Prevention research proposal sample

Environment, Water

Invasion of exotic Channa argus in USA and its

1. Introduction

Exotic species are referred to the species of living organisms when discovered in an alien habitat. These exotic species when harms the ecological balance in their introduced habitat, then they are called invasive species. Channa argus commonly known as northern snakehead are native of China, Korea and Russia (Courtenay and Williams 143). In United States, it was first discovered by a fisherman in a pond in Crofton, Maryland in the year 2002 (Fields 1). It is considered highly invasive due to its harmful impacts on the aquatic ecosystem in the United States. Firstly, these fishes are voracious creatures feeding on smaller fishes, frogs, small aquatic insects, small reptiles and also aquatic fauna when they are young. In short, they eat anything that is caught in between their teeth. Thus they compete with other large predator fishes resulting in the depleting numbers of the desired fishes. It creates a negative influence on the food chains, hence, destroying the balance of ecosystem. They can survive in low oxygenated areas also, thus making them more skilful in adaption in comparison to the fishes like Pike and Bass that are in need of more oxygen as mentioned in the article Channa argus (fish) by Global Invasive Species Database. Channa argus or northern snakeheads grow very large in size and have high survival ability. It has been found that they can stay alive outside water for nearly four days in cold temperature. So, eradicating them from the aquatic world of United States is proving to be difficult. Another injurious effect of this fish is that it carries different kinds of parasites that harm other fishes like crucian carp, salmonids, etc. as mentioned in Channa argus (fish) by Global

Invasive Species Database. All these facts when considered together Channa argus steps out as an extremely invasive species.

The Channa argus was found in lower Potomac River in 2004 and after that incident, many snakeheads have been found in ponds of FDR Park, Philadelphia, and Flushing, Queens, in New York, etc. as listed in Northern Snakehead in fishwild. vt. edu. Recent studies have shown that snakeheads has adapted itself in California, Hawaii, Florida, Maine, Maryland, Massachusetts, Rhode Island and Lake Michigan, Chicago as illustrated in the article Injurious Wildlife Species; Snakeheads from Environmental Protection Agency. In order to stop this invasive fish from permanently establishing itself in the introduced water bodies, various equipment and schemes have been launched. Promotion of hunting snakehead fish in Potomac River, or in some places like Ontario, complete ban of live possession or sale of this fish as can be referred in Northern Snakehead in Ontario’s Invading Species Awareness Program are some of the measures taken to check its growth rate. Electrofishing and netting may help in removing a few of these invasive fishes but cannot eliminate their existence completely. The most effective method that has been introduced is the usage of rotenone, an effective piscicide which is found in many plants of bean family like Jicama vine plant available in North America as cited from article Yam Bean or Jicama- A tasty and versatile Permaculture Crop by Lachy. This rotenone is mixed with other chemicals to produce piscicides like CFT Legumine or Nusyn Noxfish (Ott 6). Generally, CFT Legumine is used to eradicate Channa argus completely from a water body. But, this piscicide is toxic to other aquatic habitants as well. Rotenone stops the conversion of NADH to ATP and thus cellular oxygen

depletes resulting in mortality (Hayes 144). And an air breather fish like Channa argus can escape the situation if this treatment is done in open environment like Potomac River. Hence, the result will be that the targeted fish survived but non- targeted ones were killed. So, I propose the increase of salinity in water can eliminate this invasive fish from American water.

2. Significance

Rotenone which is established as the only means to diminish the growth of this fish, is very expensive and toxic to other organisms. Therefore, usage of rotenone becomes very complicated. Firstly, this is effective only in closed water body like pond and secondly, there has to be provision to transfer the desired fishes in other place otherwise, most of the fishes will die. Now, instead of rotenone, if simple salt or sodium chloride (NaCl) is used all these drawbacks will be eliminated and it is not a toxic element. The fact is that Channa argus is a fresh water fish and it cannot tolerate salinity as can be referred in All about Snakeheads by Dr. Andrew Lazur in washingtonpost. com. So using salt if salinity of water is increased, then it will result in the death of Channa argus. However, if this is to perform in an open water body, then first the river has to be sectioned and by part the area has to be treated.

Common salt is very cheap and so it will also reduce all the expenses behind the removal of this invasive species. And the water body will remain free of any toxic chemicals. The salinity of open water body will flush automatically so it will not be a problem. Hence, it can be regarded as the safe, cheap and effective means to eliminate this invasive species. If this method can be successfully implemented in a river, then this will help the ecosystem to a

great extent. The mass killing of all the aquatic organisms in order to eradicate only one targeted invasive species can be stopped. From many years, an alternative to rotenone that will be less expensive and less toxic to other organisms is being ferreted. And this may turn to be that alternative. This is effective in closed water body but its proper implementation in the open water surface needs to be tested. Although one notable point is that the impact of the salinity of water on Channa argus depends on the temperature also.

3. Hypothesis

Northern Snakeheads or Channa argus is a fresh water fish, hence it cannot tolerate salinity in water. My aim is to show that this invasive creature can be removed by adding common salt in water instead of using any toxic piscicide or any other complicated method. Rotenone is most commonly used piscicide. In comparison to rotenone, the availability of common salt is more and toxicity is negligible. Hence, only the targeted species can be destroyed while ensuring the safety of the rest species. In this method, the temperature plays an important role. At lower temperatures, approximately below 20 C, this fish develops a resistant against salinity in water. Along with that the amount of salinity in water will also influence on the time required for the death of this fish. This fish has very efficient survival tactics and always appears immune to most of the adverse conditions. May be this is one of the reasons that it was able to grow and reproduce in a different habitat also despite all the challenges. These fishes remain a little bit sensitive during the breeding period and that time may be the perfect time to implement this hypothesis into action. The salt content in different water

bodies varies and according to the percentage of salt in water, the type of water is determined. A list of the percentage of salt in varieties of water bodies is displayed below in the table.

This table has been taken from Fresh Water in Wikipedia. com. As can be seen from this table in fresh water the content of salt is less than . 05% which is approximately less than 500ppm of dissolved salts in water. By increasing the salinity of water, the response of the Channa argus can be cited and also the time required to end its life using common salt can also be noted.

4. Proposed Method

In order to execute this hypothesis in reality, this experiment must be first conducted in a closed water system may be a tank. The tank is filled with freshwater whose salinity is less than 0. 05%. In this tank, healthy Channa argus is released. The physical condition of this fish is recorded while this fish is left in water. In this tank water, salt is mixed in a fixed quantity. And this quantity is increased after checking the response in earlier concentration of salt. The temperature is also kept above 20 C. Because this fish grows its resistivity against salinity in lower temperature. It can be noticed throughout the experiment that their condition worsens as the salinity in water increases and finally it leads to their death.

In this experiment the amount of salt is measured in parts per thousand (ppt.). This experiment is based on studies of Northern Snakehead Working Group (5). So the concentration of salt is increased in random way. At first, the condition of fish is noted in 0 ppt. i. e. without dissolving any salt in water. The fish appeared very healthy. Next an amount of 4 ppt is dissolved

in water and its influence on the fishes is noted. This amount of salinity does not seem to affect the fish. Next an amount of 7 ppt is added in water. This seems to affect the fish. Though this amount of salt in water did not prove to be lethal to life but it sickened the fish. Its motion slowed and it appeared a little slimy. Next the amount of salt is increased to 10 ppt and it is dissolved in water. This amount of salt proved to be fatal for this fish. And when the amount of salt is increased to 11 ppt, the salinity of water is not tolerated by the fish and its death occurred. This showed that around 10 ppt of salt in water can kill this invasive fish. When the amount of salt concentration in water is increased, the death of this fish occurs more quickly but again the temperature should not be cold. It must be above 20 C.

Hence, it can be estimated that when temperature is not cold then above or 10 ppt of dissolved salt in water is fatal to this fish species but the time taken by the fish to reach mortality is nearly 10-12 days.

Now, at temperatures less than 20 C, at 10 ppt of salt dissolved in water, it shows resistance. It goes on living without any reaction to the saline content in water. Then when the concentration of salt is kept on increasing, the resistance of fish crumbles and at last at 18 ppt, of salt dissolved in water, the demise of the fish occurs. Hence, it can be said that the lower tolerance rate is at 10 ppt of salt dissolved in water and higher tolerance occurs at the 18 ppt of salt dissolved in water. During the performance of this experiment, the amount of oxygen content also must be maintained at constant level. This must be kept in consideration during the whole process, otherwise this may act as an agent to influence with the result of the experiment. Since the water is placed in a tank, so the stagnant water may turn dirty after some

time. An eye must be kept on that also. The water must be changed from time to time and salinity level must be maintained also. In order to complete the whole observation, it may take up to 2 months' time. The time will be required to slowly increase the concentration of salt in water and also to record the response of the fish to the increasing salinity in water. This Channa argus cannot tolerate salinity up to 18 ppt. and it eventually dies. The above mentioned experiment only determines the tolerance limit of the invasive fish and also shows that salinity is fatal to its life. But, by increasing the content of salt in water, the durability of this fish against salinity will be lowered and its required time to mortality can be lowered. And thus it may be implemented in practical use to eradicate this species from vast water sources without killing the valuable species residing in aquatic world. If all the factors are kept in consideration and the constancy in the created environment is maintained, then the expected result will be derived. Hence, this experiment shows that using common salt a population of Channa argus can be treated to disappear.

5. Expected Study Outcome

This experiment quite evidently shows the impact of salinity on this species. It also describes the amount of salinity that proved to be destructive for this species. This process can be applied in a pond and after the demise of Channa argus, the salinity of water can be treated using reverse osmosis method. In case of large water bodies, the water will have to be treated in sections.

There is also a possibility that the increase in salinity in water may affect other aquatic organisms of freshwater, but many fresh water species can

tolerate a certain amount of salinity in water. Hence, before this treatment, a complete survey must be done on the types of species available and also their tolerance to salinity. Using this method, other living creatures which are non-targeted ones can be saved from the effects of piscicide.

Ultimately, the conclusion is that Channa argus is an invasive species which has high adapting skills and is comfortably establishing itself in US waters. But, in order to be rid of this species, it is not wise to destroy the complete aquatic fauna and other alive species of the water. Hence, this treatment when can be implemented in large water bodies, it will serve the purpose without any damage. It will be best if this treatment is done during summer season when the climate is warm, i. e. the temperature is high and the resistance of this fish to salinity is less. The urgent requirement to abolish this species from the aquatic world is to save the ecosystem and using an expensive piscicide to kill most of the fishes cannot be termed as a way of protecting the ecosystem. Hence, a method which is inexpensive as well as not toxic must be implemented.

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