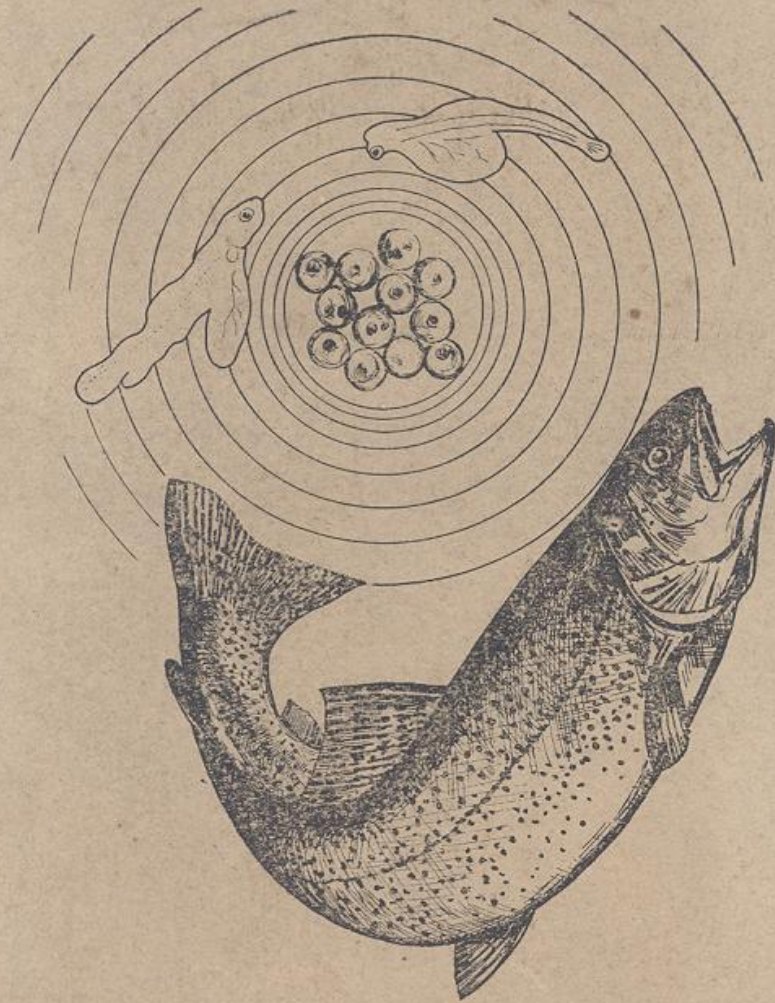


A REPORT ON FISH DISEASES IN THE TROUT HATCHERIES  
AND FARMS OF KASHMIR



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By  
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HATCHERIES AND FARMS OF KASHMIR

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## INTRODUCTION

The first studies on fish diseases have been made on fish in the confined and natural habitats of ponds and streams where epizootics have occurred from time to time. But most of the further advancements in fish pathology have been on hatchery infections (Davis, 1953; Allison, 1953; Snieszko, 1953). It is sometimes even remarked that the average hatchery is a hot bed of disease where ailing fish are the rule rather than the exception (Davis, 1944). The artificial conditions prevalent in hatcheries help in the rapid increase in the incidence of several diseases (Davis, 1953). However, it would be of interest to mention that none of the fish diseases have originated in hatcheries, but they have been introduced by wild fish. It is also known that under hatchery conditions nutritional deficiencies are also very common and these produce several disease conditions (Halver, 1954).

One of the new important research schemes undertaken at the Central Inland Fisheries Research Institute, Barrackpore, under the Third Five-Year Plan programme, is the study of fish hatchery diseases. Every year severe epidemics cause large scale fish mortalities in the trout hatcheries of the country. Very little work has been done on this problem excepting the preliminary observations made by Khan (1939 a & b) and Malik (1939). The former author described fin rot, carcinoma of the thyroid, inflammation of the intestine and fungus disease in the Punjab hatcheries. Malik has studied the lipoid or fatty degeneration of liver of rainbow trout, caused by feeding of the fish on fatty diet.

Trout culture and development programmes have been in operation in the State of Jammu and Kashmir for some years now. The State Fisheries Department has been maintaining the trout hatcheries to replenish the stocks of trout in the local streams and also to supply to other states. Severe mortality of alevins, fry and fingerlings is reported every year in these hatcheries and it is important that the causes for this be determined. Hence it was thought desirable to initiate investigations on trout diseases in the hatcheries of Kashmir and the present report is prepared on the basis of preliminary observations made during February-March 1963.

GENERAL CONSIDERATIONS

In order to have an idea about the environmental factors associated with the trout diseases, the prevailing conditions at the three State Government hatcheries at Harwan, Laribal and Achabal were studied. Harwan is about 13 km., Laribal about 19 km., and Achabal about 67 km., from Srinagar City. It is well known that the most important factor to be considered in any trout farm and hatchery is the water supply. At certain situations water that may be suitable for adult trouts may not be quite fit for the hatchery circulation. Water supply conditions at the three above mentioned farms and hatcheries have been under regular improvement during the past few years, and are now generally satisfactory. Only at Achabal there is a substantial shortage of water due to an unauthorised diversion at the source made by local people. The intensity of flow into the farm has thus been considerably reduced, seriously affecting some of the receways. However, this is engaging the attention of the authorities.

The rate of flow of water is quite satisfactory at the Harwan and Laribal farms and hatcheries. The elevation of reservoirs in the ova houses and the system of using control cocks to regulate the supply into individual rows of troughs are similar in all the three hatcheries. Although Filters have been provided, they are not being used at present due to certain practical difficulties. Water at Laribal is very clear and is reported to remain so during the entire year. Harwan water, though not as clear as at Laribal, is also satisfactory and does not provide any serious turbidity problem. At both these stations the sources of water are fast flowing streams. At Achabal farm the condition is different in that the water source is somewhat allied to a spring, but at certain seasons muddy water is reported to appear, especially after rains. Occurrence of muddy water is troublesome for fish, both in the farm and ova house.

Chances of water pollution are present at Laribal and Harwan. This is more so at the latter place, where there are a number of huts near the farm and ova house. Pollution from drainage and washing of clothes and utensils is possible, but it is reported that there is no danger of this assuming any serious proportion.

Data obtained on the temperature, dissolved oxygen content and pH of water at three stations are given below :

[All values are averages of observations taken during the particular period (February 1963)]

HARWAN

Hatchery

Inflow :

Temperature	-	7.4°C
Dissolved Oxygen	-	8.45 p.p.m.
pH	-	7.2

Outflow from hatchery troughs :

(a) Rows with fast flow of water

Temperature	-	7.5°C
Dissolved Oxygen	-	7.87 p.p.m.
pH	-	7.1

(b) First row, where the rate of flow was very low

Temperature	-	8.5°C
Dissolved Oxygen	-	7.68 p.p.m.
pH	-	7.1

Trout Farm

Tank No.1

Temperature	-	7.8°C
Dissolved Oxygen	-	9.22 p.p.m.
pH	-	7.9

Tank No.14

Temperature	-	7.9°C
Dissolved Oxygen	-	8.83 p.p.m.
pH	-	8.1

LARIBALHatchery

Inflow :

Temperature	-	6.9°C
Dissolved Oxygen	-	8.06 p.p.m.
pH	-	6.9

Outflow :

Temperature	-	6.9°C
Dissolved Oxygen	-	7.49 p.p.m.
pH	-	6.9

ACHABALHatchery

Inflow :

Temperature	-	10.4°C
Dissolved Oxygen	-	6.91 p.p.m.
pH	-	8.1

Outflow :

Temperature	-	10.4°C
Dissolved Oxygen	-	6.72 p.p.m.
pH	-	8.1

Inflow into the Main Farm :

Temperature	-	10.3°C
Dissolved Oxygen	-	6.61 p.p.m.
pH	-	8.1

Inflow into the farm from the Mogul garden :

Temperature	-	10.5°C
Dissolved Oxygen	-	6.72 p.p.m.
pH	-	8.2

Sample of Muddy water :

pH	-	8.45
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#### PREDATORS

Macroscopic animals observed in the hatchery troughs, other than the trout eggs, alevins or fry, were caddis fly larvae and amphipods. The former are reported to consume the alevins and fry in large numbers. It is known that the amphipods attack living animals rarely only and that they are omnivorous general scavengers (Pennak, 1953).

#### POSSIBILITY OF INFECTION FROM WILD SOURCES

One of the disadvantages of using stream water in hatcheries is the likelihood of transfer of disease organisms either from the fish in the stream or other animals. Such possibilities exist in the streamfed hatcheries of Laribal and Harwan. Although the water supply to Achabal farm is not from a stream, the danger of infection from wild is present here also since it was observed that some seriously diseased fish were frequenting the pool above the inflow into the farm. The amphipods which get their way into the farms and hatcheries may serve as intermediate hosts of a number of fish parasites. So also the snails, which, however, were observed at Achabal farm only.



NUTRITION

The food normally supplied to adult trouts is locally available fish and dry silk worm pupae. Immediately after the yolk sacs of the fry are absorbed, they are fed for a few days on hen's or duck's egg emulsion. The advanced fry and fingerlings are regularly supplied with dry powdered silk worm pupae.

It is felt that the nutritional requirements of the trout are not fully met with this diet. The silk worm pupae samples were found to be deficient in essential food constituents. (Detailed analysis will be reported separately). In all hatcheries of the world, nutritional deficiencies are reported to assume serious position due to economical reasons (Halver, 1953). Improvements in the trout diet can be made only after the complete nutritional requirement of the fish under different stages of development are fully studied.

TROUT DISEASES OBSERVED AT THE DIFFERENT  
HATCHERIES AND FARMSHARWAN

Brown trout (Salmo trutta fario Linn.) eggs, alevins, fry and adults were available for examination.

- (a) Disease of eggs :
- i. Fungus disease (Fig.1)

The only disease observed on trout eggs was fungus caused by infection with Saprolegnia parasitica. Mostly dead eggs were found infected, but in a few cases some which had apparently been injured earlier had developed the disease. It is known that fungus on a dead egg can develop very quickly and then spread rapidly to nearby healthy eggs also (Davis, 1953).

The main symptom of the fungus disease was the occurrence of greyish white tufts of fungal threads on the egg surface. The infection was either localised at certain region or regions or was seen all round.

(b) Diseases of Alevins :

i.. Sac disease (Fig.2)

A disease similar in certain respects to the blue-sac disease or hydrocoele embryonalis (Davis, 1953) was found in 2 troughs. The yolk sac had got enlarged considerably and also constricted at some portions. Unlike in blue-sac disease, the serous fluid did not show any colouration. White and opaque spots in the yolk were very clear, but the fusion of fat droplets was not evident in all instances. According to Davis (1953) the blue-sac disease may be the result of bacterial infection or may be caused by improper handling. Further observations on the present disease will be of value.

ii. Fungus disease (Fig.3)

Fungus infection by Saprolegnia parasitica was another common ailment of the alevins. When the living young ones were infected, the fungus was seen in minute patches and evidently this was secondary on physical injury caused by other means. The intensity of infection was more on deformed and 'monster' specimens. The hyphae of fungus appeared as tufts of greyish white threads and the mycelia had penetrated under the skin. On dead alevins (sac-frys) the fungus was found to develop very quickly. Fungus is not considered to be an obligatory parasite (Van Duijn, 1956).

(c) Diseases of 'Advanced Fry' and fingerlings:

i. Fungus disease (Fig.4)

The symptoms and pathology of fungus infection on these young ones of brown trout were similar to those described above.

ii. Ichthyophthiriasis (Fig.5)

This disease, which is sometimes known as 'white spot disease' is caused by the protozoan Ichthyophthirius multifiliis. The infection is considered to be more common on warm water fishes and less in trouts. However, sometimes it is known to cause considerable mortality in hatcheries (Davis, 1953). At Harwan hatchery many of the fry without yolk sac showed early stages of this infection. The characteristic symptom of the disease was the presence of minute white spots on the body of the fish. Each of the spots was a cyst containing numerous parasitic protozoans of the species Ichthyophthirius multifiliis. The cyst was a pathological production of the fish skin.

iii. Sporozoan infection

A few sporozoan cysts were collected from fry kept in 2 troughs of the Harwan hatchery. Although the exact identification of the parasite has not yet been made, it appears to be a myxosporidian. The infection was in the early stages only. A few sporozoans on a fish are not generally very harmful but if the number increases considerably, fish mortality may result.

(d) Diseases of Adult Trout :

i. Fungus

Saprolegnia infection on adult trout was also common whenever the fish had been injured. Specimens which had been stripped recently showed tendency to get infected quickly. The symptoms and pathology have been mentioned earlier.

ii. Whirling disease

It was reported by the farm staff that some trouts die due to a disease condition where they make circular movements near the surface of the water and eventually collapse. This might be due to either 'whirling' disease or Acute Catarrhal enterites (M'Gonigle 1940, Davis 1953). The former condition is caused by myxosporidian parasites and the latter by infection of the

intestines caused by feeding irregularities. Only one fish which was supposed to have died earlier under conditions mentioned above was available for study. This showed no myxosporidian infection, but there were signs of enterites.

LARIBAL

(Brown trout only were available)

(a) Disease of eggs :

i. Fungus

II. White spot disease of yolk

This disease was characterised by the presence of one, two or three white spots in the Yolk. A similar disease has been described by Davis (1953) who states that the condition is common in hatcheries and is more prominent in eggs that have been transported or handled roughly. It is possible that this condition was caused by minor damages caused during handling. The affected eggs were found to die in the hatchery troughs.

(b) Diseases of Alevins :

i. Fungus

ii. Sporozoan infection in gill region

Early stages of this sporozoan infection were observed in some of the live specimens collected and preserved for further study. Only about 4% of the specimens in one hatchery trough showed this infection. The identification of the parasite has not yet been made.

(c) Disease of 'Advanced fry' and Fingerlings :

i. Fungus

ii. Fin and tail rot (Fig.6)

Different stages of this disease could be observed on specimens in two rows of troughs in

the ova house. In the first stage there was a white line on the margin of the fin. In advanced condition the fin rays had got disintegrated and putrefied. The symptoms were in general similar to those described by Khan (1939 b).

iii. Whirling disease

Abnormal conditions where the fry used to make circular movements near the surface of water and then die, were noticed in a few specimens in which the yolk had completely been absorbed. Artificial feeding had begun in the particular troughs and it is presumed that the cause of the disease was enterites. When dissected, the alimentary canal showed reddish colouration, but there was no abnormal secretion of mucus.

(d) Diseases of Adult

Three specimens of adult brown trout showing disease conditions were examined. In one of them fungus infection was present near the caudal fin and there were evident signs of physical injury.

Another specimen which was reported to have died of 'whirling disease' showed a very heavily inflamed intestine and copious secretion of mucus.

The farm staff reported that death due to the whirling disease is very common and Fungus infection appears to increase after stripping.

ACHABAL

At this hatchery and farm, both Brown trout and Rainbow trout (Salmo gairdnerii Rich.) eggs, fry, fingerlings and adults were available for examination.

The infections common to both the species were :-

(a) Disease of eggs

i. Fungus

(b) Diseases of Alevins

i. Fungus

ii. Ichthyophthiriasis - early stages -

(c) Diseases of 'Advanced fry' and Fingerlings

- i. Fungus
- ii. Ichthyophthiriasis

(d) Diseases of Adult Trout

- i. Fungus
- ii. Whirling disease

The following diseases were observed in Rainbow trout only :-

(a) Alevins :

i. Sac disease

The symptoms and pathology were similar to those observed at Harwan. The rate of infection, however, was very high.

(b) Adults :

i. Dropsy

Abdominal dropsy was observed in one of the adult rainbow trouts made available for study. The symptoms were accumulation of fluid in the abdominal cavity and slight exophthalmus. The causative agent of Dropsy is considered to be a bacterium of the genus Aeromonas (Gopalakrishnan, 1961). Similar disease conditions of Rainbow trout have been described by Malik (1939) who traced the origin of the infection to lipid or fatty degeneration of the liver.

ii. Fatty degeneration of liver

Lipoid degeneration of the liver was observed in a sick rainbow trout. The liver was yellow in colour with scattered black spots. This disease is caused by the deposition of lipoids in the liver replacing the glycogen cells (Davis, 1953). The cause of the disease may be either malnutrition or incorrect feeding.

### RECOMMENDED CONTROL METHODS

On the basis of information available on the control of fish diseases (Khan, 1939 a & b; Davis, 1953; Allison, 1953; Snieszko, 1953; Van Duijn, 1956; Gopalakrishnan, 1963 & 1964) the following methods are recommended for the prevention and control of the trout diseases described above.

#### Fungus disease :

Dead eggs in a hatchery are important sources of fungus infection and so they are to be removed at very frequent intervals. No doubt, this will involve many man hours, but its importance cannot be overemphasized, especially in view of the fact that fungus disease is common in all the three hatcheries.

For all trout eggs, treatment with malachite green in dilution of 1 : 200,000 for 1 hour, helps in preventing fungus infection (Burrows, 1949). The constant flow siphon method (Davis, 1953) is suitable for this treatment. Trout eggs are known to have a wide tolerance to malachite green.

For fry, fingerlings and adults, dipping in a 1 : 15,000 solution of malachite green for 10 to 30 seconds may be tried. In all early stages of the disease, it is reported that dip treatment in 3% salt solution is effective.

Most of the physical injuries to adult trouts are caused during and immediately after spawning season. So it would be advantageous to dip the fish, especially those stripped, in 1 : 15,000 solution of malachite green or 3% salt solution.

#### Sac disease :

As mentioned earlier the likely cause of this disease is either bacterial infection or damage caused during handling of the eggs. Detailed studies on the disease are necessary before suitable controls could be suggested. However, it would be worthwhile if trials could be made by dip treatment in 1 : 3,000 Copper sulphate solution for 1 to 2 minutes or 1 : 2,000 solution of malachite green for 10 to 30 seconds.

#### Ichthyophthiriasis :

The best possible treatment methods to eradicate

Ichthyophthirius multifiliis infection are :-

- (a) To keep the infected fish in very fast flowing water so that the cysts may get dislodged.
- (b) Half to one hour baths in 1 : 5,000 formalin solution daily for 7 to 10 days.
- (c) Hourly baths in 2 or 3 percent common salt solution for 7 to 10 days.

Sporozoan infection :

No effective treatment method is known against sporozoan infections. These parasites were not found in appreciable numbers in any of the hatcheries and ordinarily there should be no dangerous consequences. However, if necessity arises, treatment for 1 hour in 1 : 5,000 formalin solution may be tried for partial relief at least.

Whirling Disease :

From evidences available it appears that the whirling disease reported is caused by infection of the alimentary canal. Since this condition is the likely result of malnutrition or incorrect feeding, attention will have to be paid to improve the quality of food supplied.

White Spot Disease of Yolk :

Since the probable cause of this disease is injury to the egg, more special care during handling may decrease the rate of occurrence of the infection.

Fin and Tail Rot :

The disease is curable during early stages only and satisfactory results may be obtained by dip-treatment for 1 minute in 1 : 2,000 copper sulphate solution. Khan (1939 b) obtained good results by treatment in 1 : 20,000 copper sulphate solution for 10 to 15 minutes. Another method for trial is an hour's treatment in 1 : 4,000 formalin, followed by flush treatment with 1 : 15,000 malachite green.

Dropsy :

Some of the antibiotics like Chloromycetin and Terramycin are likely to be effective against this disease, but



experimental data on the use of these on trout are lacking. Till more information on the subject becomes available, the measures that may be taken to reduce the chances of the infection spreading are, to destroy the specimens affected by Dropsy and dipping others in contact in 1 p.p.m. potassium permanganate solution.

Fatty degeneration of liver :

As mentioned earlier Malik (1939) has attributed this condition to feeding of the fish on fatty diet. It is possible that the degenerative changes in the fish may occur by consuming unsuitable food items and also due to vitamin deficiencies. Once the disease has appeared, it will be desirable to change the diet and supply vitamin-rich food, at least for some time.

GENERAL REMARKS

Not much is yet known regarding the trout diseases in Indian hatcheries. It is possible that manifestation of one or more of the diseases mentioned in the report may result in large scale fish mortality. It is seen that many of the diseases described appear after the yolk sac of the fry is absorbed. A notable exception to this is the Fungus infection, which is prevalent in all the hatcheries during all stages in development of the fish. It is very likely that the incidence and spread of the other diseases are closely related to the state of nutrition of the fish. In fact, it is the health condition of the individual that determines the resistance offered to infections. Detailed studies on the food requirements, resistance and susceptibility to diseases etc., of trout should be attempted. Experimental studies on therapy of the trout diseases can be conducted at the hatcheries only and these also have to be taken up. In this connection it may be pointed out that such investigations will be possible only if the services of technical staff are available at the hatcheries. Essential equipment like incubators, constant temperature ovens, refrigerators etc., are also necessary at the site so that bacteriological studies may be undertaken.

The non-availability of a vehicle for scientific workers to visit the farms and carry equipment necessary for field investigations, is also another handicap. Provision of suitable transport

facilities is one of the essential requirements for biological research and this should be considered favourably by the authorities.

#### SUMMARY

The report deals with observations on the diseases of brown and rainbow trout in the Harwan, Laribal and Achabal hatcheries of Kashmir. General considerations regarding the water supply to the farms and hatcheries have also been made, as they are related to the incidence of infections and mortality. There is possibility of infection from wild sources and organisms like amphipods and snails may serve as intermediate hosts of parasites. The state of nutrition is related to susceptibility to diseases and hence this aspect has also been mentioned.

The trout diseases described are Fungus disease, Sac disease of alevins, Ichthyophthiriasis, Sporozoan infection, 'Whirling Disease', White spot disease of yolk, Fin and Tail rot, Dropsy and Fatty degeneration of liver. Suitable methods for the prevention and control of the diseases have been recommended. Some general remarks regarding further investigations to be taken up are also appended.

#### ACKNOWLEDGEMENTS

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Legends for figures :

- Fig. 1. Brown trout eggs with fungus infection.
- Fig. 2. Brown trout alevins with sac disease.
- Fig. 3. Brown trout alevins with fungus disease.
- Fig. 4. Brown trout advanced fry with fungus disease.
- Fig. 5. Brown trout advanced fry with Ichthyophthiriasis.
- Fig. 6. Brown trout advanced fry with tail rot.

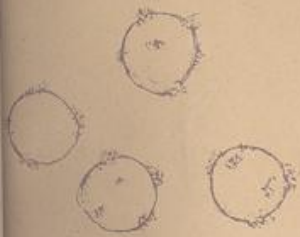


FIG. 1

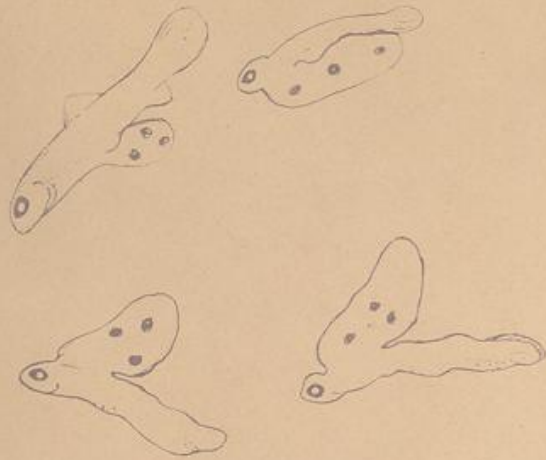


FIG. 2

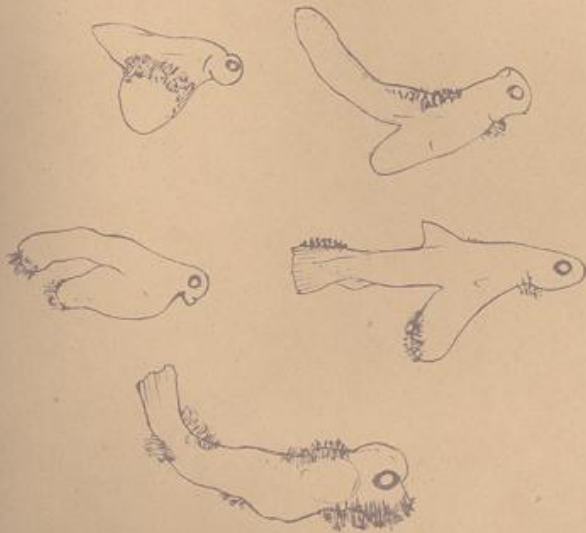


FIG. 3

FIG. 4

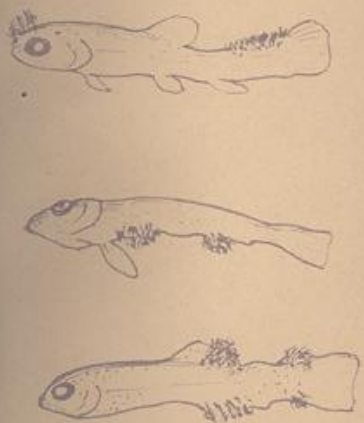


FIG. 5

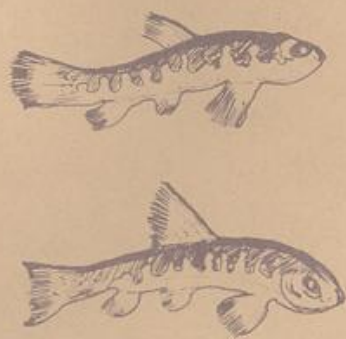


FIG. 6