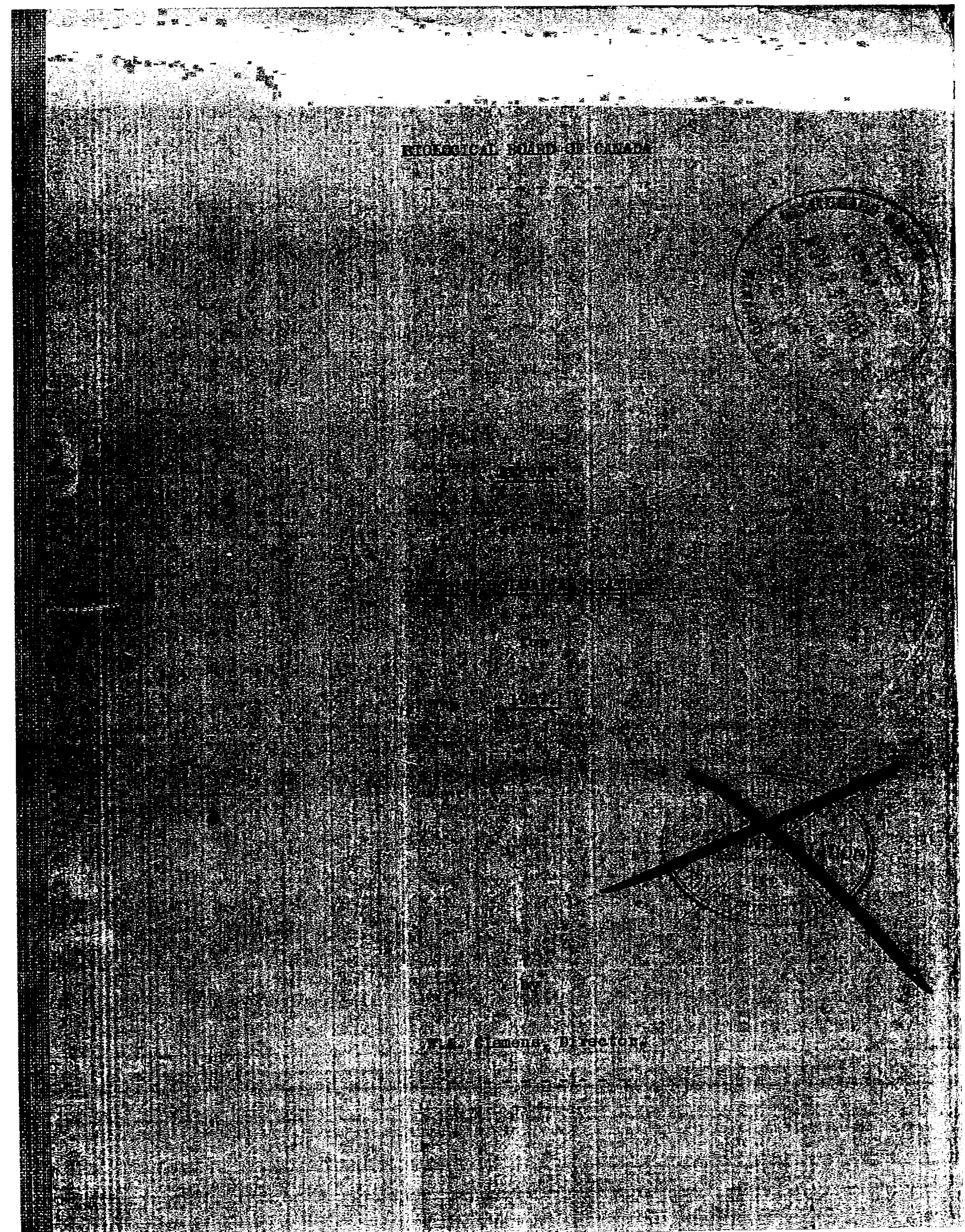

W.E. Clemens, Director

REPORT OF THE
PACIFIC BIOLOGICAL STATION
NANAIMO, B.C.
FOR 1937
BY W. A. CLEMENS, DIRECTOR.

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INTRODUCTION

In view of the fact that several programmes of investigation have been brought to conclusions either in their initial phases or completely, the year 1937 tends to mark the close of a period in the history of this Station.

During the year Dr. C. McC. Mottley and Dr. C.R. Elsey resigned to accept positions elsewhere; the former on the staff of Cornell University and the latter with the British Columbia Packers in Vancouver. With the removal of Dr. Mottley the Paul lake investigation was concluded and a complete report will be prepared in due course. The resignation of Dr. Elsey marks the end of certain phases of the shellfish investigations, but plans are being prepared for the continuation of the work along somewhat revised lines. In the pink salmon investigation the original programme has been completed both in respect to natural propagation and transplantation, and attention will now be directed toward a study of the ocean life history. Finally, with the formation of the International Fraser River Sockeye Salmon Commission, the investigation of the propagation of sockeye salmon at Cultus lake is being brought to a conclusion.

On the other hand, several new projects have been commenced during the year and plans formulated for a certain amount of reorganization of staff and programme in 1938. A survey in respect to salmon production in the Skeena river water system was begun. The Cowichan hatchery was reopened and is being operated in conjunction with an investigation of the game fishes of the Cowichan river system. In the third place, a small experimental hatchery and laboratory has been constructed in Vancouver for the study of the fish disease furunculosis.

Altogether, a very active programme of investigation has been carried forward during the year. Significant results have been obtained in practically all fields and will be reviewed briefly in this report. Before proceeding with the presentation of the various investigations reference should be made to two features.

In the first place, grateful acknowledgement is made to various Government Departments and other bodies which have co-operated and assisted so generously in the work of the Station. Among these may be mentioned the Provincial Fisheries Department, the Provincial Game Commission, the University of British Columbia, the University of Washington, the Naval Service, the Department of Marine, the Department of Health, the Meteorological Service, the Department of Fisheries, many fishing companies and many individual fishermen. Particular reference will be made to these contributions under the accounts of the various investigations.

In the second place, attention should again be called to the need of improvement in what may be termed the physical equipment of the Station. The present office and laboratory buildings are old frame structures and quite inadequate for the present work, and the valuable library should be housed in a separate fire-proof building. Furthermore, the ocean fisheries investigations are greatly handicapped through the lack of a suitable sea-going vessel.

INVESTIGATIONS

Sockeye Salmon

Propagation

The study of the relation of predatory and coarse fishes to the production of young sockeye salmon in Cultus lake has been continued by Dr. R.E. Foerster, assisted by Dr. W.E. Ricker. During the past three years a total of 137,575 predator and coarse fishes have been removed. Of these squawfish have numbered 28,644 and other known predators 3755. Under the present programme three tests have been planned, namely, one on each of egg planting, natural propagation and fry planting. In the spring of 1935, 5,590,000 eyed sockeye salmon eggs were planted in the streams tributary to the lake, and in the spring of 1936, 501,563 yearlings left the lake, representing 9 percent of the eggs planted. A severe drought may have resulted in the destruction of many eggs in two streams, but since no actual data are available it is impossible to make allowances. It will be recalled that the average production in two tests of eyed-egg planting before removal of predator fishes was 3.6 percent.

In the autumn of 1936 the adult sockeye were allowed to spawn naturally and it is calculated that 40,000,000 eggs were deposited. In the spring of 1937, 3,094,000 yearlings went to sea. This represents a production of 7.73 percent. The average production in three tests of natural spawning with predators present was 1.78 percent.

The third test, namely that on fry planting, is under way. During the spring of 1937, approximately 12,000,000 fry were distributed in the lake and the resulting yearling migrants will be counted in the spring of 1938.

It is evident that removal of predator and so-called coarse fishes has resulted in some increase in sockeye yearling production. Even though the percentage increase appears small, the results are very significant. Suppose for purposes of calculation, 10,000,000 eggs are deposited on the spawning beds. With predators present the yearling production would be 178,000. With predator reduction the yield would be 773,000. Allowing a 90 percent mortality in the sea, 60,000 additional adults would return in the second case. If the fishermen captured half of these they would represent $15,000 at a price of 50 cents each and produce 2500 cases which at $15.00 per case would be worth $ 37,500.

The present programme was undertaken having in view the need for a quick determination of the possible effectiveness of reduction in numbers of predators. Certain positive results are already indicated in the work, but there is still a mortality of 90 percent, the causes of which should be sought.

The problem of predators and coarse fish in relation to salmon and trout production is a complex one, and a sound attack on it must involve a fundamental study of populations. There is need for a thorough study of the inter-relationships among the species forming communities in lake and stream.

A number of investigations have been associated with the main programme at Cultus lake. Since the inception of the programme, a record has been maintained of the physico-chemical conditions prevailing in the lake. A study of the temperature data in relation to the seaward migration of the yearling sockeye has shown that migration commences when the water temperatures in the spring reach 4.5 to 5.5°C. The out-going movement then continues until the surface waters reach a fairly high temperature, forming what has been termed a "temperature blanket" through which any remaining young sockeye in the lake will not go. Other correlations between the environmental conditions and the growth and behavior of young sockeye salmon as well as other fishes are being developed.

In certain years all the yearlings leaving Cultus Lake have been marked in order to obtain information concerning the percentage return of sockeye adults from the sea. Such information is necessary for the development of conservational measures. Data from one experiment indicate a return of approximately 10 percent. In 1935, 323,884 migrants were marked and in 1936, 497,600. During 1937, an effort was made to determine the number of marked fish in the commercial catches by sampling the sockeye landings at certain Canadian and American canneries. By ascertaining the proportion of marked individuals recovered from the total landings at these several strategic points, a statistical computation of the probable proportion occurring in the whole fishery may be made. In addition, the marked fish appearing at the weir below Cultus lake provide data on the escapement. During the season 690 marked fish were recorded at the canneries, but the calculations have not yet been made. To date 2725 marked fish have appeared at Cultus lake.

It will be recalled that in the spring of 1934, 63,874 marked kokanee yearlings were liberated in the outlet from Cultus lake. In 1936, when they might have returned as four-year-old fish, none were reported from the fishing areas and none appeared at Cultus lake. This year, however, 25 have been recorded from the canneries where sampling was carried out and a number have been recovered at Cultus lake. A thorough study of the kokanee would be very desirable, not only from the standpoint of the possibility of adding to the sea-run stocks of sockeye, but of the relation to trout production.

Life History of Sockeye Salmon

The study and analysis of the sockeye salmon material and data collected during 1937 by the Provincial Fisheries Department from the runs to the Fraser, Skeena and Nass rivers and to Rivers inlet has been carried out by Dr. W.A. Clemens. The report is now in process of preparation.

Pink Salmon

The study of the life history and production of pink salmon has been conducted at a field station on McClinton creek, Masset inlet, Queen Charlotte islands, by Dr. A.L. Pritchard.

The investigation of the natural run to the creek has been carried out in four years, with the following results:

1930 adults	66,153	-	1931 fry	5,384,000	-	10.6 percent
1932 adults	15,600	-	1933 fry	2,230,000	-	16.7 percent
1934 adults	155,196	-	1935 fry	12,608,000	-	9.1 percent
1936 adults	52,312	-	1937 fry	3,675,000	-	6.9 percent

There is thus a range in fry production from 6.9 to 16.7 percent of the number of eggs deposited. This is an approximate average of 10 percent, which probably may be accepted as the average production in northern streams. The causes of the 90 percent mortality appear to be largely related to adverse water conditions and at the present time there seems to be no method by which the condition can be effectively remedied.

The adult returns in percentages of the number of fry migrants in the three years have been .3, 7.2 and .4. In each year of fry migration a large number of fry were marked by the removal of certain fins. Marked adults returned in considerable numbers to McClinton creek, thus establishing definitely that pink salmon mature at two years of age and tend to return to the natal stream. A small number of marked fish was captured in areas where return to McClinton was quite improbable, and thus the question of some degree of wandering has been raised. The investigation will now be directed to determining something of the ocean life history.

In addition to the study of natural propagation an attempt has been made to establish a run to McClinton creek in the so-called "off years". It will be recalled that runs occur in Masset inlet only in the even-numbered years. Eggs were taken at the Tlell river in the years 1931, 1933 and 1935 and transferred to a hatchery on McClinton creek. In the first case, fry were liberated with a return of one adult in 1933. In the second case, eyed-eggs were planted, but a very severe freshet destroyed the planting. In the third case, 6 fish returned in 1937, of which 4 were marked. No marked fish returned in any year to the Tlell river. The transplantations have failed to build up runs in the odd-numbered years and the causes of failures in the first and third cases are entirely unknown.

Skeena River Investigation

For some time it has been considered desirable to have brought together as much information as possible concerning the production of salmon in the Skeena river watershed. Second only to the Fraser river in salmon productivity, all data possible concerning the Skeena should be assembled in order to obtain a clear picture of the trends under commercial fishing, the present status and the potentialities. A management policy would seem to be an ultimate necessity.

This year a commencement has been made in the study of the system. During late summer and early autumn Dr. A.L. Pritchard made a survey of the spawning areas in three regions, namely, Lakelse, Babine and Morice lakes, and a detailed report is under preparation. In addition, Dr. Pritchard has begun a review of the catch statistics as far back as they may be available. It is hoped that a review of the records will provide data for working out an index of abundance from year to year and showing the trends of the fishery.

Pilchard

The investigations of the pilchard and herring fisheries have been continued by Dr. J.L. Hart and Dr. A.L. Tester. The programme has been greatly facilitated by the co-operation of the Provincial Fisheries Department in providing approximately half of the financial requirements.

Pilchards failed in 1937 to support a fishery off the West Coast of Vancouver island. They appeared early in the season off Barkley sound and then moved southward. Canadian vessels followed the schools and the great bulk of their catches was made southward from Swiftsure bank off the Washington coast. While the total catch of the season was about equal to that of 1936, long hauls were involved.

The catches were sampled in the same manner as in previous years. The length data seem to indicate that the large year class which entered the fishery in 1931 has ceased to influence significantly the average length of the fish comprising the population.

The tagging of pilchards by the insertion of metal tags in the abdominal cavities of the fish and the recovery by means of electro-magnets placed in the meal lines of the reduction plants has been continued. Some 10,000 tags have been applied during the two seasons and over 100 have been recovered. The majority of the recoveries have naturally been from captures in Canadian waters. However, 5 were obtained from fish taken off the California coast between San Francisco and Monterey and 9 from reduction plants in Washington and Oregon. The majority, if not all of the fish in the latter cases, were caught off the Washington coast. In addition, 21 California tags were recovered in Canadian reduction plants. The results indicate rather conclusively that there is a general movement of pilchards along the coast. The success of the tagging programme has been facilitated through the co-operation of the California, Oregon and Washington authorities.