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SCIENTIFIC ARCHIVES  
PACIFIC BIOLOGICAL STATION

BIOLOGICAL BOARD OF CANADA

ANNUAL REPORT FOR

FISHERIES EXPERIMENTAL STATION (PACIFIC)

PRINCE RUPERT, B.C.

1961

BIOLOGICAL BOARD OF CANADA

ANNUAL REPORT FOR

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1931

ANNUAL REPORT OF THE FISHERIES EXPERIMENTAL STATION  
(PACIFIC) FOR THE YEAR 1931.

By H. N. Brocklesby.

Probably the most important feature of this year's developments is the increased interest shown by the industry in the work of the Biological Board. Such confidence is gratifying since it is an attitude invaluable for the successful functioning of the organization. The fishing industry of the Pacific coast is coming to realize more and more the value of careful investigation. Some idea of the growing interest in the work is obtained from the number of inquiries received from time to time. These pertain to a variety of technological subjects and are received, not only from the Pacific coast but from such distant points as Fusan, Japan; Penryn, Cornwall; Blacks Harbour, New Brunswick; San Francisco, California; and other places.

It is recognized that the present economic condition of the industry has been partly responsible for this attitude. It is also evident, however, that personal contacts made with the men in the industry have afforded an opportunity for a clearer appreciation of mutual problems. Meetings of this nature, held in the past year, have been very successful in this respect. Finally, the Progress Reports have contributed in no small way in keeping the industry well posted on the work of the Station.

As a result of these developments, a very large number of industrial problems has been presented during the past year. It is impossible to investigate each one individually, nor is it always necessary to do so. When a problem is presented to the Station for solution, the economic and fundamental aspects are first given careful consideration. It is then discussed by the scientific staff of the Station from the standpoint of chemistry, bacteriology, physics, etc. By stressing the basic principles of a problem, and by attacking it from all scientific angles, it has been found that a great number of industrial problems can be reduced to a relatively few investigations. Thus, facts brought out in one basic research may be applicable to another, although the industrial problems from which they both arose may not be closely related. As far as possible this system has been adopted during the past year and has proved very successful.

## INVESTIGATIONS

The investigations in progress at this Station may be classified as follows:-

### 1. Fresh Fish Industry.

- (a) The Control of the Bacterial Discoloration of Halibut.
- (b) Marine Bacteria and Their Relation to the Decomposition of fish.
- (c) Effect of Fresh and Salt Water upon Bacterial Numbers and Nitrate Reduction.
- (d) Temperature Changes of Fresh Fish when Stowed in the Holds of Fishing Vessels: (i) when iced, (ii) uniced.
- (e) The Bacterial Decomposition of Fresh Raw Salmon and its Prevention.

### 2. Frozen Fish Industry.

- (a) Relationship between Temperature and Cooling Coil Area, and its Effect on Dehydration.
- (b) The Improved Construction of Cold Storage Rooms.
- (c) Prevention of Bacterial Discoloration of fish in Cold Storage.
- (d) Thermal Constants of Fish Muscle, Insulating Material, etc.
- (e) The Freezing Rates of Commercial Fishes of the Pacific Coast.
- (f) The Storage Temperature of Frozen Fish.
- (g) The Chemical Study of "rusting" of frozen fatty fish.
- (h) Engineering investigation concerning the rusting of frozen fish.
- (i) The Growth of Marine Bacteria at Low Temperatures.
- (j) A Chemical and Biological Study of the Rancidity of Salmon Oil.

3. Salmon Canning Industry.

- (a) Temperature changes in Salmon during:
  - (i) storage in holds of vessels; various methods.
  - (ii) Piling on Cannery Floor.
- (b) Bacteriological Investigation correlating with (a) above.
- (c) Bacteriology of the Canned Product.
  - (i) Changes during Storage,
  - (ii) Changes after opening the can.
  - (iii) Rate of bacterial decomposition as compared with other foodstuffs.
- (d) Vitamin A and D Potency of Fresh and Canned Salmon.  
5 species, 4 localities, sea and river caught.
- (e) Variation in properties of canned salmon oils with particular reference to the relationship between the red color and vitamin A.
- (f) Chemical study of the pigment of canned salmon with particular reference to the phenomenon of "fading". (i.e. during fading)

4. Fish Oil and Meal Industry.

- (a) Refining of Pilchard, Herring, Salmon and Other Fish Oils.
- (b) The composition of pilchard oil, dog-fish liver oil and salmon oil.
- (c) The use of pilchard oil in the protective coating industry.
- (d) The use of pilchard and other fish oils as food.
  - (i) Rate of hydrogenation.
  - (ii) Effect of temperature, pressure, catalyst, etc. on properties.
  - (iii) Composition and properties of hydrogenated oils.
  - (iv) Nutritive value of hydrogenated products.
- (e) The Use of Pilchard Oil for Animal Feeding.
- (f) Industrial Utilization of Dogfish Liver Oil.

5. Net Preservation.

Bacteriological examination of rotted nets.

6. By-Products.

- (a) Fish Glue from Fish Waste.
  - (i) The Joint Strength of Fish Glue,
  - (ii) The Examination of Fish Glue,
  - (iii) The Preparation of Liquid Fish Glue by the Dialysis and Electro-dialysis of Fish Waste Liquors.
  
- (b) The A and D Vitamin Potency of Halibut Liver Oil (Biological Determination),  
The A and D Vitamin Potency of Ling Cod Liver Oil (Biological Determination),  
The A and D Vitamin Potency of Grey Cod Liver Oil (Biological Determination).
  
- (c) The Utilization of Salmon Offal.
  
- (d) The Utilization of Pilchard Reduction Plant Effluents.

7. Miscellaneous.

- (a) The Naas River Investigation.
  
- (b) The Phenol Co-efficients of Some Commercial Disinfectants,
  
- (c) The Toxic Effect of Some Fish Meals when fed to salmon fry.

PROGRESS OF INVESTIGATIONS.

The following account is a very brief summary of the investigations in progress at this Station. Included also are those planned for the coming year. The figures in brackets indicate the page number of the report dealing with the subject referred to.

Fresh Fish Industry.

Further work has been done regarding the characteristics of marine bacteria and their relation to the decomposition of Fish (5). It has been found that some which are active in decomposing fish muscle may grow at temperatures as low as  $-5^{\circ}$  C. Among these

are a number of chromogenic bacteria. The activity of these bacteria at lower temperatures is now being investigated. The practical application of the sodium chloride treatment for the control of the bacterial discoloration of halibut at sea was not carried out, since no satisfactory arrangement could be made with any member of the halibut fleet. The small boat possessed by the Station is wholly inadequate for such experiments. Further laboratory work (3) indicates that when the temperature of the brine is lowered the penetration of the salt into the skin of the fish is reduced. It is intended trying this modification on a large scale during the next season.

The relative numbers of bacteria existing in various concentrations of salt water such as occur at the mouth of a river flowing into the sea are important industrial standpoints. Such data are necessary as a basis upon which to elaborate any future work. Investigations carried out at the mouth of the Skeena River and out at sea indicate that the numbers of bacteria decrease rapidly with the increasing salinity (8).

In order to investigate the change in temperature of fresh fish when stowed in the holds of vessels special resistance thermometers have been constructed in these laboratories (46). A preliminary experiment has been done with these instruments on salmon kept under conditions



similar to that in actual practise. Both iced and un-iced samples were used. The above system was found to be satisfactory for this type of work, much of which has to be done at sea under trying conditions.

During the summer of 1929 a preliminary study was made of the bacterial decomposition of eviscerated and non-eviscerated salmon. This work is repeated and extended to include the bacteriological effect of partial sterilization, various methods of stowage and icing (6).

#### Frozen Fish Industry.

Investigations relative to the improvement of cold storage rooms have been continued with encouraging results. The over-all efficiency of the refrigeration plant is increased as the area of the cooling surface is increased whilst the dehydrating effect decreases (42). These important results are now being checked and extended to include the storage of fishery products. The "Jacketed Cold Storage Room" has been found to be very efficient in that it permits of almost constant temperature within the room but at the same time it was found that the ordinary vertical door cannot be made sufficiently air-tight to eliminate exchange of air and hence desiccation still proceeds (44). Experiments are being made with a horizontal oil-sealed hatch which, at least in experimental work, shows great improvement over the standard refrigerator door.

In connection with the engineering aspects of the preservation of fish by cold storage it is well to mention three experiments which have been commenced at this Station in order to obtain more data on the thermal properties of fish muscle and insulating material at freezing temperatures a modified "hot plate" has been constructed (48). By this device the thermal conductivities of commercial fishes of this coast will be determined as well as a variety of common insulating material. It is of importance that the optimum freezing rates and storage temperatures of the commercial fishes of this coast be known. Two series of experiments (50) (51) have been commenced with the object of furnishing such information.

As a result of the study of the growth of marine bacteria at low temperatures (5) it was decided to find the effect of the sodium chloride treatment found so efficient in the treatment of fresh fish. Five hundred pounds of halibut were treated with a 20% brine solution and kept in cold storage in the usual manner for eighteen months. At the end of that time they were examined and found to be in good condition(3). They had not lost their glaze and they showed practically no signs of yellowing on the white part of the fish. The method is decided improvement over present practise. The oxidative type of rusting which occurs around the napes and cut surfaces is not prevented by this method and further investigations are being made concerning this.

The susceptibility of fish oils to rancidity is of importance in the preservation of fish. This is emphasized in a further study of the chemical changes taking place in the oil of frozen salmon. (28). It appears that both oxidation and a reaction with a nitrogenous substance are involved in the production of "rust". Ammonia hastens the onset of "rusting" and also turns the red pigment of salmon oil to a rusty brown color. Studies of the biological and chemical rancidity of salmon oil are in progress. The activity of ammonia producing bacteria at low temperatures is also being investigated.

#### Salmon Canning Industry.

At the request of the industry preliminary experiments have been commenced on the nutritive value of canned salmon, pending the approval of a more extended program. The preliminary work involves the vitamin A and D potency of canned sockeye, and pinks each from three producing areas. (33) These are being determined on the extracted oils. The physical and chemical properties of the oils are also being found (37). Since the work may be extended to include a larger number of samples some study is being given to the colorimetric test for vitamin A as applied to salmon oils.

As indicated in the outline, the extended program for the canned salmon investigation includes bacteriological, physical and biochemical studies of salmon from the

time it is caught until the time the canned product reaches the consumer. It is realized that this is a program that will take a long time to complete. The principle of the investigation is sound, however, and it is hoped that the essentials will be approved.

#### Fish Oil and Meal Industry.

The refining of fish oils is a prerequisite to their industrial use. Decolorization is an important process in such refining. At the present time steps are being taken to have a refinery established on the Pacific Coast. Information was desired concerning the process as applied to Canadian fish oils. As a result of an investigation carried out this last summer (20) it has been found that several B. C. deposits of diatomites and bentonites can be used economically to decolorize fish oils. Furthermore, the poorer grades can be cheaply activated by a simple process. This information is of importance to the fish oil industry.

To form a basis for the industrial investigations concerning the utilization of fish oils the composition of pilchard oil has been determined. The work is completed and will soon be ready for publication.

Industrial applications of fish oils are still being investigated. The investigation regarding the use of pilchard oil in the protective coating industry is almost completed and many valuable data have been accumulated (17).

It is possible that a fish-oil, edible-shor-tening plant may be erected on the Pacific Coast in the near future. The plans for this new industry have been delayed for two reasons. First, the Government regulation necessitating the labelling of fish oil products with the words "Made from fish oil," and secondly, the fact that no reliable data were available concerning the hydrogenation of pilchard oil. Through the efforts of the Fisheries Department the regulation has been amended and the necessary information regarding the hydrogenation of pilchard is being furnished by a comprehensive series of studies in progress at this station (14). The rate of reaction and the effect of catalytic poisons which may be met with in fish oils has been determined. Information regarding the correlation of analytical constants has also been accumulated. The research is now concerned with the change in composition of the oil as hydrogenation proceeds.

The use of fish oils in animal feeding is growing tremendously. Pilchard oil has been shown to contain adequate amounts of vitamin D but is rather low in vitamin A. The fortifying of pilchard oil with an oil of high vitamin A potency may be possible (32). Several oils from commercial fishes of this coast give high values for vitamin A when tested colorimetrically.

The investigations concerning the industrial use of dog-fish liver oil are still proceeding (27). A sulphur dioxide treatment of the oil followed by long standing and subsequent steam distillation gives promise of being a method of increasing the lubricating properties of the oil.

#### By-products Industry.

(a) The investigation concerning the possibility of the manufacture of fish glue on this coast has been completed. A simple method of making fish glue from fish waste liquors has been found. Samples of liquid glue have been prepared from the waste liquor of reduction plants and subjected to chemical analysis and joint strength tests. Glues as strong as the best commercial liquid glues can be produced. Three papers have been submitted for publication and a popular bulletin is in preparation. (23) (24) (25).

(b) The properties of the oils from some miscellaneous commercial fishes have been investigated. The high content of vitamin A (determined colorimetrically) in some of these oils is of practical interest. If the results are verified by biological tests now in progress it is planned to use some of the more potent of these oils for raising the vitamin A potency of commercial pilchard oil thereby making the latter more suitable as a poultry oil (30).

(b) A bacteriological investigation is in progress concerning the utilization of the waste liquors from pulp and reduction plants as a fertilizer. A complete chemical analysis has been made and the action of the material on various types of earths is now being investigated(9).

Miscellaneous.

(a) Naas River Investigation.

The factors involved in the depositing of Naas River mud on the nets of salmon fishermen in the Naas River area have been found. The silt coming down the river is precipitated by the sea water. When the sea contains a large number of marine organisms these form a sticky binder for the silt. The fresh water kills the organisms and they become more gelatinous, gathering large amounts of silt and holding tenaciously to any object with which they come into contact. The phenomenon occurs during excessively high tides during which time the fresh river water and the sea water are rapidly mixed. The three factors are at a maximum when the phenomenon occurs. The smelter at Anxox (originally suspected of being the cause of the trouble) has been proven to be free of any responsibility in the matter (39).

(b) The Phenol Co-efficient of some Commercial Disinfectants.

Enquiries are being received concerning the efficiency of commercial disinfectants. Eleven such substances are being tested for the information of the industry (10).

Miscellaneous continued.

(c) The Station is co-operating with Dr. Feerster in investigating the cause of the death of salmon fry when fed some fish meals. Several samples of fish meals have been received and a plan of investigation drawn up. (26).

(d) Requests have been made that this Station engage in the investigation of the deterioration of fishing nets, particularly the rotting which takes place during the winter dry storage. A preliminary study of the bacterial decomposition of rotted nets is being made.

STAFF.

The following comprised the staff of the Experimental Station (Pacific) during the year 1931.

Permanent.

Director	Vacant
Assistant Bacteriologist	Dr. R. H. Bedford
Assistant Chemist (and Acting Director)	H. N. Brocklesby.
Assistant Chemist	L. F. Smith (resigned August 1931).
Assistant Chemist	O. F. Denstedt
Assistant Chemist	F. Charnley
Mechanical Engineer	O. C. Young
Scientific Assistant (in Biochemistry).	B. E. Bailey
Laboratory Assistant (In Chemistry)	P. A. Sunderland.
Laboratory Assistant in Bacteriology	G. A. Potts (appointed in November)
Laboratory Assistant in Engineering	D. A. Ross (appointed in November)



STAFF (Continued)

Accountant	J. W. Kilpatrick
Secretary	R. I. Gillies
Janitor	H. Richmond
Washwoman	Mrs. E. Peever

Temporary.

Special Investigator Naas River Problem.	Dr. W. H. Martin
Scientific Assistant in Bacteriology	P. T. Black
Scientific Assistant in Chemistry	L. P. Moore
Scientific Assistant in Engineering	J. E. Dyck.

BUILDINGS AND ACCOMMODATION.

The Station now possesses two well-equipped buildings which should provide sufficient accommodation for some years.

New Building.

The second storey of the new building was completed this spring. This building is occupied as follows.

Basement.

Refrigeration machinery and cold storage rooms.  
Engineering workshop, furnace room. Large scale equipment.

1st Floor unfinished except for engineering laboratory. Halls finished. Empty rooms used for storage purposes and miscellaneous work.

2nd Floor completed this spring. Contains:  
offices for Director, secretary and accountant. Library;  
small biochemical laboratory (not occupied), Bacteriology

Department, .consisting of an office, 2 laboratories, media room and cold room (unfinished).

Attic:- Contains janitors room, store room, and fans for fume cupboards.

Old Building.

This building now consists entirely of chemical and biochemical laboratories. These are distributed as follows:

First Floor. Furnace room and workshop; animal room; large scale equipment laboratory containing Kjeldahl apparatus, digester, extractor, centrifuge, ball mill, hydraulic press and filter presses; Biochemical laboratory; International Fisheries Commission Office.

Second Floor. 3 chemical laboratories, balance room and office, stenographer's office, dark room and library.

Attic. Store room.

It is the intention of transferring the Chemical Laboratories to the first floor of the new building but this will not be necessary for some years. There is ample room for the chemical work in the old building which is still in good repair.

### EQUIPMENT.

The transfer of the bacteriological Laboratories to the new building has necessitated the purchase of considerable new equipment. These laboratories are now well established in the new quarters. All laboratories are now well equipped. In connection with the canned salmon preliminary experiments it has been found necessary to obtain a large autoclave and small steam boiler. These were purchased locally and are proving satisfactory. Several new pieces of microscopical apparatus have also been acquired for the above investigation. Other equipment purchased has been largely to replace broken or worn stock.

### LIBRARY.

About 60 new volumes have been added to the Station library during the past year, bringing the total up to about 500 volumes. In addition, new journals have been subscribed for, 52 now being received by the Station.

A division of the library has been made between the two buildings thus relieving to a considerable extent the congestion in the library of the old building.

### CONSULTATION.

The Station has been consulted by many firms on a variety of fisheries technological subjects. This is becoming a very important part of the duties of the

Station and is very much appreciated by the Industry. When in Vancouver, members of the Staff spend a great deal of their time on this sort of work.

The Experimental Station does not undertake commercial analysis.

#### PUBLICITY.

Addresses have been given by various members of the staff before organizations both in Prince Rupert and in Vancouver. The Acting-Director has had several conferences with the Canadian Manufacturers Association, officials and technologists of several fishing companies and brokers handling fisheries products. He has also conferred with technologists and fisheries research workers of the South Pacific Coast.

The Quarterly Progress Reports, which are being published at Prince Rupert this year, have been published regularly. The mailing list for this publication is steadily growing, it now being necessary to print 1000 copies of each issue.

#### VISITORS.

During the past year the Station has had many visitors, and men connected with the fishing industry. Several representatives of the Natural Resources Depts. of the railways have been through the laboratories. The Station has been visited by clubs, among these being the local Rotary and Gyro Clubs.

REPORTS PUBLISHED BY THE STATION.

Progress Reports

- No. 7. The Control of Discolouration or Yellowing of Halibut.  
By R. H. Bedford.
- No. 7. The Large Scale Production of Fish Glue.  
By L. F. Smith.
- No. 8. The New Low Temperature Research Laboratory and Projected Refrigeration Research.  
By O. C. Young.
- No. 9. Fish Oils as Foods.  
By H. N. Brocklesby.
- No. 9. Marine Bacteria,  
By R. H. Bedford.
- No. 9. Fish Glue from Fish Waste,  
By L. F. Smith.
- No. 10. The Fifth Annual Conference.
- No. 10. The Hydrogenation of Pilchard Oil.  
By F. Charnley.
- No. 10. The Use of Pilchard Oil in Protective Coatings.
- No. 10. The Study of the Mud Deposits on the Gill Nets in the Naas River District, British Columbia.
- No. 11. The Decolorization of Fish Oils.  
By H. N. Brocklesby.
- No. 11. Investigations in Refrigeration.  
By O. C. Young.
- No. 11. The Growth of Some Marine and Other Bacteria at Low Temperatures.  
By R. H. Bedford.
- No. 11. Composition and Vitamin Potency of Oils from Canned Salmon.  
By B. E. Bailey.

CONTRIBUTIONS TO CANADIAN BIOLOGY & FISHERIES.

(Industrial Series).

- No. 1. The Nutritive Value of Marine Products.  
IV. A Note on the Vitamin A Content of  
Commercial Pilchard Oil.  
By D. B. Finn.
- No. 2. Apparatus for Drying Oil Research.  
By H. N. Brocklesby & O. F. Denstedt.

(Series A General).

- No. 18. A Deep Sea Bacteriological Water Bottle.  
By O. C. Young, D. B. Finn and R. H. Bedford.
- No. 19. The Bactericidal Effect of the Prince Rupert  
Water Bottle.  
By R. H. Bedford.

PAPERS READY FOR PUBLICATION.

Contributions to Canadian Biology and Fisheries.

(Industrial Series)

Studies in Fish Oils

- II. The Decolorization of Fish Oils.  
By H. N. Brocklesby & L. P. Moore.
- III. The Drying Properties of Pilchard Oil,  
and the Nature of the Films.  
By H. N. Brocklesby & O. F. Denstedt.

Fish Glue from Fish Waste.

- #1. The Joint Strength of Fish Glue.
- #2. The Examination of Fish Glue.
- #3. The Preparation of Liquid Fish Glue  
by the Dialysis and Electro-dialysis  
of Fish Waste Liquors.

(Series A. General).

The Control of the Bacterial Discoloration of  
Halibut.  
By Dr. R. H. Bedford.

## BULLETINS

The Study of the Mud Deposits on the Gill Nets in the Naas River District, British Columbia.

By Dr. W. H. Martin.

The Industrial Chemistry of Fish Oils.

By H. N. Brocklesby & O. F. Denstedt.

## REPORTS IN PREPARATION.

Contributions to Canadian Biology and Fisheries.

(Series C Industrial).

The Relationship between the Cooling Coil Area, Temperature of the Cooling Medium and the Dehydrating Effect in a Cold Storage Room.

By O. C. Young.

The Jacketed Cold Storage Room.

By O. C. Young.

The Thermal Conductivity of Commercial Fish of the Pacific Coast.

By O. C. Young.

## Studies in Fish Oils.

IV. The Composition of Pilchard Oil.

By H. N. Brocklesby & O. F. Denstedt.

V. The Velocity of Hydrogenation of Pilchard Oil.

VI. The Chemical Properties of Dog-fish Liver Oil.

A. Physical and Chemical Properties and Composition of the Fatty Acids.

By H. N. Brocklesby & O. F. Denstedt.

B. Examination of the Unsaponifiable Matter.

By E. G. V. Percival.

C. The Hydroxylation of Dogfish Liver Oil.

By H. N. Brocklesby & R. S. Tipson.

A Chemical Study of the Changes in the Oil of Salmon in Cold Storage. (Preliminary).

By H. N. Brocklesby.

The Comparison of the Phenol Co-efficient of Some Commercial Disinfectants.

By Dr. R. H. Bedford.

(Series A, General).

Studies on Marine Bacteria of the Northern Pacific  
Ocean:

Paper No. By Dr. R. H. Bedford.

3. A Preliminary Survey of Their Vertical Distribution and Some Physiological Properties.
4. Carbonate Production by Bacteria; Its Significance in Relation to the Precipitation of Calcium Carbonate in the Sea.
5. Oxygen tension and Growth.
6. The Decomposition of Fish Muscle.
7. Rancidity of Fish Oils.
8. A Classification.
9. The Growth of Some Marine and Other Bacteria on Fish at Low Temperatures.



BUDGET STATEMENT

ACCOUNTS	APPROPRIATION 1931-32		RE-DISTRIBUTION		EXPENDED TO NOV. 30TH.	
	DETAILS	TOTALS	DETAILS	TOTALS	DETAILS	TOTALS
1. SALARIES	25,370.00	25,370.00	23,246.29	23,246.29	16,266.29	16,266.29
2. OFFICE & ADMINISTRATION	1,150.00	1,150.00	1,183.71	1,183.71	841.35	841.35
3. BUILDINGS & UPKEEP						
(1) NEW BUILDING						
(a) Completion of Interior	8,000.00		8,000.00		7,993.60	
(b) Laboratory Furnishings	1,400.00		1,400.00		1,287.12	
(c) Shelving Library	200.00		75.00		-----	
(d) Work Shop Equipment	500.00		100.00		40.59	
(e) Janitor's Supplies						
(1) Miscellaneous	50.00		500.00		149.78	
(2) Towels & Laundry	100.00		180.00		96.53	
(f) Repairs and Maintenance	750.00		58.14		27.03	
(g) Grounds		10,100.00	61.56	10,075.00	61.56	9,656.21
(2) OLD BUILDING						
(a) Janitor's Supplies	50.00		23.15		53.96	
(b) Repairs & Maintenance						
(1) Painting Extr. of Roof	250.00		57.55		57.55	
(2) Repairs & Maintenance	50.00		100.00		74.58	
(3) Alteration to Interior		350.00	560.00	550.00	223.71	409.80
4. WATER, HEAT, LIGHT & POWER	2,010.00	2,010.00	2,235.00	2,235.00	1,868.61	1,868.61
5. BOATS						
(a) Launch for Harbour Use	1,000.00		855.00		851.40	
(b) Row Boat		1,000.00	95.00	350.00	95.00	946.40
6. LIBRARY						
(a) Acquisitions	500.00		500.00		302.85	
(b) Subscriptions	200.00	700.00	350.00	850.00	137.24	440.09
7. PUBLICATIONS						
(a) Progress Reports	100.00		175.00		162.36	
(b) Reprints	100.00	200.00	175.00	350.00	78.73	241.39
8. TRAVELLING EXPENSES	2,000.00	2,000.00	2,250.00	2,250.00	1,837.68	1,837.68
9. CONTINGENCY	1,000.00	1,000.00	1,000.00	1,000.00	673.44	673.44
Carried Forward	43,860.00	43,860.00	43,390.00	43,390.00	33,181.26	33,181.26

BUDGET STATEMENT

ACCOUNTS	APPROPRIATION 1931-32		RE-DISTRIBUTION		EXPENDED TO NOV. 30TH.	
	DETAILS	TOTALS	DETAILS	TOTALS	DETAILS	TOTALS
Brought Forward	43,360.00	43,830.00	43,360.00	43,390.00	33,181.26	33,181.26
<b>10. LABORATORY</b>						
(1) <u>CHEMICAL LABORATORIES</u>						
(a) Equipment & Apparatus	1,000.00		1,000.00		678.30	
(b) Chemicals	500.00		750.00		649.39	
(2) <u>BACTERIOLOGICAL LABS.</u>						
(a) Equipment & Apparatus	1,000.00		1,000.00		1,122.35	
(b) Chemicals and Media	340.00		140.00		55.38	
(3) <u>ENGINEERING LABS.</u>						
(a) Equipment	500.00		500.00		249.80	
(4) <u>PAK ROOM</u>						
(a) Equipment	200.00		100.00		44.05	
(5) <u>LABORATORY EXPENSE</u>		3,540.00	100.00	3,790.00	59.81	2,859.68
<b>11. INVESTIGATIONS</b>						
(1) <u>BACTERIOLOGY</u>	700.00		820.00		391.38	
(2) <u>BIOCHEMISTRY</u>	500.00		500.00		181.39	
(3) <u>GENERAL</u>			250.00		40.00	
(4) <u>OILS</u>	1,300.00		1,150.00		780.11	
(5) <u>REFRIGERATION</u>	500.00	3,000.00	500.00	3,220.00	254.65	1,357.53
<b>TOTALS</b>	<b>50,400.00</b>	<b>50,400.00</b>	<b>50,400.00</b>	<b>50,400.00</b>	<b>37,698.47</b>	<b>37,698.47</b>
<u>FURTHER ALLOTMENTS</u>						
1. <u>REFRIGERATION PLANT</u>	2,368.00	(1) 2,368.00	2,368.00	2,368.00	2,368.00	2,368.00
2. <u>INVESTIGATIONS</u>						
(1) <u>CANNED SALMON INVEST.</u>	1,600.00	(2)	1,600.00		814.27	
(2) <u>NAAS RIVER POLLUTION</u>	1,000.00	(3) 2,600.00	1,000.00	2,600.00	1,000.00	2,600.00
<b>GRAND TOTALS</b>	<b>55,368.00</b>	<b>55,368.00</b>	<b>55,368.00</b>	<b>55,368.00</b>	<b>41,880.74</b>	<b>41,880.74</b>

NOTE: (1) Refrigeration Plant not completed last year, balance paid April 1931-32.  
(2) Canned Salmon Investigation - Additional funds to be provided for this investigation.  
(3) Naas River Pollution Investigation - Funds for this investigation included in Vote "A" and accounted for by Pacific Biological Station, Nanaimo.