18th Annual Report of the

PACIFIC MARINE FISHERIES COMMISSION

FOR THE YEAR 1965

TO THE CONGRESS OF THE UNITED STATES AND TO THE GOVERNORS AND LEGISLATURES OF WASHINGTON, OREGON, CALIFORNIA AND IDAHO

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PACIFIC MARINE FISHERIES COMMISSION

FOR THE YEAR 1965

To the Congress of the United States and the Governors and Legislatures of the Four Compacting States, Washington, Oregon, California and Idaho, by the Commissioners of the Pacific Marine Fisheries Commission in Compliance with the State Enabling Acts Creating the Commission and Public Laws 232 and 766 of the 80th and 87th Congresses of the United States Assenting Thereto.

Respectfully submitted,

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INTRODUCTION

The broad pattern of fisheries problems coming within the purview of Pacific Marine Fisheries Commission did not deviate greatly in 1965 from the preceding year. Much attention was directed to matters which were a carry-over from 1964 and earlier.

Typical of this extension was the continued concern over the seismic and oil drilling operations off the coast of Oregon and Washington particularly. The fluctuations in the abundance of spawning runs to the various salmon producing areas of the member states has never failed to be a live issue in the Commission's program, but in 1965 disquieting observations on the Columbia River salmon and steelhead runs led to some intensified attention. Discrepancies in counts of these fish at various dams reached new highs and raised the possibility of unknown mortalities or of some defects in the enumeration procedures. The situation was considered sufficiently serious by the Pacific Salmon Inter-Agency Council to warrant the creation of a special subcommittee to study the cause and seek means of correction. The Executive Director of PMFC was assigned to provide liaison between the new ad hoc group and the existing Technical Committee of the Pacific Salmon Inter-Agency Council.

The move to develop a commercial base for a hake fishery was prosecuted vigorously by the Bureau of Commercial Fisheries and backed by the Pacific Marine Fisheries Commission within its capability. The disturbing problem arising from off-reservation salmon fishing by various Indian tribes became more acute as confrontations between'the, state agencies and the Indians multiplied, and clear-cut legal guidelines continued to be nonexistent. The conflict has expanded, but the Pacific Marine Fisheries Commission can do little except to monitor developments and to provide a forum for discussion of the conflict.

Thifing the year there was a series of important legislative proposals under consideration by Congressional committees. The Pacific Marine Fisheries Commission was more active in presenting views and recommendations on these matters than it has been in recent years. The Executive Director twice visited Washington to testify on pending bills and also participated in a joint meeting of the Atlantic States and Gulf States Marine Fisheries Commissions held in Miami, Florida.

The roster of Commissioners underwent changes arising from the replacement of George C. Starlund, as Director, Washington Department of Fisheries, by Thor C. Tollefson and the election of Dick Kink to succeed Robert L. Charette as Chairman of the Washington State Legislative Interim Fisheries Committee. Washington State law provides that both the Director and Chairman shall be ex officio members of the Commission. The death of Commissioner William O. Riley of California removed a stalwart supporter of the organization. He had been appointed to the Advisory Committee in 1955. To report his passing as a loss to the Commission is no measure of the personal bereavement felt by his associates.

ADMINISTRATION

Personnel

The following served as Commissioners during 1965:

California

William O. Riley, Eureka (deceased October 4,1965)
W. T. Shannon, Sacramento, Secretary Vincent Thomas, San Pedro

Idaho

Frank Cullen, Coeur d'Alene
Arlie Johnson, Boise
John R. Woodworth, Chairman

Oregon

John P. Amacher, Winchester
Tallant Greenough, Coquille
Leonard N. Hall, Charleston
Edward G. Huffschmidt, Portland
Herman P. Meier jurgen, Beaverton
J. Pat Metke, Bend, Second Vice-Chairman
Wayne E. Phillips, Baker
Joseph W. Smith, Klamath Falls

Washington

Robert L. Charette, Aberdeen (resigned July 30, 1965)
Dick Kink, Bellingham (appointed July 30,1965)
George C. Starlund, Olympia (resigned May 1,1965)
Thor C. Tollefson, Olympia (appointed April 28, 1965) John H. Wedin,
Seattle

The Advisory Committee, which functioned under new rules and procedures approved at the 1964 meeting (Resolution #27), consisted of the following members:

California

» Charles R. Carry, Terminal Island
Clifton D. Day, San Francisco Thomas R. Gardiner, Oakland John P. Gilchrist, San Francisco, Section Chairman Anthony Nizetich, Terminal Island Ray Welsh, Fort Bragg Charles V. Williams, Crescent City

Idaho*

William B. Durbon, Moscow, Deputy Chairman R. J. Holmes, Twin Falls, Chairman Glenn Stanger, Idaho Falls

Oregon

David B. Charlton, Portland
Charles S. Collins, Roseburg
Harold C. Gramson, Warrenton
Charles F. Henne, Winchester
J. Frank Hoagland, Astoria
Andrew J. Naterlin, Newport, Section Chairman
Arthur Paquet, Astoria

*The Advisors from the host State elect an over-all Chairman and Deputy for the Advisory Committee.

Washington

Robert E. Colwell, Seattle
Harold E. Lokken, Seattle
Charles F. Mechals, Seattle, Section Chairman
Nick Mladinich, Tacoma
Bjarne Nilsen, Westport
John N. Plancich, Anacortes
James Walganski, Bainbridge Island (resigned 1965)
Earl Engman, Tacoma (for Walganski, November 1965)

Alternates were approved for those members who were unable to attend the annual meeting. These alternates serve only during the designated meeting. The permanent staff comprised:

Leon A. Verhoeven, Executive Director Gerald L. Fisher, Treasurer Mrs. Evelyn Korn, Office Secretary
They were assisted for short periods by: M. C. James, Consultant Alphonse Kemmerich, Consultant
Temporary clerical employees were utilized as needed.

Conferences and Meetings

The inter-group relationships of the Pacific Marine Fisheries Commission call for frequent participation in conferences and meetings. In furtherance of this function, the Executive Director attended the following as a representative of the Commission:

Idaho Chapter, American Fisheries Society, annual meeting, McCall, January 8-9.

Association of Pacific Fisheries, annual convention, Seattle, January 15.

Oregon Chapter, American Fisheries Society, annual meeting, Corvallis, February 5-6.

Columbia Basin Inter-Agency Committee, Portland, March 9-

U. S. Bureau of Commercial Fisheries, meeting regarding hake, Seattle, March 10.

Senate Committee on Interior and Insular Affairs, hearings » -on "Wild Rivers System-St. Croix Waterway," S. 1446 and S. 897, respectively, Washington, D.C, April 22-23.

North American Fisheries Conference, Washington, D. C, May 1-5.

Subcommittee on Merchant Marine and Fisheries of Senate Committee on Commerce; hearings on Anadromous Fish (S. 909), Extension of Fishery Loan Program (S. 998), and Protection of Pacific Salmon of North American Origin (S. 1734), Washington, D. C, May 11-12.

Western Interstate Water Conference, Corvallis, Oregon, August 5-6.

Pacific Coast Oyster Growers Association and Pacific Coast Section of National Shellfish Association, annual meeting, Olympia, Washington. (Attended research session, August 20, only.)

International Association of Game, Fish and Conservation Commissioners and American Fisheries Society, joint annual meeting, Portland, Oregon. (Attended August 20, 23 and 24 only.)

U. S. State Department, discussion on salmon trolling, Seattle, August 21.

Atlantic States Marine Fisheries Commission and Gulf States Marine Fisheries Commission, joint meeting, Miami, Florida, October 6-8.

Washington State Interim Legislative Committee on Fisheries, Seattle, November 12.

The Executive Director has continued to serve in ex officio status on several committees such as those created within the Pacific Salmon Inter-Agency Council. He has also continued to provide liaison service between the Canadian and United States sections of international committees created to resolve questions concerning trawl fisheries and chinook and coho salmon. These duties and the performance of other coordination services in the research programs of the member agencies have led to several work conferences at the headquarters office and the distribution of data relative thereto.

Administrative and Service Activities

Two services which have become routine responsibilities are the compilation of statistics relevant to the treaty obligations imposed upon the U. S. section of the International North Pacific Fisheries Commission and the allocation and listing of fin-marks to be used by agencies engaged in Pacific salmon research. These unspectacular but time-consuming operations were accomplished with the usual ready collaboration of the State agencies and the cooperation of the U. S. Fish and Wildlife Service and the University of Washington. It is interesting to note that the listing of salmon and steelhead marks assigned to cooperating agencies totaled 44 pages and represented millions of marked fish.

Although there can be no measurement of effectiveness, it can be ventured that expression of Pacific Marine Fisheries Commission views on pending federal legislation may have been the most significant administrative action during the year. These views were presented in the form of letters and briefs as well as personal testimony by the Executive Director as ^shown under "Conferences and Meetings" preceding this section. More liberal federal appropriations for the Willamette Falls fishway and for the investigation of oyster mortalities indicate that Pacific Marine Fisheries Commission support may have had some influence. Other measures providing fish protection in the Salmon River in Idaho and the establishment of a national "Wild Rivers" system had not cleared all hurdles by the time of adjournment of the first session of the 89th Congress, but remained with others in favorable status for enactment in the second session.

The action of the Executive Committee in approving the attendance of the Executive Director at a joint meeting of the Atlantic and the Gulf States Commissions was of real though intangible benefit. Proposals for changes in national policy and attitude on fishery problems which will be of far-reaching importance are coming to a head in the Congress and their impact may be felt on all three coasts. It appears most desirable that understanding of these effects on the various fisheries be facilitated by more complete communication between the Compact agencies.

The implications of these possible changes are highlighted by the advent of Russian as well as Japanese exploratory and

research vessels along the Pacific seaboard. Developments in early 1966 demonstrated that the investigative work is the forerunner of intensive fishing especially by Russia. The shape and magnitude of problems which will harass the domestic fishing industry for several years, at least, are clearly discernible. Aside from a consolidated Annual Report for calendar years 1963 and 1964, the only formal publications issued in 1965 were the Trawl Fish and the Crab and Shrimp Sections of the Data Series. The proposed Salmon Section in this series will be canceled since the data will be reported via the Pacific Salmon Inter-Agency Council.

The Executive Committee of the Commission met in Portland on July 27 in addition to the usual session at the time of the annual meeting. Major business conducted at the July meeting included the following:

1. The Executive Director was authorized to set up the program for the 1965 meeting at Boise with some modification of the procedures previously followed.

2. A research staff proposal for a cooperative sampling program on crab, shrimp, and bottom fish at the Crescent City-Brookings area was reviewed. The Committee approved the expenditure of available funds for this work through June 30, 1966 with the understanding that its continuation thereafter would be subject to the decision of the full Commission at the annual meeting.

3. After a review of pending federal legislation, the Committee approved the endorsement of certain proposals and authorized the Executive Director to register such approval by personal testimony at hearings or by the submission of briefs. Travel for this purpose and in connection with other functions of the Commission was approved. The details are cited under "Conferences and Meetings" above.

4. In connection with authorizatpp for the Executive Director to attend an interstate water conference at Corvallis, Oregon, the Executive Committee enunciated certain principles as basic Pacific Marine Fisheries Commission policy. In view of the mounting interest in water problems, the statement seems of sufficient importance to merit inclusion here. It urged the following provisions for any water usage project:

(1) Adequate rearing and transportation water for. both resident and anadromous fishes.

(2) Temperature controls to prevent increases in water temperatures beyond the rang"e in which the valuable native fishes can thrive.

(3) Funds for protection of fish and wildlife as a part of the total project costs (both capital and operational costs).

(4) Operation plans which insure the maintenance of adequate water quality for wildlife and resident and anadromous fishes.

5. The Committee reviewed the financial status as revealed by the prospective expenditures for the fiscal year ending June 30, 1966, and their relation to the biennial budget as approved at the 1964 annual meeting. Some provisional adjustments to provide funds for the cooperative shrimp research program mentioned above were approved to take advantage of a larger surplus than had been anticipated. Details are set forth in the financial statements included in this report.

6. The Committee recommended ratification by the Commission of changes in the travel regulations. The proposal that all persons (Commissioners, Advisers, Research and Office Staff) be allowed reimbursement on a per diem basis at a rate of $20 per day for meals and lodging was modified to apply the per diem basis to travel by the research and office personnel but to defer the adoption of the $20 rate until the full Commission could act upon it at annual meeting. Other items of the current regulations were recommended for changes to conform to suggestions by the auditor for correction of technical inequities.

7. The Committee considered certain data which had been prepared by the Treasurer in response to instructions at the 1964 annual meeting. The information compared State contributions against offsetting disbursements to State sections. The general subject of the ratio of State contributions was pointed up as a matter of continuing controversy, and considerable discussion ensued. One proposal was to substitute fixed minimum percentages for the calculation of the contribution by a state without a significant commercial fishery and for the calculation of a minimum contribution by a state with a significant commercial fishery. At present, a state without a significant commercial fishery contributes a fixed $2,000, while a 1962 resolution suggests that no state with a marine fishery should contribute less than $10,000 per annum. It was argued that percentages rather than fixed sums would make all contributors sensitive to changes in the budgets. No satisfactory conclusion was reached on this proposal and the staff was instructed to prepare an example of contributions apportioned on the basis of value of only those species of fish which were common to all maritime member states rather than on the gross over-all value of fisheries in each state.

The Committee was briefed on the status of activities, programs and policies arising from the previous annual meeting. In particular, a summary of the proposals and decisions developed at the March meeting of the research staff was presented.

COMMISSION ACTION

The 18th annual meeting of the Commission marked the first departure from convening within the boundaries of the three original Compact states — Washington, Oregon and California. The 1965 conference in Boise, Idaho was recognition of the expanded area of interest which came about in consequence of the State of Idaho becoming a party to the Compact. Including official participants, 110 persons registered during the course of the meeting on November 18, 19 and 20.

While the primary purpose of the annual meetings is to arrive at conclusions and recommend actions affecting the fisheries of the Pacific Coast, other matters of internal concern require consideration. Such subjects included:

1. The following alternates for Commissioners who were unable to be present were approved:

Mr. Anthony Nizetich as alternate for Commissioner Vincent Thomas (California)

Mr. Robert W. Schoning, Director, Fish Commission of Oregon, as alternate for Commissioner Edward G. Huffschmidt (Oregon)

Mr. P. W. Schneider, Director, Oregon Game Commission, as alternate for Commissioner Joseph W. Smith (Oregon)

2. Mr. E. S. Marvich, Alaska Department of Fish and Game, was asked to report on the prospect of the State of Alaska becoming a member of the Pacific Marine Fisheries Commission. He advised that the financial stringency which had prevented adherence by Alaska previously still persists and has been intensified by the problems arising from the major earthquake of March 1964. No forecast can be made as to exactly when Alaska may be able to join, but the State has a continuing interest in the Commission and appreciates the opportunity of participating as an observer.

3. The Commission received and approved reports from the Executive Director and the Treasurer. The latter is shown in full in a subsequent section of this report. Likewise, the fishery status reports and special reports presented during the progress of the program are condensed and included herein as Appendices 1 and 2, respectively.

Mr. James C. Simpson, Research Director, Idaho Department of Fish and Game, introduced the speakers who gave the status reports.

Action on 1964 Resolutions

In the interest of conserving space, it is deemed unnecessary to list here categorically those 1964 resolutions which called merely for a distribution of policy statements to appropriate agencies or individuals. The Executive Director effected such distribution. Exception is made, however, in the case of important legislative proposals which were subject to final determination or were amended or otherwise changed.

Resolution 4, A Permanent Protection Area for Anadromous Fish Spawning in the Salmon River, Idaho: This resolution was sent to 73 addressees. Twenty replies or acknowledgments were received.

On March 8, 1965, Senator Church and others introduced S. 1446, the "Wild Rivers Act." A portion of the Salmon River upstream from the town of Riggins to the town of North Fork "and the entire Middle Fork plus portions or all of five other rivers: Clearwater, Idaho; Rogue, Oregon; Ric* Grande, New Mexico; Green, Wyoming; and Suwanee, Georgia and Florida were designated as "Wild River Areas" in which the Federal Power Commission would b*e prohibited from authorizing the construction, operation, or maintenance of any dam or other project work without the specific approval of Congress. This bill, in its original form, would not have protected the anadromous fish runs of the Salmon River, as the original description of the "Wild River Area" of the Salmon River excluded the 60 or 70 miles of river downstream from the town of Riggins to the river's confluence with the Snake.

On April 22, the Executive Director of Pacific Marine Fisheries Commission appeared before the Senate Committee on Interior and Insular Affairs and presented a brief supporting S. 1446 but urging that the "Wild River Area" of the Salmon be amended to include the area downstream from Riggins. Senator Church proposed that the "Wild River Area" for the Salmon River be amended. On September 9, 1965, Pacific Marine Fisheries Commission telegraphed Senators Church and Jordan urging the passage of S. 1446, with amendment including the Salmon River below Riggins. The Senate Committee approved the bill, amended as recommended, but postponed further action until 1966.

Resolution 9, Need for Accurate Statistics: The directors of the California Department of Fish and Game, the Oregon Fish Commission and Washington Department of Fisheries were sent copies of Resolution No. 9 and were asked to evaluate the statutes and regulations of their respective states regarding the adequacy of the statutes for the enforcement of a program to produce accurate statistics by weight and species.

Both the California and Oregon directors replied that the statutes of the respective state were adequate. The Washington Director replied that his staff was of the opinion that, because of continuous effort to improve the accuracy of statistics, current statistics were probably more accurate than those of the past. However, the Director said there were some deficiencies in Washington's regulations, and revisions to eliminate these were contemplated. Subsequently Director of Fisheries' General Order No. 640 was promulgated.

Resolution 11, Oysters — Causes of Mortalities: This resolution, on January 29, 1965, was sent to all members of the congressional delegations from California, Oregon and Washington. Subsequently, a proposal for a cooperative study of oyster mortalities by federal and Pacific Coast state fishery agencies and universities was sent to key members of Congress. The proposal asked that $250,000 be included in the Bureau of Commercial Fisheries' budget for fiscal year 1966 for the cooperative study.

Senator Magnuson prevailed upon the Committee to insert $250,000 in the budget for this purpose. However, the joint conference committee of the House and Senate reduced the amount to $150,000.

Under the leadership of the North Pacific Region, Bureau of Commercial Fisheries, a steering committee of representatives from state, university and federal agencies and the Pacific Oyster Growers Association was established and a cooperative study financed primarily by the $150,000 appropriation was initiated.

Resolution 12, Public Law 88-309: Copies of this resolution were sent to members of the congressional delegations of Alaska, California, Idaho, Oregon, and Washington and also to the Chairmen of the House and Senate Appropriations Committees. The transmittal letter urged that funds for the "Commercial Fisheries Research and Development Act of 1964" be provided in a supplemental appropriation for fiscal 1965 and that the full appropriation of $5,000,000 be provided in the budget for fiscal 1966.

Subsequently, the Bureau of the Budget refused to permit the Bureau of Commercial Fisheries to ask for funds for this purpose in the supplemental budget for fiscal 1965 and only permitted a request for $2,000,000 in the budget for fiscal 1966. Congress, however, included $4,100,000 in the 1966 budget which the President signed into law.

The Legislatures of California, Idaho and Oregon appropriated sufficient funds to match the federal allocations to the respective states, but the Washington Legislature did not. California, Idaho and Oregon submitted projects to the Bureau of Commercial Fisheries for participation in the "Commercial Fisheries Research and Development Act." Some of these projects have received final approval.

Resolution 15, Fisheries Cabinet Position: This resolution, plus an appropriate transmittal letter, was sent to the President of the United States, the Chairman of the House Committee on Merchant Marine and Fisheries, and to members of the congressional delegations from Alaska, California, Idaho, Oregon and Washington.

Senator Magnuson, on April 13, 1965, introduced S. 1778 which would create a sub-cabinet position for fisheries. The bill would also abolish the U. S. Fish and Wildlife Service and would replace it with a Commercial Fisheries Service and a Sport Fisheries and Wildlife Service.

More recently, Senator Muskie and others introduced S. 2251, the "Marine and Atmospheric Affairs Act of 1965." This bill would abolish the Fish and Wildlife Service and would place fisheries within a mammoth super agency.

Resolution 17, Shrimp Research: It was the initial intention to have this research done by Oregon State University, but it subsequently developed that the University was unable to undertake the research. The California Department of Fish and Game offered to undertake the research for Pacific Marine Fisheries Commission at a maximum cost of $3,000 as part of the Fish and Game Department's over-all shrimp program. Pacific Marine Fisheries Commission's Research Staff recommended this change, and the Executive Committee approved the transfer of the research to the California Department of Fish and Game. (See Appendix 3—Cooperative Research for report.)

Resolution 26, Regarding International North Pacific Treaty: This resolution was sent to the Secretary of State; the Secretary of the Interior; the Governors of Alaska, California, Idaho, Oregon and Washington; Chairman Magnuson and the ranking member of the Senate Committee on Commerce; Chairman Bonner of the House Committee on Merchant Marine and Fisheries; all members of the congressional delegations from Alaska, California, Idaho, Oregon and Washington, and the Commissioner of the Fish and Wildlife Service. Senators Magnuson and Bartlett introduced S. 1734 "to conserve and protect Pacific Salmon of North American origin." Congressmen Meeds, Pelly and Wyatt each introduced bills (H.R! 7f87, 7269 and 7661, respectively) in the House of Representatives similar to-S. 1734. On May 11 and 12, 1965, the Subcommittee on Merchant Marine and Fisheries of the Senate Committee on Commerce held ^hearings on S. 1734 and two other bills. The Executive Director delivered in person a written statement supporting S. 1734. Other persons, some of whom are affiliated with Pacific Marine Fisheries Commission, also spoke in favor of the bill, but on behalf of other organizations.

On May 19 the Senate passed S. 1734 with amendments, but the House Committee on Ways and Means refused to act on the bill.

Subsequently, the 1965 red salmon run was a near record and the Japanese and others who oppose this legislation have been pointing to the run as evidence that high seas fishing has ^^ not been depleting the Bristol Bay stocks. However, extra- ^ft ordinary runs occurred in only 2 of 10 Bristol Bay rivers and ^^ the continuation of high seas fishing for salmon will continue to make the conservation of Bristol Bay salmon stocks extremely difficult.

American leaders of the North Pacific fishing industry met in Juneau, Alaska in November to weld a position for future fisheries negotiations with Japan that is compatible with both the foreign-policy of the United States and the needs of the fishing industry.

Resolution 9 from 1963, Indian Affairs: This resolution, as in the previous year, was again sent to members of the congressional delegations from Alaska, California, Idaho, Oregon and Washington, and to the Secretary of the Interior.

During the year, off-reservation fishing by Indians became increasingly serious as the result of: clashes between enforcement officers and Indians in Washington; the greatly increased fishing effort by Indians on the Columbia River; and poor runs of spring and summer races of Columbia River chinook salmon, especially the summer races.

The Department of Interior has proposed federal regulation of off-reservation fishing, but the States of Idaho, Oregon and Washington have objected to this proposal as an usurpation of their rights to manage their own fisheries. Presently, the States are hoping to confirm in court their rights to regulate off-reservation fishing either on the basis of cases now pending or the introduction of new cases.

New Resolutions

The extensive pre-meeting preparations, including the provision of secretarial assistance to the Advisory Committee, facilitated a careful screening of the many recommendations and resolutions which emanated from the diverse fishery interests of the Pacific Coast. Simultaneously, the Research Staff reviewed the proposals, with the result that the Commission had available the views of the Advisers and Researchers before it acted upon the pending resolutions at the final business meeting.

Twenty-four proposed resolutions were received prior to or during the meeting. Of these, five were rejected or tabled because of late submission, improper form, or question as to the competence of the Pacific Marine Fisheries Commission to act upon the subject matter. Others were amended during the screening by the Advisers. The following 19 resolutions are cited verbatim as they were approved on November 20, with the exception of Resolution # 1 which is quoted only from its initial paragraph which defines its purpose. The remaining subject matter, amounting to three pages merely spells out the justification, operating costs and procedures. **1. Port Sampler in Crescent City-Brookings-Port Orford Area to Collect Crab, Shrimp and Bottomfish Data — Cooperative Research**

It is proposed that Pacific Marine Fisheries Commission furnish manpower in the ports of Crescent City, Port Orford, and Brookings on a year around basis to monitor and sample landings on crab, shrimp, and bottomfish and collect and analyze life history data. The data and observations are necessary to determine changes in population size, age composition, or stock status, which is a prerequisite to proper management of these resources. ***3. Executive Committee's Term of Office**

WHEREAS, it has been customary for the official terms of the Executive Committee to expire on December 31 and for

*Some numbers such as 2 will be missing because the proposals assigned those numbers were not approved.

the newly elected Executive Officers to assume office on January 1 even though they may have been elected two or more months previously, and

WHEREAS, this interval between election and assumption of office does not appear to serve any useful purpose and does, in fact, lead to confusion regarding the correct Executive Officers during the interim,

NOW, THEREFORE, BE IT RESOLVED, That henceforth the newly elected Executive Officers shall take office immediately following their election at the Annual Meeting of the Pacific Marine Fisheries Commission and they shall continue to serve until the next election at the following Annual Meeting.

4. Water Diversion

WHEREAS, the subject of water diversion among the Pacific Coast States is a live and developing one at the present time, and

WHEREAS, water diversion could have a detrimental effect on the fish stocks of the States concerned, and

WHEREAS, this problem is of vital concern to the Pacific Marine Fisheries Commission,

BE IT THEREFORE RESOLVED, that the Pacific Marine Fisheries Commission publicly expresses its interest in this problem, and

BE IT FURTHER RESOLVED, that State and Federal Agencies involved in the discussion, promotion, planning or construction of projects involving interstate water diversion among or from the member states of the Pacific Marine Fisheries Commission be advised of the interest of the member states of the Pacific Marine Fisheries Commission and be requested to give the Pacific Marine Fisheries Commission an opportunity to participate in all meetings and conferences at which such water diversion is considered, and

BE IT FURTHER RESOLVED, that the Pacific Marine Fisheries Commission advise all known promoters of water diversion projects that fish and wildlife are beneficial water users and that the following provisions should be included in all water usage projects: __ *

1. Adequate rearing and transportation water for both resident and anadromous fishes.
2. Temperature controls to prevent changes in water tem peratures beyond the range in which valuable native fish cannot thrive.
3. Funds for protection of fish and wildlife as a part of the total project costs (both capital and operational costs).
4. Operation plans which insure the maintenance of ade quate water quality for wildlife and resident and anad romous fishes.

5. Hake Fishery

WHEREAS, an abundance of hake sufficent to support a substantial fishery is known to exist off the coasts of California, Oregon, and Washington, and

WHEREAS, proper utilization of the hake fishery will require coordinated research and management in order to achieve maximum sustainable yield, and

WHEREAS, several agencies and laboratories already have begun research programs, including an exploratory project on the hake fishery by the Bureau of Commercial Fisheries.

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission recommend to the respective states and to the Bureau of Commercial Fisheries that they initiate or increase their investigation and research on hake; to wit, sea surveys, exploratory fishing and gear technology, and

BE IT FURTHER RESOLVED, that the staff of Pacific Marine Fisheries Commission establish a program to coordinate the progress of such surveys.

7. Losses of Anadromous Fish

WHEREAS, there is an unaccounted for loss of adult salmon and steelhead between each of the dams on the Columbia River system, and

WHEREAS, these losses have reached a number of such proportion that the future of the anadromous fishery resources may be endangered, and

WHEREAS, the causes of these losses are unknown,

NOW, THEREFORE, BE IT RESOLVED, that the State fishery agencies, and appropriate Federal agencies, immediately undertake a research program to determine the causes for these losses and to make proposals for correction of the problem, and

BE IT FURTHER RESOLVED, that the appropriate State and Federal agencies make funds available to pay the cost of the research program.

8. Wild Rivers legislation

WHEREAS, there are rivers in the United States which possess unique water conservation, fish, wildlife, scenic, and outdoor recreation values of present and potential benefit to the American people, and

WHEREAS, there is a need to retain access to these rivers for the American people, and

WHEREAS, there are some free-flowing rivers in the United States, and

.WHEREAS, there is a need to preserve selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes, and

WHEREAS, the Salmon River and the Middle Fork of the Clearwater River fall in the category for "Wild Rivers," and

WHEREAS, the Salmon River is one of the major salmon spawning streams of the Columbia River system, and

WHEREAS, both the Salmon and Clearwater Rivers are major producers of steelhead in the Columbia River system, **and**

WHEREAS, it is necessary that these rivers be maintained in their free-flowing state to preserve these resources,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission recommends to the Second Session of the Eighty-ninth Congress that Senate Bill 1446 be passed, and

BE IT FURTHER RESOLVED, that the Salmon and Clearwater Rivers remain on the active list of rivers to be included in the "Wild Rivers System" and that these rivers not be placed on a list of study rivers for inclusion at a later date if approved by the study committee, and

BE IT FURTHER RESOLVED, that the Klamath River be included in the list of streams to be subsequently considered as "Wild Rivers," and

BE IT FURTHER RESOLVED, that copies of this resolution be sent to all members of the Pacific Coast Congressional Delegations including the Delegation from Idaho and to all members of the Senate Committee on Interior and Insular Affairs and to the Governors of Idaho, Oregon, Washington, and California.

9. Willamette Falls Fishway

WHEREAS, the installation of an efficient upstream passage facility over Willamette Falls on the Willamette River at Oregon City, Oregon, has long been considered as one of the most important potential improvements for salmon and steelhead in the entire Columbia River Basin, and

WHEREAS, the need for developing the underutilized potential for production of salmon and steelhead in the Willamette River system is becoming more and more urgent because additional dams are or soon will be completed elsewhere in the Columbia River system which will further reduce the already drastically decreased habitat available for anadromous fish production and will cause additional passage problems and associated losses, and

WHEREAS, the proposed fishway over Willamette Falls will improve the economies of the states of Oregon and Washington by increasing the annual escapement of adult salmon and steelhead by an estimated 240,000 fish which will produce a catch in all fisheries combined with an estimated value of nearly $4,000,000 annually, and

WHEREAS, this project was initiated under and funds for design were provided through the federally-financed Columbia River Fishery Development Program administered by the Bureau of Commercial Fisheries, and

WHEREAS, the construction of this facility represents an excellent example of state, federal, and private industry cooperation wherein private industry will contribute about 16 per cent of the total construction cost now estimated at over $2,300,000 and it is anticipated that the remainder of the needed funds will be provided by the Bureau of Commercial Fisheries through the Columbia River Fishery Development Program, and

WHEREAS, the sum of $600,000 was appropriated by Congress in fiscal 1966 for this project and, although no acceptable bids were received for the initial bidding, it is anticipated that reasonable bids will be forthcoming and construction of the first portion of the facility may commence in the spring of 1966, and

WHEREAS, the federal appropriation of an additional $1,500,000 in fiscal 1967 is essential to permit completion of this urgently needed facility, and

WHEREAS, the Pacific Marine Fisheries Commission, an interstate compact commission created by the Legislatures of California, Idaho, Oregon, and Washington and assented thereto by the Congress of the United States and charged with the conservation and enhancement of the fisheries of these states, believes it is essential that the needed funds be provided in the 1967 fiscal year in order to obtain the maximum benefits from the unutilized potential for production of salmon and steelhead in the Willamette River system and from funds already expended in planning this project, and

WHEREAS, the returning adults from the large numbers of juvenile salmon that were transplanted to areas above Willamette Falls in anticipation of completion of the new facility will require the proposed fishway to pass above the combined natural and man-made obstruction,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission does hereby respectfully petition the Secretary of the Interior, the Director of the Bureau of the Budget, and the Congress of the United States, and particularly the Appropriations Committees of the United States Senate and the United States House of Representatives, to assure that the necessary funds are provided in fiscal year 1967 so that completion of the final portion of the urgently needed Willamette Falls Fishway at Oregon City, Oregon, may be accomplished at the earliest possible moment.

The Executive Director of the Pacific Marine Fisheries Commission shall transmit copies of this petition to the Secretary of the Interior, the Director of the Bureau of the Budget, to the members of the Congressional Delegations of the States of California, Idaho, Oregon, and Washington, the chairmen of the Appropriations Committees, the Commissioner of the Fish and Wildlife Service, U. S. Department of the Interior, and the Governors of member states.

TO. Report of Actions Taken on Last Year's Resolutions

RESOLVED, that the Executive Director of the Pacific Marine Fisheries Commission shall submit to the advisers of the several member states a written report on the accomplishments and/or actions taken on the recommendations adopted by the Commission at its previous meeting.

12. Urge Alaska to Join Compact

WHEREAS, the State of Alaska, under the leadership of Governor Egan, has an outstanding fishery administration, and

WHEREAS, the problems of many of the fishery resources of Alaska are common to those of the present members of Pacific Marine Fisheries Commission, and

WHEREAS, all these states would benefit by the experience of Alaska in the consideration and solution of fishery problems,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission re-extend an invitation to Governor Egan and the State of Alaska to affiliate with the Pacific Marine Fisheries Commission.

13. Oyster Drills and Oyster Seed Hatchery

WHEREAS, mortalities of both Pacific and native oysters due directly to the predation of oyster drills have amounted to hundreds of thousands of dollars annually, and

WHEREAS, these predations have in some areas seriously limited culture or caused abandonment of productive Pacific and native oyster beds, and

WHEREAS, the Pacific Oyster industry has been almost entirely dependent on oyster seed from Japan, and

WHEREAS, an adequate supply of such seed is no longer guaranteed,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission endorse the efforts of the Pacific

Coast oyster industry in securing allocation of funds for State research on:

1. Laboratory and field research for control of oyster drills.
2. The development at the earliest possible date of pro cedures that can be used by the oyster industry to successfully operate commercial oyster seed hatcheries.

15. To the Memory of Commissioner William O. Riley

WHEREAS, upon the passing away of California's Commissioner William O. Riley on October 4, 1965, the Pacific Marine Fisheries Commission and the entire seafood industry lost a devoted friend and worker, and

WHEREAS, this kind and warm man served the Pacific Marine Fisheries Commission with the same devotion, quiet dedication, strong convictions and infinite understanding that he gave to promote better understanding and appreciation of the fishery resources in the State of California,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission, in regular session on the 20th day of November, 1965, in Boise, Idaho, hold a moment of silence in William O. Riley's memory, and that the Executive Director of the Pacific Marine Fisheries Commission be instructed to convey an appreciation of Bill's services to Mrs. Riley and her family.

16. Amending the Columbia River Compact to Include the State of Idaho and Designating the Regulatory Agencies Under the Amended Compact

WHEREAS, the States Washington and Oregon are parties to the Columbia River Compact, authorized by the U. S. Congress, under which they are charged with the joint regulation, protection and preservation of fish in the waters of the Columbia River and its tributaries within the confines of the States of Oregon and Washington where, such waters are state boundaries, and

WHEREAS, the Snake River which forms a part of the common boundary between the State of Idaho and the States of Oregon and Washington, and over whose waters the said States are deemed to have current jurisdiction where such waterj are state boundaries, is a major tributary of the Colum bia River, and . ,

WHEREAS, the Snake River, together with its tributaries, the Salmon River and the Clearwater River which lie wholly within the State of Idaho, are major producers of salmon and steelhead trout in the Columbia River system, and

WHEREAS, it is now apparent that proper utilization, regulation, protection, and preservation of the anadromous fishery resources of the Columbia River system would be enhanced by the State of Idaho participating with the States of Oregon and Washington in the regulation, protection and preservation of the fishery resources of joint interest to the three States,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission does hereby recommend to all appropriate agencies of the three States that steps be initiated to secure the participation on an equitable basis by the State of Idaho with Oregon and Washington in the management of fishery resources of common concern to the three States either by participation in the Columbia River Compact or other appropriate means.

(Prior to the adoption of this resolution, the following statement was read into the record.)

Statement on Resolution 16

Although Oregon votes yes, it wishes to call attention to the complexities involved in the implementation of the resolution. It is agreed that there is considerable merit in each of the States of Idaho, Oregon and Washington having regulatory authority over stocks of anadromous fish of mutual interest in the Columbia River system,

There is little doubt that the runs involved are of great importance. In 1965, in the general neighborhood of 2,000,000 salmon and steelhead entered the Columbia River, of which somewhat less than 300,000 were destined for Idaho streams.

The resolution suggests that the Columbia River Compact be amended to include Idaho. There are several inherent difficulties with this specific proposal, notwithstanding the desirable principle involved. The present compact regulates only the commercial fisheries of the lower Columbia River between Washington and Oregon. If Idaho were included in a compact encompassing the entire Columbia River drainage, all fisheries within the system should logically be included. This would give Washington and Oregon a voice regulating sport fisheries in the Columbia River system wholly within Idaho. It would also give Idaho similar authority over fisheries of the Columbia solely within Washington and Oregon. It is conceivable that two states could prevent the third from enacting what it considers to be desirable regulations on the sport or commercial fisheries wholly within that state. Commercial and sport fisheries on lower Columbia River hatchery stocks of coho and fall chinook salmon, sport fishing on the Willamette and Cowlitz River spring chinook, and sport fishing on young and adult chinook and steelhead in the Salmon and Clearwater Rivers would be subject to tri-state regulation.

Because of the far-reaching legal and biological implications involved in this proposed action, Oregon feels additional study is necessary to implement an acceptable solution. In this Oregon pledges its active support, including seeking the guidance and counsel of all concerned.

Fish Commission of Oregon and Oregon Game Commission, November 20, 1965.

17. Power Dam Moratorium

WHEREAS, during the annual meeting held in 1963 the Pacific Marine Fisheries Commission adopted a resolution on a power dam moratorium,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission in session at Boise, Idaho, does hereby reaffirm the position stated by the Commission in Resolution No. 8, titled "Power Dam Moratorium."

The text of Resolution No. 8 from 1963 was as follows:

WHEREAS, the creation of an atomic energy reactor at Idaho Falls, Idaho, for the production of electrical energy has demonstrated that atomic power is economically attractive with hydro-electrical energy, and

WHEREAS, these facts were released nationally November 11, 1963 by the Atomic Energy Commission, and

WHEREAS, the building of power dams has proven to be detrimental to anadromous fish runs of the major spawning rivers of the Pacific Coast, and

WHEREAS, many such dams are presently being considered primarily for electrical power,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission in session at Portland, Oregon, on November 15, 1963, does hereby oppose the creation of any new dams primarily for the production of electrical power that will cause further damage to anadromous fish and urges the Federal Power Commission to declare a moratorium on all such proposals immediately and urges the Federal Power Commission to expedite the creation of adequate nuclear reactors to meet the electrical needs of the nation, and

IT IS HEREBY DIRECTED, that copies of this resolution be sent to the President of the United States, Secretary of the Interior, the Chairman of the Federal Power Commission, all national and state congressional delegations of these compact States.

This Resolution was also reaffirmed at the 1964 Annual Meeting.

18. Delta Facilities of the California Water Plan

WHEREAS, during the annual meeting held in 1964, the Pacific Marine Fisheries Commission adopted a resolution on Delta facilities,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission in session at Boise, Idaho, does hereby reaffirm the position stated by the Commission in Resolution No. 20, titled "Delta Facilities of the California Water Plan."

The text of Resolution No. 20 from 1964 was as follows:

WHEREAS, the State of California and the Federal Government will construct engineering facilities *in the Sacramento-San Joaquin Delta to carry out the California Water program and to further develop the Central Valley Project, and

WHEREAS, the king salmon resources of the Central Valley of California must pass successfully through the Sacramento-San Joaquin Delta, and

WHEREAS, man's activities have already done considerable damage to the salmon resources, and there is great need to protect and rebuild these resources, and

WHEREAS, these king salmon runs are of major importance to the salmon fisheries in the ocean off California and also contribute to ocean fisheries off Oregon and Washington, and

WHEREAS, the Peripheral Canal plan is the only known engineering plan which will protect existing king salmon resources passing through the Sacramento-San Joaquin Delta and provide opportunities for passage through the delta of increased king salmon runs thereby enhancing said salmon runs, and

WHEREAS, existing conditions in the delta are detrimental to the San Joaquin River salmon runs,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission fully support the selection of the Peripheral Canal Plan by the California Department of Water Resources and the United States Bureau of Reclamation and Army Corps of Engineers and request that construction of this project be completed at the earliest possible time to protect and enhance the salmon resource of the Central Valley of California, and

BE IT FURTHER RESOLVED, that copies of this resolution be forwarded to: California Water Commission, Resources Agency of California, California Department of "Water Resources, California Department of Fish and Game, United States Bureau of Reclamation, U. S. Army Corps of Engineers, California Assembly Fish and Game Committee, California Senate Natural Resources Committee, all members of California State Legislature, and appropriate members of Congress.

20. Seismic Operations

WHEREAS, during the annual meeting held in 1964, the Pacific Marine Fisheries Commission adopted a resolution on seismic operations,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission in session at Boise, Idaho, does hereby reaffirm the position stated by the Commission in Resolution No. 16, titled "Seismic Operations."

The text of Resolution No. 16 of 1964 was as follows:

WHEREAS, this Commission recognizes the need for additional information on the effect on fish and fisheries of blasting as used in seismic methods for studying the geology of an area, and

WHEREAS, this Commission resolved at the 1963 meeting to establish a comprehensive study of the effects of all types of explosives on marine life, and

WHEREAS, the Washington Advisory Committee has deemed it necessary to explore methods of funding this program,

NOW, THEREFORE, BE IT RESOLVED, that the PMFC at its Annual Meeting in San Francisco initiate a positive program designed to produce the funds necessary for continuing research on the effects of seismic exploration in the waters of the Pacific Ocean and to define "clean practices" in the event drilling for oil is undertaken.

21. Oil Drilling Practices

WHEREAS, drilling for oil is being conducted in areas that have been good fishing grounds for years, and

WHEREAS, there have been many complaints from fishermen that gear has been lost or damaged by obstructions remaining on the bottom after oil drilling operations, and

WHEREAS, there have been no realistic studies made of abandoned or capped wells on the ocean floor,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission recommends:

1. That upon completion and capping of a well where it is necessary for an obstruction to be left, that suitable buoys be placed to mark the well.
2. That abandoned wells have all obstructions removed to a level three feet below the original ground level before the start of drilling.
3. That no debris capable of destroying or damaging fish ing gear be discarded on the ocean bottom.
4. That all possible precautions be taken to prevent seep age of harmful liquids from the exploration.

BE IT FURTHER RESOLVED, that a system for inspection be established, and

BE IT FINALLY RESOLVED, that the Pacific Marine Fisheries Commission notify the Bureau of Land Management of this action and, also, any other agencies it may deem pertinent to this subject.

22. Iron Canyon Dam, Sacramento River

WHEREAS, during the annual meeting held in 1963, the Pacific Marine Fisheries Commission adopted a resolution in opposition to the proposed Iron Canyon Dam, Sacramento River,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission, in session in Boise, Idaho, does hereby reaffirm the position stated by the Commission in Resolution No. 19, titled "Iron Canyon Dam, Sacramento River."

The text of Resolution No. 19 from 1963 was as follows:

WHEREAS, the Pacific Marine Fisheries Commission, an interstate compact organization created by the Legislatures of California, Oregon, Washington and Idaho and approved by the Congress of the United States, has considered the aspects of both the U. S. Army Engineers' Iron Canyon project and its alternatives, the Bureau of Reclamation's Sacramento River tributary dam system in resolutions #2 and #3 of 1961 and again in 1962, and

WHEREAS, no evidence has since been presented showing that the Iron Canyon project would not irreparably damage the anadromous fish runs of the Sacramento River, while on the other hand the tributary dam system would aid the fish runs, provide flood control, contribute to the overall water supply and enhance recreational values,

NOW, THEREFORE, BE IT RESOLVED, that the Pacific Marine Fisheries Commission assembled-in Portland, Oregon, this 15th day of November, 1963, reaffirms its opposition to the Iron Canyon Project and urges the adoption of the tributary system outside the areas shown on the map by E. P. Hughes dated December 7, 1961, and

BE IT FURTHER RESOLVED, that the Executive Director qf the Pacific Marine Fisheries so inform all Senators and Congressmen of California, Oregon, Washington and Jdaho, and also the Bureau of Retlamation, the U. S. Army Engineers, the Federal Power Commission, the Bureau of Outdoor Recreation, the Department of Agriculture, and all other interested parties of the intent of this resolution.

23. Commendation of News Media

WHEREAS, one of the problems of the Pacific Marine Fisheries Commission is the dissemination of information in regard to its activities, and

WHEREAS, at the current meeting of the Pacific Marine Fisheries Commission at Boise on November 16 to 20, the television stations, radio and press have been most helpful and cooperative in publicizing the proceedings of the Pacific Marine Fisheries Commission,

BE IT THEREFORE RESOLVED, that the Pacific Marine Fisheries Commission herewith expresses its commendation and thanks to the television and radio stations and news media of Boise for their interest and cooperation in connection with the activities of the current meeting of the Pacific Marine Fisheries Commission.

24. Appreciation for Meeting Arrangement

WHEREAS, the State of Idaho has been, an official member of the Pacific Marine Fisheries Commission only since 1963, and

WHEREAS, the State of Idaho has participated actively and constructively in the work of the Commission since becoming a member, and

WHEREAS, this participation has culminated in the State of Idaho being the host for the 1965 annual meeting, with a welcoming keynote being extended by the Lieutenant Governor of the State of Idaho and the Mayor of Boise,

THEREFORE, BE IT RESOLVED, that the Commission does hereby express its sincere appreciation for the admirable facilities and efficient services provided by the Idaho Commissioners to the Pacific Marine Fisheries Commission, and by the Director and staff of the Idaho Fish and Game Commission, and by other contributing agencies and individuals in making the 1965 annual meeting a pleasant and constructive event. In so doing, special recognition is extended to those ladies who manned the typewriters, the duplicating equipment, and who, as is usually the case, more than satisfied the many demands placed upon them.

Election of Officers, Etc.

The following were elected officers for 1966:

John H. Wedin, Chairman J. Pat Metke, First Vice-Chairman Walter T. Shannon, Second Vice-Chairman John R. Woodworth, Secretary

The 1966 Annual Meeting was announced, to convene at Seattle from November 15 to November 18. One day has been eliminated from the five days needed for recent meetings. On the 15th and 16th the Advisers and staff will function in committee, and on the 17th and 18th the general business and plenary sessions will be held. The better organization developed at the Boise meeting has promoted efficiency and reduced the time required for conduct of the meeting.

FINANCES

The Commission receives its finances from legislative appropriations made in accordance with ARTICLE X of the interstate Compact in which the signatory states have agreed to make available annual funds for the support of the Commission in proportion to primary market value of the products of their fisheries as recorded in the latest published reports (five-year average), with the provision that no state shall contribute less than two thousand dollars per annum and the annual contribution of each state above the minimum shall be figured to the nearest hundred dollars.

STATEMENT OF RECEIPTS AND DISBURSEMENTS

January 1, 1965 to December 31, 1965

CASH BALANCE Dec. 31, 1964 (Ending Balance 17th Annual Report)		$31,858.29
RECEIPTS: Contributions by Member States—		
California	$26,600.00	
Idaho	2,000.00	
Oregon	3,800.00	
Washington	10,500.00	42,900.00
REFUNDS:		
Registration Fee		35.00
DISBURSEMENTS:		
Salaries and Wages:		
Executive Director, Consultants, Treasurer, Office Secretary, and Temporary	$20,514.20	
Office Supplies	$ 1,221.83	
Telephone and Telegraph	456.54	
Postage, Freight, Express	475.62	
Printing of Publications	3,012.04	
Rents: Headquarters Office and Meeting Rooms	1,451.79	
Premiums: Fidelity Bonds, Fire Insurance, Workmen's Compensation Insurance	136.70	
Audit of Fiscal Books and Records	315.00	
Legal Fees	200.00	
Private Car Mileage	66.80	
Fares: Airplane, Railroad Pullman, Other	1,259.33	
Meals and Lodging	627.93	
Library Supplies	6.50	
Physician and Hospital Insurance	120.00	
Retirement Contributions	1,866.87	
Annual and Research Meetings:		
Advisory Committee	3,260.37	
Commissioners	1,031.10	
Administrative and Research	3,403.75	
All Other	120.00	
Total General Expenses	$19,032.17	
Office Furniture and Equipment	12.21	
Prepaid Employee Contribution for Pension Fund	1.29	
Cooperative Research	3,012.74	
Total Disbursements	$42,572.61	
Cash on Deposit in The United States National Bank of Portland, Oregon:		
General Checking Account, December 31, 1965	$32,220.68	
	$74,793.29	$74,793.29

AUDIT REPORT

ALLEN H. ADAMS
Certified Public Accountant
Portland, Oregon

September 20, 1965

The Board of Commissioners Pacific Marine Fisheries Commission State Office Building Portland, Oregon Gentlemen:

I have examined the books and records of the Pacific Marine Fisheries Commission for the fiscal year ending June 30, 1965. The examination was made in accordance with generally accepted auditing standards and, accordingly, included such procedures as were considered necessary in the circumstances.

The accounting procedures of the Commission reflect revenue in the accounts when it is received rather than at the date when appropriated by member states to the Commission and reflect expenditures in the fiscal period in which they arise irrespective of when paid, i.e. the accrual basis.

The following exhibits are submitted:*

A. Combined Balance Sheet, as at June 30, 1965, of the General Fund and Property Fund.
B. Statement of Revenue and Expenditures, with Budgetary comparisons, for the period July 1, 1964 to June 30, 1965.
C. Analysis of changes in Unappropriated Surplus and in the Property Fund for the period July 1, 1964 to June 30, 1965.
D. Reconciliation of changes in the cash balance with Revenues and expenditures for the period July 1, 1964 to June 30, 1965.
E. Audit Comments.
F. Scope of the Audit.

In my opinion, the accompanying statements present fairly the financial position of the Pacific Marine Fisheries Commission at June 30, 1965, and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Yours very truly, ALLEN H. ADAMS Certified Public Accountant

*Only Exhibit A has been reprinted here. A complete audit report with exhibits was sent each Commissioner.

BALANCE SHEET

June 30, 1965

EXHIBIT "A"
GENERAL FUND

	Total	General Fund	Property Fund
ASSETS:			
Cash in Bank	$16,031.47	$16,031.47	$ -----
Office Furniture and Equipment	3,818.15	-----	3,818.15
Total Assets	$19,849.62	$16,031.47	$ 3,818.15
LIABILITIES:			
Accounts Payable	$ 296.37	$ 296.37	$ -----
RESERVES:			
Reserve for Allocations— Coop. Research	$ 1,439.77	$ 1,439.77	$ -----
Reserve for Purchase Commitments	2,879.50	2,879.50	-----
Total Reserves	$ 4,319.27	$ 4,319.27	$ -----
FUND BALANCE:			
Investment in Fixed Assets	$ 3,818.15	$ -----	$ 3,818.15
Unappropriated Surplus	$11,415.83	11,415.83	-----
Total Fund Balances	$15,233.98	$11,415.83	$ 3,818.15
Total Liabilities, Reserves and Fund Balances	$19,849.62	$16,031.47	$ 3,818.15

Appendix 1 — Status Reports

STATUS OF THE 1965 PACIFIC COAST ALBACORE FISHERY

WILLIAM L. CRAIG (presented by John L. Baxter)
California Department of Fish and Game

California landings dropped sharply compared to last year, while those in Oregon and Washington improved considerably. Combined landings for all three states will approximate only 35 million pounds — 30 percent below last season and 17 percent below the 20-year mean of 42.3 million (Figure 1, Table 1).

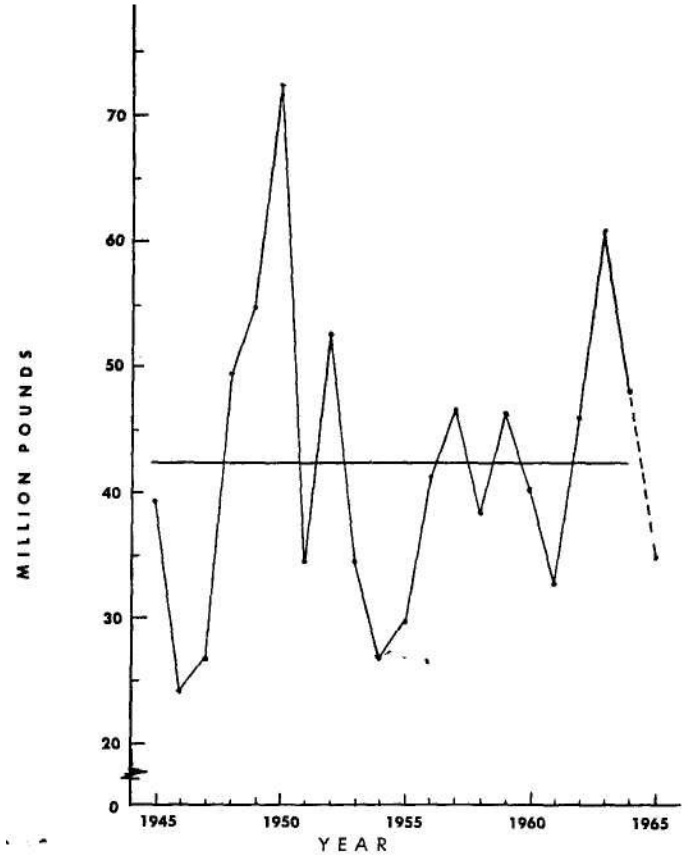

FIGURE 1. Pacific-Coast albacore landings 1945-1964 and 20-year average.

TABLE 1

Pacific Coast Albacore Landings (Thousand Pounds)

Year	California	Oregon	Washington	Total
1945	21,225	12,178	6,030	39,433
1946	18,078	3,951	2,123	24,152
1947	13,172	9,558	4,243	26,973
1948	36,456	8,004	4,917	49,377
1949	44,006	6,457	4,434	54,897
1950	61,745	5,386	5,035	72,166
1951	30,915	2,917	625	34,457
1952	49,804	2,586	177	52,567
1953	33,836	776	89	34,701
1954	26,107	469	421	26,997
1955	29,002	503	233	29,738
1956	37,055	3,654	630	41,339
1957	43,525	2,702	433	46,660
1958	27,188	9,754	1,503	38,445
1959	32,740	10,582	2,961	46,283
1960	35,113	4,563	526	40,202
1961	29,123	3,251	456	32,830
1962	36,622	8,936	365	45,923
1963	48,860	11,413	527	60,800
1964	42,551	4,452	1,055	48,058
Total	697,123	112,092	36,783	845,998
Average	34,856	5,605	1,839	42,300

California *

The fishery began some 250 miles southwest of San Pedro on July 7, about a month later than usual. Prior to this, 2 albacore were caught June 20, during our preseason survey, another on June 26, from a partyboat operating near Long Beach, and 6 more during the last 3 days in June by a Navy vessel off Cape Mendocino.

July fishing began briskly but soon lost momentum. Although scouting took place as far as 400 miles offshore, best albacore concentrations were found within 50 miles of land. Early reports indicated that the fleet was harvesting two size groups primarily: one averaging 18 pounds and the other about 10. The industry then offered $325 per ton for fish heavier than 12 pounds and $300 for smaller ones — during previous years, one price was paid for all sizes. By months-end the fishery had extended north to the Monterey-San Francisco area which usually is not very productive until mid-August. Landings were less than 2 million pounds — the poorest July since 1941.

During August, our fleet operated along the entire Pacific coast. One group fished from Cape Mendocino north to Destruction Island, Washington; another worked off the central California coast (Pt. Arguello to Cape Mendocino), and a third (the smallest) remained off southern California. Fishing -was most productive in the northern areas. August landings were about 7 million pounds; one-half those of last year.

In September, the southern California fishery ended abruptly, while fishing improved off central California. Bad weather forced much of the northern fleet southward. September landings also were low, totalling slightly over 3 million pounds; only a small fraction compared to last year. In October, central California areas produced fair catches, but bad weather curtailed fishing.

The 1965 season proved better for trailers than live-bait fishermen, who experienced only short periods of good fishing. Purse seining also was relatively poor; only 200 to 300 tons were caught in night sets on the southern grounds. Nearly all of the albacore landed in California were caught in a south-north band of water located between 15 and 40 miles offshore.

We estimate the commercial catch will total approximately 21 million pounds. This is one-half of last year's harvest and only 60 percent of the 20-year mean (Figure 2, Table 1). California partyboat anglers have taken nearly 110,000 albacore to date. This is slightly behind last year's figure, but well above the post-war average of 80,000 fish. Angling ended suddenly in mid September off southern California but persisted through October off central California.

Oregon

The fishery off Oregon began later than usual. From early August through September, however, excellent catches were made 80 to 120 miles offshore between Newport and Destruction Island, Washington. Through the first week in October, about 10 million pounds of albacore had been landed.

We estimate that 1965 commercial landings will reach 12 million pounds. This is nearly 3 times last year's catch and more than twice the 20-year average (Figure 2, Table 1).

Washington

Albacore were plentiful between the Columbia River and the Forty-Mile Banks southwest of Vancouver Island. The most intensive fishery centered 25 to 60 miles off Destruction Island.

Washington's tuna canning facilities were busy processing Japanese imports, hence most of the albacore landed were transported to Astoria, Oregon. Thus the landings do not reflect the amount of fish harvested off Washington. All albacore were caught by trailers, and fishermen received prices ranging from $275 to $335 per ton.

We estimate that Washington landings will reach 1.75 million pounds; about three-quarters of a million greater than last year and nearly equal to the 20-year average (Figure 2, Table 1).

Summary and Status

California albacore landings have declined about 40 percent compared to the 20-year mean while the combined Oregon and Washington landings have more than doubled, resulting in a 3-state harvest only slightly below normal. Incomplete data indicate that the 1965 migration was somewhat below average and was displaced northward. The manner in which the sea-surface warmed and the rate of warming were factors causing this shift.

Large annual fluctuations in the location of the migration, in the total harvest, and in the migration size and age composition are normal. Evidence at hand indicates that the albacore resource remains in good condition.

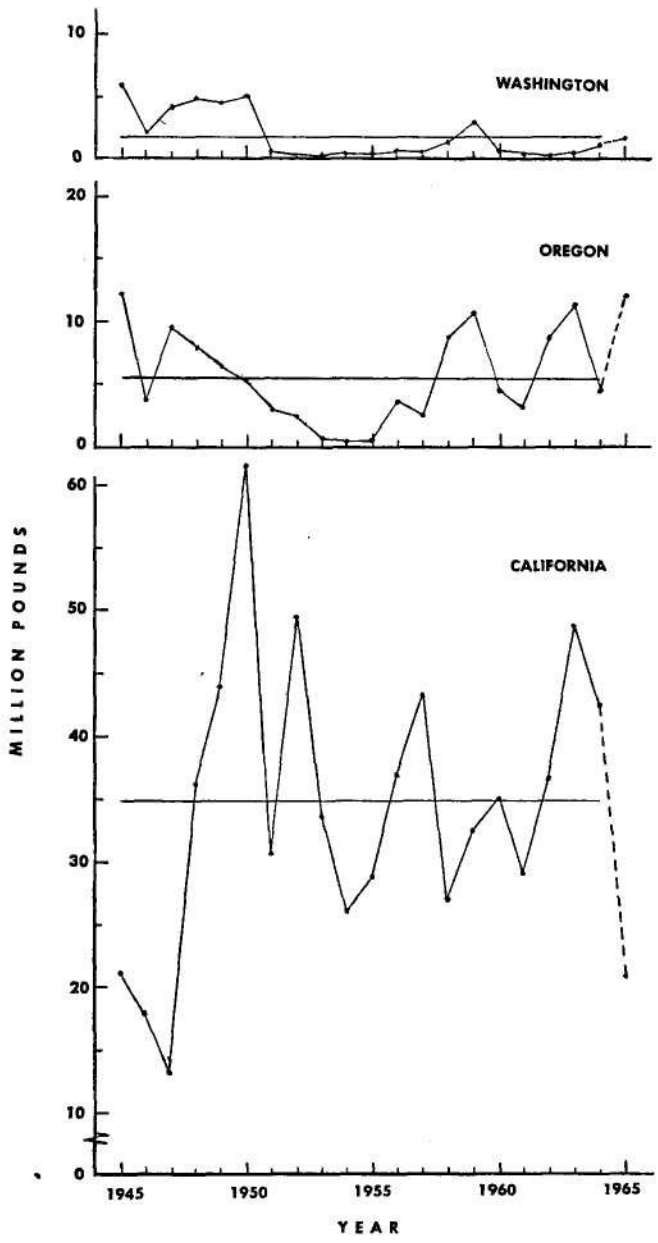

FIGURE 2. Annual albacore landings by state 1945-1964 and 20-year averages.

STATUS OF THE 1964-65 PACIFIC COAST DUNGENESS CRAB FISHERY

C. DALE SNOW
Oregon Fish Commission

Coastal crab landings reversed the downward trend for the first time since the 1956-57 season. Preliminary figures show a catch of 16.7 million pounds of crabs as compared to 9.2 and 8.3 million pounds for the 1962-63 and 1963-64 seasons. Annual coastal landings by state appear in Figure 1.

The Washington coastal crab season opened December 1 for the second year with shell condition reported as being good. Coastal landings through June totaled 5.8 million pounds as compared to 3-3 million pounds for the 1963-64 season. The Puget Sound fishery, which extended from October 31 to May 31, produced 1.4 million pounds of crabs for the 4th highest production recorded from that fishery.

Oregon crab landings through June totaled 6.1 million pounds as compared to 3.1 million pounds for the same period in 1963-64. Total landings are expected to be 6.5 million pounds or about 1 million pounds less than the long term average. Crab condition at the season opening was considered to be good.

California crab landings from preliminary figures total 4.8 million pounds as compared to 2.0 million pounds in the 1963-64 seasons. Four million pounds of the catch were from the area from Fort Bragg to Crescent City. The 800,000 pounds landed at San Francisco represent one of the worst years for this fishery. The method of measuring crabs in California was changed from a curving measurement to a straight-line measurement corresponding to the method used in Oregon and Washington. This does not change the size of crabs taken by California but merely the method by which they are measured. Although the 1964-65 crab season was not as good as many past seasons, it was considerably better than the two most recent seasons and represents a favorable trend. Limited data from northern California and Oregon seem to indicate that the 1965-66 season will be as good, if not better, than the 1964-65 „ season.

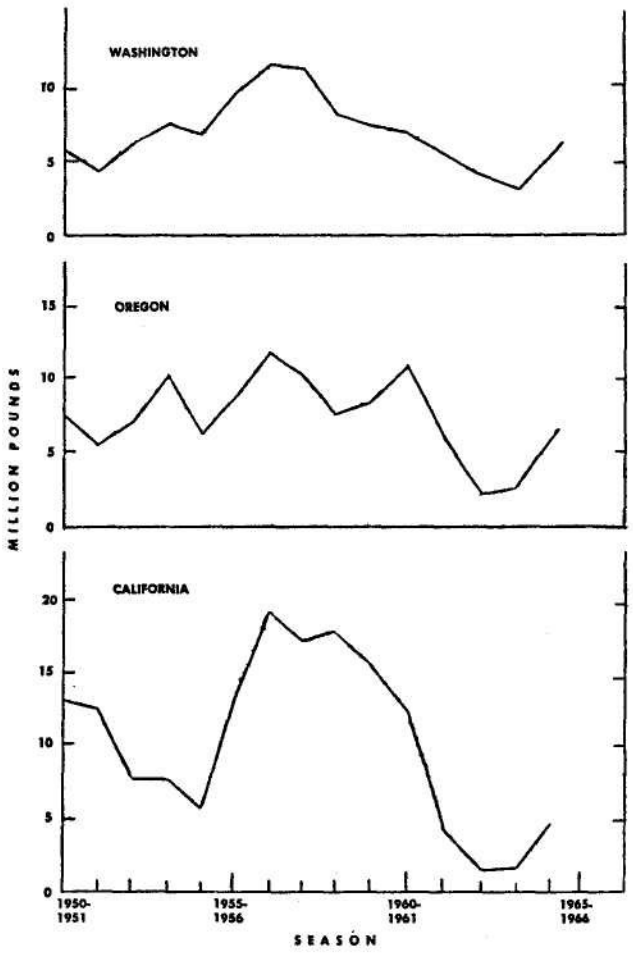

FIGURE 1. Crab landings by State.

STATUS OF THE TRAWL FISHERIES OF THE PACIFIC COAST, 1965

ED HOLMBERG Washington
Department of Fisheries

Last year Mr. Tom Jow stated that the trawl fishery with its complexities of species and influencing factors is by no means predictable. He had predicted correctly the decline in California for 1964, but Oregon had a 5% increase. Washington's decline was not as much as predicted and Canada had a 30% increase. Total trawl landings for the Pacific Coast for 1964 were slightly over 136 million pounds compared to the 10-year average of 132 million pounds. Pacific cod and Pacific Ocean perch landings were above average.

Statistics for the first half of 1965 indicate another above average catch. California expects about the same amount of food fish with a slight increase in animal-food landings. Oregon

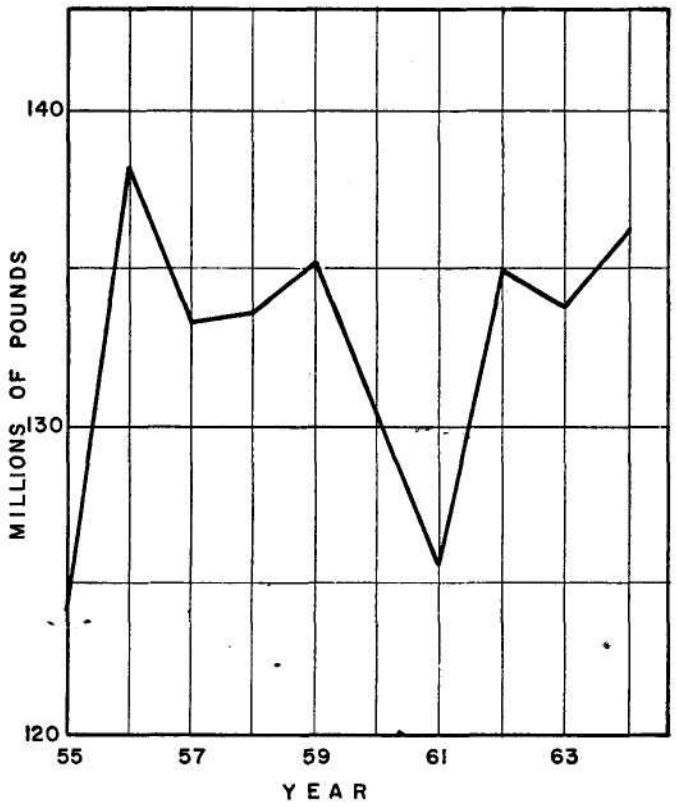

FIGURE 1. Total Pacific Coast trawl landings, 1955-1964.

and Washington fishermen have enjoyed good weather and markets. Canada reports another record year. Unless the fall season is a complete failure, the 1965 total domestic catch could attain 150 million pounds.

That fish consumption is on the increase is indicated by the increase in domestic landings and the U. S. Bureau of Commercial Fisheries' report of a 12% increase in groundfish imports during the first half of 1965 over the comparable period of 1964. If this increase continues throughout the year, imports of groundfish excluding halibut may exceed 300 million pounds.

Petrale Sole

Petrale sole landings declined in all areas except Canada during 1964. There were about 8 million pounds landed during 1964 which is 16% less than the 9-5 million pounds landed during 1963.

The outlook for 1965 is better with first-half landings increased by 8% which will project the annual total at about the 10-year average of 8.8 million pounds.

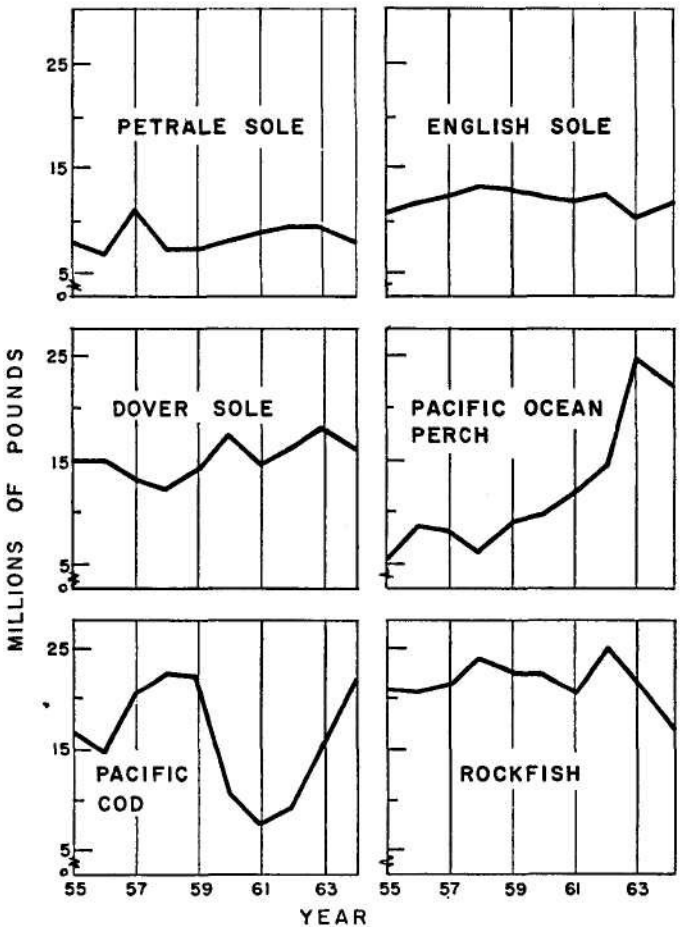

FIGURE 2. Pacific Coast trawl landings, 1955-1964.

English Sole

The 1964 landings of English sole equaled the 10-year average of 11.7 million pounds. This represented a 5 % increase over the 11.1 million pounds landed in 1963.

All agencies report further improvement during 1965. Catches during the first 6 months are increased almost 20% which would result in a coastwide total of 14 million pounds.

We are encouraging fishermen to use large mesh while fishing sole off Washington. There was a 2-million pound annual increase in the English sole landings during the period

when the large mesh regulation was in effect and we attribute at least 1 million pounds of this increase to the escapement of small fish through the large mesh.

Dover Sole

After a record landing of 18.2 million pounds in 1963, Dover sole total catch declined to 17 million pounds during 1964 which equals the 10-year average.

In California where 9 to 10 million pounds of Dover sole are landed each year, the catch during the first half of 1965 was less than for the first half of 1964. The delay of landing limits due to market restrictions in 1965 should increase the total landings. It is doubtful that the Oregon catch will reach 5 million pounds although this quantity is usually attained with ease. A coastwide catch of about 16 million pounds is indicated.

Pacific Ocean Perch

The 1964 statistics for perch show a slight decline to about 22 million pounds from the 24.7 million pounds taken in 1963. Nevertheless, the 10-year mean was increased to 12.4 million pounds.

All agencies reported increased landings of perch during the first 6 months of 1965 except in California where perch seldom occur in the landings. If the trend continues for the remainder of 1965, a new record of 30 million pounds will be established. A Russian mothership with a fleet of catcher boats removed an unknown additional amount of perch off of the lower west coast of Vancouver Island early this year.

Pacific Cod

Cod landings continued to increase from 15.4 million pounds in 1963 to 22 million pounds in 1964. Both Canada and Washington had substantial gains. Oregon fishermen take cod off the northern Washington coast, from Destruction Island northward. This species does not appear in California landings.

The increasing trend will continue into 1965 as first-half landings have already exceeded the 1964 total by 2 million pounds. The 1965 total for cod could exceed 30 million pounds.

Rockfish

California is the greatest producer of species in the rockfish category. The 1963 coastwide landings were 22 million pounds. In 1964 only 17 million pounds were landed. There is some optimism that 1965 will bring an end to the downward trend and may even show a gain. About 18 million pounds are expected this year in contrast to the 22-million pound 10-year average. Market demand appears to be limiting the landings of rockfish.

Summary

Trawl landings along the Pacific Coast during 1964 were 136 million pounds, a gain over the 133 million pounds landed during 1963 and the 10-year average of 132 million pounds. Pacific cod continued to increase. It is hoped that the influx of warm water off the Pacific Northwest during the summer of 1965 will not affect the spawning of cod adversely as it apparently did in 1958. Increased English sole landings reversed last year's decline. Pacific Ocean perch landings will establish a new record in 1965.

Most of the other species in the 1965 landings indicate declines. Some species are being overexploited but market demand is continuing to control the landings of others.

STATUS OF THE TROLL SALMON FISHERY AND A REVIEW OF PAST LANDINGS

TED C. BJORNN Idaho Fish
and Game Department

The combined Pacific coast troll landings of chinook and coho salmon in 1965, excluding Alaska, will be near 49 million pounds. The combined landings in 1964, excluding Alaska, were were 52 million pounds. The combined landings in 1964, including Alaska, were near 63 million pounds — the highest since 1952 when combined landings were 72 million pounds. Landing estimates for the Alaska troll fishery were not available at the time this report was prepared; however, the catch of chinook and coho was believed to be down from 1964. Landings of chinook salmon were down slightly in all areas but California. Landings of coho salmon in Oregon and Washington in 1965 were larger than in 1964.

Troll Fishery Catch of Chinook Salmon

Pacific coast chinook salmon landings, excluding Alaska, for 1965, will be near 18 million pounds. Chinook landings in 1964, including Alaska, were near 26 million pounds — the highest since 1959 when landings were also 26 million pounds. The landings in 1964, excluding Alaska, were 20 million pounds (Figure 1).

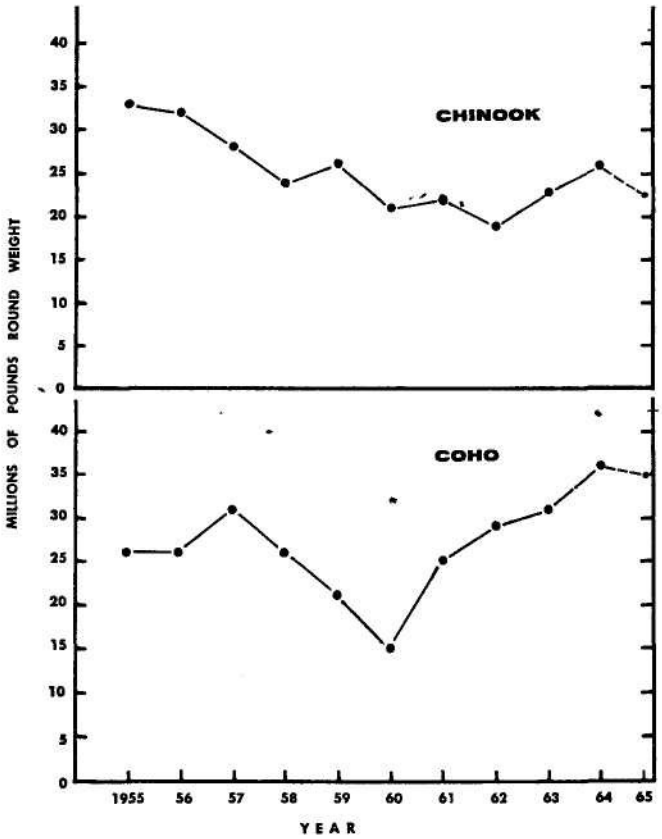

FIGURE 1. Pacific coast landings of troll-caught chinook and coho salmon (1965 data are preliminary).

Alaska troll chinook landings in 1965 will be down from 1964 when just over 5 million pounds were landed. Landings in Alaska reached a low point in 1961 when less than 3 million pounds were landed (Figure 2).

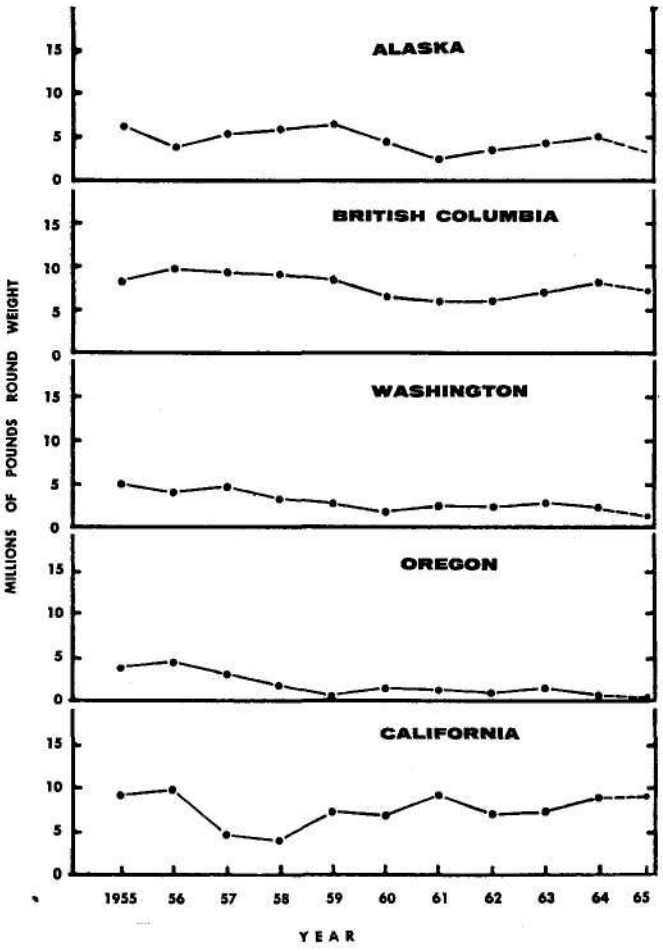

FIGURE 2. Landings of troll-caught chinook salmon by area (1965 data are preliminary).

British Columbia landings of troll-caught chinook in 1965 will be approximately 7 million pounds. Landings in 1964 were approximately 8 million pounds. British Columbia landings have fluctuated between a high of about 10 million pounds in 1956 and a low of nearly 6 million pounds in 1962.

Washington landings of troll-caught chinook salmon during 1965 will be 1.4 million pounds. Landings in 1964 were just over 2 million pounds. Washington troll landings of chinook salmon have been on a slight decreasing trend since 1955, the 1965 catch being the smallest during the past 11 years.

Oregon landings of troll-caught chinook salmon in 1965 will be approximately 600,000 pounds. Troll landings in 1964 were 700,000 pounds. The reduced landings in 1965 continued the decline that began in 1957.

The harvest of chinook salmon by the troll fishery in California during 1965 is estimated at approximately 9 million pounds. Landings in 1964 were just under 9 million pounds Troll fishery landings of chinook salmon in California have fluctuated between a high of just under 10 million pounds and a low of 4 million pounds during the past 11 years

Troll Fishery Catch of Coho Salmon

The Pacific coast coho salmon troll fishery landings excluding Alaska, for 1965 will be approximately 31 million pounds. Landings in 1964, excluding Alaska, were just over 32 million pounds. Total troll fishery landings, including Alaska, in 1964, were almost 39 million pounds (Figure 1)

Complete Alaska troll fishery landings of coho salmon in 1965 were not available when this report was prepared however, the landings were less than in 1964 when nearly 7 million pounds were landed (Figure 3).

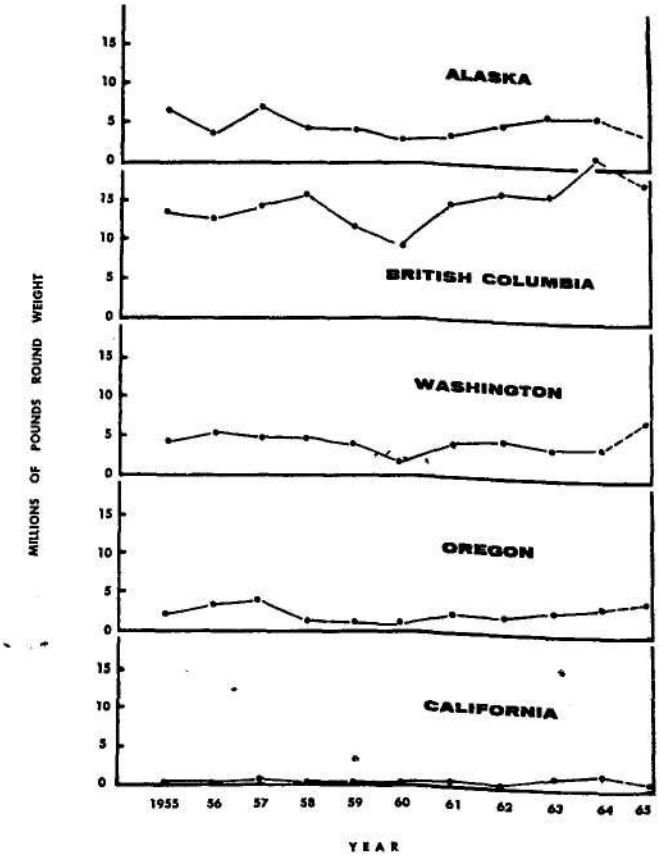

FIGURE 3. Landings of troll-caught coho salmon by area (1965 data are preliminary).

A preliminary estimate of the British Columbia troll fishery coho landings for 1965 is 18 million pounds. Landings of coho salmon in 1964 were over 21 million pounds. The landings in 1964 exceeded every year since 1920 with the possible exception of 1934 when nearly 22 million pounds were landed.

Washington landings of troll-caught coho salmon in 1965 are nearly 8 million pounds — the largest during the last 11 years. Washington landings have averaged approximately 4 million pounds but have been as low as 2 million pounds in I960.

The estimated catch by the Oregon troll fishery in 1965 is approximately 4.5 million pounds. The landings of coho salmon in 1964 were 4.2 million pounds. Landings of coho salmon in the Oregon troll fishery have been increasing each year since I960 when a record low of under one million pounds was recorded.

Coho landings by the California troll fishery in 1965 will be approximately one million pounds. The catch of coho in 1964 was slightly more than two million pounds. Landings of coho in this troll fishery are traditionally small, rarely exceeding 500,000 pounds.

Ocean Sport Fishery

A preliminary estimate of the chinook and coho catch from the Columbia River estuary and ocean area indicates a continued increase in the sport catch. Approximately 305,000 salmon (58,000 chinook and 247,000 coho) are estimated to have been caught in 1965 as compared to a combined take of 162,000 in 1964. Hatchery production of coho salmon has contributed significantly to the increased landings as shown by the many marked coho recovered in both the sport and troll fisheries during the last two years.

Preliminary estimates of the 1965 Washington ocean sport catch are 131,000 chinook and 489,000 coho salmon. The catch at the mouth of the Columbia River is included in these data since a majority of the fish are landed in Washington.

The sport catch of coho adults in British Columbia through September, 1965, was estimated at 98,000 fish, similar to the catches in recent years. The catch of coho grilse (coho weighing less than 3 pounds) was estimated to be 54,000 fish, or substantially below the catches of recent years.

The estimated sport catch of adult and jack chinook salmon in British Columbia through September, 1965, is 47,000 fish. The sport catch of chinook salmon has ranged from approximately 40,000 to 89,000 during the period 1958-1963. (The statistical problems inherent in evaluating the sport fishery annually prevent the preparation of reliable coastwide estimates in time for presentation at PMFC Annual Meetings.—Editor)

STATUS OF THE PACIFIC COAST PINK SHRIMP FISHERY- 1965*

JACK G. ROBINSON
Oregon Fish Commission

Total 1965 Pacific Coast shrimp production (exclusive of Alaska and British Columbia) of 3.2 million pounds was down from previous years. This total was 53% less than the 9-year average of 5.9 million pounds. Alaska landings through September were 10.1 million pounds, slightly less than the 9-year average of 10.7 million pounds, although an improvement over 1964 when only 7.6 million pounds were landed after the earthquake and tidal wave disaster. Coastwide landings, excluding Alaska, since 1957 are shown in Figure 1.

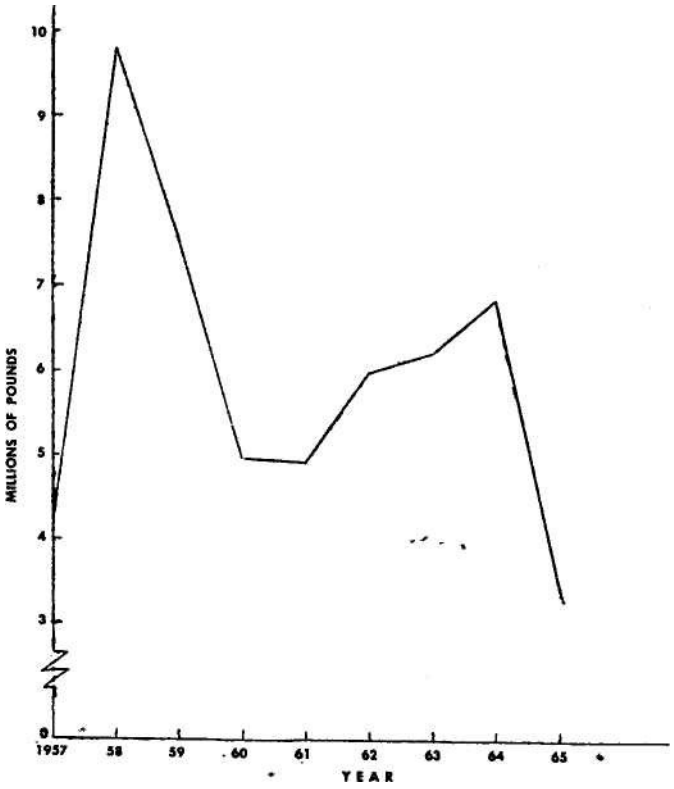

FIGURE 1. Total shrimp landings for Washington, Oregon, and California combined.

Decreased coastwide landings were due to the near absence of a commercial fishery in Washington and a much decreased Oregon fishery. The failure of the 1962 and 1963 year classes along with an apparently very numerous but small-in-size 1964 year class, which resulted in small shrimp and low catch per effort, was thought to be the cause of the reduced landings.

California

California ocean shrimp landings totaled 1,425,773 pounds through September 22, compared to last year's total of 980,608 pounds. The quotas of 1,000,000 pounds in Area A (Eureka-Crescent City) and 250,000 pounds in Area B-2 (Bodega Bay) were reached during the latter part of July, and these areas were closed by California Fish and Game Commission action. Very little effort and catch have taken place in the other two open areas, Area B-l (Fort Bragg) and Area C (Morro Bay). Figure 2 shows annual landings in California, as well as for Washington and Oregon.

It required just three months for the northern California shrimp fleet to fill the one million pound quota for Area A. A total of 15 boats landed 1,167,941 pounds in California from the Klamath River-Redding Rock area. Approximately 10,000 pounds were landed at Brookings, Oregon, from Area A according to available log book data.

The 1965 Area A fishery extended from just south of the Oregon-California border to off Patrick's Point in 50 to 100 fathoms. Best catches came from southwest of Point St. George and off Redding Rock. Monthly landings increased from a low of 238,900 pounds in May to 594,851 pounds in July. The average catch per unit of effort remained below last year's figure throughout the season; the seasonal average was 432 pounds per hour compared to last year's 524 pounds.

The 1964 year class in Area A was one of the strongest in recent years; an average 76% by number *and* 59% by weight of the commercial catch were one-year-old shrimp.

Area B-2 landings were 253,502 pounds compared to 35,878 pounds landed in 1964. Fishing locations were principally between Fort Ross and Salt Point in 50 to 60 fathoms of water. The catch per hour for the entire season was 602 pounds compared to 207 for 1964.

The outlook for 1966 is good in Area A because of the strong showing of one-year olds this year. Prospects for other areas are not good due to reduced populations.

Washington

The prediction made a year ago that Washington "can look for poor fishing until a sizeable year class appears" unfortunately proved to be well founded. The 1965 fishery could hardly be considered a commercial enterprise, as landings totaled only 20,418 pounds compared to 314,130 pounds in 1964. Two boats prospected from Destruction Island to Cape Lookout and made five landings in May, June, and July. Catch-per-hour drag was less than 150 pounds.

Failure of the 1965 fishery off Washington is attributed to failure of the 1962 and 1963 year classes. Size samples from the commercial landings in May and June averaged about 145 shrimp per pound and included about 40% one-year olds. The one-year olds were too small to be fully available to the gear in May and June when they tallied nearly 300 shrimp per pound. Although this 1964 year class is certain to be the strongest since 1961, its actual strength is not known because of the early termination of the fishery.

Oregon

The total Oregon landings in 1965, were 1,748,000 pounds which were considerably less than the record 5,477,400 pounds landed in 1964 and 77% of the 9-year average of 2,261,000 pounds. The 1965 total was slightly higher than the previous low landings recorded in I960 and 1961 (Figure 2). Scarcity of the 1963 year class in all areas off Oregon is responsible for the poor fishery. The combination of abundant one-year-old shrimp — up to 90% by number — and low catch per effort hampered and discouraged fishing most of the season, particularly north of Cape Blanco. A closure was placed on shrimp landings from south of the Oregon-California border in August to support California's closure of Area A.

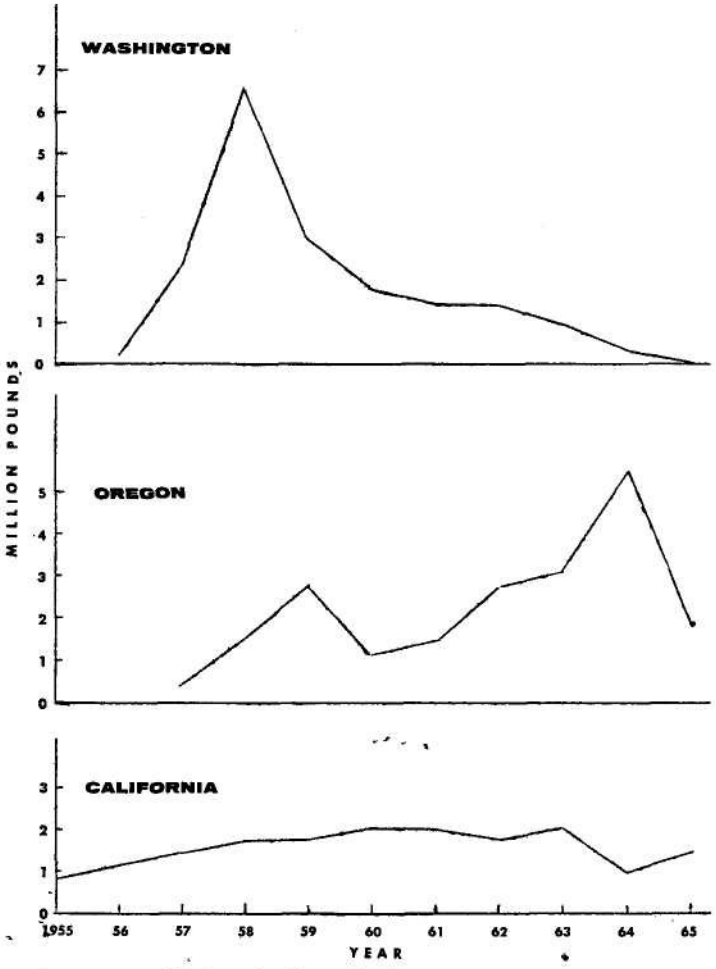

FIGURE 2. Shrimp landings by State.

Faster growth of one-year olds, in combination with the joint Oregon-California closure on fishing off northern California in late July, encouraged a number of California vessels to fish adjacent to and immediately north of the California-Oregon border in August and September. They and two Oregon vessels delivered 393,563 pounds at Brookings during these months. Landings there averaged 125 shrimp per pound during August, as compared to an average of 140 in June. Total landings at Brookings in 1965 were 552,000 pounds and surpassed the total Brookings landings for 1963 and 1964. Of this total, 10,000 pounds were known to have come from Area A, largely from adjacent to the Oregon-California border. Catch-per-unit effort for 1965 was 329 pounds per hour, down considerably from 1964 when it was 580 pounds per hour.

The fisheries at Warrenton and Coos Bay were severely hampered by the predominance of small one-year-old shrimp and scarcity of older, large shrimp. Warrenton landings in 1965 totaled 73,422 pounds, the lowest since inception of the fishery there and only 31% of the 1964 total of 233,425 pounds. The 1964 year class made up 49% of the catch by number in May, and limited data suggest that over 80% of the northern Oregon population in mid-September were one-year-old shrimp.

The fishery at Coos Bay as at Warrenton was disappointing. Landings amounted to 916,300 pounds compared to the 4,299,700 pounds landed in 1964 and 1,560,674 pounds in 1963. Catch per effort was down to 307 pounds per hour compared to the record 1964 and 1963 averages of 649 and 582 pounds per hour, respectively. The lowest previous catch per effort was 340 pounds per hour in 1962. Several vessels switched to larger mesh during the year to avoid taking one-year-old shrimp. The 1964 year class made up approximately 80% of the landings in September, by number, and this year class averaged 176 shrimp per pound early in October. This very abundant year class is expected to support an improved Oregon fishery in 1966, assuming that natural mortality will not be excessive during the winter of 1965-1966.

Appendix 2 — Special Reports

STATUS REPORT OF THE SPORT SALMON FISHERY IN WASHINGTON STATE[1]

RAYMOND M. BUCKLEY
Washington Department of Fisheries

Sport salmon catch records, or "punch cards," were inaugurated in Washington in January 1964 to improve the system of sport-catch estimates. These free, nonlimiting, required cards were issued to 318,550 salmon anglers, of which 42,686 (13.4%) were out-of-state anglers. Oregon anglers were most common in this category (21,938), followed by California (6,542), Idaho (2,199), and Canada (1,698). The 318,550 salmon fishermen in 1964 accounted for 1,217,341 angler trips, second only to the 1963 record pink salmon year tally of 1,467,412.

Catch estimates calculated for marine and fresh-water areas from the voluntary punch-card returns were corrected through a random subsample of actively sought cards (4% of the total issue). Catch-per-effort data and biological information were again determined through an extensive system of catch sampling.

The punch-card system made possible the first extensive catch estimates for the approximately 1,000 miles of streams open to salmon angling in Washington in 1964. These estimates gave a total fresh-water harvest of 28,988 salmon, in which the main-stem Columbia River was first with 14,096 followed by the Cowlitz River (2,243), the Skagit River (1,112), the Kalama River (1,110) and the Lewis River (1,045).

Punch-card estimates were used for all the marine areas in 1964 and closely correlated with estimates made with the previous system, except at Westport. Failure to receive all of the stub booklets from Westport resulted in a conservative punch-card estimate. In this instance, the "old method" estimate, based on U. S. Coast Guard boat counts coupled with catch sampling data, was considered to be the most accurate.

Impressions gained thus far indicate the following trends in 1965:

1. A record coho catch and a good chinook catch for coastal areas south of Cape Flattery.
2. Fair coho and poor chinook fishing in Juan de Fuca Strait.
3. Poor coho and chinook fishing inside Puget Sound.
4. A failure of pink salmon fishing in Juan de Fuca Strait and Puget Sound.

Following are the catch estimates for the State's various marine sport-fishing areas for the years 1958 through 1964:

Year	Anglers	Chinook	Coho	Pink	Total salmon	Salmon per angler
Mouth of Columbia River* (Punch card Area 1)						
1958	55,900	25,600	39,600	0	65,200	1.17
1959	75,000	23,400	50,500	0	73,900	0.99
1960	78,000	37,700	34,600	0	72,300	0.93
1961	89,800	20,500	85,500	0	106,000	1.20
1962	116,400	29,600	119,200	0	148,800	1.27
1963	117,800	32,600	116,200	0	148,800	1.26
1964	79,030	22,069	89,316	0	111,385	1.41
Westport (Punch card Area 2)						
1958	85,300	36,000	47,000	0	83,000	0.97
1959	87,000	41,000	60,000	100	101,100	1.17
1960	90,500	43,000	32,000	0	75,000	0.83
1961	95,000	45,000	57,000	300	102,300	1.08
1962	132,400	50,000	143,000	1,400	194,400	1.47
1963	142,200	52,300	120,100	1,400	173,900	1.22
1964	148,300	68,000	72,000	0	140,000	0.94
La Push (Punch card Area 3)						
1958	16,000	4,000	11,000	0	15,000	0.95
1959	11,000	1,800	9,400	500	11,700	1.04
1960	9,000	3,400	2,900	0	6,300	0.68
1961	10,500	1,200	6,600	400	8,200	0.78
1962	13,164	2,477	9,366	0	11,843	0.90
1963	15,131	3,459	13,338	6,055	22,852	1.51
1964	11,938	1,913	9,142	0	11,055	0.93

Year	Anglers	Chinook	Coho	Pink	Total salmon	Salmon per angler
Juan de Fuca Strait (Neah Bay - Port Townsend) (Punch card Areas 4, 5, 6)						
1958	148,062	43,036	78,679	0	121,715	0.82
1959	132,123	46,376	82,926	24,750	154,052	1.17
1960	94,226	21,787	17,441	12	39,240	0.42
1961	118,584	38,657	47,571	12,730	98,958	0.83
1962	87,398	18,460	34,643	430	53,533	0.61
1963	152,749	22,052	57,571	149,519	229,142	1.50
1964	217,713	46,014	59,258	0	105,272	0.48
Puget Sound and San Juan Islands (Punch card Areas 7, 8, 9, 10, 11, 12)						
1958	539,812	126,433	125,408	296	252,147	0.47
1959	527,691	84,452	81,520	26,600	192,572	0.36
1960	543,289	89,338	37,378	0	126,716	0.23
1961	721,086	99,762	82,788	65,496	248,046	0.34
1962	778,755	112,579	80,578	0	193,157	0.25
1963	1,039,522	154,638	120,916	280,169	555,723	0.53
1964	760,360	62,397	53,471	0	115,868	0.15
Washington, including mouth of Columbia*						
1958	845,074	235,079	301,687	296	537,062	0.64
1959	832,814	197,028	284,346	51,950	533,324	0.64
1960	815,015	195,225	124,319	12	319,556	0.39
1961	1,034,970	205,119	279,459	78,926	563,504	0.54
1962	1,130,717	213,116	383,487	1,830	598,433	0.53
1963	1,467,412	265,067	428,090	437,151	1,130,308	0.77
1964	1,217,341	200,393	283,187	0	483,580	0.40

"■1958-1963: Washington and Oregon combined; 1964: Washington side only.

STATUS REPORT ON THE MARINE "NON-SALMON" SPORT FISHERY IN WASHINGTON STATE[1]

RAYMOND M. BUCKLEY
Washington Department of Fisheries

The sport fishery harvest of "non-salmon" marine food fish is increasing in Washington as is the expenditure of effort toward its management. Incidental catches by salmon anglers still seemed to follow an inverse relationship to sport salmon landings in 1964, while specific "non-salmon" fisheries showed increasing popularity.

Jetty fisheries in coastal fishing areas received significant effort increases in 1964, with anglers concentrating mainly on lingcod, greenling and various rockfish and surf perch species. Surf perch continued to receive pressure from razor clam diggers who fish various coastal beaches on incoming tides after clam digging. Also believed to be increasing, is the dip-bag-net sport fishery for surf smelt on a few ocean beaches.

The incidental sport catch of non-salmon species has been estimated annually since I960 at the mouth of the Columbia River onlv:

Year	Angler trips*	Rockfish	Lingcod	Halibut	Other**	Total
1960	78,000	20,970	119	79	271	21,439
1961	89,000	12,742	1,560	551	3,333	18,186
1962	116,400	6,539	378	360	3,182	10,459
1963	117,800	7,526	462	102	4,554	12,645
1964	113,104	15,600	478	40	2,806	18,924

*Washington and Oregon combined.

**Includes miscellaneous flatfish, sculpins, shark, steelhead and cutthroat trout, perch, sturgeon, Pacific mackerel, and blackcod.

Catch estimates are also made for incidentally caught halibut in the Westport and La Push sport fisheries. Westport landings since I960 are as follows:

Year	Number of halibut
1960	1,500
1961	1,000
1962	160
1963	100
1964	150

The estimated halibut catch at La Push in 1964 was 44 fish.

Puget Sound and the San Juan Islands incidental and "purposeful" catches of "non-salmon" marine food fish followed the same general increasing trend in 1964. In this area there are several specific fisheries for a particular species, such as lingcod, true cod, rockfish, etc. The most recent of these to receive management attention is the inshore spearfishing (skin-diving) harvest of lingcod during the winter spawning months.

Sport catch estimates for all the important "non-salmon" marine food fish will be available for the first time in 1965, due to increased emphasis on these species in the catch sampling program.

EFFECTS OF FOREST SPRAYING ON AQUATIC ORGANISMS

DONALD R. CORLEY Idaho
Fish and Game Department

Hughes Creek Research Study— 16,000 Acres

A study, financed by the U. S. Forest Service and conducted by Idaho Fish and Game Department personnel, was conducted on Hughes Creek in 1964 to determine what effect a carefully controlled program of DDT application to the forest would have upon aquatic organisms. The control program called for helicopters to spray one pound of DDT per acre at 400 feet from streamside out to 800 feet, and for TBM-type aircraft to spray the remainder of the area beyond 800 feet also at the rate of one pound of DDT per acre.

Spray distribution as detected with eight oil-sensitive card lines was fairly close to the proposed limits. The helicopters average 486 feet from the stream with a swath width of 541 feet, rather than the target of 400 feet from the stream with a 400-foot spray swath width. The fixed-wing aircraft appeared to be overly conservative, averaging 1,040 feet rather than 800 feet from the stream.

Some fish mortality did occur during the study but the cause of death has not yet been determined. Aquatic insect losses were very evident by analysis of the drift-net information from each day of spraying. These data indicate that the fixed-wing aircraft operators find it especially difficult or impossible to keep DDT out of the stream when it is applied at these prescribed distances. If DDT can be applied as accurately on a large spray operation as it was during this study, large scale fish and aquatic insect mortalities can be prevented.

Since we do not know the direct'impact upon fingerling salmon and steelhead of reducing the aquatic insect population and hence, the food supply, and if our objective is to keep DDT out of the stream, then I feel the control measures incorporated into this study were inadequate.

Salmon National Forest Spruce Budworm Control Project — 500,000 Acres *

Part of the Salmon National Forest near the city of Salmon was sprayed during 1964 in an effort to control an epidemic population of spruce budworm. The area sprayed was located in the drainages of Panther Creek, Horse Creek, Yellowjacket Creek, Silver Creek, North Fork Salmon River, and the Salmon River between Horse Creek and Tower Creek.

At the beginning of the project helicopters were spraying one-half pound of DDT per acre at 300 feet from the streams out to 700 feet. The fixed-wing aircraft were spraying one pound of DDT per acre on the remainder of the forest beyond the 300 to 700-foot helicopter zone.

Upon monitoring the streams for DDT contamination, it was found that the controls placed upon the spray aircraft were not stringent enough to keep the spray out of the streams. Several adjustments were made in the application pattern during the project until on the final spray day, helicopters were applying one-half pound of DDT per acre at 600 feet from the streams out to 1,400 feet, and the fixed-wing aircraft were

Type of Aircraft Spraying	Number of Streams Monitored	Distance from Stream	Percentage of Streams Hit with DDT
Helicopters	11	300 feet	27.3
Helicopters	6	400 feet	16.6
TBM	8	800 feet	62.5
TBM	21	1,400 feet	19.0
Multiple Engine	13	1,400 feet	61.5

From the data collected in the monitoring of this project, it was found that:

1. Helicopters are much more accurate in applying spray to a designated area and, therefore, should be used on the stream perimeters.
2. TBM-type aircraft are quite difficult to maneuver in rug ged terrain such as the Salmon National Forest area, and should be used only in areas without streams or more than 1,400 feet distant from the streams.
3. Multiple-engine aircraft such as the B-25, DC-3, and PB4Y2, are even more difficult to maneuver than the TBM and should not be used to spray rugged terrain such as the Salmon National Forest area when valuable aquatic wildlife resources are involved.

DDT Long-Range Study

During the Salmon National Forest spray project, a three-year research study was initiated in an effort to determine the long-term effect of sublethal amounts of DDT upon aquatic insect abundance, residue accumulation in fish, reproductive success in fish, and delayed mortality in fish.

Rainbow fingerlings and adult rainbow were held in live boxes during the spraying activity and throughout the summer with the following resultant mortalities:

Location of Live Box	Size of Fish	No. Placed in Box	Mortality at End of Summer (%)
Geertson Cr.—Control	fingerlings	300	13
Indian Creek	fingerlings	300	44
Panther Creek	fingerlings	300	97
Geertson Cr.—Control	adults	30	17
North Fork[1]	adults	30	10
North Fork[2]	adults	25	12
Indian Creek	adults	30	37
Panther Creek[3]	adults	30	47

[1]These fish were held in the upper end of the North Fork hatching channel and received no supplemental feeding.

[2]These fish were held in the lower end of the North Fork hatching channel and were fed DDT-killed aquatic insects.

[3]A partial load of DDT was dumped into the upper end of Panther Creek.

On July 17 a multiple-engine spray aircraft dumped some 500 gallons of insecticide across a small tributary of Panther Creek approximately 35 miles above the Panther Creek live box station. Four days later on July 21 significant mortalities began to occur in the fingerling live box and did not subside until August 21. By October 21, 97 percent of the fingerlings had died in this live-box compared to 44 percent in the Indian Creek live-box, and only 13 percent at the control station. The rates of fingerling rainbow mortality throughout the summer at the three locations are portrayed by Figure 1.

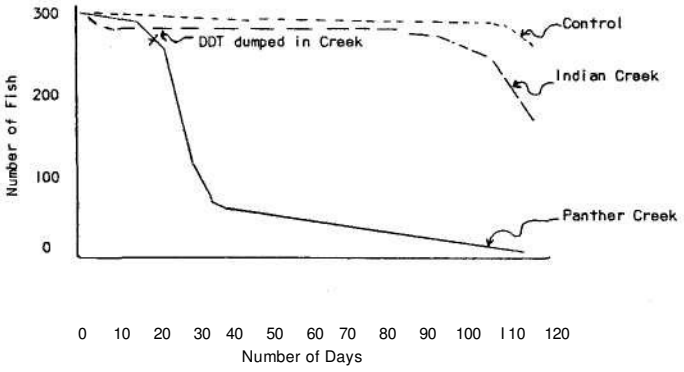

FIGURE 1. The number of fingerling rainbow trout that remained alive throughout the summer in the live boxes that were placed in Panther Creek, Indian Creek, and a control stream.

All fingerlings and adult rainbow used in this study are now being held at Mackay hatchery. The fingerlings will be observed for DDT content, differential mortality, rate of maturation, and general physical fitness. The adults will be spawned and the eggs and sperm tested for DDT content, fertility, hatching success, swim-up success, and general well-being of the resultant fry.

Insect bottom samples were taken at Hughes Creek and will be taken again in 1965 and 1966 to measure population abundance and species composition after being exposed to a forest spray project.

Five thousand cutthroat eyed eggs were held in a hatchery basket and trough at the North Fork channel test station and another five thousand were held in a similar manner in a control stream. There was no significant difference in the hatching success of these eggs.

Chinook eggs were taken from live, partially spawned adult fish in the North Fork and also from completed redds in the stream bed. These, along with eggs taken in a similar manner from a control stream, have been sent to the laboratory for DDT analysis. The results have not yet been received from the laboratory.

Wild rainbow/steelhead fingerlings were collected from Hughes Creek before spraying commenced and again after it terminated. These fish have been sent to the laboratory for tissue analysis, but the results have not yet been received.

WATER POLLUTION PROBLEMS IN IDAHO IN RELATION TO THE AQUATIC RESOURCE

WILLIAM E. WEBB Idaho Fish
and Game Department

Although the State of Idaho is fortunate that it does not have the multitude of water pollution problems confronting many other states, pollution of Idaho's waters does pose a serious threat to a multimillion dollar resource that supports fishing, hunting, and other water-oriented recreation. If in-addition we take into account other water uses, for example, domestic, agricultural, and industrial, no dollar sign can be realistically placed upon Idaho's water resources.

DEFINITION OF POLLUTION

The term pollution has been loosely used and tends to mean different things to different people. The following sentences quoted by Dr. Clarence Tarzwell, I believe, correctly define the term: "Pollution is the addition of any material or any change in water quality or character that interferes with, lessens, or prevents its use for a desired purpose." "Under this definition, pollution is tied to usage and water is not polluted unless its desired use is adversely affected."

SOURCE OF WATER

The potential supply of water for the United States is roughly 1,300 billion gallons a day — all from precipitation. Three-quarters of this amount is returned to the atmosphere via evaporation and plant transpiration. The other one-quarter, or 325 billion gallons daily, runs into streams and lakes or percolates into underground aquifers; THIS IS OURS!

Approximately 46 percent of this water demand goes to industry, 46 percent to agriculture, and'fhe other 8 percent is used for domestic purposes. If water is heavily polluted, it cannot be reused. Without clean water, a nation cannot grow or long survive.

Water pollutants generally fall into one or more of the following six categories: putrescible wastes, inert inorganic materiak, toxic wastes, thermal wastes, radioactive wastes, and contaminants or tainting materials. Each of these will be discussed separately in relation to its influence on Idaho's aquatic resources.

PUTRESCIBLE ORGANIC WASTES

This type of pollutant includes sewage and all organic material that can be decomposed by bacterial action. These wastes are one of Idaho's biggest water pollution problems, particularly in the southern part of the State.

The food processing industry in Idaho has expanded by leaps and bounds during the past ten years. The processing of sugar beets, potatoes, and other vegetables has become the major industry. Unfortunately, in processing, many wastes are created, including such materials as potato peelings, culled potatoes and french fries, starch, beet pulp, and dissolved sugars. Since it has always been simple to dispose of wastes in running water, these plants are located along rivers where plant effluents may flow in with little or no expense. It is the old "out of sight, out of mind" attitude. Most of these ingredients have a high biochemical oxygen demand and may reduce the dissolved oxygen level to critical levels for aquatic life and cause heavy mortalities.

An excellent example of the deleterious effects wastes of high oxygen demand may have upon aquatic life is the annual fish kill which occurred in Milner Reservoir, located on the Snake River, in south Central Idaho during each of the winters of 1959 through 1962. A combination of tremendous loads of organic wastes from upstream food processing plants, ice cover, and low river flows, resulted in the second largest pollution-caused fish kill in the Nation in I960.

Since most of the food processing plants are located in Southern Idaho, the Snake River and many of its tributaries receive the brunt of this type of organic waste. There are approximately twenty food processing industries emptying organic wastes directly or indirectly into the main Boise River alone, a major tributary of the Snake River.

Not to be forgotten, of course, are the untreated domestic wastes which still enter many of our streams and rivers. At the present time, this problem in Idaho is mainly with the small communities. Some small towns release untreated domestic wastes into small ditches and streams which automatically become a health hazard to everyone living in the area.

It has been pointed out that one of the more deleterious effects of organic wastes in the stream is the reduction of dissolved oxygen in the water to levels which are too low for survival of aquatic organisms. Most of these wastes are also rich in nitrates, phosphates, and other nutrient materials which can trigger a build-up of algae and bacterial slimes in a stream. Even the effluent from a sewage plant is rich in nutrient elements.

Algae and slimes can blanket a stream bottom causing suffocation of fish-food organisms thus depleting the fish-food supply. If these forms are abundant enough, they can suffocate eggs of fish spawned in the gravel. The aesthetic value of a stream does not improve either with addition of these organic nuisances. The main Boise River and several smaller Snake River tributaries have been adversely affected by the blanketing effect of algae and slimes.

A stream or river containing much nutrient-rich organic matter flowing into a lake or reservoir may result in an extensive bloom of blue-green algae in the impounded water. These blooms not only ruin the aesthetic value of such a body of water and cause taste and odor problems but, upon decomposition, help reduce the dissolved oxygen in the lower strata of water. A good example of this phenomenon is Brownlee Reservoir, an impoundment on the Snake River lying on the Oregon-Idaho border. During the warm summer months, the dissolved oxygen levels throughout much of this reservoir are extremely low. The decomposition of prodigious algae blooms are given partial credit for this.

During the past few years, progress has been made in the abatement of our organic pollution problems. Many of the

food processing plants have installed primary treatment facilities which remove most of the solid materials formerly entering our waters. However, the dissolved materials high in "BOD" and nutrient value are still a problem. A few of the larger plants are considering installing secondary facilities for treating dissolved solids. The recent installation of several municipal sewage plants in the State has aided immensely in removing many of the domestic wastes that formerly entered our waters. However, much is left to be done.

INERT ORGANIC MATERIALS

A pollutant that affects many streams and rivers throughout the State and is familiar to all of us is common soil. Silt naturally enters water during spring runoff periods and during freshets. However, man can cause silt to be an almost permanent addition to our waters.

Some examples of man's influence on the addition of silt to Idaho's waters are: placer mining, logging, other types of poor soil management resulting in erosion, road building, irrigation return flow and wash water from food processing industries. There are more but these are the major causes.

Heavy silting of a stream disrupts the aquatic balance by first smothering the bottom organisms present and then completely eliminating the aquatic insect habitat by creating a sandy, constantly shifting stream bed. Silt may also smother incubating eggs or reduce water seepage through gravel beds causing high mortality to eggs of important game fish species such as trout and salmon. It may eventually destroy important habitat by covering the gravel permanently. Silt has also been given credit for increasing the water temperature of a stream.

Erosion caused by logging or road building has indirectly been a large factor in the silting of some major anadromous fish streams such as the South Fork' "of* the Salmon River. During the flooding in December and January (1964-65), the denuded hillsides in portions of this area offered no watershed protection and consequently, tons of silt and sand poured into the South Fork channel, blanketing many of the prime salmon spawning areas. The addition of soil to our waters is one of the. worst pollution problems in the western United States and is probably the most difficult one to control. Continuous silt deposits in lakes from upstream river sources eventually reduce depth, and in a shallow lake already on the border line of depth, could result in winter kill if the lake freezes over.

A side effect of the mining industry, although not really falling into a pollution category, is the elimination of fish habitat. When a section of stream is dredge mined, besides the obvious silt problem that results, the mining may remove stream bank cover (causing increase in water temperature); remove riffle and pool structure; and reduce depth and velocity by widening the stream channel.

TOXIC WASTES

Pesticides

In recent years with the widespread use of pesticides, loss of fish and wildlife has increased alarmingly throughout the Nation. In I960, some 637 million pounds of synthetic organic pesticides were manufactured in the United States. This has increased each year since then. A certain amount of these materials reaches our waters either directly or indirectly with consequent harm to the aquatic biota. Since 1961, agricultural poisons have led all known sources of fish kills nationwide.

In Idaho where agriculture is the root of the economy, pesticides are used extensively to control insect and other biological depredation to crops, timber, and other lands. Many of these synthetic organics do not decompose readily and upon entering the water, most of them are capable of killing fish and particularly fish-food organisms at very low concentrations. These compounds may also have long-term cumulative effects on fish and wildlife, and we are only very recently beginning to discover what some of these effects may be.

Many streams in Idaho during the past few years have suffered extensive losses of aquatic insect life due to the spraying of surrounding areas with malathion and DDT for the control of grasshoppers and spruce budworm, respectively. How drastic these losses affect the fish populations present cannot be determined quickly. It has been observed, however, that stone fly and caddis larvae do not come back in great abundance the year following a drastic depletion of these forms in a stream. Studies initiated on C. J. Strike Reservoir in 1965 to determine if the drastic reduction of crappie and bass could be due to pesticides so far has not resulted in significant answers. Although samples of water, algae, and fish do show various concentrations of chlorinated hydrocarbons present, it cannot be determined how important these concentrations are until further more extensive research is done. ,

In Idaho, the annual aquatic weed removal in irrigation ditches during the spring and summer months with chemical herbicides, particularly the aromatic petroleum solvents, often leads to fish mortalities as many of these chemicals are quite toxic to aquatic life, especially in the high concentrations frequently used.

Heavy Metals

Another source of toxic waste in Idaho's waters comes once again from the mining industry. Mining for heavy metals, such as copper, lead, and zinc, often causes releases of toxic wastes into streams. Very minute amounts of heavy metals may be very toxic to aquatic life, depending to some extent on water chemistry. The South Fork of the Coeur d'Alene River for many miles of its length is virtually a biological desert due to the continuous long-term release of mining wastes containing toxic materials into its waters. This situation has existed for many years.

Detergents

A toxic pollutant that has received a good deal of publicity during the past several years is the synthetic household detergent. Due to the chemical properties of most of these detergents, bacteria cannot decompose them. Therefore, they pass through a sewage treatment plant relatively unchanged. An ingredient found in most of these detergents "alkyl benzene sulfonate" (ABS) has been found to be quite toxic to fish and in 1959, a fish kill occurred in the Boise River during a low flow period which was attributed to this ingredient. With the advent of bio-degradable detergents, this problem may be lessened.

Phosphate Industry

In Eastern Idaho, wastes from phosphate chemical plants enter the Portneuf and Bear Rivers. Fish kills have been attributed to excess acids and fluorides in these waters.

Pulp Mills

Pulp mills, of which Idaho has but one, a Kraft plant at Lewiston, can create toxic problems, particularly where the effluent enters the river with very little dilution water. Some problems have existed on occasion at this plant; however, with its effluent entering the Snake River, usually enough dilution water is present. The numerous pulp mills on the Pacific Coast cause many pollution problems.

THERMAL POLLUTANTS

The warming of water to unsuitable temperatures for fish life occurs frequently in areas where industries use river waters for cooling purposes and then release the warmed water back into the river. Steam-generated electric power plants are creating local temperature problems in eastern cities which are expected to become more widespread in the future. Increases in water temperature also decrease the dissolved oxygen in water.

Thermal pollutants have not been a great problem in Idaho although effluent from the phosphate plant near Pocatello reaches temperatures of 104° F. However, due to a cold spring entering the river directly below the effluent, no adverse effects have been observed.

RADIOACTIVE WASTES

Radioactive wastes are similar to silt and pesticides in that they do not always originate at a point" source but may come from entire watersheds. The effect of these wastes on aquatic life in natural waters in Idaho are at present an unknown quantity, but we are sure to hear more of them.

CONTAMINANTS OR TAINTING MATERIALS

Certain materials added to waters have properties causing tastes and odors in the water and actual tainting of fish flesh. Some examples of these are: Kraft pulp mill effluents, chlorophenols, naptha-based herbicides, petroleum wastes, chlorinated hydrocarbons and chlorine. Some of these have caused local problems throughout Idaho.

WHAT ARE THE ANSWERS?

Reams of data have been collected over the past few years by many agencies concerning the effects of various pollutants on our aquatic resources. However, solutions to many pollution problems remain unavailable or unknown.

The emphasis has been on "cleanup" of organic wastes which are actually the easiest to show some progress on. However, the emphasis is going to have to be shifted to controlling the most difficult problem — land and water management. Better irrigation practices reducing the silt and nutrient properties in irrigation return flow, such as the sprinkler method, must be discovered. Better logging methods which do not rape the land and cause costly erosion have been devised and must be used more frequently. Better range management is needed on overgrazed rangelands.

One of Idaho's problems and a big one in the western states has been the curtailment of downstream dilution water when dams are built. Many of our organic pollution problems stem as much from lack of dilution water to handle the wastes as the wastes themselves. This is particularly true where reservoir water is primarily stored for irrigation and no allowances are made for sufficient water downstream from the dam for fishery purposes. Frequently the water flow is reduced to a trickle after the irrigation season terminates. Minimum flows for downstream releases must be written into all future dam projects.

If we are to maintain a sound, healthy economy, the water resources of the State must be protected and the water quality maintained at a high level for domestic, industrial, recreational, and fish and game use.

RECENT DEVELOPMENTS IN FISH FACILITIES AND MITIGATIVE FACILITIES AT HYDROELECTRIC PROJECTS

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The ever-increasing encroachment of civilization on our water resource makes it increasingly necessary to fit salmon production into a static mold where they must respond to given criteria imposed upon them by the many other uses that man must make of water, the most valuable of our natural resources. No longer can we expect that the vast river systems of the Pacific Northwest will remain as they historically were, the greatest natural salmon-producing areas in the world. Compresensive basin-planning studies are in various stages of execution at the present time on the Willamette River, Puget Sound Basin, and the Columbia River. These studies will determine the water needs for the next 50 to 100 years for municipal and industrial use, pollution abatement, irrigation, recreation, and fish and wildlife. It is obvious that further encroachment upon our natural stream patterns will continue.

Prior to the construction of Grand Coulee Dam, the Columbia Basin contained over 3,100 miles of streams within the State of Washington and Canada that were accessible to migratory salmon and steelhead. With the advent of Grand Coulee Dam, 1,140 miles were lost to salmon production. By 1967, with the completion of Well's Dam, the entire Columbia River will be pooled from Bonneville Dam upstream to Grand Coulee with the exception of *46* miles of spawning area located in the proposed Ben Franklin project site near Hanford, Washington. The same story is true for the main stem of the Snake River with proposed dams pooling water to Brownlee and beyond. Similar development is propose3 for all basins throughout the Pacific Northwest.

Within the Columbia River Basin, the tributary streams must at present be called upon for maximum production in order to sustain runs of sufficient size to maintain the resource. However, proposed dam-site locations are to be found on almost every important tributary in not only the Columbia Basin, but in all the coastal basins of the States of Oregon and Washington. Many of these high-head hydro and storage projects have already been constructed and pose serious threats to the remaining spawning and rearing areas in the coastal states and Idaho.

The fishery agencies of these northwestern states have attempted for many years to forestall such projects in an effort to maintain the watersheds in as natural a state as possible for the maximum production of salmon and steelhead. It is evident that they have not been able to forestall the majority of these projects; and therefore, with this realization, the various fishery agencies and research groups have been forced to "fit the fish to the mold." The fact that significant runs of salmon and steelhead exist today in spite of man's encroachment shows that important advances in fishery technology are taking place.

In the field of power-dam biology, biologists, engineers, statisticians, and bacteriologists have had to (1) combine their efforts in order to transport fish past the dams both upstream and downstream, and (2) compensate for the loss of spawning and rearing area brought about by the creation of deadwater reservoir areas behind the dams.

Power-dam research can be broken simply into three main categories:

1. Upstream passage,
2. Downstream passage, and
3. Mitigative facilities for spawning and rearing.

1. Upstream passage

Fish ladders are as old as the Middle Ages. Man-made devices that enabled easier upstream passage of adult fish past obstructions were noted in the literature as early as the 12th through 14th centuries; however, critical engineering and design work did not appear until approximately 1875. Fish-ladder facilities have been modified and improved over the years from the somewhat standard pool-and-weir-type ladder found at most main-stem Columbia plants such as Bonneville, McNary, etc., to the vertical-slot fishway, Denil and Alaska steep pass. More important probably than the ladders themselves are the types of collection facilities found at the downstream end of the fishway. This can be as simple as the ladder flowing directly into the open stream or as complex as a powerhouse face collection system and the barrier-dam collection system now being employed at many of the high-head power projects. A recent development is the use of a high-velocity jet of water that will attract the fish to a fishway entrance located adjacent to the jet. Although special innovations may be needed at any specific project, upstream collection and passage facilities must, at the present state of our knowledge, be classified as relatively simple to design and operate in relation to the complexities faced in the passage of downstream migrants past hydroelectric or storage projects.

2. Downstream passage

Downstream passage problems for anadromous fish are filled with complications. In a low-head, run-of-the-river-type plant such as is found on the main-stem Columbia River, migrants must pass through the reservoir and then pass the dam by one of two methods, either over the spillway or through the turbines. Studies by several investigators have shown that mortalities over the spillway are probably less than *2%;* however, the same investigators have found that mortalities through the turbines more nearly approximate 11%. Since most of the migration occurs during the spring months on the Columbia River (during periods of high-flow run-off when heavy spill conditions exist), significant proportions of the downstream migration are probably utilizing the spill exits from the dams. In the future, however, now that plans for Canadian storage and Southwest interties are a reality, more and more control will be exerted over river conditions with the result that there will be little or no spill at the projects. This will mean that the only egress from the low-head plants will be by turbine passage with the resulting high mortalities.

Investigations are at present underway in order to determine if these fish can be separated from the main flow of the turbine intake and guided to safe collection areas for passage around instead of through the turbines.

Experimentation on ski-jump-type spillways for high-head plants began in 1955 and they were found to give fish a safer means of transportation over the spillway than other conventional-type spillway buckets. As a result of tests conducted by the Washington Department of Fisheries, a ski-jump type bucket was designed and built at Mayfield Dam to provide more efficient and safer passage of downstream migrants over spillways.

Downstream passage studies at high-head plants by fishery investigators were intensified in the early 195O's. At Baker Dam on the Baker River, a tributary of the upper Skagit River, Washington, the high-head plant blocked downstream passage. Beginning in 1923 all downstream egress of sockeye and coho smolts was accomplished by passing over the spillway or through the turbines. Investigation disclosed that mortalities by the two routes varied from 40 to 70%. In 1954 the Washington Department of Fisheries began studies aimed at devising a downstream collection device that would safely pass downstream migrants around the spillway and turbine complex. This work continued until 1958 and culminated in the construction of a floating downstream migrant collection device that would attract fish into it as they approached the dam and safely by-pass them around both the spillway and the turbine exits. Two collection units have been built, one for lower Baker and one for upper Baker Dam, and have been judged to be satisfactorily handling the downstream migration problem at these projects. A migrant'collector of similar design was constructed in 1963 and placed in operation for experimental purposes at Merwin Reservoir on the Lewis River. The experimental results of this investigation indicated that basic modifications in the designed depth of fishing had to be made in order to increase its efficiency up to 65%. In 1965 the "exp'erimental migrant trap (gulper) was moved to$_t$ the upper end of Mayfield Reservoir to determine if migrants could successfully be collected as they enter the reservoir from the river above. It was demonstrated.conclusively that this floating migrant collector would not collect downstream migrants at the head of a reservoir in sufficient quantity to allow its use as a production tool.

In one case on the Baker River system in northern Washington, for coho and sockeye populations, it appears to be highly effective. On another reservoir of similar size in southern Washington, its efficiency on coho was of questionable importance. In a third instance, where it was operated in the inlet end of a reservoir, the results were negative.

In addition to floating gulpers, studies to successfully collect fish as they approach the dam are progressing on louvered turbine intakes located near the surface at the dam, multi-gate fish outlets, Alaskan-type floating traps, and other devices.

Although passage of the downstream migrants through some high-head reservoirs has been successful, passage through many appears unsuccessful. Conditions found within the reservoirs themselves seem to inhibit successful passage from the river into and through the reservoir to the dam site.

Information to date indicates that limnological conditions within the impoundment may inhibit successful migration to the dam and produce residualism (landlocking) of the stocks. Reservoir dynamics, the movements of water masses and its related physical and chemical interactions, seem to play important parts in the fishes' ability to successfully negotiate 10 to 50 miles of impoundment area on their journey to the sea. Results to date are not encouraging for high-head dam reservoirs of 10 miles in length. With this information in hand, studies are now underway in an attempt to design a device that could actually separate the downstream migrants from a moving water mass in the river upstream of the reservoir. Studies involving high-frequency sound, attraction by lights, and traveling-screen devices have been and are underway in an effort to find a practical and cheap method of obtaining the separation.

In areas where entire spawning areas will be inundated by a reservoir project, or where downstream fish-passage success is doubtful, other measures must be undertaken to insure the perpetuation of a particular stock.

3. Mitigative facilities

In order to mitigate for losses of spawning and rearing area in an effort to perpetuate a given stock of fish, artificial propagation facilities may be built. In the past these have usually taken the form of two basic types: (1) translocation of the particular stock affected into a new watershed, or (2) introduction of the stock into a standard-type hatchery facility. Translocations of stocks have at best had doubtful results. In .most cases the transferred stock had to compete in a new area with an already existing stock with the resultant loss of a portion or all of the translocated stock. In some recent situations, a standard hatchery facility has not been feasible because of physical conditions encountered, and the technique of using artificial spawning channels was initiated. The basic concept for a chinook spawning channel is to provide a comparatively inexpensive means for replacing or supplementing natural spawning areas with a minimum of fish handling.

This new technique also brought new problems; for example, mitigation facilities at Priest Rapids, Rocky Reach, and Well's Dams had to be designed in a manner that would allow minimum handling of the adult fish during their spawning activity because of excessively high water temperatures during the holding period.

New knowledge needed to solve this and other problems of design and operation was obtained through research studies conducted by the Washington Department of Fisheries during 1953 through 1956. Basic data on the natural criteria needed by spawning chinook salmon was obtained and utilized in the

construction of the first artificial spawning channel for chinook salmon located at McNary Dam. The results of these experiments concluded that artificial spawning areas could be constructed which would duplicate the requirements needed for spawning chinook salmon, that the eggs would be viable, and that fry could be produced.

The first chinook production channel was placed in operation in 1961 to mitigate for losses of spawning area at Rocky Reach Channel on the upper Columbia River. In 1963 the second channel was constructed at Priest Rapids to mitigate for losses in the Priest Rapids - Wanapum area of the Columbia. A third channel is presently being constructed as mitigation for Well's Dam which is located above Rocky Reach Dam. When all of the channels are in production, they will accommodate approximately 10,000 female chinook (50 million eggs). Rocky Reach and Priest Rapids Channels have been in operation for four and two years respectively. The success of the operation has varied from year to year. At Rocky Reach excessive prespawning adult mortalities (between 12 and 84%) were experienced; however, improvements in technique have led to a reduction of the mortality rate within the past year. The percentage survival from estimated egg deposition to fingerling release has been excellent (between 42 and 50%). At Priest Rapids Channel, prespawning adult mortalities have been less than 2%; however, juvenile survival has varied in the two years of operation from 32% for the first year's operation to 3.5% for the second year's operation. Various factors are being investigated at the present time to determine the reasons and possible solutions for improving survival in both the adult and juvenile phases. One factor has already been isolated as being detrimental to salmon. It has been discovered that the waters of the Columbia are supersaturated with dissolved nitrogen gas. This situation causes a condition of the fish commonly known as "gas-bubble disease" and can be very lethal. Studies are now underway in the channels to eliminate the nitrogen problem by reducing its supersaturated levels to a safe condition. Although the biological criteria for the channels are based upon sound research, there remains the problem of continuity and'uniformity which through scientific efforts can be improved.

Another type of artificial spawning facility was constructed as mitigation for losses in sockeye spawning area due to the construction of a hydro complex on the Baker River. The construction of upper Baker Dam made useless the natural sockeye spawning beach in old Baker Lake. It was therefore necessary to construct an artificial sockeye spawning beach that would simulate the conditions found in nature at their natural spawning site. A pond was constructed with a subterranean water inflow that percolated vertically through a gravel bed and simulated the conditions experienced by the sockeye in nature. Fry survivals from potential *egg* depositions have ranged from 25 to 75%, considerably higher than those experienced in nature which average approximately 10 to 15%.

Another method which is being experimented with at the present time to offset the loss of rearing area is natural pond rearing. In this concept the adult salmon are taken into a hatchery, spawned, and the resultant fry are reared in natural ponds adjacent to the watersheds in which they are to be liberated. Experimentation conducted at Ringold Springs located on the Columbia River upstream from Pasco over the last four years has shown that survivals have ranged from 2.8 to 81% for chinook and 63 to 78% for coho salmon. Utilizing natural food available in the ponds only, the production of chinook ranged from 10 to 190 lb. per acre and from 122 to 364 lb. per acre for coho. The production per surface acre at Ringold greatly exceeded that achieved in similar experiments on the west side of the Cascades indicating that water of the upper Columbia River is extremely fertile and well suited to this type of rearing program. Experiments are continuing to determine the maximum yields that can be expected on a sustained basis. Adults returns to Ringold for chinook made their first appearance in the fall of 1964 with over 335 adult chinook homing to the ponds. Adult chinook returns in 1965 totaled 258 chinook with 30% of the season remaining. The over-all survival rates are such to give optimistic hope for the future of such production methods in the Columbia Basin.

As can be seen, many of the problems discussed previously have been solved. Others are in the process of solution and many remain unsolved. It is hoped in the future, with time, money, and research, that more of the extremely complex problems will be isolated and satisfactory solutions obtained.

(A summary presentation illustrated with color slides was presented at the 1965 annual meeting.)

KILLER WHALES VS. SALMON

EARLE D. JEWELL[1]
Washington Department of Fisheries

On September 27, 1964 the Department of Fisheries was conducting a salmon tagging program from the chartered purse-seine vessel VICTORY at Eagle Point on the southwest shore of San Juan Island in Puget Sound.

Just as the last of the day's catch was tagged and released at about 5 p.m., a crew member noticed a large number of killer whales *(Orcinus orca)* approaching the area. Within minutes the whales were very near the boat, approximately 100 yards.

As we watched we could see the wake of a salmon swimming rapidly near the surface with a killer whale a short distance behind. Within seconds the killer whale sounded and came up under the salmon throwing it into the air. The salmon was not caught on this pass and when the killer whale surfaced several seconds later it still had not caught the salmon. However, on the next pass when the killer whale broke the surface, rolling onto its side as it did so, the salmon was clearly observed crosswise in its mouth. The entire action took less than one minute from start to finish. It is very possible that the salmon caught by the whale was one that we had just tagged although no tag is visible on the motion picture films of the action.

A short time later while transporting tagging crew members ashore at West Beach we ran back through the herd of whales. Several whales, a female and a calf, were followed closely while we attempted to take pictures. While following these whales three others were observed to be on or nearly on a collision course with our 18-ft., outboard-motor boat. These three whales sounded about 50 ft., from the boat and passed just under water within 20 ft. of the stern of the boat. It was observed that large air bubbles were being blown from the blow hole while the whales were submerged.

Being out of film we left the area and proceeded to shore.

To the best of my knowledge this is the only case where a killer whale has been photographed in a natural environment catching and eating a salmon.

CRAB MOLTING AND MATING

C. DALE SNOW
Oregon Fish Commission

AN ABSTRACT

Two Dungeness crabs *(Cancer magister)* in the pre-mating and mating embrace were observed for 192 hours. Their behavior and reactions were described and illustrated with color slides and a 5-minute movie. The molting of a male crab was also described and illustrated.

BIOASSAY WITH BIVALVE LARVAE

CHARLES E. WOELKE
Washington Department of Fisheries

Problem

Persons working with bioassays sooner or later feel the need for better tools for measuring toxicity. A bioassay method which is economical to conduct, yields reproducible results, detects either chronic or acute toxicities or both, can be used for either laboratory or field samples any season of the year, and utilizes a nonmigratory commercially-important organism would seem to approach the ideal situation. Work being conducted in a number of areas indicates that bioassays using bivalve larvae may fulfill these requirements. I am speaking primarily of the larvae of clams and oysters.

Materials and Methods

The procuring of bivalve larvae is not difficult and a trained biologist in a marine laboratory can fairly quickly and easily learn the techniques. During the normal reproductive season, adult clams and oysters are available from their native habitats for spawning. At other times of the year these molluscs can be "conditioned" for spawning by placing them in flowing warm sea water for three to four weeks. Adult clams and oysters with ripe gonads are stimulated to spawn naturally by increasing the water temperature 5 to 10° C, and adding sperm to the water. The fertilized eggs are added to water containing the material to be bioassayed at a density of 15,000 to 20,000 eggs per liter by some workers, less by others. After 48 hours at 20° C, the eggs normally, develop to free-swimming, straight-hinge larvae. At this time samples are taken and microscopically evaluated to determine the effect of the material on the embryonic development of the eggs. Bioassays may be terminated at this point or the larvae may be fed on phytoplankton and grown in the test container. Often materials which have little or no affect on embryonic development at a given concentration will have subsequently marked effects on either the growth of the larvae or their ability to metamorphose from larvae to juveniles. This is particularly true of some of the insecticides and herbicides. These bioassays can be conducted in the laboratory with dilutions of materials you wish to test. Bioassays can also be conducted using water from the field in which the material is known or suspected to occur.

Technique Problems

From this brief summary of the method, one might assume there are no control or technique problems with the bivalve larvae bioassay. This of course is not true; the important point, however, is that most of these problems can be either solved or controlled without undue difficulty.

Among the problems associated with the larval bioassay, a major one is procurement of larvae whenever desired. Earlier workers sacrificed adults with ripe gonads and washed the eggs free from the female. Due to the frequency with which unsatisfactory results were achieved, apparently due to immature eggs, this practice was dropped. Larvae are now procured only from naturally-liberated eggs. This method has resulted in consistent reproducible results. The drawback to this procedure is the everpresent danger of being unable to achieve a spawning when desired. It has been our experience that a stock of 30 to 40 thermally-conditioned adults is adequate to assure a spawning for bioassay purposes at any planned time plus or minus 30 minutes.

"Age of the water" used, i.e., time elapsed between removal from the natural environment and introduction of the eggs to the water, has an effect on the results. We have found that water held 2 hours or less in 1-gallon containers has no measurable effect on bioassay results. Water from 3 to 6 hours old may have an effect; water which is 24 hours old has a very definite effect on the results of larvae bioassays. In our work we make every effort to utilize water less than "3 hours old".

The "quality" of control water is also of concern, since metal ions, bacteria, temperature, plankton, and other suspended material may affect results. To minimize the danger of problems from these sources, we utilize water drawn through nonmetallic, nontoxic lines with a hard-rubber pump. This water is heated to a constant temperature of 20° C, filtered through a 5-micron filter, and treated with ultraviolet light. While much of this seemingly elaborate treatment is not necessary at all times, we prefer to use control water of as near a constant quality as possible.

We have found that the size of containers used and the type% (glass or plastic) have slight statistical effect on our results — not great enough to be of concern but nevertheless great enough to indicate the merit of utilizing the same size and type of container in any given series of bioassays.

The age of developing embryos, when introduced to the variable being bioassayed, must be controlled. With many materials response changes (general decline) with increasing age; therefore, to achieve comparable results we introduce developing embryos to the material being bioassayed between 1 and 2 hours after fertilization. This practice is satisfactory where we are concerned with relative toxicities only. Where minimal toxicity levels are desired, fertilization must occur in the presence of the variable.

Where low-level effects are being considered, problems of sampling variation can mask results; however, this problem can be minimized by increasing the number of cultures in the control and test situations to increase the statistical reliability. In our work a given bioassay will usually be made up of 60 cultures, with at least 10% of them controls and triplicate cultures of each variable or test.

Our 48-hour bioassays are generally carried on in 1-liter polyethylene beakers seeded with 20,000 to 30,000 eggs.

The 48-hour bioassays are evaluated on the basis of per cent abnormal larvae. Normal larvae are those which are fully shelled. Some of those called normal are often of irregular shape and undersized; however, using this "full-shelled" criterion eliminates much of the variability which arises when several people are evaluating the larvae samples. It has been our experience that those larvae termed abnormal will not feed and grow and as a result, die within a few days. A further basis for considering the abnormals undesirable is the absence of abnormal larvae in plankton samples from nature. We, therefore, use per cent abnormal larvae as an index of effect and consider a material which induces abnormality in excess of the controls to be adversely affecting the larvae. We consider a material which gives less than 5% abnormal larvae as nontoxic, a material which gives 5 to 15% abnormal larvae slightly toxic, and any material which gives over 15 % abnormal larvae to be toxic. Where over 50% of the larvae are abnormal, it is very probable that the lethal threshold has been reached. Where abnormals reach 90% we consider the variable to be clearly lethal to the larvae.

Throughout the entire method every precaution is taken to ensure a healthy group of larvae for use in bioassays; however, occasional inferior larval lots are encountered. These are readily detected by the per cent abnormality of the control — we totally reject any bioassay where our controls have in excess of 10% abnormals; between 5 and 10% we are extremely cautious in making firm conclusions. We prefer to deal with larval groups where the controls average less than 2.5% abnormals.

In addition to the aforementioned problems, feeding rates and infestation of the cultures with other organisms, especially small marine worms and crustaceans, must be solved where growth, survival, and setting of the larvae are studied. The problem of feeding the larvae in these longer studies materially increases the complexity and cost of a larval bioassay program. As a general rule We do not attempt to feed and grow larvae unless we have reason to suspect effects which are not detected in the 48-hour bioassays.

Depending on the type of work being done, all of these problems, part of them, or additional ones may be encountered when using the bivalve larvae bioassay. It is sufficient to reiterate that while problems exist, they are not insurmountable.

Results from Larval Bioassays

While in many respects this bioassay tool is in early stages of development, the costs in terms of equipment supplies, and time required to achieve results make it an extremely attractive one; especially when dealing with concentrations of materials which appear to act in a chronic rather than acute manner on the adult organisms.

Thus far, workers have reported studies with industrial wastes, salinity, temperature, insecticides, weedicides, chemicals, silt, and effects of materials such as stainless steel, plastics, metals, etc., on water quality.

Toxicity information reported from larval bioassays is not extensive as yet; however, I will mention a few of the results of which I am aware. In general, water which has been oftentimes only briefly in contact with metals, especially some types of stainless steel, is lethal. Many plastic materials, notably pure polyethylene, are nontoxic; many of those which contain platsicizers are lethal. For example, solid polyvinylchloride is nontoxic but sheet polyvinylchloride, which contains a plasticizer, is toxic. Glass is nontoxic. Potassium cyanide is lethal at 0.014 ppm, mercuric chloride at 0.027 ppm, copper sulfate at 0.04 ppm, sodium sulfide at 2.44 ppm, sulfuric acid at 33-11 ppm, Roccal at 1 ppm, Dowicide A at about 10 ppm, Dowicide G at 0.25 ppm, NABAM at 0.50 ppm, allyl alcohol at 2.5 ppm, DIURON at 5 ppm, NEBURON at 2.4 ppm, sevin at 5 ppm, toxaphene at 10 ppm, Guthion at 1 ppm, Dicopthion at about 2 ppm, and one of our big local problems, sulfite waste liquor, has been found lethal at 13 ppm when the eggs are fertilized in the sulfite waste liquor. It cannot be stated that all of these values were derived under exactly the same procedures outlined in this report; however, the general techniques would appear to be the same.

In Operation

At our Point Whitney Laboratory we routinely use 48-hour development of Pacific oyster *(Crassostrea gigas)* larvae as a bioassay tool. New materials such as plastics, paints, chemicals, and even wood (treated and untreated) which will come in contact with our laboratory water supply are bioassayed before we use them. In the past, we have conducted bioassays with Pacific oyster larvae of the natural water within 4 miles of our laboratory for nearly a year to collect data on the statistical validity of the method, its reproducibility, and the range of variation found in the larvae response to "field water".

■ Subsequently, we have conducted fieldwater bioassays covering over 95% of our oystering areas and 80% of the state's water in general. In these bioassays, water samples were collected by airplane in the field and flown to our laboratory where they were bioassayed with fertilized eggs of the Pacific oyster. Figure 1 shows flow diagram.

Monthly bioassays of the marine waters at the Port Angeles, Bellingham-Anacortes, and Everett areas have been conducted from May of 1963 to July of 1965 in co-operation with the United States Public Health Service.

In the future we plan extensive use of larval bioassay in areas where shellfish problems exist to ascertain whether adult mortalities, poor growth, reduced fatness, or reproductive failures are related to poor water quality as measured by the larvae.

Application and Interpretation

One major stumbling block to the general acceptance of this bioassay tool by lay and technical people has been that it deals with only one phase of the life cycle of the organism.

The contention often put forth is that while biologically interesting, the larval approach is not realistic since it does not necessarily reflect the effect on the adult, which after all is the item of economic interest. We must object to this rather fuz2y thinking and must point out that if a material breaks the life cycle of the organism considered, very soon there will be no adults to worry about. In our opinion, any material which breaks the life cycle of an organism at the reproductive stage represents an adverse effect on the adult. A more valid objection, however, deals with low concentrations of a material which have an adverse effect on the larvae but are not necessarily lethal. Critics maintain that we cannot validly infer "effect" on the larvae as evidence of long-range effect on the adults. This objection does have merit. Work is currently being carried on by several agencies which should provide data on the relationship of effect on larvae versus effect on the adult. In the interim we prefer to take the stand that an adverse effect on the larvae most probably will be reflected in undue stress on the adult. Under stress the adult's normal resistance to disease, changes in ecology, temperature, salinity, dissolved oxygen, or other environmental variables may be adversely affected.

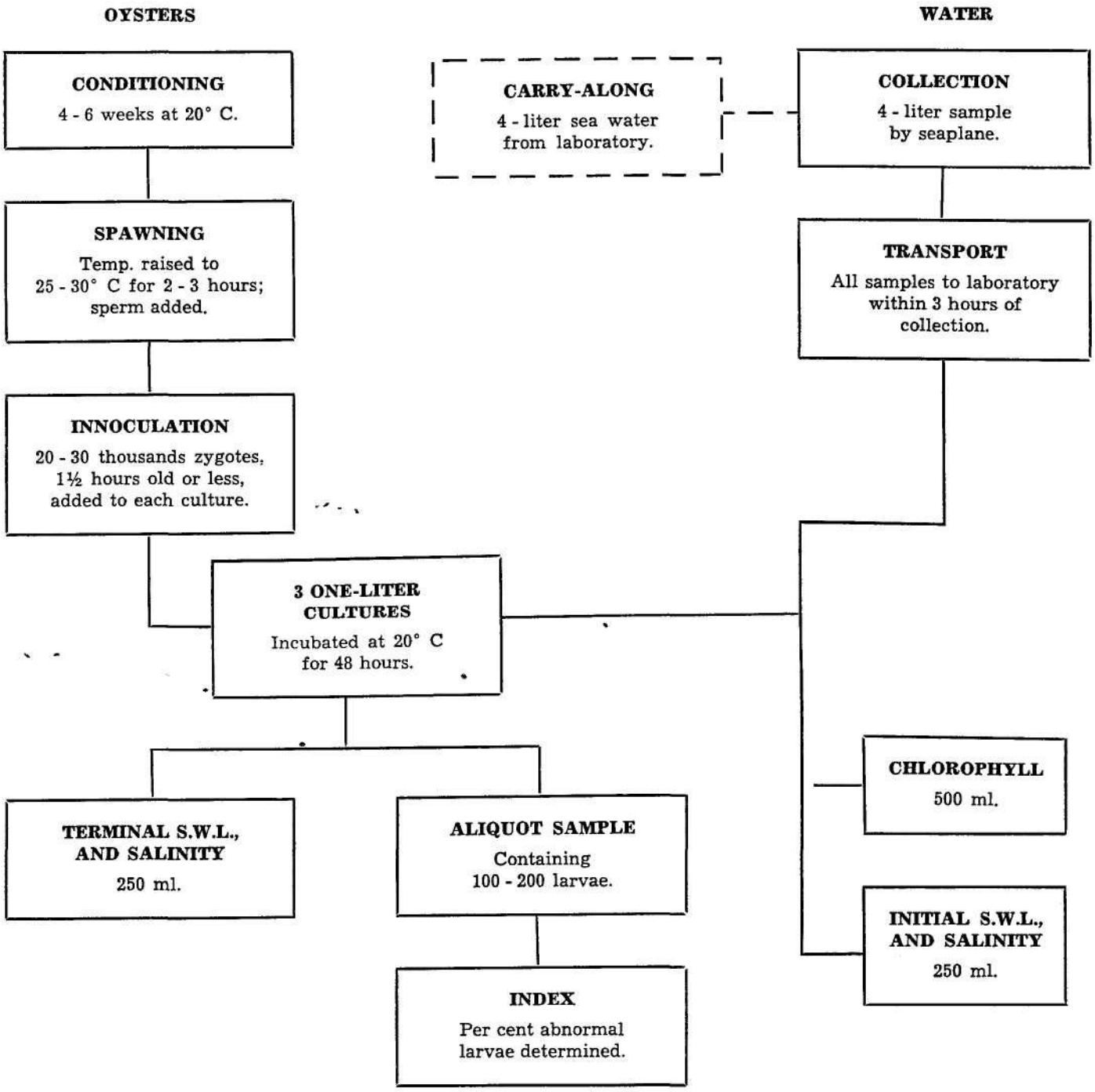

FIGURE 1. Flow diagram of bioassay with Pacific oyster larvae. (S.W.L., is sulfite waste liquor.)

PACIFIC HAKE FISHERY: A PROGRESS REPORT

HERBERT H. SHIPPEN U. **S.**
Bureau of Commercial Fisheries

My purpose is to review the progress that has been made in efforts by various research groups to encourage a fishery upon Pacific hake found off the coast of California, Oregon, and Washington.

The Pacific hake, *Merluccius productus,* a member of the codfish family, is one of a half dozen or so species of the genus which is world wide in its distribution. Hake are found and fished off the coasts of Europe, South Africa, and South America. On the east coast of the United States where hake usually go under the name of "whiting", close to 100 million pounds are landed yearly and are largely utilized for human consumption. World hake landings in recent years have averaged around 400,000 metric tons. What then of hake on the Pacific Coast of the United States?

The general abundance of hake on the west coast of North America has been known to commercial and sports fishermen for many years, and recently some effort at quantifying the extent of the resource has been made. Egg and larval surveys by California Cooperative Oceanic Fisheries Investigations and Bureau of Commercial Fisheries Laboratory at La Jolla, California, have indicated that the Pacific hake ranks second to only the northern anchovy in abundance off California. The size of the standing crop of hake spawning off California has been estimated from eggs and larvae to be in the order of magnitude of 6 billion pounds. " " •

A second means of estimating the quantity of hake is through exploratory fishing in conjunction with echo sounding surveys. This work has been carried out by the Seattle Exploratory Fishing and Gear Research Base of the U.S. Bureau of Commercial Fisheries. The vessel JOHN N. COBB is equipped with a large mid-water trawl developed by the Bureau's Gear Research section. This pelagic trawl has pressure sensing devices that permit the trawl to be fished precisely at any desired depth. It has proved to be very effective on hake when used in conjunction with Simrad echo sounding gear. The trawl has additional advantages in that it can be fished over any type of bottom and takes catches that contain little else than hake.

Explorations by the JOHN N. COBB in 1964 established that large compact schools of hake were present off Washington, Oregon, and Northern California from mid-May until mid-November. Mid-water trawling off Washington and Oregon during this period consistently took catches in excess of 15,000 pounds per *V2* hour with a high catch of 60,000 pounds in *Vi* hour. These explorations suggested that hake were sufficiently abundant along that Washington-Oregon coast to support a commercial fishery during the period when hake were present.

Assuming that the COBB located all of the hake schools off Washington and Oregon and that all fish in front of the trawl were captured, both very conservative assumptions, the standing crop of hake off Washington and Oregon during 1964 was estimated at 1 billion pounds.

Studies of Pacific hake at the Seattle Biological Laboratory of the Bureau of Commercial Fisheries are being conducted as a part of the Groundfish Program, a new area of investigation begun in 1964. The principal objective of hake studies is to provide an assessment of the maximum sustainable yield of hake found off Washington and Oregon to aid in the management of the resource.

Using available information on rates of growth, mortality, and recruitment, biologists at the Seattle Biological Laboratory placed the maximum sustainable yield of the resource off Washington and Oregon at from 100,000 to 150,000 tons per year, enough to support the operation of a moderate size reduction plant during the 6-month period when hake are available. Let me emphasize that this estimate of the maximum sustainable yield is most conservative and assumes that the exploratory sampling effort was 100 per cent efficient. A continuing effort is being made to improve on the accuracy of this estimate. Personnel from the Seattle Biological Laboratory accompany the JOHN N. COBB during its hake surveys to collect biological data relating to this objective.

This past summer the Seattle Exploratory Fishing and Gear Research Base continued its surveys for hake along the Pacific Coast. A commercial vessel, the WESTERN FLYER, was chartered for 99 days to simulate commercial fishing on hake off Washington and Oregon. Deliveries were made to a reduction plant located at Warrenton, Oregon near Astoria. During the 62 days of actual fishing activity the WESTERN FLYER took 872 tons of hake. This was much less than was originally anticipated and was caused by an inexplicable scarcity of hake schools in the vicinity of the Columbia River mouth. Nevertheless, the crew of the WESTERN FLYER quickly learned the use of the pelagic trawl with its telemetering system and made 170 drags with the gear. A second commercial fishing vessel, the ST. MICHAEL, was chartered to test smaller versions of the COBB pelagic trawl which may be suited for smaller and less powerful boats than are required to use the full-size gear.

Commercial utilization of hake has been under investigation by Oregon State University and the Seattle Technological Laboratory of the Bureau of Commercial Fisheries. Uses that have been found or suggested for hake include human food, animal food, fish meal and oil, and fish protein concentrate or fish flour. Of these products the most promising use for hake at the present appears to be fish meal. Fish meal has an estab-

lished market throughout the world, and there is a trend of increasing demand as its use in poultry and livestock feeds continues to grow. Because of a sharp increase in the price of fish meal during the last few years, the economic outlook for this product is much more favorable than in the past.

Hake taken off Washington and Oregon have been found to consist of 15 per cent protein, from 2 to 5 per cent oil, about 2 per cent ash and the remainder, about 80 per cent, moisture. This means that 5 to 6 tons of raw hake are required to produce 1 ton of fish meal. The variable oil content of Pacific hake means that (1) equipment for oil extraction must be provided in a hake processing plant to produce a uniform quality meal and (2) a hake meal industry with a relatively small or non-existent income from oil must be a high-volume efficient operation in order to produce fish meal at a competitive price on the world market.

The fishing industry has shown a keen interest in the development of a hake fishery. If present plans are fulfilled, a new reduction plant should begin the processing of hake on the Washington coast by next spring. It is also likely that one or more hake reduction plants will be operating in California by next year.

The extensive use of Pacific hake as human food is somewhat less promising than its use as fish meal. A common complaint about fresh Pacific hake is that it is soft, bland, and of a watery texture. On the other hand, most of the hake landed on the eastern coast of the United States are accepted as human food so a similar market would appear to be available for Pacific hake. Research on methods of marketing fresh hake products is continuing.

Another potential use for hake as human food is found in fish protein concentrate or fish flour. Hake appears to present no special problem as a source of F.P.C, but development must await the completion of feasibility studies on the east coast as well as clearance of the product by the Food and Drug Administration.

*

During the past year meetings have been held between State and Federal agencies to exchange information and to

Appendix 3 — Cooperative Research

LARVAL DEVELOPMENT OF LABORATORY-REARED OCEAN SHRIMP

*Pandalus Jordan** Rathbun.

JOHN C. MODIN and **KEITH** W. **COX**
California Department of Fish and Game

Although nine species of pandalid shrimps are found along the Pacific coast of North America, the ocean shrimp, *Pandalus jordam,* comprises 95 to 97 per cent of the catch taken off California, Oregon, and Washington. Advanced larval stages of several closely related species of North American Pacific coast shrimp have been described from larvae collected from plankton, but the ocean shrimp larva has never been described. Most shrimp larvae are similar in appearance and identification to species is assured only if the complete development has been observed under controlled conditions in the laboratory.

Shrimp larvae are planktonic and subject to many physical, chemical, and biological phenomena in the ocean during this, the most vulnerable part of their life. Recognition of the various larval stages in plankton makes it possible to predict their survival and distribution. This knowledge is necessary for more effective and intelligent management of the fishery.

Up to the present time, only seven of the many species of shrimp in the world are known to have been reared successfully through complete metamorphosis. California's project is the first to rear pandalid shrimp from the egg through metamorphosis.

On March 23, 1965, ripe, egg-bearing ocean shrimp collected off Crescent City by the California Department of Fish and Game research vessel, N. B. SCOFIELD, were transported by state plane to a temporary sea-water laboratory near Menlo Park-

*

A special aquarium system was designed, incorporating the most recent advances in larval shellfish rearing methods (Plate 1). Due to the lack of a continuous supply of fresh sea-water, a closed system was designed. However, the water was replaced periodically so that a complete change was effected about once every 10 days.

Water was collected from the open ocean and transported to the laboratory in plastic, 30-gallon containers. A sand filter of $3 beach sand was used to remove larger organisms and suspended materials. The filtered water was introduced into the system at the sump (Plate 1, S). A 5-micron filter element (Plate 1, F), of polyvinylchloride and orlon, and an ultraviolet unit (Plate 1, UV), prevented smaller, undesirable organisms and bacteria from contaminating the system.

Water temperature was maintained between 50 and 54° F. by a cooling unit (Plate 1, C). Two power failures during the experiment caused temperatures to increase 10 to 12° F. for approximately 24 hours. Apparently neither larvae nor adult shrimp were adversely affected by the change.

On March 28, the larvae began to hatch. These larvae were placed in compartmented, plastic tackle boxes (Plate 1, B), the bottoms of which were replaced with synthetic *(Nitex)* screening: 202-micron mesh. Styrene floats were attached to these boxes and the units placed in aquaria (Plate 1, A). Newly-hatched brine shrimp, *Artemia salina,* were cultured and fed to the developing larvae.

Sea-water was circulated through the *Nitex* screening to provide a continuous exchange of filtered, ultra-violet-treated, cool water to the developing larvae. By this method, toxic materials were prevented from accumulating in the rearing compartments and the necessity for frequent water change was eliminated. As far as known, this technique has not been used previously. As a control, an attempt was made to rear larvae in closed containers with daily changes of water. None

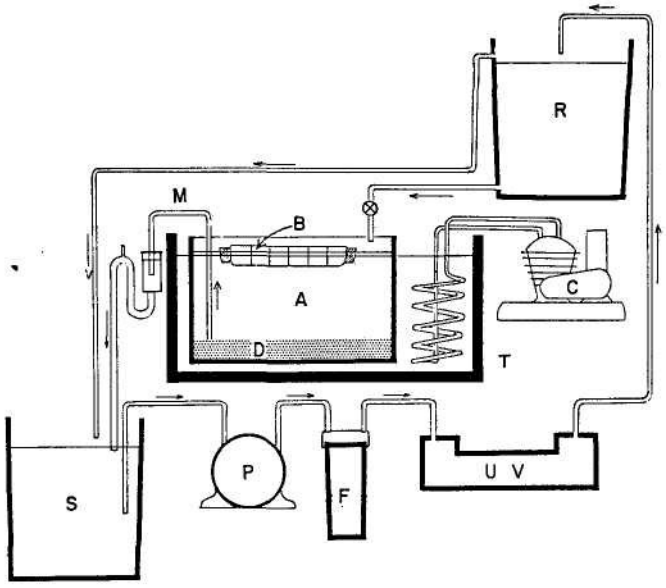

PLATE 1. Circulation plan of aquarium system for rearing *P. jordani* larvae. Arrows indicate direction of flow. Water is drawn from sump S, by pump P, through microfilter F, and ultraviolet sterilizer UV, to reservoir R, where it flows by gravity into aquarium A, circulates through NITEX screening in compartmented box B, filters through sand D, and returns via siphon M, to sump. Water temperatures controlled by cooling unit C, immersed in water table **T.**

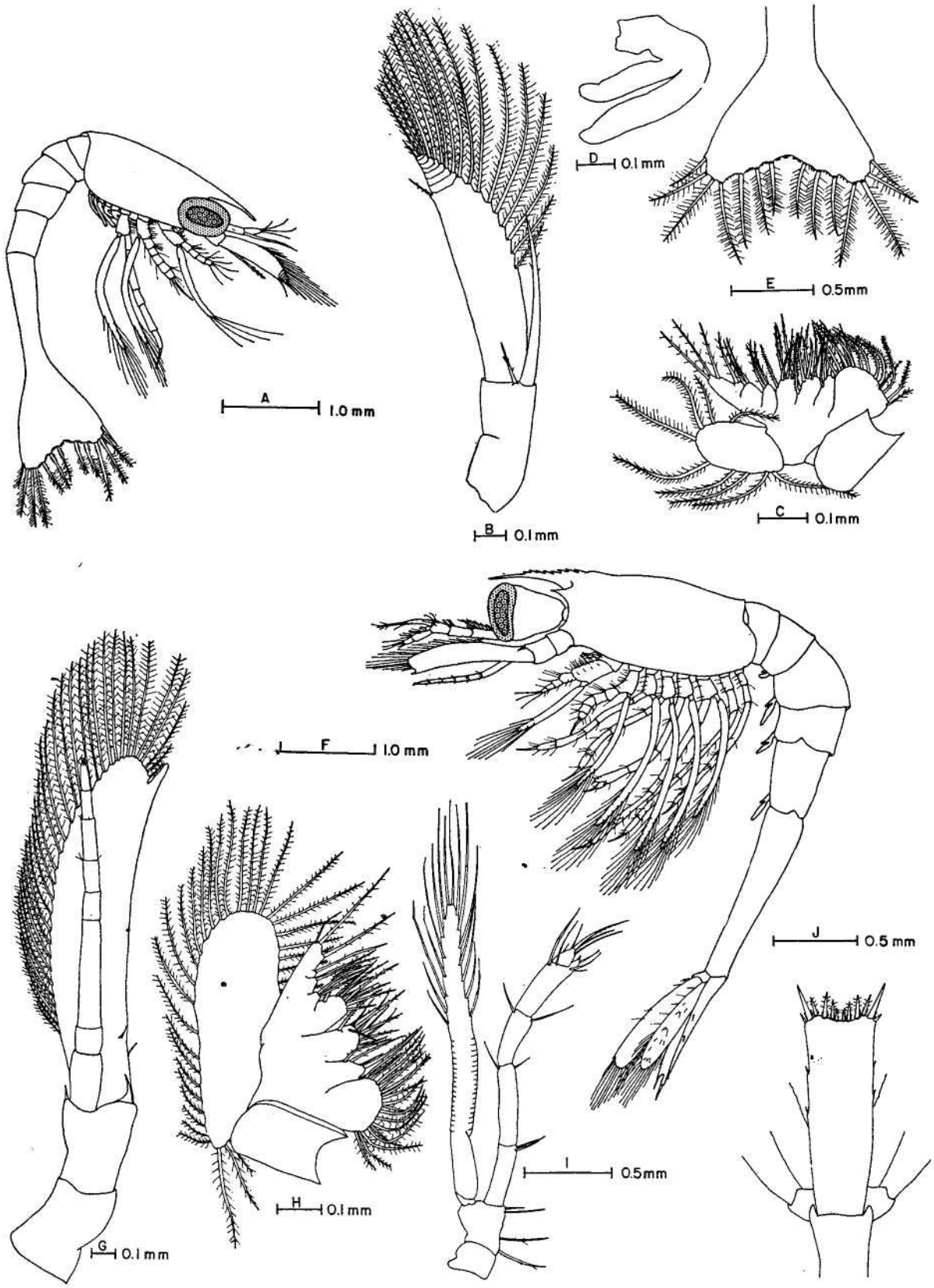
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PLATE 2

of these larvae survived beyond the first stage. Ocean shrimp larvae pass through 11 stages, each averaging 6.8 days in length. Three stages which most clearly illustrate larvae development are described in this paper.

First Zoeal Stage

The 1st stage larvae (Plate 2, Fig A) hatch directly from egg-bearing females and are approximately 5 mm long from the posterior margin of the telson to the anterior tip of the antennal scale.

This stage can be identified by rudimentary periopods, large immobile unstalked eyes, and the absence of uropods at the base of the telson. The peripods (Plate 2, Fig. D), originating immediately posterior to the 3rd maxilliped, are small simple, finger-like fleshy appendages. The 1st three pairs are bi-ramus, the remaining two pairs uni-ramus; none is functional.

The eyes, immobile and close together in the 1st stage, becomes stalked and project laterally from the carapace in the 2nd stage.

The telson (Plate 2, Fig. E) is continuous with the 6th abdominal segment and bears 14 spine-like setae on the terminal margin. In the 2nd stage, the telson becomes distinct from the 6th abdominal segment. The uropods, which can be seen developing under the transparent, chitinous integument of the telson in the 1st stage, have become functional and fringed with numerous heavily-plumed setae in the 3rd stage.

The fringed antennal scale (Plate 2, Fig. B), distally segmented in the 1st and 2nd stages becomes non-segmented in the 3rd stage. The flagellum is a stout, unsegmented, stem-like structure approximately one-half as long as the antennal scale. It becomes long and whip-like in the adult.

Except for a gradual increase in overall size and in the number of setae, the maxilla (Plate 2, Fig. C) remains basically unchanged throughout the entire larval development. The number of setae on the endopodite remains constant, at 9, and the distal lobe of the* coxopodite bears 4 large, plumed setae until the 6th stage when a 5th small simple seta develops.

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Sixth Zoeal Stage

Approximately 34 days after hatching, the zoea has reached the 6th stage (Plate 2, Fig. F) and has completed about one-half of its larval development. It is about 9-5 mm long and has 8 or 9 dorsal spines on the rostrum. The periopods have become functional and the flagellum is segmented. The uropods have developed numerous plumed setae and are nearly as long as the telson.

The flagellum (Plate 2, Fig. G), at this stage, is approximately the same length as the antennal scale and is divided into 7 segments.

The minute chela or claw which later forms on the endopodite of the 1st periopod has not yet developed. A chela is present or beginning to form on the terminal segment of the 2nd periopod (Plate 2, Fig. I), and the exopodite of the 3rd periopod is approximately one-half the length of its endopodite. The 4th and 5th periopods, although smaller than the 3rd, bear no exopodites and are essentially adult-like.

The maxilla (Plate 2, Fig. H) has increased in size and bears a correspondingly higher number of setae. A small, simple seta has developed on the distal lobe of the coxopodite, adding to the 4, large, plumed setae already present. The number of setae now present on the endopodite and on the distal lobe of the coxopodite will remain constant throughout the remainder of the larval life.

The telson (Plate 2, Fig. J) has become rectangular and is approximately 4 times as long as wide. There are 5 pairs of stout terminal spines, and 3 pairs of small, simple spines on the lateral margin. The outermost pair are the largest of the terminal spines. The uropods are almost as long as the telson, the ventral pair being slightly larger than the dorsal. Long, heavily-plumed setae originate on both inner and outer margins of the dorsal uropods and on the inner and terminal margins of the larger ventral uropods. A few small, slender setae are scattered over the surfaces of both dorsal and ventral uropods.

Eleventh Zoeal Stage

The 11th stage, reached approximately 68 days after hatching, is the final larval stage before metamorphosis into the juvenile-adult.

At this stage, the larva is about 17 mm long and can be identified by the long antennal flagellum, heavily setose pleopods, and the appearance, for the first time, of inferior, rostral spines (Plate 3, Fig. A).

The most significant development in the antenna (Plate 3, Fig. B) in the 11th stage is the increase in the length of the flagellum: it is approximately 3 times as long as the antennal scale, and is divided into 45-50 segments.

A proximal lobe and additional heavily plumed setae have developed on the exopodite of the maxilla. The 9 and 5 setae on the endopodite and on the distal lobe of the coxopodite remain constant, as in the preceeding stages.

A rudimentary chela, or claw, which appears in the 9th stage on the endopodite of the 1st periopod, remains distinct in the 11th stage but is not apparent in the adult.

On the 2nd periopod (Plate 3, Fig. D), the chela is almost completely developed and the first of many segments appears on the carpopodite. The last 3 periopods undergo no important structural changes and remain similar to preceding stages.

The telson, proximally expanded and quite similar to that of the adult, bears 7 pairs of lateral spines and 5 pairs of terminal spines. The middle pair of terminal spines are much larger than in previous stages and longer than the adjoining 3 pairs.

The uropods, although larger and more fully developed, remain basically unchanged from those of the 6th stage larvae.

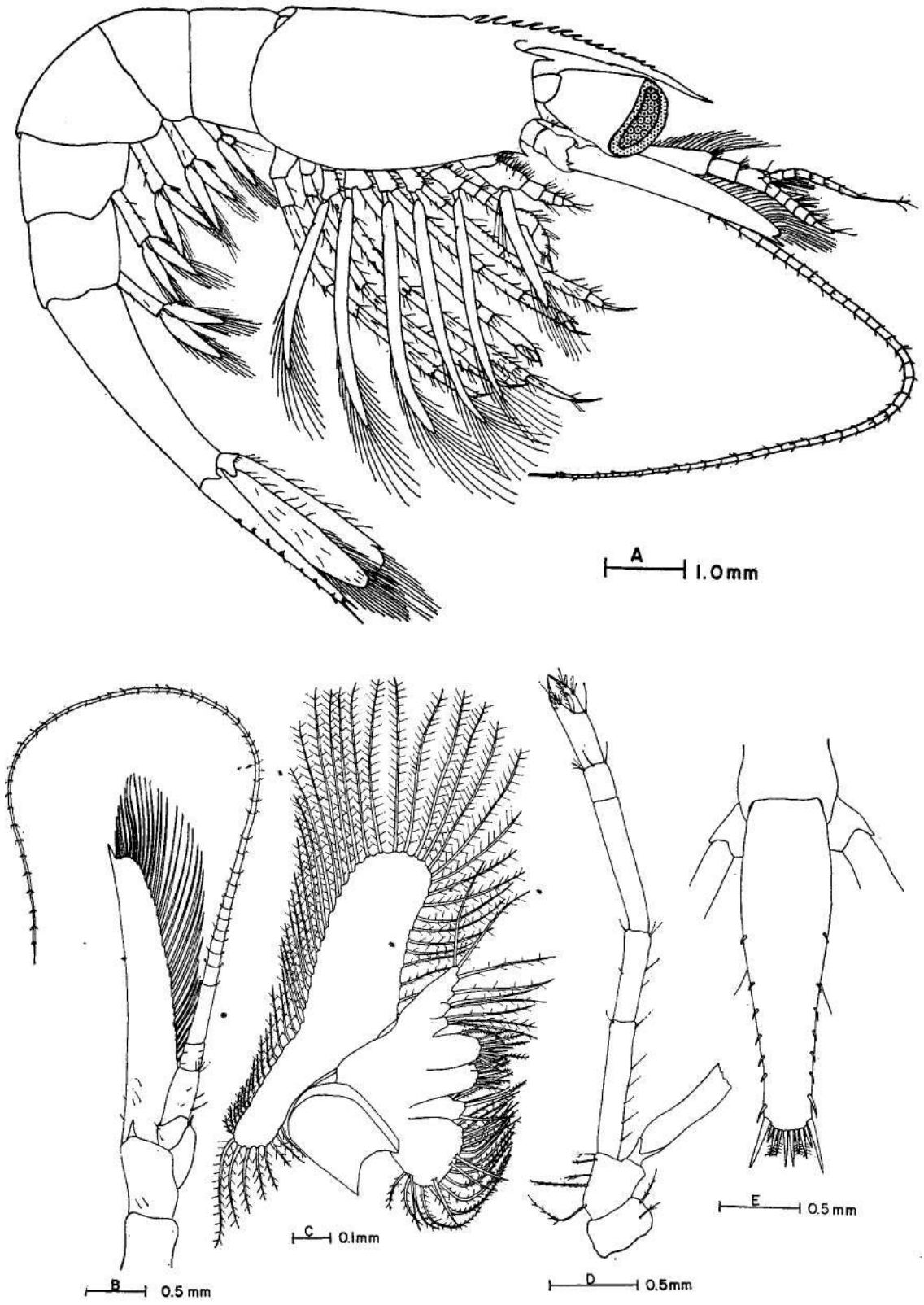

PLATE 3

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