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REVIEW ARTICLE

ROLE OF ICHTHYOPHAGUS BIRDS ON CULTURE BASED FISHERIES IN AQUA SECTOR, THEIR PREVENTION AND CONTROL: A REVIEW

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ABSTRACT

Several bird species have been identified as "problem species" on culture based fisheries in aqua field. Many species of birds prey on cultivable fishes causing significant losses, predators can kill or wound fish (primary infection), then secondary infection like bacterial, viral and fungal infection starts then cause stress to the fish that results in reductions in appetite that in turn causes poor growth and reduced resistance to disease. This in turn causes poor production and profitability. Records shown that *Peligans* are the highest predatory fishes, 15kg/month is consumed by this bird. *Cormorants, Terns* are the lowest predatory fishes, 1.5kg/month consumed by this fishes. Not only that damage equipment and nets, resulting in escape of fishes through damage. Due to predation on fishes by the predatory birds so much economic loss, so it is significantly need the prevention and control of predatory birds in aqua field.

INTRODUCTION

There are over 200 species of birds identified all over the world. Majority of all birds better suited to stay in marsh or estuary. Open water and concentration of culture aquatic animals attract predatory birds. Several bird species have been identified as "problem species" on aquaculture farms. Predatory birds are highly mobile, efficient and adaptable pray on aquatic cultivable fishes, also cause injury to the fishes (leading to secondary disease), spread diseases. Common types of predatory birds includes Double-crested Cormorant *(Phalacrocoraxauritus)*, American White Pelican *(Pelecanuserythrorhynchos)*, Hooded Merganser *(Lophodytescuculatus)*, Great Blue Heron *(Ardeaherodias)*, Great Egret *(Casmerodiusalbus)*, Snowy Egret *(Egrettathula)*, Tricolored Heron *(Egretta tricolor)*, Green-backed Heron *(Butoridesstriatus)*, Black-crowned Night Heron *(Nycticoraxnycticorax)*, Yellow-crowned Night Heron *(Nycticoraxviolaceus)*, White Ibis *(Eudocimusalbus)*, Belted Kingfisher *(Cerylealcyon)*, Osprey *(Pandionhaliaetus)*, and various species of gulls and terns (Stickley, 1990). Not only the damage, primary infection, secondary infection of fishes and it can cause the damage equipment and nets, resulting in escape of fishes through damage. Due to predation on fishes by the predatory birds so much economic loss, which have led to the development of several strategies to reduce predation (Draulans, 1987; Littauer, 1990; Cezily, 1992; Littauer*et al.*, 1997). So it is significantly need the prevention and control of predatory birds in aqua field.

Loss of fishes due to predation of birds

Bird predation can have a significant economic impact on aquaculture operations. Birds may also negatively affect aquaculture production by transmitting or transporting diseases, weed seeds, and parasites from pond to pond or from one facility to another. Due to predation on fishes by the predatory birds so much economic loss, graphical presentation of fish consumption by birds in Kg/month is shown in the following graph (Fig.1). *Peligans* are the highest predatory fishes; 15kg/month is consumed by this bird. *Cormorants, Terns* are the lowest predatory fishes, 1.5kg/month consumed by this fishes.

Common Ichthyophagus birds

Common classification of Ichthyophagus birds

1. Those that dive from air and catch fish with bill: Examples are kingfishers; terns and pelicans are rarely in small ponds,
2. Those that dive from air and catch fish with feet: Examples are eagles and ospreys are rarely in small ponds,
3. Those that dive from water surface: Examples are cormorants, mergansers, various fish-eating ducks; rarely in small ponds,
4. Those that wade in pond; or catch fish from edge of pond and floating plants, etc: Examples are herons (includes egrets).

Cormorants

Worldwide there are more than 30 species are present. In North America the double-crested cormorants is the most problematic predators. Cormorants have long, flexible neck and a straight hook tipped beak (Fig.2). Do not have water repellent feathers. Normally solitary feeders. Breeding colonies are primarily located in specific coastal areas. It consumes between 0.25kg and 0.5 kg fish per day.

Anhingas

It is also called snake birds or water turkeys (Fig.3). Do not have water repellent feathers. Have straight bill not hooked one. Consume about 0.23 kg fish per day.

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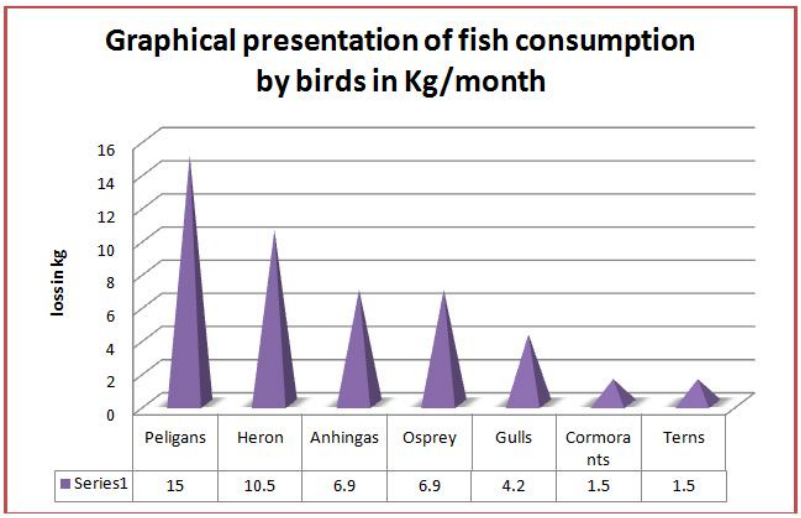
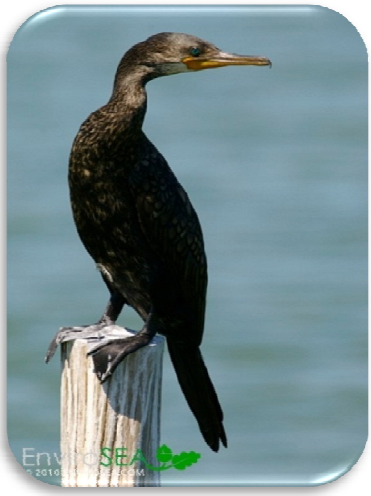


Fig.1. Graphical presentation of fish consumption by birds in kg/month



Phalacrocoraxcarbo

Anhinga anhinga

***Phalacrocoraxfuscicollis* (Fig.2)**

***Anhinga melanogaster* (Fig.3)**

Pelicans

Capture fish near the surface with their scoop like pouch (Fig.4).Out of seven species the white pelican is predominant. This bird capture their prey while swimming. They drive fish into the shallow where the birds encircle them and capture them in their pouches. White pelicans are among the largest birds in the world. They consume approximately 0.5 kg of fish per day. Brown pelicans are typically only ion marine habitats. White pelicans inhabit both marine and fresh water environment.

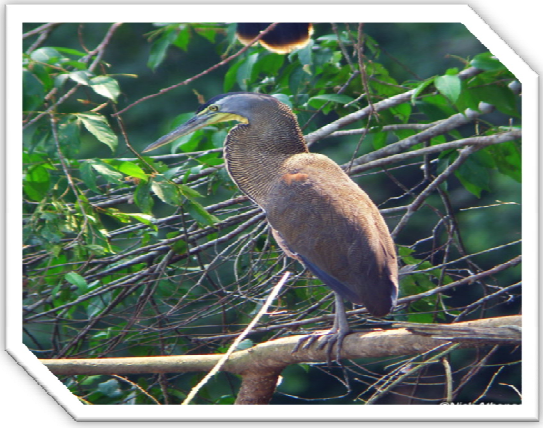
Pelecanuscrispus

***Pelecanusonocrotalus* (Fig.4)**

Herons, Egrests, Ibies and Stroks

These are prey on some extent of fish and shell fish. Members of this order are long necked and relatively long legged. They stalk their prey often by wadding through shallow water then striking with a rapid thrust of the bill. Large herons and egrets (great blue herons and great egret) consume between 0.14-0.35 kg of fish per day. Peak feeding at dusk or at night (April and August month).Ibises are common predators of crustaceans such as Cray fish. Strokes tend to prey on invertebrates and sick or weakened fish.

Ex. Tigrisomamexicanum (Fig.5)
Botaurusstellaris (Fig.6)



***Ex. Tigrisomamexicanum* (Fig.5)**

***Botaurusstellaris* (Fig.6)**

Kingfishers

They are small birds that are territorial and solitary, day time hunters. Plunge dive to catch their prey. Worldwide there are more than 80 species of kingfisher. They are problematic around ornamental and tropical farm.They consume from 0.02 -0.07 kg of fish per day.
Families: Alcedinidae, Halcyonidae, Cerylidae C:\Users\HOME\ AppData\Local\wiki\River_kingfisher

Ex: Oriental Dwarf Kingfisher (Fig.7), Green Kingfisher (Fig.8), Pied Kingfisher, White-throated Kingfisher,

Oriental dwarf king fisher (Fig.7)

Green kingfisher (Fig.8)

Gulls and Terns

Worldwide there are more than 80 species of gulls and terns. Gulls have hooked beaks while terns have strongly and pointed. Terns are solitary day time hunters, dive headfirst into the water to capture prey. Gulls also capture prey while swimming and can scoop prey from the water without plugging. Gulls usually feed in flocks, scavenge readily and consume aquaculture feed off the surface of ponds and raceways. Gulls consume between 0.07and 0.14 kg per day while terns consume only about 0.05 kg per day.

Family: Laridae, Genera: Larus, Xema, Pagophila, Rissa
Ex: *Larusheermanni* Common Gull, *Laruslivens* Glaucous Gull, *Larusglaucescens* Western Gull, *Larusmarinus* Kelp Gull (Fig.9), *Laruscanus* (Fig.10)

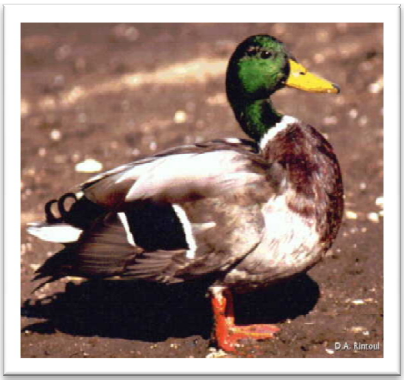
Larusmarinus **(Fig.9)**

Laruscanus **(Fig.10)**

Ducks

They prey o fish and shellfish. Loons, grebes, mergansers and other diving ducks capture prey by diving and swimming underwater. Many diving ducks feed extensively on mollusks and cause heavy losses in cultured sp of oyster, clams and mussels. Mergansers prey on small fish and crustaceans and can became problematic for farms if in large flocks

Family: Sternidae
Example: *Sterna aurantia*
Duck is the common name for a number of species in the *Anasplatyrhynchos.* (Fig.11)

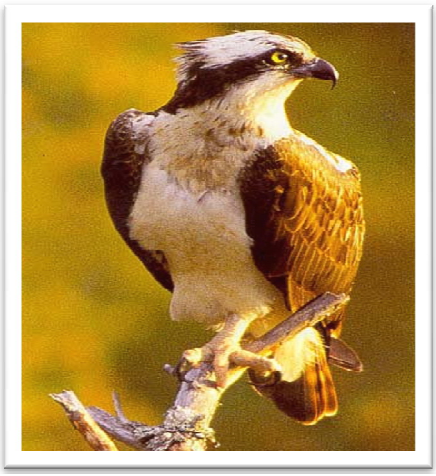


Anasplatyrhynchos **(Fig.11)**

Hawk, Osprey and Eagle

- ✓ They are solitary hunters.
- ✓ They are not major concern for fish farms but have been known to cause problems by preying upon brood fish.

Order: Accipitriformes, Family: Accipitridae
The Accipitridae: The family which includes the “trure hawks” (Accipiters) as well as eagles,kites, harriers and buzzards.
For ex: The “osprey” or fish hawk (Fig.12), red tail hawks (Fig.13)



Osprey (Fig.12)

Red tail hawk (Fig.13)

Other predatory birds (Fig.14)

Some miscellaneous facts

The heron is an important intermediate host in the lifecycle of the cestode *Diphyllobothrium*sp, a parasite prevalent of cage trout farms. Otters are final hosts for the digenean Haplorchissp a common parasite of Tilapia. Birds are also act as a vectors of pathogenic bacteria and virus. So birds are transfer the harmful diseases to fishes one to another.

Prevention and control methods

Several methods of deterrence and exclusion have been proposed. At its simplest level, the presence of dogs or scarecrows can deter predators and scavengers. In Israel, concerted efforts have been made to deter cormorants from visiting ponds, principally through use of scaring tactics such as scare cannons, sirens and shooting (Sly and Frankenberg, 1995). However, while causing an effective decline in numbers, the harassment techniques have impaired breeding of the protected pygmy cormorant *P. pygmaeus* (Be'er, 1995). According to Curtis *et al*, 1996, has given overview of techniques for reducing bird predation at aquaculture Facilities. Method to discourage or prevent bird depredation have included completely enclosing the facilities, perimeter fencing, overhead wires and lines, automatic cannons or exploders, pyrotechniques, scarecrow, alarm or distress calls, water sprays, lights ultra light radio-controlled, model aircraft. Complete enclosure is the only method to entirely prevent birds depredation but is usually limited to raceways and ponds smaller than 5 ac (2ha).Birds are quickly or habituate to scary devices. So, these devices must be moved every few days and if possible, set so that they go off at random intervals and varying intensities.

Solutions or techniques for reducing bird damage

Barriers

All physical barriers should be visible to birds to maximize the effectiveness of the barrier and to minimize the potential for accidental injury or entrapment. Two types of physical barriers can be used for controlling bird predation at aquaculture facilities;

(1) Complete enclosures: Which totally exclude predators from gaining access to cultured stocks, Complete enclosures are extremely effective against all birds but are more expensive than partial exclosure systems.
(2) Partially-covered systems: Which interfere with predators' feeding behavior.

Total exclusion

Total exclusion techniques is the only completely effective method for eliminating bird predation at aquaculture facilities. Total exclusion is the complete enclosure of fish tanks, raceways, and/or ponds with screen, cage or net. Total exclusion is impractical for most large ponds due to the difficulties of spanning large distances. Other problems associated with exclosures are that they may negatively affect aesthetics of the site, hinder other management operations, and have a high initial cost. Due to the long-term benefits that total exclusion can provide, however, this method may be cost-effective for some facilities. So better go for partial exclusion.

Partial exclusion

If total exclusion is not used or is not feasible at a facility, then the goal of damage control should be to reduce losses to an acceptable level while incurring the lowest possible cost. Facilities managers should recognize that some loss is unavoidable, even with the best predation management strategy.

Overhead lines and wires

Overhead line/wire systems are most effective against flying predators such as terns, gulls, cormorants, and ospreys, rather than against wading birds. Sides and ends should be protected as birds may attempt to enter the area by these routes. Raceways and ponds can be covered with heavy-gauge monofilament lines or high-tensile galvanized or stainless steel wires suspended horizontally in a grid pattern or in one direction over the water's surface. Overhead line/wire systems, like total exclusion systems, are impractical for large ponds due to the difficulties of spanning large distances. Another problem is that birds may learn to avoid the overhead lines/wires. Aside from replacing an occasional broken wire and maintaining adequate wire tension, overhead line/wire systems typically require little maintenance. Sides and ends should be protected as birds may attempt to enter the area by these routes (Fig.15).

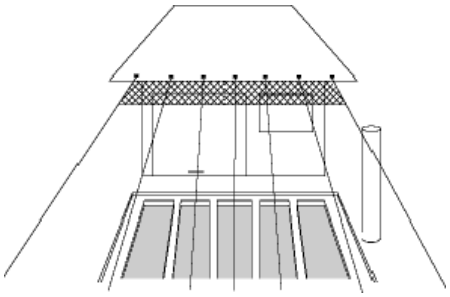


Fig.15. Netting where wires attach to building prevents birds from walking down the roof and jumping through the wires into the facility

Perimeter fencing and wires

Wires or perimeter fencing around ponds or raceways can provide some protection from wading birds, although birds may eventually learn to avoid these obstacles. These systems are largely ineffective against flying predators. For ponds, fencing that is at least 3 feet high should be constructed in water that is 2-3 feet deep. Small fish may be prevented from entering the shallow water by constructing the fence with a small mesh material, although this may require the removal of algae buildup from time to time. Construction of inward-angled or vertical barriers, typically made of plastic netting, chicken wire, or monofilament lines, around raceways or ponds may prevent predators from foraging from the edge of a holding structure or from entering raceways and ponds from the side. In general, wading birds prefer to land on solid ground before wading into the edge of ponds. Fences should be high enough to prohibit feeding from the wall.

Electric wires and fencing

Use of electric fences has had varying levels of success largely depending on the design of the culture facility and the type of bird species involved. In this method, electric wire/fencing of the type

specifically designed for agricultural fencing applications is placed around the perimeter of ponds and/or raceways. This method is more effective than unelectrified wires or fencing as birds cannot push against the wires/fence. In another application, electric wires may be strung on supports that suspend them over the water's edge near the natural shelf that often forms in shallow areas of the pond margin. This system discourages wading birds from feeding on fish while walking along the shelf; however, if pond bottoms slope too gradually from the bank, wading birds may still be able to fish on the water side of the fence. Great care must be taken when installing and using electric fencing to ensure its safe operation. Operators should be knowledgable about electric fencing or should get qualified, professional help prior to installing this type of system. Electric fences should only be charged with commercial electric fence charges that send brief pulses of electricity through the fence. Charges must be nonlethal to humans and birds. Like perimeter fencing and wires, this technique is most effective against wading birds. Also like perimeter fencing/wires, birds may learn to avoid these obstacles. This system is ineffective against gulls, terns, cormorants, and pelicans that typically fish in the central part of the pond. Other problems include maintenance and preventing the system from becoming grounded, commonly caused by blowing debris and interference from vegetation. A combination of electrified or unelectrified perimeter fencing or wires combined with overhead lines/wires may be successful at deterring both wading and flying predators.

Fig.16

Frightening methods

Frightening techniques rely on sight and sound stimuli to discourage birds from remaining at a site by making the birds believe the site is dangerous for them. A wide range of fear-provoking devices are commercially available for scaring bird predators. The success of a frightening program may vary depending on a range of factors, including the bird species involved, how long the birds have been at the site, the type(s) of technique(s) used, the duration and frequency of their use, the location of the site relative to roosting and loafing sites, and the proximity of alternative food sources.

Noice

Distress calls: *Recorded bird alarm or distress calls may be of some use in frightening birds away from an area.* Reactions of birds to recordings of species-specific distress calls depend on the species, the time of year and day, size of the area, location, and distance of the birds from the broadcasting equipment.

Pyrotechnique devices

- Cracker shells
- Whistle bombs, screamer rockets, Bangers
- Rope firecrackers: Rope firecrackers are relatively inexpensive tools that are useful in frightening birds. Fig.17

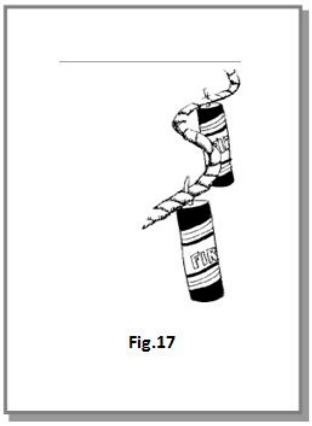


Fig.17

Live ammunition or blanks

Automatic exploder: Propane gas or acetylene gas is used to operate a small cannon that is equipped with an electronic timing mechanism (Fig.16)

Electronic noise makers (Fig.18)

Fig.18

Visual scar devices:

Lights

A variety of light-emitting devices can be used to confuse, frighten, temporarily blind, and interfere with the activities of night-feeding bird predators such as great blue herons and night herons. Typically, only short-term success is achieved with light devices as the majority of birds quickly become accustomed to them. A number of the more commonly-used devices are described below.

Construction of flashers: Flashing, amber-colored construction lights are placed at intervals around raceways and ponds to deter approaching predators.

Area lights: Bright lights, such as street lights or flood lights, are placed in specified areas. The use of motion-detecting mechanisms improves the effectiveness of these techniques.

Revolving beacons: These devices project a very bright, revolving beam of light.

Store lights: A high-i ntensity intermittent light is emitted from these devices.

Bird scaring device: predators quickly habituate to these scary images and their effective ness is short lived unless used in conjugation with other deferent method.

Scarecrows, effigies, predator models

Models or silhouettes of humans and/or predators are placed in strategic locations at a facility. Dressing models in similar clothing to facility personnel or in hunter orange may improve performance. Pop-up versions and models with moving parts are available and are more effective than stationary units. The location of models should be changed frequently. The success of these methods may be increased with the addition of pyrotechnics fired within close proximity of the models.

Mirrors, reflectors, streamers

Objects with shiny surfaces, such as balloons, pie tins, pinwheels, and reflective ribbons ortape, are placed around a facility. Success with these methods typically is minimal and short-term.

Vehicles

A vehicle parked in a strategic location may be effective if birds are easily scared by a vehicle driven around the facility. The vehicle should be moved occasionally to reduce habituation. Occasional use of pyrotechnics and effigies near the vehicle may enhance effectiveness.

Radio controlled airplanes or boats

Radio-controlled scale models of airplanes and/or boats provide noise along with a visual stimulus. Planes appear to be most successful when used as birds attempt to land at a site. One plane operatorcan effectively cover a 200-300 acre area. The cost of using these methods tends to be high and their use is restricted by surrounding obstructions and weather conditions. Additionally, some birds may dive to avoid harassment and the devices run the risk of crashing.

Water spray devices

Rotating or stationary water sprinkler devices can be placed in or around raceways or ponds. Water spray devices provide both sight and sound stimulation. The water spray limits the visibility of fish in the water and may repel certain birds, especially herons and gulls. Increased water pressure and intermittent water spraying instead of continuous spray increase the effectiveness of this technique. Still, birds often become accustomed to the water spray and feed among the sprinklers.

Patrols or visltation

Patrols/visitation, on foot or in a vehicle, may frighten and disrupt birds. The effectiveness of this method may be enhanced by increasing the frequency of patrols/visitation and by broadcasting noises or using pyrotechnics at the same time as the patrols/visitation.

Dogs

The presence of a dog/dogs has been used to deter birds from landing at a site. This method has achieved varying levels of success.

Conclusion

The predatory birds are the most problematic predators around aquaculture facilities. First they cause physical damage; it can cause the secondary infection of the bacteria, virus and fungal diseases, most of the birds consume the cultivable fishes. The predatory birds can also cause damage to the nets and equipment's. So much economic loss due to consumption of cultivable fishes and as well as damage to the equipment's and nets. And the predatory birds act as a the vectors for transmission of diseases. Sometimes they can act as a transfer of foodborne diseases through raw fish. So significantly need require for the prevention and control of predatory birds in aqua fields for sustainable aquaculture. It may cause environmental problems and loss of birds species. They should be protected by either federal and state laws or international treaties. The lethal control of the birds are strictly avoided. Prevention is the better method to prevent the loss of cultivable fishes. Dogs are best for preventing the predatory birds in aqua field, so many farmers also following the same method.

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