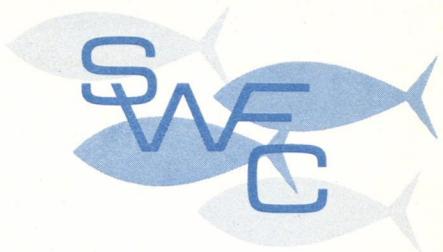




HONOLULU

LA JOLLA

TIBURON



SOUTHWEST FISHERIES CENTER

MONTHLY REPORT—JANUARY 1975

RESEARCH HIGHLIGHTS

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SOUTHWEST FISHERIES CENTER
La Jolla, California

HONOLULU LABORATORY
LA JOLLA LABORATORY
TIBURON LABORATORY

MONTHLY REPORT—JANUARY 1975

STATUS OF PUBLICATIONS

Published

Fox, William W., Jr. 1975. Fitting the generalized stock production model by least-squares and equilibrium approximation. *Fish. Bull., U.S.* 73(1): 23-37.

A least-squares method for fitting the generalized stock production model to fishery catch and fishing effort data which utilizes the equilibrium approximation approach is described. A weighting procedure for providing improved estimates of equilibrium fishing effort and an estimator of the catchability coefficient are developed. A computer program PRODFIT for performing the calculations is presented. The utility and performance of PRODFIT is illustrated with data from a simulated pandalid shrimp population.

Neill, William H., and John J. Magnuson. 1974. Distributional ecology and behavioral thermoregulation of fishes in relation to heated effluent from a power plant at Lake Monona, Wisconsin. *Trans. Am. Fish. Soc.* 103: 663-710.

To assess distributional responses of fishes to operation of the 220-megawatt power plant at Lake Monona, Wisconsin, the outfall area and two reference areas were electrofished on 30 dates between August 8, 1968 and August 21, 1969. Some fishes avoided the outfall area; these were Perca flavescens, Cottus bairdi, subadult Morone mississippiensis, and subadult Ictalurus melas. Others were occasionally or usually concentrated in the outfall area relative to reference areas-- Lepisosteus osseus, adult Cyprinus carpio, adult M. mississippiensis,

This report does not constitute publication and is for information only.

young Lepomis gibbosus, L. macrochirus, and Micropterus salmoides. The tendency for fish of a given species and size to concentrate in or avoid the outfall area generally did not reverse from season to season or from day to night. Any differences in growth rate of young fishes among outfall and reference areas were obscured by size-dependent movements of the fish.

Owen, R.W., and C.K. Sanchez. 1974. Phytoplankton pigment and production measurements in the California Current region, 1969-72. NOAA, NMFS, Data Report 91, 185 p.

Phytoplankton production, standing stocks, and some relevant environmental characteristics were systematically measured for the first time in the California Current system during the period from 1969 through 1972. This work describes the systems and methods of measurement, and presents the data obtained.

Struhsaker, Jeannette W., Maxwell B. Eldridge, and Tina Echeverria. 1974. Effects of benzene (a water-soluble component of crude oil) on eggs and larvae of Pacific herring and northern anchovy. In Pollution and Physiology of Marine Organisms (F.J. Vernberg and W.B. Vernberg, eds.), Academic Press, p. 241-272.

This paper presents the results of preliminary experiments testing lethal and sublethal concentrations of benzene on eggs and larvae of Pacific herring and northern anchovy. Developing embryos were exposed at two stages to contrast their sensitivity to benzene: 1) eggs a few hours after fertilization, and 2) larvae a few hours before or after completion of yolk absorption. Parameters measured include percent mortality, percent abnormal larvae, types of abnormalities, length of larvae and growth, yolk utilization, feeding and respiration.

Approved for Publication by Center Director

"The association of oceanic boundary features and albacore tuna in the north-east Pacific" by R. Michael Laurs and Ronald J. Lynn. For publication in the STD Conference Symposium Papers.

"Results of tuna live bait transporting experiments of the Honolulu Laboratory" by Tamio Otsu. [In Japanese.] For publication in Proceedings, Japan Tuna Research Conference, Shimizu, Japan, February 4-6, 1975.

ALBACORE FISHERIES INVESTIGATIONS

Results of NMFS Albacore Research Presented at Fishermen's Workshops

Dr. Michael Laurs, Leader of the Albacore Fishery Investigations, presented results of the cooperative NMFS-American Fishermen's Research Foundation albacore studies to fishermen's workshops organized by the University of California Sea Grant Marine Advisory Program, January 16 and 17. The meetings were held at Bodega Bay and Watsonville, California. About 25 fishermen attended the Bodega Bay meetings and 75 fishermen were present at the meeting in Watsonville. Dr. Laurs discussed findings made concerning the development of a new offshore fishery for albacore, albacore migrations based on tagging studies, and albacore-ocean relationships. The Coordinator for Sea Grant Advisory Services subsequently reported to Dr. Laurs that the talk was very well received by the fishermen and generated interest in the program, indicated by requests for publications as well as requests to be placed on the mailing list for sea surface temperature information.

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Dr. Laurs and Mr. R. Lynn, Oceanographer at the La Jolla Laboratory have completed a manuscript entitled, "The association of oceanic boundary features and albacore tuna in the northeast Pacific," for publication in the STD Conference-Workshop Proceedings, sponsored by Plessey Environmental Systems. Dr. Laurs and Mr. Lynn also continued work on a manuscript dealing with the offshore distribution and relative abundance of albacore during early season and migration routes followed by albacore into North American waters.

Minimum Swimming Speeds Estimated for Albacore Tuna

Mr. Ron Dotson, Biological Technician at the La Jolla Laboratory has computed estimated minimum swimming speeds for albacore tuna of various fork lengths using a method described by Magnuson (1970) and (1973). Dotson collected data and albacore pectoral fins during Jordan Cruise 86 in June 1974. Pectoral lifting area and albacore buoyancy in sea water were calculated. Initial results indicate the estimated minimum speeds are similar to yellowfin tuna. Calculations gave 57 cm/sec at 50 cm fork length and 44 cm/sec at 80 cm. A report of results is presently under review. This project, conducted under the direction of albacore oceanography investigators, fulfilled requirements for a special studies research credit at San Diego State University.

COASTAL FISH COMMUNITIES INVESTIGATIONS

Manuscript on Interaction Among Marine Fishes and Their Prey Nears Completion

Dr. Edmund S. Hobson, Project Leader, reports that he has nearly completed a manuscript on "Interactions among marine fishes and their prey in the nearshore water column of Southern California." James R. Chess, Fishery Biologist, prepared figures for the MS. Chess, in addition, continued the analysis of gut contents from fish specimens collected in other phases of the work at Catalina Island.

COASTAL FISHERIES INVESTIGATIONS

Silver Salmon Successfully Transported from Mad River Hatchery

Susumu Kato, Chief, Coastal Fisheries Investigations, and Lloyd Richards, Biological Technician, returned from the Mad River Hatchery on January 23 with a thousand juvenile silver salmon obtained from California Department of Fish and Game's hatchery at Mad River. Transit mortality was 28 fish (3 percent). The fish averaged 21.5 gm and were from the same brood that was reared and released from the floating net pen at the Tiburon Laboratory in November 1974.

At the time of release the average weight of the fish was about 200 mg, i.e., rearing in warm salt water accelerated the growth by a factor of 10. The juvenile salmon will be used in experimental tagging studies, as well as to determine if it is possible to convert their feed from Oregon moist pellets to cheaper dry feed.

One tagged fish from the earlier tagging study died this month, making a total tagging mortality of nine fish out of 26 (35 percent). None of the controls (non-tagged fish) have died. All remaining fish have grown considerably and appear to be in good health.

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Lumber to build three new floating pens arrived and members of the San Francisco Tyee Club will start construction of the pens at the end of this month. All work will be performed by volunteers from the sport-fishermen's group.

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Angler's Guide to the United States Pacific Coast in Final Stages of Preparation

The Angler's Guide is now in the stage of final editing and typing. The book, co-authored by James Squire, Fishery Biologist at the La Jolla

Laboratory and Susan Smith, Publications Specialist at the Tiburon Laboratory, describes marine game fish, fishing grounds and angler facilities all along the U.S. Pacific Coast from California and Alaska, and also includes Hawaii, American Samoa and Guam.

This month, the Washington section was revised to incorporate suggestions of Washington State reviewers, and final editing was completed for the remainder of the book. Due to the size of the manuscript, it is expected that final typing and proofreading will take another month, and hopefully, the manuscript will be ready to submit for Laboratory and Center approval sometime in early March 1975.

FISH ENVIRONMENT INVESTIGATIONS

Definition of Pacific Habitat of Skipjack Tuna is Based on Physiological Studies Conducted at Honolulu Laboratory

The Skipjack Tuna Oceanography Task of the Honolulu Laboratory, under the leadership of Dr. Richard A. Barkley, replaces the Island Wake Investigations. This new Task attempts to relate the distribution, abundance, and behavior of skipjack tuna to their environment, and increase the catch and the catch per unit of effort of this valuable underutilized species. Synthesis of existing data on the skipjack tuna and its environment, together with Laboratory research on tuna physiology and behavior, are used to define the habitat of skipjack, infer routes of migration, and examine possible environmental cause and effect relationships which may influence year class sizes. A major objective of this Task is to determine which environmental variables are most significant in influencing the apparent abundance of skipjack in the various fisheries so as to permit the formulation of well-posed hypotheses for field testing.

During the month of January, Dr. Barkley completed a MS defining the habitat of skipjack tuna in the Pacific, based on physiological studies conducted by the Life Studies group. The habitat is the upper thermocline and not the mixed surface layer for all fish larger than about 40 cm standard length. It was previously thought that skipjack were surface fish, but the temperature of the upper mixed layer is clearly too warm for all but the smallest skipjack caught by the commercial fishery. In addition, it was found that in certain areas of the tropical Pacific, water in the upper thermocline is too low in dissolved oxygen, even when the temperature range is appropriate, so that it is now possible to exclude relatively large areas of the tropical Pacific as unsuitable to skipjack, thus narrowing down considerably the scope of exploratory fishing efforts. This hypothesis also suggests certain preferred paths of migration for larger skipjack. This explains some hitherto puzzling anomalies in the distribution of catch in the eastern Pacific. Plans are to test this hypothesis when the Cromwell is reactivated.

Observation Continues on Feeding Activity in Free-Swimming Tuna

Ms. Sherry Steffel, graduate student at the University of Wisconsin, under the direction of Drs. John J. Magnuson, of the University and Andrew E. Dizon, of the Honolulu Laboratory, is determining the input parameters for the tuna bioenergetics model of Kitchell, Heill, and Magnuson. The first study in the project involves determination of maximum daily consumption and diel feeding periodicities.

A kawakawa has been trained to swim through a submerged trough to receive pieces of smelt. The fish is allowed access to the trough at specified times; all passes receive food reinforcement.

During December, the fish was permitted to eat 2-g pieces of smelt on demand for 1 hour each day. On January 6, the particle size was changed to 1 g. The median (and quartile range) amounts of food eaten (grams) are: for 2-g particles: 161 (199-123), for 1-g particles: 148 (167-123).

The food particle size will be kept at 1 g for about 1 more week. It appears that the smaller particle size is resulting in a slightly decreased food intake by the fish. Next phases will involve looking for effects of feeding time-of-day on uptake.

MARINE MAMMAL INVESTIGATIONS

Marine Mammal Staff at La Jolla Laboratory Reorganized

In a recent memo to the staff, Dr. Brian Rothschild, Director, Southwest Fisheries Center, outlined reorganization of porpoise work at the La Jolla Laboratory. Overall responsibility for the scientific aspects of the program have been assigned to Dr. William Fox since the porpoise work fits into the ocean fisheries resource area. Dr. Fox, in turn, has designated Dr. William Lenarz, Fishery Biologist, as the Program Leader.

In order to reduce the burden of certain administrative details on the scientific staff, Dr. Rothschild has asked Mr. Robert Scott, Acting Deputy Center Director, to be responsible for, and participate in, all communications external to the Center on porpoises. All contacts with NMFS in Washington, D.C., will henceforth pass through Mr. Scott, including requests for technical information. All contacts from the Washington office or from NOAA will be made through Mr. Scott or Dr. Fox.

Mr. Scott has also been designated as the focal point for contacts with constituent groups, and communications will always be made through him, or in his absence, Dr. Fox. Dr. Rothschild has asked Mr. Scott to organize regularly-scheduled meetings with constituent groups to discuss progress and exchange ideas on the porpoise work.

Dr. Eric Barham, former Porpoise Program Manager, has been assigned to Dr. Rothschild's staff to advise him on various porpoise matters.

Twenty-Two NMFS Porpoise Observers Still at Sea

As of the close of January 1975, 22 NMFS porpoise observers had been placed and departed on U.S. purse seiners fishing tuna in the Commission Yellowfin Regulatory Area (CYRA). Two of the vessels carrying observers were forced to return to San Diego for repairs but were expected to return to sea within a week or so. A 23rd observer has been assigned to an additional vessel expected to unload in Puerto Rico and to leave for the CYRA within a week or two. As of late January, radio reports had been received from nine observers. One vessel had half a load, six are known to be fishing on porpoise, one on school fish only, and two reported that fishing was slow but did not report whether fishing on porpoise or school fish.

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As of January 20, an international fleet with a carrying capacity of 89,200 metric tons was reportedly fishing in the CYRA. Scattered reports indicated that fishing was good off southern Mexico to Panama. The 1975 catch to date is 14,400 metric tons of yellowfin, up by 27% over that of 1974; the catch of skipjack is up by 64% for the same period in 1974.

NMFS Scientist Collaborates on Worldwide Revision of Porpoise Genus

Dr. William Perrin, Fishery Biologist in the Marine Mammal Investigations, spent a week, January 12-18, working with Dr. and Mrs. David Caldwell at the Whitney Marine Laboratory, University of Florida, Miami, Florida on the systematics of Stenella. Dr. Perrin is participating in a collaborative study to revise this porpoise genus, and to describe stocks of Stenella on a worldwide basis. Two species of this genus, Stenella attenuata, the spotted porpoise, and Stenella longirostris, the spinner porpoise, are the principal porpoises taken incidentally in the eastern tropical Pacific tuna fishery.

Dr. Perrin reports that he had useful discussions with the Caldwell's concerning Stenella taxonomy and arranged for the shipment of a number of animals and skeletal material of Stenella from the Caribbean to the Center for further work. Dr. Caldwell is an Associate Professor at the University of Florida and Director of the Biocommunications Laboratory. His wife collaborates with him on porpoise research.

Whale Observers Assigned to SWFC

Messrs. L. Tsunoda and G. Nitta, Biological Technician attached to Monitoring and Surveillance, NMFS, Washington, D.C., have been temporarily assigned to the Marine Mammal Investigations at the La Jolla Laboratory. The two men have just returned from Japan, where they inspected the catches of the Japanese shore-based whaling fleets during the season that ended in December,

under a reciprocal arrangement in the International Whaling Commission. Messrs. Tsunoda and Nitta will return to Japan in time for the beginning of the 1975 whaling season, about May 1. While at the Center they are assisting with the processing of biological samples collected by NMFS porpoise observers on tuna boats. Tsunoda is assisting Ms. R. Miller, Biological Technician, in sectioning and analyzing ovaries, and Nitta is helping Mr. D. Holts, Biological Technician, with sorting, mounting, and sectioning of teeth of the spinner porpoise, Stenella longirostris, to be used in constructing a growth curve for the species.

PHYSIOLOGY INVESTIGATIONS

Study Made on Chronic Effects of Low Concentrations of Benzene on Pacific Herring

Investigators at the Tiburon Laboratory continued their study of effects of crude oil components on various life stages of fishes.

Maxwell Eldridge, Fishery Biologist (Research) and Tina Echeverria, Biological Technician, are continuing a series of experiments testing the chronic effects of low concentrations of (ppb) benzene on energy utilization of different early life stages of Pacific herring. In the first experiment, conducted in December, eggs were exposed to benzene just after fertilization. Differences in metabolic rates, growth, heartbeat rates, and uptake were observed in the exposed embryos relative to controls.

During January the yolksac larval stage was studied and again effects on metabolism of larvae exposed to low benzene concentrations were noted. At the beginning of the yolksac stage metabolic rates, as measured by continuous 24-hour respiration studies, were equal among all treatments. On the third day, respiration rates in all treatments increased, then subsequently declined until day five when yolk absorption was complete. During this period of decline the larvae exposed to the higher benzene concentration respired at a higher rate than with other treatments. Measurements of the caloric content of whole body tissues in calories/mg dry weight showed differing values in the two benzene concentrations relative to controls. Larvae exposed to the 0.52 ppm concentration had lower caloric values initially while larvae in 0.035 ppm increased in caloric content. All treatments, including controls, then declined in value. A secondary mode or rise in the caloric content followed in all larvae in agreement with the pattern found in respiration rates. No differences between treatments were found in standard lengths, body depths, or dry weights throughout the yolksac stage. Yolk volumes of control larvae, however, were larger than exposed larvae after day three.

Uptake and accumulation of ^{14}C -labeled benzene was similar to that found in earlier embryos. The 0.52 ppm concentration larvae accumulated 2.40 ppm

(or 4.6X) in their tissues within 12 hours while those larvae exposed to 0.35 ppm accumulated more rapidly, 0.250 ppm (or 7.1X) in less time (six hours). Twenty-four hours after exposure concentrations in larvae from both benzene treatments declined to 3.5 and 2.6X the original benzene concentrations in the sea water.

The final experiment dealing with effects of ppb benzene post-yolksac larvae is currently underway. The principle difference at this stage as opposed to the embryonic and yolksac stage is the dependence on exogenous sources. Feeding rates and caloric values of food are being monitored. This study is scheduled to last approximately 14 days.

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Nina Hirsch, Biological Technician at the Tiburon Laboratory, is preparing her M.S. thesis through our Physiology Investigations and the University of the Pacific at Dillon Beach. The thesis is on the uptake, distribution, and depuration of labeled benzene in several fish.

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The following student volunteers are now working on a regular basis on petroleum research with scientists of the Physiology Investigations at the Tiburon Laboratory: Patricia Marshall, College of Marin, undergraduate; Larry Smith, San Francisco State University, graduate student; Steve Kreshkin, San Francisco State University, graduate student; Michael Bowers, Sonoma State University, undergraduate student; Dick Taylor, Sonoma State University, undergraduate student. The volunteers from Sonoma State University joined the group this month.

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Research Chemist Pete Benville is continuing work on a National Pollutant Discharge Elimination System (NPDES) permit which the Tiburon Laboratory received from the Environmental Protection Commission (EPA) for our sewer system. The monthly data collected for the last quarter was compiled and a report submitted to EPA. Progress was made in organizing the format that will be used for monitoring the sewer plant's influent and effluent.

STOCK ASSESSMENT AND FISHERY EVALUATION INVESTIGATIONS

Manuscript Describes Procedures Used to Estimate Length Composition of Atlantic-Caught Tunas

A manuscript that describes the procedures used by the staff of the Stock Assessment and Fisheries Evaluation Investigations at the La Jolla Laboratory to estimate the length composition of tunas caught in the Atlantic has been completed by Fishery Biologist G. Sakagawa, Mathematician A. Coan

and Fishery Technician E. Holzapfel. Included in the manuscript is an analysis of the length composition of tunas caught by American seiners in the eastern tropical Atlantic in 1968-73. In those years, the catch of yellowfin tuna ranged from 0.2 to 1.1 million fish with 1-year olds dominating the 1968 and 1970-72, and three-year olds dominating in 1969 and 1973. The annual catch of skipjack tuna was estimated to be 1.2 to 12.8 million fish. One-year olds dominated in virtually all years. Only a few bigeye tuna (530 to 29,400 fish annually) were caught by the American fleet. Four age groups of bigeye tuna were represented but none was dominant.

Report Prepared on Growth of Laboratory-Reared Anchovy

A manuscript on the growth of laboratory-reared northern anchovy was completed by Dr. G. Sakagawa and Mr. M. Kimura, Fishery Biologists at the La Jolla Laboratory. Their study showed that a two-phase Gompertz growth model satisfactorily described the cyclic growth pattern observed in anchovies reared in the laboratory. From the model, they estimated that the average standard length of laboratory-reared anchovies is 102 mm at 1 year of age and 119 mm at 2 years. Ninety-five percent of the first year's growth was completed by the 8th month of life and about 91% of the second year's growth was completed by the 20th month of life. Growth was comparable to that of anchovies in the wild.

Work Started on Tuna Data Base

Mathematician Al Coan and Computer Technician Ken Brennecke of the La Jolla Laboratory started work in January on creation of tuna data bases on the INFONET COML system. This system was selected for use because of its wide capabilities for archiving and managing dissimilar types of data files. Initial phases will involve the creation of the two data bases for Atlantic tunas, one for length frequencies and total landings by country and gear and one for catch and effort statistics by country and gear. Eventually, tuna statistics from other oceans will be placed on the data base.

Brazilian Scientist on Training Assignment at La Jolla

Mr. Robert Verani of the Sao Paulo Institute of Fisheries is on a 6-month training assignment in the United States. During the past 3 months he attended the University of Washington and worked with NMFS scientists at the Northwest Fisheries Center in Seattle, Washington. Currently, Mr. Verani is at the La Jolla Laboratory where he will spend 3 months training under the direction of Drs. W. Fox, W. Lenarz, and G. Sakagawa of the Stock Assessment and Evaluation Investigations. Mr. Verani is receiving training in standard techniques of data collection, compilation and analyses used in stock assessment. The training stresses application of the techniques to data from the Brazilian sardine fishery. Mr. Verani is in charge of monitoring this fishery in Sao Paulo.

STOCK AND RECRUITMENT INVESTIGATIONS

Larval Fish Colloquium Held at SWFC

Culminating many months of planning and preparation, a colloquium jointly sponsored by the Southwest Fisheries Center and the Marine Life Research Program of the University of California, Scripps Institution of Oceanography, was held at the Center January 20-24, to discuss the concept of stock and recruitment as it is affected by the cause and effect mechanisms that produce larval fish mortality. Chaired by Dr. Reuben Lasker, Leader of the Stock and Recruitment Investigations at the La Jolla Laboratory, attendees at the meeting were: Dr. J. Blaxter, Marine Laboratory, Oban, Scotland; Dr. J. Cushing, Fisheries Laboratory, Suffolk, England; Dr. John Gulland, FAO, Rome; Prof. J. Isaacs, Scripps Institution of Oceanography; Dr. R. Jones, Marine Laboratory, Aberdeen, Scotland; Dr. G. Laurence, NMFS, Narragansett; Dr. J. Mullin, Scripps Institution of Oceanography; Professor J. Reid, Scripps Institution of Oceanography; and Dr. N. Wilimovsky, University of British Columbia, Canada. Participants from the Center, in addition to Dr. Lasker, included Drs. E. Ahlstrom, J. Hunter, W. Lenarz, C. O'Connell, B. Rothschild, P. Smith, and Ms. G. Theilacker.

The colloquium discussions centered on three interrelated topics:

- 1) Is larval mortality an important determinant of year-class strength?
- 2) What are the possible causes of larval mortality?
- 3) What new approaches or changes in present procedures should be emphasized to answer the first two questions?

On the first day of the meeting, a general discussion of these topics and of past and current research was held, areas of agreement and disagreement outlined and subcommittees appointed and asked to produce a short written document on a specific aspect of the topics on the second morning. On the afternoon of the 2nd day, copies of each committee's report were distributed to each participant and on the 3rd and 4th days, a general review of the entire document by all participants took place.

According to Dr. Lasker, the rationale for larval studies in the laboratory and in the field was explored and recommendations made for those areas of research needing intensive effort. The recommendations of the participants, meant to guide CalCOFI scientists in stock and recruitment studies, are presently being edited for distribution by Dr. Lasker.

Possible Energy-Sparing Mechanism Discovered for Larval Anchovy

Mechanisms that reduce activity and thereby conserve energy are probably important in the survival of larval fish. Two such mechanisms have been studied in the northern anchovy: 1) kinetic behavior which results in reduced swimming speed in areas of high food concentration and 2) the effect of temperature on activity. The reduction in activity associated with lower temperatures, however, may be offset by slower growth rates

which may increase the exposure to predation. Another possible energy-sparing mechanism was discovered for larval northern anchovy last month. Dr. John Hunter, Fishery Biologist, and Ms. Carol Sanchez, Biological Technician, examined in the laboratory the extent of inflation of the gas bladder as a function of time of day and larval length.

They found that northern anchovy when they are 12 mm long inflate the gas bladder at night and deflate it in the day. At night larvae were found to have greatly distended gas bladders which often were so large that they partially constricted the gut, whereas by 2-4 hours after the onset of light the bladders were deflated. At night an obvious gas bubble was present in the bladder; during the day it was absent. At night larvae appeared to be suspended motionless in the water, whereas during the day they were continually swimming and feeding. The most tenable explanation for this diel change in the inflation of the gas bladder is that it permits the larva to adjust its buoyancy to neutrality at night and consequently to conserve energy. The work of a Japanese scientist on another species of anchovy demonstrated that anchovy show the same behavior in the sea.

Histological Comparisons Aid in Development of Criteria for Evaluating Condition of Anchovy Larvae Collected at Sea

Dr. C. O'Connell, Fishery Biologist at the La Jolla Laboratory, reported continued progress on the histological comparison of starved and fed anchovy larvae up to 10 days old. The purpose of this work is to develop criteria from laboratory material for evaluating the condition of larvae collected at sea during the current spawning season.

The pancreas appears to be the most obvious indicator of condition. The size and condition of cells in this organ and the degree to which the pancreatic duct is filled with zymogen (digestive enzymes) invariably decline as time without food lengthens. The hindgut appears to be a good indicator of whether a fish has been feeding recently. Prominent eosinophilic inclusions occur in the cells of the hindgut (protein or lipid undergoing intracellular digestion) in all specimens with food in the digestive tract. Some larvae that have been reared in the presence of food but have no food in the digestive tract also show hindgut inclusions, which implies that the specimens have eaten recently.

On the basis of these and indicators associated with other tissues the majority of larvae from laboratory experiments are readily classified as being well fed and robust or underfed and severely emaciated. However, there is a sizable portion of larvae reared without food that are not so easily classified. Many of them do show subtle signs of cytoplasmic diminution and nuclear alteration that are probably indicative of an early stage of fasting. Recognition of these early changes may be important in evaluating the condition of larvae from the ocean.

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Dr. E. Ahlstrom reports that some progress was made on the nearly completed study on the early life history stages of stromateoid fishes, being carried out jointly by Ahlstrom, John Butler and Barbara Sumida of the Smithsonian Institution.

A study of early larval stages of eastern Pacific carangid fishes was undertaken. This study will be the basis of a talk to be given at the symposium to be held at Ensenada, Baja California, Mexico, February 16-22. This work is being done jointly by Ahlstrom and Sumida. Time permitting, Dr. Ahlstrom plans to cover 10 life history series representing as many genera of carangids. Material on carangids also is needed for the Handbook on California Current Fish Eggs and Larvae, hence this study is relevant to the larger undertaking.

Ms. Elizabeth Stevens, Biological Technician, spent most of the month at sea aboard the Jordan, hence little progress was made on the neuston net-CalCOFI net comparisons of catches on CalCOFI Cruise 7205.

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Fishery Biologist H. Geoffrey Moser reports progress was made on the identification guide to the larvae and pelagic juveniles of rockfishes and scorpionfishes. The manuscript is nearly complete and in its final form will treat seven genera and 20 species of the family Scorpaenidae. Three of these genera and eleven of the species have not previously been described or illustrated. The paper includes species of rockfish from all oceans in which they occur and provides a basis for comparison of the early life histories of these commercially important fishes.

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Dr. Ann Hurley, NOAA/National Research Council Associate at the La Jolla Laboratory, continued her work on the biology of the squid, Loligo opalescens, a commercially important nearshore species in the California Current. Dr. Hurley has made underwater observations of the reproductive behavior of squid in breeding schools in the La Jolla Canyon. She also continued rearing groups of squid from the egg using nauplii and adult Artemia as food.

Dr. Hurley reports that she has made respiration measurements on newly-hatched squid at 10°, 15° and 20°C for 3-week old animals at 15°C. Newly hatched squid consumed 1.0 μ l O₂/mg dry weight at 10°C, 2.6 μ l O₂ at 15°C, and 3.8 μ l O₂ at 20°C. These data along with other data on feeding behavior will be used to develop an understanding of the variables affecting survival of squid in the California Current.

SURVEY SYSTEMS ANALYSIS INVESTIGATIONS

Report Issued on Workshop Held to Define Research Requirements in Predicting Pollutant Transport in the Southern California Bight

As an expression of interest in the oceanography off Southern California, 17 scientists from government and industry assembled in November 1974 at the Southwest Fisheries Center in La Jolla for a 3-day workshop to discuss the state of knowledge of circulation and transport of substances in the Southern California Bight, and to specify what further work would be useful.

A primary motivation for intensified oceanographic studies in the Bight is man's increasing use of the region for oil extraction, dumping, power plant siting, food and recreation. An improvement in our understanding of circulation in the Bight is necessary and will result in an increase in the ability of responsible administrators to make good decisions in resource management, and thereby prevent the detrimental impact of exploitation on the ocean and shore environment. This significance to coastal communities of transport of pollutants has been demonstrated in one aspect by the fact that drift bottles are returned to Southern California beaches from virtually all locations in the Bight. Direct demonstrations of this significance were furnished by events following the 1969 Santa Barbara oil spill and by the high incidence of tar balls on Southern California beaches.

The workshop, organized by Dr. Robert Owen of the La Jolla Laboratory, issued its 14-page report this month entitled, "Research to Define Ocean Circulation and Transport of Substances in the Southern California Bight." This report presents a general description of the complex current system and identifies the main driving mechanisms. The authors summarize the information and scale of resolution (1 month, 35-75 km) that may be culled from an extensive data bank on hand. However, the need for greater resolution to reflect the interaction of tidal forcing, local wind forcing and topographic constraints (the Bight is characterized by several island masses, deep canyons, basins and connecting channels) requires new field programs for monitoring both water circulation and air flow. Discussion of pollutant behavior and transport, near field and far field, is presented and a need for the examination of toxicological thresholds is demonstrated. Finally, the concept of numerical modeling of circulation is presented in the context of short-term (event) and long-term (average) approaches.

TUNA ASSESSMENT AND DEVELOPMENT INVESTIGATIONS

Analytical Procedures Developed for Systems Analysis and Economic Analysis of Anchovy Transport System

During January, Dr. Jerry Wetherall, Fishery Biologist with the Honolulu Laboratory, developed analytical procedures for a systems analysis and detailed feasibility study of the NMFS anchovy transport scheme. The study is intended to show the feasibility of shipping live northern anchovy from California to Hawaii in specially designed bait tankers aboard roll-on/roll-off freighters, and using the delivered anchovies as a substitute or supplemental baitfish in the Hawaiian aku fishery.

The feasibility of the transport scheme requires that the cost per pound of anchovies delivered be no greater than the adjusted opportunity cost per pound of nehu, the Hawaiian anchovy currently used as bait. Dr. Wetherall has estimated the opportunity cost of nehu on a weekly basis for 1968-73, and has averaged over the 6 years to obtain a mean seasonal pattern. The opportunity cost depends principally on three factors: the proportion of available working days now spent baiting (instead of fishing for aku), the ex-vessel price of aku, and the amount of aku caught per quantity of bait used. The price of aku is highest in the December-March period, whereas the catch rate is greatest in the summer months (peak of the aku fishing season). The proportion of days baited is fairly constant throughout the year. As a result, the opportunity cost of nehu is especially high during April-August and again during November and December.

Dr. Wetherall has developed a series of analytical procedures to establish the feasibility of alternative anchovy delivery systems and to find the system which will maximize net returns to the Hawaiian aku fleet. The search procedure evaluates cost structures for different configurations of the transport system, each with a particular number of transport tankers, aging and storage capacities, shipping schedules, and so on.

The feasibility study will be concluded with an analysis of investment risks and various aspects of decision-making under risk situations, using a stochastic simulation model of the transport scheme. The simulation model, which is being prepared with the assistance of Mathematician Marian Yong, will also be used to "fine tune" the best delivery system in various ways, such as by evaluating the net benefits of expanding bait storage capacity.

Tagging Data From Hawaiian Fishery Contribute to Study of Skipjack Tuna Growth

The Tuna Monitoring and Assessment Task places major emphasis on those aspects of the SWFC's skipjack development plan dealing with fishery analysis. In addition, the status of exploited stocks of other tuna and tunalike resources of U.S. concern are monitored through the systematic collection and analysis of fisheries data. To accomplish these ends, the Task is organized into three subtasks: fishery liaison and monitoring, assessment of skipjack tuna resources, and assessment of other tuna and tunalike resources. In the assessment of skipjack tuna resources, Dr. Robert Skillman, Task Leader, and Mathematician Marian Y.Y. Yong are continuing their study of skipjack tuna growth utilizing tagging data. In order to check for potential seasonal differences in growth, the recapture data were grouped and analyzed by month of release (May, July, August, September, and October 1957 and May and June 1958). By setting up multiple regression equations, where change in length was regressed on days out and initial length at release, for each month, it was found

that only June 1958 and July 1957 could be used jointly. All other months should be analyzed individually because of heterogeneity of variance or differences in "adjusted group means" or regression coefficients. Fitting of von Bertalanffy growth curves to the above data resulted in a set of estimates of growth parameters in which only those for June 1958 and July 1957 combined were at all reasonable. Since the month-to-month variation in parameter estimates seemed to be related to sample size and range in days out and in size at release rather than to season, pooling of the data seems called for. The overall growth estimates were $L_{\infty} = 80.0$ cm FL and $K = 0.5036$ with $N = 1,228$. An "averaged" growth curve is now being computed.

Roback Fishing Machines Take Skipjack Tuna During Successful First Test in Hawaii

The installation of four Roback automatic fishing poles on the skipjack tuna fishing vessel, Anela was completed on January 23 by Messrs. Ray Sumida, Don Aasted, Tom Hida, Paul Shiota, and Tom Kazama of the Honolulu Laboratory, under the supervision of Mr. Koichi Hatakeyama of Ena Industry, Ltd., manufacturers of the equipment. Accompanied by Messrs. Hatakeyama, Sumida, and Hida, the Anela left January 28 on a fishing trip to test the machines. Anela fished one school of skipjack tuna off Kahoolawe and landed 951 skipjack in 39 minutes of fishing. They ranged in size from 10 to 20 pounds and averaged 14 pounds. Fishing was carried out by eight fishermen and two Roback poles, one on each side. The two Robacks accounted for 125 skipjack tuna. Since chumming was conducted from one side of the vessel, the fishing machines were effective only during the first 10 minutes of fishing when the skipjack tuna were in a biting frenzy. Thereafter, one of the poles was effective for another 14 minutes. After 24 minutes of fishing the skipjack were out of range of the Roback pole and were fished for the remaining 15 minutes by fishermen using longer poles. The catch rate of skipjack tuna during the last 15 minutes was much lower than the first 24 minutes of fishing. The machines functioned well and were well-received by captain and crew. Further adjustments will be made since the machines were throwing the skipjack tuna beyond the penned area set aside for dropping fish, and even landing them in the baitwells.

Shrimp Trawling in Hawaii Continues; Catches Small but Steady

Exploratory bottom trawling in recent years by research vessels of the Honolulu Laboratory has led to the discovery of a small local shrimp resource. In November 1974 a 50-foot west coast trawler began fishing for Penaeus marginatus in Hawaiian waters. This one vessel has continued to trawl locally for shrimp, and while her catches remain relatively small, they are larger than the auction can handle and some of the shrimp are being sold directly from the vessel. Prices remain high (\$2.50-3.25/pound heads-on), and casual examination of the catch records indicates no reduction in CPU. A second vessel, the 102-foot Sea Hawk, will commence trawling soon.

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Fishery Biologist Dr. Paul Struhsaker has completed a second draft of the proposal for a cooperative investigation of the Northwest Hawaiian Islands. Additional modification of the proposal is being carried out. During January, Dr. Struhsaker devoted several days to visiting investigators and members of industry. Discussions included biological collections for the Smithsonian Sorting Center, skipjack tuna and baitfishes, shrimp trawling, and longline methods. Approximately 15 hours were devoted to subjects concerning the reactivation of the research vessel, Townsend Cromwell, which will be based in Honolulu.

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Research Assistant James Uchiyama completed reading otoliths from the three largest skipjack examined to date (76.1 to 80.3 cm). These data were incorporated with earlier readings and resulted in L_∞ and K values of 87.4 and 1.02 for central Pacific fishes. Previous values were 88.1 and 0.99.

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At the request of Laboratory Director Richard Shomura, Mr. Richard Uchida has completed a summary of the number of Hawaiian skipjack tuna fishing vessels operating in each month and the average number in each year for the period 1965-73. This was prepared for Mr. Wilvan Van Campen of Pacific Tuna Development Foundation. Mr. Uchida also completed a preliminary draft of a paper entitled "A summary of environmental and tuna fishing information of the Line Islands," also at Mr. Shomura's request. In this draft, special emphasis is placed on Christmas Island; information on the remaining Line Islands is being incorporated into the report.

Mr. Uchida revised his manuscript, "Recent development in fisheries for skipjack tuna, Katsuwonus pelamis, in the central and western Pacific and Indian Oceans" following outside review.

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In American Samoa GAS employee Pulou Niuatoa recorded the lengths of 550 albacore from 11 vessels during the period January 1-24. He also collected 50 sets of catch and effort data. An average size of 91.1 cm and an albacore catch per 100 hooks of 2.3 were determined using data from 10 vessels.

SEMINARS

Honolulu Laboratory

January 22 - Roger E. Green, Fishery Biologist with the Honolulu Laboratory, discussed the progress of the anchovy transport program at an informal seminar given in the laboratory seminar room.

January 29 - Six scientific staff members presented brief talks on current research projects at the Honolulu Laboratory to a class of University of Hawaii students.

MEETINGS AND TRAVEL

January 6-10 - Dr. Jeannette W. Struhsaker of the Tiburon Laboratory attended a session for the preparation of the OCS study plan for the Bering, Beaufort, and Chukchi Seas, Alaska to be proposed to the Bureau of Land Management. The session was sponsored by NOAA, ERL, and held in Seattle, Washington. Dr. Struhsaker participated in the preparation of a Physiology-Behavioral study plan on the effects of petroleum. The physiology workshop was chaired by Dr. Donald Malins of NWFC, Seattle.

6-10 - Center Director Brian Rothschild in Miami, Florida to attend the Law-of-the-Sea Institute Conference and the National Research Council's Ocean Policy Committee meeting of which he is a member.

7-9 - Program Planning Officer David Mackett of SWFC traveled to San Francisco to attend a meeting of the National Fisheries Plan jointly sponsored by the Southwest Region, Pacific Marine Fisheries Commission, and NOAA's Sea Grant.

8 - Honolulu Laboratory Director Richard Shomura called a general staff meeting to review the past, present, and future of Honolulu's research activities. He plans to hold such meetings annually.

10 - Meeting to discuss planned work on the cooperative silver salmon project was held at the Tiburon Laboratory and attended by representatives of the California Department of Fish and Game, members of the Tyee Club, and U.C. Davis Sea Grant personnel.

11 - Dr. Michael Laurs, La Jolla Laboratory, attended the American Fishermen's Research Foundation Board of Director's meeting in San Diego where preliminary plans were made for cooperative NMFS-AFRF albacore studies for the 1975 fishing season.

12 - Dr. Michael Laurs attended the NMFS Standing Committee on Oceanography meeting held in Seattle, Washington.

15 - Dr. Rothschild attended a meeting of the CalCOFI Committee held at the Center.

January 15 - Dean Ken Kamimura, Leeward Community College, discussed with Mr. Shomura the possible placement of students on the Townsend Cromwell as part of LCC's Marine Technical Program.

16 - Skip Naftel of Costa Mesa, California, captain of the M/V Easy Rider discussed local fishery problems with Mr. Shomura and Regional Representative Robert Iversen.

20 - Mr. Shomura reviewed Honolulu's research activities for Sea Grant Advisory Specialist John L. Ball, Jr. and several of his newly appointed Fisheries Extension agents. These gentlemen also visited the Honolulu library to acquaint themselves with the available material.

23 - Dr. Colin Nash, Director, Oceanic Institute, discussed fishery-related matters with Mr. Shomura.

January 27-February 7 - Mr. Shomura was on travel status for 2 weeks to: 1) attend a meeting at the Pacific Marine Center (PMC) in Seattle relating to the Townsend Cromwell's return to and operation in Hawaii, 2) meet with Seattle laboratory personnel on research and gear problems of mutual interest, 3) meet with Mr. Norman Abramson, Director of the Tiburon Laboratory, 4) attend the Marine Fisheries Advisory Committee (MAFAC) meeting in La Jolla, and 5) discuss program and budget matters at the Southwest Fisheries Center.

31 - Mr. Tamio Otsu, Fishery Biologist, departed for a 3-week trip to attend the Japan Tuna Research Conference and to visit laboratories in Japan doing research on skipjack and other tunas.

VISITORS

Honolulu Laboratory

January 2 - Mr. Bill Coleman, American Samoa.

- Mr. John Laney, Honolulu.

14 - Mr. Leslie Knapp, Smithsonian Institution, Woods Hole, Massachusetts.

20 - Mr. Koichi Hatakeyama, Chief Engineer, Ena Industry, Ltd., Fukushima, Japan.

La Jolla Laboratory

January 2 - Mr. Kenneth L. Simpson, University of Rhode Island, Kingston, Rhode Island.

17 - Dr. Harold L. Goodwin, Oceanic Institute, Waimanalo, Hawaii.

- Professor Alan Pessary, CSIRO, Cronulla, Australia.

27 - Mr. Clem Bribitzer, NMFS Southwest Region, Terminal Island.

Tiburon Laboratory

January 3 - Ken Pfiefer, Oregon State University, Oregon.

8 - Dave Rice, CSUH.

9 - Alice Cook, Service Representative, Pacific Telephone Co., Mill Valley, California.

10 - Carl Eschler, Tyee Club, San Francisco, California.

- Bob Brown, Tyee Club, San Francisco, California.

- Frank Dyer, Tyee Club, San Francisco, California.

- William Ver Brugge, Tyee Club, San Francisco, California.

- Pete Adams, Sea Grant, University of California at Davis.

- Robert Parsons, Sea Grant, University of California at Davis.

- Chris Dewees, Sea Grant, University of California at Davis.

- Jack Robinson, California Department of Fish and Game, Sacramento, California.

13 - James Johnson, Director, NMFS, Pacific Environmental Group, Monterey, California.

16 - Luis de Castro, Fisheries Institute, Department of Agriculture, Sao Paulo, Brazil.

20 - Eric Hurst, University of California at Davis, Davis, California.

January 22 - Brent Bixler, Santa Barbara, California.

- Robert Elwell, California Department of Fish and Game, Sacramento, California.

27 - Michael Bowers, Sonoma State University, Sonoma, California.

- Dick Taylor, Sonoma State University, Sonoma, California.

29 - Mr. and Mrs. Paul Wares, Northwest Fisheries Program, USFWS.

31 - Richard S. Shomura, Director, Honolulu Laboratory, Honolulu, Hawaii.

PERSONNEL ACTIONS

New Employees

<u>Name</u>	<u>Title</u>	<u>EOD</u>	<u>Appt. NTE</u>	<u>Laboratory</u>
Burris, Oden Stokes	Computer Tech.	1/6	1 year	- La Jolla
Parrish, Randall E.	Computer Tech.	1/6	1 year	- La Jolla
Brennecke, Kenneth	Mathematics Tech.	1/20	1 year	- La Jolla
Dorr, Harold W.	Laboratory Asst.	1/7	130 days (intermittent)	- La Jolla
Ueki, Dale (name changed to Radabaugh, effective 1/25)	Biological Aid	1/19	1040 hours (intermittent)	- La Jolla

TRAINING

Mr. Jim Coe and David Holts, Biological Technicians, and Charles Oliver, Computer Technician, attending University of California, San Diego Extension course, "Overview of Information Systems and Systems Analysis."

January 14-16 - Ms. Johanna Alban, Clerk-Typist, Tiburon Laboratory, attended the Career Women's Seminar in San Francisco, California.

NMFS Biologist Completes Course in Fish Pathology

Under the auspices of the Government Training Act, Ms. G. Theilacker, Fishery Biologist at the La Jolla Laboratory, returned to the Center in January after completing a semester-long class in fish pathology at the University of Washington in Seattle. According to Ms. Theilacker, the course was structured to encompass the major factors (bacterial, viral, protozoan, parasitic and physiological) which cause disease in fish. Training emphasized the recognition, treatment and control of fish diseases. In addition to the course work at the University of Washington, Ms. Theilacker received training at the Fish and Wildlife Service's Western Fish Disease Laboratory in Seattle on the use of histopathological techniques.

