

# Fishing For Living; Shrimp Farmer's Perception Of Heronry Birds In Kannur District Kerala, India

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## Abstract

*A questionnaire survey and field investigation in the shrimp farms were conducted in the Kannur District of South India from 28<sup>th</sup> July, 2013, to 5<sup>th</sup> August, 2013. A total of 30 shrimp farms were studied in Kannur district of Kerala. Shrimp farms were facing many threats of which only 30% were due to bird menace. Among the different bird species Cormorants were observed to be threat to shrimp farming. Group forager, diver and being an opportunistic feeder make Cormorants an ideal predator of shrimps (53%). Our present study revealed that cormorants predate and feed nestlings with large quantity of shrimps. Other problematic species were Night Herons, Little Grebe, Egrets, Kingfishers, Storks, Darter, Green Herons, and Whistling Ducks. High food availability in farms (26%) and ease to catch shrimps (22%) are the major reasons proposed for bird predation. Other reasons were ecological changes (11%), lack of food and water sources (19%) in natural systems and clear and stagnant water in shrimp farms (22%) makes predation more easier. There were different mitigation measures were applied to control bird menace. Tying nylon threads across farms (55%) were the common mitigation measure found employed in shrimp farms. Other bird deterrent measures -auditory methods and visual methods were discussed below. The majority of farmers preferred low cost mitigation measure, whereas few farmers employed costly measures like protection of farms with net (5%), crab nets (2%) and blooming water (2%). Most farmers lost their tolerance level due to the sustained bird menace (76%) and seek immediate measures to control bird damage in shrimp farms.*

**Key words:** Shrimp farms, cormorants, heronry, threat, mitigation

## INTRODUCTION

The term “heronry” can be considered as group nesting of colonial water birds of the orders Ciconiiformes, Pelecaniformes and Suliformes which comprises of herons, egrets, storks, pelicans, ibis, darter and cormorants during breeding period which shows spatial and temporal clumping of nests. As these birds are piscivorous their main diet rely on fishes, this has resulted in conflict between fisheries and aquatic birds. The first documented conflict between water birds and man was reported from Ireland in the seventh century, and involved agricultural damage by geese (Kear 1990). There after many documentation of water bird conflict was recorded throughout the world. Water birds are an integral party of aquatic eco-system and they do have their own role in maintain its health. Thus, these birds have social and economic importance.

Fisheries sector is one of the main livelihood sources for coastal people. Both marine and inland fisheries are practiced in Kerala. Geographically, inland fisheries have great scope in the state. Many fresh water fishes Carp (*Cyprinus carpio*, *Ctenopharyngodon godonidella*), Pearl Spot (*Etroplus suratensis*) and shrimps (*P.momodon*, *P.vannamie etc.*) are being cultivated in Kerala. In 2010, Kerala produced 17763 MT prawns (Kerala Inland Fisheries Statistics 2010). Shrimp farming is a growing sector in Kerala with both marine and inland shrimp culture practices, the produce of which are widely exported and also sold in local markets. Shrimp, regarded as pink gold of the sea, is costly, highly nutritive and preferred among people all around the world.

Kannur District, which is blessed with an extensive coastal line of 82 km, has high potential in fisheries and many of its peoples depend upon fisheries for their livelihood. Mahe, Dharmasamkayal, Valapattanam,

Palakkode and Cheruvathur are the four main brackish water areas in Kannur with a total area of 4157.42 ha and majority of the shrimp farms are concentrated here. Kurinjimangalam, Ezhome, Kattampally, Mandallor and Eranholi are the main inland fishing villages in Kannur District. The main aquaculture species cultivated in Kannur are Tiger Shrimp, Pear Spot and mussels. Kannur produced 108 MT prawns as per the report of Kerala Inland Fisheries Statistics (Anon 2010).

The conflict between birds and the fisheries sector has also been present since a long time. Increase in number of cormorants in Kannur District of Kerala during the past decades has led to much conflict, particularly with fish farming (Sashikumar and Dinesh Chervatur pers comm). Predation by birds on commercial fish farms was an on-going problem that was encountered world-wide (Kevan and Weseloh 1992). many studies in the diet of cormorants was carried out all around the world and many corrective measures were undertaken (Liordos and Goutner 2008; Keller 1995; Veldkamp 1995;; Humpheries *et al.*, 1992; Glahn *et al.* 1998; Engstrom 2001; VanEerden and Gregersen 1995). These studies have led to create a database on dietary preferences of cormorants. In India, there has been no study reported in this field. Cormorants were reported as threat to fisheries. The objective of this study was to document the species and the problems faced due to those species in fisheries sector (Shrimp farms).

## MATERIAL AND METHOD

Farmer’s attitude towards economic impact of the heronry birds, especially cormorants, was quantified by conducting questionnaire survey among the shrimp farmers of Kannur District (Annexure 1). Field investigation in the farms was conducted to identify the problems faced during shrimp

farming, especially those that were caused by birds. The survey was conducted in selected farms in Kannur District from 28<sup>th</sup> July, 2013, to 5<sup>th</sup> August, 2013. A total of 30 farms were visited and data was collected. Pictorial bird guide (Ali 2003) was showed to farmers to identify the problematic birds. To minimize identification errors by farmers, species were clubbed into major categories namely Egrets (includes Little Egret (*Egretta garzetta*), Median Egret *Mesophoyx intermedia*) and Large Egret (*Ardea alba*), Cormorant (includes Little Cormorant (*Phalacrocorax niger*), Great Cormorant (*Phalacrocorax carbo*) and Indian Cormorant (*Phalacrocorax fuscicollis*) and Kingfishers (includes Common Kingfisher (*Alcedo atthis*), White Breasted Kingfisher (*Halcyon smyrnensis*), Stork-billed Kingfisher (*Pelargopsis capensis*) and Pied Kingfisher (*Ceryle rudis*)).

## RESULTS

Based on the questionnaire survey, it was found that shrimp farms in Kannur District are facing many issues that can be broadly categorized into management problems (Farm management, water management, labours), biological problems (disease, predation, growth issues) and problems due to increased raw material prices (Fig.1). The major problems concerned with shrimp farming were disease (34%) and bird menace (30%). Among disease, White Spot Syndrome (WSS) was the main, causing 100% mortality in affected farms. Bird predation remained one of the important threats to the farmers and birds could also act as a carrier of various diseases which could get transmitted from one pond to others. Increase in raw material price (10%) such as feed, seeds, diesel, etc. affected shrimp farms. Unavailability of good quality seeds (8%), growth issues of shrimps (7%) and maintenance of water quality (8%) for proper growth were the other problems. Staff issues (3%) include labour charges and lack of

labourers available to work made shrimp farming difficult in Kannur. Due to various such reasons many farmers didn't cultivate shrimps for this season. To summarize, the birds menace in the farming area was low 30% compared with other major problems (diseases and management related issues; 70%).

### Problematic birds in Shrimp farms

Birds acted both as predator and disease transmitters in shrimp farms (Fig.2). Among birds, Cormorants (53%) were the main problematic species in Kannur. The foraging habits of this bird as an active predator and diver, foraging in groups had mainly led to conflict with shrimp farmers. During night hours, shrimps lying near the banks of ponds were predated by Night Herons (24%). Other diving birds such as Little Grebe (7%) caused threat as a predator. Egrets (4%) and Kingfishers (4%) moderately predated on shrimps. The bird species such as Storks, Darter, Green Heron and Whistling Ducks constituted 2% each.

Farmers' perception on bird predations and reasons for conflict in the shrimp farms were reviewed based on the questionnaire survey and the findings are presented in Fig.3. Greater availability of food in the farms (26%) and ease to catch shrimps (22%) were two major reasons identified. Furthermore, lack of food (15%) and water (4%) and ecological changes (11%) might have attracted these birds into shrimp farms. Other suggested reasons were clear (15%) and stagnant water (7%) enabled to prey easily on shrimps in the farms than natural water bodies.

### Mitigation measures

Many mitigating measures were employed to control birds entering into farms (Fig.4). Tying nylon threads (55%; Fig.6A) all across the field was the common mitigation method found practiced in shrimp farms in Kannur. Well maintained protection with

nylon threads were found very effective. Manual method (14%) of chasing away birds and other intruders were found practiced in some farms. Auditory methods of chasing birds away from field like making sound using bottles filled with marbles (7%; Fig.6B), bursting crackers (5%) and noisy tins (3%) were observed in some fields. Visual deterring methods like tying shining plastic paper (5%) and video cassette reel (2%) were also practiced but seemed to be less efficient in control. Majority of the farmers preferred low cost mitigation methods. Other costly mitigation measure like full protection of the farm with net (5%), crab nets (2%) and blooming of water (artificial colouring of water; 2%) were employed by few farmers.

Similar results were observed in the highly economically important Pearl's Spot (*E. suratensis*) cultivation farms in Kannur. Cormorants were found to create economical loss to the farms. Pearl spot is cultivated in small ponds with maximum protection to farms, thus even a small amount of predation will have high economic loss.

#### **Attitude of farmers to bird menace**

Different tolerance levels were observed among shrimp farmers towards the bird menace, of which 76% of the farmers lost their tolerance level due to sustained conflict and required immediate measures to prevent loss. About 20% of the farmers were able to tolerate bird predation to some extent. Only 4% of farmers tolerated bird predation and supported bird conservation.

Farmers proposed number of requirements from the Government for better farming like control measures to prevent bird menace, subsidy, research and even culling of birds (Fig.5). The major requirement of farmers was provision of net (57%) to control bird menace.

#### **DISCUSSION**

Studies on parental preference of feeding in heronry birds in Valapattanam Heronry results found that cormorants mainly feed and fed their nestling with shrimp fries and thus conflict with farms (Author unpublished data). Cormorants foraged either in solitary or a group of 5-10 individuals. They are opportunistic predators which are found to be very adaptive to farming areas. The population growth of little cormorant showed increased in past decade which indicated the surplus availability of food to support. Shrimps are good sources of protein for growing nestlings. It is very easy to catch and is abundant in ponds. During moulting period shrimps are less active and are found in bottom of ponds which make them more prone to predation. Other bird species such as Little Grebes is diving bird were found to predate on shrimps. Nocturnal piscivorous birds like Night heron forage during night times in shrimp ponds. It enters the pond through the sides where there is no protective measures (nylon threads) and catches the shrimps. Other birds like egrets, kingfisher, storks, darter, green heron and Whistling Ducks predate on shrimps in small percent (23%).

Birds alone can't be blamed of causing disease in shrimp farms, there were number of other reasons reported such as environmental factors, pathogenic organisms, food scarcity, water pollution, temperature, salinity variations, algal blooms and over stocking of shrimps in the farm (Unnithan 1985). Other animals like crabs, frogs and fox were also caused problem in the farms. Packs of foxes are major problem in Pinarayi and Andallur regions of Kannur District. During night they enter the ponds and catch large sized shrimps. These foxes can also act as carrier of many virus from pond to pond.

Similar conflict issues were observed in other aquaculture practices like Pearl's spot culture (*Etroplus suratensis*). Cormorants were

also found to predate pearl's spot from the rearing ponds. Pearl's spot is State fish of Kerala and has high economic importance.

According to farmers availability of high food source and ease of preying on shrimps are the main reasons which have attracted cormorants in shrimp farms. Lack of food and water sources outside and ecological changes might also have attracted these birds into shrimp farms. With an increase of habitat loss for piscivorous birds, along with an increase in new commercial fisheries operations, there is a likelihood of more predation on fish farms (Parsons *et al.* 1990). Stagnant and clean water makes the shrimp vulnerable to predation. To conclude the factors such as rapid conversion of natural water bodies into shrimp farming areas, high food availability in the farms, stagnant and clean water in farm were important factors for increased conflict.

Even though Birds have economic impact on aquaculture practices, there are many other issues affecting economic of shrimp farming.

### **Other issues in shrimp farms**

#### **1. Disease**

WSS is the major disease threat in shrimp farms. WSS can infect pond through contaminated water or soil, feed or mechanical transmission by carriers. After infection, shrimps swims to water surface and concentrate to sides of the pond. White spots/patches on shell and carapace is the typical clinical sign. Infection can spread widely across the full pond within days and can cause 100% mortality in severe cases. The virus infects a wide range of crustaceans. Birds act as a carrier of this virus from one farm to another via mechanical transmission, fecal contamination or dropping infected shrimps to another farm. Beyond this, many bacterial and fungal infections are seen in

shrimps. Insurance policies for shrimp farms for disease outbreak were having many constraints and thus it was not effective for getting any benefits.

#### **2. Increase in raw material price**

In 1990, price of feed for shrimps was Rs 28/kg, diesel for aerators and generator to pump in and out water from pond costs Rs 7/lit and shrimps had average market price of Rs 450-550/kg. But, now increase in market price of raw materials and non-profitable sale of shrimps make many farmers to change to other agricultural practices. In 2013, a liter of diesel cost around Rs50, feed Rs85/kg, and market price of shrimps decreased to Rs 250-350/kg.

#### **3. Water quality**

Many parameters together govern the quality of water such as dissolved oxygen, salinity, water temperature, pH, ammonia, nitrogen, sulphides, carbon dioxide and water level. Dissolved oxygen is the major factor concerned with water quality (normally 3.5ml/liter; Suseelan 1978). Ponds should be maintained in optimum saline (10-35ppt) condition for better growth of shrimps (Muthu 1980). Seepage of water during rainy season and alteration in water temperature also affects growth of shrimps. Proper temperature (25-30°C) is also required for the wellbeing of shrimps, if the temperature goes below 20°C, it can get susceptible to diseases like WSS. All these factors affect shrimp growth, yield and molting process and productivity. Ponds water level should be 0.75 to 1 m. If height goes below this, there is a chance of getting water heated during summer and water depth more than two meter is considered congenial from productivity point of view (Sinha 1983).

#### **4. Others**

Good seed availability is another issue. Getting quality seed is difficult which affects the growth rate and production. Fluctuating market price Rs250- 550/kg of shrimps also affects farmers. High productivity of white shrimps (*P. vannamie*) and low price sale from Tamil Nadu is affecting Kerala shrimp farmers. Kannur farmers produce mainly Tiger Shrimps which are not getting suitable market price due to competition with Tamil Nadu's white shrimps and farmers were forced to sell it for low prices. Many farmers were found to have dropped shrimp farming during the study season due to above mentioned reasons.

Thus, there were numerous issues related to shrimp farming. However, the damage due to birds was very low when compared to other factors. Applying lethal mitigation measures to control bird can affect globally threatened bird species such as Oriental Darter. Thus proper control methods should be encouraged to control bird menace.

### **Mitigation and Management measures**

Protecting the farm with nylon net is the effective way to prevent bird predation. Even though protecting with net is a costly affair. There are different avian deterrent techniques practiced worldwide to get rid of bird menace in aquaculture facilities. They can be broadly classified into auditory, visual, physical and lethal methods.

#### ***Auditory methods***

Auditory method include manual making of sounds to scare birds, burning crackers, making sound with tin. A method of making sound using plastic bottles filled with few marbles tied in rope was noted in some fields. When a bird enters the field the rope was pulled and released which make loud sounds. This is found effective in controlling bird menace and require a person to guard.

Gas cannons (or 'exploders' in the USA) are mechanical devices that produce loud banging noises by igniting either acetylene or propane gas mainly used in foreign countries. The unexpected bang produced causes a 'startle' reflex and promote escape flight (Harris and Davis 1998) but Conniff (1991) reported that gas cannons eventually became perches for double-crested cormorants. It is clear that effectiveness varies with mode of deployment.

Distress calls can be used as a frightening technique to scare the fish eating birds from aquaculture ponds (Littauer 1990). Broadcasting alert calls or predators calls can frighten birds away. These techniques have to be tested to study the reaction of fish predating birds. However reactions to distress calls can vary both with the species and the individual bird (Schmidt and Johnson 1983). In Haifa, Israel, more than 80% of visiting night herons (*Nycticorax nycticorax*) were frightened off trout ponds when recorded distress calls of juvenile and adult (combined) night herons were broadcasted (Spanier 1980). This method has to be tested in the field for their efficacy in controlling the picivorous birds in the study area.

#### ***Visual methods***

Any visual object that restricts the bird entering into farms can be regarded as visual determinant. Humans are the effective model to scare away many birds. Human model/scare crows can be employed in farms to scare away the birds. Birds get habituated to non-motile and non-dangerous models very fast, so it's better to change the position of scare crow twice in a month. If possible visual method should be supplemented with auditory signals to get both effective. Highly reflective mylar ribbon (flash tape), hawk silhouette kites, and helium balloons have shown to be effective at times in scaring birds (Littauer 1990). Large balls with large eye spot to mimic the stare of large birds of prey can be employed to scare

birds. Owl's eye balls are available in foreign countries. Two circular eyespots arranged horizontally, each containing concentric rings of bright colour appear to be the most alarming. Nocturnal birds like night heron can be frightened away by using flashing lights (Littauer 1990).

### ***Physical methods***

Preventing the bird entering to the field is the best way to stop bird predation. There are different methods applied to stop the movement of bird into farms, for example using nets, ropes/threads, bird fencing, etc. Net is the most effective way to control bird entering the field, but netting the whole farm is very costly and cannot be afforded by local farmers. Tying ropes/nylon thread across the farm is another physical barrier to prevent bird predation. Nylon threads tied 1 foot apart covering whole area of farm is found effective.

### ***Lethal methods***

The last way to get rid of bird predation is shooting those birds that come in the field. Shooting of birds is of high ethical importance and Wildlife Act 1972 strictly offends it. Even though many illegal shooting of birds are going all around. During the survey it was observed that poaching of cormorant for meat consumption in Valapattanam heronry. In other countries lethal method of controlling population were applied by knowing carrying capacity and proper scientific studies. Whereas in India populations were not monitored in long term and the carrying capacity of the area were also unknown, without such basic population data any management intervention could not be performed.

To conclude applying one control measure might not be effective due to habituation. Employing of different techniques and changing the methods might be effective.

Efficacy of different control methods should be studied scientifically tested in the field.

Economic importance of the species such as cormorant, egrets and herons are not so easy to evaluate. These species play an important role in ecosystem, replacing any one of them can have adverse effect on another, which destroys the harmony of the ecosystem. For eg; considering a species of cormorant, its socio-economic concerns included economic losses from depredation at aquaculture facilities, potential impacts on fishing-related businesses, loss of fish in private lakes and damage to trees on private property (Sullivan and Curtis, 2006). It has been reported that cormorants might reduce biodiversity by competing with herons for nest trees and depredation of fish population (Veldkamp 1997). Duffy (1995) studied cormorant ecology and human sociology and quoted that cormorants (Phalacrocoracidae) had a long history of conflict with fishermen and more recently with fish-farmers. Even though there is negative impact of cormorants on other species Hughes *et al.* (1999) opined that cormorants predation on fish stocks might allow aquatic plants and invertebrates to flourish thus might also have positive effect on biodiversity. Thus removal of a top predator such as cormorant in an aquatic ecosystem will have adverse effect, which might cause increase in prey species (fishes) which decreases the plankton diversity in water, which invariably cause decline in fish population and thus complete loss of life form in that system. Thus the economic values of cormorants are much more than the loss they cause due to predation.

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**TABLES AND FIGURES**

Fig.1: Issues in the management of shrimp farming in Kannur District, Kerala.

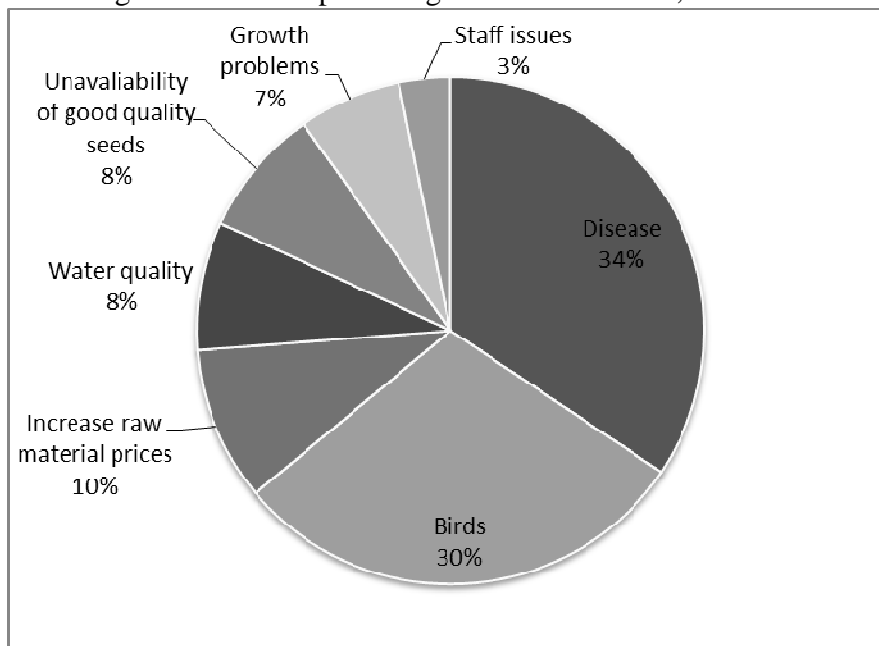


Fig.2: Per cent composition of different birds causing problem in the shrimp farming in Kannur District of Kerala.

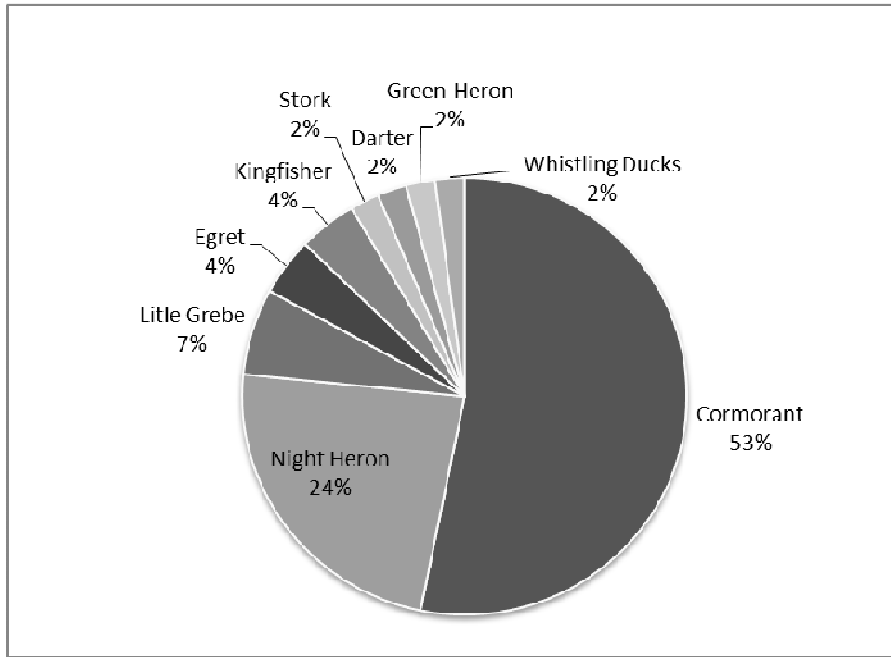


Fig.3: Proposed reasons for bird predation in shrimp farms in Kannur District of Kerala during the study period (2013).

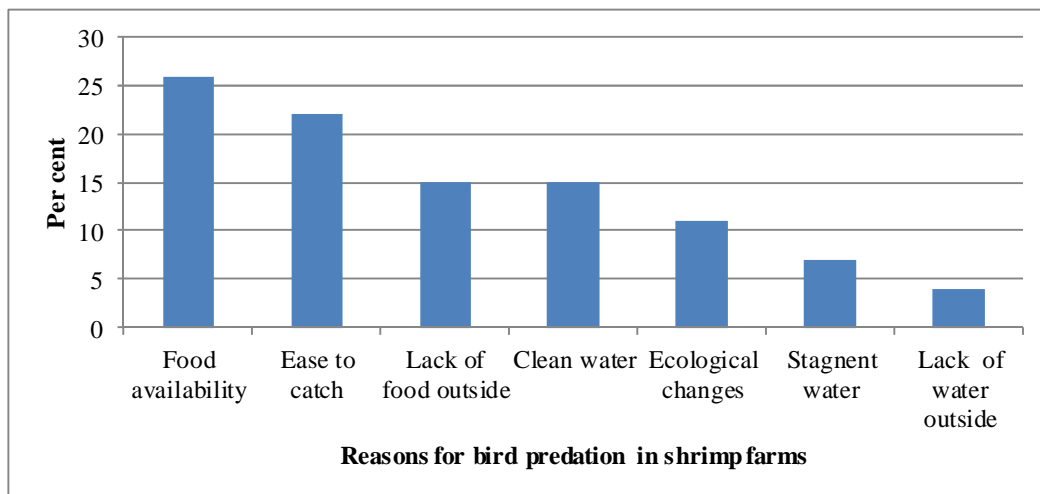


Fig.4: Mitigation measures used to control bird menace in shrimp farms and their average cost in Kannur district, Kerala

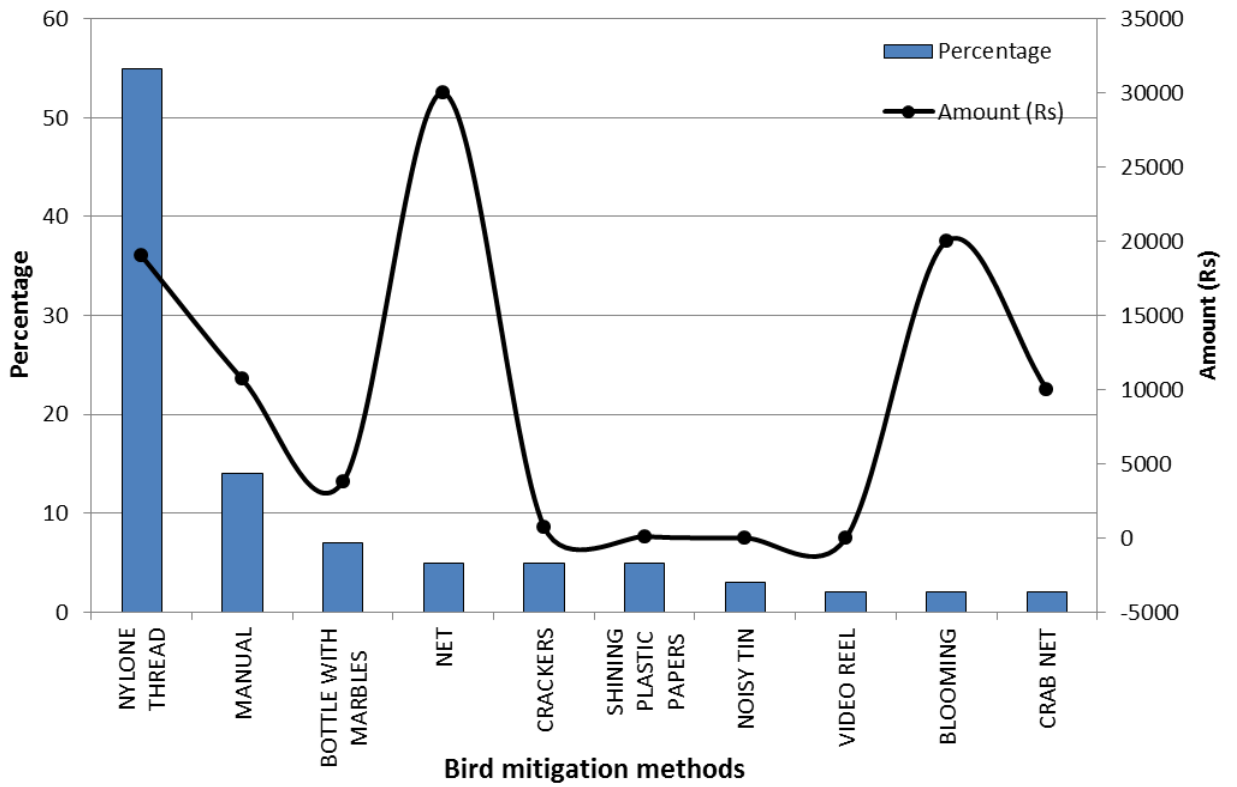


Fig.5: Requirements suggested by farmers for better farming in Kannur District of Kerala.

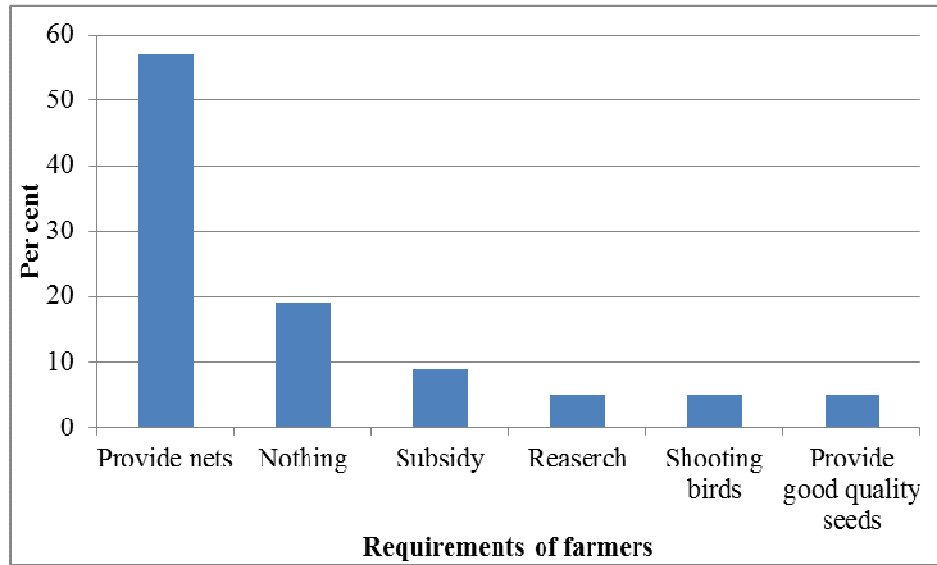


Figure-6: Mitigation measures to control bird menace in Kannur Shrimp farms (A. Bottle with marbles, B. Nylon thread and side fencing)

