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The importance of catch records in the management of the fisheries of Virginia with recommendations for the establishment of a fishery statistical laboratory

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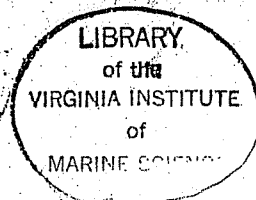
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THE IMPORTANCE OF CATCH RECORDS IN THE MANAGEMENT OF THE
FISHERIES OF VIRGINIA WITH RECOMMENDATIONS FOR THE ESTABLISHMENT
OF A FISHERY STATISTICAL LABORATORY

(Report by a subcommittee to the Fisheries Research Committee of the
Advisory Council on the Virginia Economy presenting a plan for obtain-
ing fisheries statistics)

1949



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THE IMPORTANCE OF CATCH RECORDS IN THE MANAGEMENT OF THE
FISHERIES OF VIRGINIA WITH RECOMMENDATIONS FOR THE ESTABLISHMENT
OF A FISHERY STATISTICAL LABORATORY

(Report by a subcommittee to the Fisheries Research Committee of the Advisory Council on the Virginia Economy presenting a plan for obtaining fisheries statistics)

INTRODUCTION

In the United States the right for any state to control the fisheries within its territorial waters has long been recognized. This responsibility was seldom realized, however, until the production from certain of the fisheries had declined to such an extent that regulations and restrictions were imposed to prevent complete failure of the resource. The laws and regulations which ensued were governed by social and political factors -- by "trial and error", in many cases -- simply because there was not available the biological and economic background upon which the law-makers and administrators could base their decisions.

The management and maintenance of a fisheries is big business for any state. For Virginia the fishing industry represents an estimated gross annual value of more than twenty-one million dollars and employs about 9,600 fishermen.¹ Yet, only the crudest estimates are made of the numbers of fish taken each year and there is no knowledge whatever of the quantity of fish remaining upon which the industry is dependent for its next year's catch.

We, as a special committee, were instructed to consider the need of a statistical system that would provide for a detailed record of fish and shellfish taken from the waters of Virginia. We have reviewed the development of catch records now obtained by state and federal agencies; their original purpose and use; and their inadequacies and limitations. We have studied the application of catch statistics to practical management problems; their relation to the economic security of the fishing industry; and their value to law-makers in formulating wise and adequate legislation. We have compared the statistical systems successfully in operation in other states; the methods used in collecting, recording, and analyzing their records; and the funds and personnel required to undertake this part of their work.

Finally, after careful review, we are convinced that the very foundation for any critical study of a fishery, whether it be biologic, economic or social, reduces to the common requisite of knowing the number of fish taken, when they were taken and where; and of knowing how many people were fishing and the type and effectiveness of their gear. That system which we believe will most accurately, adequately and economically answer these questions must provide for:

1. A statistical laboratory to be established as a part of the Virginia Fisheries Laboratory,
 2. Legislative authority to collect catch records from the fishing industry
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¹ Fishery Statistics of the United States, 1945. U. S. Dept. of Int., Fish and Wildlife Service. Statistical Digest No. 18. p. 172-173. 1949.

with penalty for failure to furnish reports or for reporting falsely; the Commission of Fisheries of Virginia to act as the enforcement agency,

3. Issuance of licenses to dealers and fishermen; the applications to be in duplicate requiring such statistical information as requested by the laboratory,
4. A system based upon triplicate dealer delivery receipts; one copy for the dealer, one for the fisherman and one forwarded to the statistical laboratory, and
5. A periodical examination of the system with the adoption of recommended modifications in order that continued adequacy and best utilization of the data will be assured.

The operation of the statistical system is dependent upon adequate personnel and funds and, accordingly, the Committee has devoted much of its time considering the organization and cost of the statistical laboratory. In summary, provision must be made for a chief, an assistant, a junior analyst, three statistical agents, four statistical clerks and a clerk stenographer. The cost, including rental of tabulating equipment, will require an appropriation of \$50,000 a year.

THE IMPORTANCE OF THE FISHERIES

The first settlers that arrived along our shores found an abundance of fish and shellfish which saved many from starvation when agricultural crops failed. Because of the vast numbers of fish, they were convinced that the supply was "inexhaustible." As years passed and the country grew, exploitation of the fishery became more and more intense to satisfy the demand created by the growing population. As means of transportation improved, markets for fish and shellfish developed throughout the entire United States. This normal expansion of the industry was coupled, however, with waste, as tons of less desirable fish were discarded for a few choice ones. Destruction of the native streams by the construction of dams and by domestic and industrial pollution completed the events so that the runs of Atlantic Salmon, Sturgeon and Shad, which were once thought to be inexhaustible in numbers, have now disappeared from many of our streams.

It has been less than 100 years since pioneers moved into the west. The soil that once produced heavy yields is now exhausted and requires continual addition of minerals and humus materials. The forests have been cut, burned and wasted to a point where strict curtailment of cutting and a program of replanting must be followed to prevent an end to our timber supply. Once these resources were believed to be inexhaustible; our fisheries could easily fall into the same stage of exhaustion.

The population of the world is estimated to double in about every hundred years and at this rate in one to two hundred years there will not be sufficient land to support the population. As the population pressure increases, the use of land shifts from the production of beef to mutton to pork to grains,² accompanied

² Our Natural Resources and their Conservation. Parkins, A. E., and Whitaker, J. R. pp. 178-179, xiv and 647 pp. Wiley & Sons, N. Y. 1939.

by an ever increasing demand for seafoods in order to satisfy the demand for essential proteins. Our present day example is Japan where most of the animal proteins in the people's diet and a considerable amount of the fat come from the sea.³ Our marine fisheries are a unique crop, requiring no arable land for a yield and presenting no conflict with production of our agriculture crops. But they are limited in productivity and the future supply is dependent upon the wisdom our administrators use now in protecting and managing this resource.

DEVELOPMENT OF A STATISTICAL SYSTEM

Systems for collection of catch records have passed through at least three recognizable stages of development. First, there is the need to know the magnitude of the fisheries as an indicator of the amount of business handled or for a comparison of the value of fisheries with the other industries of the state. This is usually a gross annual estimate used to show whether the "business" is increasing or decreasing from year to year and it is the type of information that is found in summaries of natural resources published by state agencies, chambers of commerce, or similar organizations.

The second phase of development comes when the administrative body, in its efforts to manage the fisheries, desires to know the amount of business transacted in each locality in order that local and seasonal fluctuations in catch may be detected. These records may be obtained first as a haphazard estimate by temporary inspectors or enforcement officers incidental to their normal duties; but sooner or later, as their value is realized, a system of simple reports from the industry is established that will give the volume and composition of the monthly business. The records provide particularly valuable information on the seasonal importance of each fishery in each locality and their characteristics and trends can be followed from month to month and from year to year. This is basic information continually sought by administrative officers and by the law-makers when regulations applying to any of our fisheries are under discussion.

The third and final stage is reached when conservation principles are applied to the management of the fisheries for which we must have a thorough knowledge of the dynamics of the fishery. Are the fluctuations in catch caused by overfishing? by natural causes? by economic conditions? To make such analyses and to form reliable conclusions requires above all a detailed record of the operations and catch of each boat or of each unit of gear.

PRESENT STATUS OF VIRGINIA FISHERY STATISTICS

In Virginia the present source of catch records are from two independent federal agencies. First, the U. S. Army Engineers collect the gross pounds of fish landed at certain ports with no reference as to species, time, or locality of capture. These statistics show the annual gross business of a certain port or water area and govern decisions to dredge a channel or repair a dock or undertake other projects.

Second, and most applicable, are the figures collected by the Fish and Wildlife Service, U. S. Department of the Interior, for here we have information as to

³ Fisheries Education and Research in Japan. U. S. Dept. of Interior, Fish and Wildlife Service, Fishery Leaflet 236. p. 3. Washington. May 1947.

the catch of each kind of fish by gear, the area of landing, the number of persons and apparatus engaged in the industry, and the value. The statistics show neither seasonal abundance nor do they record area of capture -- information vital for the administration of the fishery. But their greatest disadvantage lies in the lapse of two or more years before the statistics become generally available. An administrator must follow the continually shifting trends in the fishery in order to intelligently formulate new laws and regulations. This requires statistics from month to month -- not two years afterwards.

APPLICATION OF STATISTICS TO FISHERY MANAGEMENT

The aim of fisheries administration is to so manage the resource that over a period of years the greatest possible return will be realized. To attain this goal, the supply must be known for the yield depends primarily on this.

The total catch figures alone are no indication of the supply of fish. Nor does a change in the catch from year to year necessarily mean an increase or decline in the stock. Frequently, we have watched a steady rise in catch figures for a fishery ignoring the increased number of boats fishing and believing that since the catch shows no decline, the stock can well support the yield. Finally, the catch reaches a point where it is unable to maintain itself even when the number of boats are doubled or redoubled. By now the damage has been done and the supply, upon which the economic security of the industry depends, has fallen to a dangerously low level. Had we considered catch per unit effort or a similar index of abundance, the catch could have been adjusted so as to give a high average yield year after year. This is our objective.

It is not intended to minimize the importance of natural mortality by our reference to depletion through fishing. Generally speaking, the removal of fish by natural causes exceeds many times the numbers taken by the commercial fishery. Chemical and physical factors, food, predators and competitors, all influence the survival of fish but because of the complexities and inter-relationships it has rarely been possible to evaluate their effect on the individual kinds of fish. We do recognize, however, that because of differences in their life histories, the annual production of certain fish are more stable than others -- thus, fish like the halibut and certain of the salmon appear to be subjected to and/or affected less by variations in natural conditions than the sardine or the striped bass. Adequate statistics will pave the way to a better understanding of these fluctuations.

The administrator, ideally, should be in a position to predict supply but failing this, the relative abundance of fish must be known at all times so that the trends in the supply of fish can be followed and regulations adjusted accordingly. An adequate system of catch records with proper biological and economic analysis will provide such an index of abundance.

COLLECTION OF CATCH RECORDS

There are two general types of statistical systems now in use by other states where detailed information is collected similar to that required by Virginia. One type has been in operation in Michigan for over twenty years covering the commercial fishery of the Great Lakes. Mr. F. A. Westerman⁴ gives the following brief

⁴ Letter, Westerman, F. A., Jan. 19, 1949.

review of this system:

"The basis of this information are daily reports of activities which are submitted to this office following the close of each month by each fisherman. The necessary forms are provided by the department in sufficient quantities so the fisherman may keep one for his personal files. Our statute requires regular submission of these reports and provides a penalty of suspending the license for failure to submit these reports for two or more consecutive months, and further restriction in that no license is renewed until any delinquent reports are cleared up. No special field agents are involved. The entire program is handled by correspondence...

"We assume the obligation of collecting the reports and insuring that they are in proper form. Incomplete or inadequate reports are returned for correction. We summarize the production by species by months for the principal ports where these fish are landed. The reports are then turned over to the...U. S. Fish and Wildlife Service where more complete analyses are made."

The committee was impressed by the low cost of the Michigan plan operating on about \$5,000 a year for a staff of three people and for costs of printing, postage, etc. However, upon careful examination, the costs of the detailed analysis of the records -- so vital to fishery management -- is not included in the \$5,000 and would amount to approximately \$12,500 or a total of \$17,500 per year.

The fisheries of Michigan differ greatly from those of Virginia as will be seen in Table 1. Virginia has almost five times the number of fishermen that Michigan has, four and a half times the number of dealers (wholesale and manufacturing), two and a half times the variety of fish landed and eleven times the total poundage. After considering the more extensive Virginia industry, the cost of the Michigan plan if used by Virginia would be more than doubled.

At this time the committee is reluctant to recommend returns from the fishermen. With any system of reports, there is always the temptation to file false returns undetectable to the analyst. For example, in the preparation of the monthly report, it is easy for the fisherman to merely guess at his landings during the month. A system dependent upon the actual business transaction would overcome such a deficiency.

Our decision against the use of fishermen's records does not necessarily mean that these records should not be obtained in the future. There are certain valuable data that can only be obtained from actual fishermen's records. This is especially applicable to the determination of certain indices of abundance based on the actual fishing time of the individual units of gear, and a precise location of each fishing trial. However, until a system of catch records has become accepted as routine by the industry, we believe the Virginia system should not attempt to collect reports from all the fishermen but if required, could be undertaken, as a special study of an individual species.

The plan which appears to be most applicable to Virginia's fisheries has been in use for more than twenty years in California, and more recently has been adopted by Oregon and Washington and by the two international commissions on the Pacific Coast. The receipt book method of securing catch records is described by Conner⁵

⁵ The Commercial Fish Catch of California for the years 1930-1934, inclusive.
Calif. Div. Fish and Game, Bur. Comm. Fish, Bull. No. 44. p. 16. 1935.

TABLE I.

Comparison of the Michigan and Virginia Fisheries⁶

<u>State</u>	<u>Number Fishermen</u>	<u>Number Dealers</u>	<u>Number Varieties Landed</u>	<u>Total Pounds</u>
Michigan	2,064	79	19	23,960,200
Virginia	9,641	356	49	252,786,600
Greater magnitude of Virginia Fisheries (Virginia/Michigan)	4.67	4.51	2.58	10.64

⁶ Fishery Statistics of the United States, 1945. U. S. Dept. of Int., Fish and Wildlife Service. Statistical Digest No. 18, 1949.

as follows:

"... The cannery and dealers, under a law having to do with merchandising within the state, issued receipts to the fishermen when the fish were landed at the dock or on a barge. This receipt was used in the company bookkeeping systems and the fisherman retained his copy to present for the collection of money due him. Often the transaction was not completed immediately as purchase of the boats and gear was financed by the dealers. Because financial transactions between the fisherman and the dealer depended upon these receipts they offered the best possibilities for accurate records for the state's statistical system. Furthermore, their use was accepted procedure with the industry, and the new project would not be hampered by objections to a radical departure.

"In order to have the record uniform and to get the specific data desirable, the state printed and supplied to the industry, without cost, receipt books similar to those already in use. These receipts carried serial numbers and were printed on carbon backed paper so that three copies could be made at one time. The white original receipt was for the fisherman, the yellow carbon copy for the dealer, and the third ('pink ticket') was collected by the Division of Fish and Game. To meet the particular bookkeeping requirements of the dealers and because of the various types of fishing activities, several different forms of receipt books were issued, but the returns on all forms provided the same fundamental data for statistical purposes."

Success of the system is due primarily to the natural way it fits into the business operations of the fish dealers. The extra carbon is obtained with little additional effort and there is no extra "government form" to fill out. We propose that this system be adopted by Virginia.

ORGANIZATION

While the statistics are of immediate concern to the administrator and the law-maker, the interpretation of the crude catch records depends upon a thorough understanding of the behavior of the individual population of fish. Much supporting biological data is required on migrations, reproductive capacity, growth and similar problems. Application of the principles of Baranov, Ricker, Schaefer, Silliman, Thompson and other workers must be made to convert the catch figures into terms of supply, recruitment and mortalities before the records can be intelligently used for practical management problems. The adequacy and reliability of the return must be frequently evaluated by mathematical treatment -- especially with regards to the design and theory of sampling. Because of the intimate association of the laboratory with fisheries research problems, the statistical laboratory should be made a part of the Virginia Fisheries Laboratory and this agency should be allowed full freedom in formulating the detail and mechanics of the program.

In this connection it should be emphasized that the function of the statistical laboratory is primarily biologic. The statistical systems now operating in Oregon, Washington, and Michigan and in the U. S. Fish and Wildlife Service are staffed primarily by men trained as biologists and we feel that the analysts for the Virginia laboratory should be biologists but with an understanding of statistical procedure. However, it is anticipated that sampling and other problems will arise and these

should be referred to a trained statistician or a statistical laboratory for examination and advice.

Because of the value of the catch records to the Commissioner of Fisheries and other agencies, the Fisheries Laboratory should issue regularly a summary of the landings supplemented by an interpretation of observed trends in catch, predictions of yield and other information of practical value to the administrator and to the industry.

The Commissioner of Fisheries for Virginia should be responsible for enforcement of the laws pertaining to the operation of the statistical system and especially should have the power to revoke a license should the licensee fail to supply an accurate report of catch.

The committee has considered the staff required for the statistical laboratory and suggests the organization shown in Figure 1. The proposed staff will consist of a chief analyst (\$5,000/year) responsible only to the Director of the Virginia Fisheries Laboratory, an assistant analyst (\$4,000/year), a junior analyst (\$3,600/year), three statistical agents (\$9,000/year total), one clerk-stenographer (\$2,700/year) and four statistical clerks (\$9,600/year total). The organization is based on the division of Virginia into three statistical areas with a field agent assigned to each.

COST

In estimating the cost for the Virginia system, we again have compared the characteristics of the fisheries of California and Washington with that of Virginia (Table 2). Briefly, we find that both California and Washington have a greater number of fishermen than Virginia, and that California exceeds Virginia in both the varieties of fish and the total poundage landed. On the other hand the Virginia industry is characterized by the larger number of individual dealers -- actually the key to the operation of our proposed statistical system.

In Table 3, the costs for the Virginia statistical laboratory is compared with those of California and Washington. Our estimate of cost for the Virginia system is \$50,000 a year, which is roughly midway between Washington at \$19,000 and California at \$90,000. However, on examination of the distribution of funds, we find that the greatest discrepancy is in the amounts spent for salaries and accordingly, we have reconsidered carefully the relation between staff cost and work load.

There are three things that will influence the work load of a statistical system: the number of fishermen, the number of dealers, and the number of species landed. In this case, both California and Washington have more fishermen but Virginia will have to deal with over twice as many dealers as Washington and there will be records for over a third more varieties of fish to tabulate and analyze. As an indication of work-load, the product of the three items (i.e. fishermen, dealers, and species) has been calculated for each state as a "work index", and compared with salary cost in Figure 2.

Admittedly, this index is at best approximate, for to be true it should be based on detailed operational data and the various components weighed accordingly. So far as we know such data is non-existent. Accepting the index, however, as an

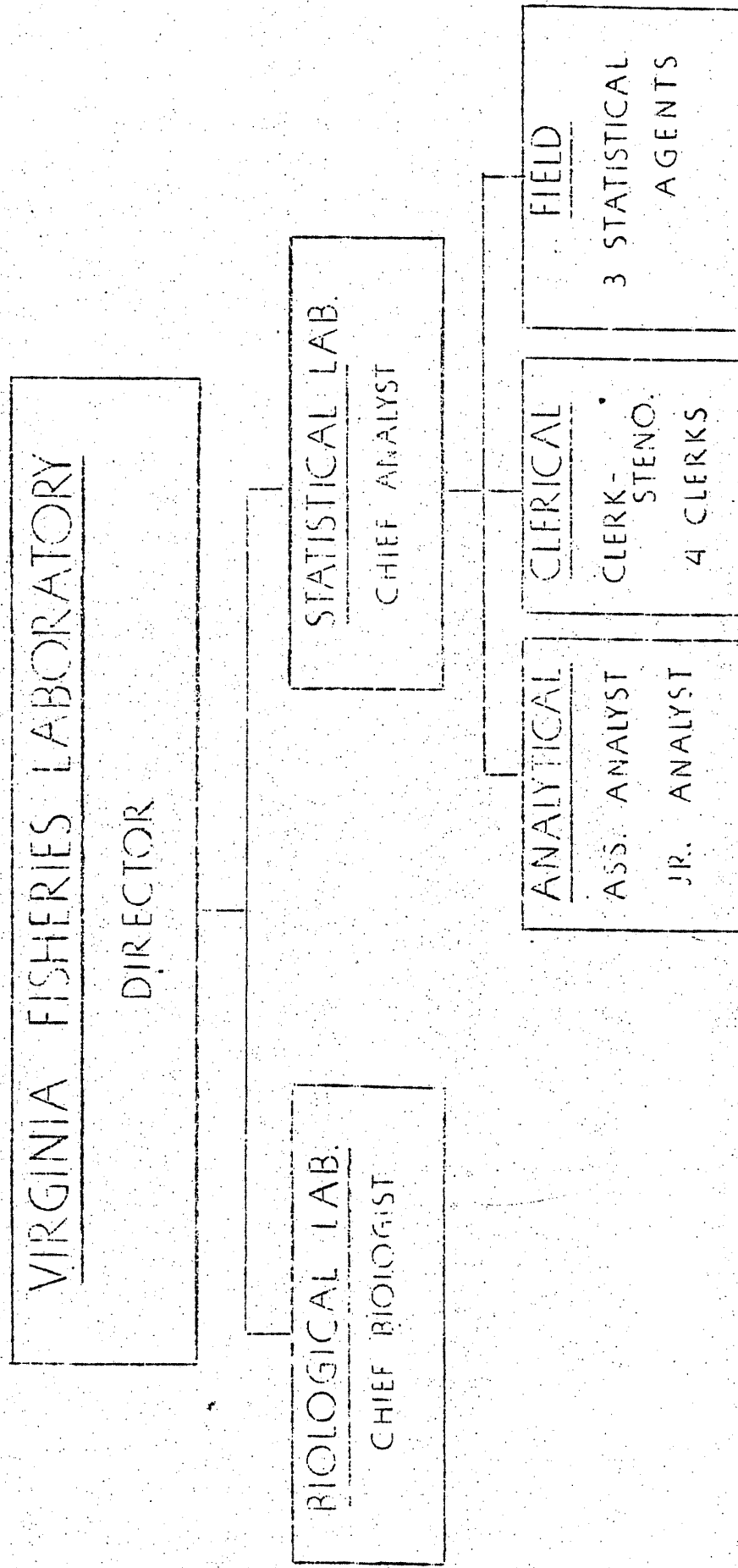


FIG. 1 ORGANIZATION PROPOSED FOR VIRGINIA
STATISTICAL LABORATORY

TABLE 2.

Comparison of the Virginia Fisheries with
those of California and Washington⁷

<u>State</u>	<u>Number Fishermen</u>	<u>Number Dealers</u> ⁸	<u>Number Varieties Landed</u>	<u>Pounds Landed</u>
California	9,739	205	61	1,159,368,800
Washington	19,131	(79)	34	196,135,600
Virginia	9,641	356	56	252,786,600

⁷ Fishery Statistics of the United States, 1945. U. S. Dept. of Int., Fish and Wildlife Service. Statistical Digest No. 18, pp. 172-173, 260-264, 1949.

⁸ Number of dealers are based on 1948 estimates for California and Virginia, 1947 estimate for Michigan.

TABLE 3.

A Comparison of the Costs of the California and Washington systems with those Estimated for the Virginia Statistical Laboratory.

<u>State</u>	<u>Salaries</u>	<u>Travel</u>	<u>Printing, Supplies and Equipment</u>	<u>Rent I.B.M. Machines</u>	<u>Not Classified</u>	<u>Total</u>
California ⁹	\$69,000	\$ --	\$3,000	\$7,000	\$11,000	\$90,000
Washington ¹⁰	11,674	1,036	4,798	1,354	--	18,862
Virginia	35,000	3,000	4,000	5,000	3,000	50,000

⁹ Letter, Roedel, P. M., Jan. 26, 1949

¹⁰ Letter, Robison, R. S., Jan. 27, 1949

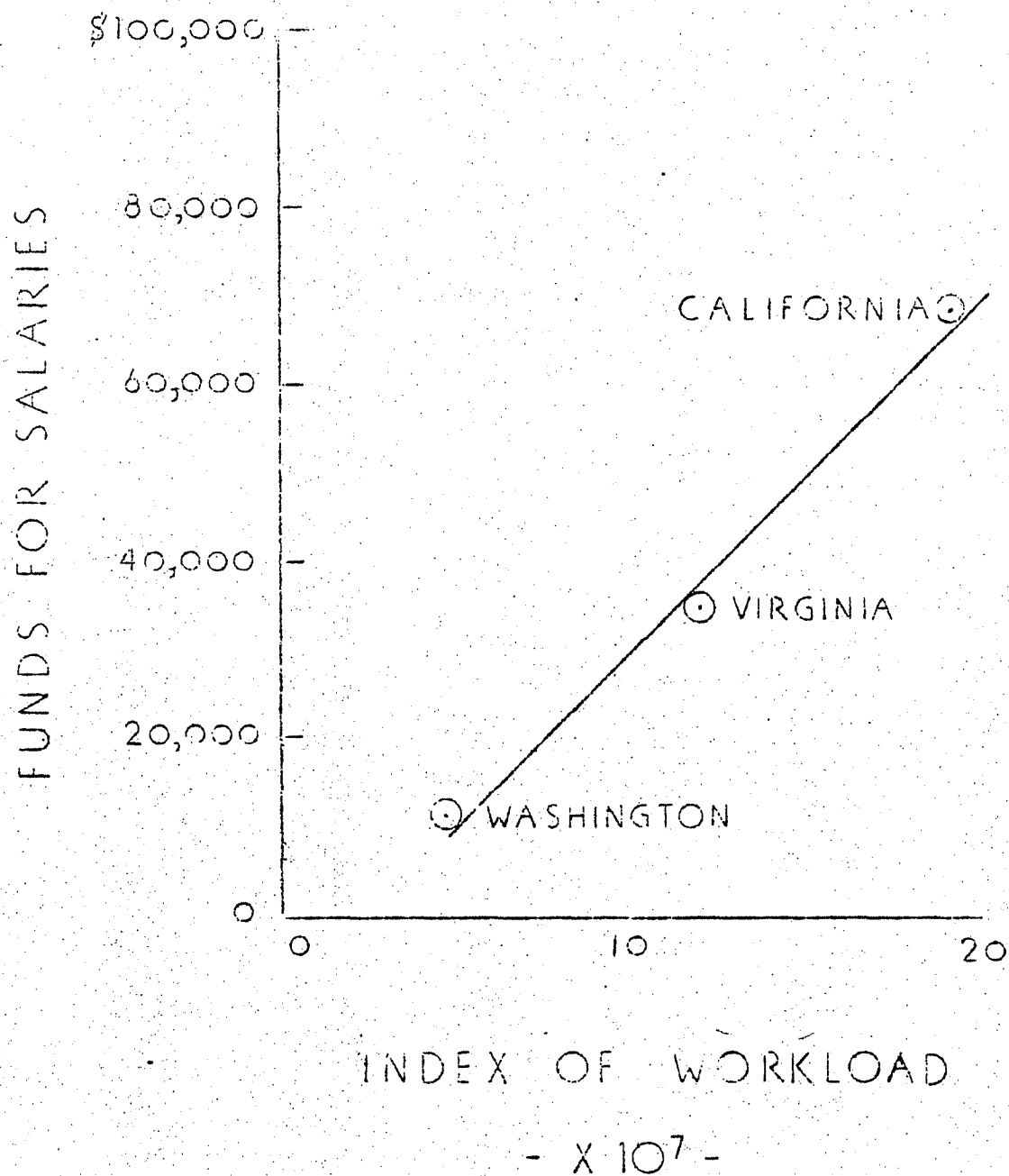


FIG. 2 COMPARISON OF SALARIES
WITH WORKLOAD

TABLE 4.

Calculation of Crude Index of Workload

<u>State</u>	<u>Number Fishermen</u>	<u>Number Dealers</u>	<u>Number Varieties Fish</u>	<u>Index (Products)</u>
California	9,739	205	61	12×10^7
Washington	19,131	79	34	5×10^7
Virginia	9,641	356	55	19×10^7

approximation of the work-load, we find general agreement of the salaries for the Virginia statistical laboratory with the observed trend. The recommended size of staff, therefore, is believed just and reasonable and if less were allowed for this item we feel that the laboratory would be unable to make a proper analysis of the records.

Finally, it should be noted that the costs given in Table 3 are only for the operation of statistical systems. An additional \$10,000 is allowed by California for time and expenses of the patrol officers for their part enforcing the system. Although no specific figures are given for Washington, they state that "the patrol department expends quite a bit of their time and expenses on checking our receiving tickets as made out by the dealers". The committee recognizes that the system will impose added duties to the officers of the Commissioner of Fisheries of Virginia and therefore, recommends an increase in their annual appropriation of \$10,000 for increased staff and expenses.

RECOMMENDATIONS

NOW, THEREFORE, after consideration of these facts and in fulfillment of our obligation to the Fisheries Research Committee of the Advisory Council on the Virginia Economy, we recommend that:

1. The Commonwealth of Virginia establish a system for the regular and continuing collection of catch statistics of its fisheries including not only the total catch by species but information as to the place, time, and method of capture.
2. Legislation be enacted to provide a Statistical Laboratory at the Virginia Fisheries Laboratory, with authority to obtain catch records as outlined in these recommendations from persons engaged in the fishery, and to provide as a penalty the revocation of license by the Virginia Commission of Fisheries, designated as the enforcement agency, for failure to furnish reports or for reporting false returns. Such legislation shall include the provision that all records collected and used by the Statistical Laboratory will remain confidential and shall not be released under any circumstances to private individuals or to State or Federal tax collection agencies.
3. The Dealers shall be licensed as well as fishermen with revocation of dealers license should no reports or inaccurate reports be supplied the statistical laboratory.
4. The statistical agents rely upon frequent contact with persons engaged in the fishery to obtain their confidence and cooperation rather than an arbitrary use of penalties provided by legislation.
5. The agencies of Virginia and the U. S. Fish and Wildlife Service coordinate their program to prevent duplication of effort and to obtain the best coverage of the Virginia fishery.
6. The statistical system be based upon the dealers delivery receipts to each fisherman. Each receipt shall be prepared in triplicate with one

copy for the fisherman, one for the dealer and one forwarded directly to the statistical laboratory.

7. The report be designed by the statistical laboratory to give the region of capture, type of gear, date, and kind of fish in pounds that will fulfill the biological needs of the fisheries agencies.
8. Licenses and applications for licenses be issued in duplicate and contain as far as practicable such information as required by the statistical laboratory for the solution of biological or other problems.
9. The objective shall be to first secure catch statistics from the entire fishery but that study should be given to the possibility of improved records through a comprehensive sampling procedure or by other techniques.
10. Ample provision be made to periodically evaluate the operation of the statistical system so as to insure adequacy of information obtained and to assist agencies in the full utilization of the data.

Respectfully submitted,

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