress test are very important tests to find out the good seed for cultivation. But in the survey, very few numbers of farmers had followed above tests (table 06). Due to this reason the risk of disease spread and variance of the harvest is increased. This situation is a must to change. No test for PLS had been conducted by the ASC. (table 07). Those tests had being conducted by the other institutes.

Next, considered the alertness of the farmers about water quality management. As can be clearly identified in the table 10 every farmer had followed the tests for salinity, ammonia and water pH. Only the 23.3 percent of farmers had done water H_2S test. But in some situation H_2S level can be increased and cause lose of the all harvest.

Comparing with other institutes the water quality test was supplied mainly by the ASC. The reason for this is that the ASC is the only institute which provides a mobile service for the farmers in the filed.

Testing of turbidity is a very simple test. Most of the farmers had followed this test them selves.

Considering the farmers expectations tests for soil pH, salinity, DO, Ammonia, Alkalinity and pH were expected by more than 50% of farmers while PCR test was expected by 83.3 percent of farmers. Currently the PCR test is not conducted by the ASC.

93.3 percent of farmers expected services regularly. Only the 6.7% of farmers mentioned they expect services at the time of imported. After testing of water quality 97.7% of farmers expected to get guidance in improving the water quality.

The water quality can be changed rapidly in some conditions. This condition may cause stress and death of shrimps. Therefore water quality tests are advisable at the site.

At the time of discussion with ASC officers they mentioned that they supply advises just after the water quilt management test in the filed, "but as some farmers get constancy services from another person therefore they expect only to do the test" the officers of ASC further mentioned.

50 percent of farmers who faced the questionnaire was satisfied with the tests and results. Others were somewhat satisfied, or not satisfied or had no idea. Instrumental errors, using expired chemicals and incorrect ways of testing were given as the reasons for non-satisfaction.

53.3 percent of farmers wanted to consult services and they were ready to get this service at a fee. 11 farmers out of 16 mentioned that they could pay for the consulting after harvest. This factor is very important because of the risk of loosing the harvest due to various reasons.

Now the ASC is supplying consulting services in few numbers. Improvement of consultancy service section is emphasized.

83.3 percent of farmers accepted that the officers have enough knowledge for their services 6.7 percent of farmers under the view that the officers do not have enough knowledge for their services. After doing the test and visiting the filed the officers and consultants give advises to farmers for the betterment of their culture. 63.3% of farmers had followed these

advises. If the farmers do not follow the advises the reasons were because they do not have enough facilities and some farmers had ignored these advises.

The culture ponds were prepared by destroying mangroves; coconut land or some time paddy fields in northwestern province. Due to this reason very significant habitats may be lost. Preparation of EIR reports is a one of the activity of ASC. Lagoon water quality turns from bad to worse due to the stagnant water, which is released by farmers from their culture ponds.

Only 23.3 percent of farmers considered definitely about the environmental factors before preparing their pond 63.3 percent of farmers considered some time only and 13.3 percent of farmers had not give any consideration about the environment.

"Now a days the cost of production is very high and price of our harvest is very low no any government support for improvement"most of farmers mentioned.

CHAPTER 06

6.1 Suggestions for improvement

- Preparation of the information flowing method among the farmers.

  During the survey it was identified lack of knowledge was the main reason for farmers failure. Therefore farmers education program must be supplied time to time inaddition to that. Farmers must be enforced to follow the necessary precautions and testing during there cultivation.

- Regular field visits.

  Large number of farmers was expected site advice and regular visit by the officers during there culture cycle. To identified the risk factor at the beginning and minimize the disease-spread condition the field investigation one of the main importance things to do.

- Establish enforcement group.

  Preparation of EIA is the main activity of the ASC activity plan. Currently it is not conducting. For the betterment of the farmers and also environment preparation of EIA is very essential before establishment of ponds. During the culture period farmers must attend about their risk activity like wise releasing stagnant water. The enforcement group can enforce the farmers to follow the necessary precaution before establishing ponds, releasing stagnant water, and refilling their culture pond by lagoon water.

- Officers education programs

  Always the new technology and new treatment methods are discovered in the field of shrimps farming also. Renewing of the knowledge of the officers is very important to improve the service of ASC. The regular education program, workshops are necessary for theses

- Monitoring the lagoon condition regularly.

  For the identification of lagoon water quality-testing sample for water quality from several places of lagoon may very important. Then the risk factors.

- Preparation a method for supply food, other necessary chemicals and for selling farmers harvests at a reasonable price.

  Large numbers of branded foods are available in the market for shrimps. Their prices are very. Farmers select they're feed according to their experience. Supply good quality feeds and other necessities are very essential.

  Due to the small number of Bayer, the farmers, get low price most of the time for their harvest. Enacting of certified price by the government is very important for the betterment of farmers.

- Continuation of incentives and salaries.
  All the officers of ASC were expected incentives for their service in addition to the salary. All are satisfied or somewhat satisfied about their salary. Continuation their incentives are emphasizes.

- Good communication method.

- Supply efficient mobile service.

- Supply necessary chemicals for tests without interrupting.

6.2 Further recommendations.

1. Large amount of ground water is used for shrimps farming in some area of Puttalam district.
   The environment of damage from this not evaluate at any level further more. The identification of what will be the future of ground water due to large amount of pumping is recommended.

2. Loss of coastal habitats likewise mangroves are major impact of shrimp farming,assessment of environmental damage due to shrimp culture is suggested

3. Due to the small sample size compression of various factors in this survey were unable after selecting large sample long period for this type of survey can be done very successfully.

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Appendix 01

Preparation of questioners for farmers (format)

1. Topic

2. Responded background

3. Identification the farmer wants

4. Extract his views about the services

6. Find out the farmer's willingness to pay

7. Farmers view about the officers of ASC

8. Farmers knowledge about the environment and disease condition

9. Suggestions for improvement

Appendix 02

Participatory Rapid Appraisal (P.R.A)

For ASC officers

1. Profession and his/her education background

    1.1. Education qualification and relation to the job (Extra qualification)
    1.2. Satisfactory about the job
    1.3. About salary, incentives and their satisfaction

2. Major problems in the field

3. Institute payment for tests and their reasonability

4. Main aim of the institute

5. Suggestions for the improvement the institute

6. Requirements of the institute for the better service

7. Management system of the institute

8. Idea about the farmers in the field

9. Reason for the crop failure

10. Idea about the companion

11. Farmers idea about the institute

12. Publicity about institute

13. Idea about the other institute in relevant field

14. Control out breaks

15. About environment damage and mitigation

Appendix 03

P.R.A. for other officers

CHECK LIST

1 Type of services

2. Qualification and experience of in the field

3. Weather the farmers are follow the advises of consultants

4. Idea about farmers in the field

5. Idea about the ASC and other institute in the field

6. Suggestions for the improvement these institute

7. Knowledge abut the environment, and damage of shrimps farming to the environment, and mitigation methods

Appendix 04

Ranking the responses acceding to the importance

10.Reasonces for crop failure

Lack of information	3	4	2	4	3
Farmers faults	2	1	4	2	2
Incorrect consultansies	4	3	3	1	1
Poor environment condition	1	2	1	3	4

11.Farmer's idea about the institute

Satisfy						
Don't know about the institute						
No satisfaction						
No idea						

12.Majour problems in the field

No enough instruments						
No enough transport facilities						
No enough training and knowledge						
Communications problems						
1						

13. Control out break

Awareness of the farmers						
Regular testing and treatments						
Stop cultivation for five periods						

14.Environment damage

Must be follow the mitigation methods						
Very difficult to consider						

15.Suggetions for improvement

Supply enough instruments and chemicals						
Supply good mobile service for farmers						
Training and workshop programs to the farmers and the officers						
Improvement of communication facilities						
Motivate the farmers to follow the rules and regulations						

Appendix 06

SR NO

A Survey to find out the effectiveness of the Aquaculture Srvice Centre (ASC) in the field of shrimps farming and to fill the gap between the requirement of shrimps industry and services of ASC.

Introduction

I am a student of Sabaragamuwa University following BSc degree in Natural Resources. I am conducting a survey about the shrimps farmers. I appreciate your cooperation with me .

1

1.1 Age

C1	
15-30	1
31-40	2
41-50	3
Above 50	4

1.2 Education level

C2	
Non schooling	1
Primary	2
ordinary level	3
Advance level	4
University	5

1.3. Can you explain your cultivation field in following?

Total area	Storage pond	Cultivated pond	Empty pond
C103	C104	C105	C106

1.4.What type of tests you have done in the shrimps farming?

Test	Respond	
SOIL		
pH		C3
FRY QUALITY ANALYSIS TEST		
MBV		C4
PCR		C5
DOT BIOT Method		C6
Formalin stress test		C7
WATER QUALITY		
Salinity		C8
D.O		C9
Temperature		C10
Ammonia		C11
H2S		C12
Iron		C13
Alkalinity		C14
Nitrite		C15
Nitrate		C16
Phosphate		C17
Chlorine		C18
Turbidity		C19
Heavy metals		C20
pH		C21

1.5. From above tests, what are the tests you have given by the service providers?

Test	ASC	NARA	GLOBLE	NASA	AQUA SERV:	OTERS	
SOIL							
pH							C22
FRY QUALITY ANALYSIS TEST							
MBV							C23
PCR							C24
DOT BIOT Method							C25
Formaline stress Test							C26
WATER QUALITY							
Salinity							C27
D.O							C28
Temperature							C29
Ammonia							C30
H2S							C31
Iron							C32
Alkalinity							C33
Nitrite							C34
Nitrate							C35
Phosphate							C36
Chlorine							C37
Turbidity							C38
Heavy metals							C39
pH							C40

1.6 Do you know the necessity of above tests?

Test	Yes	No	
SOIL			
pH			C41
FRY QUALITY ANALYSIS TEST			
MBV			C42
PCR			C43
DOT BIOT Method			C44
Formalin stress test			C45
WATER QUALITY			
Salinity			C46
D.O			C47
Temperature			C48
Ammonia			C49
H2S			C50
Iron			C51
Alkalinity			C52
Nitrite			C53
Nitrate			C54
Phosphate			C55
Chlorine			C56
Turgidity			C57
Heavy metals			C58
pH			C59

1.7 Do you think that the obtained results are true?

C60	
Yes	1
Some can accept	2
No	3
I have no idea	4

If answer is no question 1.8

1.8.Why do you think of that results are falls?

C61	
Instruments are not good	1
Chemicals are expired	2
Tests are done incorrect way	3

1.9.What is your idea about the payments for tests?

		ASC	*NARA*	*GLOBLE*	*NASA*	*Aqua service*	*OTHERS*
Cheap	1						
Reasonable	2						
Expensive	3						
Very expensive	4						
I have no idea	5						
		C62	C63	C64	C65	C66	C67

1.10.What are the main important tests do you expect?

Tests	**Respond**	
SOIL		
pH		C68
FRY QUALITY ANALYSIS TEST		
MBV		C69
PCR		C70
DOT BIOT Method		C71
Formaline stress Test		C72
WATER QUALITY		
Salinity		C73
D.O		C74
Temperature		C75
Ammonia		C76
H2S		C77
Iron		C78
Alkalinity		C79
Nitrite		C80
Nitrate		C81
Phosphates		C82
Chlorine		C83
Turbidity		C84
Heavy metals		C85
pH		C86

1.11. Can you mention the time that you expect from the services?

C87

In out break period	1
Regularly	2
When we informed	3

1.12.Do you think testing of water quality is advisable at site?

C88

Yes	1
Sometimes	2
No	3

1.13.Can you mention the harvest per acre in last time in Kg

C89

500>	1
500-800	2
801-1000	3
1001-1200	4
1200-1400	5
1400<	6

1.14.How long have you been in this field?

C90

1>	1
2	2
3	3
4	4
5	5
5<	6

2 About Officers And Consultants

2.1.What are your idea about the ability of the ASC officers?

C91

I can satisfy	1
No satisfaction	2
No idea about that	3

2.2.Can you contact the ASC officers easily when you need the services?

C92

Easy to contact	1
Sometimes difficult	2
Very difficult	3

If the respond is 2 or 3, question 2.3

2.3 What is the reason for this?

C93

No T.Pfacilities in office	1
No any officer in office	2
No vehicle in the office	3

(T.; Transport)

2.4. Do you expect the consultant service from the ASC officers, in addition to the laboratory services?

C94

Yes	1
No	2
Some times	3

2.4 Do you like to get the consultant services at a fee?

C95

Yes	1
No	2
Some times	3

2.6. Can you mention the time of payment?

C96

Daily	1
Monthly	2
At the time of service	3

2.7.Do you think that the ASC officers have enough knowledge for your services?

C97

Yes	1
No	2
Some times	3

2.8 Do you follow the advises, rules and regulations given by the ASC officers and consultants?

C98

Yes	1
No	2
Some times	3

If answer is 2 question 2.9

2.9.Why don't you follow these?

C99

We have no enough facilities	1
We have no enough time	2
We don't consider these	3

2.10.Do you follow the advises, after adding with you own ideas?

C100

Yes	1
Sometimes	2
No	3

3.About the Environment

3.1.Do you consider the environment before construct the ponds and during the culture season?

C101

Definitely consider	1
Some times consider	2
Not consider	3

3.2.Do you careful when water is exchanged?

C102

Careful only refilling	1
Careful only release	2
Careful in both	3
No any careful	4

Other information:

Appendix 07

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
1	1	4	1	0	1	0	0	1	1	1	1	1	0	1
2	2	4	1	0	0	0	0	1	1	1	1	0	1	1
3	2	4	1	0	1	0	0	1	1	1	1	0	1	1
4	3	3	1	0	0	1	0	1	1	1	1	0	1	1
5	2	3	1	0	0	0	0	1	1	1	1	0	0	1
6	3	5	1	0	0	1	1	1	1	1	1	0	1	1
7	3	4	1	1	0	1	0	1	1	1	1	1	1	1
8	2	4	1	0	0	1	0	1	1	0	1	0	0	1
9	2	4	1	0	0	0	0	1	1	0	1	0	0	0
10	2	4	1	0	1	0	1	1	1	1	1	1	0	1
11	3	4	1	0	0	0	0	1	1	0	1	0	0	1
12	4	4	1	0	0	0	0	1	0	0	1	0	0	0
13	4	3	1	0	0	0	0	1	0	0	1	0	0	1
14	2	3	1	0	1	0	0	1	1	1	1	0	1	1
15	3	3	1	0	0	0	0	1	1	1	1	0	1	1
16	3	3	1	0	1	0	0	1	1	1	1	1	1	0
17	2	3	1	0	1	0	0	1	1	1	1	0	1	1
18	3	3	1	0	0	1	0	1	1	1	1	0	1	1
19	2	4	0	1	1	0	0	1	1	1	1	0	1	1
20	4	3	1	1	1	1	0	1	1	1	1	0	1	1
21	2	4	1	1	0	0	1	1	1	1	1	1	1	1
22	2	3	1	0	0	0	0	1	1	1	1	0	0	1
23	2	4	1	1	1	0	1	1	1	1	1	1	1	1
24	3	3	1	1	1	0	1	1	1	1	1	0	1	1
25	3	3	0	1	0	0	1	1	1	1	1	0	1	1
26	2	4	1	1	1	1	1	1	1	1	1	0	1	1
27	2	3	1	1	0	0	1	1	1	1	1	0	1	1
28	2	3	1	1	0	0	1	1	1	1	1	1	1	1
29	3	3	1	1	1	0	1	1	1	1	1	0	0	1
30	3	3	0	0	0	0	0	1	1	1	1	0	0	0

Appendix 07

	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28
1	0	0	0	0	0	0	1	3	2	3	3	3	3	3
2	1	1	0	0	1	0	1	1	*	*	*	*	6	6
3	1	1	0	0	1	0	1	3	*	2	*	*	3	3
4	1	1	1	1	1	0	1	1	*	*	5	*	1	1
5	0	0	0	0	1	0	1	1	*	*	*	*	1	1
6	1	1	0	0	1	0	1	6	*	*	*	*	6	6
7	1	1	0	1	1	0	1	3	3	*	6	*	3	3
8	0	0	0	0	1	0	1	3	*	*	3	*	3	3
9	1	1	0	0	1	0	1	1	*	*	5	*	1	1
10	1	1	0	0	0	0	1	6	2	*	*	6	3	3
11	0	0	0	0	0	0	1	6	*	*	*	*	3	1
12	0	0	0	0	0	0	1	6	*	*	*	*	1	*
13	0	0	0	0	0	0	1	6	*	*	*	*	1	*
14	1	1	0	0	0	0	1	6	*	2	*	*	3	3
15	0	0	0	0	1	0	1	1	*	*	*	*	0	1
16	0	0	0	0	1	0	1	6	6	*	*	*	6	6
17	0	0	0	0	0	0	1	3	*	2	*	*	3	3
18	0	0	0	0	1	0	1	3	*	*	5	*	3	3
19	1	1	0	0	1	0	1	6	5	2	4	*	6	3
20	1	1	0	0	1	0	1	6	6	2	6	*	6	6
21	0	0	0	0	0	0	1	1	6	*	*	6	1	1
22	0	0	0	0	1	0	1	1	*	*	*	*	1	1
23	1	1	1	1	1	0	1	6	*	*	*	*	*	*
24	0	0	0	0	0	0	1	6	3	2	*	3	*	3
25	0	0	0	0	1	0	1	*	3	*	*	3	1	1
26	1	1	0	1	1	0	1	1	5	2	*	6	1	1
27	0	0	0	0	0	0	1	6	3	*	*	3	1	1
28	0	0	0	0	0	0	1	1	6	*	*	6	1	1
29	1	1	0	0	1	1	1	1	5	2	*	5	1	3
30	0	0	0	0	0	0	1	0	0	0	0	0	1	1

Appendix 07

	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42
1	6	1	*	*	1	*	*	*	*	*	*	3	1	0
2	6	3	*	3	3	1	1	*	*	6	*	1	1	1
3	6	3	*	3	3	3	3	*	*	*	*	3	1	1
4	6	1	*	1	1	1	1	0	0	6	*	6	1	0
5	1	1	*	*	1	*	*	*	*	6	*	1	1	0
6	6	6	6	6	6	6	6	6	*	6	*	6	1	1
7	3	3	3	3	3	3	3	3	3	6	*	3	1	1
8	*	3	*	*	3	*	*	*	*	6	*	3	1	0
9	6	1	*	*	1	*	*	*	*	*	*	1	1	0
10	3	3	3	*	*	*	*	*	*	6	*	3	1	1
11	6	3	*	*	1	*	*	*	*	*	*	1	1	1
12	1	1	*	*	*	*	*	*	*	*	*	1	1	0
13	1	1	*	*	1	*	*	*	*	*	*	1	1	0
14	3	3	*	3	3	3	3	*	*	*	3	3	1	1
15	1	1	*	1	1	*	*	*	*	6	*	1	1	0
16	6	6	*	6	6	*	*	*	*	6	*	6	1	1
17	6	3	*	3	3	*	*	*	*	6	*	3	1	0
18	3	3	*	3	*	*	*	*	*	6	*	3	1	1
19	6	3	*	3	3	3	3	*	*	6	*	3	1	1
20	6	*	*	6	*	*	*	*	*	6	*	6	1	0
21	1	1	1	1	1	*	*	*	*	*	*	1	1	1
22	1	1	*	*	1	*	*	*	*	6	*	1	1	0
23	*	*	*	*	*	*	*	*	*	*	*	1	1	1
24	6	3	*	*	*	*	*	*	*	*	*	3	1	6
25	6	1	*	1	1	*	*	*	*	6	*	1	1	1
26	1	1	1	1	1	1	1	*	5	6	*	1	1	1
27	1	1	*	1	*	*	*	*	*	*	*	1	1	1
28	1	1	1	1	1	*	*	*	*	*	*	1	1	1
29	6	1	*	*	1	*	*	*	*	6	*	1	1	1
30	6	1	*	*	*	*	*	*	*	*	*	1	1	1

Appendix 07

	C43	C44	C45	C46	C47	C48	C49	C50	C51	C52	C53	C54	C55	C56
1	1	1	0	1	1	1	1	1	0	1	0	0	0	0
2	0	0	0	1	1	1	1	0	1	1	0	0	0	0
3	1	1	1	1	1	1	1	0	0	1	1	1	0	1
4	1	1	0	1	1	1	1	0	1	1	1	1	0	0
5	1	1	0	1	1	1	1	0	1	1	0	0	0	0
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	0	1	1	1	1	1	1	1	1	1	1	0	0
9	1	1	1	1	1	1	1	0	1	1	1	1	0	0
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	0	1	0	1	1	1	1	1	0	1	1	1	1	0
12	0	0	0	1	1	1	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	0	0	1	1	1	1	0	1	1	1	1	0	0
15	1	0	0	1	1	1	1	0	0	0	0	0	0	0
16	1	1	0	1	1	1	1	0	1	0	0	0	0	0
17	1	0	1	1	1	1	1	0	1	1	0	0	0	0
18	1	1	0	1	1	1	1	0	1	0	0	0	0	0
19	1	1	0	1	1	1	1	1	1	1	1	1	0	0
20	0	0	0	1	1	1	1	0	1	0	0	0	0	0
21	1	0	1	1	1	1	1	1	0	0	0	0	0	0
22	1	1	0	1	1	1	1	1	0	1	0	0	0	0
23	1	0	1	1	1	1	1	1	1	1	0	1	1	1
24	1	0	1	1	1	1	1	0	0	0	0	0	0	0
25	1	0	1	1	1	1	1	0	1	1	1	1	0	0
26	1	1	1	1	1	1	1	1	1	1	1	1	1	1
27	1	0	1	1	1	1	1	1	1	1	1	1	0	0
28	1	0	1	1	1	1	1	0	1	0	0	0	0	0
29	1	1	1	1	1	1	1	0	1	1	1	1	0	0
30	1	0	0	1	1	1	1	0	1	1	1	1	0	0

Appendix 07

	C57	C58	C59	C60	C61	C62	C63	C64	C65	C66	C67	C68	C69	C70
1	1	0	1	2	2	3	5	1	5	5	5	1	0	1
2	1	0	1	2	*	2	6	2	6	2	6	1	0	0
3	1	0	1	2	*	6	6	2	6	3	6	1	1	1
4	1	0	1	3	2	2	5	5	5	3	5	1	0	1
5	1	1	1	1	*	2	5	5	5	5	5	1	0	0
6	1	1	1	1	*	2	3	2	5	5	5	1	0	1
7	1	1	1	2	3	5	5	2	5	5	5	1	0	1
8	1	1	1	2	*	5	5	2	5	3	5	1	0	1
9	0	0	1	2	*	2	5	5	5	3	5	1	0	1
10	1	1	1	4	3	3	4	2	5	5	3	1	1	1
11	1	0	1	2	*	2	5	2	5	5	5	1	1	1
12	0	0	1	1	*	3	5	5	5	5	5	1	0	0
13	0	0	0	1	*	2	5	5	5	5	5	1	0	0
14	1	1	1	2	1	6	3	3	5	5	5	1	1	1
15	1	0	1	1	*	2	5	5	5	5	5	1	0	1
16	1	0	1	1	*	2	5	5	5	5	1	1	0	1
17	1	0	1	1	*	5	3	2	5	5	5	1	0	1
18	1	0	1	1	*	5	5	2	5	2	1	1	0	1
19	1	1	1	1	*	5	3	2	2	5	2	1	1	1
20	1	0	1	2	*	5	3	5	5	5	2	1	1	1
21	0	0	1	2	*	3	5	5	5	5	1	1	0	1
22	1	1	1	1	*	3	5	5	5	5	5	1	0	0
23	1	0	1	2	*	3	3	5	5	3	3	0	1	1
24	1	0	1	1	*	5	3	2	5	5	2	1	0	1
25	1	0	1	1	*	2	5	2	5	5	5	1	1	1
26	1	1	1	1	*	3	3	2	5	3	5	1	1	1
27	0	0	1	1	*	2	5	3	5	5	1	1	1	1
28	0	0	1	2	*	3	5	5	5	5	1	1	0	1
29	1	0	1	1	*	2	3	2	5	2	5	1	1	1
30	1	0	1	2	*	2	5	2	5	5	2	1	0	1

Appendix 07

	C71	C72	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84
1	1	0	1	1	0	1	1	0	0	0	0	0	0	0
2	0	0	1	1	1	1	0	0	0	0	0	0	0	0
3	0	0	1	1	0	1	0	0	1	0	0	0	0	1
4	1	0	1	1	1	1	0	1	0	0	0	0	0	0
5	0	0	1	1	1	1	0	0	1	0	0	0	0	0
6	1	1	1	1	0	1	0	0	1	0	0	0	0	1
7	1	0	1	1	1	1	0	0	1	1	1	0	0	1
8	0	0	1	1	0	1	0	0	1	0	0	0	0	0
9	0	1	1	1	0	1	0	0	1	0	0	0	0	0
10	0	0	1	1	0	1	0	0	1	0	0	0	0	1
11	0	0	1	1	0	1	0	0	1	0	0	0	0	0
12	0	0	1	0	0	1	0	0	0	0	0	0	0	0
13	0	0	1	0	0	0	0	0	0	0	0	0	0	0
14	0	0	1	1	0	1	0	0	1	1	1	0	0	0
15	0	0	1	1	0	1	0	1	1	0	0	0	0	0
16	0	0	1	1	1	1	0	0	1	0	0	0	0	0
17	0	0	1	1	1	1	0	1	0	0	0	0	0	1
18	1	0	1	1	1	1	0	1	0	0	0	0	0	0
19	1	0	1	1	1	1	0	1	1	1	1	0	0	1
20	1	0	1	1	1	0	0	1	1	0	0	0	0	1
21	0	0	1	1	0	1	0	0	0	0	0	0	0	0
22	0	0	1	1	1	1	0	0	1	0	0	0	0	0
23	0	1	0	0	0	1	0	0	1	0	0	0	0	0
24	0	1	1	1	0	1	0	0	0	0	0	0	0	0
25	0	1	1	1	0	1	0	0	0	0	0	0	0	0
26	0	1	1	1	0	1	0	0	0	0	0	0	0	0
27	0	1	1	1	1	1	0	1	1	0	0	0	0	0
28	0	0	1	1	0	1	0	0	0	0	0	0	0	0
29	0	1	1	1	0	1	0	0	0	0	0	0	0	0
30	0	1	1	1	0	1	0	0	1	1	0	0	0	0

Appendix 07

	C85	C86	C87	C88	C89	C90	C91	C92	C93	C94	C95	C96	C97	C98
									c					
1	0	1	2	1	4	6	3	2	1	3	1	3	3	3
2	0	1	3	1	4	6	1	1	*	2	*	*	1	*
3	0	1	2	1	3	4	3	4	*	3	3	*	1	*
4	0	1	2	1	1	2	1	1	*	2	*	*	1	1
5	0	1	2	1	1	1	1	1	*	3	3	3	1	1
6	0	1	3	1	3	6	1	2	3	3	3	3	2	1
7	1	1	2	1	1	6	3	4	*	3	2	*	1	3
8	0	1	2	1	3	6	3	4	*	1	3	4	1	3
9	0	1	2	1	4	5	1	2	3	1	1	3	1	3
10	0	1	2	1	1	6	3	1	*	1	1	4	1	1
11	0	1	2	1	1	1	1	2	1	1	3	3	1	1
12	0	1	2	1	4	6	2	1	*	1	1	4	2	1
13	0	1	2	3	3	6	1	4	*	1	2	*	1	1
14	0	1	2	1	2	4	1	4	*	2	*	*	*	*
15	0	1	2	1	1	3	1	1	*	1	2	3	1	2
16	0	1	2	1	4	6	3	1	*	1	1	2	1	1
17	0	1	2	1	4	6	3	4	*	2	1	4	1	1
18	0	1	2	1	3	6	3	4	*	2	1	4	1	3
19	0	1	2	1	4	6	3	4	*	2	1	2	1	1
20	0	1	2	1	2	6	2	4	*	2	1	4	1	3
21	0	0	2	1	4	2	1	3	2	1	1	4	1	1
22	0	1	2	1	1	1	2	1	1	1	2	2	1	1
23	0	0	2	1	5	6	3	1	*	2	2	*	3	1
24	0	1	2	1	3	6	1	4	*	3	1	*	1	1
25	0	1	2	1	4	5	1	1	*	1	1	4	1	3
26	0	1	2	1	4	6	1	1	*	1	1	4	1	1
27	0	1	2	1	3	3	2	4	*	1	1	3	1	1
28	0	0	2	1	4	2	1	3	2	1	1	2	1	1
29	0	1	2	1	4	6	1	1	*	1	3	4	1	1
30	0	1	2	1	3	5	3	1	*	3	1	3	1	1

Appendix 07

	C99	C100	C101	C102
1	3	2	2	1
2	*	*	2	1
3	*	2	2	4
4	*	1	3	4
5	*	3	2	4
6	*	2	2	3
7	3	2	2	1
8	*	2	2	1
9	1	2	3	4
10	*	2	1	4
11	*	2	2	4
12	*	3	2	4
13	*	2	2	4
14	*	2	2	3
15	*	1	1	3
16	*	2	1	3
17	*	2	2	1
18	*	2	2	1
19	*	2	1	2
20	*	2	2	1
21	*	3	3	1
22	*	3	2	4
23	*	2	3	4
24	*	2	2	4
25	1	2	1	4
26	*	1	1	1
27	*	2	1	4
28	*	2	2	3
29	*	2	2	4
30	*	2	2	4

Appendix 08

Age	No of farmers	percentage
15-30	1	3.3
31-40	15	50.0
41-50	11	36.7
Above 50	3	10
Total	30	100.00

Appendix 09

Education Level	No of farmers	Percentage
Non schooling	0	0.0
Primary	0	0.0
Ordinary level	16	53.3
Advance level	13	43.3
University	1	3.3
Total	30	99.99

Appendix 11

Harvest kg	Frequency	Percentage
<500	7	23.3
500-800	2	6.7
801-1000	8	26.7
1001-1200	12	40.0
1200-1400	1	3.3
1400<	0	0
Total	30	100

Appendix 12

Time period	No of farmers	Percentage
>1	3	10.0
2	3	10.0
3	2	6.7
4	2	6.7
5	3	10.0
5<	17	56.7

Appendix 13

Respond	No of farmers	Percentage
1. satisfy	15	50.0
2.no satisfy	4	13.3
3 no idea	11	36.7

Appendix 14

Reason	No of farmers	Percentage
1. Easy to contact	13	43.3
2. Sometimes difficult	4	13.3
3.very difficult to contact	2	6.7
4. No idea	11	36.7

Appendix 15

Respond	Frequency	Percentage
Yes	15	50.0
No	8	26.7
Sometimes	7	23.3

Appendix 16

Respond	Frequency	Percentage
Yes	16	53.3
No	8	26.7
Sometime	6	20.0

Appendix 17

Respond	Frequency	percentage
Yes	25	83.3
No	2	6.7
Sometimes	3	10.0

Appendix 18

Respond	Frequency	Percentage
Yes	19	63.3
No	1	3.3
Sometimes	7	10.0
Don't get advisers	3	23.3

Appendix 19

Respond	Frequency	percentage
1.deffinitely consider	7	23.3
2. Sometimes consider	19	63.3
3.No any consideration	4	13.3

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