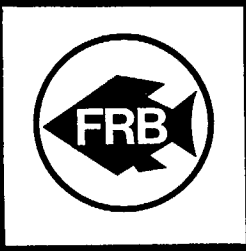


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ARCHIVES

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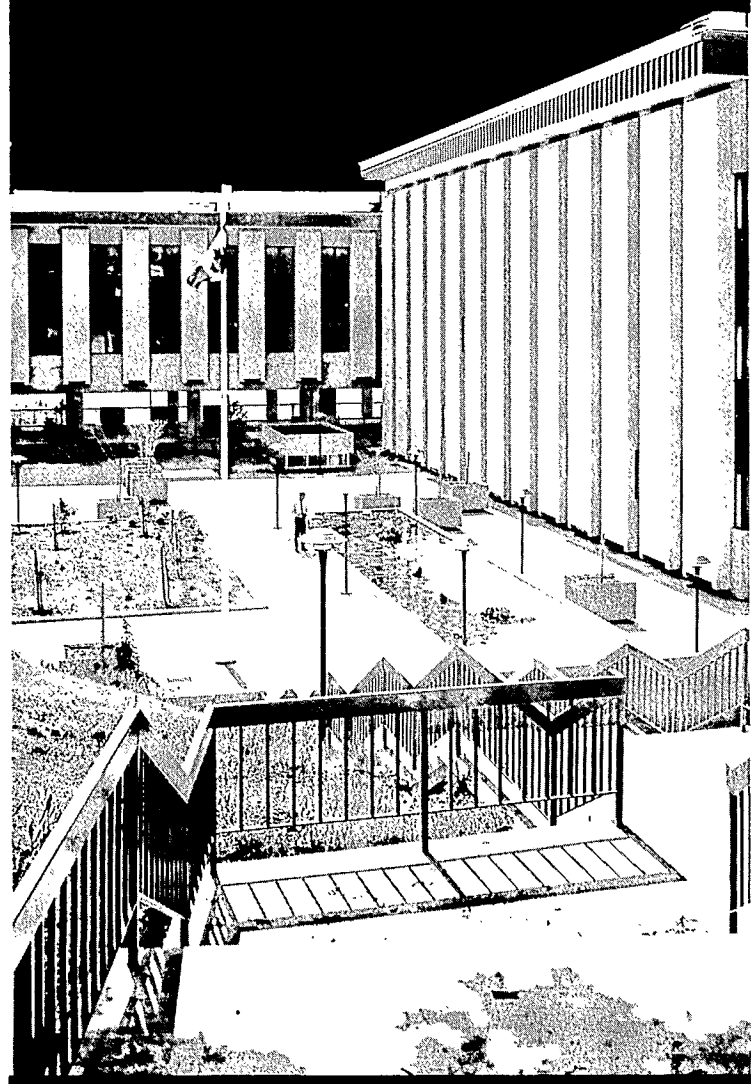


BIOLOGICAL STATION

Nanaimo British Columbia

LIBRARY
FISHERIES AND OCEANS
BIBLIOTHÈQUE
PÊCHES ET OCÉANS

*Miscellaneous
Special
Publication
No. 14/15*



FISHERIES RESEARCH BOARD OF CANADA

Edited by G. L. Robins

Nanaimo, May 1970



FISHERIES RESEARCH BOARD OF CANADA
OFFICE DES RECHERCHES SUR LES PÊCHERIES DU CANADA



BIOLOGICAL STATION
P.O. DRAWER 100
NANAIMO, B.C.

Our Biological Station is one of eight research establishments maintained by the Fisheries Research Board of Canada. The Pacific Oceanographic Group is under the administration of this Station and operates as a major investigation-programme of the Station.

Name - FISHERIES RESEARCH BOARD OF CANADA, BIOLOGICAL STATION, NANAIMO, B. C.

Location - Shore of Departure Bay near Nanaimo on the east coast of Vancouver Island approximately 30 miles due west of Vancouver, British Columbia, and 70 miles north of Victoria, British Columbia.

Year Founded - 1908.

Director - K. R. ALLEN.

Assistant Director - DR. K. S. KETCHEN.

Head of Fisheries Biology Group - S. J. WESTRHEIM.

Head of Experimental Biology and Pathology - DR. L. MARGOLIS.

Head of Environmental Research Group - DR. T. R. PARSONS.

Head of Pacific Oceanographic Group - A. J. DODIMEAD.

Size of Staff - 186 positions which include 47 Scientists, 64 Technicians, 40 Vessel Crew, 30 Administrative and Clerical, and 5 Maintenance. In addition, approximately 100 seasonals are engaged on a fixed term basis.

Objectives - To conduct fundamental and applied research of general fisheries biology and oceanography to add knowledge necessary for the development, conservation and management of commercial stocks of marine fish and invertebrates of the Canadian Pacific Coast and to meet Canada's commitments in international treaties involving Pacific Coast fishes.

Scope of Activities - Included are studies in both fresh water and the ocean of distribution, population dynamics, life history, migration behaviour, genetics, parasitism and diseases, predators, identification of stocks and physiology of salmon, herring, flounders, cod oysters, clams and crabs, shrimps, lobsters and other marine fauna. Studies are conducted on primary productivity in the sea, phytoplankton and zooplankton, artificial propagation of salmon, water pollution monitoring and control measures, fishing gear design, bio-assays of fresh and salt water and tolerance of fish to various combinations of stress factors. Oceanographic investigations are conducted of the coastal waters of British Columbia and northeast Pacific Ocean of the physical and chemical characteristics of ocean currents and water masses, seasonal changes of temperature and salinity structures, ocean weather, the vertical and horizontal distribution and changes of nutrients as they might affect the seasonal distribution and migration of fish and other aquatic life. Oceanographic studies include use of theoretical and hydraulic models, collating of data from all available sources and regular dissemination of oceanographic information in the form of charts.

Publications - The research work done at the Station is published in many national and international journals, and in our own outlets - the Journal of the Fisheries Research Board of Canada and special Bulletins. Popular expositions of our work, and its relation to fishery problems, are presented from time to time in the Department of Fisheries' monthly periodical and in various commercial journals and newspapers.

Over.....

Education - This Station does not offer academic instructional courses, but has been approved for the supervision of recipients of the National Research Council of Canada Fellowships. There is close liaison and considerable exchange of assistance with local universities.

Facilities - Chemistry, microbiology, physiology and fish meristics laboratories equipment include: Refrigerated and high velocity centrifuges, autoclaves, gas flow geiger counter; liquid scintillation counter; precision balances, carbon hydrogen analysers, Ph meters; Warburg apparatus; automatic titrator; I.R., U.V. and visible recording and Beckman DU spectrophotometers; liquid and gas chromatography; technicon auto-analysers; freeze-dryer; incubation cabinets; refrigerated and cold room facilities, auto-tissue processor; cryostat; Coulter particle counter and sizer; photo-microscopy apparatus for colour; O₂ sensors and micro-volt recorders; X-ray; fish scale press and readers; fish operating and dissecting facilities; respirometers; fish stamina tunnels.

Aquaria facilities provide for both salt and fresh water culturing of up to 500 gallons per minute. Refrigeration and heating equipment can provide up to 35 gallons per minute of precisely temperature-controlled water either fresh or salt. Dechlorinators of 150-gallon per minute capacity are provided should chlorine content of City-provided fresh water become noxious. Considerable fish holding aquaria, acclimation aquaria and fish behaviour tanks are maintained as a Station service as well as aquaria within laboratories. Water is not re-circulated for fear of disease epidemics.

There is a 200-ft. cement surface deep-sea wharf with approaches dredged to 23-ft. depth.

A moderately complete Marine Fisheries Library contains about 6,000 textbooks. At present, the Station subscribes to over 140 periodicals. Good inter-library loan exchange arrangements exist.

The Station electronic data processing centre includes an 1130 Computer, a 1627 Plotter, 1131 Printer, 1442 Card Read Punch, Alpha Numerical Key Punch, Verifier, Sorter, and an Analogue Computer. Considerable computer contracting is done with the University of British Columbia, University of Washington and I.B.M. at Vancouver and Victoria.

The Station has an underwater television unit and three types of underwater camera equipment. There is a Station master diver to provide hard-hat and scuba diving service and to train staff as required for scuba diving.

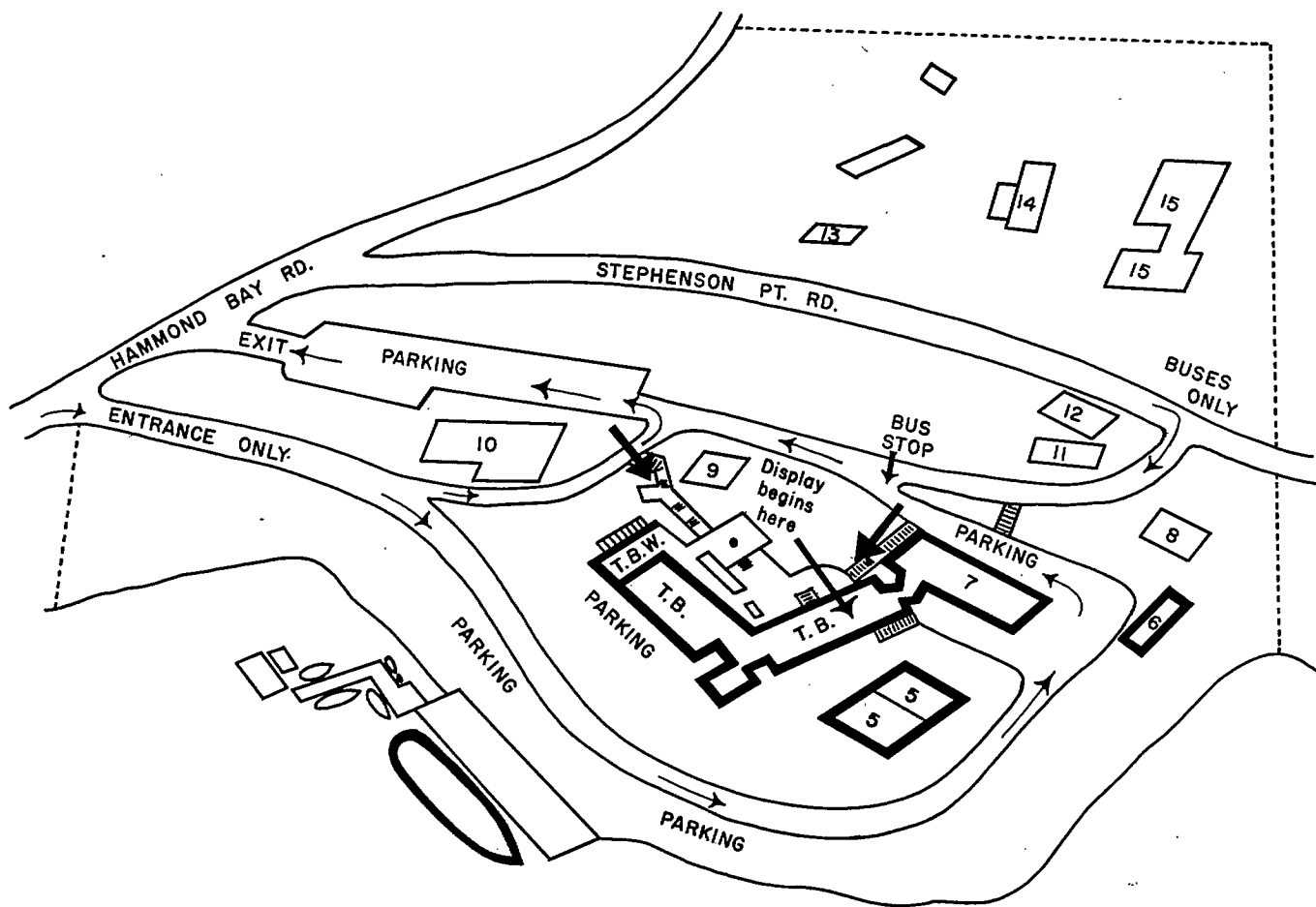
The Station operates the following major facilities:

- Nine field camps located along the Pacific Coast and along the Skeena River water system.
- A salmon hatchery and field laboratory in northern British Columbia.
- A number of large fish counting fences or weirs on various rivers and streams.
- A large pink salmon egg-collecting facility.
- A technical services building which houses well-equipped machine, carpenter and electronics shops and a photography studio.
- A gear research and net loft building.

The Station-operated vessels include:

- C.G.S. "G. B. Reed" - 177' deep-sea trawler with considerable laboratories and refrigeration equipment.
- M.V. "A. P. Knight" - 77' general-purpose fishing vessel.
- M.V. "Investigator No. 1" - 55' trawler.
- M.V. "Caligus" - 54' drum seiner.
- Four 35' aluminum hulled gillnetters and drum seiners.
- Research Barge "Velella" - 72', 14-man accommodation and laboratory barge.
- A fleet of diesel and gasoline powered inboard and outboard small craft.

In addition, we charter from 6-12 months of fishing vessel time each year. We also make use of several large government vessels of other departments at various seasons for oceanographic work.

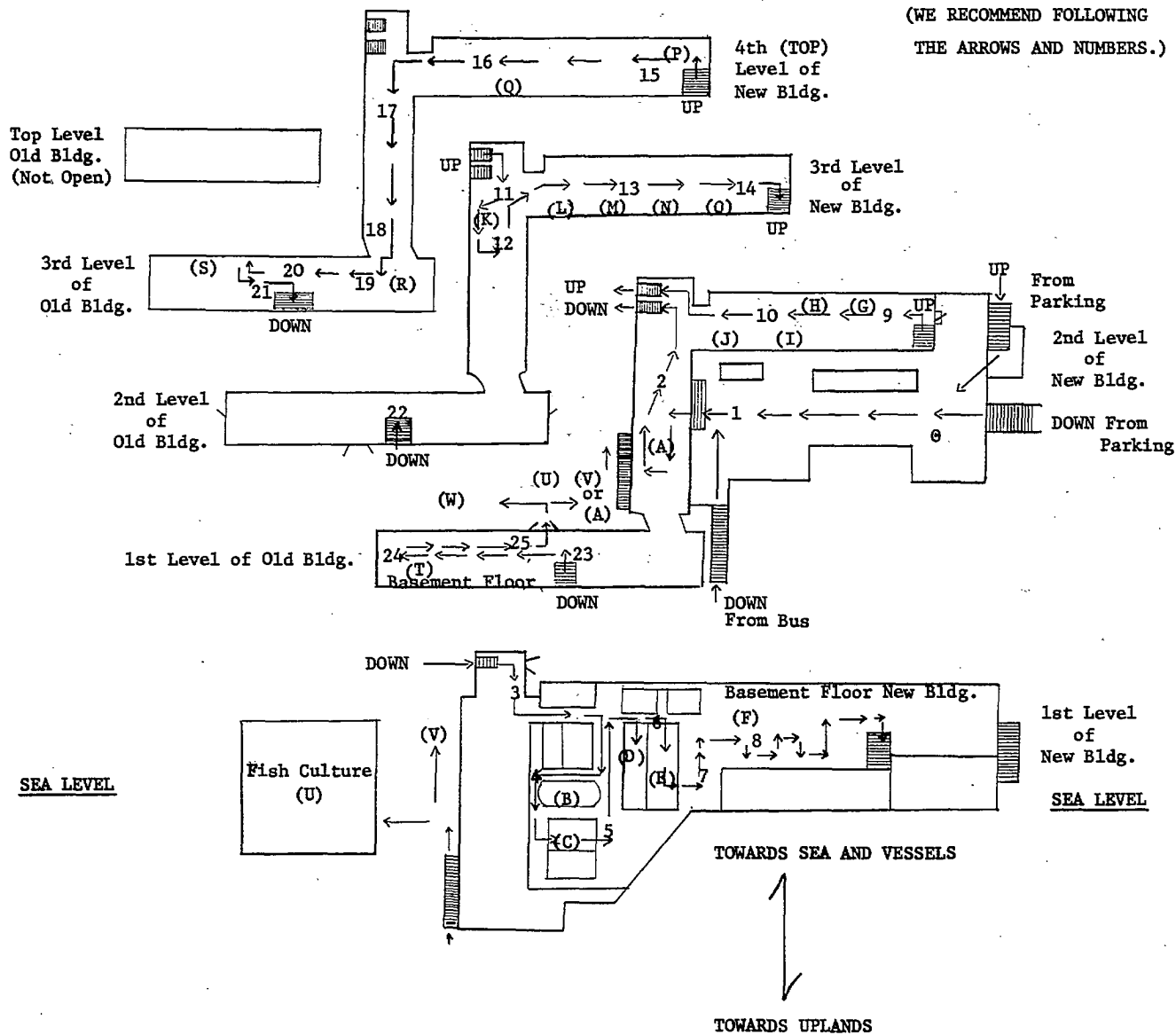


NANAIMO BIOLOGICAL STATION CAMPUS

- 5 = FISH CULTURE BUILDING
- 6 = TEA ROOM (CANTEEN)
- 7 = MAIN BUILDING
- 8 = CARETAKER'S RESIDENCE
- 9 = DIRECTOR'S OLD RESIDENCE
- 10 = ANNEX OR POG BUILDING
- 11 = OLD WAREHOUSE
- 12 = NEW WAREHOUSE
- 13 = POG WAREHOUSE
- 14 = GEAR RESEARCH BUILDING
- 15 = TECHNICAL SERVICES BUILDING
- T.B. = TAYLOR BUILDING
- T.B.W. = TAYLOR BUILDING WAREHOUSE

LOCATION OF EXHIBITS

(WE RECOMMEND FOLLOWING
THE ARROWS AND NUMBERS.)



EXHIBITS

- (A) NATIONAL AND GENERAL
- (B) LARGE POOL - PINK SALMON
- (C) RESPIROMETER & FISH PRODUCTION
- (D) SALMON BEHAVIOUR
- (E) HERRING
- (F) MARINE INVERTEBRATES
SHRIMPS & CRABS
GROUND FISH
HERRING
- (G) ENVIRONMENTAL RESEARCH
- (H) HISTOLOGY
- (I) PHYSIOLOGY
- (J) PHYSIOLOGICAL ECOLOGY
- (K) PHYSICAL OCEANOGRAPHY
- (L) GENETICS
- (M) PARASITOLOGY
- (N) SHELLFISH
- (O) PARASITOLOGY
- (P) MICROBIOLOGY
- (Q) ENVIRONMENTAL RESEARCH
- (R) SALMON MANAGEMENT
- (S) AGING OF SALMON & SOCKEYE
PRODUCTION
- (T) COMPUTER
- (U) FISH CULTURE
- (V) "G. B. REED"
- (W) FILMS (Temporary Bldg.)

NANAIMO BIOLOGICAL STATION

The Station undertakes a programme of research on
the aquatic environment and its resources

THE RESOURCE		
UNDERSTANDING	ADDING TO THE RESOURCE	IMPROVING MANAGEMENT AND HARVESTING
↓	↓	↓
Disease & Parasites	<u>Improved Culture</u>	Salmon
Physiology	Salmon	Herring
Growth & Mortality	Blackcod	Rockfish
Feeding	Oysters	Sole & Cod
Genetics	Crayfish	Crabs
Behaviour	<u>Introductions</u>	Shrimps & Prawns
Distribution	Lobsters	Oysters & Clams

* * * * *

THE ENVIRONMENT		
INCREASING PRODUCTIVITY	PROTECTING	UNDERSTANDING
↓	↓	↓
<u>Lakes</u>	<u>Pollution Control</u>	Physical Oceanography
Sockeye salmon	Pollution surveys	Biological Oceanography
<u>Streams</u>	Chemical studies	Limnology (lakes)
Coho salmon	Tolerance of animals to pollutants	Stream Ecology

ENVIRONMENTAL RESEARCH GROUP

Water covers more than 71% of the earth's surface; all life is dependent on water while for some animals it is also the environment in which they live. The Environmental Research Group is concerned with multi-discipline studies on water as a medium for the support of life in streams, lakes, estuaries and oceans, and with water quality as it affects life processes. The following specific studies are currently being undertaken by the group:

A) Oceans

(1) Study of food chains in the ocean to understand the intricate relationships which exist between organisms and to understand the consequences which occur when the environment is drastically changed, such as by pollution.

(2) Study of major current systems in the North Pacific and their effect on migratory species, especially salmon.

(3) Long-term studies of the production of the Northeastern Pacific using data collected from commercial vessels.

(4) Study of the economic value of harvesting of zooplankton as a diet or supplementary diet for the intensive culture of aquatic animals.

B) Estuaries

(1) Intensive study of the effect of pulpmill wastes on the survival of juvenile fish with special emphasis on the sub-lethal effects of pollution.

(2) Studies on the potential of estuarine environments for the culture of aquatic organisms.

C) Lakes

(1) Food chain studies of young sockeye salmon in relation to different growth rates in different lakes.

(2) Studies on the fertilization of barren lakes which act as nursery grounds of sockeye salmon.

(3) Research on the possibility of crayfish culture in small ponds and lakes.

D) Streams

(1) Intensive studies of natural streams, particularly with regard to factors which influence the growth and survival of coho salmon and trout.

(2) Study of logging practices and their effect on the stream environment.

(3) Studies of the problems of operating hatcheries for commercial species of fish.

From the above outline it is apparent that we seek to improve the utilization of marine and freshwater aquatic environments in three ways,

(1) understanding their natural state,

(2) protecting them from pollution,

(3) enhancing their production through environmental manipulations.

FISHERIES BIOLOGY GROUP

The Fisheries Biology Group conducts research into the biology of fish and shellfish of commercial or recreational importance, to provide a scientific basis for development and/or management. The Group deals with many species in a variety of environments. Principal groups of aquatic animals are the salmon, herring, groundfishes (soles, lingcod, grey cod, and rockfishes), and shellfish (clams, oysters, crabs, shrimp, and lobsters). Geographically, our activities extend throughout the freshwater and marine areas of British Columbia, and in the northeast Pacific Ocean from California to western Alaska.

More specifically, our studies are involved with resource assessment and resource enhancement. Assessment studies are concerned with determining the present state of the various fish and shellfish resources — how large, actual production, potential production, etc. This information forms the scientific basis not only for local management of each resource, but also for negotiations with other countries concerning management policies and procedures applied to fisheries resources of concern to Canada which are harvested outside our territorial limits.

Enhancement studies are aimed at artificially increasing fish and shellfish resources by such techniques as hatcheries, spawning channels, and transplantations. All of these techniques of enhancement originated from fundamental studies into the biology of the various species and are an important segment of our resource assessment program.

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EXPERIMENTAL BIOLOGY AND PATHOLOGY

Objectives of Group

To learn what affects survival and growth of important commercial and recreational fishes, what makes these fishes abundant or scarce, what makes them live where they do and what makes them migrate, and what affects their health. Having learned about these things, to use the knowledge for development and improvement of methods of producing more fish.

Objectives of Investigations within the Group

Ethology (study of ways fishes behave, reasons for them and similar subjects)

To learn what makes salmon migrate the way they do and what senses they use to find their way down to the sea and later, when they are getting ready to spawn, back to the place where they were born.

Genetics (study of inheritance)

To find out how important for survival, growth and behaviour of salmon stocks are the characters the fish inherit from their parents and the influences of their environment; to learn in what fashion the fish inherit their parents' characteristics.

Microbiology (study of bacteria and related organisms causing disease in fishes)

To understand natural defenses of fishes against diseases and learn ways of assisting them to develop resistance against diseases; to learn about diseases of important local fishes and reasons why they break out suddenly.

Parasitology (study of animals living in or on fishes)

To find out how severely wild and cultured fishes are harmed by parasites and, where possible, to devise protective measures; to use some parasites as "labels" by means of which the place of freshwater birth of salmon caught at sea can be determined (important in domestic and international management of fishes). This knowledge can be gained only by knowing the distribution and abundance of parasites, by learning what they are and how they live.

Physiological Ecology (study of relationship between the working of the fish's body and the way it lives)

To study the causes of natural mortality in the early life of marine fishes (groundfish, herring) and to learn how to predict the abundance of successive generations; to measure the ability of young salmon to cope with changes in their environment and to determine the conditions under which they can best survive.

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Experimental Biology and Pathology - 2

Physiology (study of the working of the fish's body)

To find out how much energy is used by migrating salmon, how well they utilize their food for growth and what are the effects on growth of changes in the environment; to improve methods of culture of salmon by learning about their response to temperature, salinity, light, pollutants and the quantity and quality of food.

Chemical Tags

It has been discovered recently that one can determine electronically the chemical composition of the fish (or any other organism) and that fish of the same species but living in different places are chemically distinct. We are now trying to find out if these chemical characteristics can be used as "labels" to identify the stream or rivers of birth of salmon caught at sea.

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THE PACIFIC OCEANOGRAPHIC GROUP (POG)

Man's ability to utilize the sea for many purposes, such as a supplier of food and minerals, a "sink" for industrial and human wastes, or an element in national military posture, would be woefully incomplete without a knowledge of the physical properties and processes characterizing the marine environment. The major concern of POG of the Fisheries Research Board of Canada (FRBC) is to obtain such "physical oceanographic" knowledge about the northeast Pacific Ocean out to several hundred miles from the B.C. coast; this oceanic area is of vital importance to the country. To fulfill this task, the Group carries out physical oceanographic research itself. It also provides such oceanographic "support" (with both personnel and equipment) to other investigations at the Biological Station; in addition, it routinely obtains chemical and biological data for use by these investigations.

One project of the Group is being carried out in the "Inside-Coastal" waters, and involves the determination of the complete circulation (by the measurement of surface and subsurface currents) in the Strait of Georgia. Such knowledge is vital to:

(a) An understanding of the "biology" of the Strait, with particular reference to the various life stages of the commercially-valuable fishes such as salmon and herring that spawn in, feed in, or migrate through the Strait.

(b) A knowledge of the dilution and dispersal of various pollutants introduced into the Strait. These would include sewage from the Fraser River, effluent from pulp mills, oil from vessels (released accidentally or otherwise), and (possibly) coal dust from the new coal-loading facility at Roberts Bank. This consideration is important to the health both of human and of aquatic life; the aesthetic and recreational values of the Strait are also involved. (Another study, complementary to this "anti-pollution" aspect, investigates such factors as the effect of wood and of chemical wastes on the marine environment).

A further investigation concerns the waters of the "Outside-Coastal" waters, to a distance of about 250 miles off the B.C. coast. This effort obtains chemical and biological, as well as physical, information in the area. It is vital to the complete understanding of the behaviour of valuable resident aquatic life such as groundfish, herring and lobsters.

A program of daily oceanographic "surface" observations is carried out from 17 lighthouse stations along the "Inner" and "Outer" B.C. coast. The data obtained are extremely useful as an additional aid to researchers in determining why and how significant fluctuations occur in the "coastal" fish populations.

A varied oceanographic program is also carried out at the Canadian weather ship at Station "P" (located about 900 miles from the B.C. coast), and between the weather ship and the coast. Physical, chemical and biological data are obtained. The major physical oceanographic study has several objectives which include: knowledge of both "long- and short-term" variations in the sea as an aid to the complete understanding of physical (and other)

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oceanography of the deep northeast Pacific; ascertaining the effect of these variations on climate and weather, with a view to better meteorological predictions (which will, of course, be of special significance to B.C.).

The Group also contributes by supplying oceanographic support (and aid in the development of techniques) to marine investigations "outside" of FRBC, such as those taking place in the Arctic Ocean, which are essential to various aspects of the security and profit of Canada.

Within the next year, the Group will move to a new Fisheries Research Board Station at West Vancouver to carry on its work.

* * * * *

The following illustrations are representatives of the tidepool specimens seen in our outdoor ornamental pool. All animals are characteristic of tidal waters in this area.

Drawings courtesy of Vancouver Public Aquarium.

STRIPED SEAPERCH

Embiotoca lateralis



YOUNG COPPER ROCKFISH

Sebastes caurinus



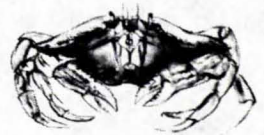
PLUMOSE ANEMONE

Metridium senile



PACIFIC EDIBLE CRAB

Cancer magister



ROCKWEED

Fucus sp.

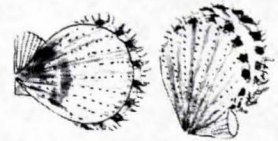


DECORATOR CRAB



SCALLOP

Pecten



STARRY FLOUNDER

Platichthys stellatus



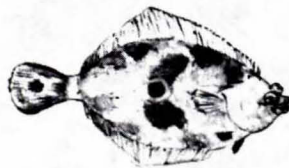
COMMON PACIFIC STARFISH

Pisaster ochraceus



C-O SOLE

Pleuronichthys coenosus



YOUNG LINGCOD

Ophiodon elongatus



ANEMONE

Tealia felina



YOUNG PACIFIC HERRING

Clupea pallasii



GREEN SEA URCHIN

Strongylocentrotus drobachiensis



GIANT KELP

Nereocystis luetkeana

