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Prevalence of Columnaris, ecto-parasite and fungal conditions in selected fish farms

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ABSTRACT

The study investigated prevalence of columnare disease, fungal infections, ecto-parasites and underlying factors in ten (two intensive and eight low production) fish farms for six months. A questionnaire was used capture data on farm infrastructure, feeding practices, health and disease control measures, sensitization and level of awareness in aspects of fish health. Fish were examined for ecto-parasites using a hand lens and light microscope followed by collection of swabs on lesions for culture. The mean water temperature; dissolved carbon dioxide and oxygen were: 23.6^{0}C 0.132; 42 ppm 2.91 and 3.4 ppm 0.145, respectively. *Flavobacterium. columnare* and fungal infections was prevalent in 35% and 25% of the samples cultured from lesions, respectively. The ecto-parasites seen were *Gryodactylus spp, Dactylogrus spp*, Trichodina spp and leeches. Diseases were more on intensive farms as the water sources had relative low or no oxygen and high stocking densities. It was recommended that farms using ground water aerate the water in the tank and avail prophylactic measures to control columnaris disease and ecto parasites on the farm.

Keywords: *Fish diseases, hatchery, stocking densities, Uganda*

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Introduction

Aquaculture is a fast growing food-producing sector and it has immensely contributed to economic development and food security worldwide (F.A.O, 2008). Africa's output remained stagnant over the last ten years, with declining availability per inhabitant and the consumption of fishery and aquaculture products from 8.8 kg per capita in 1990 to about 7.8 kg in 2001(F.A.O, 2008). In Uganda only 0.1% of the 25,000 metric tons exported world wide in 2003 was obtained from aquaculture (Nyombi, 2009) and this fetched US $ 70 million. Parasitic conditions and nutritional deficiencies in fish have largely been reported in the last three years and the common parasites reported include: *Dactylogarus, Gyrodactylus,* leeches and anchor worms ((Isyagi, 2006); (Akoll P; Konecny, 2006).

Fungal infections are common in fish and these include water moulds from the class Oomycetes

Although there are several water moulds that can affect fish, the most common and significant are the saprophytic water moulds *(Saprolegnia and Achyla), Saprolegna* are aquatic decomposers which grow as cottony masses on dead algae or fish, mainly in freshwater habitats (Brown, 1995 & Stevenson, 2002).

The majority of fish bacterial pathogens are short gram negative rods belonging to the families Enterobacteriaceae, Pseudomonadaceae and Vibrionaceae and these cause septicaemic and ulcerative disease conditions (Robert, 1989). Columnare is world wide in distribution and most species of fresh water and anadromous fish are susceptible. Under intensification practices on fish farms; the morbidity and mortality have reached 100% and 70% respectively (Post, 1984).

There is currently limited empirical data on fish health status in Uganda largely because the impact of fish production under aquaculture was insignificant as compared to capture fisheries. However, with the increase in levels of

intensification especially in hatcheries, economic impact of fish disease has become significant in aquaculture (Isyagi, 2006).

The overall objective of the study was to establish the prevalence of columnaris disease, ecto- parasite infestations and fungal conditions and associated risk factors in selected fish farms in eastern and central Uganda

Materials and methods

All the 10 fish farms covered by the FISH (Fish Investment for Sustainable Harvest) project located in the districts of Wakiso, Mpigi, Iganga, Jinja, Mukono were included in this study from March to August 2007. Retrospective and longitudinal studies were undertaken. The farms were disaggregated (according to production level as intensive (n=3) and those with low production (n= 7); and according to water supply system as those with a flow through (n= 9) and those with a re-circulated water system (n=1).

Ten semi structured questionnaires were administered to managers or the owners in all the farms. Questions were read to the manager or farm owner and his/her answers filled in by the researcher. The questionnaires captured data on background information on the farm, farm infrastructure, feeding practices, health and disease control measures, sensitization and level of awareness in aspects of fish health. The data from the questionnaires were coded, cleaned and descriptive statistics computed using SPSS version 17. In addition, to administration of the questionnaires, an 8-hour observation was done to record a daily activity schedule of each study farm.

Preliminary visits were made to the study fish farms (n=4) in order to establish the number and composition of the tanks and ponds. This was done in March and the researcher was tasked with documenting the stocking rate, ages, fish species, feeding regime, stocking density and management practices for each pond/ tank..

In each of the selected ponds, about 30 fish were targeted for physical examination for presence of ectoparasites and lesions basing on random sampling. the selected fish in each pond fish were visually examined by use of a hand lens for presence or absence of any skin lesions and ecto-parasites. Wet mounts from both lesions and scrapings (gill and skin) were put on microscopic slides and examined for presence of the bacteria, ectoparasites or hyphae. Where lesions occurred, swabs were taken from four to six fish (Brown, 1993) for culture *Flavobacterium columnare* and fungi. The swabs were kept in Stuart's transport media, in an ice box before being transported to the laboratory for culturing. Any ecto-parasites found were preserved in 10% formalin for further identification.

Flavobacterium columnare isolation was carried out according to (Roberts, 1989; Valerie, 1993.). Fungal isolation was achieved by inoculation on to Sabourauds agar (Oxoid, Basington, England).The medium was acidified to pH 3.5 by adding 1.0 ml of lactic acid 10% to each 100 mls of sterilized medium (Roberts ,1989). Skin and gill scrapings from the sampled fish were mounted on a slide in saline, and were examined under a microscope at ×10 for presence of ecto-parasites (Robert, 1989; (Brown, 1993)

In each of the study ponds and tanks, the following physico-chemical properties of water were measured for a total of six months: pH, dissolved oxygen, temperature, ammonia, nitrite, carbondioxide, and water hardness. A corning 313 pH/T^0C meter (YSI, USA) was used to measure the pH and the temperature of the water in the tanks and ponds; while the dissolved oxygen levels were measured using an oxygen meter. All the other parameters were measured using a viscolor water kit (Lamotte, USA) and this involved use of ingredients which were compared against standards all present in the water kit according to the manufacturer's instructions.

Results

Farm characteristics

Farm characteristics were as shown in Table 1 below.

Disease occurrence on study fish farms

Of the four farms chosen for the cross sectional study, two were classified as intensive production farms based on the stocking densities of fish (1kg of fish stocked per cubic litre of water) and the amount of fingerlings produced per month (above 100,000 fingerlings); and the other two had less stocking densities and production capacities than the above. The farms were also classified depending on the system of water flow (either as a flow through system or recirculated system). Disease conditions were found in both intensive and non-intensive systems.

Intensive production with aeration and a flow through water system

Columnare disease

Out of the 20 samples that were cultured in the laboratory, *F. columnare* was isolated in seven samples, giving a prevalence of 35% as shown in Table 2. All the seven samples that were positive for *F. columnare spp* were taken from fish in the hatcheries.

Fungal infections

Out of a total of 20 samples that were cultured, fungi were isolated in only five samples giving a prevalence of 25% Table 2.

Diseases detected and control measures in farms with different production systems

At the two farms with high intensive production with aeration and re-circulation system, two diseases were observed, which included gas bubble disease and columnaris disease as shown in Table 3.

Table 1: Farm characteristics

Parameters	Attribute	Frequency	%
Types of feeds used	floating feeds sinking feeds	2 8	18.2 72.7
Water sources on the farm	Ground/ spring water Stream/ river water Pipped water Lake water	4 3 1 1	44.4 33.3 11.1 11.1
Onset of farm (2000)	Before After	2 5	26.8 74.2
Nature of farm	H & G only H, G & B Cages G & B	1 5 2 1	11.1 55.6 22.2 11.1
Size (acres)	1 - 3 4 - 7 >8	4 1 3	50 12.5 37.5
No. of hatchery tanks	1 - 5 6 - 10 >10	1 2 3	16.7 33.3 50
No of grow out tanks	1 - 5 6 - 10 >10	3 4 1	37.5 50 12.5
No. of brood stock ponds	1 - 5 6 - 10	7 1	87.5 12.5

Table 2: Samples Taken For Lab Analysis on Farm

Date Of Collection	Section	Findings
18/6/2007	GT7	Columnare
22/6/2007	GT9	Fungal
24/6/2007	GT10	Columnare
25/6/2007	GT7	Columnare
7/7/2007	GT9	Columnare
8/7/2007	GT 1	Fungal
8/7/2007	GT8	Columnare
15/7/2007	GT8	Columnare
23/7/2007	GT 7	Fungal
25/7/2007	GT9	Fungal
10/8/2007	GT10	Fungal
11/6/2007	GT7	Columnare

Table 3: Fish disease conditions detected and control measures in farms with different production systems

Type of production system	Pond identification	Fish population	Disease condition	Preventive measures	Weekly Mortality rates
Intensive (recirculation)	A	15,000	Gas bubble	None	None
	E	20,000	None	None	None
	Green House	25,000	Columnaris disease	Salt & Oxytet in feeds	None
Low production (urban based)	N/A	N/A	Accumulated feed in tanks	None	0.67%
	N/A	N/A	Predators	None	0.01%
	N/A	N/A	Columnaris disease	None	0.53%
	N/A	N/A	Dactylogyrus spp	None	0.53%
	Holding tank	N/A	Trichodina	None	None
	Brood stock	N/A	Trichodina Gryodactylus spp Leeches	None	None
	Grow out		Trichodina	None	None
Low production (rural based)	Hatchery tanks	N/A	Anoxia (0-1.5ppm)	None	1.0%
	Hatchery tanks	N/A	Dropsy	None	None

Discussion

A narrow majority (55.6 %) of the farms studied had hatcheries, grow out and brood stock sections while the rest had one of the three. This impacted on the ability to produce fingerlings and stockers in large numbers. Due to absence of brood stock on 33.3% of the farms studied, the latter had to depend on other farms to supply disease free stock for their farms. This could lead to disease outbreaks on the recipient farms since F .columnare and Saprolegna are able to survive long spells in the environment of high water hardness and organic matter, ((Valerie, 1993.);(Brown, 1993); (Stevenson, 2002);)

Only 44.5 % of the farms studied used ground/ spring water as the primary water source and this was attributed to the fact that underground water had its own limitations such as little or no oxygen and a lot of carbon dioxide hence mitigation measures have to be put in place to combat the shortfalls in water quality. This is in agreement with earlier studies which observed that ground and spring waters are not saturated with oxygen but supersaturated with nitrogen and if acidic have high levels of carbon dioxide (Roberts, 1989). Intensive aeration may be necessary to add oxygen and remove nitrogen and carbon dioxide.

Most of the diseases were observed on intensive farms as compared to the low production farms and this was attributed to the fact that the water sources on the farms had relatively low or no oxygen hence the need for aeration and degassing; the high stocking densities on the farm easily lead to stress of the fry and fingerlings which in turn is the major cause of disease on the fish farms. Previous research showed that physiological stress and physical injury are the primary contributing factors of fish disease and mortality in aquaculture (Rottmann 1992). Many potential fish disease pathogens are continually present in the water, soil, or fish. In nature, fish are often resistant to these pathogens, and they are able to seek the best living conditions available and this explains why fish when stressed will begin showing clinical signs after three days (Rottmann 1992). Regardsless of the system of management, columnaris disease was observed on all the four farms studied due to stress arising from increased fish density and poor water quality (low dissolved oxygen, undesirable temperature or pH, increased levels of carbon dioxide, ammonia, nitrite, hydrogen sulfide, organic matter in the water) (). Other factors include: injury during handling during capture, sorting, transporting; inadequate nutrition; and poor sanitation. The most common stressors observed on the intensive farms studied were water shortage and high stocking densities, while on low production farms the major stressor was poor water quality (low levels of dissolved oxygen and anoxic conditions).

The common ectoparasites observed on the low production farms were Gryodactylus, Dactylogrus, Trichodina, leeches and none was found on the intensive farms. In the former, the parasites were found in the brood stock and grow out sections of the farm especially where happas are used and were only introduced into the hatcheries if the brood stocks were not dipped in a salt or potassium permanganate bath. In happas due to the high stocking density and the poor water quality, Trichodina and other ecto parasites will always be present and if there numbers are so vast then treatment will be sought and this was consistent with earlier studies which showed that heavily infested fish may have an increased production of cuticular material, frayed fins, skin ulcers and damaged gills ((Akoll P; Konecny, 2006); Roberts, 1989). The study revealed that the major predilection sites for the Trichodina were the gill and skin (Roberts, 1989) and this was the only parasite which was transported to the holding tank during conditioning of the fish before spawning.

Fungal diseases were only found in the intensive farm with flow through system and none in the low production or recirculation farms. This occurred concurrently with columnaris disease and this was mainly attributed to water shortage which usually stresses the fish. Work done by(doctor, 2007.), also found out that fungi are opportunistic parasites, able to take advantage of damaged or stressed fish. In addition, (Maria Laura 2007) and (Stevenson, 2002) established that Saprolegniasis is mainly a secondary infection seen after damage to the fish integument (skin and gills) caused by parasites, viruses, bacterial infections and other skin damage.

Conclusions

Of the fish farms studied, 45% used ground water as the source of water on the farms. The prevalence of Columnaris disease and fungal infection in the high intensive production farms with a flow-through system were 35% and 25% respectively. Ecto parasites were observed only on low production farm and the former were mainly found in the broodstock and grow-out sections of the farms.

Recommendations

All farms using ground and spring water as main water sources must have an efficient degassing mechanism and use aeration to improve on the water quality in the hatchery tanks. Future studies should be set up to categorise Flavobacterium columnare strains found in the hatchery. Prophylactic measures should be instituted to control columnaris disease and ecto parasites in the broodstock and growout sections of the farms.

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