Predator Control in Commercial Aquaculture in Canada

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Predatory problems . . . *with mammals, birds and invertebrates are encountered, to varying degrees, within the Canadian aquaculture industry. This factsheet reviews the principal predatory species affecting the Canadian aquaculture sector and describes some of the methods used to control them. The factsheet is written for a broad, general audience. Farmers and other individuals seeking more detailed information should review the references and internet links provided.*

Principal Predatory Species

The principal predators in coastal, marine finfish aquaculture are aquatic mammals (e.g. seals) and birds (e.g. herons), while those of inland, freshwater finfish aquaculture are primarily birds (Table 1). The saltwater culture of invertebrate species like shellfish, can be affected by several predators, including starfish, diving ducks and crabs (Table 1). Although hundreds of potentially predatory species of mammals, birds and invertebrates exist within coastal and inland water bodies, most of these animals are either rarely encountered, occur only for brief periods during their migration routes, or otherwise have limited direct contact with aquaculture facilities. Generally, there are only a small number of species that represent a significant threat to farmed aquatic livestock or the facilities in which they are held.

Type and Extent of Damage Inflicted by Predatory Species

Predators may cause damage to livestock or farm facilities either directly, indirectly or both. Direct damage results when the fish or other cultured organism is killed or seriously maimed by the predator and is therefore lost from production. Indirect damage is highly variable, and includes: non-lethal wounding of fish; chronic stress with a consequent reduction in feeding efficiency or health; transfer of harmful disease-causing organisms, including bacteria, viruses and parasites; and sometimes even physical damage to the animal enclosure system leading to escapement.

Often, the indirect damage caused by a predator can result in a greater economic loss than that caused by direct damage. For example, a seal which tears a hole a netcage and eats a few fish is a small loss compared to the pending escape of potentially large numbers of the remaining fish. In addition, the loss of "disease-free" status of a farm because of transfer of an exotic pathogen by predatory bird for example, can far exceed the value of any fish consumed by this same predator! So, the total extent of damage to an aquaculture stock by predators can be highly varied and extremely costly depending on many factors.

Some predatory animals have a high capacity for causing damage which may cause significant economic losses for the farmer. In New Brunswick for example, impacts by seals have been estimated to exceed several million dollars per year. On the other hand, many predators are rare, or have a low potential for causing either direct or indirect damage, and thus are unlikely to cause substantial economic loss. Detailed knowledge of the negative effects of any given predator at aquacultural sites requires an assessment of the predators' population biology, feeding behaviour, aggressiveness, migratory movements and the likelihood of effective control measures existing to control damages. Estimating the 'true' impacts resulting from predation is sometimes difficult. Nevertheless, some predators are known to cause serious impacts in the aquaculture industry and a relative ranking of the hazard potential for a variety of predatory species is given in Table 1. Some bird species represent a unique hazard to aquaculture because of the potential for this predator to travel vast distances between farms. This may result in the spread of certain disease-causing organisms between farms that are otherwise geographically isolated from one another, or from wild animals to the farm stock. An additional concern to shellfish farmers is the potential for increases in bacterial (faecal) coliform contamination that may result from the presence of large numbers of waterfowl (both predatory and non-predatory) near shellfish beds. The end result is that the shellfish may become unsuitable for human consumption or sale.

Herons are common predators at fish farms.

Means of Controlling Predation

Although in many cases, farmers have a legal right to protect their livestock from predatory wildlife, there are certain limitations to the types of methods employed to achieve this protection. Before any control method is considered, aquaculture producers should first determine, 1) whether predatory control is economically justified, and 2) if federal or provincial laws protect the predatory species in any way. Most wild mammals and all wild bird species are protected to some extent by either federal of provincial legislation. Some predatory species can be hunted pending issuance of appropriate licenses or permits. The Migratory Birds Convention Act and the Canadian Wildlife Act enables Environment Canada to protect wildlife though a variety of regulatory mechanisms. The Canadian Wildlife Service regulates the availability the permits necessary to control most predatory birds.

There are three main approaches to controlling predation at aquaculture sites and a summary of these techniques is given in Table 2.

1. Exclusion and Barrier Techniques

The separation of the cultured animal from its potential predators is the most effective solution for controlling the impacts of predation. Several techniques exist for relatively secure containment of aquatic livestock in farming systems that use cages, raceways and tanks. These containment methods include the use of separate nets, covers, building enclosures and other types of 'barriers', which can

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Circular trout tanks with overhead shade-cloth to protect from sun and predators.

Table 1. Principal Predators Affecting Commercial Aquaculture in Canada

Predator Type	Common Name of Predator Species [2]	Relative Impact [3]
Birds [1]	Black-crowned night heron	High
	Double-crested cormorant	High
	Great blue heron	High
	Green heron	Moderate
	American coot and common moorehen	Low
	Belted kingfisher	Low
	Bitterns	Low
	Common gallinule	Low
	Common grackle	Low
	Common loon	Low
	Eagles	Low
	Grebes	Low
	Gulls and terns	Low
	Mergansers & other diving ducks	Low
	Osprey (fish hawk)	Low
	Sandhill crane	Low
Mammals [1]	Seal	High
	Mink	Moderate
	Otter	Moderate
	Sea Lion	Moderate
	Bears	Low
	Muskrat	Low
	Raccoon	Low
Fish	Black drum	Low
	Piscivorous fish (e.g. Northern pike)	Low
	Sharks (e.g. dogfish)	Low
Others	Crabs	Moderate
	Crayfish	Low
	Starfish	Low
	Turtles	Low

Note:

1 All birds and most mammals are protected by either federal or provincial laws.

2 Species may be categorized as either endangered, threatened or of special concern by the Committee on the Status of Endangered Wildlife in Canada. Details are given at: http://www.speciesatrisk.gc.ca/Species/English/Default.cfm

3 All predatory species listed prey upon fish, except for black drum, starfish, crabs and some diving ducks which prey upon shellfish.

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Salmon cage with bird-netting enclosure.

range in cost from relatively inexpensive to prohibitive, depending on the size of the enclosure required. Marine cage-culture farms often utilize perimeter nets, shark guards installed at the pen bottom, and nets stretched over the tops of the pens to prevent access to water and aerial predators. These predator nets provide both physical protection as well as a visible deterrent.

2. Deterrents

A variety of so-called 'deterrent' methods can be used to discourage predators from attacking their prey. These usually involve some form of auditory, visual or physical noxious stimuli, such as scarecrows and models of other natural predators, or by the use of guard dogs, birds of prey (e.g. falcons), noise emitting devices and even systems to spray water to scare away undesirable species.

Generally, farmers can expect deterrents to reduce but not eliminate predation. For a deterrent program to be effective over the long-term, several methods need to be used in combination. Frequently, predators will habituate to most deterrents and eventually recognize them as non-threatening stimuli. For example, pre-cast models of owls, eagles, alligators and killer whales have been used on farms to scare away certain bird and mammalian predators, but they quickly learn that these are not real and will ignore them.

In some situations like the pond culture of fish, it is possible to reduce easy access and feeding opportunities of a predator. This may involve redesigning the culture system by creating steeper banks and having deeper shoreline water which reduces the effectiveness of wading birds, or by limiting the availability of protective habitat for the predator to hide in.

3. Removal of Predator by Transfer or Destruction

If benign, non-lethal techniques fail, the final recourse is to remove the predator from the farm. Removal methods, when feasible, include live trapping and relocation to other suitable sites. In extreme circumstances, and usually only after other non-lethal methods of control have been exhausted, it is sometimes necessary to kill a nuisance predator, especially those which represent a high impact risk to the farmer. Wherever possible, this is accomplished using the quickest, safest and most humane method available. This is a control strategy of last resort, and not one encouraged within the aquaculture industry. Firearms may be used, and require that, 1) staff are appropriately trained and licensed 2) only appropriate firearms for humane dispatch of the predator are used 3) only predators that are actively attacking cultured animals are shot, and 4) predator kills are recorded and reported to the appropriate governing body where necessary. Strict control measures are in place to ensure that other animals and people are not placed at risk.

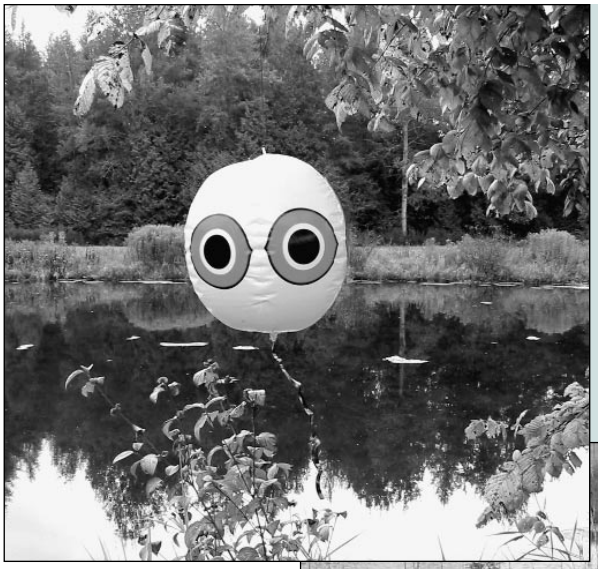
Table 2. Methods of Predator Control in Aquaculture

Control Method	Examples	Predator Type
Exclusion and Barrier	Perimeter nets surrounding cages & ponds	Birds, Mammals, Fish
	Overhead wires	Birds
	Reduced net mesh size	Birds, Mammals, Fish
	Enclosed buildings	Birds, Mammals, Fish
Deterrents	Acoustic deterrent devices (automatic exploders, emission of specific frequency sounds)	Birds, Mammals
	Lights	Birds
	Alarm, distress calls	Birds, Mammals
	Pyrotechnic dispersal devices	Birds
	Water spray devices	Birds
	Scarecrows, reflectors, silhouettes	Birds
	Human activity	Birds, Mammals
	Trained dogs	Birds, Mammals
	Culture system design: e.g. steep banks, increased water depth, remove possible perches	Birds
Removal	Trapping and relocation	Birds, Mammals, Fish
	Killing of predators	Birds, Mammals, Fish

Ethics of Predator Management

Aquaculturists are in the business of raising livestock, and accordingly, they have a high awareness and regard for the value of animal life. In general, farmers have a legal right to protect their livestock and other property from predation. While the legal right to destroy a predator may exist, most farmers adhere to established ethical standards, respecting the value of all animal life. Most fish farmers try to use preventative methods, such as net covers or other barriers, to reduce predation impacts.

In summary, predator control is a management precaution necessary to ensure the health and safety of captive livestock and to protect the economic interests of the farmer. Not unexpectedly, there are emerging ethical issues surrounding the appropriateness and humaneness of some of the control methods currently employed. Society must constantly weigh the benefits of predator management to farmers and the animals in their care, against the potential negative impacts to those wild animals which may be affected. In this context, the aquaculture industry enthusiastically supports innovations in non-traumatic predator control technologies, and utilizes strategies which prevent interactions between predators and farm stocks wherever possible.



Bird-scaring devices. Predators quickly habituate to these 'scary' images and their effectiveness is short-lived unless used in conjunction with other deterrent methods.

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