

## HEALTH STATUS OF SALMONIDS IN RIVER SYSTEMS IN NATAL. I. COLLECTION OF FISH AND PARASITOLOGICAL EXAMINATION

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### ABSTRACT

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A detailed microbiological and parasitological survey of salmonids and indigenous fish in the upper reaches of selected river systems in Natal was undertaken. Fish were collected from the rivers by electro-fishing, from dams by gill netting and from hatcheries along the rivers. A total of 678 fish from 26 different sites along 8 river systems were collected. No parasites could be detected on fish from four of the rivers tested. Parasites were, however, detected on fish from large production sites in Natal and in the rivers feeding these sites. Parasites which were detected were *Ichthyophthirius multifiliis*, various *Trichodina* spp., *Apiosoma* sp. and *Gyrodactylus* sp.

The heads of all fish estimated to be less than one year of age were collected and examined for the spores of *Myxosoma cerebralis*. All of the samples were found to be free of this parasite.

### INTRODUCTION

Rainbow trout (*Oncorhynchus mykiss*) were first successfully introduced into South Africa in 1897 (McC Pott, 1987) while the first introduction of this fish into Natal was in 1899 (Pike, 1980). Today, rainbow trout are farmed with throughout the country, the largest production coming from the Transvaal. Both rainbow and brown trout (*Salmo trutta*) have been stocked into a number of suitable rivers throughout the country and in many of these rivers successful breeding populations have been established.

Most of the suitable rivers and dams in Natal have been stocked with rainbow and brown trout for angling. There are also four large commercial trout hatcheries in Natal, one on the Bushmans River, one on the Mlambojwe River, one on the Polela River (which had been closed for some time) and one on the Ingwagwana River. Another small hatchery is found along the Umzimouthi River. This hatchery produces trout mainly for the restocking of rivers and dams and the stocking densities on this site are low. In addition, the Natal Parks Board (NPB) has a large hatchery at Kamberg on the Mooi River, one on the Mahai and one on the Umzimkulu which has subsequently been closed down.

Since the first introduction of trout into South Africa, no extensive survey of the pathogens in the feral river fish and hatchery fish has been undertaken. Various parasitological surveys have been done on numerous fish species from certain rivers in this country (Van As & Basson, 1983; Basson, Van As & Paperna, 1983; Van As, Schoonbee & De Wet Brandt, 1981; Boomker, 1986; Viljoen & Van As, 1985; Mashego & Saayman, 1981). All of this work was, however, carried out on non-salmonid fish such as *Clarias gariepinus* (Mashego & Saayman, 1981), cichlid and cyprinid fish (Basson *et al.*, 1983) or in areas where salmonids do not occur because of very high water temperatures (Boomker, 1986). There is thus very little information available on the levels of parasitic infestations on trout in the rivers of South Africa.

There has been a number of documentations on the detection, isolation and identification of various pathogens from trout in production ponds in South Africa. Most of these reports involve bacterial diseases (Boomker, Innes, Cameron, Naudé &

Schoonbee, 1979; Boomker, Henton, Naudé & Huchzermeyer, 1984; Bragg & Broere, 1986; Bragg & Henton, 1986; Bragg, 1988), and there has been one report on the isolation of a virus (Bragg & Combrink, 1988) in this country.

This survey was undertaken to gain some knowledge of the health status of salmonids in various river systems in Natal where both rainbow and brown trout are known to occur, either through the establishment of natural breeding populations, or through stocking for angling purposes. The first part in this three part series deals with the method of collecting fish and their parasitological examination.

### MATERIALS AND METHODS

#### *Identification of rivers, dams and production sites for collection of samples*

The NPB assisted with the identification of river systems in Natal in which trout are known to occur. Trout hatcheries along these rivers were also identified with the assistance of the NPB. Sites along the rivers where the electro-fishing equipment could be used to collect fish were also identified by the field staff of the NPB.

#### *Collection of fish*

Samples of fish were collected from the rivers by using electro-fishing equipment. The power source for the electro-fishing apparatus was a Yamaha EF 600 generator with an output of 240 volts A.C. current. The actual fishing equipment was developed and constructed by the NPB.

Fish from farm dams were caught by laying gill nets in the dams in the evening and collecting caught fish the next morning.

Fish were obtained from the hatcheries by using hand nets to collect fish which were showing abnormalities such as darkened skin colour, erratic swimming or accumulation at the outflow points in the ponds.

#### *Collection of samples for parasitological examination*

A total of 407 fish from eight rivers were examined for the presence of parasites. Each fish was processed separately. A glass coverslip was used to make a scraping of the body surface of the fish. The glass coverslip was then placed into a sterile 20 ml McCartney bottle which contained 10 ml of a 10 % (v/v) solution of formaldehyde in sterile water. A section of a gill was removed and placed into the same bottle.

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TABLE 1 List of all sites in Natal where samples were collected as part of the survey

No.	River	Site description	Species	Number collected
1	Mooi	Below Kamberg	Rainbow	2
2	Mooi	Below Kamberg	Brown	38
3	Mooi	Above Kamberg	Brown	5
4	—	Pringle (Dam)	Rainbow	12
5	—	Muller (Dam)	Rainbow	6
6	Mooi	Invermooi	Rainbow	27
7	—	Highmore (Dam)	Rainbow	6
8	—	Shaw (Dam)	Rainbow	1
9	Umzimkulu	Underberg Trout Farm	Rainbow	13
10	Umzimkulu	Goshen	Rainbow	50
11	Ingwagwana	Glencree	Rainbow	30
12	Umzimouthi	Splashy Fen	Rainbow	13
13	Umzimkulu	The Droplet	Rainbow	20
14	Polela	Glencairn	Rainbow	30
15	Bushmans	River	Brown	6
16	Bushmans	River	Rainbow	10
17	Bushmans	Bushmans River Trout	Rainbow	17
18	Mooi	River (below Kamberg)	Brown	25
19	Mooi	River (above Kamberg)	Brown	20
20	Mooi	Kamberg	Brown	8
21	Mooi	Kamberg	Rainbow	7
22	Bushmans	River	Rainbow	10
23	Bushmans	River	Brown	20
24	Bushmans	Bushmans River Trout	Rainbow	47
25	Umzimkulu	River	Rainbow	40
26	Polela	River	Rainbow	50
27	Polela	Glencairn	Rainbow	9
28	Ingwagwana	River	Rainbow	25
29	Ingwagwana	River	Non-salmonid	10
30	Umzimouthi	River	Rainbow	18
31	Umzimouthi	Splashy Fen	Rainbow	21
32	Ingwagwana	Glencree	Rainbow	21
33	Mlambonjwa	River	Rainbow	22
34	Mlambonjwa	River	Brown	5
35	Mlambonjwa	River	Non-salmonid	10
36	Mlambonjwa	Tryme	Rainbow	12
37	Mahai/Tugela	Rivers	Rainbow	12
38	Mahai/Tugela	R.N.N.P.	Rainbow	10

R.N.N.P. = Trout hatchery at the Royal Natal National Park

The heads of all fish less than one year of age were removed and placed into a sterile 20 ml McCartney bottle. These heads were investigated for spores of *Myxosoma cerebralis*, the causative agent of whirling disease.

#### Parasitological examination of samples

The coverslip was removed from the formalin and placed onto a clean glass slide. The section of the gill was also removed and placed onto the same glass slide. This was then examined under a 10 × objective of a microscope for the presence of parasites. The results from each fish were recorded.

Heads of fish for the examination for the spores of *M. cerebralis* were processed according to the digest method described by Amos (1985).

### RESULTS

#### Collection of fish

A total of 678 fish were collected from 26 different sites, from eight different river systems in Natal. A full list of all sites and species of fish can be seen in Table 1. Of the 678 fish collected, 407 were examined for the presence of parasites and 284 were found to be less than one year old and the heads from these fish were examined for *M. cerebralis*.

#### Parasitological examination

Results of the examination of the skin scrapings and sections of the gills can be seen in Table 2. All of the fish examined from the Mooi, Umzimouthi, Umzimkulu, Mahai and Tugela Rivers were found to be free of external parasites. Varying incidences

of parasitic infestations were found on fish from the Bushmans, Mlambonjwa, Polela and Ingwagwana Rivers.

All the samples collected for the detection of the spores of *M. cerebralis* were found to be free of spores.

### DISCUSSION

The use of electro-fishing equipment for the collection of fish from the rivers proved to be a most suitable method for the collection of large sample sizes of fish. No information on the possible effects of the electro-fishing procedure on the densities of external parasites on the surface of the caught fish was found and it was assumed that this technique would not adversely disturb the external parasites. An average of about 34 fish per river were obtained. The lowest number of fish were collected from the Mahai and Tugela Rivers in the Royal Natal National Park. It would appear that the established population in these rivers is very small as about one kilometre of one section of the Mahai River was fished without obtaining a single fish, in spite of very favorable fishing conditions. Normally the fishing operation is started about one kilometre down stream from some obstruction, such as a weir, and the fish swim ahead of the fishing apparatus until they reach the obstruction. Once there, they are easily stunned and caught. It is, however, difficult to obtain any indication of the actual population sizes of the fish in any one section of a river. It is thus not possible to calculate statistically the size of sample which should be collected from each river. It was

TABLE 2 Results of the parasitological examination of fish collected from various river systems in Natal

No.	River	<i>Ich.</i>	<i>Trich.</i>	<i>Apiosoma</i>	<i>Gyrodactylus</i>
1	Mooi	N/D	N/D	N/D	N/D
2	Mooi	N/D	N/D	N/D	N/D
3	Mooi	N/D	N/D	N/D	N/D
4	—	N/D	N/D	N/D	N/D
5	—	N/D	N/D	N/D	N/D
6	Mooi	N/D	N/D	N/D	N/D
7	—	N/D	N/D	N/D	N/D
8	—	N/D	N/D	N/D	N/D
9	Umzimkulu	N/D	N/D	N/D	N/D
10	Umzimkulu	N/D	N/D	N/D	N/D
11	Ingwagwana	N/D	N/D	N/D	N/D
12	Umzimouthi	N/D	N/D	N/D	N/D
13	Umzimkulu	N/D	N/D	N/D	N/D
14	Polela	N/D	N/D	N/D	N/D
15	Bushmans	N/D	N/D	N/D	N/D
16	Bushmans	N/D	N/D	N/D	N/D
17	Bushmans	N/D	N/D	N/D	N/D
18	Mooi	Negative	Negative	Negative	Negative
19	Mooi	Negative	Negative	Negative	Negative
20	Mooi	Negative	Negative	Negative	Negative
21	Mooi	Negative	Negative	Negative	Negative
22	Bushmans	Negative	Negative	Negative	Negative
23	Bushmans	3,3 %	Negative	Negative	Negative
24	Bushmans	29,4 %	Negative	Negative	Negative
25	Umzimkulu	Negative	Negative	Negative	Negative
26	Polela	8,3 %	Negative	Negative	Negative
27	Polela	Negative	Negative	Negative	Negative
28	Ingwagwana	Negative	Negative	8,0 %	Negative
29	Ingwagwana	Negative	10 %	Negative	Negative
30	Umzimouthi	Negative	Negative	Negative	Negative
31	Umzimouthi	Negative	Negative	Negative	Negative
32	Ingwagwana	5,0 %	Negative	62 %	Negative
33	Mlambonjwa	Negative	Negative	Negative	4,5 %
34	Mlambonjwa	Negative	Negative	Negative	Negative
35	Mlambonjwa	Negative	Negative	Negative	Negative
36	Mlambonjwa	Negative	41,7 %	Negative	Negative
37	Mahai/Tugela	Negative	Negative	Negative	Negative
38	Mahai/Tugela	Negative	Negative	Negative	Negative

*Ich.* = *Ichthyophthirius multifiliis*

*Trich.* = *Trichodina*

N/D = Not done

therefore decided to fish any one section of the river for two to three hours. All fish collected during this time were sampled.

Only 407 of the 678 fish collected were examined for parasites. The fish which were not examined were collected primarily to ascertain if infectious pancreatic necrosis virus, which had been isolated at the NPB hatchery at Kamberg (Bragg, 1991), had spread to other water bodies in Natal.

The fact that ecto-parasites were detected only on fish from the Bushmans, Ingwagwana, Polela and Mlambonjwa Rivers or from the hatcheries on these rivers, the only rivers in Natal where intensive aquaculture takes place, suggests that these activities may contribute to the parasitic load on both river and hatchery fish.

There is some evidence that fish in the rivers are becoming infested with parasites as a result of high parasitic infestations of the fish held in the hatcheries. This is evident when examining the results obtained from the Ingwagwana River. *Apiosoma* sp. was detected on 62 % of the hatchery fish from Glencrec Trout Farm on this river, while only 8 % of the fish collected from the river were infested. This parasite was only detected in the Ingwagwana River. Van As & Basson (1983) found that the members of the genus *Apiosoma* are not wide-spread in South Africa and they recorded them only in 27 out of the 70 rivers which were tested. Most of these parasites were detected on *Oreochromis* spp., *Tilapia* spp. and *Labeo* spp. and there has been only one record

of this parasite on rainbow trout from the Lydenburg area (Basson, 1981; as cited in Van As & Basson, 1983). As trout were obtained from a production site in the Lydenburg area for the stocking of Glencrec Trout Farm, it would appear likely that this parasite was introduced into the Ingwagwana River via these trout and that the parasites have spread from there into the river.

There are no records of *Trichodina* spp. and *Ichthyophthirius multifiliis* on fish in the rivers of the Natal Drakensberg area. These parasites appear to be more common in Southern African waters than *Apiosoma* and both parasites have been detected on trout from various areas in the Transvaal (Bragg, 1989, unpublished data). *I. multifiliis* was detected on brown trout from the Bushmans River and on rainbow trout from Bushmans River Trout Farm (Table 2). The high incidence of the parasite in fish from the hatchery (29,4 %) compared to an incidence of 3,3 % in the river fish, suggests that this parasite was probably introduced on to the farm with fish obtained from other sites in the country where the parasite is wide-spread. This parasite was also found on fish from Glencrec Trout Farm on the Ingwagwana River but was not detected on the fish, both salmonid and non-salmonid, obtained from the river.

*Trichodina* spp. were detected only on fish on Tryme Trout Farm on the Mlambonjwa River and on both salmonid and non salmonid fish in the Ingwagwana River. None of the fish from the

Mlabonjwa River were found to be infested with *Trichodina* spp. in spite of the very high incidence levels found on the hatchery fish. This also indicates that these parasites are associated with the hatchery fish and do not occur naturally in the rivers in Natal. An unexpected result was found in the Ingwagwana River where *Trichodina* spp. were found in the river fish but not in the hatchery fish. At some stage, most of the fingerlings escaped from Glencree Trout Farm during flooding. It is possible that fish carrying the parasite were washed into the river and that the fish which were obtained to restock the hatchery were free of *Trichodina* but were carrying *Apisoma*.

#### CONCLUSION

Electro-fishing proved to be most useful for the collection of large numbers of fish from river systems for microbiological examination. The possible effects of this form of catching fish on the ectoparasitic population of the fish is unknown, but it is assumed that this method will have a minimal effect on the parasites.

There is some evidence to link intensive fish farming operations to parasitic infestation of fish, both salmonid and non-salmonid, in the rivers. *Apisoma* spp., *I. multifiliis* and *Trichodina* spp. were detected and recorded for the first time from salmonids in Natal. Fish from the Mooi, Umzimouthi, Umzimkulu, Mahai and Tugela Rivers were found to be free of parasites. *I. multifiliis* was found on feral fish and from the hatcheries on the Bushmans, Polela and Ingwagwana Rivers. *Trichodina* spp. were detected on the feral fish from the Ingwagwana River and from the hatchery on the Mlabonjwa River. *Apisoma* was only found on fish from the Ingwagwana River and the hatchery on the river. *M. cerebralis* was not found on any of the fish tested.

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